Establishing a Spatial and Economic Baseline of Human Uses in the North Central Coast Region of California

A part of project R/MPA-16 09-015: *Baseline Monitoring of Ecosystem and Socioeconomic Indicators for MPAs along the North Central Coast of California*

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ESTABLISHING A SPATIAL & ECONOMIC BASELINE OF HUMAN USES

EXECUTIVE SUMMARY REPORT
Submitted to the *California Sea Grant College Program*
April 2013

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A PART OF PROJECT R/MPA-16 09-015:
Baseline Monitoring of Ecosystem & Socioeconomic Indicators for MPAs along the North Central Coast of California

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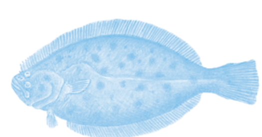
INTRODUCTION

This executive summary report provides a summary of the methods and major findings from a four-part study conducted by Ecotrust to provide baseline estimates of the quantity, spatial distribution, and economic value of human uses in the North Central Coast (NCC) study region. The NCC region stretches from Alder Creek in the north to Pigeon Point in the south. Specifically, we provide results in the following four types of human uses: commercial fishing, commercial passenger fishing vessels, coastal recreation, and the recreational abalone fishery. This study is a part of the larger marine protected areas (MPAs) monitoring effort, entitled the MPA Baseline Program, which is tasked with characterizing the ecological and socioeconomic conditions within the NCC region and across the state. Specifically, this study addresses the Baseline Program's objective of describing human use patterns across the study region and establishing initial data points for long-term tracking of conditions and trends.

We would like to emphasize that the purpose of this report is not to measure or assess the impact of MPAs on human uses in the study region. To quantitatively measure the impact of MPAs requires robust long term data sets in both pre and post MPA periods that enable analyses to account or control for the complex interplay of regulatory, environmental, and socioeconomic factors that drive change in human use patterns. Such a study was beyond the scope of this project but the information we have collected can be used to help better understand the complex system of coastal and ocean human uses and inform future research efforts to measure and quantify the impact of MPAs.



COASTAL RECREATION

INTRODUCTION & METHODS

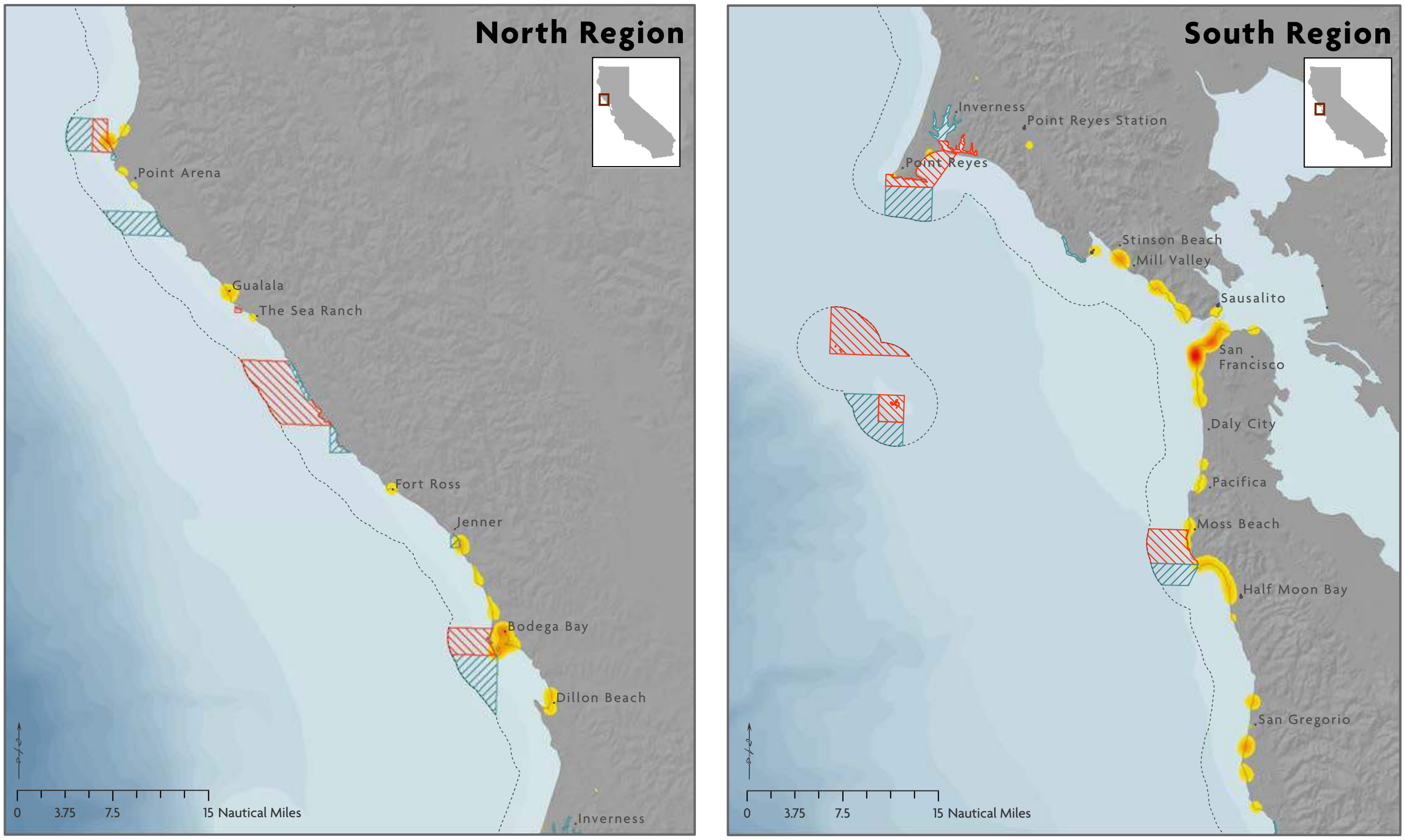
Coastal recreation provides significant economic and social benefits to coastal communities and to the state of California as a whole. These benefits include both the financial impact of direct expenditures (e.g., hotel stays, dining, shopping) as well as non-market benefits such as enhanced human well-being. To understand the impacts recently established marine protected areas (MPAs) might have on future coastal recreation use patterns in the region it is necessary to establish a baseline of how many people use the coast, what they do, and the economic contributions of these different types of uses—especially in a geospatial context. Through a peer-reviewed methodology we surveyed a probability-based sample of 5,079 individuals in select North Central Coast region counties to establish a baseline characterization of coastal recreation and visitation statistics and a spatial baseline of coastal recreation use patterns in the North Central Coast region.

MAJOR FINDINGS

- Coastal trips to San Francisco County were most popular among respondents, constituting approximately 37.4% of total coastal trips. The county of San Mateo followed closely behind at 30.2% of total reported visits. Mendocino County had the fewest coastal visitors, at approximately 6.9% of survey respondents.
- The top five most popular coastal activities among people in the region were scenic enjoyment (77.1% of study population), beach going (65.2%), photography (41%), biking or hiking (39.3%) and watching birds and/or other marine life from shore (38.6%).
- Spatial data sets and maps were developed displaying the extent and intensity of use for coastal recreation overall and for specific coastal recreation activities (***Map 1***).
- The average individual in the North Central Coast takes approximately 3.2 trips a year to the coast for an estimated total of 22.2 million trips a year among the study population.
- On an average coastal recreation trip, an individual spends approximately $54.48 for a total annual coastal recreation expenditure value of approximately $1.21 billion dollars[1] (***Table 1***).

MAP 1

California North Central Coast Coastal Recreational Survey
All Survey Waves – All Activities



KEY Map depicting the relative intensity of coastal recreation use in the North Central Coast region

MARINE PROTECTED AREAS

= State Marine Conservation Area

= State Marine Reserve

= State Marine Recreational Management Area

DENSITY OF RECREATIONAL ACTIVITY

low N=13,955 high

-------- = 3NM STATE WATER LINE

TABLE 1

Estimated total number of coastal trips and direct trip expenditures in the North Central Coast region

STUDY POPULATION	AVERAGE # OF TRIPS PER YEAR PER PERSON	ESTIMATED # OF COASTAL TRIPS FOR STUDY POPULATION	AVERAGE EXPENDITURE PER TRIP	TOTAL ESTIMATED ANNUAL COASTAL RECREATION TRIP EXPENDITURES
6,943,138	3.2	22,197,663	$ 54.48	$ 1,209,258,380

[1] *This is a higher bound estimate of coastal recreation trip expenditures. Please see the full report for the lower bound estimate*

COMMERCIAL FISHING

INTRODUCTION & METHODS

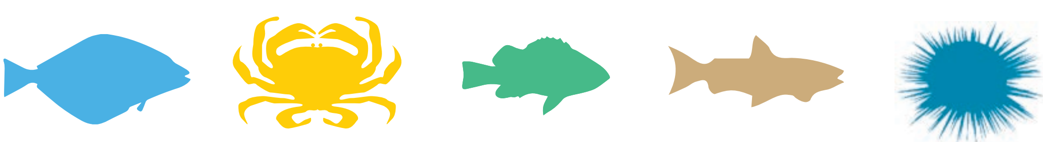
The waters off the North Central Coast of California have long supported fishing activities that are integral to the cultural and economic history of the area. Commercial fishing exemplifies this interdependency between the natural environment and coastal communities that have characterized California since well before statehood.

The goal of this study was to establish a baseline characterization of the commercial fishing fleet in the California North Central Coast (NCC) region and assess initial changes since marine protected area (MPA) implementation in May, 2010. The results of this study provide a better understanding of the current economic health of the region's commercial fishermen and provide a benchmark of economic conditions and spatial fishing patterns against which future MPA impacts and benefits can be measured. Our study provides three sets of primary findings:

1. A baseline characterization of spatial fishing patterns and economic status of commercial fishermen in the North Central Coast region;
2. An assessment of initial changes in spatial fishing patterns and initial economic changes following NCC MPA implementation; and
3. A qualitative investigation into the impact of NCC MPAs on commercial fishermen and the specific MPAs impacting commercial fisheries at the port and region scale.

To provide these findings our research team examined California Department of Fish and Wildlife (CDFW) commercial landings data and conducted in-person interviews with 101 commercial fishermen who made landings in 2010 in the study region for the following state water fisheries: *California halibut (hook & line)*; *Dungeness crab (trap)*; *Nearshore finfish (live—fixed gear)*; *salmon (troll)*; and *urchin (dive)*.

NORTH CENTRAL COAST FISHERY CATEGORIES



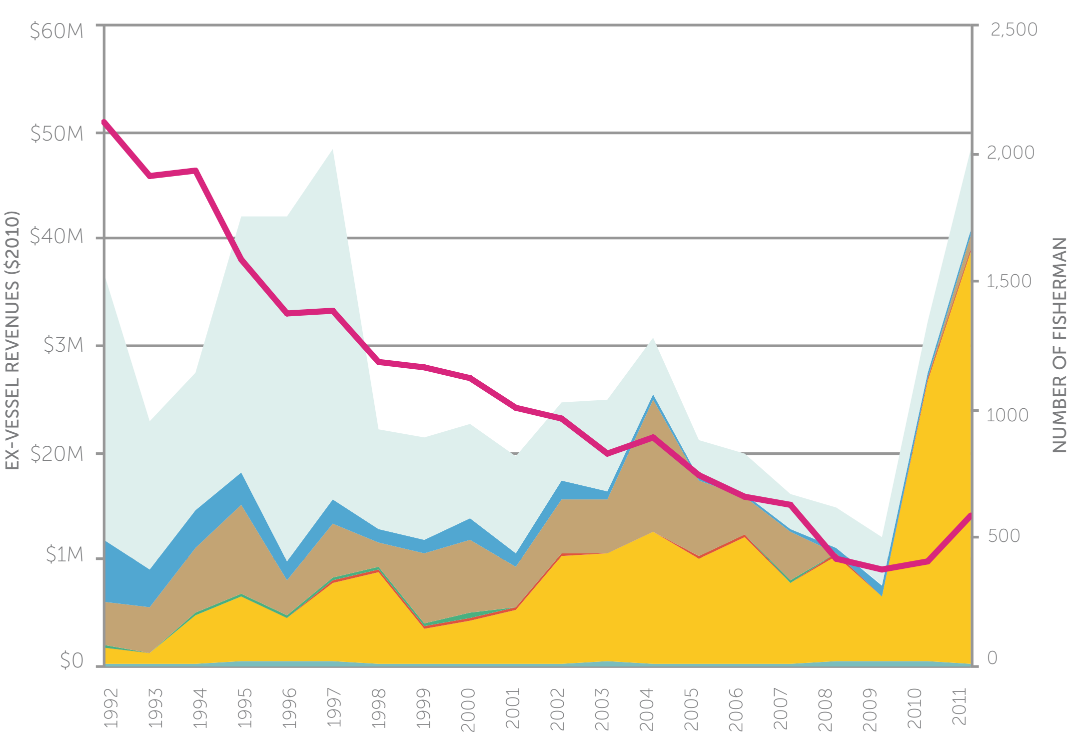
CALIFORNIA HALIBUT *HOOK & LINE* | DUNGENESS CRAB *TRAP* | NEARSHORE FINFISH *LIVE, FIXED GEAR* | SALMON *TROLL* | SEA URCHIN *DIVE*

MAJOR FINDINGS: HISTORICAL TRENDS & INITIAL CHANGES IN FISHERIES REVENUE

- Total landings in the North Central Coast for state water fisheries averaged 7.8 million pounds and $16 million in ex-vessel revenue annually from 1992–2011 (***Figure 1***).
- The number of fishermen making landings in the North Central Coast region declined dramatically by 72.5% (from 2,126 to 584 fishermen) from 1992 to 2011. This decline has been due to a series of factors such as increased fishery regulations/restrictions, economic decline, salmon fishery closures, and natural fishery cycles.
- State water fisheries are increasingly significant in the region. In 1992 these fisheries comprised 32% of the region's ex-vessel revenue increasing to 84.1% in 2011. This increase in significance is largely due to a reduction in the federal waters trawl fleet in California and recent large increases in revenue in the Dungeness crab fishery.
- Overall ex-vessel revenue in the region increased significantly since 2009 due to dramatic increases in revenue in the Dungeness crab fishery. Fishermen noted there were many factors influencing the growth of the Dungeness crab fishery which included reaching a peak in the natural cycle of the fishery, recent efforts to clean up the San Francisco Bay (an important nursery ground for crab), increased fishing effort from out of state and north coast fishermen, and expansion of both domestic and international markets.
- The average ex-vessel revenue per fisherman has been variable from pre to post MPA years, with notable increases in the Dungeness crab fishery as discussed above and decreases in the salmon fishery due the limited season of fishery (***Figure 2***).

FIGURE 1

COMMERCIAL FISHERMAN + EX-VESSEL REVENUE IN THE NORTH CENTRAL COAST



KEY:

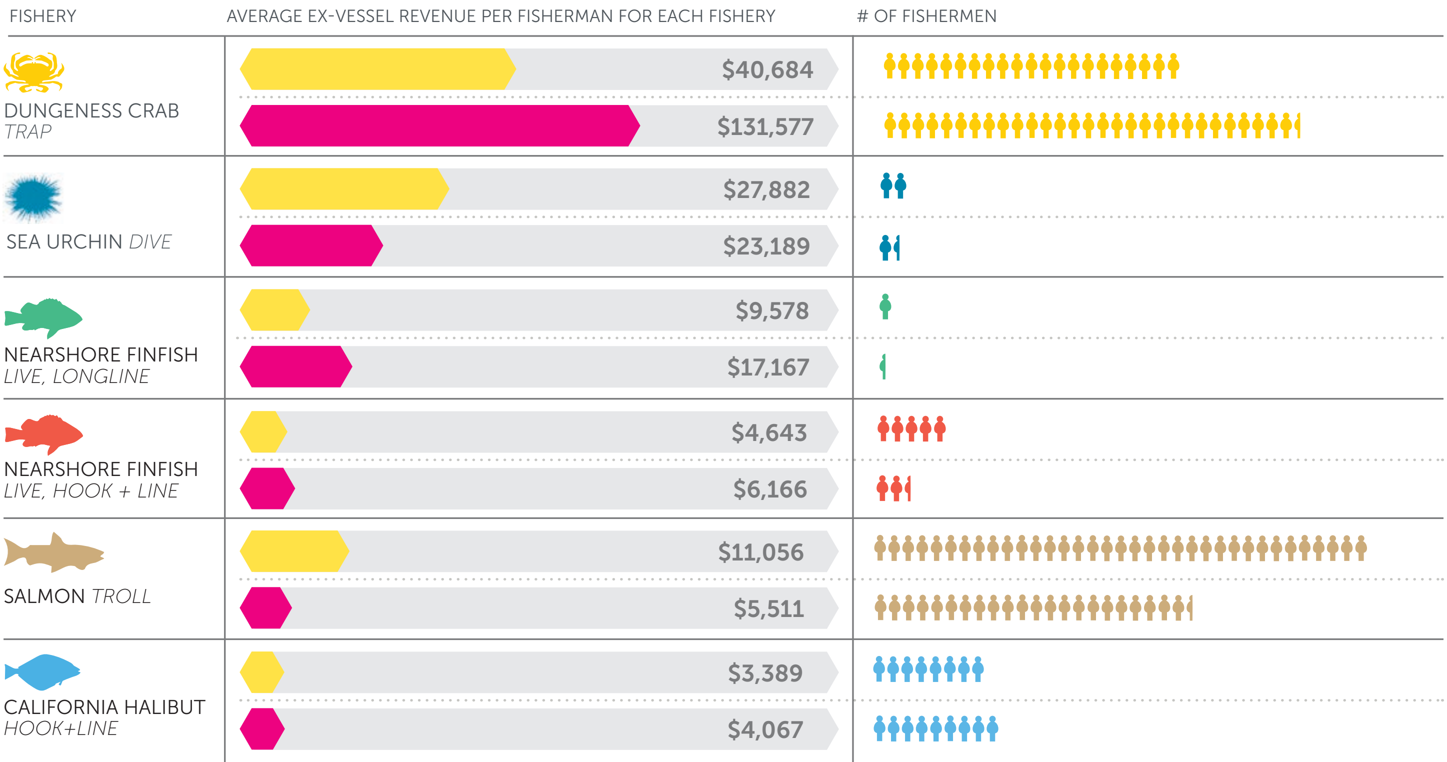
- = *OTHER*
- = URCHIN *DIVE*
- = SALMON *TROLL*
- = NEARSHORE FINFISH *LIVE, LONGLINE*
- = NEARSHORE FINFISH *LIVE, HOOK & LINE*
- = DUNGENESS CRAB *TRAP*
- = CALIFORNIA HALIBUT *HOOK & LINE*
- = # OF FISHERMEN

FIGURE 1
Fishery-specific commercial ex-vessel revenue and total number of fishermen, North Central Coast Region, 1992-2011

FIGURE 2

COMMERCIAL FISHERMAN + EX-VESSEL REVENUE IN THE NORTH CENTRAL COAST

= PRE-MPA: ANNUAL AVERAGE 2000-2009
= POST-MPA: 2011
= 10 FISHERMAN

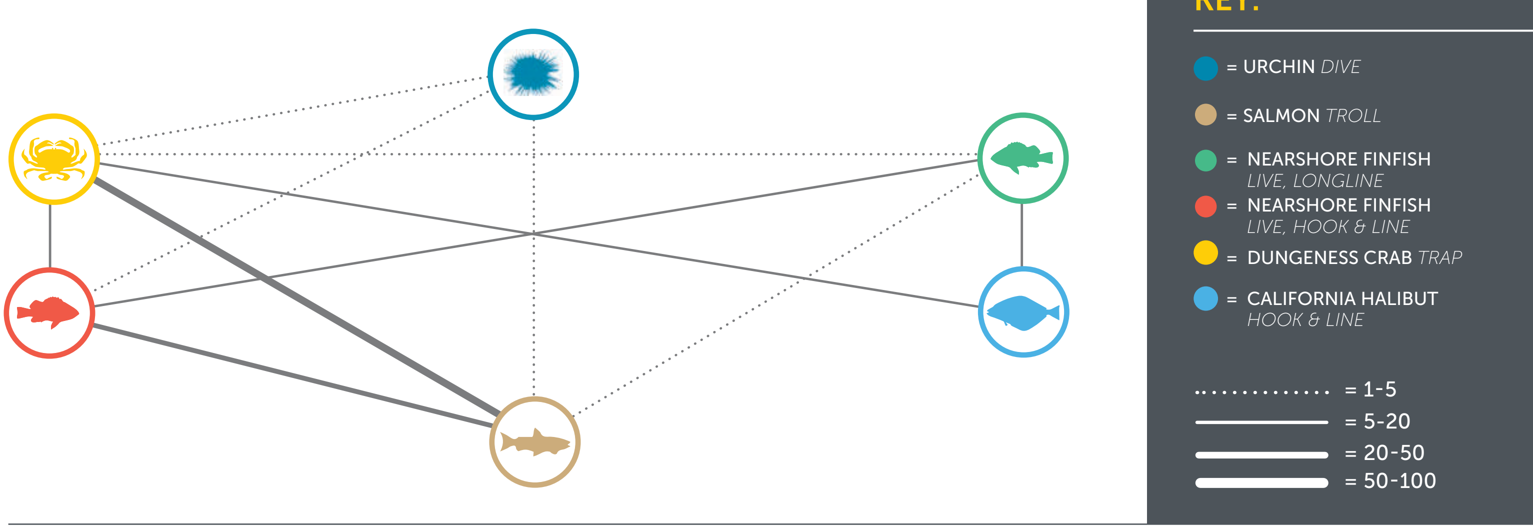


TOTAL # OF FISHERMEN: PRE-MPA = 563 / POST-MPA = 494

FIGURE 3

HOW MANY FISHERMAN PARTICIPATE IN MULTIPLE FISHERIES?

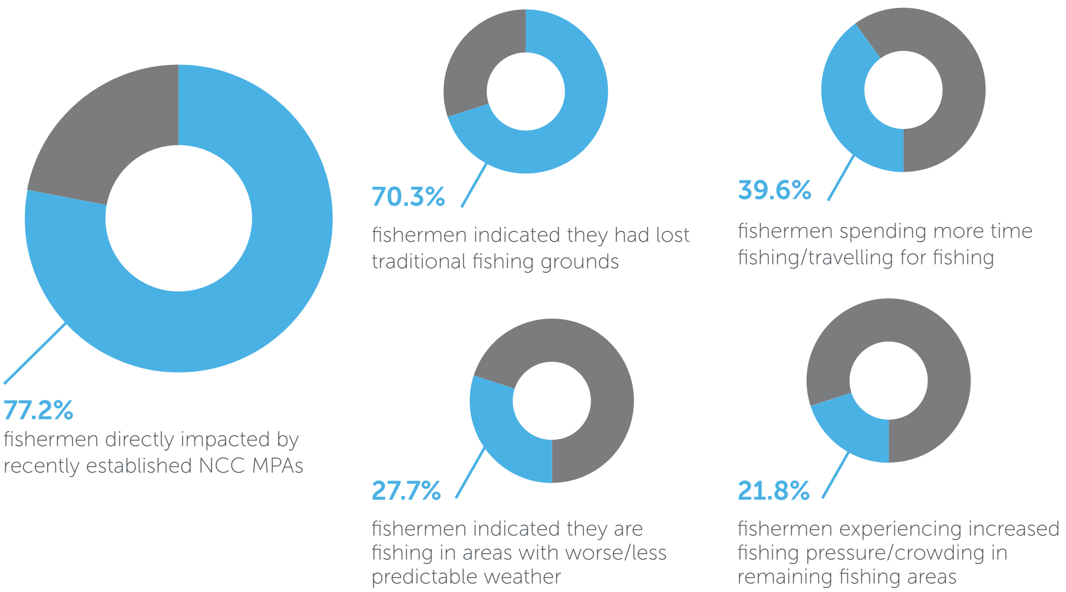
KEY:



MAJOR FINDINGS:
MARINE PROTECTED AREAS + COMMERCIAL FISHING

- Approximately 77.2% of fishermen interviewed indicated they had been directly impacted by recently established NCC MPAs.

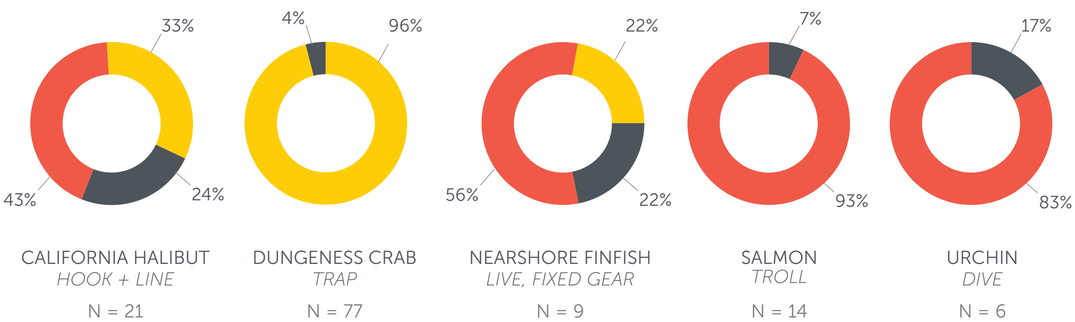
FIGURE 4



- Point Reyes State Marine Reserve is directly impacting the largest number of fishermen interviewed in the region (35.6%), followed by Stewarts Point State Marine Reserve (27.7%), and the Montara State Marine Reserve (22.8%).
- When asked to compare his/her success in specific fisheries compared to the previous five years the majority of Dungeness crab (trap) fishermen responded they were doing better, while the majority of fishermen in the nearshore finfish (live-fixed gear), salmon (troll), and urchin (dive) fisheries were doing worse (***Figure 5***).

FIGURE 5

How do you compare the success in your fishery last year to that of the previous five years?



KEY:

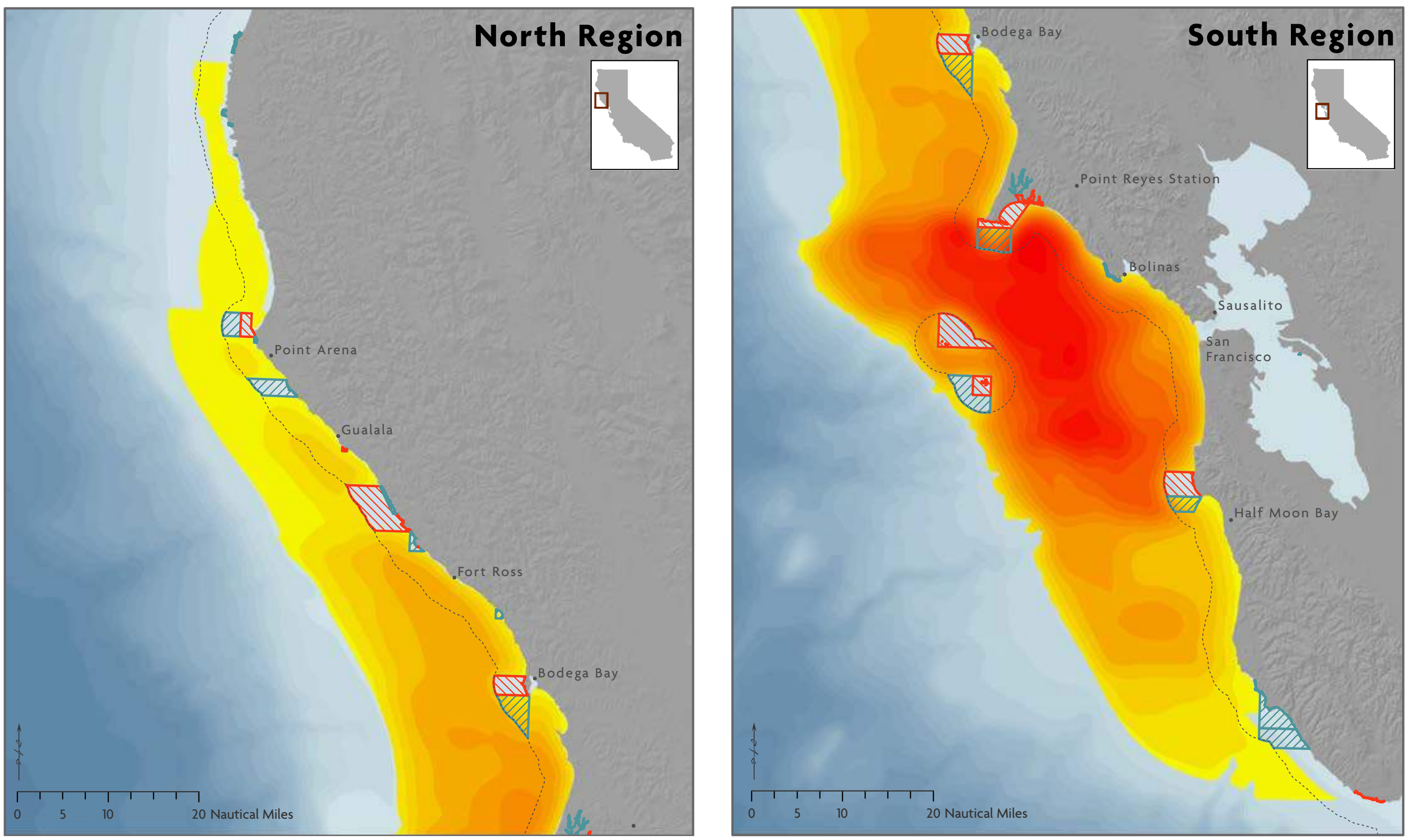
- = BETTER
- = THE SAME
- = WORSE
- N = NUMBER RESPONDING

MAJOR FINDINGS: SPATIAL FISHING PATTERNS

- Maps and spatial data sets were developed to establish a post-MPA baseline on the relative value of commercial fishing grounds for each commercial fishery at the port and region wide level (***Map 2***). These data can be used along with ecological data collected in and around MPAs to assess the impact of reductions or increases of fishing pressure on marine resources.

MAP 2

California North Central Coast 2010 Commercial Fishing Grounds & Landings
All ports – Dungeness crab (trap)



KEY **Survey Sample Size:** 79 | **Total Ex-vessel Revenue (2010):** $26,321,804.71 | **Percent of Ex-vessel Revenue Represented by Survey Sample:** 46.85%

MARINE PROTECTED AREAS

= State Marine Conservation Area = State Marine Reserve = State Marine Recreational Management Area

RELATIVE VALUE OF FISHING GROUNDS

low high

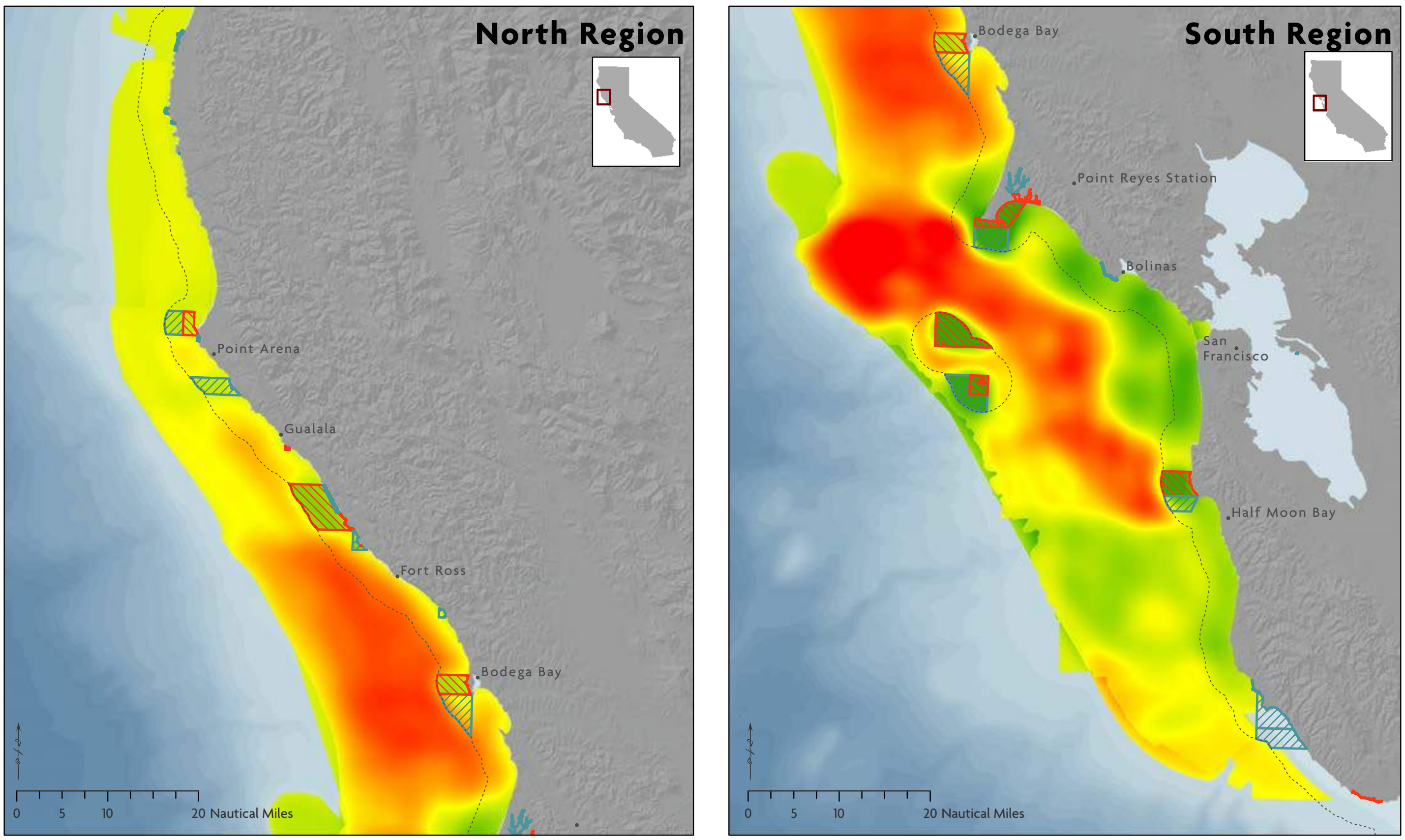
----------- = 3NM STATE WATER LINE

Dungeness crab (trap) commercial fishery map depicting the relative value of fishing grounds at the region-wide level for the 2010/2011 season.

- Maps and spatial data sets were developed to assess changes in spatial fishing patterns between pre- and post- MPA periods (***Map 3***). Developing a time series of spatial fishing patterns can help reveal how environmental and regulatory change may be influencing the location and value of fishing grounds.

MAP 3

California North Central Coast Spatial Analysis:
Relative Value of Commercial Fishing Grounds Pre-MPA (2007) to Post-MPA (2010), ALL PORTS Dungeness crab trap



KEY **Survey Sample Size:** 89 (2007) and 79 (2010) | **Percent of Ex-vessel Revenue Represented by Survey Sample:** 46% (2000-6) and 47% (2010)

MARINE PROTECTED AREAS

= State Marine Conservation Area

= State Marine Reserve

= State Marine Recreational Management Area

RELATIVE CHANGE IN VALUE OF FISHING GROUND

decrease — increase

----------- = 3NM STATE WATER LINE

Spatial change in the relative value of Dungeness crab (trap) commercial fishing grounds between pre- and post-MPA periods. Red areas indicate high relative increases in value and green indicates relative decreases in value.

COMMERCIAL PASSENGER FISHING VESSELS (CPFV)

INTRODUCTION & METHODS

Commercial Passenger Fishing Vessels (CPFV) are often called party-boats or charter fishing boats and make a business in taking members of the public to recreationally fish and, more recently, to enjoy non-consumptive type trips such as whale watching or leisure cruises. In a study conducted by Responsive Management in 2007, the majority of Californians (84.0 percent) agree that CPFV opportunities are important to maintain as they provide opportunities for people to experience coastal resources who otherwise would not be able to as they cannot afford a boat of their own.

The goal of this study was to establish a baseline characterization of the commercial passenger fishing vessel (CPFV) fleet of the California North Central Coast region. The results of this study provide a better understanding of the current economic health of the region's CPFV operations and provide a benchmark of economic conditions and spatial fishing patterns against which future MPA impacts and benefits can be measured. Our study provides three sets of primary findings:

1. A baseline characterization of spatial fishing patterns and the economic status of CPFV operators in the North Central Coast region;
2. An assessment of initial economic changes following MPA implementation; and
3. A qualitative investigation into the impact of NCC MPAs on CPFV operators and the specific MPAs impacting CPFV fisheries at the port and region scale.

To provide these findings our research team examined California Department of Fish and Wildlife CPFV logbook data and conducted in-person interviews with 30 CPFV operators who were operating in 2010 in the study region. The ports in which we targeted CPFV interviews were: Bodega Bay, Sausalito, Berkeley, Emeryville, San Francisco, and Half Moon Bay.

MAJOR FINDINGS

- On average from 2000 to 2011 the majority of fish caught (70.9%) in the region were rockfish; however, the majority of trips in the region (44.6%) target salmon (***Figure 6***).
- The total number of CPFV anglers has declined by approximately 46.1% from 2000 to 2011. This is largely due to general economic decline in recent years as well as the closure of the salmon fishery.
- The fisheries management closure of the salmon season in 2008 and 2009 caused dramatic decreases in the number of anglers, trips, and fish caught during those years.
- Total number of anglers, trips, and number of fish caught have increased since 2009 due to the reopening of the salmon season, but have generally not recovered to pre-2008 levels. This may be due to the recent economic recession and generally shorter salmon seasons.

- Approximately 93.3% of CPFV operators interviewed indicated they had been directly impacted by recently established MPAs. Fishermen noted the loss of traditional fishing grounds, travelling further to fish, fishing in areas with worse/less predictable weather, and increased fishing pressure in open fishing areas.
- Approximately 70% of CPFV operators indicated the various MPAs in the Farallon Islands have directly impacted them—specifically in the rockfish fishery.
- Maps and spatial data sets were developed to establish a post MPA baseline on the relative value of CPFV fishing grounds for each fishery at the port and region wide level (***Map 4***). These data can be used along with ecological data collected in and around MPAs to assess the impact of reductions or increases of fishing pressure on marine resources. Furthermore, developing a time series of spatial fishing patterns can help reveal how environmental and regulatory change may be influencing the location and value of fishing grounds.

FIGURE 6

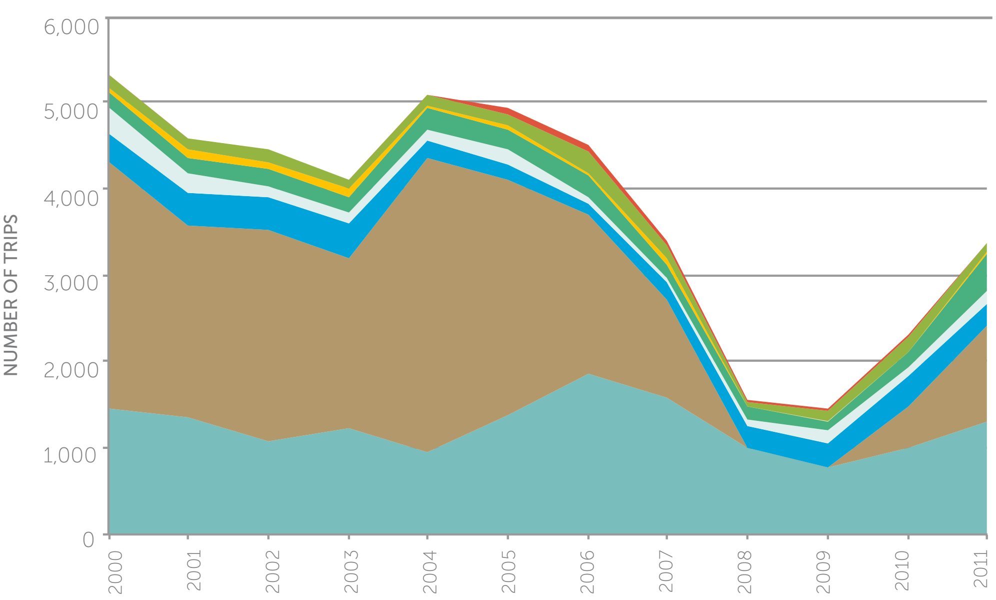
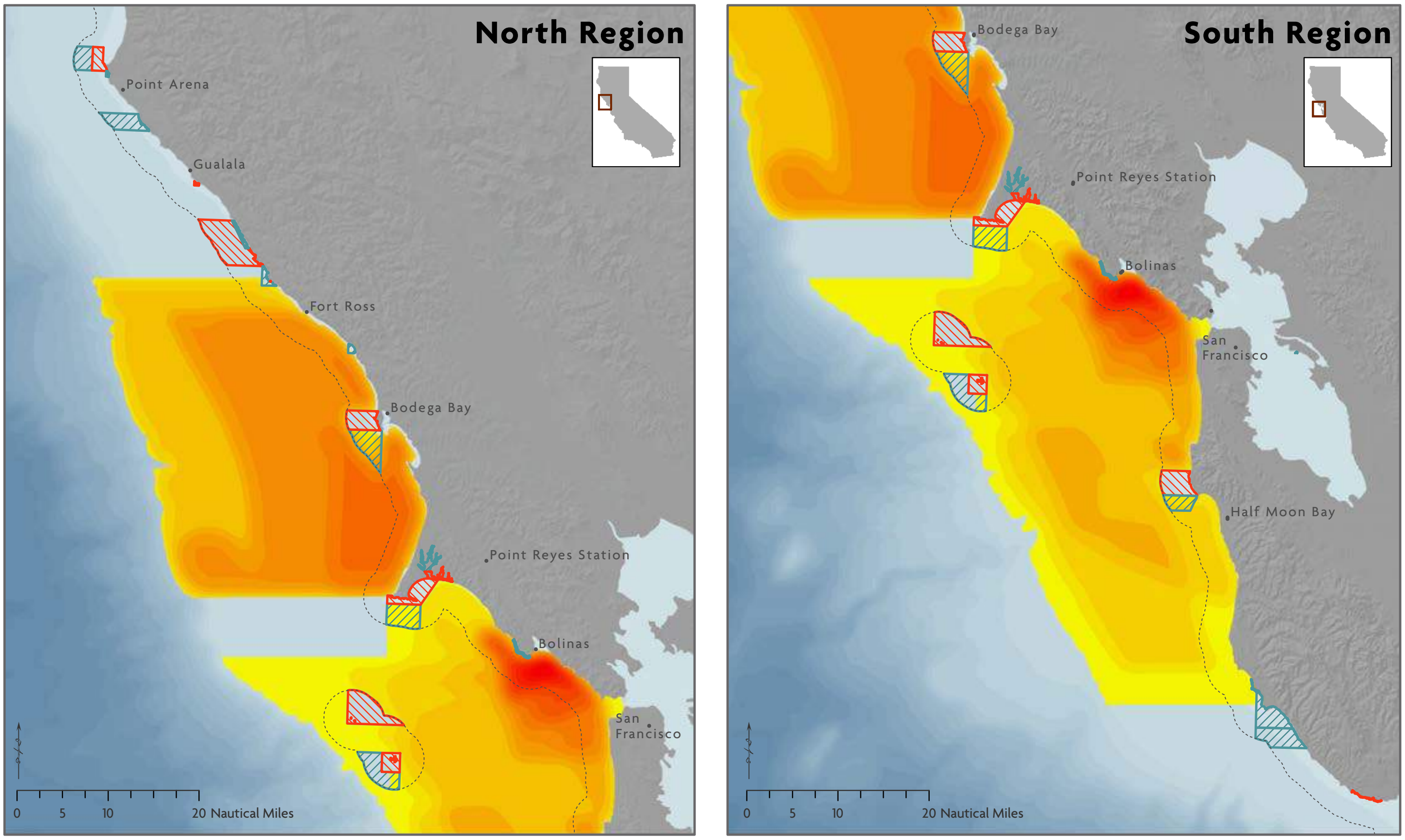


FIGURE 6
Number of CPFV trips by target fishery 2000-2011 North Central Coast Region

MAP 4

California North Central Coast 2010
Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
ALL PORTS – Salmon



KEY **Survey Sample Size:** 25 | **Total Number of Fish Caught (2010):** 2,277

MARINE PROTECTED AREAS

= State Marine Conservation Area
= State Marine Reserve
= State Marine Recreational Management Area

RELATIVE VALUE OF FISHING GROUNDS

low high

----------- = 3NM STATE WATER LINE

Map depicting the relative value of CPFV fishing grounds for the 2010 **salmon** fishing season at the region wide scale

RECREATIONAL ABALONE HARVESTING

INTRODUCTION & METHODS

Red abalone (*Haliotis rufescens*) is an important recreational fishery species in the North Central Coast of California. Historically harvested by American Indians and early settlers, this fishery remains integral to the cultural and economic history of the region. The results of this study provides a benchmark of user characteristics, economic contribution, and spatial harvest patterns against which future MPA impacts and benefits can be measured. Our study provides three sets of primary findings:

1. A baseline characterization of spatial harvest patterns at the punch card site and region wide level;
2. An economic baseline characterization of abalone harvesters that includes demographic characteristics, site selection preferences, and annual expenditures associated with recreational abalone harvesting; and
3. An investigation into marine protected areas awareness among recreational abalone harvesters in the region.

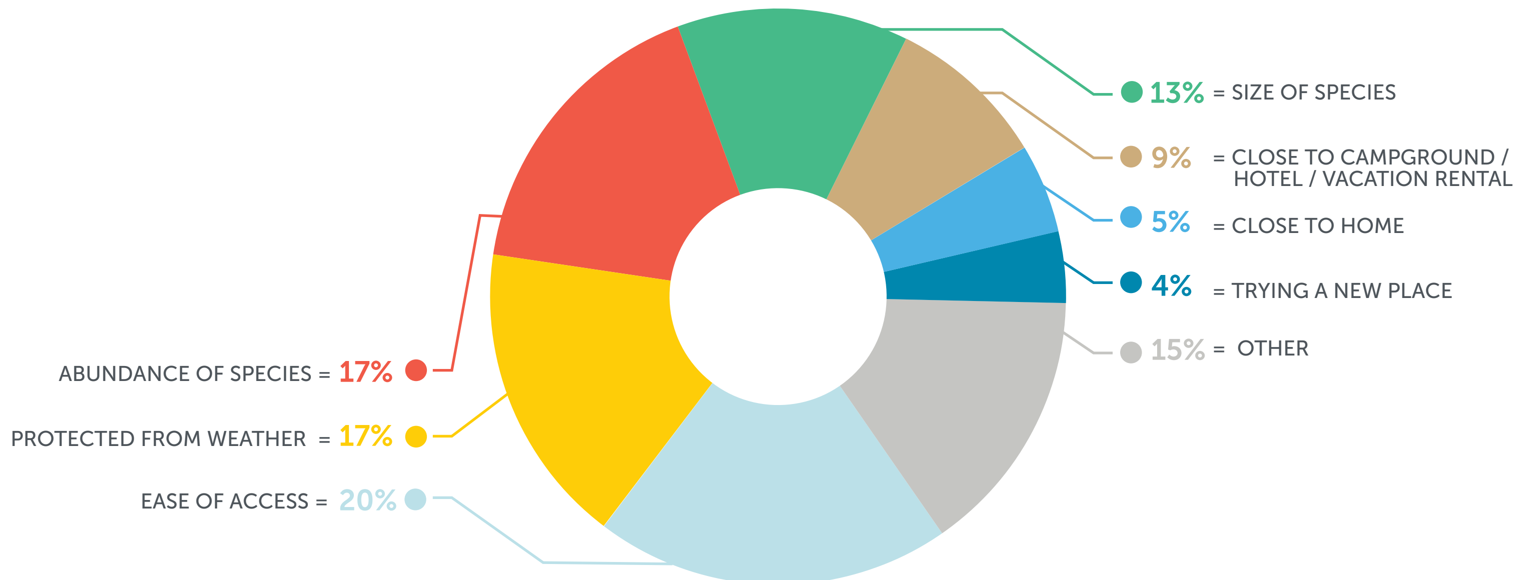
Ecotrust collaborated with key leaders in the recreational abalone fishery community to design the project survey instrument and utilized a randomly compiled database of abalone report card purchaser telephone numbers from the California Department of Fish and Wildlife (CDFW). To collect data, Ecotrust conducted phone interviews by randomly selecting individuals from the contact list provided by CDFW. Approximately 656 individuals were contacted; a total of 162 individuals responded and of those respondents 96 harvested abalone in 2010 in the region and completed a full interview.

MAJOR FINDINGS

- The average number of days spent harvesting abalone in 2010 was 5.9 days for abalone diving and 3.7 days for abalone shore picking.
- Approximately 89% of respondents indicated they were aware of the MPAs and largely knew of them through CDFW (37%) or word of mouth/friends (28%).
- Approximately 41% of respondents were aware of the Stewarts Point MPA, Salt Point MPA (36%), and Gerstle Cove MPA (28%).
- Approximately 30% of respondents indicated that they did not return in 2010 to a previously visited site due to the establishment of MPAs.
- The most popular punch card site used by survey respondents was Fort Ross/Reef Campground (25% of respondents) followed by Timber Cove (17% of respondents).
- Ease of access/entry (20% of respondents) was the primary reason respondents chose to harvest at a site followed by protection from weather (17%) and abundance of abalone (17%) (***Figure 7***).
- On average respondents spent $1,021 in recreational abalone harvesting expenditures each year.
- Spatial data sets and maps were developed displaying the extent and intensity of use for abalone punch card sites region wide (***Map 5***).

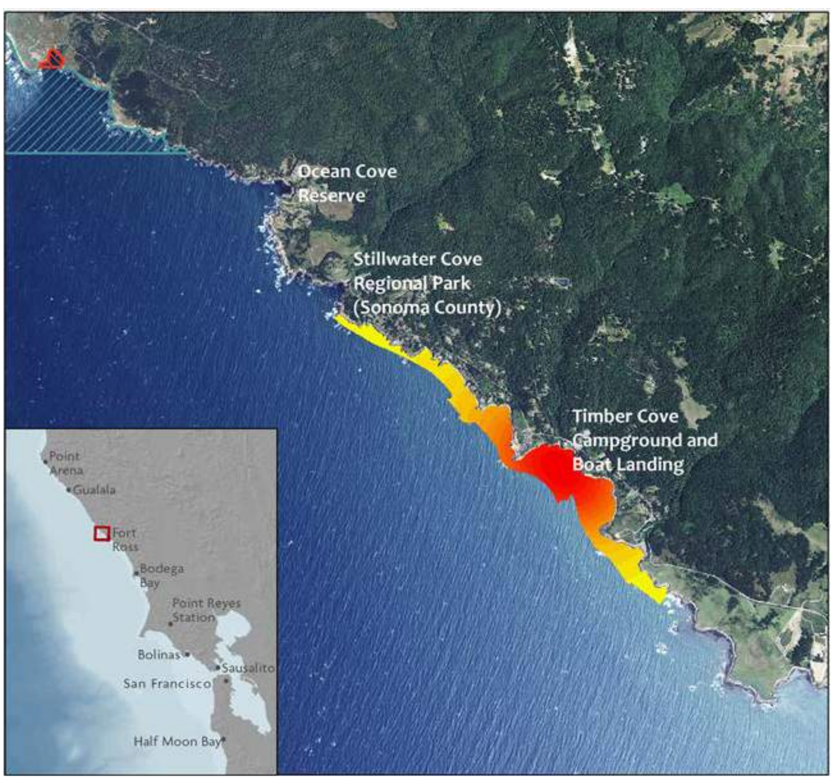
FIGURE 7

Primary reason for harvesting abalone at a specific site.



MAP 5

California North Central Coast Abalone Fishery Timber Cove Punch Card Site–
2010 Dive/Shore Picking Grounds



Survey Sample Size: 28

Weighted by the number of days that the Timber Cove punch card site was used in 2010.

MARINE PROTECTED AREAS

= State Marine Conservation Area

= State Marine Reserve

RELATIVE VALUE OF FISHING GROUNDS

low high

Map depicting extent and intenstiy of use at Timber Cove

CONCLUSION

During the years leading up to MPA establishment, the ocean environment, the regulatory environment, and the socioeconomic environment experienced several changes. The California Current System at this time was transitioning from a warm to a cold water regime which affected the availability of certain kinds of fish targeted by anglers. Major changes in regulations occurred for rockfish (season closures initiated in 2000 with the addition of depth closures starting in 2001) and salmon (in particular, closures in 2008 and 2009). Furthermore, a deep recession, which began in December 2007, and higher gas prices impacted people's livelihoods and discretionary monies. All of these factors affected fishing and other human uses in the study area to various degrees and continue to affect them in the post MPA period.

It is difficult to discern the specific effects of MPAs on fishing communities and human uses as they are confounded by a multitude of factors. However, advancing our understanding of how humans utilize, value, and rely upon marine space will be critical to unraveling these interconnections as well as monitoring how MPAs are benefitting or impacting fishing and coastal communities into the future. This information may then be used in adaptive management measures to improve the performance of MPAs towards meeting ecological and socioeconomic goals. Similarly, it is our hope that the data collected/compiled and lessons learned through this project will be applied to future MPA monitoring efforts to build a time series data set on how human uses and the socioeconomic health of fishermen and coastal communities are changing over time. This type of robust longitudinal dataset that provides both socioeconomic characterization and spatial patterns on human uses would provide much needed information to a wide array of marine planning and management applications and help inform socially and economically responsible management measures.

Questions or comments, please contact

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An Economic and Spatial Baseline of Coastal Recreation in the North Central Coast of California

Report to The California Sea Grant College Program

In partial fulfillment of Grant No. #09-015
through the California Sea Grant College Program

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EXECUTIVE SUMMARY

Coastal recreation provides significant economic and social benefits to coastal communities and to the state of California as a whole. These benefits include, for example, the financial impact of direct expenditures (e.g., hotel stays, dining, shopping), non-market benefits of coastal recreation, and associated enhanced human well-being. To understand the impact recently established marine protected areas (MPA) might have on future coastal recreation use patterns in the region it is necessary to establish a baseline of how many people use the coast, what they do, and the economic contributions of these different types of uses—especially in a geospatial context.

This study is a part of a larger baseline marine protected areas monitoring effort, entitled the North Central Coast (NCC) MPA Baseline Program, tasked with characterizing the ecological and socioeconomic conditions within the NCC region. The NCC study region extends from Alder creek in the north to Pigeon Point in the south. To investigate coastal recreation patterns in the NCC region, we utilized a standing internet panel hosted by Knowledge Networks (KN) designed to be demographically representative based on 2010 U.S. Census statistics. Through this sample methodology we surveyed 5,079 individuals in select NCC region counties to establish a baseline characterization of coastal visitation and recreation statistics and a spatial baseline of coastal recreation use patterns in the North Central Coast region. We focused on estimating spatial use and trip expenditure patterns among recreational users of the coast; we did not estimate non-market economic values.

Coastal trips to San Francisco County were most popular among respondents, constituting approximately 37.4 percent of total coastal trips. The county of San Mateo followed closely behind at 30.2 percent of total reported visits. Mendocino County had the fewest coastal visitors, at approximately 6.9 percent of survey respondents. The top five most popular coastal activities among survey respondents were scenic enjoyment (77.1 percent of study population participate in this activity in the last 12 months), beach going (65.2 percent), photography (41 percent), biking or hiking (39.3 percent), and watching birds and/or other marine life from shore (38.6 percent). Spatial data sets and maps are provided for coastal recreation overall and the top eight most popular coastal recreation activities, which include: scenic enjoyment; beach going; photography, biking or hiking; watching birds and/or other marine life from shore; sitting in the car watching the scene, beachcombing; and swimming or body surfing in the ocean. These maps display the extent and intensity of use for each specific activity.

This study also estimated the total number of coastal visitation trips and direct trip expenditures per year among the study population. Given that survey respondents took an average of 3.2 coastal trips per year, we estimated a total of 22.2 million trips per year among the study population. With respondents spending an average of $54.48 per trip, we estimated that the study population's total annual coastal visitation trip expenditures were approximately $1.2 billion. This is a higher bound estimate of coastal recreation trip expenditures as some coastal trips may not have had a coastal recreation component. With an estimated 86.9 percent of survey respondents indicating their last trip was for primarily coastal recreation purposes we further estimate the lower bound of coastal recreation trip expenditures of approximately $1.05 billion. This is a lower bound estimate as some coastal trips where the primary purpose was not recreation (e.g., work or school related) may have included a coastal recreation component.

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The North Central Coast MPA Baseline Program

This study is a part of a larger baseline marine protected areas monitoring effort, entitled the North Central Coast (NCC) MPA Baseline Program, tasked with characterizing the ecological and socioeconomic conditions within the NCC region. Specifically, this study addresses the Baseline Program objectives by describing human use patterns across the study region and establishing initial data points for long-term tracking of conditions and trends in the North Central Coast. This study is also a part of a four-part study conducted by Ecotrust to provide baseline estimates of the quantity, spatial distribution, and economic value of human uses—specifically human use in four specific sectors: coastal recreational, commercial fishing, commercial passenger fishing vessels, and the recreational abalone fishery in the NCC region.

Ecotrust

For more than 20 years, Ecotrust has converted $80 million in grants into more than $500 million in capital for local people, businesses, and organizations from Alaska to California. Ecotrust's Marine Consulting Initiative builds tools that help people make better decisions about the ocean. Our tools help visualize and map marine ecosystems and uses, bridge differing perspectives, and implement management decisions in a more inclusive and transparent way. The marine planning tools are part of Ecotrust's 20-year history of doing innovative things with knowledge, technology, and capital to create enhanced conservation and economic development for coastal communities on a global scale. Learn more at http://www.ecotrust.org.

For questions or comments, please contact Cheryl Chen, Marine Planning Project Manager, at Ecotrust,
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1. INTRODUCTION

Coastal recreation provides significant economic and social benefits to coastal communities and to the state of California as a whole. These benefits include, for example, the financial impact of direct expenditures (e.g., hotel stays, dining, shopping), non-market benefits of coastal recreation, and associated enhanced human well-being. To understand the impact recently established marine protected areas (MPA) might have on future coastal recreation use patterns in the region it is necessary to establish a baseline of how many people use the coast, what they do, and the economic contributions of these different types of uses—especially in a geospatial context.

This study is designed to establish a baseline characterization of coastal recreation participation rates and trip expenditures and provide a spatial baseline of coastal recreation use patterns in the North Central Coast region. A customized, web-based survey instrument, which utilizes Ecotrust's Open OceanMap survey and mapping technology, was used to collect spatially explicit data on coastal recreation. This survey utilized a standing internet panel hosted by Knowledge Networks (KN) designed to be demographically representative based on 2010 U.S. Census statistics. Knowledge Networks is a leader in deploying custom online surveys for various academic, governmental, and commercial applications. Ecotrust employed KN's services because the company specializes in probability sampling and providing statistically representative survey data through a peer-reviewed data collection methodology that reaches across the U.S. population, including many difficult-to-survey populations such as cell phone–only households, non-internet connected households, African Americans, Latinos, and young adults. It should be emphasized that respondents could not self-select for this survey and all respondents were sampled through Knowledge Network's methods.

Utilizing KN's services, Ecotrust in partnership with NaturalEquity designed this coastal recreation study to collect spatially explicit data on coastal recreation use patterns, characteristics, and associated trip expenditures. This would have been difficult to achieve using traditional mail or intercept survey methods. The advantage of deploying Ecotrust's survey tool in combination with KN's services was that all data collected constituted a weighted representative sample (based on U.S. Census data of household characteristics) of the larger study population. We extrapolated from this sample to the larger study population to estimate:

- Proportion of population that visits the coast each year and participation rates for specific coastal recreation activities;
- Spatial patterns of use for overall and specific coastal recreation activities;
- Direct financial impact of coastal recreation in the region; and
- Average per person and total number of coastal visitation trips taken each year.

The goal of this report was to focus on estimating general spatial use patterns and trip expenditures among recreational users of the coast. It should be emphasized that we did not estimate non-market economic values and that trip expenditures are but a portion of the overall economic value of coastal recreation. Furthermore, in this study we do not account for the secondary economic effects of coastal recreation such as the value (e.g., jobs and wages) of coastal recreation to support industries such as the local tourism economy. Indeed, additional valuation methods to investigate the full economic value of coastal recreation and their associated social and cultural value to the health of local economies and people are important to understand and account for in future monitoring efforts.

It is difficult to discern the effects MPAs will have on coastal recreation patterns and vice versa, however, advancing our understanding of how humans utilize, value, and rely upon coastal and ocean areas will be critical to monitoring how MPAs and other management decisions can best benefit coastal communities into the future.

1.1. Coastal Recreation Survey Methods

The North Central Coast (NCC) region coastal recreation survey was launched in February of 2011 after extensive testing to ensure the mapping component of the survey tool would capture quality spatial data at the appropriate scale and in a user-friendly manner. In an effort to capture seasonal variations in coastal use, we collected data on the respondent's most recent coastal trip, and deployed the survey in four survey "waves" over a one-year period.

Data collection was completed in December 2011, and the data were then subsequently analyzed and synthesized. In the survey, respondents were asked to recount details of their coastal visitation trips over the previous 12 months and of their last trip, including information about the number of trips taken, participation in recreational activities, the location of activities, and expenditures made. This section describes the survey and analysis methods, and the results are presented in the following section. The survey questions regarding coastal visitation and recreation use can be found in Appendix A.

Our study population ("sample frame") was defined as the total resident population over the age of 18 years of California counties within our study area (see Figure 1). We chose this study population as the primary goal of this study was to investigate coastal recreation which is commonly defined as day trips to the coast (outside of daily routine) that does not typically involve an overnight stay (although some coastal recreation trip by residents we captured did involve lodging, see trip expenditure section below). We differentiate this from coastal tourism which is often defined as involving overnight stays. However, establishing clear distinction between the two categories is somewhat difficult as they undoubtedly overlap making isolation difficult in survey efforts. Furthermore, the value of coastal real estate also may overlap with the value of coastal recreation in the case of coastal resident who may often recreate on the coast but do not incur any trip expenditures. One may argue that the value of this type of coastal use is captured in coastal real estate values where the individual resides.

The results of this study were designed to largely encompass trip expenditures of coastal recreation. It should be noted; however, the results provided here also encompass some coastal tourism and visitation expenditures and conversely do not capture the value of coastal recreation stored in coastal real estate values.

These counties below were chosen as our study population as they are within a reasonable one-day's trip to the North Central Coast:

- Alameda
- Contra Costa
- Lake
- Marin
- Mendocino
- Napa
- Sacramento
- San Francisco
- San Mateo
- Santa Clara
- Santa Cruz
- Solano
- Sonoma

Table 1 displays the study population (6.9 million), the total population of the study area (9 million), and the population of the state of California (37.3 million).

Table 1. Number of survey respondents and 2010 population data

Area	Population
Study population (>18 yrs)	6,943,138
Study area total population	8,984,415
California state population	37,253,956

Source: Current study and data from the U.S. Census Bureau (2010)

Survey data were collected over four successive waves distributed across a calendar year to capture the seasonal variation in coastal use patterns. Table 2 displays the dates over which each wave was conducted and the respective number of respondents. Overall, the survey was completed by 5,079 respondents, however, there were more respondents in the first wave of the survey as we used this wave of the survey to determine an optimal sample size in each wave given the variance on the data collected and subsequently chose to reduce the sample size in subsequent survey waves. Table 3 displays the median survey length, ten minutes, and the total number of respondents that completed the mapping portion of the survey (3,018 which is approximately 60 percent of total respondents).

Table 2. Survey wave information

Survey wave	Wave dates	Respondents	%
Wave 1	Jan. 26–Feb. 23, 2011	1,996	39%
Wave 2	May 3–May 31, 2011	1,020	20%
Wave 3	Aug. 10–Sep. 7, 2011	1,028	20%
Wave 4	Nov. 1–Nov. 30, 2011	1,035	20%
TOTAL		**5,079**	**100%**

Source: Current study

Table 3. Survey length and completion

Total number of respondents	5,079
Median survey length (min)	10
# of respondents that completed the mapping portion	3,018

Source: Current study

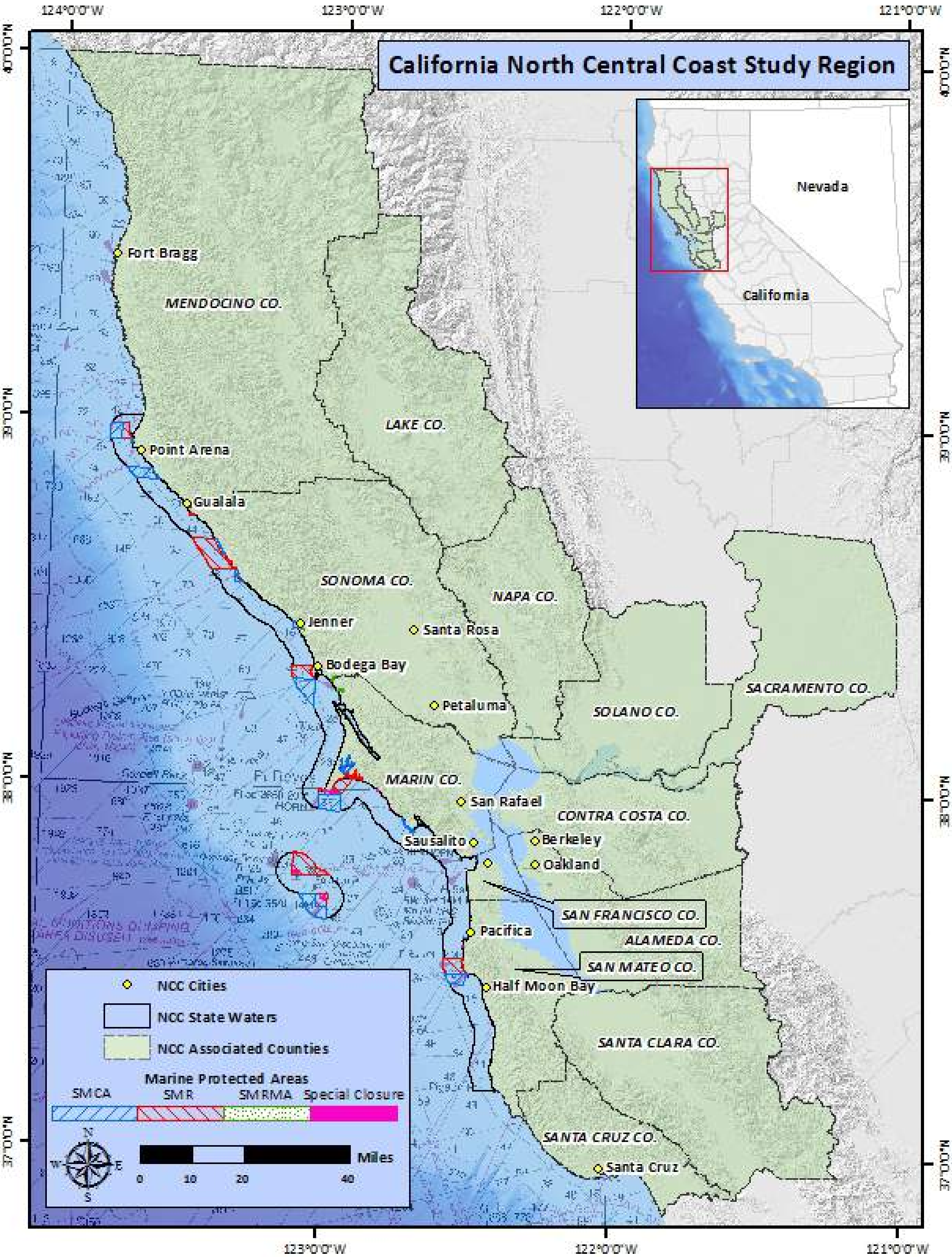
We incorporated verbatim the US Census Bureau demographic survey questions into our survey. We then compared our findings to US Census demographic findings as an indication of how representative our survey sample is of the sample frame, see Table 4. Our survey aimed to be representative of the study area population, and while our data are relatively well matched with 2010 Census findings, there are two exceptions: 1) females are overrepresented; and, 2) Hispanic people are underrepresented.

Table 4. Demographics of survey and study populations

Demographics	Survey respondents	Study area population
Male	34.1%	49.5%
Female	65.9%	50.5%
White, Non-Hispanic	63.8%	44.4%
Black, Non-Hispanic	3.5%	6.7%
Other, Non-Hispanic	21.8%	21.1%
Hispanic	8.4%	23.4%
2+ Races, Non-Hispanic	2.6%	3.6%

Source: Current study and data from the U.S. Census Bureau (2010)

Figure 1. North Central Coast Study Region



1.2. Coastal Recreation Data Analysis Methods

To analyze the survey data, Knowledge Networks provided a post-stratification survey-weighting methodology to more closely align our survey sample representation with the study population's demographics. Once the survey was complete, Knowledge Networks applied data weights informed by demographic data to adjust each respondent's contribution to overall survey results. A data weight is effectively a multiplier that adjusts a given respondent's contribution to compensate for a variety of both planned and unexpected disproportionate effects. The aim of post-stratification survey-weighting is to adjust the weight given to individual sample data based on demographic characteristics so as to better reflect the population they are intended to represent.[1]

Once all respondents completed the survey, Knowledge Networks provided the post-stratification survey weights, and Ecotrust used the statistical software R to apply the weights and analyze the data, determining the weighted means as well as confidence intervals[2] as presented in the results below.

To analyze data gathered regarding trip expenditures respondents made on their last trip, we took the following steps to ensure we utilized the best data possible to convey results:

- Respondents who did not indicate they had purchased an item were given a zero value expenditures for that item.
- If respondents indicated that they purchased an item but refused to provide a cost or answer for how many people the expenditure was made for, the entire cost-per-person estimate was assumed to be invalid and was removed from the sample.
- We provide two tables to present analysis results on trip expenditures:
    - The first table (Table 9) displays the average per-person expenditures made by respondents on their last trip. These expenditures are averaged across all respondents who indicated any expenditures, providing an average total trip expenditure estimate which can be scaled up to the larger study population.
    - The second table (Table 10) presents cost-per-person, averaged only across respondents who indicated expenditure for a given item. These values are not weighted and cannot be up scaled but provide information as to how much people on average are spending on expenditure items.

In addition to survey questions, respondents were asked to map the location where they conducted specific coastal recreation activities on their last trip. Details on this component of the survey effort and results are discussed in section 3.

[1] More details about Knowledge Network's post-stratification survey-weighting methods can be found on the KN website: http://www.knowledgenetworks.com/accuracy/summer2007/disogra.html

[2] Confidence intervals (CI) are statistical measures of variability which indicate the range of values in which the true value is likely to be given a specified probably, in this report confidence intervals are reported at 95 percent probability.

2. ESTABLISHING A COASTAL RECREATION ECONOMIC BASELINE

2.1. Trips and Activities

Table 5 displays the percentage of survey respondents who visited the NCC in the last twelve months, the average number of trips made annually over all respondents, and the primary reason and average number of nights spent per trip for respondents' last trip. Overall, 62.2 percent of respondents visited the NCC over the last twelve months. Across all respondents, that is including those who had not visited the NCC at all in the last twelve months, the average number of trips per year was 3.2. The primary reason for respondents' most recent trip to the coast was overwhelmingly for recreation (86.9 percent), followed by "other" primary reasons (9.7 percent). The most popular "other" fill-in response was to visit friends and family. On average, respondents spent approximately one night at the coast on their most recent coastal trip.

Table 5. NCC coastal visitation summary statistics

		Average % of total sample	95% Confidence Interval	
			Low	High
Last 12 months	Respondents who visited the NCC	62.2%	60.9%	63.6%
	Average # of trips over all respondents	3.20	2.81	3.59
Last Trip	Primary reason: Recreation	86.9%	85.8%	88.1%
	Primary reason: Work	3.0%	2.4%	3.5%
	Primary reason: School	0.3%	0.1%	0.5%
	Primary reason: Other	9.7%	8.7%	10.7%
	Average number of nights per trip	1.09	1.05	1.13

Source: Current study

Table 6 displays the distribution of coastal trips reported by survey respondents over the last 12 months, including confidence intervals. Coastal trips to San Francisco County were most popular among respondents, constituting approximately 37.4 percent of total coastal trips. The county of San Mateo followed closely behind at 30.2 percent of total reported visits. Mendocino County had the fewest coastal visitors, at approximately 6.9 percent of survey respondents.

Table 6. Distribution of coastal trips reported in the last 12 months

County	Average % of total sample	95% Confidence Interval	
		Low	High
Mendocino	6.9%	4.7%	8.3%
Sonoma	9.1%	10.6%	8.1%
Marin	16.4%	14.8%	17.4%
San Francisco	37.4%	40.4%	35.6%
San Mateo	30.2%	29.5%	30.6%

Source: Current study

Table 7 displays the activity participation rates of survey respondents over the last 12 months. The top five most popular activities among survey respondents were scenic enjoyment (77.1 percent), beach going (65.2 percent), photography (41 percent), biking or hiking (39.3 percent), and watching birds and/or other marine life from shore (38.6 percent). The confidence intervals for each of these participation rates are also displayed in Table 7. Approximately 15.2 percent of survey respondents indicated that they also participated in “other” activities. The most popular activities people indicated as “other” activities were dinning, shopping, and camping.

Table 7. Activity participation in each activity in the last 12 months

Activity	Average % of total sample	95% Confidence Interval	
		Low	High
Scenic enjoyment	77.1%	75.6%	78.5%
Beach going (dog-walking, kite-flying, jogging, etc.)	65.2%	63.6%	66.8%
Photography	41.0%	39.4%	42.7%
Biking or hiking	39.3%	37.6%	40.9%
Watching birds and/or other marine life from shore	38.6%	37.0%	40.2%
Sitting in your car watching the scene	36.6%	35.0%	38.2%
Collection of non-living resources/beachcombing (agates, fossils, driftwood)	15.1%	13.9%	16.4%
Swimming or body surfing in the ocean	11.8%	10.7%	12.9%
Fishing (hook and line) from pier/shore	7.2%	6.4%	8.1%
Kayaking in the ocean or estuary/slough	5.0%	4.2%	5.7%
Fishing (hook and line) from a boat	4.8%	4.1%	5.5%
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	4.3%	3.6%	5.0%
Surfing (board, boogie, stand-up paddle, kayak)	3.7%	3.0%	4.3%
Sailboating	2.7%	2.1%	3.2%
Powerboating	2.4%	1.9%	2.9%
Trap/net from pier or shore (crabbing)	2.4%	1.9%	2.9%
Free-diving/snorkeling (from shore, from boat)	2.4%	1.9%	2.9%
Scuba diving (from shore, from boat)	1.9%	1.4%	2.4%
Skimboarding	1.7%	1.2%	2.1%
Diving (picking or spear fishing) from a shore	1.4%	1.0%	1.8%
Using a personal water craft (jet skis)	1.3%	0.9%	1.6%
Trap/net from boat (crabbing)	0.9%	0.6%	1.2%
Diving (picking or spear fishing) from a boat	0.6%	0.4%	0.9%
Kiteboarding	0.6%	0.3%	0.8%
Windsurfing	0.6%	0.3%	0.8%
Surfing (tow-in)	0.4%	0.2%	0.7%
Hang gliding/parasailing	0.3%	0.1%	0.5%

Source: Current study

When asked specifically about coastal activities conducted on their most recent "last" trip, participant activity rates differed slightly, see Table 8. The top five activities respondents participated in on their last trip were scenic enjoyment (69.3 percent), beach going (44.5 percent), photography (37.7 percent), watching birds and/or other marine life from shore (28.3 percent), and scenery-watching from a car (27.3 percent). Approximately 14.3 percent of survey respondents indicated that they also participated in "other" activities. Again, the most popular activities people indicated as "other" activities were dinning, shopping, and camping. Table 8 also displays the confidence intervals for each activity participation rate.

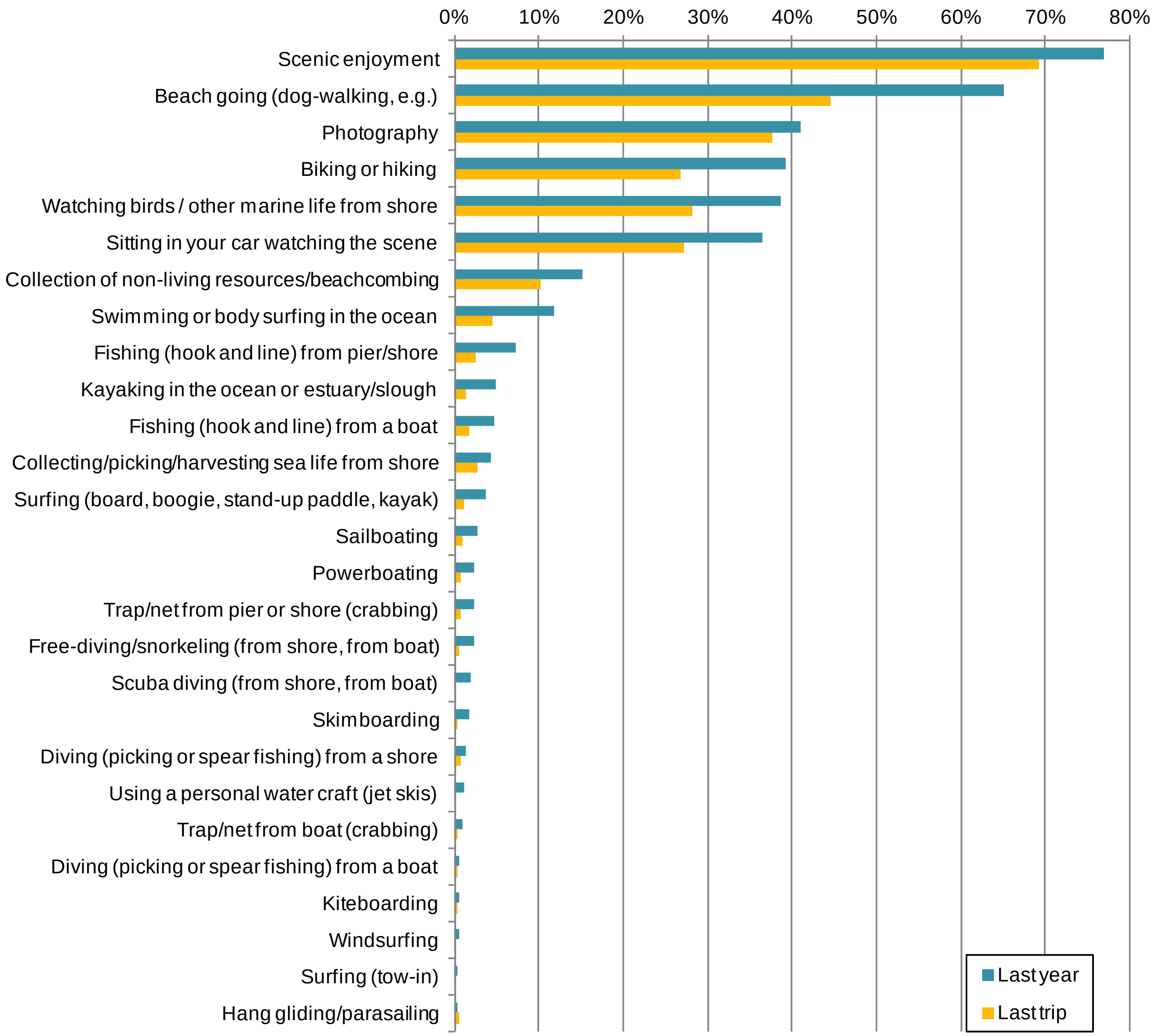
Table 8. Participation in each activity for the last trip

Activity	Average % of total sample	95% Confidence Interval	
		Low	High
Scenic enjoyment	69.3%	67.8%	70.9%
Beach going (dog-walking, kite-flying, jogging, etc.)	44.5%	42.8%	46.2%
Photography	37.7%	36.1%	39.3%
Watching birds and/or other marine life from shore	28.3%	26.8%	29.8%
Sitting in your car watching the scene	27.3%	25.8%	28.8%
Biking or hiking	26.8%	25.3%	28.3%
Collection of non-living resources/beachcombing (agates, fossils, driftwood)	10.3%	9.3%	11.3%
Swimming or body surfing in the ocean	4.4%	3.7%	5.1%
Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	2.8%	2.2%	3.3%
Fishing (hook and line) from pier/shore	2.5%	1.9%	3.0%
Fishing (hook and line) from a boat	1.7%	1.3%	2.2%
Kayaking in the ocean or estuary/slough	1.3%	0.9%	1.7%
Surfing (board, boogie, stand up paddle, kayak)	1.2%	0.8%	1.5%
Sailboating	1.0%	0.7%	1.4%
Trap/net from pier or shore (crabbing)	0.8%	0.5%	1.2%
Powerboating	0.7%	0.5%	1.0%
Diving (picking or spear fishing) from a shore	0.7%	0.4%	1.0%
Free-diving/snorkeling (from shore, from boat)	0.7%	0.4%	0.9%
Hang gliding/parasailing	0.5%	0.3%	0.8%
Skim-boarding	0.4%	0.2%	0.6%
Trap/net from boat (crabbing)	0.4%	0.2%	0.6%
Kiteboarding	0.4%	0.2%	0.6%
Diving (picking or spear fishing) from a boat	0.3%	0.1%	0.5%
Scuba diving (from shore, from boat)	0.3%	0.1%	0.4%
Using a personal water craft (jet skis)	0.3%	0.1%	0.4%
Windsurfing	0.2%	0.0%	0.3%
Surfing (tow-in)	0.1%	0.0%	0.3%

Source: Current study

Figure 2 shows reported activity participation rates comparing trips over the last twelve months to the most recent trip

Figure 2. Activity participation rates, last year and last trip



Source: Current study

2.2. Trip Expenditures

Table 9 displays the average expenditures made for each item across all respondents on their last trip. Averaged across all respondents (including those without dining expenses), the highest expense was food and beverage purchases at a restaurant or bar at approximately $18.46. These were also the most prevalent type of expenditures made, with 59.7 percent of respondents reporting such expenditures. The next largest average expenditure per respondent was lodging, at approximately $17.99 per trip, though only 18 percent of respondents reported these. Adding together the average expenditures per item across all items, we estimate a total trip expenditures figure at approximately $54.48 per person, per trip.

Table 9. Average trip expenditures per person by item across all respondents, last trip

Item	Average expenditures ($)	95% Confidence Interval Low ($)	95% Confidence Interval High ($)	% of observations
Food and beverages at a restaurant or bar	$18.46	$17.54	$19.39	59.7%
Lodging (if you stayed overnight)	$17.99	$16.14	$19.83	18.0%
Food and beverages from a store	$6.24	$5.74	$6.74	46.9%
Souvenirs (T-shirts, posters, gifts, etc.)	$3.28	$2.90	$3.66	14.3%
Parking	$2.51	$1.82	$3.20	25.3%
Museum, aquarium, or other entrance fee	$1.67	$1.44	$1.90	9.4%
Car rental	$0.84	$0.53	$1.15	1.6%
Sundries (sunscreen, surf wax, motion sickness pills, batteries, film and processing, etc.)	$0.54	$0.43	$0.65	5.8%
Boat rental	$0.49	$0.30	$0.69	1.1%
Charter fee (whale watching, etc.)	$0.44	$0.20	$0.68	0.7%
Bike rental	$0.34	$0.22	$0.47	1.3%
Lessons, clinics, camps	$0.30	$0.05	$0.54	0.6%
Kayak rental	$0.28	$0.14	$0.41	0.7%
Dive equipment rental and airfills	$0.28	$0.10	$0.45	0.4%
Boat fuel	$0.24	$0.12	$0.35	0.8%
Bait and tackle	$0.20	$0.14	$0.27	1.7%
One-day fishing license fee	$0.15	$0.09	$0.21	1.0%
Surfboard or bodyboard rental	$0.14	$0.05	$0.23	0.4%
Ramp fees	$0.06	$0.03	$0.10	0.8%
Hang glide rental	$0.02	$0.00	$0.06	0.1%
Total Expenditures	**$54.48**	**$47.98**	**$60.99**	

Source: Current study

Table 10 displays the average expenditure for each item across only respondents who indicated expenses for that item. In other words, among all respondents who spent money on lodging expenses, the average expenditure amount was approximately $99.42 per person per last trip. Lodging expenses in fact were the highest per person per trip average expenditure out of all items. This was followed by expenditures on dive equipment rental and airfills ($69.91) and on charter fees ($65.89). It is important to explicitly note that the average expenditures per item presented in Table 10 should not be added together. For example, only 0.4 percent of total respondents indicated expenses on dive equipment rentals. Because some of the sample sizes used to estimate the average expenditures presented in Table 10 were small, these amounts have not been weighted and are therefore not upscale-able to the population of the entire study area.

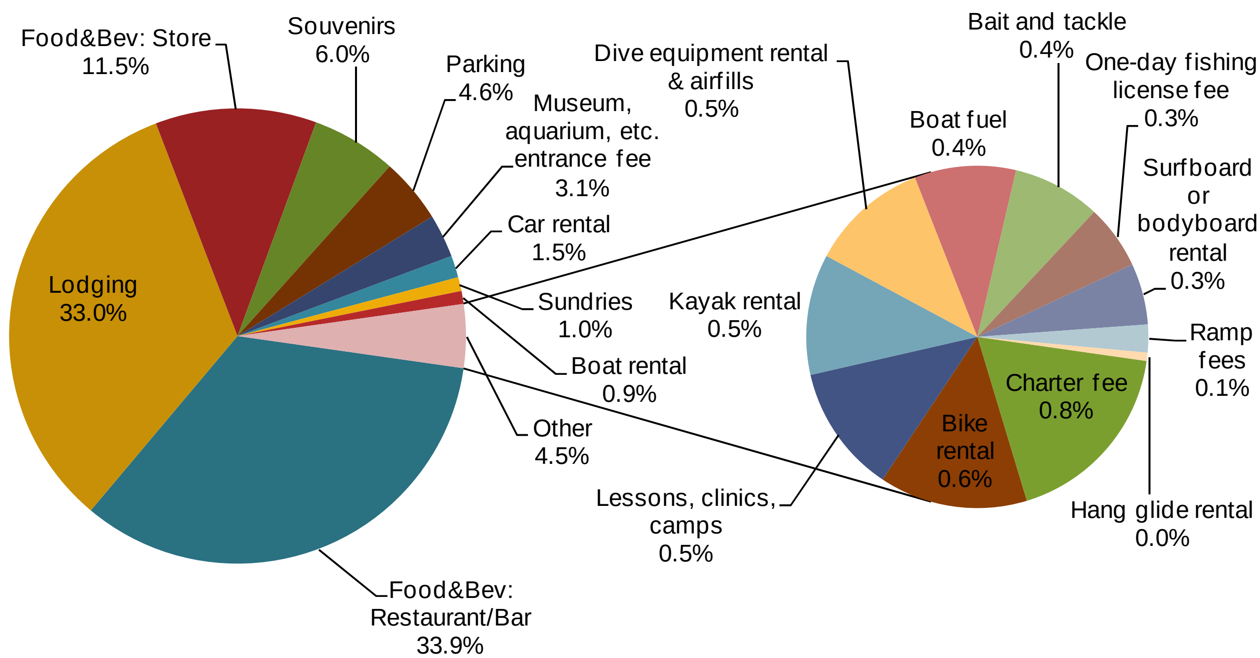
Table 10. Average expenditures per item per person across respondents reporting expenditures for a certain item, last trip

Item	Average expenditures ($)	95% Confidence Interval		% of observations
		Low	High	
Lodging (if you stayed overnight)	$99.42	$92.33	$106.52	18.0%
Dive equipment rental and airfills	$69.91	$44.73	$95.08	0.4%
Charter fee (whale watching, etc.)	$65.89	$44.88	$86.89	0.7%
Car rental	$53.14	$38.80	$67.47	1.6%
Lessons, clinics, camps	$48.10	$8.91	$87.29	0.6%
Boat rental	$43.25	$33.20	$53.30	1.1%
Kayak rental	$37.27	$27.50	$47.03	0.7%
Surfboard or bodyboard rental	$36.93	$22.20	$51.67	0.4%
Food and beverages at a restaurant or bar	$30.94	$29.69	$32.19	59.7%
Boat fuel	$28.59	$19.34	$37.85	0.8%
Bike rental	$27.41	$21.71	$33.11	1.3%
Hang glide rental	$23.77	$0.00	$57.65	0.1%
Souvenirs (T-shirts, posters, gifts, etc.)	$22.89	$21.09	$24.69	14.3%
Museum, aquarium, or other entrance fee	$17.70	$16.18	$19.23	9.4%
One-day fishing license fee	$15.60	$11.90	$19.31	1.0%
Food and beverages from a store	$13.29	$12.36	$14.22	46.9%
Bait and tackle	$12.13	$9.22	$15.04	1.7%
Parking	$9.92	$7.28	$12.55	25.3%
Sundries (sunscreen, surf wax, motion sickness pills, batteries, film and processing, etc.)	$9.32	$8.04	$10.61	5.8%
Ramp fees	$8.56	$4.82	$12.31	0.8%

Source: Current study

Figure 3 displays the relative average expenditures made per person per trip for all items as displayed in Table 9. Expenditures on food and beverages and lodging combined make up 78.4 percent of the total average trip expenditure per person.

Figure 3. Average expenditure per trip for coastal recreation trip



Source: Current study

Table 11 displays the estimated total number of trips and direct expenditures per year among the study population. Given that survey respondents took an average of 3.2 coastal trips per year (average across all survey respondents), we estimated a total of 22.2 million trips per year among the study population. With respondents spending an average of $54.48 per trip, we estimated that the study population's total annual coastal visitation trip expenditures were approximately $1.2 billion (22.2 million trips x $54.48 per trip = $1.2 billion). This is a higher bound estimate of coastal recreation trip expenditures as some coastal trips may not have had a coastal recreation component. With an estimated 86.9 percent of survey respondents indicating their last trip was for primarily coastal recreation purposes, we estimate the lower bound of coastal recreation trip expenditure at approximately $1.05 billion. This is a lower bound estimate as some coastal trips where the primary purpose was not recreation (e.g., work or school related) may have included a coastal recreation component.

Table 11. Estimated number of trips and direct expenditures

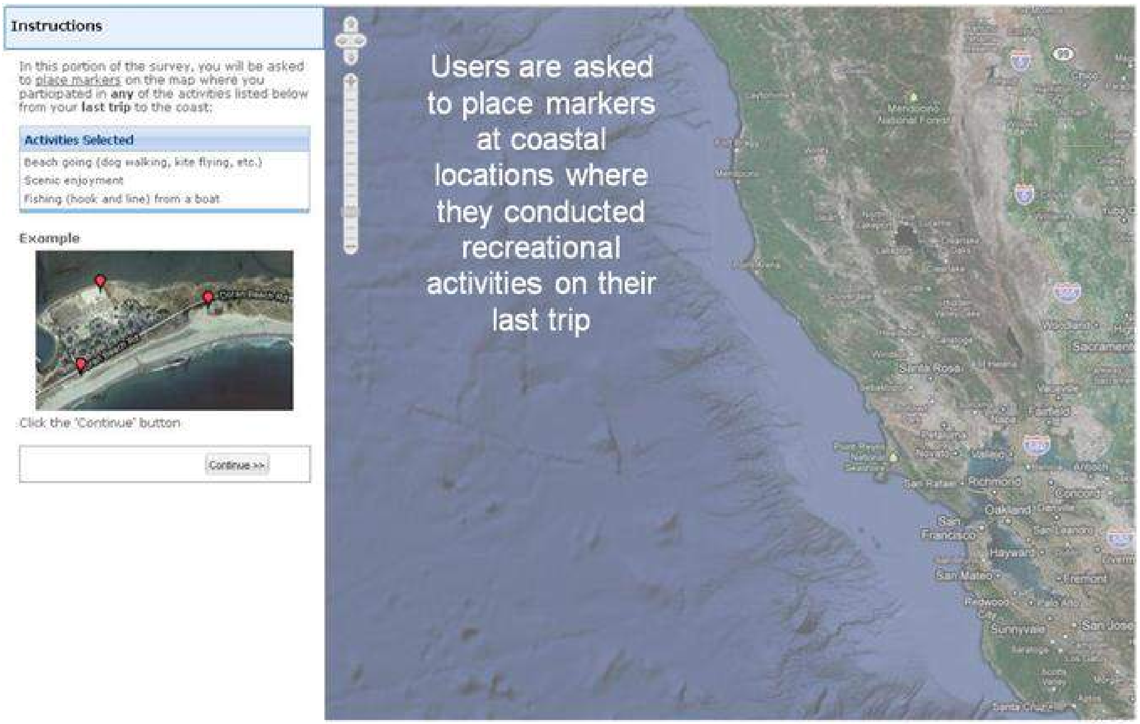
Study population (>18 yrs)	6,943,138
Average # of trips/year	3.20
Estimated number of trips for total study population	22,197,663
Average expenditure/trip	$54.48
Total estimated annual coastal visitation expenditures	**$1,209,258,380**
Percent of coastal trips where recreation was the primary purpose	86.9%
Total estimated annual coastal recreation trip expenditures	**$1,050,845,532**

Source: Current study

3. ESTABLISHING A COASTAL RECREATION SPATIAL BASELINE

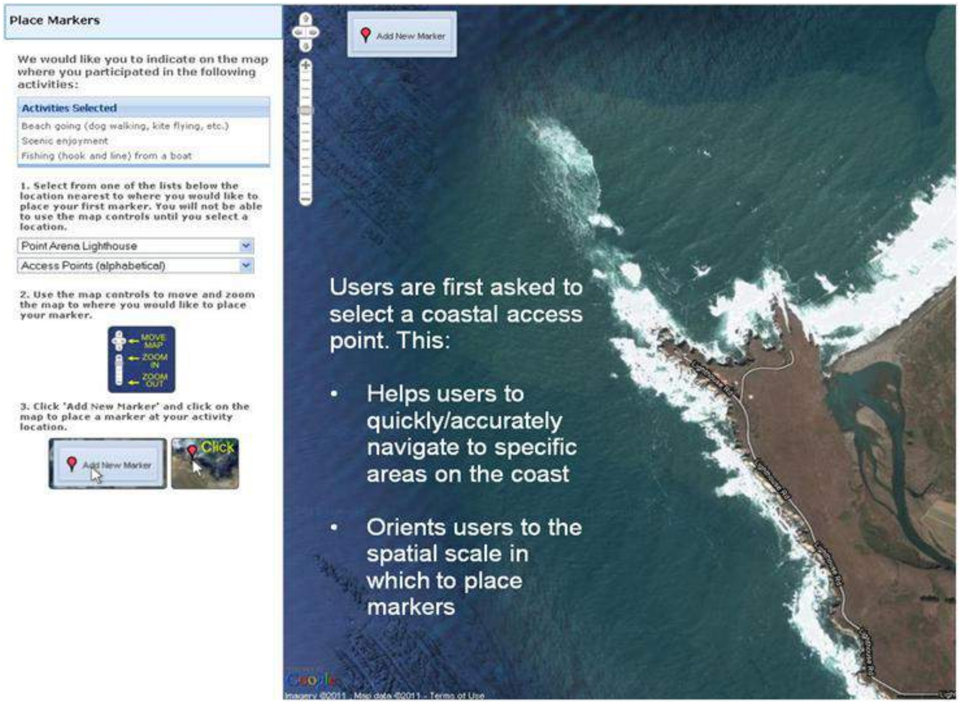
In addition to survey questions, respondents were asked to map the location of where they conducted specific coastal recreation activities on their last trip. To map locations, Ecotrust developed a sophisticated mapping tool utilizing Open OceanMap survey technology together with Google Maps (displayed in the screenshots below). The mapping tool was designed to be user-friendly and easily navigable. It required each respondent to zoom to a particular spatial scale in order to ensure that accurate and quality data were collected.

Figure 4. Screenshot of coastal recreation survey: Map interface



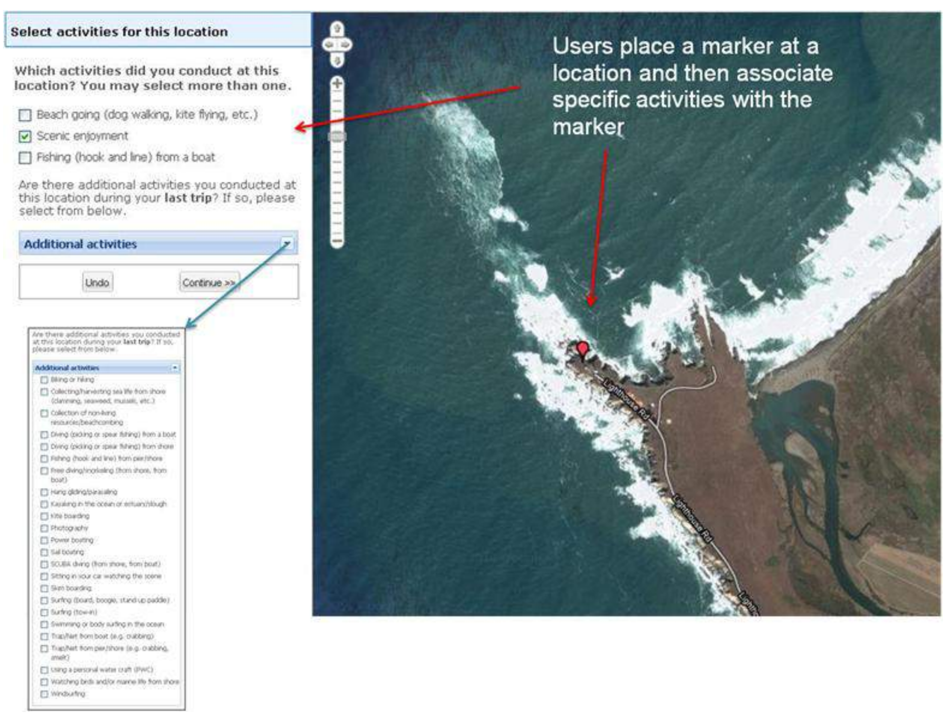
Source: Ecotrust

Figure 5. Screenshot of coastal recreation survey: Map navigation



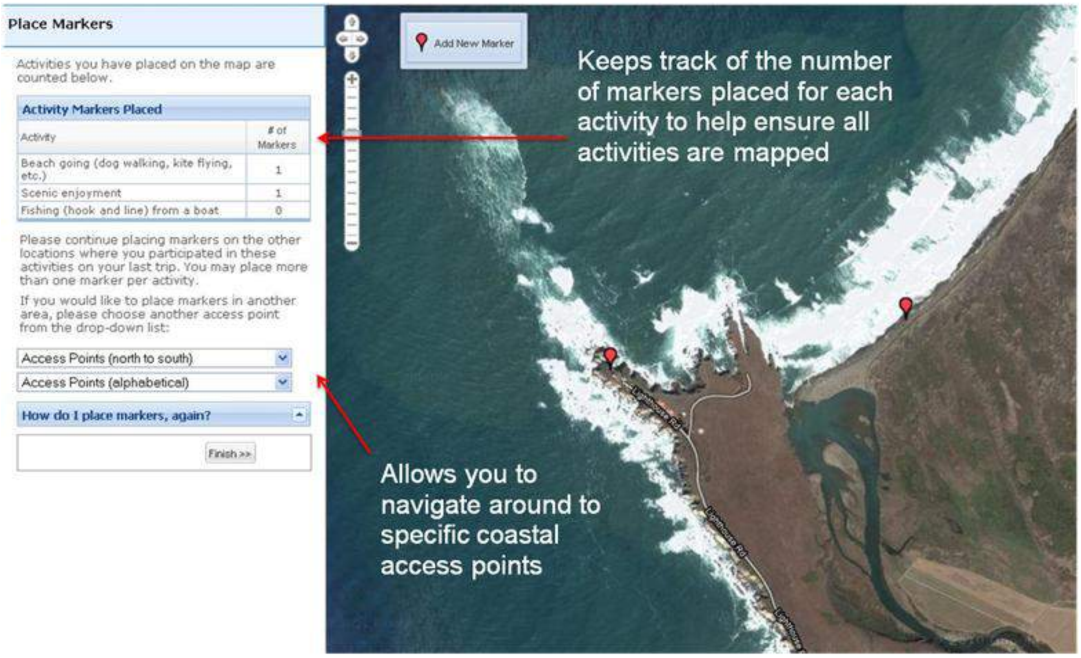
Source: Ecotrust

Figure 6. Screenshot of coastal recreation survey: Placing activity markers



Source: Ecotrust

Figure 7. Screenshot of coastal recreation survey: Tracking activity markers



Source: Ecotrust

As noted above the data were collected in four waves to capture seasonal variations in coastal recreation use patterns. The spatial data are a combined set across all four survey waves. The survey respondents provided information by placing a point or marker on a map and then indicated which activity or activities they conducted at each specific location on their last trip (Figure 6). There were a total of twenty-seven activities mapped, but only eight activities had a large enough sample (>100 point markers) to create a robust map product. Appendix B of this report contains maps depicting the spatial patterns of use (distribution and intensity of use) across the region for coastal recreation overall and for those select coastal recreation activities. Table 12 indicates the number of makers placed per activity per survey wave for all activities.

To create the spatial data, Ecotrust utilized a kernel density analysis in ArcGIS. The kernel analysis is a nonparametric statistical method for estimating probability densities from a set of point data. Conceptually, a smooth raster surface is fitted over each point. The surface value is highest at the location of the point and diminishes with increasing distance (i.e., search radius), eventually reaching zero. Based on previous experience conducting a similar analysis in Oregon and after conducting several tests, the kernel density analysis on all activities was given a search radius of one mile.

Weights given to the markers placed by individual respondents were also used and incorporated into the kernel density analysis. As discussed above, these weights were created by Knowledge Networks to align respondent demographics with study population demographics. The resulting dataset is a smooth raster surface depicting the intensity use or density of an activity. Table 12 displays the total number of activity markers that respondents placed for each activity in the mapping survey.

Table 12. Number of markers placed for each activity in mapping survey

Activity name	Number of activity markers placed Wave 1	Wave 2	Wave 3	Wave 4	TOTAL
Scenic enjoyment	1,802	827	736	830	**4,195**
Photography	984	438	413	470	**2,305**
Beach going (dog-walking, kite-flying, etc.)	979	448	386	395	**2,208**
Watching birds and/or marine life from shore	637	319	283	339	**1,578**
Biking or hiking	634	300	233	314	**1,481**
Sitting in your car watching the scene	481	260	166	256	**1,163**
Collection of non-living resources/beachcombing	184	99	64	98	**445**
Swimming or body surfing in the ocean	56	38	23	20	**137**
Collecting/harvesting sea life from shore (clamming, seaweed, mussels, etc.)	34	13	7	11	**65**
Fishing (hook and line) from pier/shore	15	9	8	20	**52**
Surfing (board, boogie, stand up paddle)	18	10	11	7	**46**
Kayaking in the ocean or estuary/slough	14	8	6	13	**41**
Sailboating	7	12	12	5	**36**
Fishing (hook and line) from a boat	10	6	8	9	**33**
Powerboating	7	6	7	9	**29**
Trap/Net from pier/shore (e.g. crabbing, smelt)	10	7	3	3	**23**
Diving (picking or spear fishing) from shore	6	6	1	5	**18**
Free-diving/snorkeling (from shore, from boat)	5	6	4	2	**17**
Skimboarding	7	5	1	1	**14**
Using a personal water craft (PWC)	7	5	1		**13**
Trap/Net from boat (e.g. crabbing)	6	4	-	2	**12**
Hang gliding/parasailing	3	7	1	-	**11**
Diving (picking or spear fishing) from a boat	2	4	2	-	**8**
Kiteboarding	2	4	1	1	**8**
Scuba diving (from shore, from boat)	1	4	1	2	**8**
Windsurfing	2	4	-	-	**6**
Surfing (tow-in)	-	3	-	-	**3**
Total number of activity markers	**5,913**	**2,852**	**2,378**	**2,812**	**13,955**

Source: Current study

4. CONCLUSION

As stated above, the goal of this report was to focus on estimating general spatial use patterns and trip expenditures among recreational users of the coast. It should be emphasized that we did not estimate non-market economic values and that trip expenditures are but a portion of the overall economic value of coastal recreation. Furthermore, in this study we do not account for the secondary economic effects of coastal recreation such as the value (e.g., jobs and wages) of coastal recreation to support industries such as the local tourism economy. Indeed, additional valuation methods to investigate the full economic value of coastal recreation and their associated social and cultural value to the health of local economies and people are important to understand and account for in future monitoring efforts.

Coastal recreation generates significant economic revenues to coastal economies but also provides residents and visitors with non-market benefits and values that contribute to local and regional well-being. Despite this tremendous value of coastal resources, the question of how valuable these coastal recreation uses are and the value of the environmental attributes which draw people to these areas remain largely unanswered—especially in spatially explicit terms. In future studies we will build upon this current survey effort to collect and analyze this type of information. This information is critical to supporting coastal and ocean management by providing quantitative and spatial information that can be integrated in cost-benefit analyses, ecosystem-based impact assessments, or a long term monitoring program to inform coastal management/policy actions.

It is difficult to discern the effects MPAs will have on coastal recreation patterns and vice versa, however, advancing our understanding of how humans utilize, value, and rely upon coastal and ocean areas and environmental attributes will be critical to monitoring how MPAs and other management decisions can best benefit coastal communities into the future.

Appendix A. Coastal Recreation Survey Questions

The following is an exact copy of the survey text.

We are conducting a survey of coastal recreation that is practiced in North Central California coastal waters, estuaries and upland coastal areas. We want to hear from you even if you have not been to the coast recently.

SCREENER1. Do you currently live in California?

SCREENER2. Do you live in one of the following counties?
Alameda
Contra Costa
Lake
Marin
Mendocino
Napa
Sacramento
San Francisco
San Mateo
Santa Clara
Santa Cruz
Solano
Sonoma

Q1. We are interested in knowing about your coastal activity outside of San Francisco Bay. Have you been to the North Central California coast (dark blue area) at least once in the last 12 months? [Figure: Map of study region, with shaded area distinguishing West of Golden Gate Bridge.]

These questions are about your visits to the North Central California coast in the last year.

Q2a. Please estimate how many visits you have made to the North Central California coast in the last 12 months.

Q3. We are interested in knowing what you do when you go to the coast. For each of these activities, please indicate if you have participated in that activity during the last year (choose all that apply).
a. Beach going (dog walking, kite flying, jogging, etc.)
b. Biking or hiking
c. Collection of non-living resources/beachcombing (agates, fossils, driftwood)
d. Photography
e. Scenic enjoyment
f. Sitting in your car watching the scene
g. Watching birds and/or other marine life from shore
h. Fishing (hook and line) from pier/shore
i. Fishing (hook and line) from a boat
j. Diving (picking or spear fishing) from a boat
k. Diving (picking or spear fishing) from a shore
l. Trap/net from pier or shore (crabbing)
m. Trap/net from boat (crabbing)
n. Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)
o. Hang gliding/parasailing
p. Kite boarding
q. Skim boarding
r. Surfing (board, boogie, stand up paddle, kayak)
s. Surfing (tow-in)
t. Swimming or body surfing in the ocean
u. Windsurfing
v. Free diving/snorkeling (from shore, from boat)
w. Kayaking in the ocean or estuary/slough
x. Power boating
y. Sail boating
z. SCUBA diving (from shore, from boat)
aa. Using a personal water craft (jet skis)
bb. Other, please list:

Q4. Please share with us the locations you visited on the North Central California coast during the last 12 months. For each of the coastal areas on the map below, please indicate how many times you visited each of these coastal areas in the last 12 months. If you did not visit a particular coastal area, please choose 'zero'. Your best estimate of the location is fine. [MAP OF COASTAL COUNTIES AND TEXT BOX TO ENTER IN # OF VISITS]

Q5. For how long have you been visiting this area(s) and enjoying one or more of the activities you identified?
Just the last year
One to three years
About four to ten years
More than ten years
All my life

The following questions relate specifically to your last trip to the North Central California coast.

Q6. When did you last visit one of the coastal areas on the previously shown map? Your best estimate is fine. [Respondent presented with calendar to indicate date]

Q7. On your last trip, did you start your trip from your home?
Yes
No

Q8. What mode(s) of transportation did you use to get to the coast? (Choose all that apply)
Bus
Bike
Walking
Drove personal car
Drove a rented car
Rode with someone else – carpooled
Other, please specify:

Q9. How would you describe the car that you used to get to the coast?
Compact car, small sedan or light pick-up truck
Large sedan
Wagon
Mini-van
Cross-over
Sport utility vehicle
Standard pickup truck
Hybrid sedan
Other, please specify:

Q10. Approximately how many people (including yourself) went on that trip?

Q11. Please estimate how many of these people (including yourself) permanently reside in California.

Q12. Was recreation the primary reason for your trip to the coast or ocean?
Yes
No

Q13. What was the primary reason for your trip to the coast or ocean?
Work
School
Other, please specify:

Q14. Did you participate in any of the following activities during your last trip to the coast?
a. Beach going (dog walking, kite flying, jogging, etc.)
b. Biking or hiking
c. Collection of non-living resources/beachcombing (agates, fossils, driftwood)
d. Photography
e. Scenic enjoyment
f. Sitting in your car watching the scene
g. Watching birds and/or other marine life from shore
h. Fishing (hook and line) from pier/shore
i. Fishing (hook and line) from a boat
j. Diving (picking or spear fishing) from a boat
k. Diving (picking or spear fishing) from a shore
l. Trap/net from pier or shore (crabbing)
m. Trap/net from boat (crabbing)
n. Collecting/picking/harvesting sea life from shore (clamming, seaweed, mussels, etc.)
o. Hang gliding/parasailing
p. Kite boarding
q. Skim boarding
r. Surfing (board, boogie, stand up paddle, kayak)
s. Surfing (tow-in)
t. Swimming or body surfing in the ocean
u. Windsurfing
v. Free diving/snorkeling (from shore, from boat)
w. Kayaking in the ocean or estuary/slough
x. Power boating
y. Sail boating
z. SCUBA diving (from shore, from boat)
aa. Using a personal water craft (jet skis)
bb. Other, please list:

Q15. [GO TO ECOTRUST MAPPING PORTION OF SURVEY TO MAP LOCATION OF ACTIVITIES]

Q16. To help us improve future surveys, was the mapping portion of this survey easy to understand and use?
Strongly Agree
Somewhat Agree
Neither Agree nor Disagree
Somewhat Disagree
Strongly Disagree

Q17. How many nights did you spend at the coast during your last trip to the coast?

Q18. During your last trip to the coast, please indicate if your party spent money on the following items.
a. Parking
b. Food and beverages from a store
c. Food and beverages at a restaurant or bar
d. Souvenirs (t-shirts, posters, gifts, etc.)
e. Sundries (sunscreen, surf wax, motion sickness pills, batteries, film and processing etc.)
f. Boat rental

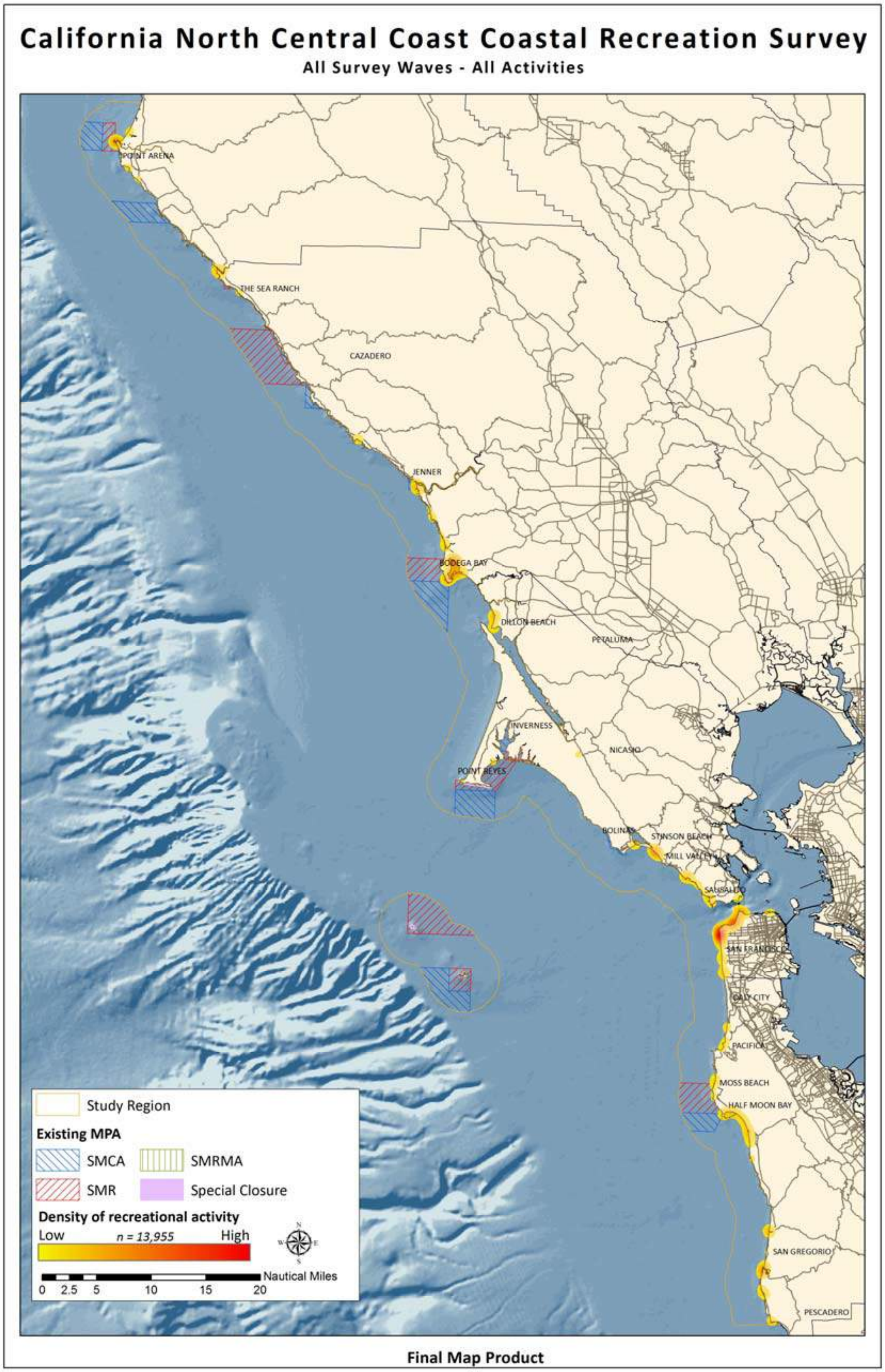
g. Car rental
h. Dive equipment rental and airfills
i. Kayak rental
j. Surfboard or bodyboard rental
k. Bike rental
l. Boat fuel
m. Ramp fees
n. Bait and tackle
o. Lodging (if you stayed overnight)
p. Charter fee (whale watching, etc.)
q. Museum, aquarium, or other entrance fee
r. Lessons, clinics, camps
s. One-day fishing license fee
t. Hang glide rental

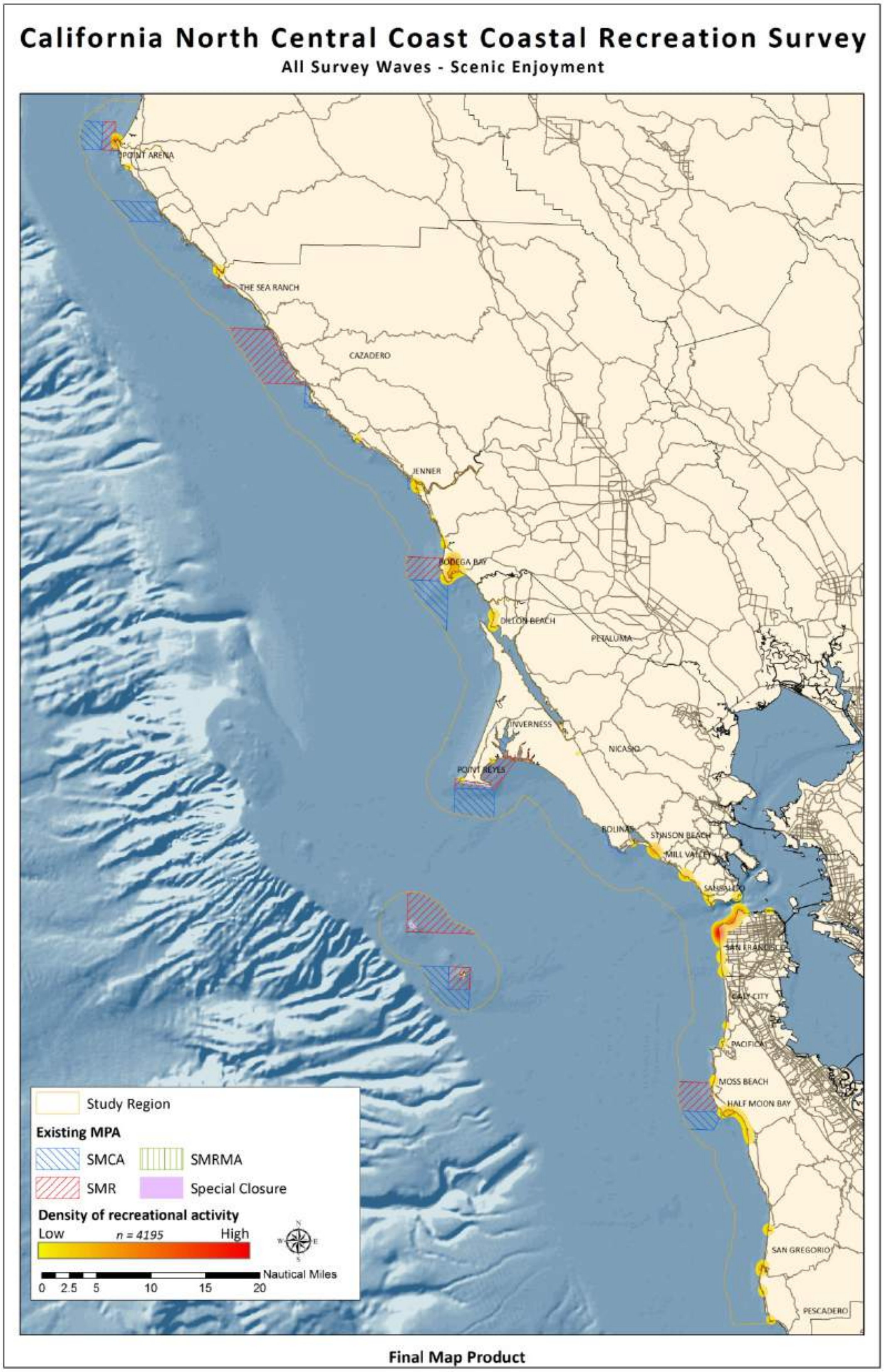
Q19. During your last trip to the coast, please estimate how much your party spent on the [above indicated] items and whether the expenditure occurred within 30 miles of the coast.

Q20. Please estimate the number of miles driven during your last trip to the coast (roundtrip).

A series of demographic and other questions were also included by Knowledge Networks

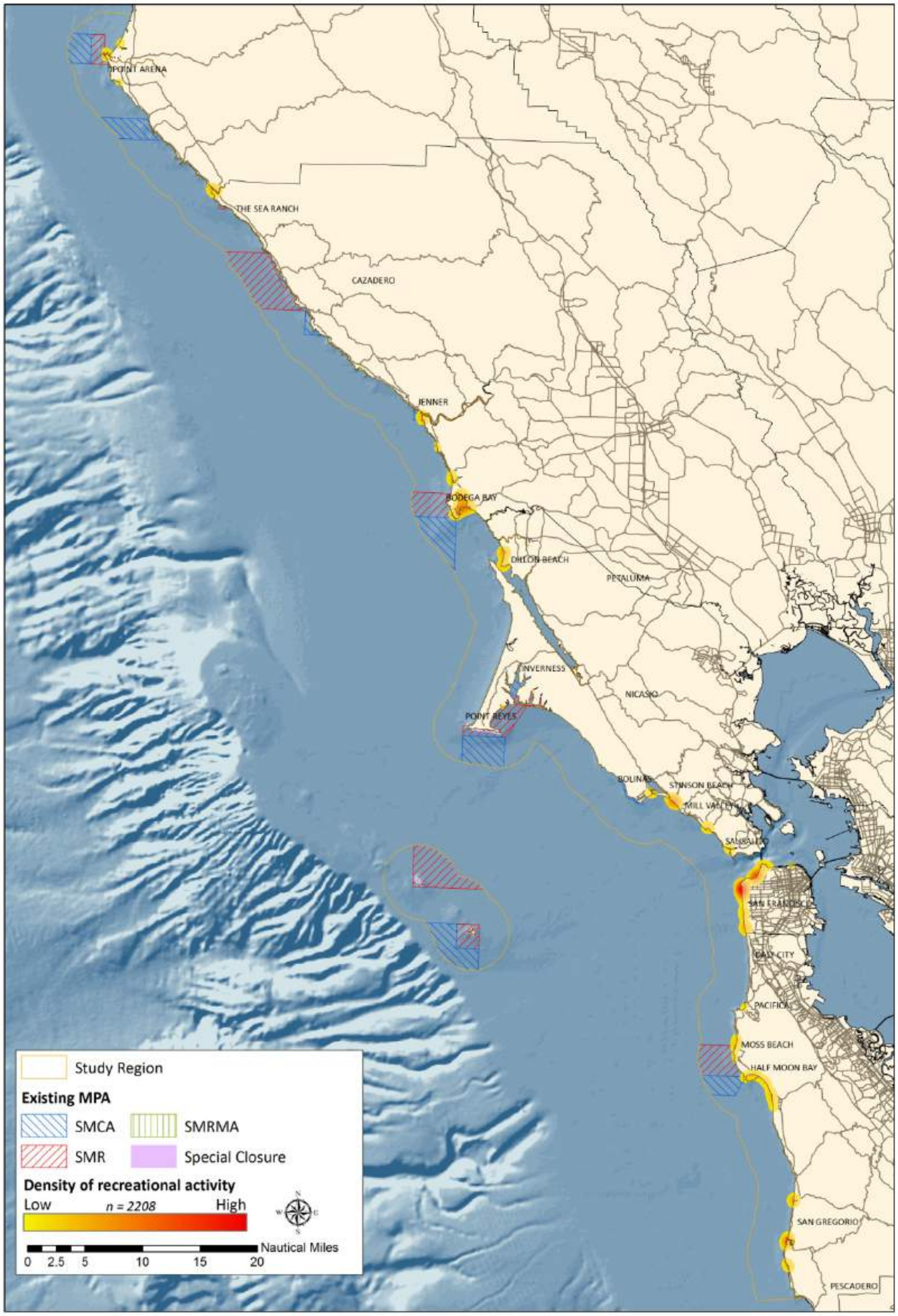
Appendix B. Coastal Recreation Map Products




California North Central Coast Coastal Recreation Survey
All Survey Waves - Scenic Enjoyment
POINT ARENA
THE SEA RANCH
CAZADERO
JENNER
BODEGA BAY
DILLON BEACH
PETALUMA
INVERNESS
NICASIO
POINT REYES
BOLINAS
STINSON BEACH
MILL VALLEY
SAUSALITO
SAN FRANCISCO
DALY CITY
PACIFICA
MOSS BEACH
HALF MOON BAY
SAN GREGORIO
PESCADERO
Study Region
Existing MPA
SMCA
SMRMA
SMR
Special Closure
Density of recreational activity
Low
n = 4195
High
Nautical Miles
0 2.5 5 10 15 20
Final Map Product

California North Central Coast Coastal Recreation Survey

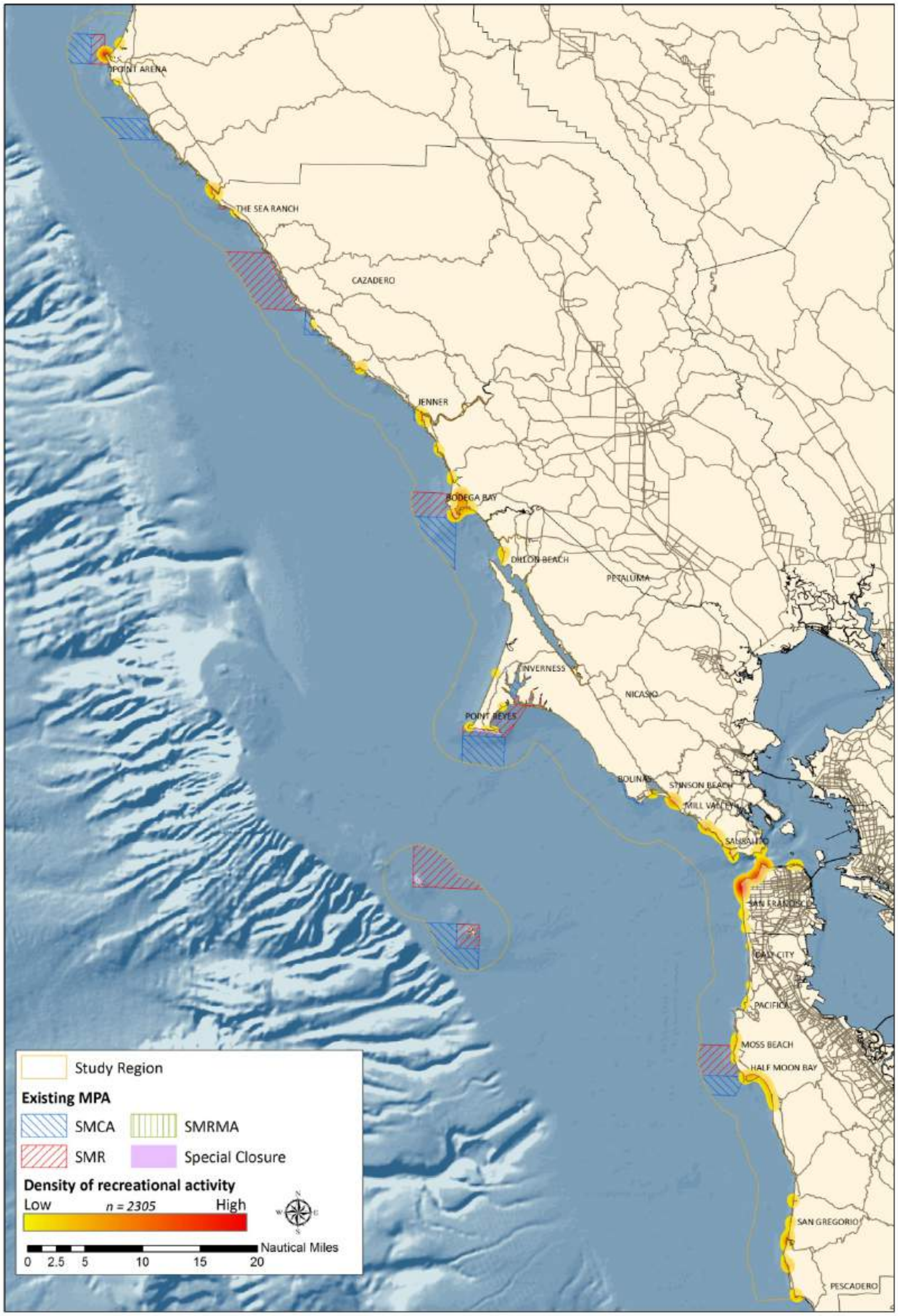
All Survey Waves - Beach Going



Final Map Product

California North Central Coast Coastal Recreation Survey

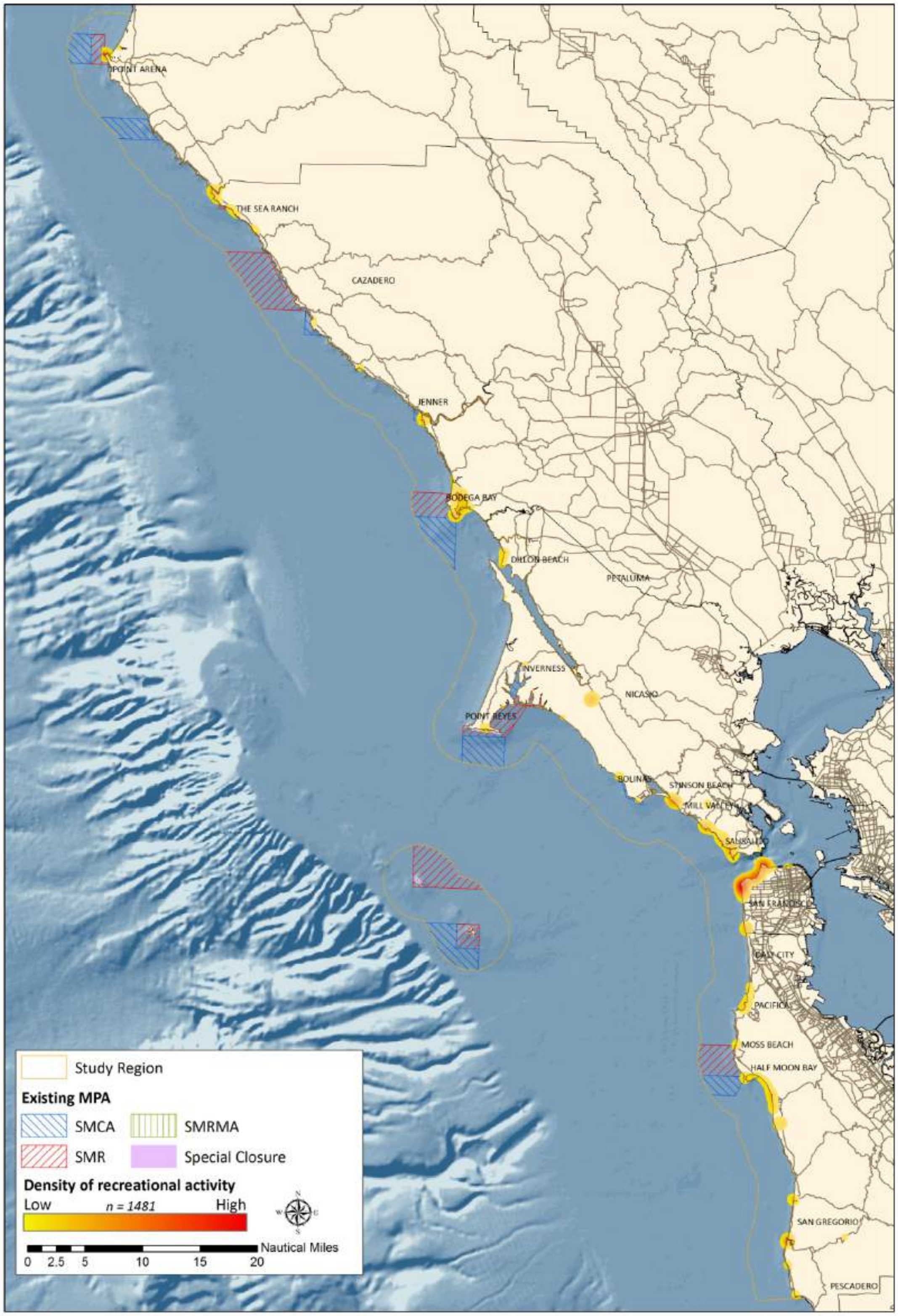
All Survey Waves - Photography



Final Map Product

California North Central Coast Coastal Recreation Survey

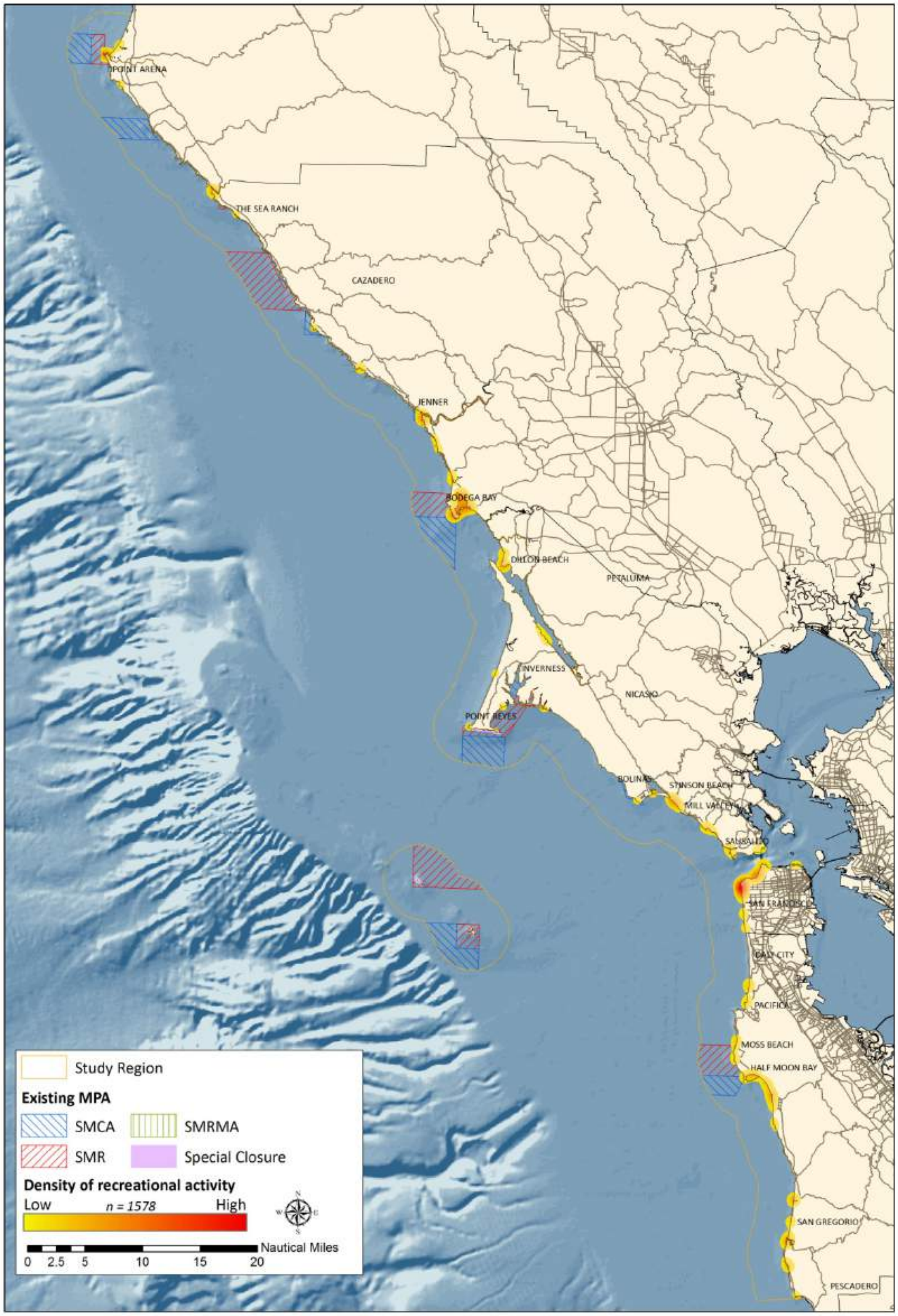
All Survey Waves - Biking or Hiking



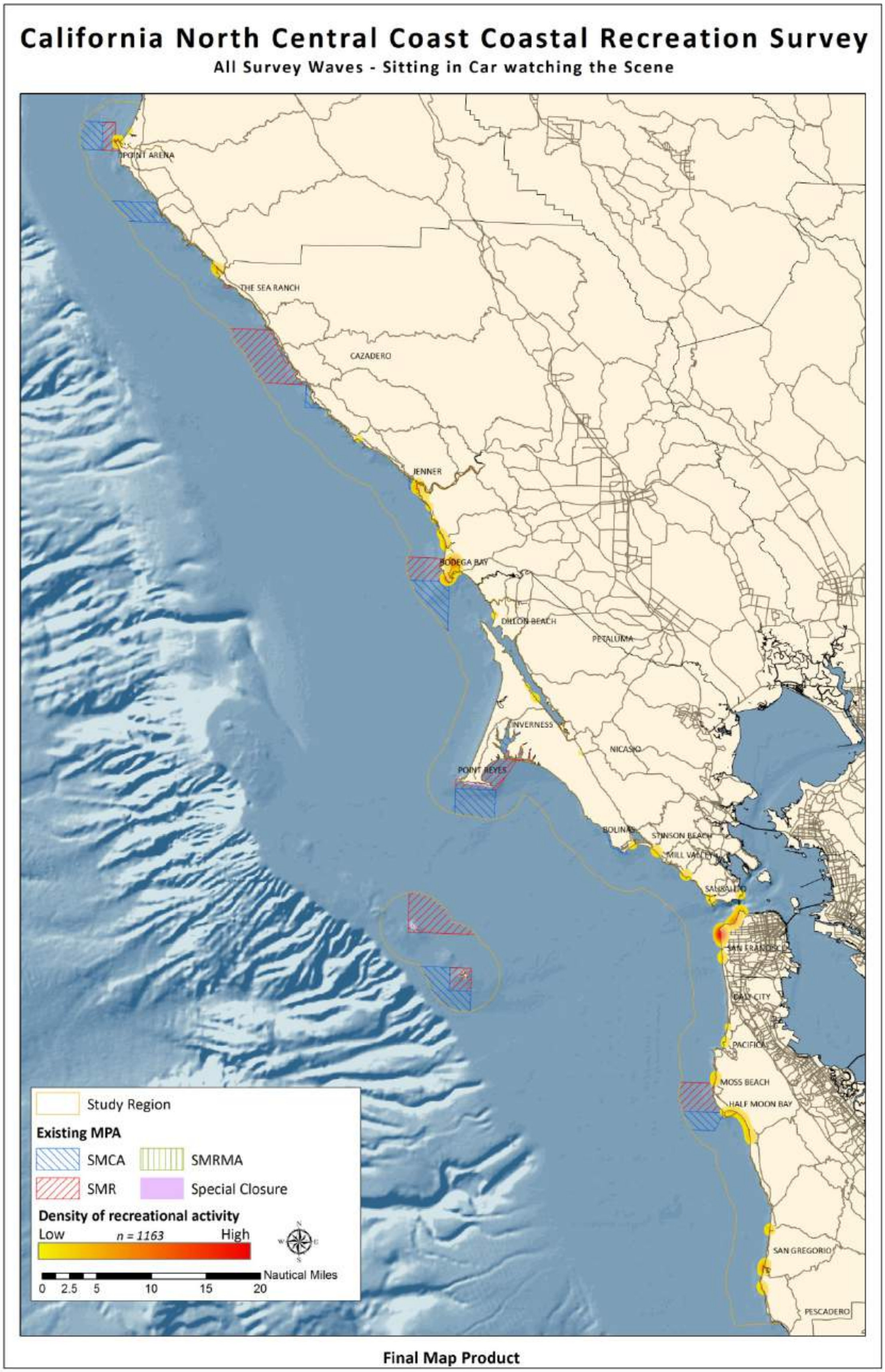
Final Map Product

California North Central Coast Coastal Recreation Survey

All Survey Waves - Watching Birds and/or Marine life from shore

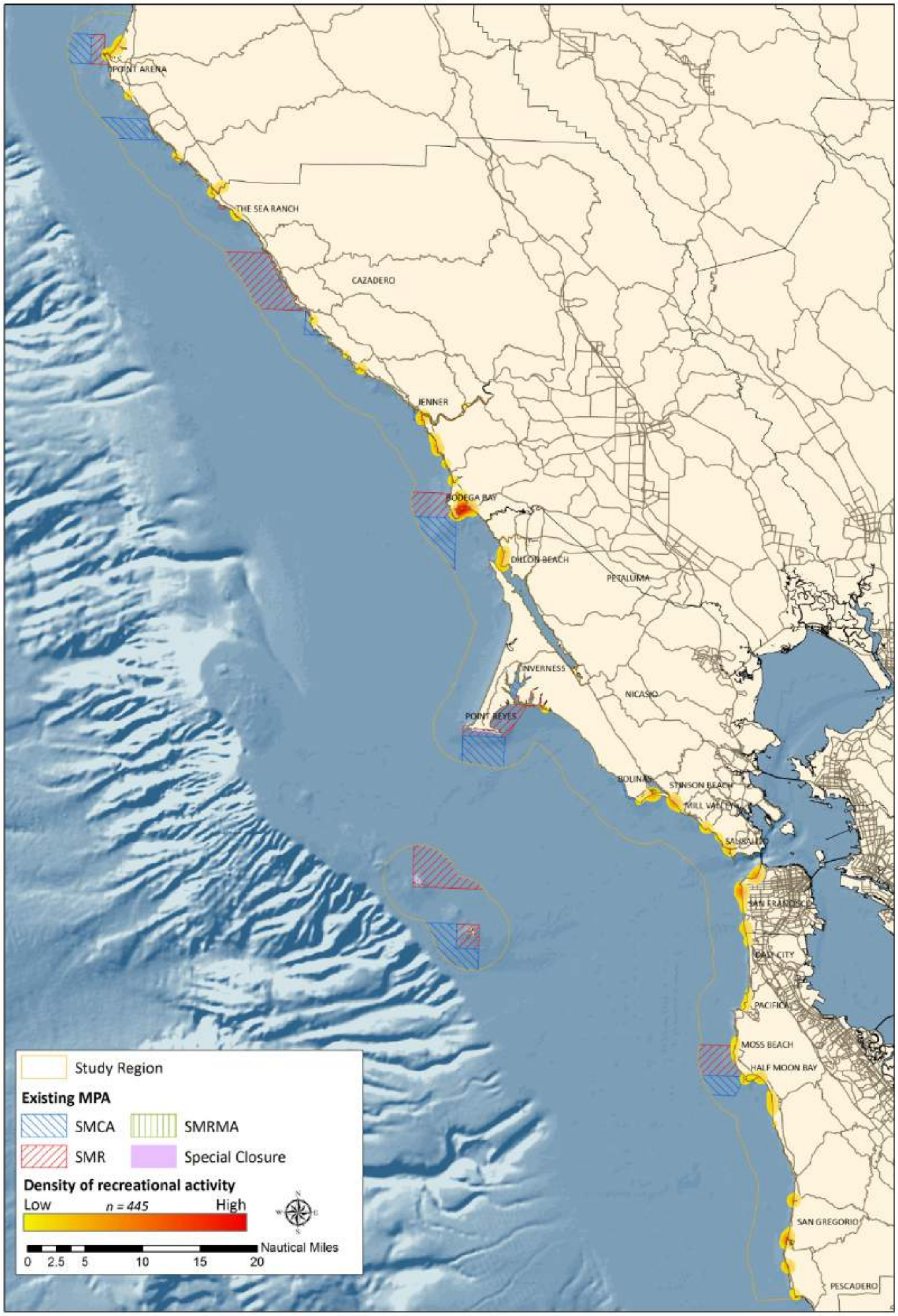


Final Map Product


California North Central Coast Coastal Recreation Survey
All Survey Waves - Sitting in Car watching the Scene
POINT ARENA
THE SEA RANCH
CAZADERO
JENNER
BODEGA BAY
DILLON BEACH
PETALUMA
INVERNESS
NICASIO
POINT REYES
BOLINAS
STINSON BEACH
MILL VALLEY
SAUSALITO
SAN FRANCISCO
DALY CITY
PACIFICA
MOSS BEACH
HALF MOON BAY
SAN GREGORIO
PESCADERO
Study Region
Existing MPA
SMCA
SMRMA
SMR
Special Closure
Density of recreational activity
Low
n = 1163
High
0 2.5 5 10 15 20
Nautical Miles
Final Map Product

California North Central Coast Coastal Recreation Survey

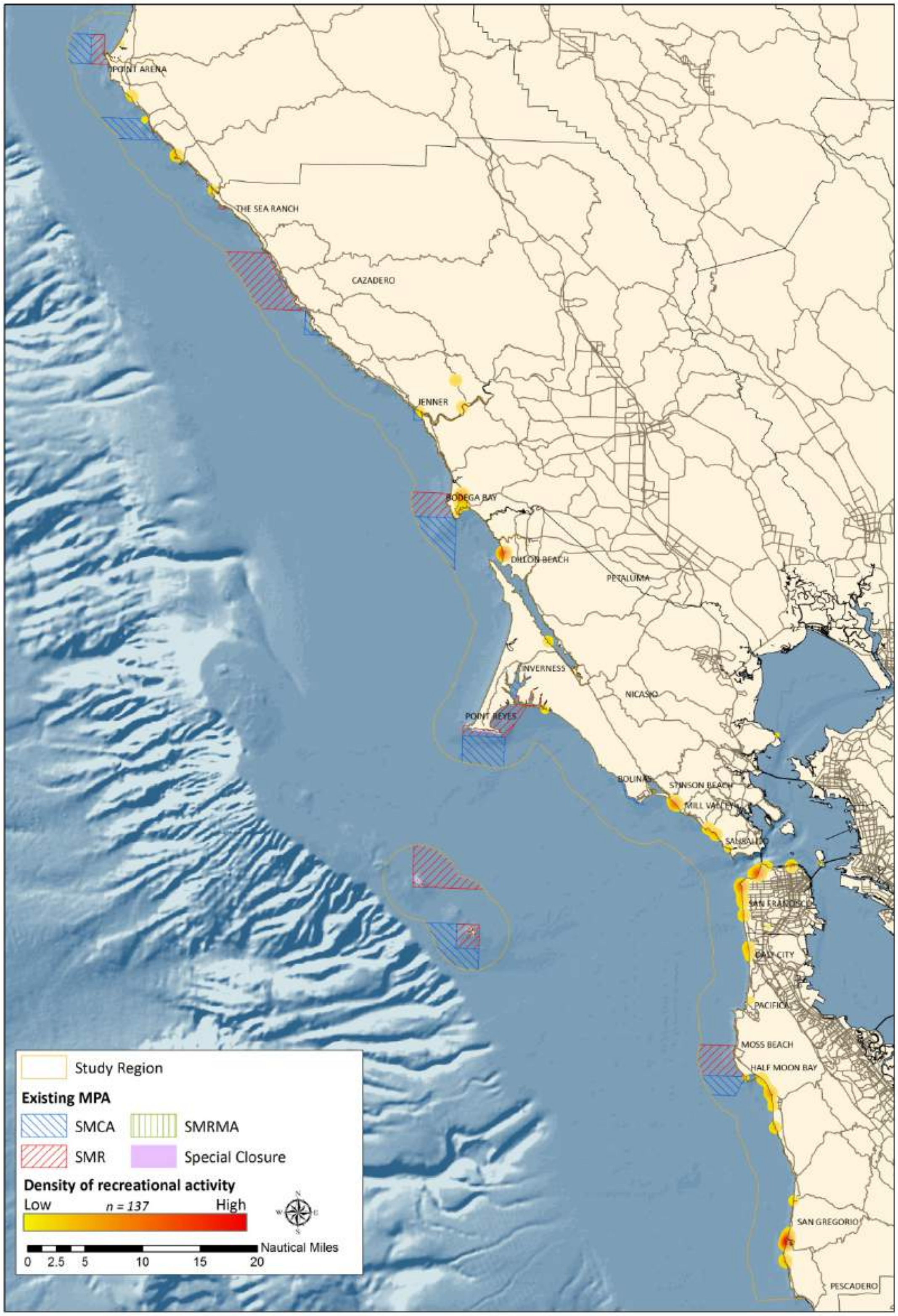
All Survey Waves - Collection of Non-living resources / Beachcombing



Final Map Product

California North Central Coast Coastal Recreation Survey

All Survey Waves - Swimming or Body Surfing in the Ocean



Final Map Product

Establishing a Baseline and Assessing Initial Spatial and Economic Change in the California North Central Coast Commercial Fisheries

Report to the California Sea Grant College Program

In partial fulfillment of Grant No. #09-015
through the California Sea Grant College Program

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ecotrust

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The North Central Coast MPA Baseline Program

This study is a part of a larger baseline marine protected areas monitoring effort, entitled the North Central Coast (NCC) MPA Baseline Program, tasked with characterizing the ecological and socioeconomic conditions within the NCC region. Specifically, this study addresses the Baseline Program objectives by describing human use patterns across the study region and establishing initial data points for long-term tracking of conditions and trends in the North Central Coast. This study is also a part of a four-part study conducted by Ecotrust to provide baseline estimates of the quantity, spatial distribution, and economic value of human uses—specifically human use in four specific sectors: coastal recreational, commercial fishing, commercial passenger fishing vessels, and the recreational abalone fishery in the NCC region.

Ecotrust

For more than 20 years, Ecotrust has converted $80 million in grants into more than $500 million in capital for local people, businesses, and organizations from Alaska to California. Ecotrust's Marine Consulting Initiative builds tools that help people make better decisions about the ocean. Our tools help visualize and map marine ecosystems and uses, bridge differing perspectives, and implement management decisions in a more inclusive and transparent way. The marine planning tools are part of Ecotrust's 20-year history of doing innovative things with knowledge, technology, and capital to create enhanced conservation and economic development for coastal communities on a global scale. Learn more at http://www.ecotrust.org.

Acknowledgements

Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the commercial fishermen who provided guidance and feedback during this study as well as the countless other community members, state agency staff, and observers of this project. We are deeply thankful to the commercial fishermen who participated in this project and for making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us.

1. INTRODUCTION

The waters off the North Central Coast of California have long supported fishing activities that are integral to the cultural and economic history of the area. Fisheries exemplify the interdependencies between the natural environment and coastal communities that have characterized California since well before statehood. On May 1, 2010, as part of the Marine Life Protection Act (MLPA) Initiative, the California Fish and Wildlife Commission (CFWC) designated 31 marine protected areas (MPAs) which include six special closures within the North Central Coast state waters of California. The North Central Coast Region of California stretches from Alder Creek in the north to Pigeon Point in the south (see Map 1 and 2).

As part of the baseline marine protected area monitoring effort to characterize the ecological and socioeconomic conditions and changes within the North Central Coast Region since MPA implementation, this report provides three sets of primary findings:

1. A baseline characterization of spatial fishing patterns and economic status of commercial fishermen in the North Central Coast (NCC) region;
2. An assessment of initial spatial and economic changes following MPA implementation; and
3. A qualitative investigation into the impact of MPAs on commercial fishermen and the specific MPAs impacting commercial fisheries at the port and region scale.

Establishing a baseline characterization of the commercial fishing fleet of the California North Central Coast provides a better understanding of the current economic health of the North Central Coast fishing communities and provides a benchmark of economic conditions and spatial fishing patterns against which future MPA impacts and benefits can be measured. Furthermore, assessing historical trends along with initial changes in economic conditions and spatial fishing patterns that followed MPA implementation will help inform how MPAs and other driving factors may interplay to influence observed changes.

This project will directly inform the 5-year management review of the North Central Coast MPAs in which the California Department of Fish and Wildlife (CDFW) will make management recommendation to the California Fish and Wildlife Commission based on findings from the baseline MPA monitoring projects and other sources of information. This project was developed in close coordination with the MPA Monitoring Enterprise (Monitoring Enterprise), a program of the California Ocean Science Trust, in partnership the California Department of Fish and Wildlife, and supported by the California Sea Grant College Program and the California Ocean Protection Council (OPC).

The primary goal of this project was to collect up-to-date information on historical trends, current economic conditions, and the spatial distribution and relative economic value of fishing grounds for the commercial fishing fleet in the North Central Coast Region to inform future long-term monitoring efforts.

To accomplish this goal our research team conducted extensive community outreach in the region and developed and deployed an interactive, web browser-based interview instrument called Open OceanMap that was customized to the North Central Coast Region and project objectives. The survey instrument was utilized by field staff on laptop computers to collect geo-referenced information from fishermen about the extent and relative importance of California North Central Coast marine waters and related economic data. Data collection occurred during the summer and fall months of 2011 and 2012. The data were then compiled in aggregate form into spatial datasets (e.g., raster data layers, kernel density layers, pdf maps) and various excel workbooks and delivered to the California Sea Grant College Program and MPA Monitoring Enterprise. We would like to emphasize that no individual information was delivered; only data in the aggregated form (requiring three or more fishermen in each data point) was delivered. This report details the approach and methods we used to collect, analyze, verify, and interpret the various data sets utilized in this project.

It should be noted that in the main body of this report only the first year of data collected (data collection conducted in 2011 inquiring about the post MPA 2010 fishing year) is reported. We chose to do this as the survey sample in the first year of data collection was significantly more robust and thus more representative and reliable as a baseline characterization of the North Central Coast region commercial fishing fleet. The regional results of the second year of data collection are provided in an appendix of this report and the summarized port level data are available in the MS excel workbooks delivered as part of this project. Furthermore, throughout this report we do add information to the report narrative that may be of interest from the second year of data collection.

The main body of this report consists of two main sections—1) a region-wide profile of the commercial fisheries and 2) commercial fishing profiles for each port. To help better facilitate the use of the data presented in this report in accordance with the Monitoring Enterprises' monitoring framework, each sub-section is further broken out into the MPA monitoring framework components of 'initial changes' and 'baseline characterization'. Furthermore, specific spatial baseline and spatial change sections are provided in this report to organize all the spatial data into specific sections rather than distributing them throughout the report.

We would like to emphasize that the purpose of this report is not to measure or assess the economic impact of MPAs on the commercial fishing fleet in the region. To quantitatively measure the impact of MPAs requires robust long term economic data sets in both pre and post MPA periods that enable analyses to account or control for the complex interplay of regulatory, environmental, and economic factors that drive economic change in commercial fishing. Such a study was beyond the scope of this project but to provide insights into the possible impacts of MPAs we collected qualitative information from commercial fishermen as to the ways in which MPAs are affecting their success as a commercial fisherman. The information we have collected can be used to help better understand the complex system of commercial fishing and how MPAs may directly or indirectly be impacting a commercial fisherman's success as well as inform future research efforts to possibly measure and quantify these impacts.

Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the commercial fishermen who participated in this study as well as the countless other community members, agency staff, and observers of this project. We are deeply thankful to the commercial fishermen who participated in this project and for making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us.

2. SURVEY AND ANALYSIS METHODS

2.1. Target Commercial Fisheries and Ports of Interest

To focus efforts upon information which may be most useful and cost effective in informing a 5-year management review of the North Central Coast MPAs, this project identified key consumptive user groups and associated fisheries in which to target our data collection and analysis efforts. These user groups and key fisheries have been identified as occurring mostly in state waters and are most likely to experience both short-term spatial and economic changes associated with MPA implementation and are of high economic importance to the North Central Coast Region.

The following is the list of key commercial fisheries targeted for this project. We focused on these target fisheries for data collection. This list below was developed in collaboration with the California Department of Fish and Wildlife, the MPA Monitoring Enterprise, and the North Central Coast fishing community to define when applicable the species groupings that compose a fishery. These fisheries below will be referenced as ‘target fisheries’ throughout this report. The target fisheries for this project are:

1. California halibut–hook & line (*Paralichthys californicus)*
2. Dungeness crab–trap (*Metacarcinus magister* - formerly *Cancer magister*)
3. Nearshore finfish–live–fixed gear
    a. Nearshore finfish–live–hook & line
    b. Nearshore finfish–live–longline
4. Salmon–troll (*Oncorhynchus sps.)*
5. Urchin–dive (*Strongylocentrotus franciscanus*)

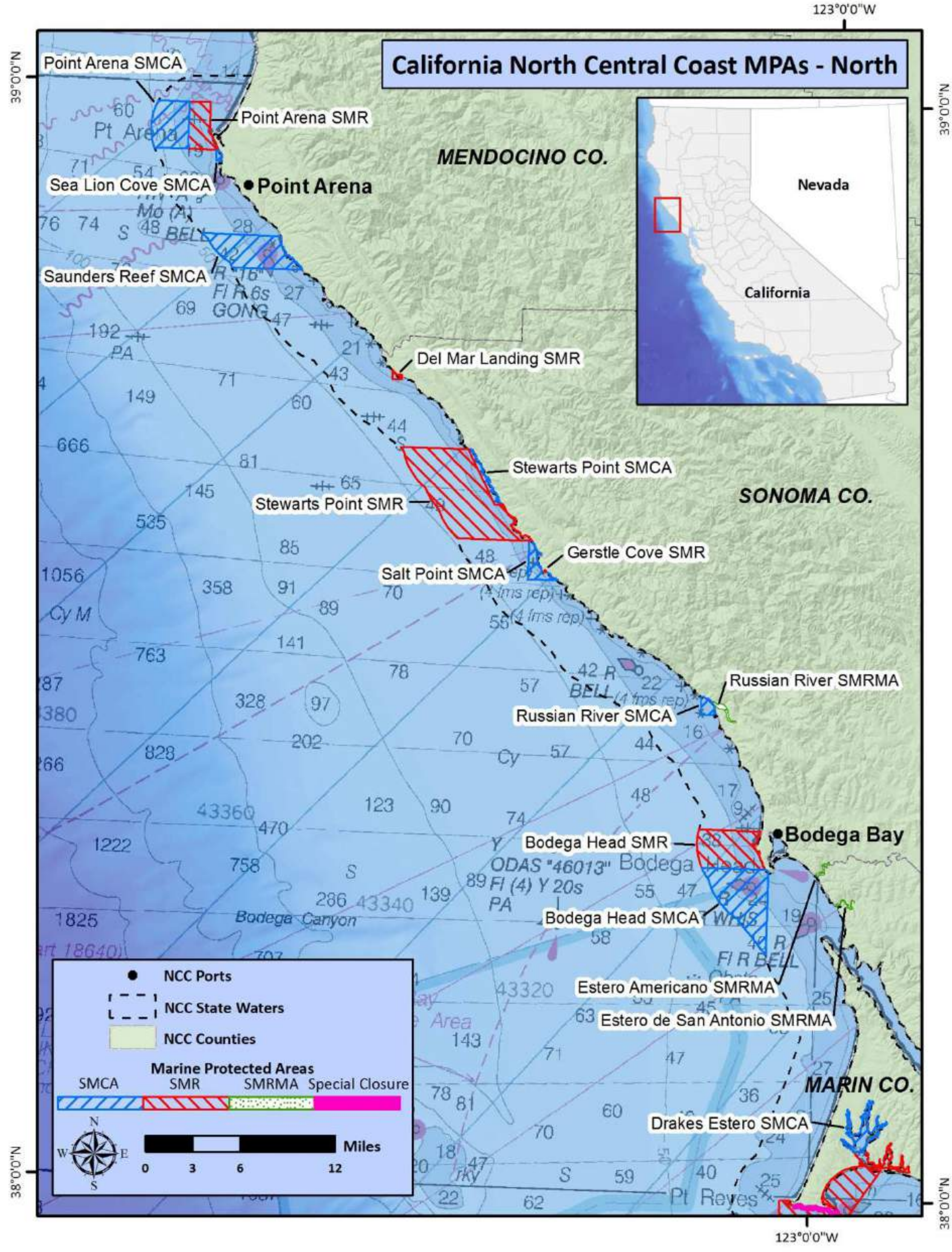
The nearshore finfish fishery is a state fishery grouping managed through the California Nearshore Fishery Management Plan which consists of the following 19 species: Rockfish, gopher (*Sebastes carnatus*); Rockfish, black (*S. melanops*); Rockfish, black-and-yellow (*S. chrysomelas*); Rockfish, blue (*S. mystinus*); Rockfish, kelp (*S. atrovirens*); Rockfish, copper (*S. caurinus*); Rockfish, grass (*S. rastrelliger*); Rockfish, brown (*S. auriculatus*); Rockfish, quillback (*S. maliger*); Rockfish, china (*S. nebulosus*); Rockfish, calico (*S. dallii*); Treefish (*S. serriceps*); Rockfish, olive (*S. serranoides*); Cabezon (*Scorpaenichthys marmoratus*); California sheephead (*Semicossyphus pulcher*); California scorpionfish (*Scorpaena guttata*); Kelp greenling (*Hexagrammos decagrammus*); Rock greenling (*Hexagrammos lagocephalus*); and Monkeyface prickleback (*Cebidichthys violaceus*). It should be noted that even though California sheephead, California scorpionfish, and Monkeyface prickleback species are included in the nearshore finfish grouping they are largely found outside of the North Central Coast Region.

Based on California Department of Fish and Wildlife landings data the commercial fishing ports of interest for this project are defined as (Map1 and Map 2):

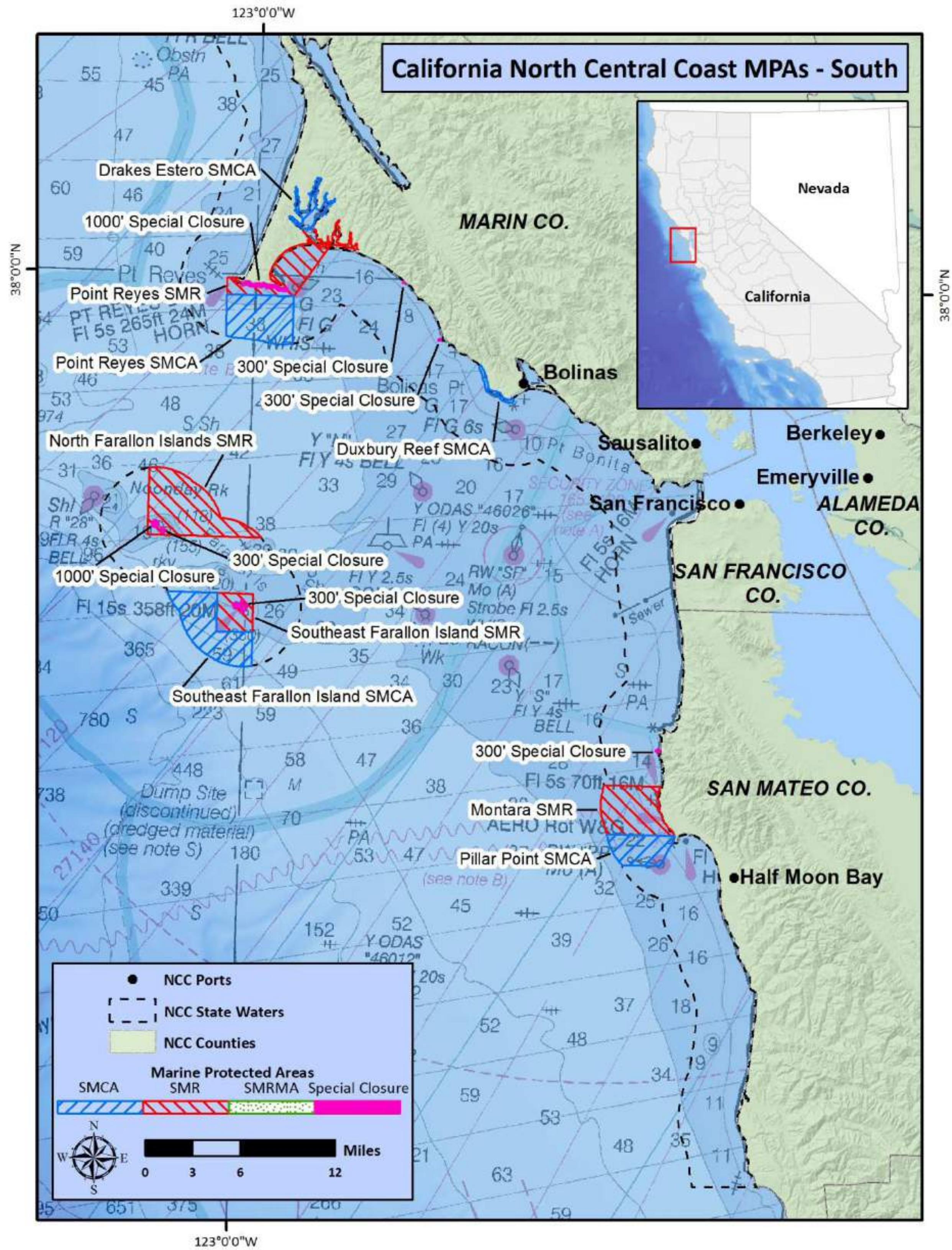
1. Point Arena
2. Bodega Bay
3. Bolinas
4. San Francisco
5. Half Moon Bay

Smaller surrounding commercial fishing ports were grouped into the ports of Bodega Bay and San Francisco. The smaller ports grouped into the Bodega Bay port were: Dillion Beach, Drakes Bay, Healdsburg, Inverness, Jenner, Marconi Cove, Marshall, Petaluma, Point Reyes, San Rafael, Tiburon, and Tomales Bay. The smaller ports grouped into the San Francisco port were: Alameda, Alviso, Berkeley, China Camp, Crockett, Danville, El Sobrante, Emeryville, Foster City, Fremont, Martinez, Newark, Oakland, Pacifica, Pinole, Redwood City, Richmond, Rio Vista, Rodeo, San Leandro, Sausalito, South San Francisco, Vallejo, and Yountville.

Map 1. North Central Coast study region, ports, and marine protected areas – Northern portion



Map 2. North Central Coast study region, ports, and marine protected areas – Southern portion



2.2. CDFW Landings Data Analysis Methods

Under a non-disclosure agreement with the California Department of Fish and Wildlife (CDFW), the commercial fisheries landings data presented throughout this report was developed in collaboration with CDFW staff using ex-vessel landings receipt data contained in the CDFW's Commercial Fisheries Information System (CFIS) database. As the CFIS database is continually updated it is important to document the date the CFIS database was queried so that the status of the data sets used are known. For 1992–2009 landings data the CFIS database was queried on March 9th, 2011 and for 2010 landings data the CFIS database was queried on April 18th, 2012 and for the 2011 landings data the CFIS database was queried on September 22, 2012. All data were sent to Ecotrust by CDFW staff.

All dollar values presented in this report are corrected for inflation, and are reported in 2010 dollars using the Implicit Price Deflators for Gross Domestic Product from the U.S. Bureau of Economic Analysis. It is important to note that ex-vessel revenues are merely suggestive of differences in economic value, as they do not account for differences in operating costs, and thus profitability, across fisheries. Likewise, they are only first order approximations of the value of fisheries to local economies; a comprehensive assessment of fishery operating costs, multiplier effects, and the full value of fishing activities to local economies are important to assess but are beyond the scope of this study.

Finally, we present only a subset of the landings data available—following CDFW protocol we suppressed all landings data with fewer than 3 commercial fishermen. We strived to summarize the landings data in the most compelling and visual formats. We have consistently color-coded fisheries throughout the report and presented data in consistently formatted and scaled graphs in order to facilitate quick reference of specific fisheries and comparison across fisheries or ports. We avoid repetition whenever possible and recognize there are many more ways to query and analyze the data, however, throughout this report we aimed to present the most relevant and informative analyses possible.

2.3. Survey Data Collection and Analysis Methods

While the use of GIS technology and analysis in marine and fisheries management has expanded steadily over the past decade (Kruse et al. 2001; Breman 2002; Valavanis 2002; Fisher and Rahel 2004; Meaden 2009), its use for socioeconomic research is still somewhat limited. Nevertheless, a growing body of literature has examined GIS-enabled approaches to community-based MPA design and assessment (Aswani and Lauer 2006; Hall and Close 2006; St. Martin et al. 2007; Ban et al. 2009; Gleason et al. 2010) and there are several good examples to build on for improving the spatial specificity of the West Coast knowledge base and data landscape.

Some of the most pertinent applications of GIS technology to socioeconomic questions in marine fisheries concern the spatial extent and intensity of fishing effort (Caddy and Carocci 1999; Green and King 2003; Parnell et. al 2010; Lee et. al 2010) and the use of participatory methods similar to the ones employed here (Wedell et al. 2005; St. Martin 2004; 2005; 2006; Scholz et al. 2011a). We built on these approaches and adapted them for the California North Central Coast context, following best practices for the use of participatory GIS in natural resource management (Quan et al. 2001), as described in the remainder of this section.

Our project approach builds on methods developed in previous projects on the West Coast of the United States (Chen et al. 2012; Steinback et al. 2010; Scholz et al. 2004; 2005; 2006a; 2006b; 2008; 2010; 2011a; 2011b), which demonstrated novel approaches for collecting, compiling, and analyzing spatial fishing patterns and associated economic information at various geographic resolutions to aid the design and assessment of various marine spatial planning efforts (e.g., marine protected areas and wave energy siting). The successes and lessons learned in these projects were directly applied to the methods and tools deployed in this project. As Ecotrust continues to conduct MPA monitoring work in other regions in California we aim to help close existing coastal and marine use information gaps and provide a tested, consistent, and cost-effective method for long-term monitoring across California.

Specifically, Ecotrust's approach involved several steps that are designed to engage the fishing community throughout the project from project/survey design to the development of final products. These steps are generally categorized below:

1. Fishing community outreach/engagement;
2. Survey questions and survey tool design;
3. Data collection;
4. Data analysis;
5. Review and validation of data analysis results; and
6. Final reporting.

Ecotrust conducted a series of outreach meetings throughout the data collection period with key fishing community members and fishing organizations/associations prior to beginning interviews in the region and in each port. The objectives of these meetings were to provide a project overview, answer questions, develop relationships, gain insights into the current fishery issues/challenges, raise general awareness, and solicit potential interview participants. During these initial meetings Ecotrust also gathered feedback on its proposed project and survey design, such as on what types of information the fishing community felt were important to capture, and when possible the feedback received was incorporated into the data collection tool and data analysis plan.

2.3.1. Sampling Method

Ecotrust carried out two waves of field work in the summer and fall months of 2011 and 2012 to collected data on the 2010 post MPA fishing year and the 2011 fishing year. To determine a sampling method for the commercial fishing sector, Ecotrust compiled CDFW commercial fishing ex-vessel revenue and landings data and as well as contact data (phone numbers taken from the CDFW permits database) for the given year of interest (2010 or 2011 for each of the two years of data collection respectively). We then organized these data into port-fishery combinations to identify commercial fishermen[1] to interview in each target fishery in each port in the region.

As fishermen may land fish in more than one port the port specific listing of commercial fishermen was not a mutually exclusive list and thus we could not conduct a random sample as this would bias the sample towards fishermen who land in multiple ports. Furthermore, implementing any systematic or random sample strategy is difficult as at times fishermen are unwilling to participate in interviews. Our experience is that at times fishermen who make a relatively small amount of revenue in a fishery are less invested in participating in interviews which in itself creates a sample bias and together essentially results in a convenience sample.

Given the considerations above, project staff set out to contact every commercial fisherman in the landings database in each of our port-fishery lists with the sampling goal of interviewing as many fishermen as possible. The exception to this is in the salmon fishery in which we did not specifically target fishermen to interview. Most commercial fishermen participate in the salmon fishery and so the landings data for this fishery contains hundreds of fishermen which was not feasible to fully contact. During interviews we collect data on each fisherman's full portfolio of fisheries and thus collected salmon fishery data largely through these means.

For the purpose of this project, Ecotrust defines a commercial fisherman as an individual who has commercial fishery landings data (pounds and ex-vessel revenue) associated with his/her commercial license number (L number). Given our sample strategy, we investigated how our sample was spread across the various ex-vessel revenue ranges for each fishery we stratified each fishery into four revenue strata. Please see Table 1 for the number of commercial fishermen interviewed in each target fishery compared to the number of fishermen in the landing database separated by the four revenue stratification levels. We indicated the approximate revenue range when possible for each stratification to demonstrate the multitude of relatively small dollar values that are landed by individuals in each fishery. This may be

[1] The term 'fishermen' is used to denote people who fish. In the California fishing community this is the preferred term regardless of gender.

due to several reasons which could include amongst others: fish caught as bycatch in a different fishery but were still landed/sold; fishermen who were trying out a new fishery or new gear type for a fishery and thus landed a relatively small amount; families of fishermen who fish together and land their catch on various L numbers of family members—sometimes just once or twice for an individual; fishermen from outside the region who landed only once or a few times in the region; or fishermen who must land some amount of catch to maintain a permit but do not actively fish the permit as a major income source.

Table 1. Number of fishermen interviewed as a percent of each quartile revenue strata for each fishery, North Central Coast Region

Fishery	Revenue strata (quartiles)	Number of individuals interviewed with 2010 landings	Number of individuals in 2010 landings	Percent of individuals in landings strata interviewed	Approximate 2010 Revenue Strata Range (2010$)
California halibut–hook & line	**Total**	**22**	**105**	**21%**	**$427,021**
	1	1	3	33%	$27,000-$50,000
	2	6	7	86%	$12,000-$26,500
	3	7	15	47%	$4,500-$11,500
	4	8	80	10%	$0-$4,500
Dungeness crab–trap	**Total**	**79**	**255**	**31%**	**$26,321,805**
	1	9	14	64%	$322,000-$622,500
	2	14	27	52%	$180,000-$321,000
	3	17	45	38%	$108,500-$179,000
	4	39	169	23%	$100-$108,500
Nearshore finfish–live–fixed gear	**Total**	**9**	**26**	**35%**	**$210,672**
	1	0	1	0%	*
	2	2	2	100%	*
	3	1	4	25%	$10,500-$18,000
	4	6	19	32%	$0-$8,000
Salmon–troll	**Total**	**12**	**61**	**20%**	**$79,123**
	1	2	4	50%	$4,000-$5,500
	2	3	6	50%	$3,000-$4,000
	3	1	8	13%	$2,000-$3,000
	4	6	43	14%	$0-$1,500
Urchin–dive	**Total**	**6**	**12**	**50%**	**$424,114**
	1	0	1	0%	*
	2	2	2	100%	*
	3	2	2	100%	*
	4	2	7	29%	$1,500-$53,000

Source: California Department of Fish and Wildlife, Current study

** indicates data were collected but cannot be shown due to confidentiality constraints*

2.3.2. Interview Protocol

Field Staff Training
Building upon our experience conducting large scale human use data collection projects with fishing communities Ecotrust has established rigorous field staff training procedures and interview protocols to ensure that:

1. Field staff are able to effectively engage in conversations with fisherman about the goals/objectives of this project and the larger MPA monitoring/assessment effort this project will inform;
2. Sensitive fishermen contact information is kept secure and confidential;
3. Fishermen are properly informed of the research project goals and possible risk and agreements on data use before the fishermen engages in an interview;
4. Fisherman data remains confidential and is securely stored, transmitted, and analyzed;
5. Interviews are conducted professionally and consistently; and
6. High quality data is consistently collected across interviews.

To accomplish this, Ecotrust staff who are trained in human subjects research protocols conducted extensive training with Ecotrust field staff on proper research protocols and interview approach and procedures. This training includes providing background on Ecotrust's project history with fishing communities, the Marine Life Protection Act planning process, the MPA monitoring program, and possible reservations fisherman may have to participate in interviews in order for field staff to effectively engage in meaningful conversations with fishermen to solicit interviews. Furthermore, field staff were trained in being aware and respectful of the sensitivities of collecting fishing data and were provided with human subjects research protocols to ensure field staff are aware of proper ways of presenting the research goals and risks to fishermen and that proper informed consent is obtained before interviews begin.

Furthermore, strict procedures and mechanisms are put in place so that individual fisherman data is kept secure and confidential throughout the project from data collection, to transmission of the data, to data analysis, and subsequent storage of the data. Interviews were conducted under individual non-disclosure consent forms and all data were collected on password protected laptop computers. Furthermore, data collection and analysis protocols were utilized which masks all names and identifying characteristics of an individual's fishing grounds.

Field staff are also fully trained in how to ask survey questions and capture responses in a consistent manner. The field staff coordinator initially conducted fisherman interviews with each field staff member to ensure the quality of interviews and periodically conducted fisherman interviews with field staff throughout the field season to ensure that interview quality was maintained. Furthermore, survey data is checked as it is transmitted to the Ecotrust main office and reviewed by Ecotrust staff to ensure quality data are being captured consistently across field staff.

Interview Procedure
The data collection methods in this project were designed to complement existing data previously acquired from commercial fishermen in the North Central Coast Region (see Scholz et al. 2008) before the MPA network was established. Interviews in this project were conducted in person using a one-on-one interview format. All interview data were entered directly into a spatially enabled, Open Source GIS survey tool developed by Ecotrust called Open OceanMap[2]. Field staff used Open OceanMap (Figure 1) to collect non-spatial survey data (e.g., demographics, basic operating information, descriptive fishing characteristics, impacts from MPAs and other factors, and associated qualitative questions) and to map areas representing a participant's fishing grounds. Open OceanMap's mapping component utilizes NOAA nautical charts which can be zoomed in and out to reveal more detailed nautical charts and moved directionally (similar to Google Maps) to allow fishermen to draw fishing areas in their natural sizes (polygons) rather than confining responses to a statistical grid or to political boundaries.

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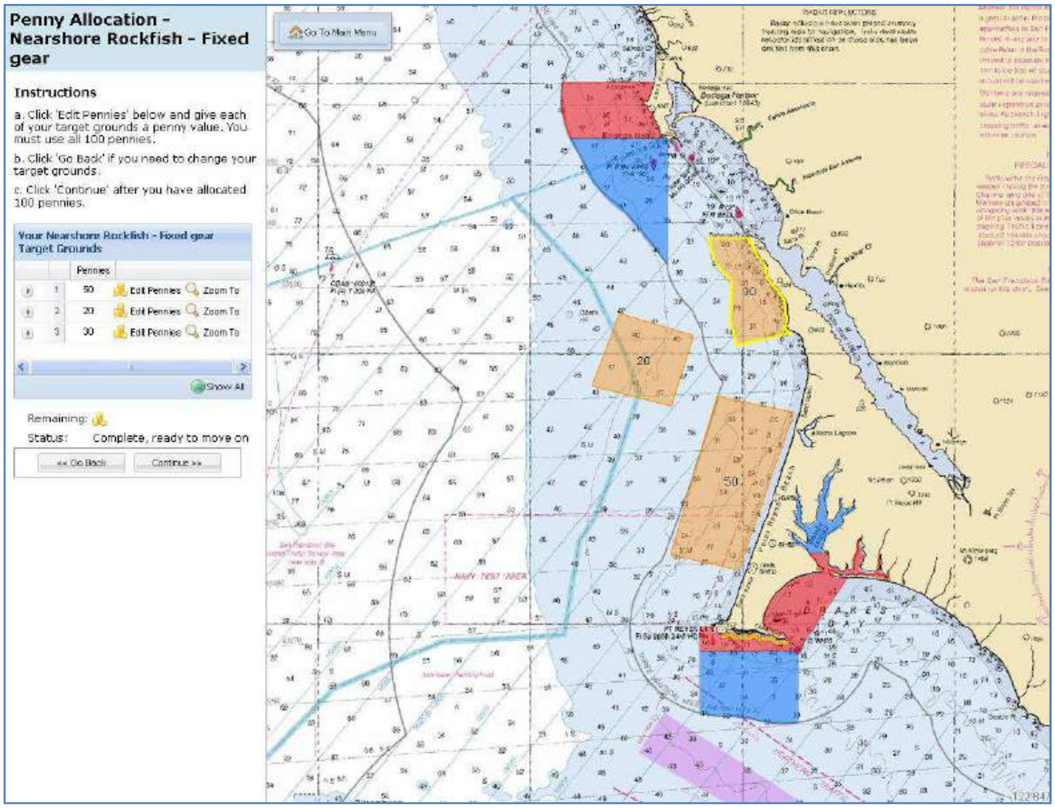
[2] For more information on Open OceanMap please see http://www.ecotrust.org/marineplanning/

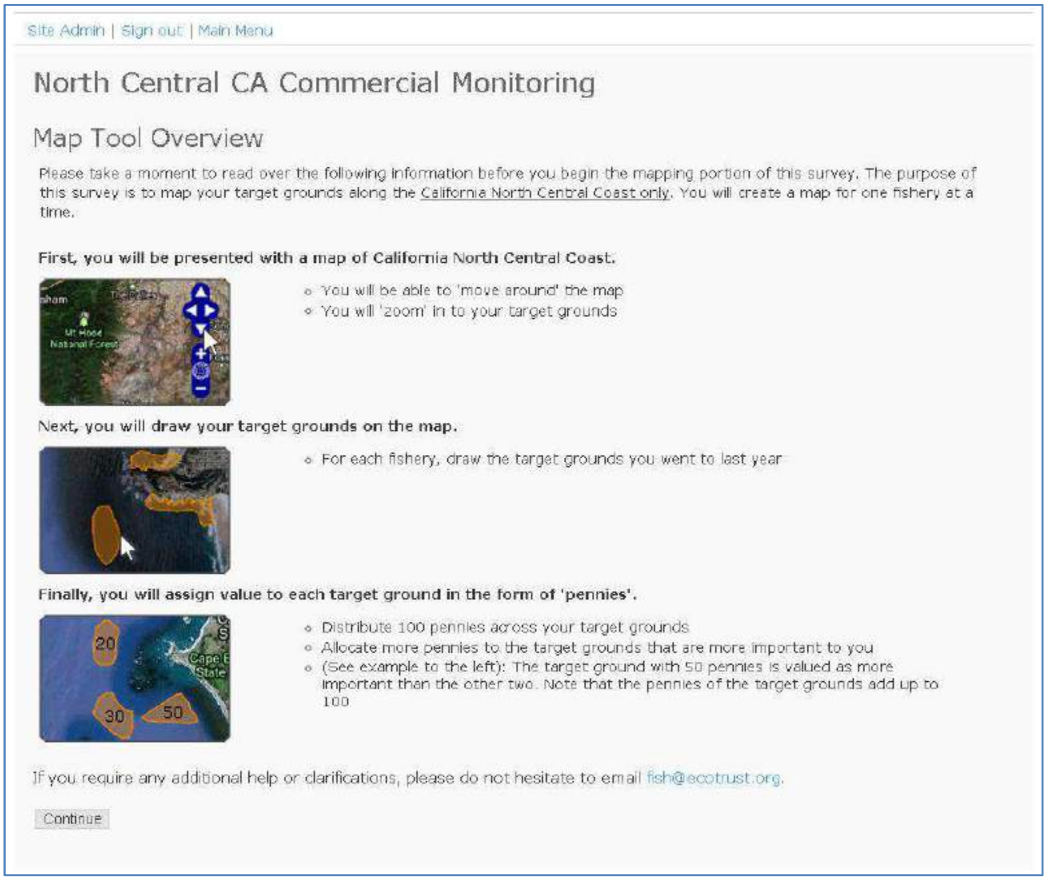
Figure 1. Screenshot of Open OceanMap mapping tool showing mock fishing ground



All interviews followed a shared protocol:

1. Interviews begin with an explanation of the project goals/objectives, the types of data collected, how data will be analyzed, possible risks of participating in the interview, and any other project information the fisherman would like to discuss.
2. The fisherman is presented an informed consent form agreement which allows Ecotrust to utilize interview data, however, the agreement legally binds Ecotrust to present data only in the aggregate form and to never release individual data or the identities of those interviewed.
3. Non-spatial survey data is collected on questions pertaining to individual fisherman characteristics and overall commercial fishing operations.
4. Non-spatial survey data is collected for each fishery/activity within a commercial fisherman's portfolio.
5. Fishing grounds are mapped following these steps (see Figure 2). These steps are repeated to map each fishery separately:
    a. <u>Establish a maximum extent:</u> Using the electronic nautical charts embedded in Open OceanMap, fishermen were asked to identify the maximum extent north, south, east, and west they would target a fishery. This is done to orient the map to the full extent of their fishing area before fishermen are asked to identify/delineate specific fishing grounds.
    b. <u>Map fishing grounds:</u> Within this maximum extent, fishermen were then asked to delineate the area(s) they fish for a particular species/fishery in a given time period. Under the guidance of the fisherman, field staff drew these fishing areas in the Open OceanMap survey tool and record associated boundary information for each area such as depth limits and geographic landmarks.
    c. <u>Assign value:</u> Fishermen are then asked to rank these fishing areas using a weighted percentage — in which they split and distribute 100 points or '100 pennies' over the various fishing areas based on their relative importance.

Figure 2. Screenshot of Open OceanMap mapping tool overview



We would like to note that for the first year of data collection (conducted in 2011 inquiring about 2010 fishing grounds) we asked fishermen to only map post-MPA fishing grounds in order to capture a post-MPA spatial baseline data. In the 2012 data collection wave we inquired about the full 2011 calendar fishing year but as mentioned before the 2010 data collected is from a much more robust sample than the 2011 data collected and therefore the 2010 data set is the focus of this report. Furthermore, for the Dungeness crab-trap fishery we asked fishermen to map their fishing grounds according to the Dungeness crab season which for the 2011 data collection year was mapped for the November 2010 to June 2011 (entirely post MPA) Dungeness crab season and for the 2012 data collection year was mapped for the November 2011 to June 2012 season.

2.3.3. Data Review and Verification

There are several data review and verifications steps throughout this project. The following standard quality assurance and quality control (QAQC) steps were conducted:

1. Editing of spatial data by Ecotrust staff based on notes from interviews and when required to standardize the data (e.g. clipping a shape to the shoreline or specific depth);
2. Review by each participant of his/her individual maps and information; and
3. Review by fishing community, through group and individual meetings, to verify aggregated results.

The collection of spatial data has an inherent higher margin of error and thus several QAQC steps were implemented in our project to ensure the spatial data collected were of the highest quality possible. First, notes were taken on the boundaries of each fishing area drawn during an interview with a fisherman. Once spatial data are collected and transmitted to Ecotrust staff for analysis, each spatial dataset is checked against spatial data notes to ensure fishing areas are drawn to the indicated depth limits and spatial extent. Furthermore, if any spatial outliers are identified within a given fishery, individual fishermen are contacted to verify their spatial dataset is accurate. Second, each individual fisherman is mailed maps of his/her fishing grounds for each fishery they provided spatial information on to review/verify its accuracy. These individual maps are printed on security paper that cannot be photocopied and are mailed with a return addressed and stamped envelope and contact information so fisherman may easily communicate any changes to their spatial data. Third, once all spatial fishing data are aggregated, these maps are reviewed by the fishing community with Ecotrust staff.

These review meetings with the fishing community are complimentary to the individual interviews and take a synergistic approach that is important in several ways. Review meetings are an opportunity to review and verify map products as well as share other data analysis results such as having the fishing community assist in interpreting logbook data analysis results, review drafts of the project report, discuss project next steps, build trust within the fishing community, and continue established relationships.

For review meetings, each individual who participated in interviews was contacted to participate in the project results review. During these individual or group review meetings, map products were reviewed for errors. It should be emphasized that spatial data sets are not augmented based on the where an individual who reviews the map(s) thinks areas of importance should be. Instead, the purpose of reviewing the map products are to ensure there are no large errors in the data sets made during the collecting, editing, and compiling of the data. Example of errors include fishing areas that extend beyond regulatory depth limits or geographic areas in which the fishery occurs (e.g., nearshore finfish grounds extending into rockfish conservation area boundaries) or areas in which no-fishing is allowed. Based on our experience, having the community review these map products helps ground-truth the data sets, produce data sets that are of higher quality, and help establish transparency and trust between researchers and the fishing community.

Data validation with independent data sets is an important step in providing rigorous research methods as data collected in any survey are liable to the inconsistencies of memory, subjective judgment, and possible deliberate falsification. Furthermore, validating data sets may also reveal possible sample biases which can inform interpretation of survey results. Much of the data Ecotrust collected in this project from commercial fishermen are novel, or similar data sets to our knowledge do not exist or are not readily accessible to compare survey results. To verify the spatial fishing data sets, commercial logbook data could have been used, however this data is confidential at the individual level and would take considerable resources to compile and analyze at the aggregate level. Furthermore, the spatial scale in which data are collected with logbooks (10 by 10 mile square blocks) are at a much larger scale than Ecotrust's data, making it difficult to compare data sets.

For the commercial fishing sector, the landings database provided by CDFG did not contain data on individual fishermen that were comparable to our survey results and we were unable to identify any other data sources to utilize for validation. In light of the difficulties in obtaining and analyzing existing data sets to compare our results, Ecotrust thoroughly reviewed all data sets with the fishing community to ensure all data products submitted were verified and accepted by the fishing community and are of the best quality possible.

2.3.4. Spatial Data Analysis Methods

In this section we further detail how spatial data were analyzed in this project. Ecotrust's methodology to analyze spatial fishing data collected was developed and refined through collaboration with fishing communities across California during the MLPA process (Scholz et al. 2011a). The analysis of the fishing grounds information is broadly comprised of two components: determination of the fishing grounds and determination of relative (economic) importance. Below we present a detailed methodology for how spatial data were weighted, analyzed, and aggregated for the commercial fishing sector's spatial fishing data.

As stated above all fishermen were asked to map fishing grounds for each fishery separately. For each commercial fisherman, individual spatial fishing data were weighted based on the ex-vessel revenue for the year 2010 (or 2011 in the second season of data collection conducted in 2012) from each specific fishery/activity. For the Dungeness crab-trap fishery the ex-vessel revenue was derived from landings from November 2010 to June 2011 and November 2011 to June 2012 for the two data collection efforts respectively.

Spatial Analysis Methodology

The following is a detailed methodology of how we analyzed and aggregated individual spatial fishing data to create port and region level spatial data sets on the relative importance of fishing areas. We would like to emphasize that fishermen are asked to map each fishery separately and the spatial data analysis methodology detailed below is conducted for each fishery separately as well.

Step 1: Individual weighted fishing grounds

During the interview process, each fisherman was presented with a navigable nautical chart (e.g., interviewer could zoom in/out and move the map around) contained within the mapping portion of the Open OceanMap survey tool (Figure 1). Fishermen were then asked to direct field staff to draw polygons or areas that could be of any shape or size. Each fisherman was asked to identify his or her fishing grounds for a particular fishery if fishing from any port in the North Central Coast region. This may include mapping areas outside the study region such as north or south of the study region. Furthermore, these fishing grounds could be one or more set of polygon/areas and together they comprise his or her total fishing grounds for a particular fishery.

Once the fishing area(s) were mapped, we then ask fishermen to allocate some portion of 100 pennies to each fishing area (or if there is only one fishing area all 100 pennies would be allocated to that area by default) such that the sum of the pennies allocated across his/her fishing areas for a particular fishery equals to 100. This is done to determine the relative importance of fishing areas in comparison to each other.

Step 2: Standardize and apply economic value to individual fishing grounds

The second step is to apply economic value to the individual fishing areas and distribute that value spatially based on the proportion of pennies allocated to each fishing area. For commercial fishermen we utilized the reported ex-vessel revenue for each fisherman earned from a fishery (found in the CDFW landings data) and distributed that economic value across the fishing area(s) proportionally with the amount of pennies allocated to a specific fishing area. For example, if a commercial fisherman's ex-vessel revenue from rockfish was $50,000 and one fishing area was assigned 50 pennies we would allocate $25,000 in economic value to that specific fishing area. This allocation of economic value is applied to each individual spatial fishing data set.

Individual spatial fishing data were weighted based on the specific fisherman's ex-vessel revenue for the full calendar year 2010 (or 2011 in the second season of data collection conducted in 2012) from a given fishery. For the Dungeness crab-trap fishery the ex-vessel revenue was summarized from landings from November 2010 to June 2011 and November 2011 to June 2012 for the two data collection efforts respectively.

To standardize each data set for aggregation we then converted each fisherman's fishing ground data layer (polygon layer) for a particular fishery into a 100 x 100 meter cell size grid or raster layer.

Step 3: Aggregate individual fishing ground values to port level data set

To aggregate the individual fishing ground data layers (raster layers) we simply summarize the values in each cell across the individual raster data layers for all respondents in a given home port. The resulting data set is a 'heat map' depicting the relative value of fishing areas for a given fishery in a given port.

Step 4: Aggregate port level data sets to regional data sets

To create regional level data sets for a specific fishery each port data layer is further weighted by the port's total ex-vessel revenue for the specific fishery (for the given year of interest) which is provided by the CDFW landings data and then combined into a regional data layer. We apply the total ex-vessel revenue to each port level data layer when combining data layers to control for any sample bias at the port level. For example, if we interviewed more fishermen in a given port it may not necessarily mean that the economic value of that port is greater than that of another port in which we interviewed less commercial fishermen.

Applying this aggregation weight is done by distributing the total ex-vessel revenue value across the respective port level data layer proportionally by the value in each raster cell. Each of these port level raster data layers are then aggregated by summing the values in each raster cell across the port data layers in the region.

2.3.5. Non-spatial Data Analysis Methods

The design of survey questions within this project were largely modeled from survey questions developed through the survey work Ecotrust conducted during the MLPA planning process (2005-20011). The survey was further refined through review with key informants within the North Central Coast fishing community to tailor the questions and select target fisheries specific to the North Central Coast Region. The survey questions were designed so that fishermen could easily provide answers/estimates from readily available knowledge commonly known by fishermen. For the instances in which fishermen were unable to provide answers using on-hand information, Ecotrust field staff later followed up with the individual to collect the information or the information was omitted when calculating averages.

All non-spatial survey data were exported from Open OceanMap to an MS Access database and then imported into MS Excel files which were then summarized into tabular format primarily using pivot table queries. As emphasized above, all data for ports or fisheries with fewer than three respondents have been withheld from publication to protect the confidentiality of the survey respondents. An asterisk, '*', can be found in the data tables in which data has been suppressed. A dash, '–', in the data tables indicates a zero value or that data was not collected for a given port-fishery combination. Often if data were not collected in a given port-fishery combination the fishery does not occur or is not a significant fishery in a port (e.g., is not a target fishery).

Ex-vessel revenue and landings data points with less than three fishermen were suppressed and to ensure the confidentiality of fishermen data, secondary suppression were also made when appropriate in order to prevent the back calculation of suppressed data points from regional totals. In ports with suppressed landings data, the data were not deleted from the aggregate port totals, but instead coded and included as 'other'.

In the report, there are several survey summary tables which report out on characteristics of fishing activities/income from the year 2007. These averages were taken from a study conducted by Ecotrust in 2008 (Scholz et al. 2008). We provide this information to investigate possible economic change since 2007. During interviews we asked fishermen to provide estimates on fishing activities/income both in 2007 and 2010/2011 (e.g., percent of personal income from commercial fishing, percent of gross economic revenue used towards operating costs, etc.). We did not however report out on the 2007 estimates given but rather used these two data points given in the interview to ask open ended questions as to why these may have changed over time. This gathered important qualitative information on the major factors driving any reported/perceived changes between the two years. In each table we provide the number of fishermen interviewed in 2007 and 2010/2011 to compare the difference in sample size when considering the results from each year.

3. NORTH CENTRAL COAST REGIONAL PROFILES

3.1. North Central Coast Region Commercial Fishing Historical Trends and Initial Changes

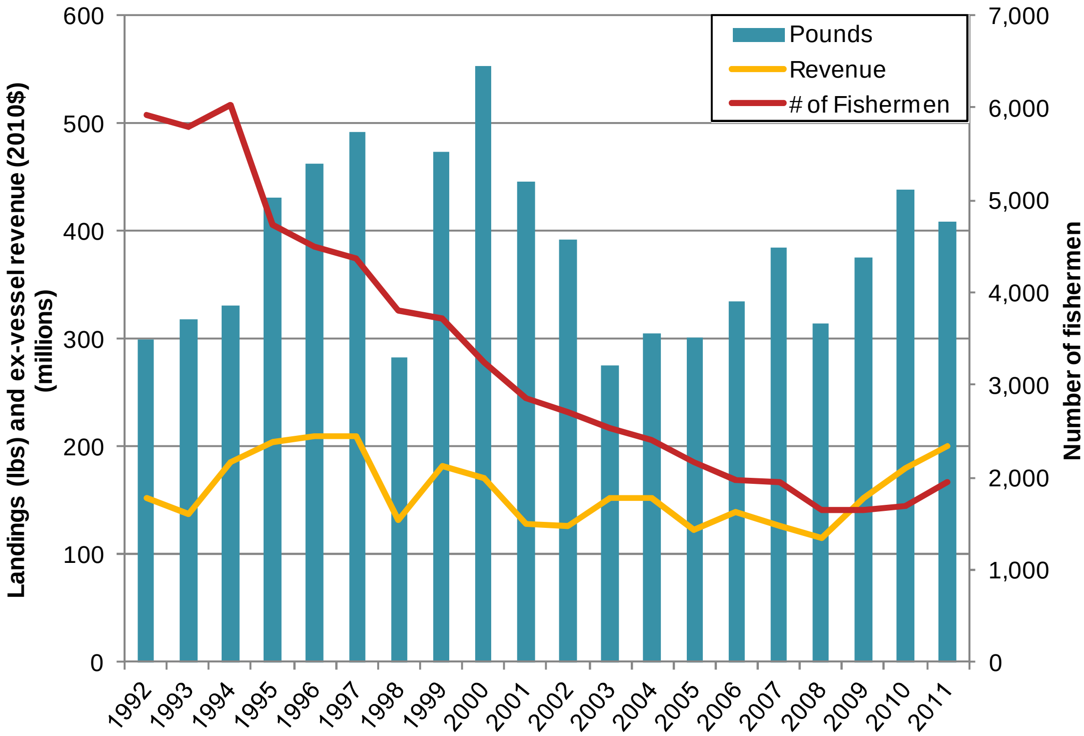
Figure 3 displays statewide commercial landings in California from 1992–2011. Landings fluctuated over the study period; they were lowest in 2003 at 275.3 million pounds and highest in 2000 at nearly 554 million pounds. At the end of 2011, landings were at 407.8 million pounds. The ex-vessel revenue over the study period increased from $151.5 million in 1992 to a high of $210.6 million in 1996, and was at approximately $201 million at the end of 2011. It is interesting to note that the highest and lowest years of ex-vessel revenue do not correspond with the highest and lowest years for volume or pounds landed, this is likely due to changing composition of landings and ex-vessel price paid in particular fisheries each year. Overall, landings and ex-vessel revenue for the state of California increased by 36.2 and 32.6 percent respectively from 1992 to 2011. The number of fishermen consistently declined over the study period, 67 percent total, from 5,920 in 1992 to 1,951 in 2011. Some fishermen noted that increased operating expenses and regulations have made it difficult for small boat and small revenue fishermen to operate and many of them are finding it too costly to remain in operation. Additionally, fishermen noted that those who fished commercially as a second job or hobby are also dropping out of the commercial fishing.

Figure 4 displays commercial landings made in the North Central Coast region from 1992–2011. Overall trends in the region varied from those found for the state of California, generally declining until the end of the study period. Landings in 1992 were 46.6 million pounds, which was the highest point during the entire study period, and at the end of 2011 were at 24.6 million pounds. Ex-vessel revenue over the study period increased from $36.7 million in 1992 to a high of $48.5 million in 1997 before generally declining and increasing again to $48.4 million in 2011. Overall, the ratio of ex-vessel revenue to pounds landed in the North Central Coast region was significantly higher to that of the state of California during the same study period. And while landings for the North Central Coast region decreased significantly from 1992 to 2011 (47.2 percent decrease) while an increase was observed for the state of California, ex-vessel revenue increased by approximately the same percent (31.8). Both the state and the North Central Coast region saw a decrease in the number of fishermen by approximately two-thirds.

As displayed in Figure 5, the significance of the North Central Coast region relative to California state fisheries as a whole has varied over time. In 1992, 15.6 percent of all California landings and 24.2 percent of all California ex-vessel revenue were made in ports within the North Central Coast region. The percentage of North Central Coast region ex-vessel revenue to state ex-vessel revenue peaked at both the beginning and end of the study period while the percentage of North Central Coast region landings to state landings peaked in 1992 before declining to 6 percent at the end of the study period in 2011. Fishermen in the North Central Coast region represented nearly a third of all California fishermen on average over the study period, ranging from 22.6–37.2 over time.

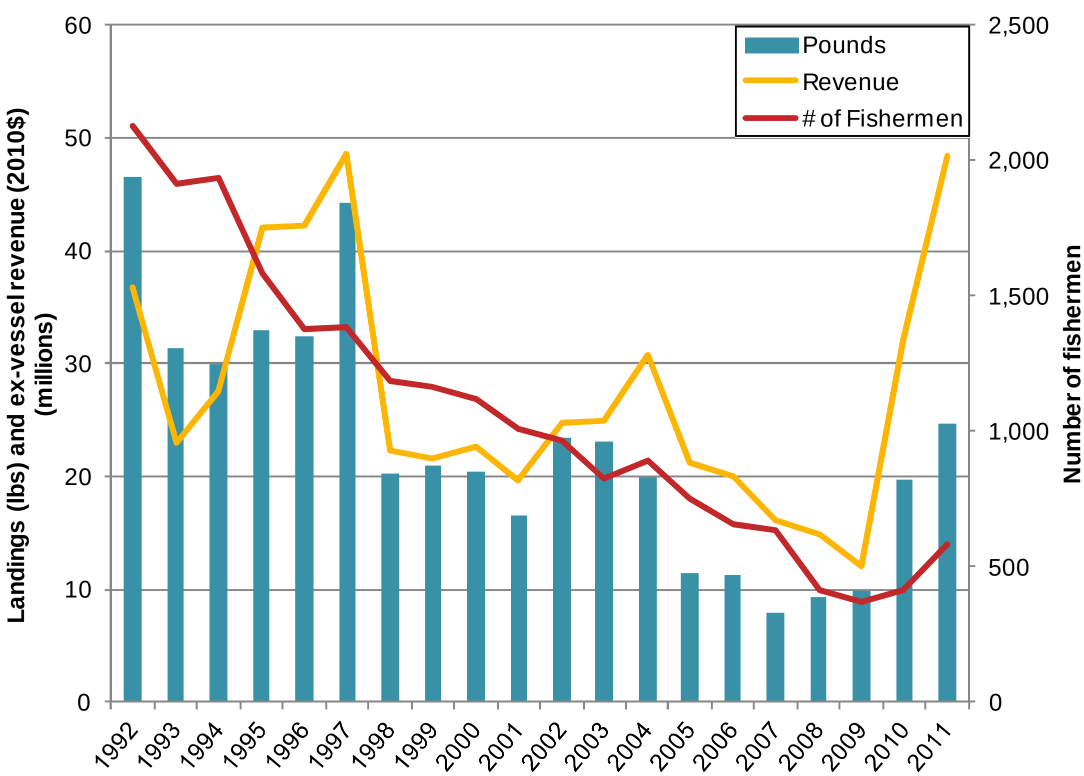
As illustrated in Figure 4 the number of fishermen making landings in the North Central Coast region declined dramatically during the study period (72.5 percent). However, the average landings and ex-vessel revenue per fisherman increased over time (see Figure 6). The average rise in landings ex-vessel revenue per fisherman suggests an increase in the scale of fishing operations overall, shifts to higher value fisheries, or an increase in ex-vessel price in select fisheries in the North Central Coast region. These and other possible explanations for observed changes are explored at the region-fishery and port-fishery level throughout this report. It should be highlighted that presenting a North Central Coast region average does not reveal trends at the individual fishery or port level which may be experiencing average per vessel decreases in landings and ex-vessel revenue.

Figure 3. State of California total commercial landings, ex-vessel revenue, and number of fishermen, 1992–2011



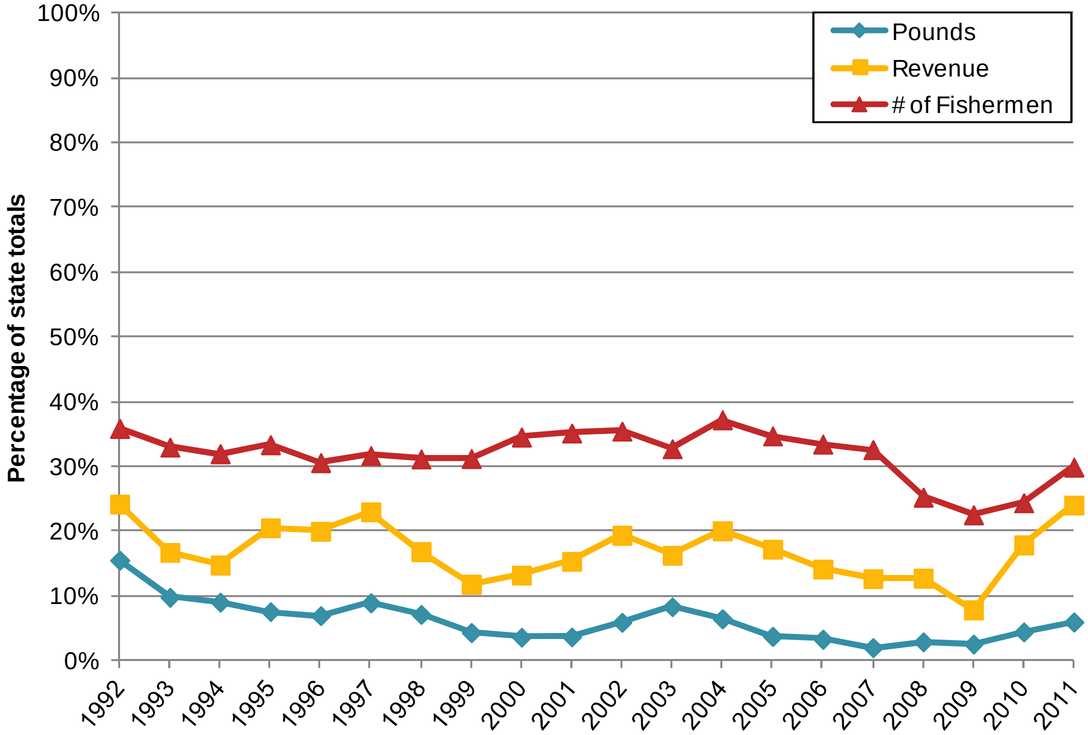
Source: Landings data from CDFW.

Figure 4. North Central Coast region total commercial landings, ex-vessel revenue, and number of fishermen, all fisheries, 1992–2011



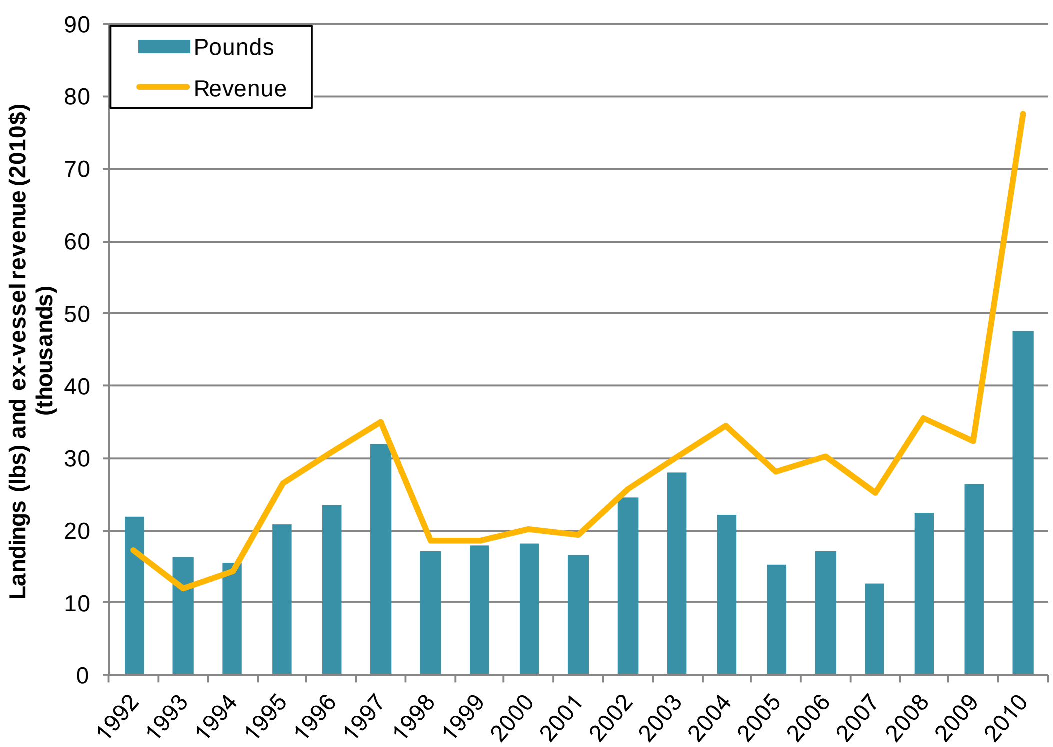
Source: Landings data from CDFW.

Figure 5. North Central Coast region total commercial landings as a percentage of state commercial landings and ex-vessel revenue, 1992–2011



Source: Landings data from CDFW.

Figure 6. Average commercial landings and ex-vessel revenue per fisherman in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

The initial changes sections of this report examine the commercial landings data for six fisheries of interest in the North Central Coast region. The six fisheries of interest are presented in Table 2.

Table 2. Commercial fisheries of interest

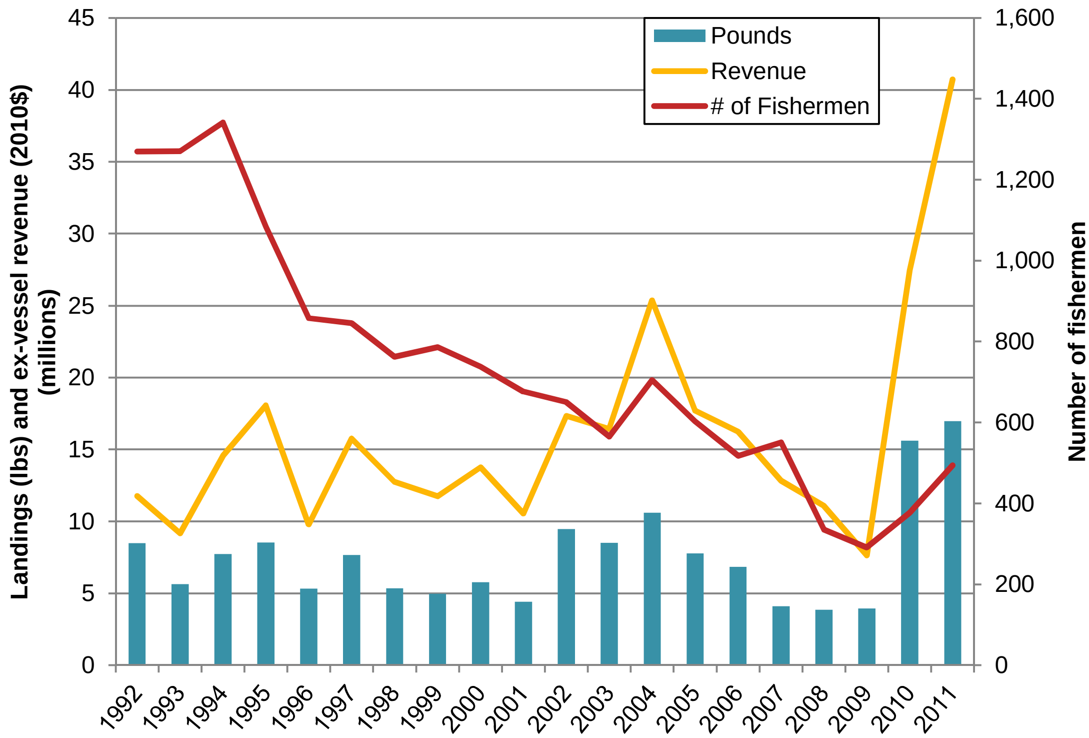
Fisheries of Interest
California halibut–hook & line
Dungeness crab–trap
Nearshore finfish–live–hook & line
Nearshore finfish–live–longline
Salmon–troll
Urchin–dive

It is important to note that unless marked 'all fisheries', most figures in this report are examining the commercial landings and ex-vessel revenue trends specific to these six fisheries of interest. Of course, these six fisheries of interest are not the only fisheries that occur in the North Central Coast region, and additional landings and ex-vessel revenue from other fisheries are mentioned in the narrative for each North Central Coast region port. As stated earlier in the methods section these fisheries were selected for further analysis as they occur mostly in state waters and are most likely to experience both short-term spatial and economic changes associated with MPA implementation and are of high economic importance to the North Central Coast region.

Total landings in the North Central Coast region for all fisheries averaged 22.8 million pounds annually and $27.6 million in ex-vessel revenue from 1992–2011. Total landings in the North Central Coast region for the six selected fisheries of interest averaged 7.8 million pounds annually and $16 million in ex-vessel revenue from 1992–2011, see Figure 7. While total landings decreased overall for all fisheries, they increased nearly 100 percent among the six fisheries of interest from 1992–2011. Ex-vessel revenue also increased nearly two and half times over the same period among the fisheries of interest; as seen in Figure 10, this was largely due to an increasing pursuit of the Dungeness crab–trap fishery. The decline of fishermen was only slightly less (61.1 percent) among fisheries of interest as compared to the overall region total, with 1,270 fishermen in 1992 and 494 fishermen in 2011.

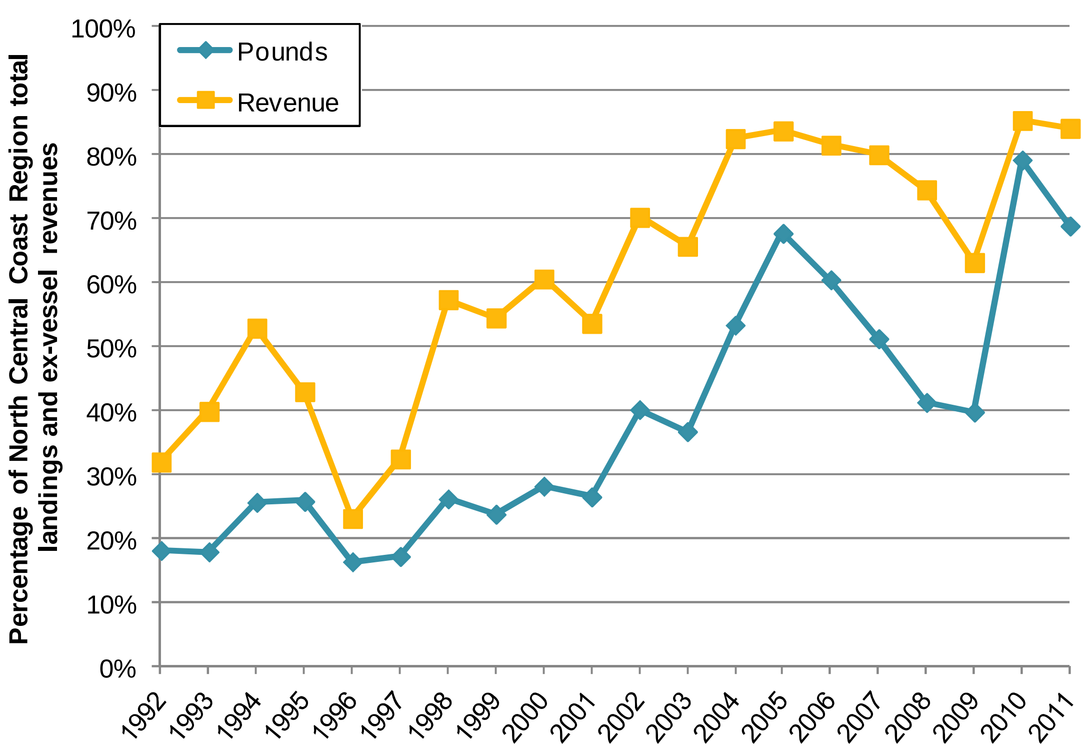
The significance of the six fisheries of interest to total regional landings has increased over time. Figure 8 displays the percentage of total landings and ex-vessel revenue the six fisheries of interest represented of total landings and ex-vessel revenue from all fisheries in the North Central Coast region over the study period. In 1992, fishery of interest landings and ex-vessel revenue comprised only 18.2 percent and 32 percent of total landings and ex-vessel revenue respectively. By 2011, these percentages increased to 68.9 percent and 84.1 percent overall as the fisheries became more significant in the North Central Coast region overall. Averaging across the entire study period, landings and ex-vessel revenue from the six fisheries of interest constituted 38.3 percent and 61 percent respectively.

Figure 7. North Central Coast region commercial landings, ex-vessel revenue, and number of fishermen, fisheries of interest, 1992–2011



Source: Landings data from CDFW.

Figure 8. Fisheries of interest as a percentage of all commercial fisheries landings and ex-vessel revenue in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

Averaging annually across the study period, the top five additional fisheries in the North Central Coast region contributing to landings included Pacific herring roe (averaging 18.2 percent), groundfish–bottom trawl (17.5 percent), market squid–seine/net (5 percent), coastal pelagics–seine/net (3.6 percent), and Pacific herring (2.8 percent). In terms of average annual ex-vessel revenue, the top five additional fisheries in the North Central Coast region were Pacific herring roe (averaging 9.7 percent), groundfish–bottom trawl (8.7 percent), California halibut–bottom trawl, (3.5 percent), Pacific herring (2 percent), and swordfish (1.8 percent).

Table 3 displays the average annual landings and ex-vessel revenue of the six fisheries of interest over the study period. The percentage of each fishery's ex-vessel revenue to total ex-vessel revenue in the North Central Coast region are displayed over various time segments of the study period to enable comparisons both pre and post-MPA implementation. The Dungeness crab–trap fishery averaged 49.6 percent of total ex-vessel revenue over 2000–2011, increasing from 33 and 53.7 percent pre-MPA (2000–2004 and 2005–2009 respectively) to 80.7 percent post-MPA (2010–2011). The increasing significance of the Dungeness crab–trap fishery is especially notable over the study period, as is the decline of the salmon–troll fisheries. These trends are likely due to a combination of several factors including changes in regulations, status of fish stocks, market forces, and oceanographic conditions.

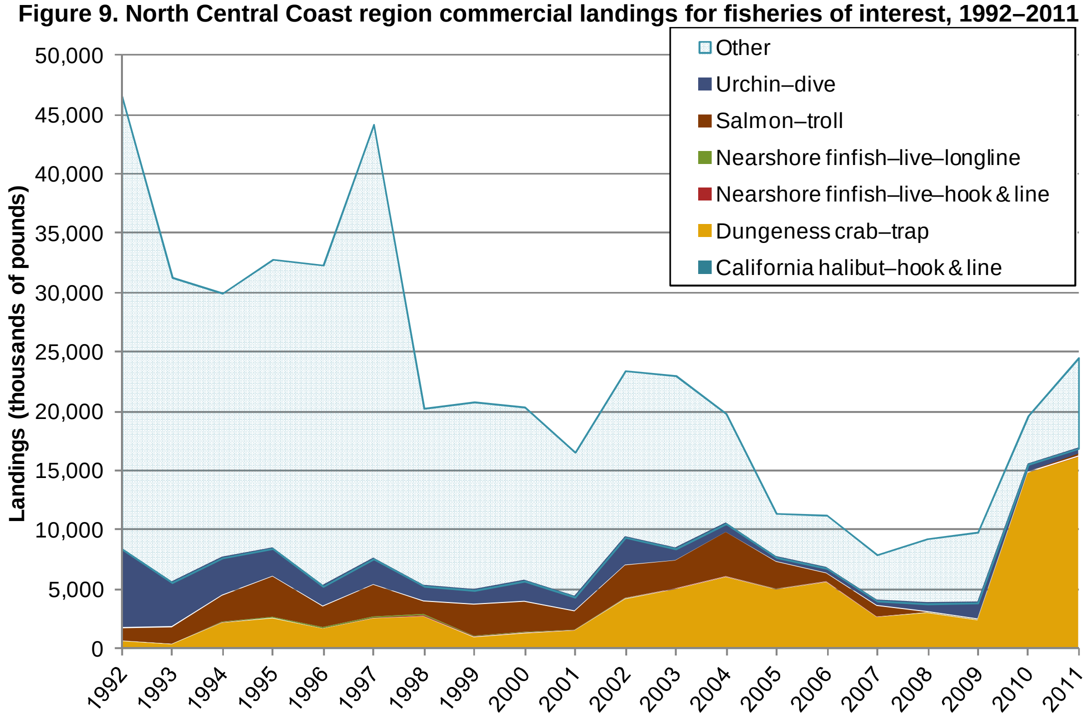
Figure 9 and Figure 10 illustrate these shifts in the composition of total landings and ex-vessel revenue in the North Central Coast region graphically. We would like to highlight that for ex-vessel revenue and landings composition figures shown throughout this report at the port level, not all six fisheries of interest are visible in the figures due to relatively low values of some fisheries in relation to total landings and ex-vessel revenue. These compositional figures display the total landings and ex-vessel revenue for all fisheries with non-fisheries of interest represented as 'other' in light, transparent blue shading. The trend represented in Figure 8 is also apparent in Figure 9 and Figure 10: the six fisheries of interest have become relatively more significant in relation to other fisheries in the North Central Coast region over the study period.

Table 3. Average annual percent contribution of fishery ex-vessel revenue to North Central Coast region total ex-vessel revenue, commercial fishing

	Annual averages 1992–2011		Average annual % of revenue to total revenues			
Fishery	**Landings**	**Ex-vessel Revenues**	**Pre-MPA (2000-2004)**	**Pre-MPA (2005-2009)**	**Post-MPA (2010-2011)**	**2000-2011**
California halibut–hook & line	84,330	$325,731	1.2%	2.3%	1.0%	1.6%
Dungeness crab–trap	4,043,454	$9,390,860	33.0%	53.7%	80.7%	49.6%
Nearshore finfish–live–hook & line	27,168	$144,930	0.7%	1.0%	0.4%	0.8%
Nearshore finfish–live–longline	35,295	$142,710	0.7%	0.4%	0.2%	0.5%
Salmon–troll	1,641,560	$4,468,209	22.2%	16.1%	1.4%	17.7%
Urchin–dive	1,742,116	$1,562,111	5.2%	3.1%	1.0%	3.6%

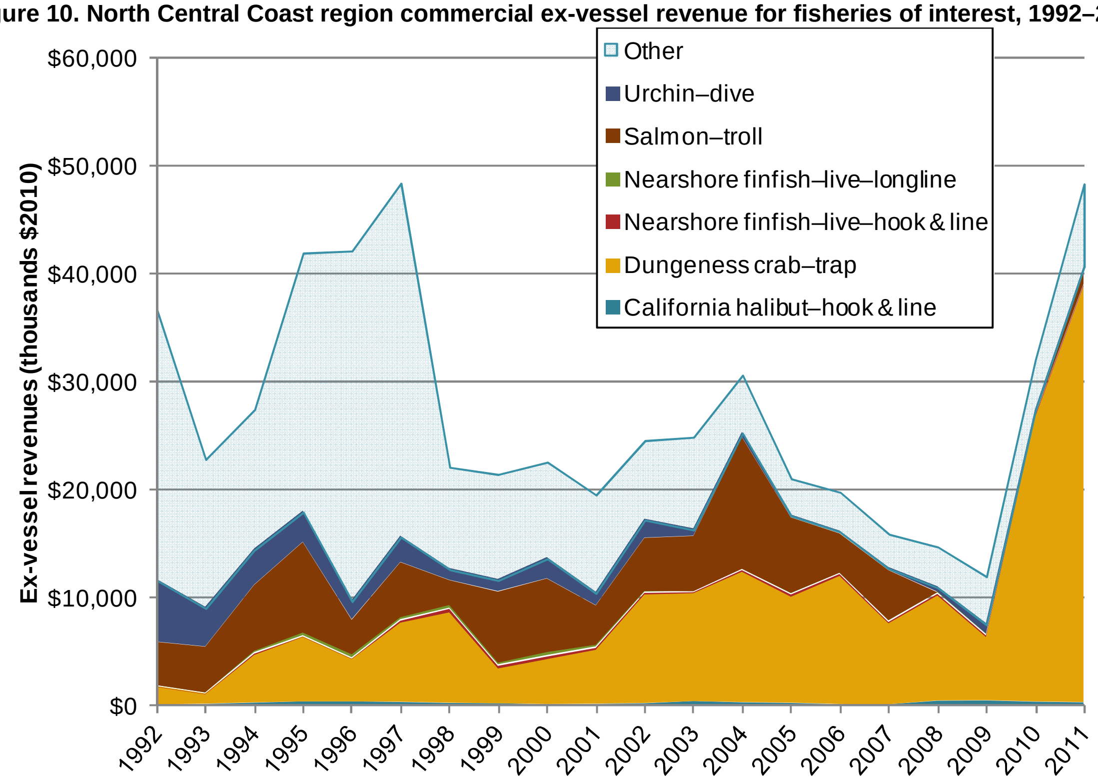
Source: Current study using CDFW landings data

Figure 9. North Central Coast region commercial landings for fisheries of interest, 1992–2011



Source: Landings data from CDFW.

Figure 10. North Central Coast region commercial ex-vessel revenue for fisheries of interest, 1992–2011



Source: Landings data from CDFW.

Figure 11 displays the average relative percent fishing income from the six commercial fisheries of interest from 1992–2011 and was created using CDFW landings data. Similar figures are presented for each North Central Coast region port later in the report. These figures were developed to explore changes in how much fishermen rely upon specific fisheries of interest over time. It should be noted that these percentages may not reflect upon a fisherman's full fishing portfolio, we examined the majority of ex-vessel revenue (approximately 90–100 percent each year)[3] from only the North Central Coast region. Fishermen who fish outside of the region may have additional fishing income that is not accounted for in these figures.

To create this figure, ex-vessel revenue from thirty two distinct fisheries, including the six fisheries of interest, for each individual fisherman making landings in the region or a specific port were summed by year to estimate a 'total fishing income'. The twenty six non-fisheries of interest are represented as 'other' in light, transparent blue shading. Using this 'total fishing income', the percentage of fishing revenue from each fishery of interest and from the 'other' fishery was calculated for an individual. These individual percentages were then averaged across all fishermen at either the region or port level. The resulting percentages indicate the relative importance of the six fisheries of interest to all other fisheries in the North Central Coast region, or in a particular port. For ports, total averages do not add up to 100 percent as fishermen may land in multiple North Central Coast region ports.

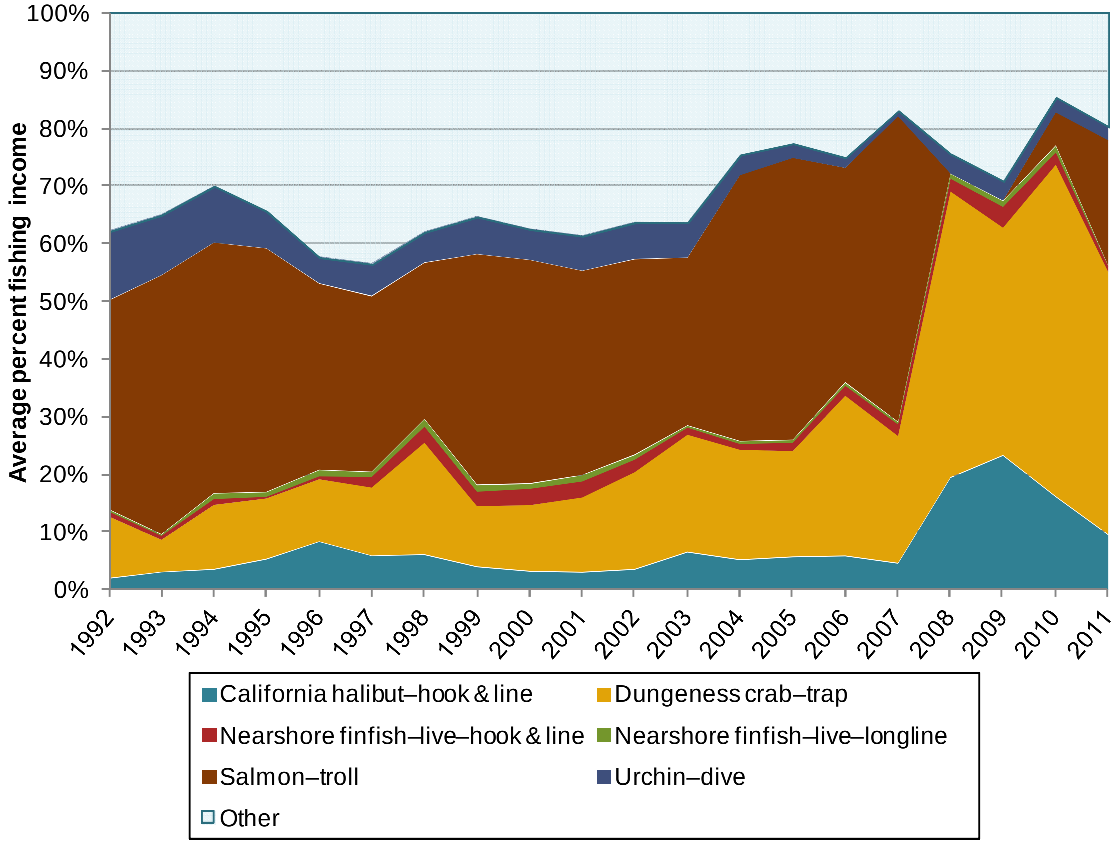
The figures are not intended to portray an individual fisherman as most fishermen tend to fish between only one to three fisheries in a given year on average. Instead, the figures display how important the revenue from a specific fishery was relative to the other fisheries for the average fisherman.

Most striking is the reliance fishermen in the region had on the salmon–troll fishery relative to other fisheries of interest—contributing on average approximately 40.0 percent of revenue from all fisheries of interest over the study period. In years that the salmon–troll fishery was closed, 2008 and 2009, many fishermen relied more heavily upon other fisheries, most notably the California halibut–hook & line, Dungeness crab–trap, and nearshore finfish fisheries. During the years 2008 and 2009 the California halibut–hook & line fishery contributed approximately three times more than it had in years previous to a fisherman's individual fishing income.

While some of these fisheries, such as the California halibut–hook & line fishery continued to provide increased contributions to fishing revenue with the reopening of the salmon–troll fishery, others tapered off again. The rising reliance of fishermen on the California halibut–hook &line fishery is a trend that is not as observable when examining just ex-vessel revenue for that fishery over time. Ex-vessel revenue from the California halibut–hook & line fishery averaged 16.5 percent of the average North Central Coast region fisherman's revenue from fisheries of interest in 2011. This may be due to the open-access nature of this fishery and thus the higher majority of California halibut–hook & line fishermen (many who are part time fishermen) who derive 100 percent of their fishing income from this fishery.

[3] Some landings/ex-vessel revenue may have been made in marginal or rare fisheries which may not be captured in this analysis; additionally, in some years fishing license numbers or their associated landings/ex-vessel revenue may have been entered incorrectly and thus were removed from this particular average percent of individual fishing income analysis.

Figure 11. Average percent of individual fishing income from commercial fisheries of interest, North Central Coast region, 1992–2011



Source: Landings data from CDFW.

3.2. North Central Coast Region Commercial Fishing Baseline Characterization

In the commercial fishing baseline characterization sections found throughout this report we summarized the primary data collected from commercial fisherman interviews carried out in the summer and fall of 2011. Data collected in 2012 is not discussed here but can be found at the regional level in the appendix at the end of this report. We chose not to include results from the second year of data collection in the main body of the report as we interviewed fewer respondents in 2012 (76 fishermen compared to 101 fishermen) but generally received similar responses both years. The data collected in the first round of data collection are a better representation of fishermen in the study region and thus are presented here. Where relevant, notes are made throughout the report to indicate where data may have differed significantly in the 2012 survey data. In addition to data collected in 2011 regarding the 2010 fishing year we include information from interviews conducted in the 2008 study by Ecotrust, which asked questions regarding the 2007 calendar year.

In Table 4 below, the number of fishermen interviewed is organized by target fishery and homeport. Homeport is identified by the fisherman interviewed and is typically where they land the majority of their catch. While each individual may be included in more than one of the target fisheries, each individual is only associated with one homeport. For example, we interviewed 25 fishermen who indicated that Bodega Bay was their homeport. Twenty-three of these individuals participated in the Dungeness crab–trap fishery and six participated in the salmon–troll fishery. Some fishermen in the salmon–troll fishery also participated in the Dungeness crab–trap fishery.

We interviewed the most respondents in Bodega Bay (25), followed by Half Moon Bay (24), San Francisco (23), and then Point Arena (7) and Bolinas (5). Additionally, we interviewed some respondents whose homeport was outside of the study region but who had landings at one or more of the ports within the North Central Coast region. Due to the limited season in 2010 we did not specifically target fishermen with salmon landings for interviews, but did ask questions regarding the salmon fishery as part of our survey questions that investigate a fisherman's full fishing portfolio.

Table 5 shows the number of fishermen who made landings in each of the target fisheries within the North Central Coast study region and the total revenue generated by those landings. The Dungeness crab–trap fishery generated the most ex-vessel revenue, with over 26.3 million dollars in 2010 (over 95 percent of the total ex-vessel revenue landed by the five target fisheries). We interviewed 80 of the 255 fishermen who landed Dungeness crab in the North Central Coast region. All the target fisheries combined generated $27.5 million and we interviewed 101 of the 377 fisherman who made landings in the study region in 2010.

Table 4. Number of commercial fishermen interviews conducted, non-spatial survey, 2010, North Central Coast Region

Homeport	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All target fisheries (unique individuals)
Point Arena	—	4	2	2	4	7
Bodega Bay	4	23	1	6	1	25
Bolinas	3	4	—	—	—	5
San Francisco	11	13	2	3	—	23
Half Moon Bay	4	19	5	2	—	24
North of study region	—	10	—	—	1	10
South of study region	—	5	—	1	—	5
Out of state	—	2	—	—	—	2
Total number of individuals	22	80	10	14	6	101

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 5. Number of commercial fishermen interviews conducted and fishery ex-vessel revenue value, 2010, non-spatial survey, North Central Coast

Fisheries	2010 total ex-vessel revenue (2010$)	Total number of individuals in 2010 landings	Number interviewed
California halibut–hook & line	$427,021	105	22
Dungeness crab–trap	$26,321,805	255	80
Nearshore finfish–live–fixed gear	$210,672	26	10
Salmon–troll	$79,123	62	14
Urchin–dive	$424,114	12	6
All target fisheries (unique individuals)	$27,462,734	377	101

Source: California Department of Fish and Wildlife, Current study

As shown below in Table 6, the average fisherman across all target fisheries was 51.9 years old at the time of interview and had 26.9 years of experience commercial fishing. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. This average, for all target fisheries, is for unique individuals and includes each individual only once, regardless of how many fisheries they participated in. The oldest individual we interviewed was 80 years old, while the youngest was 23 years old.

Table 6. Average age and years of experience commercial fishing, 2010, North Central Coast

	Age			Years of experience		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
California halibut–hook & line	22	47.1	10.7	22	17.3	12.9
Dungeness crab–trap	76	53.1	10.0	80	29.5	12.0
Nearshore finfish–live–fixed gear	10	46.7	7.1	10	21.8	8.1
Salmon–troll	14	55.2	9.9	14	29.6	12.6
Urchin–dive	6	51.7	6.8	6	27.7	4.2
All target fisheries (unique individuals)	97	51.9	10.4	101	26.9	12.8

Source: Current study

Fishermen were asked what percent of their personal income came from commercial fishing in the 2010 calendar year. In Table 7 below, we compare the averages across respondents for 2010 to averages across respondents in 2007, which, as mentioned before, are from the Ecotrust study conducted in 2008 (Scholz. et al 2008). Fishermen were not asked to respond for each fishery they participated in, but rather in regards to their fishing a whole. Responses were then broken by fishery in the table below. The percent change was then calculated using the averages from both years.

Across respondents interviewed in each separate survey effort, on average there was an increase of 4.9 percent of total personal income from commercial fishing. Furthermore, by comparing the results from the 2008 study, we estimate that fishermen who participated in the nearshore finfish–live–fixed gear and California halibut–hook & line fisheries on average had the largest decrease in the percent of their total revenue coming from commercial fishing. Additionally, fishermen in these two fisheries generally made a smaller portion of their income from commercial fishing than those participating in other target fisheries.

It should be noted that the large increase by those participating in the urchin–dive fishery in the percent of total personal income from commercial fishing seen across 2007 and 2010 may be due to the fact that we interviewed many more divers in the North Coast region in our 2008 study than in our 2011 study. The North Coast region experienced a large kelp die off in the mid-2000s which impacted the fishery primarily in the North Coast, although somewhat in the North Central Coast as well. Due to the kelp die off many divers reported a very low percentage of their income came from commercial fishing. However, if we consider only those interviewed in both years these individuals reported an average of 91.6 percent of their income came from fishing in 2007 which would result in a 6.4 percent increase between 2007 and 2010. This is likely a more reasonable representation of the change in income from commercial fishing experienced by North Central Coast homeport based urchin divers.

The increase in percent income from commercial fishing reported by salmon–troll fishermen may be indicative of a decrease in the number of part time fishermen. Some fishermen we spoke to commented that as fishing expenses have increased over time it becomes less viable for part time or small revenue fishermen to continue to operate. Additionally, with increased regulations it may become harder for part time fishermen with other occupations to keep up on regulations. Lastly, as the length of the season becomes more limited part time fishermen are not able to be as opportunistic about when they fish.

Table 7. Percent change in income from overall commercial fishing from 2007 - 2010, North Central Coast

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent Change**
California halibut–hook & line	19	68.8%	37.5%	22	57.5%	42.4%	-16.4%
Dungeness crab–trap	100	90.6%	20.1%	80	86.3%	22.7%	-4.8%
Nearshore finfish–live–fixed gear	5	70.0%	41.0%	10	57.4%	44.3%	-18.0%
Salmon–troll	138	75.2%	34.2%	14	88.9%	18.0%	18.2%
Urchin–dive	21	65.3%	36.6%	6	97.5%	6.1%	49.3%
All target fisheries (unique individuals)	174	75.2%	34.34%	98	78.9%	31.1%	4.9%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^2007 data were taken from Scholz, A.J. et al 2008.

Of the 101 fishermen we interviewed, 47 of them reported they had an additional source of income in 2010 besides commercial fishing. The most commonly reported additional source of income was skilled labor, such as carpentry, painting, or maintenance work. This was closely followed by other fishing related jobs such as operating a CPFV boat or making and selling fishing gear. Additional sources of income are shown below in Table 8.

Table 8. Other sources of income other than commercial fishing in 2010, North Central Coast

	Number responding					
Response	**California halibut–hook & line**	**Dungeness crab–trap**	**Nearshore finfish–live–fixed gear**	**Salmon–troll**	**Urchin–dive**	**All fisheries (unique individuals)**
Construction/Contractor	1	—	1	—	1	2
Farming/Ranching	—	4	—	—	—	4
Fisheries research	—	7	—	4	—	7
Harbor/City job	1	2	2	—	—	4
Office work	1	—	—	—	—	1
Other fishing related work	4	5	—	—	—	9
Other specialized work	4	3	1	1	—	6
Property management	2	2	—	—	—	4
Retirement/Social Security/Investments	2	6	—	2	—	7
Salmon disaster relief	1	6	1	1	—	7
Skilled labor	6	4	2	—	—	10
Number of individuals responding	15	31	6	5	1	47

Source: Current study
— indicates that the port/fishery was not sampled or a zero value data point

Respondents were asked to estimate what percent of their total gross economic revenue (GER) from commercial fishing went back into their overall commercial fishing operating costs. Overall, fishermen reported that in 2010 on average 51.9 percent of their GER was spent on operating costs and that this number has increased since 2007. Again we emphasize that this question is asked about overall commercial fishing operating costs across all fisheries for a particular fisherman.

Shown below, when comparing results from the 2008 and 2011 study the nearshore finfish–live–fixed gear fishery saw an increase in operational expenses from 31.0 percent of GER in 2007 to 34.6 percent of GER in 2010 (an increase of 11.6 percent). The most frequently reported reason for increasing operating costs was the increased cost of fuel, followed by general increases in costs such as bait, gear, and other fishing related items. Reasons as to why operating costs were changing were asked as an open ended question and responses were coded into the categories shown in Table 10.

Table 9. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, North Central Coast

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
California halibut–hook & line	19	45.9%	25.0%	22	51.7%	20.7%	12.4%
Dungeness crab–trap	98	48.6%	18.7%	80	52.1%	17.5%	7.3%
Nearshore finfish–live–fixed gear	5	31.0%	23.0%	10	34.6%	14.4%	11.6%
Salmon–troll	135	46.6%	21.3%	14	47.7%	13.6%	2.4%
Urchin–dive	21	39.7%	15.7%	6	43.2%	17.9%	8.9%
All target fisheries (unique individuals)	171	47.4%	21.2%	98	51.9%	18.3%	9.5%

Source: Current study

^2007 data were taken from Scholz, A.J. et al 2008.

Table 10. Cause of change in percent of gross economic revenue used towards overall operating costs, North Central Coast

	Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live– fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
		Number responding					
Reason for decrease	Large purchase or capital investment in 2007	—	2	—	—	—	2
	2007 was a bad fishing year	—	4	—	2	—	4
	Made less revenue in 2007	—	3	—	1	1	3
	Had more costs in 2007	—	1	—	—	1	1
Reason for increase	Large purchase or capital investment in 2010	—	8	1	1	—	8
	2010 was a bad fishing year	—	1	—	—	—	1
	Made less revenue in 2010	—	1	1	—	1	3
	Increased fuel prices in 2010	1	17	2	4	3	20
	More crew in 2010	—	3	—	1	—	3
	Fished out of multiple ports in 2010	—	1	—	1	—	1
	General cost increase in 2010	—	11	1	3	1	13
Number of individuals responding		1	34	3	8	4	37

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

We asked fishermen how many years of experience and how many days they spent targeting each of the fisheries they participated in. As indicated in Table 11, fishermen have been fishing the salmon–troll fishery the longest, on average just less than 30 years. Fishermen in the California halibut–hook & line and nearshore finfish–live–fixed gear fisheries had the fewest number of years of experience (17.6 and 18 years, respectively) of the five target fisheries. Fishermen spent the fewest number of days targeting salmon–troll in 2010, an average of just 3.7 days. The most frequently targeted fishery was nearshore finfish–live–fixed gear, which was targeted an average of 71.9 days in 2010.

Table 11. Years of experience and number of days targeting specific fisheries in 2010, North Central Coast

	Years of experience in fishery			Days spent targeting fishery		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
California halibut–hook & line	22	17.6	13.0	21	68.5	56.1
Dungeness crab–trap	80	24.4	12.9	74	64.2	34.8
Nearshore finfish–live–fixed gear	10	18.0	10.0	8	71.9	70.8
Salmon–troll	14	29.6	12.7	11	3.7	1.3
Urchin–dive	6	26.5	3.7	5	57.0	27.5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Fishermen were also asked how many crew they used for each fishery and what percent of their GER was spent on their crew. Many fishermen reported they did not use a crew (and subsequently zero percent of their GER was spent on crew) and they are included in the averages in Table 12, below. The Dungeness crab–trap fishery utilized the highest average number of crew (2) and therefore also reported the highest percent of gross economic revenue (GER) spent on crew (28.3 percent). However, the average percent of fishery specific GER spent on fuel was the lowest for the Dungeness crab–trap fishery (11.4 percent). Only one respondent in the urchin–dive fishery reported using a crew, however; they did not provide information regarding what percent of their GER went to their crew.

Table 12. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, North Central Coast

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
California halibut–hook & line	22	0.3	0.6	22	5.2%	12.3%	21	24.8%	14.7%
Dungeness crab–trap	80	2.0	1.0	77	28.3%	11.0%	68	11.4%	6.1%
Nearshore finfish–live–fixed gear	10	0.2	0.4	10	4.0%	8.8%	8	23.6%	18.1%
Salmon–troll	13	0.5	0.5	14	8.1%	8.7%	14	25.7%	29.9%
Urchin–dive	6	0.2	0.4	5	—	—	4	14.0%	5.2%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Fishermen were asked if they added or dropped any fishery since 2007 or if they did not fish a fishery in 2010. The reasoning behind this question was to investigate any underlying factors that may be driving socioeconomic change in specific fisheries. Overall, of the fishermen interviewed in 2011, there was very little change in the composition of an individual's fishing portfolio from 2007 to 2010. As shown below in Table 13, two individuals added the California halibut–hook & line fishery and three individuals added the Dungeness crab–trap fishery between 2007 and 2010. No one indicated they had permanently dropped a fishery altogether from their portfolio during this time period, although some individuals indicated they did not fish a particular fishery in 2010.

Table 13. Commercial fisheries added/dropped since 2007 or not fished in 2010, North Central Coast

		Percent responding		
Fisheries	**Number responding**	**Added**	**Dropped**	**Not fished in 2010**
California halibut–hook and line	22	2	—	—
Dungeness crab–trap	80	3	—	1
Nearshore finfish–live–fixed gear	10	—	—	1
Salmon–troll	14	—	—	2
Urchin–dive	6	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Both California halibut–hook & line fishermen who said they had added the fishery since 2007 said they were new to commercial fishing as a whole. Three of the four Dungeness crab–trap fishermen, who reported adding the fishery or not fishing it in 2010 cited different reasons, which are listed below in Table 14. The nearshore finfish–live–fixed gear fisherman who said he did not target this fishery in 2010 indicated it was due to MPAs. The salmon fishermen who reported not fishing in 2010 indicated it was due to the bad season and because they had other work that was more profitable. While most fishermen indicated they did not have a productive salmon season due to the shortened season and general poor weather conditions, they did indicate that they at least targeted the fishery at some point in 2010 and are therefore not included in Table 13 and Table 14.

Table 14. Reason for adding/dropping a fishery since 2007 or not fishing in 2010, North Central Coast

	Number responding				
Response	**California halibut–hook & line**	**Dungeness crab–trap**	**Nearshore finfish–live–fixed gear**	**Salmon–troll**	**Urchin–dive**
New to commercial fishing	2	1	—	—	—
Purchased boat with permit	—	1	—	—	—
Not enough time due to other work	—	1	—	1	—
Increased difficulty due to MPAs	—	—	1	—	—
Bad season	—	—	—	1	—
Number responding	2	3	1	2	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Fishermen were asked separately for each fishery they participated in to compare his/her success in the fishery in 2010 to that of the last five years. As shown in Table 15 below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked as an open ended question and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

All Dungeness crab–trap fishermen indicated that fishing was better in 2010 and most of respondents (77.5 percent) said they were doing significantly better. Almost exclusively the reasons to which they attributed this were environmental (Table 17); they noted there was a larger quantity of crab and that the 2010 season was at the peak of a natural cycle of crab abundance. Some fishermen also noted that improved water quality in the San Francisco bay area, which is an important crab nursery ground, may have also contributed to the increase in crab abundance. Urchin–dive and salmon–troll fishermen indicated that their fisheries were either the same or worse than the previous five years, both citing regulatory reasons as the cause, such as MPAs (Table 16). Additionally salmon–troll fishermen indicated environmental impacts such as a general lack of fish, bad weather, and lack of salmon spawning grounds.

Below, in Figure 12, responses to the question in how the fisherman's success in the fishery in 2010 compared to that of the last five years are shown in graphical form for each port and target fishery within the study region. For this graphic responses were grouped together into three categories; better, worse, and the same.

Table 15. Overall success in specific commercial fishery in 2010 compared to previous five years, North Central Coast

		Percent response					
Fisheries	Number responding	Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
California halibut–hook & line	22	4.5%	4.5%	27.3%	22.7%	18.2%	22.7%
Dungeness crab–trap	80	3.8%	77.5%	15.0%	3.8%	—	—
Nearshore finfish–live–fixed gear	9	—	10.0%	10.0%	20.0%	30.0%	20.0%
Salmon–troll	14	—	—	—	7.1%	7.1%	85.7%
Urchin–dive	6	—	—	—	16.7%	16.7%	66.7%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 16. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	4	—	3	12	5
	Responses	**Count of responses**				
Worse	Regulated season too short	1	—	—	11	—
	MPAs	2	—	3	2	5
	No permit required	1	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 17. Environmental changes/factors influencing success in a specific commercial fishery in 2010 a compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	7	69	4	10	—
	Responses	**Count of responses**				
Better	Larger quantity of fish	3	50	2	—	—
	Peak of natural cycle	1	31	—	—	—
	Good weather	1	1	—	—	—
	Good ocean conditions	—	2	—	—	—
	Good quality fish	1	1	1	—	—
	More bait/feed in the ocean	—	—	—	—	—
Worse	Low quantity of fish	2	—	1	5	—
	Bad weather	—	—	—	4	—
	Poor ocean conditions	1	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	2	—
	Red tide	—	—	1	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 18. Economic changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	—	1	2	—	—
	Responses	**Count of responses**				
Better	Good price	—	1	—	—	—
	Good/new market	—	1	—	—	—
Worse	Increase in fuel costs	—	—	2	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 19. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	6	—	1	—	—
	Responses	**Count of responses**				
Better	Able to fish more frequently	1	—	—	—	—
	Becoming more experienced	1	—	—	—	—
Worse	Others changing fishery	3	—	—	—	—
	Boat problems/breakdowns	—	—	1	—	—
	No access to live bait	2	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Figure 12. Overall success in specific commercial fishery in 2010 compared to previous five years, North Central Coast

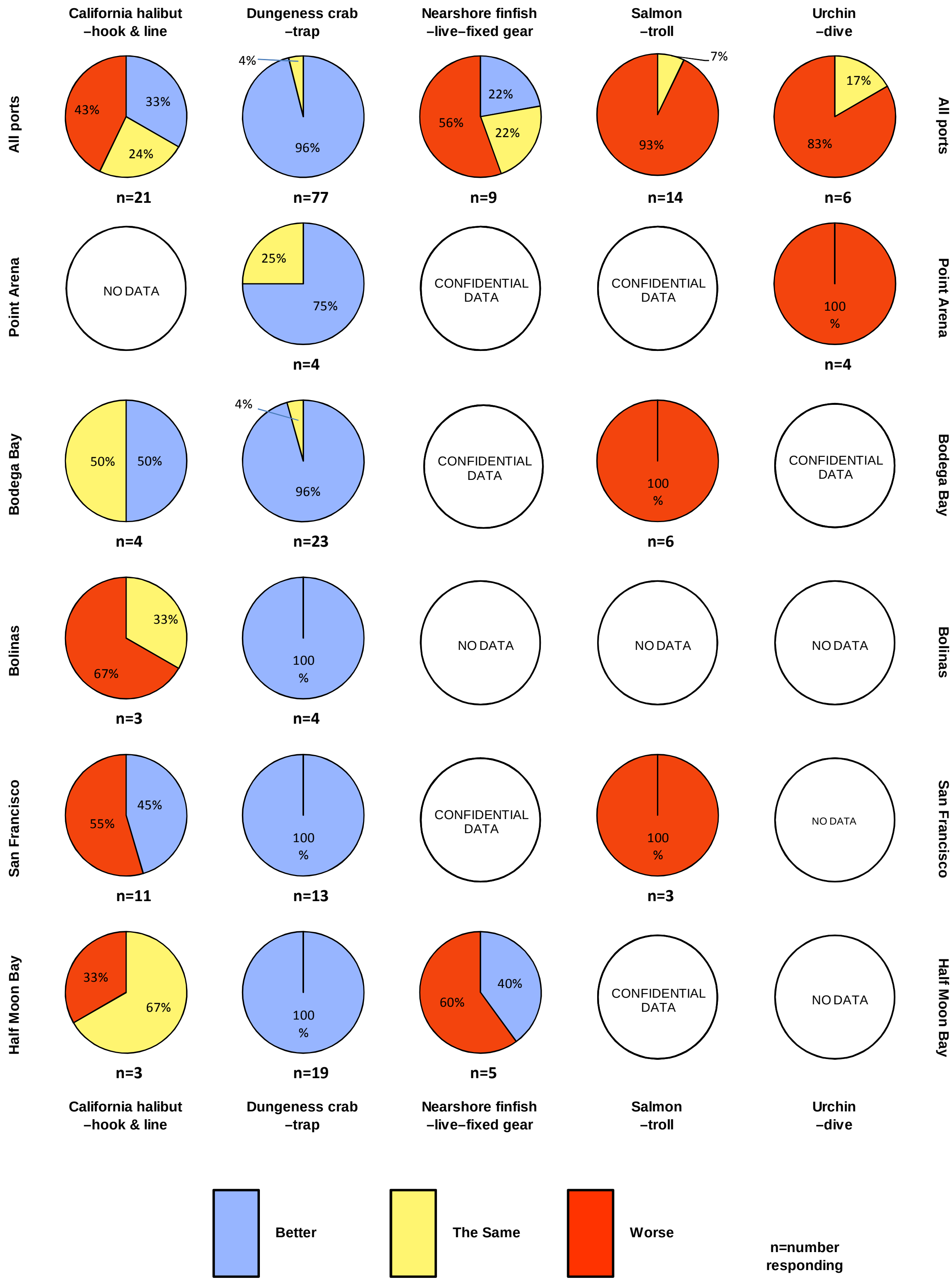


Table 20 lists permits that individuals cited they owned, but did not use in 2010. This question was asked to further investigate underlying factors which may be driving change in fishing opportunities in the region. The most frequently unused permit in 2010 was a California salmon–troll permit.

Table 20. Permits not used in 2010, North Central Coast

	Number responding									
Permit type	Number of respondents reporting not using a permit type	Limited season/no season	Fish not around	Bad weather	Fishery is not profitable	Marine Protected Areas	Limited/ bad market	Not a priority fishery	Had other work besides fishing	Too heavily regulated/ political
Albacore	5	—	1	—	—	—	—	—	1	—
Dungeness crab (out of state)	5	—	—	—	1	—	—	4	—	—
Federal groundfish	1	—	—	—	—	—	—	1	—	—
General gill net	1	—	—	—	—	—	—	1	—	—
General trap permit (blackcod)	1	—	—	—	—	—	—	—	1	—
Herring	6	—	1	—	4	—	2	3	—	—
Highly migratory species permit	3	—	—	—	—	—	—	2	—	—
Pink Shrimp (California)	2	—	—	—	1	—	1	—	—	—
Pink shrimp (out of state)	3	—	—	—	1	—	—	2	—	—
Rockfish (deeper nearshore)	7	—	—	—	1	1	—	2	1	—
Rockfish (nearshore)	2	—	—	—	—	1	—	1	—	—
Rockfish (unspecified)	1	—	—	—	—	—	—	—	—	—
Salmon (California)	43	34	14	6	8	—	1	8	1	3
Salmon (out of state)	9	4	1	1	1	—	—	4	—	—
Sardine	1	—	1	—	—	—	—	—	—	—
Swordfish	3	2	—	—	—	—	—	1	—	—
Urchin	2	—	—	—	—	2	2	—	—	—
All permit types (not unique individuals)	95	40	18	7	17	4	6	29	3	4

3.3. North Central Coast Region MPAs and Commercial Fishing

Determining and measuring the impact of MPAs upon commercial fishermen is challenging to quantify and unravel from the multitude of environmental, regulatory, and economic factors influencing systems of fishing. Despite this, we sought to capture information from fishermen as to how they perceive they have been impacted by MPAs and the specific MPAs which are impacting their fisheries. This section provides information at the region and port levels and summarizes the response from the following three questions which were asked for each fishery during interviews:

1) Has your fishery been directly impacted by the recently established MPAs?;
2) If so, how have you been impacted?; and,
3) What MPAs have impacted your specific fishery?

Question one was posed as a simple yes or no response and questions two and three were open-ended questions in which responses were later coded and categorized into the tables below. Additionally, fishermen were given a map of the MPAs in the North Central Coast to aid in identifying and naming the MPAs impacting them. The questions above were asked for every fishery an individual participated in. We'd like to note that the data provided here is only from fishermen who are currently still fishing or participating in a fishery. Fishermen who dropped out of fishing or who dropped out of specific fisheries since MPA implementation are not captured here.

As shown below in Table 21, 77.2 percent of individuals we interviewed indicated they had been directly impacted by MPAs in a least one of their target fisheries. Impacts varied by fishery, with 100 percent of urchin–dive fishermen indicating they had been impacted by MPAs in 2010. Nearshore finfish–live–fixed gear fishermen also had a high rate of individuals indicating they had been impacted (80 percent). Salmon–troll was the relatively least impacted target fishery in 2010, with 42.9 percent responding they had been impacted.

It should be noted that some salmon–troll fishermen who responded that they were not impacted by MPAs mentioned that this was because they had such limited opportunity to target salmon in 2010 and that impacts would likely be greater in a better year. Indeed, our data collected in 2012 regarding the 2011 fishing year (see Appendix at end of report) indicated that 78 percent of the 41 salmon–troll fishermen we interviewed were impacted by MPAs. The salmon-troll fishery was the only fishery where we interviewed more respondents in year two of data collection than we did in year one. This was due to the fact that many fishermen felt they could not respond to questions regarding the 2010 salmon fishery due to the extremely limited season.

Loss of traditional fishing grounds was the most frequently cited type of impact for each fishery. Many individuals (48.5 percent) also indicated that since the MPAs had gone into effect they had found themselves fishing at the borders of MPAs, 39.6 percent of individuals indicated that they were spending more time fishing or traveling to fish, 27.7 percent of respondents indicated they were fishing in areas with worse or less predictable weather, and 21.8 percent of respondents mentioned that some remaining fishing grounds are becoming increasingly crowded and are being more heavily fished. Fishermen explained that this concentration of effort and localized over-fishing results in the catch of increasingly smaller fish in some remaining open areas.

All of the urchin–dive fishermen interviewed also indicated that they had to spend more time traveling to reach some of their fishing areas and were spending more time in the water. Additionally 66.7 percent of urchin divers indicated they have either had to switch homeports or were fishing from multiple ports as a direct result of the MPAs. For one fisherman in particular this meant having to travel away from his family for significant portions of the year to dive for urchins in Southern California. Quality of life impacts, like this, may not be adequately accounted for in economic or spatial analyses which are the primary objective of this project but are important to consider in order to understand the full range of impacts MPAs have had on the fishing communities. Urchin divers also mentioned (33.3 percent of them) that some of the areas put into MPAs were highly productive areas. Specifically, they reported that these areas produced high quality urchin that often received a better price than those they can currently target.

In addition to the impacts already discussed, many fishermen provided responses that indicated a misunderstanding of MPA regulations. For example, some fishermen thought they were not allowed to transit through MPAs or anchor within them. Some also mentioned that they were unaware of specific boundaries and what fisheries they could and could not target in State Marine Conservation Areas and were unsure of where they could go to obtain such information. Nearly all respondents mentioned that they were concerned regarding the potential expansion of MPAs and in some case mentioned they were hesitant to provide any additional information that could potentially be used against them, such as the current spatial extent of their fishing grounds. Some fishermen noted that there was a lack of effective enforcement of MPA regulations and that they often see people fishing in MPAs. They indicated that because of this, MPAs tend to harm the honest, law abiding fishermen. Lastly, some respondents, primarily from northern ports, mentioned they were unaware of any outreach and/or monitoring efforts being done by the state. They expressed concern that no research was being done (or that they were unaware of such research), to determine the efficacy of the MPAs and their impacts on fish populations.

There are 31 MPAs (including special closures) in the study region and 26 of them were indicated as impacting at least one individual that we interviewed. Point Reyes SMR was indicated as impacting the highest percentage of respondents for the Dungeness crab–trap (32.5 percent), salmon–troll (28.6 percent), and California halibut–hook & line (27.3 percent), fisheries. Saunders Reef SMCA impacted the highest percent of nearshore finfish–live–fixed gear (30 percent) and Stewarts Point SMR impacted all urchin–dive fishermen. Additional information regarding which MPAs impacted each of the target fisheries can be found below in Table 22. Many MPAs have an impact on only fishermen from a specific port in the region and so impacts on smaller ports may not be well represent in this table. Port specific tables found in this section should be referenced for this.

Table 21. Percent of individuals indicating specific direct impact from MPAs in 2010 for each fishery, North Central Coast

	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number interviewed	22	80	10	14	6	101
Percent indicating direct impacts from MPAs	54.5%	72.5%	80.0%	42.9%	100.0%	77.2%
Response	**Percent responding**					
Loss of traditional fishing grounds	40.9%	66.3%	70.0%	42.9%	100.0%	70.3%
Fishing at the borders of MPAs	13.6%	50.0%	40.0%	21.4%	66.7%	48.5%
Spending more time fishing/traveling for fishing	18.2%	33.8%	60.0%	21.4%	100.0%	39.6%
Fishing more in areas with worse/less predictable weather	18.2%	23.8%	50.0%	14.3%	50.0%	27.7%
Increased fishing pressure/crowding in open areas	18.2%	20.0%	—	7.1%	16.7%	21.8%
Loss of highly productive area	13.6%	1.3%	20.0%	—	33.3%	7.9%
Open areas less productive due to increased pressure	4.5%	2.5%	20.0%	—	33.3%	6.9%
Moved homeport/fishing multiple homeports	—	1.3%	—	—	66.7%	4.0%
Loss of revenue	—	5.0%	—	—	16.7%	5.0%
Shift of fishing effort into other fisheries	18.2%	—	—	—	—	4.0%
Increase in operating expenditures (fuel etc.)	—	2.5%	—	—	—	2.0%
Fishing less	—	3.8%	—	7.1%	—	4.0%
Distress regarding unintended fishing infractions	—	2.5%	—	—	—	2.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 22. Percent of respondents indicating specific MPA impacting commercial fishery in 2010, North Central Coast

MPAs	Percent responding: California halibut– hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number responding	22	80	10	14	6	101
Bodega Head SMCA	—	1.3%	—	7.1%	—	2.0%
Bodega Head SMR	—	16.3%	—	14.3%	16.7%	14.9%
Del Mar Landing SMR	—	3.8%	10.0%	—	—	4.0%
Double Point/Stormy Stack SC	—	1.3%	—	—	—	1.0%
Drake's Estero SMCA	4.5%	6.3%	—	—	—	5.9%
Duxbury Reef SMCA	18.2%	—	10.0%	—	—	5.0%
Egg (Devil's Slide) Rock to Devil's Slide SC	—	—	—	—	—	—
Estero Americano SMRMA	4.5%	—	—	—	—	1.0%
Estero de Limantour SMR	4.5%	—	—	—	—	1.0%
Estero de San Antonio SMRMA	—	—	—	—	—	—
Gerstle Cove SMR	—	—	—	—	—	—
Montara SMR	18.2%	21.3%	20.0%	7.1%	—	22.8%
North Farallon Islands SC	—	8.8%	10.0%	7.1%	—	9.9%
North Farallon Islands SMR	—	15.0%	10.0%	21.4%	—	15.8%
Pillar Point SMCA	9.1%	—	10.0%	—	—	2.0%
Point Arena SMCA	—	6.3%	20.0%	7.1%	33.3%	7.9%
Point Arena SMR	—	12.5%	20.0%	14.3%	66.7%	14.9%
Point Resistance Rock SC	—	1.3%	—	—	—	1.0%
Point Reyes Headlands SC	13.6%	16.3%	10.0%	14.3%	—	17.8%
Point Reyes SMCA	18.2%	10.0%	10.0%	21.4%	—	15.8%
Point Reyes SMR	27.3%	32.5%	10.0%	28.6%	—	35.6%
Russian River SMCA	—	1.3%	—	—	—	1.0%
Russian River SMRMA	—	—	—	—	—	—
Salt Point SMCA	—	3.8%	20.0%	7.1%	66.7%	8.9%
Saunders Reef SMCA	—	2.5%	30.0%	—	—	5.0%
Sea Lion Cove SMCA	—	—	—	—	16.7%	1.0%
Southeast Farallon Island SC	—	7.5%	10.0%	7.1%	16.7%	9.9%
Southeast Farallon Island SMCA	—	6.3%	10.0%	7.1%	16.7%	8.9%
Southeast Farallon Island SMR	—	11.3%	10.0%	14.3%	16.7%	13.9%
Stewarts Point SMCA	—	3.8%	10.0%	7.1%	83.3%	8.9%
Stewarts Point SMR	—	26.3%	10.0%	14.3%	100.0%	27.7%
Total number of MPAs impacting fishery/region	9	22	18	16	10	27

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All individuals we interviewed in Point Arena indicated they had been impacted by MPAs (Table 23) and all indicated they had been impacted specifically by Point Arena SMR (Table 24). Additionally, 85.7 percent of individuals indicated they were spending more time fishing or traveling to fish for at least one of the fisheries they targeted. The urchin–dive fishery reported the highest impacts with all four respondents indicating that they had lost traditional fishing grounds and were spending more time diving or traveling to dive. Specifically, some divers explained that they were being forced to travel outside of the study region to either northern or southern California for at least a portion of the year to dive for urchins. Additionally, respondents in Point Arena remarked that because the only launch method available to them is a hoist, they are limited to small boats, which may be unable to travel the distance to reach fishing areas past MPAs. The commented that they feel they are being restricted to smaller and smaller areas and have limited opportunities to rotate fishing areas.

Point Arena SMR was indicated by all Point Arena fishermen as impacting as least one of the fisheries in which they participated in. This reserve is closed to all commercial fishing and sits right outside of the Point Arena harbor. Point Arena SMCA lies just west of the SMR, is closed to all commercial fishing except for salmon–troll, and impacted the second largest group of Point Arena fishermen interviewed (71.4 percent). The urchin–dive fishery was impacted by the largest number of MPAs (10) and all urchin divers reported they were impacted by Point Arena SMR and Stewarts Point SMR. All MPAs impacting fishermen from Point Arena are shown below in Table 24.

Table 23. Percent of individuals indicating specific direct impact from MPAs in 2010 for each fishery, Point Arena

	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number interviewed	—	4	2	2	4	7
Percent indicating direct impacts from MPAs	—	75.0%	*	*	100.0%	100.0%
Response	**Percent Responding**					
Loss of traditional fishing grounds	—	75.0%	*	*	100.0%	100.0%
Fishing at the borders of MPAs	—	50.0%	*	*	75.0%	71.4%
Spending more time fishing/traveling for fishing	—	25.0%	*	*	100.0%	85.7%
Fishing more in areas with worse/less predictable weather	—	50.0%	*	*	75.0%	71.4%
Increased fishing pressure/crowding in open areas	—	—	*	*	25.0%	14.3%
Loss of highly productive area	—	—	*	*	50.0%	42.9%
Open areas less productive due to increased pressure	—	—	*	*	25.0%	28.6%
Moved homeport/fishing multiple homeports	—	—	*	*	50.0%	28.6%
Loss of revenue	—	—	*	*	—	—
Shift of fishing effort into other fisheries	—	—	*	*	—	—
Increase in operating expenditures (fuel etc.)	—	—	*	*	—	—
Fishing less	—	—	*	*	—	—
Distress regarding unintended fishing infractions	—	—	*	*	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 24. Percent of respondents indicating specific MPA impacting commercial fishery in 2010, Point Arena

	Percent responding					
MPAs	California halibut– hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number responding	—	4	2	2	4	7
Bodega Head SMR	—	—	*	*	25.0%	14.3%
Point Arena SMCA	—	75.0%	*	*	50.0%	71.4%
Point Arena SMR	—	75.0%	*	*	100.0%	100.0%
Salt Point SMCA	—	—	*	*	50.0%	28.6%
Saunders Reef SMCA	—	—	*	*	—	28.6%
Sea Lion Cove SMCA	—	—	*	*	25.0%	14.3%
Southeast Farallon Island SC	—	—	*	*	25.0%	14.3%
Southeast Farallon Island SMCA	—	—	*	*	25.0%	14.3%
Southeast Farallon Island SMR	—	—	*	*	25.0%	14.3%
Stewarts Point SMCA	—	—	*	*	75.0%	42.9%
Stewarts Point SMR	—	—	*	*	100.0%	57.14%
Total number of MPAs impacting fishery/region	—	2	*	*	10	11

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

The three MPAs most frequently mentioned by Bodega Bay fishermen as impacting them were Stewarts Point SMR (impacting 60 percent of individuals), Point Reyes SMR (impacting 48 percent of individuals), and Bodega Head SMR (impacting 40 percent of individuals) (Table 25). Additionally, despite being open to the Dungeness crab–trap fishery, a small percentage (4.3 percent) of fishermen indicated that they had been impacted by the Bodega Head SMCA for this fishery. Across individuals, trends in Bodega Bay in terms of types of impacts were similar to region wide trends with 88 percent indicating they had loss traditional fishing grounds, 72 percent indicating they were fishing at the borders of MPAs, and 60 percent spending more time fishing/traveling for fishing. Additionally, 91.3 percent of Dungeness crab–trap fishermen indicated they had been impacted by MPAs, which is higher than the regional average of 72.5 percent and the highest for Dungeness crab–trap in any port. Although data cannot be shown here for urchin divers due to confidentiality constraints, it should be noted that fishermen indicated that urchin divers have left Bodega Bay over the past few years due to restrictions imposed by MPAs. As mentioned earlier, the one diver we were able to interview indicated that he now spends a large portion of the year fishing out of ports in southern California. Additionally, one fisherman we interviewed in Point Arena had moved there from Bodega Bay after the MPAs were implemented. More information regarding MPA impacts in Bodega Bay can be found below in Table 25 and Table 26.

Table 25. Percent of individuals indicating specific direct impact from MPAs in 2010 for each fishery, Bodega Bay

	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number interviewed	4	23	1	6	1	25
Percent indicating direct impacts from MPAs	25.0%	91.3%	*	16.7%	*	92.0%
Response	**Percent responding**					
Loss of traditional fishing grounds	—	87.0%	*	16.7%	*	88.0%
Fishing at the borders of MPAs	—	73.9%	*	—	*	72.0%
Spending more time fishing/traveling for fishing	—	56.5%	*	16.7%	*	60.0%
Fishing more in areas with worse/less predictable weather	—	26.1%	*	—	*	28.0%
Increased fishing pressure/crowding in open areas	—	30.4%	*	—	*	28.0%
Loss of highly productive area	—	—	*	—	*	4.0%
Open areas less productive due to increased pressure	—	4.3%	*	—	*	12.0%
Moved homeport/fishing multiple homeports	—	—	*	—	*	4.0%
Loss of revenue	—	13.0%	*	—	*	16.0%
Shift of fishing effort into other fisheries	—	—	*	—	*	—
Increase in operating expenditures (fuel etc.)	—	8.7%	*	—	*	8.0%
Fishing less	—	8.7%	*	16.7%	*	12.0%
Distress regarding unintended fishing infractions	—	4.3%	*	—	*	4.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 26. Percent of respondents indicating specific MPA impacting commercial fishery in 2010, Bodega Bay

	Percent responding					
MPAs	California halibut– hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number responding	4	23	1	6	1	25
Bodega Head SMCA	—	4.3%	*	—	*	4.0%
Bodega Head SMR	—	43.5%	*	16.7%	*	40.0%
Del Mar Landing SMR	—	8.7%	*	—	*	12.0%
Drake's Estero SMCA	25.0%	—	*	—	*	4.0%
Duxbury Reef SMCA	25.0%	—	*	—	*	4.0%
Estero Americano SMRMA	25.0%	—	*	—	*	4.0%
North Farallon Islands SMR	—	13.0%	*	—	*	12.0%
Point Arena SMR	—	13.0%	*	—	*	12.0%
Point Reyes Headlands SC	—	13.0%	*	—	*	12.0%
Point Reyes SMCA	—	4.3%	*	—	*	4.0%
Point Reyes SMR	—	52.2%	*	—	*	48.0%
Salt Point SMCA	—	—	*	16.7%	*	12.0%
Saunders Reef SMCA	—	—	*	—	*	4.0%
Southeast Farallon Island SC	—	4.3%	*	—	*	4.0%
Southeast Farallon Island SMCA	—	4.3%	*	—	*	4.0%
Southeast Farallon Island SMR	—	8.7%	*	—	*	8.0%
Stewarts Point SMCA	—	—	*	16.7%	*	12.0%
Stewarts Point SMR		52.2%	*	16.7%	*	60.0%
Total number of MPAs impacting fishery/region	3	12	*	4	*	18

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In Bolinas all California halibut–hook & line fishermen interviewed indicated that the fishery had been directly impacted by the MPAs and conversely, all fishermen interviewed indicated that the Dungeness crab–trap fishery was not impacted by MPAs. Unlike others throughout the study region, California halibut–hook & line fishermen in Bolinas did not indicate they were fishing at the borders of MPAs. Bolinas fishermen mentioned four MPAs that were impacting their California halibut–hook & line fishing. These were the Point Reyes SMR, SMCA, and SC and Duxbury Reef. They specifically mentioned the Chimney Rocks area within Point Reyes SMCA as a particularly productive California halibut ground that was difficult for them to lose. More information is found below in Table 27 and Table 28.

Table 27. Percent of individuals indicating specific direct impact from MPAs in 2010 for each fishery, Bolinas

	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number interviewed	3	4	—	—	—	5
Percent indicating direct impacts from MPAs	100.0%	—	—	—	—	60.0%
Response	**Percent responding**					
Loss of traditional fishing grounds	100.0%	—	—	—	—	60.0%
Fishing at the borders of MPAs	—	—	—	—	—	—
Spending more time fishing/traveling for fishing	66.7%	—	—	—	—	40.0%
Fishing more in areas with worse/less predictable weather	66.7%	—	—	—	—	40.0%
Increased fishing pressure/crowding in open areas	—	—	—	—	—	—
Loss of highly productive area	100.0%	—	—	—	—	60.0%
Open areas less productive due to increased pressure	—	—	—	—	—	—
Moved homeport/fishing multiple homeports	—	—	—	—	—	—
Loss of revenue	—	—	—	—	—	—
Shift of fishing effort into other fisheries	—	—	—	—	—	—
Increase in operating expenditures (fuel etc.)	—	—	—	—	—	—
Fishing less	—	—	—	—	—	—
Distress regarding unintended fishing infractions	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 28. Percent of respondents indicating specific MPA impacting commercial fishery in 2010, Bolinas

	Percent responding					
MPAs	California halibut– hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number responding	3	4	—	—	—	5
Duxbury Reef SMCA	33.3%	—	—	—	—	20.0%
Point Reyes Headlands SC	33.3%	—	—	—	—	20.0%
Point Reyes SMCA	66.7%	—	—	—	—	40.0%
Point Reyes SMR	100.0%	—	—	—	—	60.0%
Total number of MPAs impacting fishery/region	4	—	—	—	—	4

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

In San Francisco, 54.5 percent of California halibut–hook & line fishermen said they had been directly impacted by MPAs and mentioned that many fishermen were shifting their fisheries and moving into the California halibut–hook & line fishery. Specifically, they mentioned this could be due to the loss of nearshore finfish–live–fixed gear fishing grounds to MPAs and the lack of salmon seasons. Fishermen from San Francisco noted 14 MPAs that had impacted their fishing and these are shown below in Table 30. Across individuals, the MPAs surrounding Point Reyes impacted the most respondents (34.8 percent – Point Reyes Headlands SC and 30.4 – percent Point Reyes SMCA and SMR).

Table 29. Percent of individuals indicating specific direct impact from MPAs in 2010 for each fishery, San Francisco

	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number interviewed	11	13	2	3	—	23
Percent indicating direct impacts from MPAs	54.5%	46.2%	*	66.7%	—	60.9%
Response	**Percent Responding**					
Loss of traditional fishing grounds	36.4%	46.2%	*	66.7%	—	52.2%
Fishing at the borders of MPAs	9.1%	30.8%	*	33.3%	—	26.1%
Spending more time fishing/traveling for fishing	—	15.4%	*	—	—	13.0%
Fishing more in areas with worse/less predictable weather	9.1%	30.8%	*	33.3%	—	26.1%
Increased fishing pressure/crowding in open areas	27.3%	15.4%	*	—	—	21.7%
Loss of highly productive area	—	—	*	—	—	—
Open areas less productive due to increased pressure	—	—	*	—	—	—
Moved homeport/fishing multiple homeports	—	—	*	—	—	—
Loss of revenue	—	7.7%	*	—	—	4.3%
Shift of fishing effort into other fisheries	36.4%	—	*	—	—	17.4%
Increase in operating expenditures (fuel etc.)	—	—	*	—	—	—
Fishing less	—	—	*	—	—	—
Distress regarding unintended fishing infractions	—	—	*	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 30. Percent of respondents indicating specific MPA impacting commercial fishery in 2010, San Francisco

	Percent responding					
MPAs	**California halibut– hook & line**	**Dungeness crab–trap**	**Nearshore finfish–live–fixed gear**	**Salmon–troll**	**Urchin–dive**	**Unique individuals**
Number responding	11	13	2	3	—	23
Bodega Head SMR	—	7.7%	*	—	—	4.3%
Double Point/Stormy Stack SC	—	7.7%	*	—	—	4.3%
Duxbury Reef SMCA	18.2%	—	*	—	—	13.0%
Estero de Limantour SMR	9.1%	—	*	—	—	4.3%
Montara SMR	18.2%	—	*	—	—	8.7%
North Farallon Islands SC	—	15.4%	*	—	—	17.4%
North Farallon Islands SMR	—	23.1%	*	33.3%	—	21.7%
Point Reyes Headlands SC	18.2%	30.8%	*	33.3%	—	30.4%
Point Reyes SMCA	18.2%	15.4%	*	66.7%	—	30.4%
Point Reyes SMR	27.3%	23.1%	*	66.7%	—	34.8%
Southeast Farallon Island SC	—	15.4%	*	—	—	17.4%
Southeast Farallon Island SMCA	—	7.7%	*	—	—	13.0%
Southeast Farallon Island SMR	—	15.4%	*	—	—	17.4%
Stewarts Point SMR	—	7.7%	*	33.3%	—	8.7%
Total number of MPAs impacting fishery/region	6	11	*	5	—	14

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Over sixty percent of fishermen from Half Moon Bay (62.5 percent) indicated they had been directly impacted by MPAs with 54.2 percent specifying they had lost traditional fishing grounds. Montara MPA, which sits just outside of the Half Moon Bay harbor, impacted 70.8 percent of the individuals we interviewed from Half Moon Bay. Additionally, several individuals mentioned they had been impacted by Aña Nuevo – an MPA in the Central Coast Region in San Mateo County, north of Santa Cruz. Additional information regarding the specific types of impacts and the specific MPAs impacting each fishery are shown in Table 31 and Table 32.

Table 31. Percent of individuals indicating specific direct impact from MPAs in 2010 for each fishery, Half Moon Bay

	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number interviewed	4	19	5	2	—	24
Percent indicating direct impacts from MPAs	50.0%	63.2%	60.0%	*	—	62.5%
Response	**Percent Responding**					
Loss of traditional fishing grounds	50.0%	57.9%	40.0%	*	—	54.2%
Fishing at the borders of MPAs	50.0%	36.8%	20.0%	*	—	37.5%
Spending more time fishing/traveling for fishing	50.0%	31.6%	40.0%	*	—	33.3%
Fishing more in areas with worse/less predictable weather	25.0%	26.3%	20.0%	*	—	25.0%
Increased fishing pressure/crowding in open areas	25.0%	15.8%	—	*	—	16.7%
Loss of highly productive area	—	5.3%	—	*	—	4.2%
Open areas less productive due to increased pressure	25.0%	5.3%	—	*	—	8.3%
Moved homeport/fishing multiple homeports	—	—	—	*	—	—
Loss of revenue	—	—	—	*	—	—
Shift of fishing effort into other fisheries	—	—	—	*	—	—
Increase in operating expenditures (fuel etc.)	—	—	—	*	—	—
Fishing less	—	5.3%	—	*	—	4.2%
Distress regarding unintended fishing infractions	—	—	—	*	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 32. Percent of respondents indicating specific MPA impacting commercial fishery in 2010, Half Moon Bay

	Percent responding					
MPAs	California halibut– hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number responding	4	19	5	2	—	24
Montara SMR	50.0%	68.4%	40.0%	*	—	70.8%
North Farallon Islands SMR	—	—	—	*	—	*
Pillar Point SMCA	50.0%	—	20.0%	*	—	8.3%
Point Reyes SMCA	—	5.3%	—	*	—	4.2%
Point Reyes SMR	—	10.5%	—	*	—	12.5%
Salt Point SMCA	—	—	20.0%	*	—	4.2%
Southeast Farallon Island SC	—	5.3%	—	*	—	4.2%
Southeast Farallon Island SMCA	—	5.3%	—	*	—	4.2%
Southeast Farallon Island SMR	—	5.3%	—	*	—	8.3%
Total number of MPAs impacting fishery/region	2	6	3	*	—	9

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

3.4. Regional Commercial Fishery Profiles: Historical Trends, Initial Changes, and Baseline Characterization

3.4.1. California Halibut–Hook & Line Commercial Fishery

In the past, California halibut (*Paralichthys californicus*) was targeted primarily by trawl and gill net gear types and hook and line gear made up a fairly small portion of the California halibut landings (CDFG 2004). Regulations have prohibited trawling for California halibut within state waters (except in the California halibut trawl grounds in southern California) and in 2006 the Pacific Fishery Management Council prohibited the use of trawl gear in designated Essential Fish Habitat conservation zones (Frey et al. 2012). Additionally, gill nets have seen a variety of restrictions across the California coast. With limitations placed on other types of gear and the fact that the California halibut fishery remains an open access fishery, the number of fishermen and ex-vessel revenue levels increased in 2007 as shown in Figure 13 below. During interviews, fishermen reported that increases in the number of fishermen participating in the fishery were also due to increasing restrictions on other commercial fisheries and fishermen seeking to diversify their fishing portfolios. Specifically, they mentioned this in regard to the salmon–troll fishery. As shown in Figure 13, the number of fishermen targeting the California halibut–hook & line fishery increased in 2008 and 2009, which were the two years when the salmon–troll fishery was closed. Additionally, the California halibut is a summer fishery and it remains an open access fishery, many fishermen who fish for Dungeness crab in the winter months may participate in the fishery without large upfront costs of purchasing a permit or investments in specialized gear.

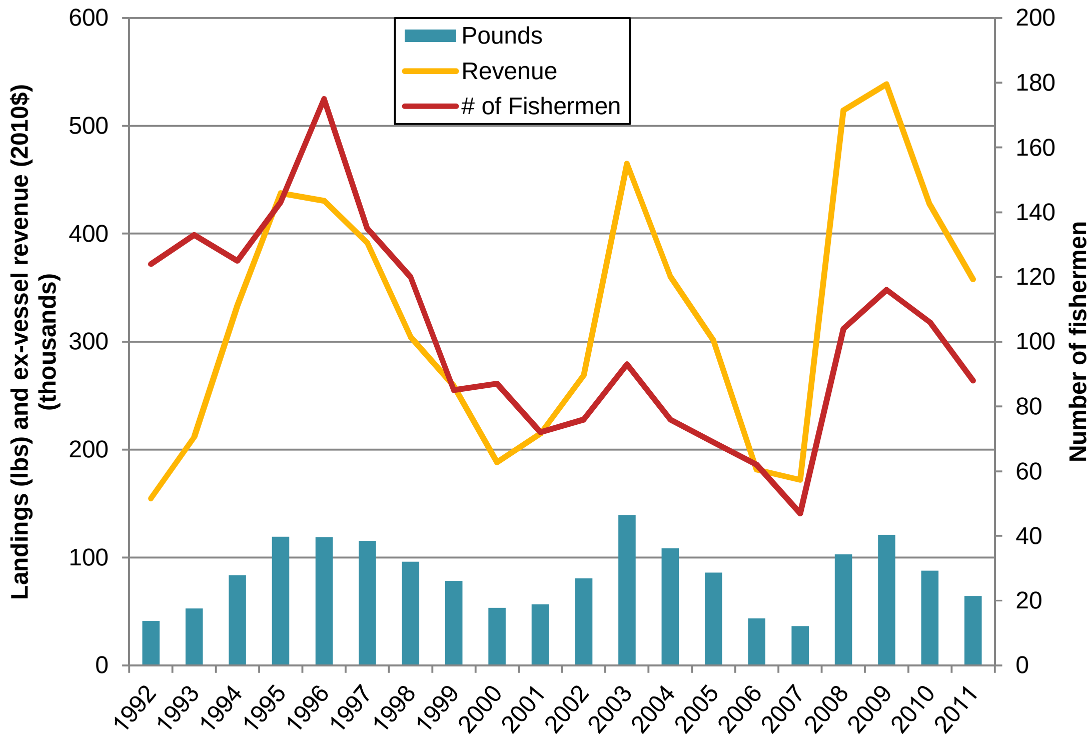
The California halibut—hook & line fishery is a high value fishery, where fishermen receive a relatively high ex-vessel price per pound landed, as can be seen in Figure 13. Over the study period, a maximum of 139,524 pounds was landed in 2003, but maximum ex-vessel revenue for this fishery occurred in 2009 at $538,768. Again, all dollar values are presented in 2010 dollars unless otherwise noted.

In relation to total regional landings and ex-vessel revenue, the California halibut–hook & line fishery constituted only a small portion of total landings and revenue. At most, it represented 4.5 percent of total ex-vessel revenue in the North Central Coast region in 2009 when regional ex-vessel revenue were at their lowest; but over the entire study period, the fishery averaged only 1.4 percent annually. However, as a percentage of individual fishing income, the California halibut–hook & line fishery average 7.2 percent of the average individual fishing income in the region (Figure 11).

Over the study period, on average, a North Central Coast region California halibut–hook & line fisherman landed an annual total 860 pounds for $3,330 in ex-vessel revenue, making ten landings a year on average to do so, see Figure 14. Over the study period, the pounds landed, ex-vessel revenue, and count of landings per year per fisherman increased overall. Fishermen in 2011 landed twelve times the amount fishermen in 1992 landed, receiving 22 times the ex-vessel revenue.

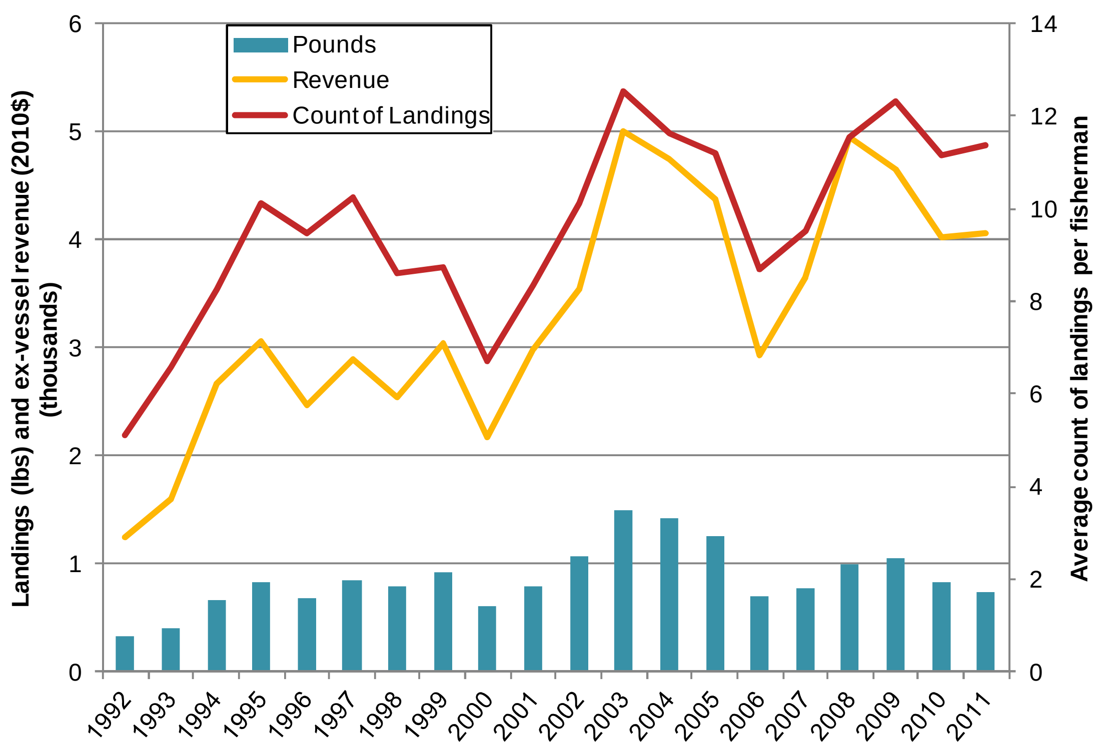
Average ex-vessel price per pound rose steadily from 1992 to 2011 from $3.77 per pound to $5.56 per pound respectively, see Figure 15. The lowest ex-vessel price over the study period occurred in 1998 at $3.17 per pound. The 2011 ex-vessel price was the highest of the study period, at $5.56 per pound, and an increase of nearly 50 percent from 1992.

Figure 13. California halibut–hook & line commercial landings, ex-vessel revenue, and number of fishermen in the North Central Coast region, 1992–2011



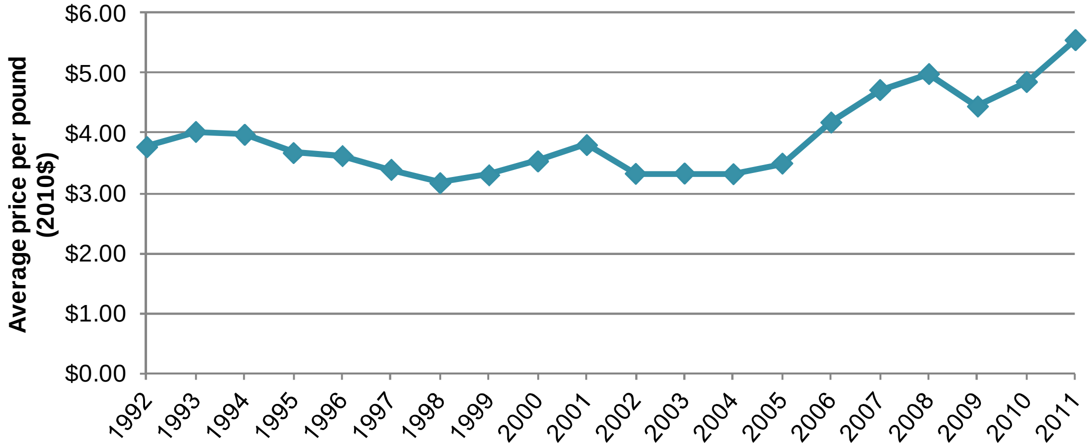
Source: Landings data from CDFW.

Figure 14. California halibut–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, 1992–2011



Source: Landings data from CDFW.

Figure 15. California halibut–hook & line commercial fishery average ex-vessel price per pound in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

Table 33 displays the average annual percent change in ex-vessel revenue and average ex-vessel revenue per fisherman for the California halibut–hook & line fishery over recent time periods organized into both pre and post-MPA implementation periods. Changes are presented for the North Central Coast region and compared with those observed in the fishery at the state level. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods. State and regional total and average per fisherman ex-vessel revenues increased in both pre-MPA periods on average annually, but at a greater pace in the region, at 27.6 percent annually on average over 2005–2010 as compared with 7 percent for the state for example. This trend is also reflected in the overall period of 2000–2011. However, during the post-MPA period (one year) of 2010–2011 total ex-vessel revenues for the region fell by 16.2 percent, though barely increasing on an average per fisherman basis by 1 percent, while increasing in the state by 8.7 percent while state fishermen simultaneously saw an average per fisherman ex-vessel revenue decrease of 4.9 percent.

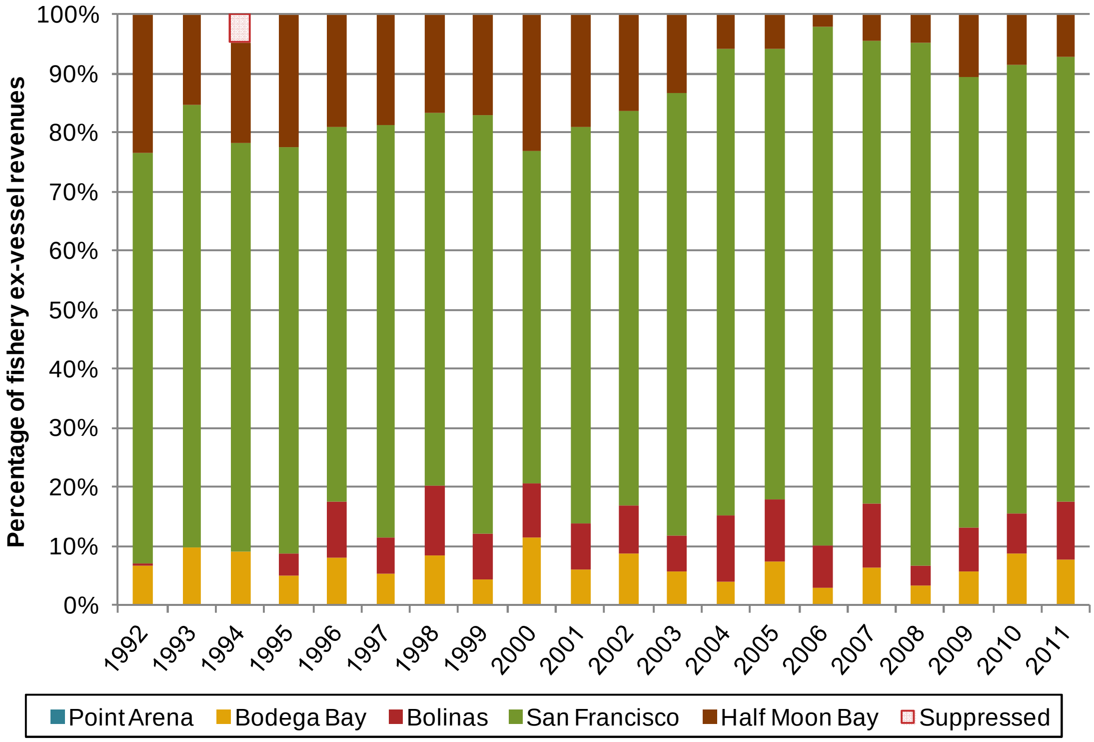
Figure 16 displays the commercial ex-vessel revenue for the California halibut–hook & line fishery by North Central Coast region ports. The port of San Francisco had the highest percent of total ex-vessel revenue among North Central Coast region ports over the study period by far, averaging 72.6 percent annually, followed by Half Moon Bay at 13.6 percent. While San Francisco's portion of total California halibut–hook & line ex-vessel revenue increased slightly from the first half of the study period to the latter half, Half Moon Bay's ex-vessel revenue portion decreased. Bolinas and Bodega Bay also contributed to regional California halibut–hook & line ex-vessel revenue (averaging 7.3 percent and 6.6 percent annually respectively).

Table 33. California halibut–hook & line: Average annual percent change in commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

		Average annual percent change			
Level	**Ex-vessel revenue**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
North Central Coast region	Total	14.7%	27.6%	-16.2%	17.7%
	Average per fisherman	16.9%	1.6%	1.0%	8.5%
State	Total	7.9%	7.0%	8.7%	7.5%
	Average per fisherman	13.9%	0.9%	-4.9%	6.3%

Source: Landings data from CDFW

Figure 16. California halibut–hook & line commercial ex-vessel revenue by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW.

The California halibut–hook & line fishermen we interviewed on average were slightly younger than the average fisherman throughout the North Central Coast study region. Fishermen with the most overall commercial fishing experience in the California halibut–hook & line fishery were on average, from Bolinas (28.3 years) and those with the least experience on average where from Bodega Bay (9.5 years). It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. More information is shown below in Table 34.

Table 34. Average age and years of experience commercial fishing, 2010, California halibut–hook and line

	Age			Years of experience		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Point Arena	—	—	—	—	—	—
Bodega Bay	4	46.3	8.0	4	9.5	6.4
Bolinas	3	48.3	10.5	3	28.3	13.3
San Francisco	11	48.2	13.1	11	17.6	14.6
Half Moon Bay	4	44.0	8.5	4	15.8	9.2
All respondents (unique individuals)	22	47.1	10.7	22	17.3	12.9

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

On average, across the region California halibut–hook & line fishermen saw a decrease in the percent of their personal income that came from commercial fishing (

Table 35). This was the case in all ports except Bolinas, where there was a slight increase. Again, it is important to note that this question was not asked in regards to California halibut–hook & line specifically, but generally about someone's overall commercial fishing experience. Additionally, 2007 averages were taken directly from the 2008 study conducted by Ecotrust. Only three fishermen who fished California halibut–hook & line provided explanations as why they felt their percent of total income from commercial fishing had changed and those responses are provided in Table 36. Fifteen of the 22 California halibut–hook & line fishermen we spoke to indicated that they had additional sources of revenue in 2010 besides commercial fishing. The most frequently reported source of additional revenue was skilled labor (Table 37).

Table 35. Percent change in income from overall commercial fishing from 2007 - 2010, California halibut–hook and line

	2007^			2010			
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent Change**
Point Arena	—	—	—	—	—	—	—
Bodega Bay	—	—	—	4	65.0%	43.6%	n/a
Bolinas	6	78.3%	34.3%	3	86.7%	23.1%	10.6%
San Francisco	7	56.0%	40.0%	11	46.8%	45.0%	-16.4%
Half Moon Bay	6	74.2%	40.1%	4	57.5%	47.3%	-22.5%
All respondents (unique individuals)	19	68.8%	37.5%	22	57.5%	42.4%	-16.4%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 36. Cause in change in percent income from commercial fishing from 2007 - 2010, California halibut–hook and line

		Number responding					
	Response	Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	All respondents (unique individuals)
Reason for increase	Relied more on other sources of income in 2007	—	—	—	1	—	1
	Natural fluctuation in fish abundance/presence (worse in 2007)	—	—	—	—	—	—
	Fishing less actively in 2007	—	—	—	—	—	—
	Started fishing after 2007	—	—	—	—	—	—
Reason for decrease	Relied more on other sources of income in 2010	—	—	—	—	—	—
	Natural fluctuation in fish abundance/presence (worse in 2010)	—	—	—	1	—	1
	Fishing less actively in 2010	—	—	1	—	1	2
	Age health/worse in 2010	—	—	—	—	—	—
	Fishing was less profitable in 2010	—	—	—	—	1	1
	Not able to fish salmon in 2010 due to regulations	—	—	1	—	—	1
	Number of individuals responding	—	—	1	1	1	3

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 37. Other sources of income other than commercial fishing in 2010, California halibut–hook and line

	Number responding					
Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**	**All respondents (unique individuals)**
Construction/Contractor	—	—	—	1	—	1
Farming/Ranching	—	—	—	—	—	—
Fisheries research	—	—	—	—	—	—
Harbor/City job	—	—	—	—	1	1
Office work	—	—	—	1	—	1
Other fishing related work	—	—	—	—	—	—
Other specialized work	—	1	1	2	—	4
Property management	—	—	—	1	1	2
Retirement/Social Security/Investments	—	1	—	1	—	2
Salmon disaster relief	—	—	—	—	1	—
Skilled labor	—	1	1	2	2	6
Number of individuals responding	—	2	1	9	3	15

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

As shown in Table 38, California halibut–hook & line fishermen in most ports, on average, experienced an increase in operating costs from 2007 to 2010. This increase was as high as 50.4 percent in Bolinas, although those in Half Moon Bay saw a very slight decrease (3.1 percent). Only one person provided further information, indicating that they had seen an increase in the prices of fuel (Table 39).

Table 38. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, California halibut–hook and line

	2007^			2010			
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
Point Arena	—	—	—	—	—	—	—
Bodega Bay	—	—	—	4	32.3%	10.0%	n/a
Bolinas	6	38.3%	22.5%	3	57.7%	15.3%	50.4%
San Francisco	6	45.4%	25.9%	11	57.9%	23.8%	27.4%
Half Moon Bay	7	54.2%	28.2%	4	52.5%	17.1%	-3.1%
All respondents (unique individuals)	19	45.9%	25.0%	22	51.7%	20.7%	12.4%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 39. Cause of change in percent of gross economic revenue used towards overall operating costs, California halibut–hook and line

	Response	Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	All ports (unique individuals)
		Number responding					
Reason for decrease	Large purchase or capital investment in 2007	—	—	—	—	—	—
	2007 was a bad fishing year	—	—	—	—	—	—
	Made more revenue in 2007	—	—	—	—	—	—
	Had more costs in 2007	—	—	—	—	—	—
Reason for increase	Large purchase or capital investment in 2010	—	—	—	—	—	—
	2010 was a bad fishing year	—	—	—	—	—	—
	Made more revenue in 2010	—	—	—	—	—	—
	Increased fuel prices in 2010	—	—	—	—	1	1
	More crew in 2010	—	—	—	—	—	—
	Fished out of multiple ports in 2010	—	—	—	—	—	—
	General cost increase in 2010	—	—	—	—	—	—
Number of individuals responding		—	—	—	—	1	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Shown below in Table 40, fishermen from Bolinas, on average, had the most experience targeting the California halibut–hook & line fishery (28 years, compared to the regional average of 17.6 years) and those from Bodega Bay had the least experience (9.5 years). Those from Bodega Bay also on average indicated they spent the fewest number of days (38.5) targeting this fishery while those from San Francisco on average spent the most days (86.5).

Crew is not always used in the California halibut–hook & line fishery, but used somewhat more frequently in Bolinas than other ports. Expectedly, Bolinas also reported spending the highest proportion of their gross economic revenue on crew, 13.3 percent. Half Moon Bay California halibut–hook & line fishermen reported the highest percent of GER going towards fuel (30 percent) which is above average for the fishery across the region. GER spent on fuel was much lower in Bodega Bay, which reported using only 10.7 percent towards fuel.

Table 40. Years of experience and number of days targeting California halibut–hook & line, 2010

Ports	Years of experience in fishery			Days spent targeting fishery		
	Number responding	Average	Standard deviation	Number responding	Average	Standard Deviation
Point Arena	—	—	—	—	—	—
Bodega Bay	4	9.5	6.4	4	38.5	27.5
Bolinas	3	28.0	12.8	3	60.0	45.8
San Francisco	11	17.6	14.6	10	86.5	64.7
Half Moon Bay	4	17.8	10.8	4	60.0	61.6
All respondents (unique individuals)	22	17.6	13.0	21	68.5	56.1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 41. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, California halibut–hook & line

Ports	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
Point Arena	—	—	—	—	—	—	—	—	—
Bodega Bay	4	0.3	0.5	4	1.3%	2.5%	4	23.8%	20.6%
Bolinas	3	0.7	0.6	3	13.3%	15.3%	3	10.7%	8.1%
San Francisco	11	0.3	0.6	11	5.0%	15.0%	10	27.4%	12.1%
Half Moon Bay	4	0.3	0.5	4	3.8%	7.5%	4	30.0%	16.3%
All respondents (unique individuals)	22	0.3	0.6	22	5.2%	12.3%	21	24.8%	14.7%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Fishermen were asked if they added or dropped the California halibut–hook and line fishery since 2007 or if they did not fish the fishery in 2010. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. One fisherman from Bodega Bay and one from San Francisco indicated they had added the California halibut–hook & line fishery since 2007 (Table 42). As shown in Table 43 both of these individuals indicated they were not fishing commercially in 2007. In general, a consistent statement we heard from fishermen was that the number of participants in the California halibut–hook & line fishery has been steadily increasing over time. The fishery is open access and does not require a special permit; as fisheries such as nearshore finfish and salmon become more heavily regulated or have poor seasons, many fishermen turn to the California halibut-hook & line fishery to supplement their income.

Table 42. California halibut–hook and line, added/dropped since 2007 or not fished in 2010

		Percent responding		
Ports	**Number responding**	**Added**	**Dropped**	**Not fished in 2010**
Point Arena	—	—	—	—
Bodega Bay	4	1	—	—
Bolinas	3	—	—	—
San Francisco	11	—	—	—
Half Moon Bay	4	1	—	—
All respondents (unique individuals)	22	2	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 43. Reason for adding/dropping a fishery since 2007 or not fishing in 2010, California halibut–hook & line

	Number responding				
Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**
New to commercial fishing	—	1	—	—	1
Purchased boat with permit	—	—	—	—	—
Not enough time due to other work	—	—	—	—	—
Increased difficulty due to MPAs	—	—	—	—	—
Bad season	—	—	—	—	—
Number responding	—	1	—	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents were asked to compare his/her success in the California halibut—hook & line fishery in 2010 to the previous five years. As shown in the table below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better;3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishing. This question was asked as an open ended question and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

California halibut–hook & line fishermen responded to this question in a varied manner, but generally Bolinas indicated the fishery was either the same or worse noting factors such as MPAs, more people participating in the fishery, and lack of access to live bait to compete with the CPFV operators. Bolinas fishermen noted that if CPFV operators are fishing with live bait that California halibut will be less likely to be lured by their artificial bait and have to move to other grounds.

Respondents from Bodega Bay responded that the fishery was either doing the same or better and indicated primarily environmental factors including good weather, higher quantities of fish, and better quality of fish (Table 46). Responses from San Francisco were slightly more varied with 45.5 percent indicating the fishery was somewhat better, 36.4 indicating it was significantly worse, and 18.2 indicating it was somewhat worse. Three individuals who felt the fishery was doing worse mentioned different regulatory factors (Table 45), specifically they mentioned MPAs, the length of the season, and that because the fishery is open access more people have been targeting California halibut using hook and line gear. Additional information can be found in Table 44 through Table 47.

Table 44. Overall success in specific commercial fishery in 2010 compared to previous five years, California halibut–hook and line

Ports	Number responding	Percent response: Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Point Arena	—	—	—	—	—	—	—
Bodega Bay	4	—	25.0%	25.0%	50.0%	—	—
Bolinas	3	—	—	—	33.3%	33.3%	33.3%
San Francisco	11	—	—	45.5%	—	18.2%	36.4%
Half Moon Bay	4	25.0%	—	—	50.0%	25.0%	—
All respondents (unique individuals)	22	4.5%	4.5%	27.3%	22.7%	18.2%	22.7%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 45. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, California halibut–hook and line

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	—	—	1	3	—
	Responses	**Count of responses**				
Worse	Regulated season too short	—	—	—	1	—
	MPAs	—	—	1	1	—
	No permit required	—	—	—	1	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 46. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, California halibut–hook and line

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	—	2	—	4	1
	Responses	**Count of responses**				
Better	Larger quantity of fish	—	1	—	2	—
	Peak of natural cycle	—	—	—	1	—
	Good weather	—	1	—	—	—
	Good ocean conditions	—	—	—	—	—
	Good quality fish	—	1	—	—	—
	More bait/feed in the ocean	—	—	—	—	—
Worse	Low quantity of fish	—	—	—	1	1
	Bad weather	—	—	—	—	—
	Poor ocean conditions	—	—	—	1	—
	Loss of salmon spawning grounds	—	—	—	—	—
	Red tide	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 47. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, California halibut–hook and line

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	—	1	2	3	—
	Responses	**Count of responses**				
Better	Able to fish more frequently	—	1	—	—	—
	Becoming more experienced	—	—	—	1	—
Worse	Others changing fishery	—	—	1	2	—
	Boat problems/breakdowns	—	—	—	—	—
	No access to live bait	—	—	2	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

3.4.2. Dungeness Crab–Trap Commercial Fishery

Dungeness crab (*Metacarcinus magister* - formerly *Cancer magister*) is an important fishery along the entire Pacific Coast. It generally ranges from the Aleutian Islands to Point Conception, California. Only male Dungeness crabs are allowed to be kept and are required to be at least 6.25 inches in diameter in California. Additional management efforts have included designating the fishery limited access in 1995 which restricted residential permits to 600 and 70 non-resident permits (Petterson et al. 2010). The season typically begins in November and continues through June 30th, with catch abundance often significantly reduced in the later months. Often, the majority of the catch is caught during the highly competitive first few weeks of the season (Dewees et al. 2004). During interviews Dungeness crab fishermen often discussed impending regulations that will establish a Dungeness crab trap limit program. Additionally, many fishermen mentioned the cyclical nature of fish stocks when specifically referencing the strong Dungeness crab seasons in 2010 and 2011. It is estimated that Dungeness crab abundance peaks in approximately ten year cycles (Dewees et al. 2004)

The Dungeness crab–trap fishery in the North Central Coast region has increased significantly from 1992 to 2011. In 1992, landings and ex-vessel revenue were 396,535 pounds and $949,702 respectively, while in 2011 the fishery experienced it's maximum landings and revenue over the twenty year period at 16.1 million pounds landed for $38.6 million in ex-vessel revenue. In other words, landings and ex-vessel revenue increased by approximately 23 times and nearly 22 times respectively from 1992 to 2011. Compared to other fisheries, the number of fishermen participating in this fishery did not decrease as much by the end of the study period. Beginning with a high of 339 active Dungeness crab–trap fishermen in 1992, there were only 172 fishermen in 2009, two years later the number climbed back up to 293.

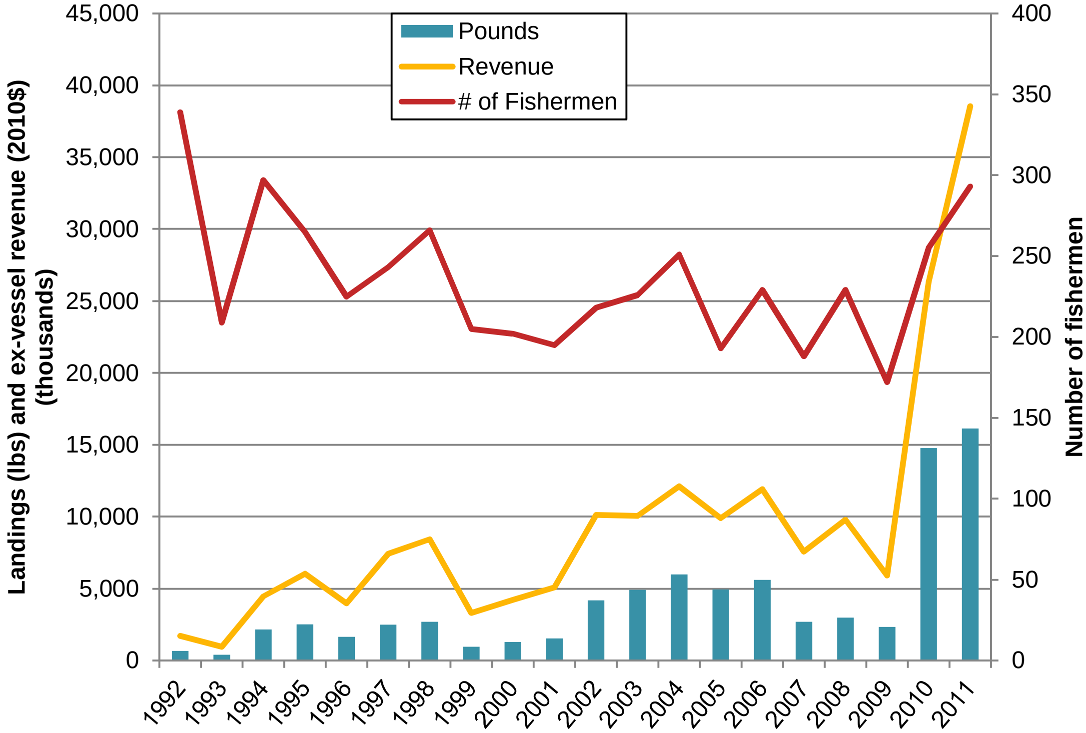
In reviewing this data with fishermen they explained there were many factors influencing the growth of the fishery over the 1992-2011 time period. In addition to the cyclical nature of the fishery, fishermen mentioned recent efforts to clean up the San Francisco Bay, increased efforts from out of state and north coast fishermen, reduction of the trawl fleet, as well as trawlers shifting effort into the Dungeness crab–trap fishery. Additionally, fishermen mentioned the expansion of both domestic and international markets. Specifically, they mentioned new markets in China for both live and canned Dungeness crab. Lastly, they mentioned there has been a general increase in demand and the fleet has built larger more competitive operations to respond to that demand.

In relation to total regional landings and ex-vessel revenue, the Dungeness crab–trap fishery grew in significance over the study period. In 1992 landings and ex-vessel revenue from this fishery constituted only 1.4 and 4.6 percent respectively; by 2011 these percentages grew to 65.6 and 79.6 respectively. In 2011, ex-vessel revenue from this fishery constituted 45.5 percent of the North Central Coast fisherman's average individual fishing income (Figure 11).

Over the study period, on average, a North Central Coast Dungeness crab–trap fisherman landed an annual total 16,796 pounds for $39,248 in ex-vessel revenue, making 13 landings a year on average to do so, see Figure 18. Over the study period, the pounds landed, ex-vessel revenue, and count of landings per year per fisherman increased significantly and greater than in any other fishery of interest in the North Central Coast region. The average fisherman in 1992 landed only 1,977 pounds for $5,009 in ex-vessel revenue while his 2011 counterpart landed 55,086 pounds for $131,577 in ex-vessel revenue. Additionally, the count of landings similarly increased, from 7 landings per year per fisherman on average in 1992, to a high of 19 in 2011.

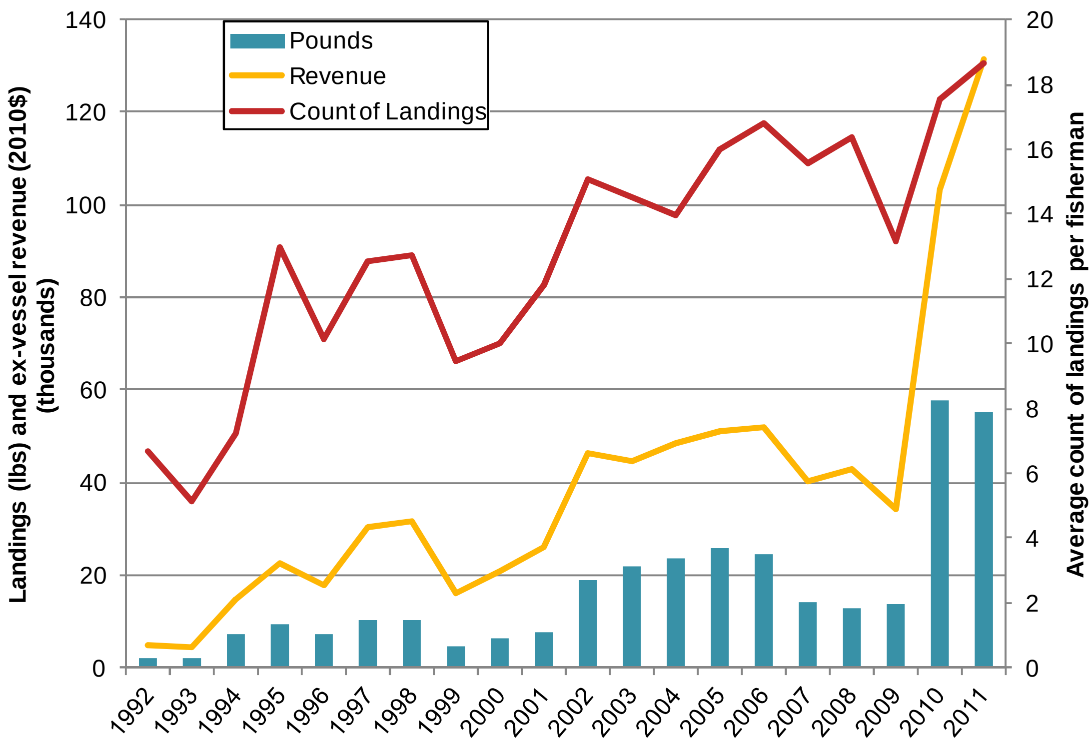
Average ex-vessel price per pound for the Dungeness crab–trap fishery fluctuated over 1992 to 2011 to a low of $1.78 per pound rather recently in 2010, from a high of $3.48 in 1999, see Figure 19.Fishermen explained that they often receive a lower price in large volume years, and this inverse relationship can be seen by comparing Figure 18 and Figure 19.

Figure 17. Dungeness crab–trap commercial landings, ex-vessel revenue, and number of fishermen in the North Central Coast region, 1992–2011



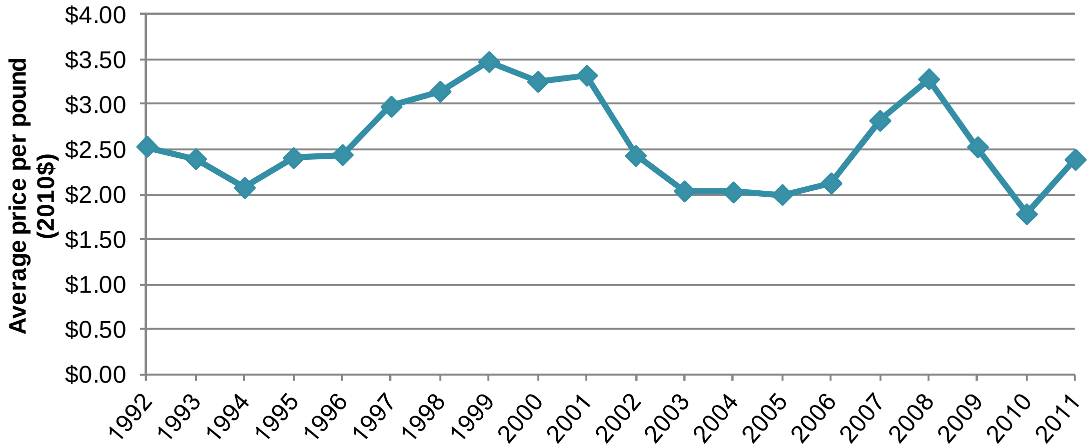
Source: Landings data from CDFW.

Figure 18. Dungeness crab–trap: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, 1992–2011



Source: Landings data from CDFW.

Figure 19. Dungeness crab–trap commercial fishery average ex-vessel price per pound in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

Table 48 displays the average annual percent change in ex-vessel revenue and average ex-vessel revenue per fisherman for the Dungeness crab–trap fishery over recent time periods organized into both pre and post-MPA implementation periods. Changes are presented for the North Central Coast region and compared with those observed in the fishery at the state level. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods. In the North Central Coast region and throughout the state, Dungeness crab–trap ex-vessel revenue increased by similar amounts, close to 25 percent, over the pre-MPA period of 2000–2005. During 2005-2010, the ex-vessel revenue for the fishery increased more in the North Central Coast region, 63.8 percent on average annually, than in the state (29.6 percent). Though the increases were not as great, this proportional trend continued in the post-MPA period of 2010–2011, at increases 46.5 and 27.5 percent respectively.

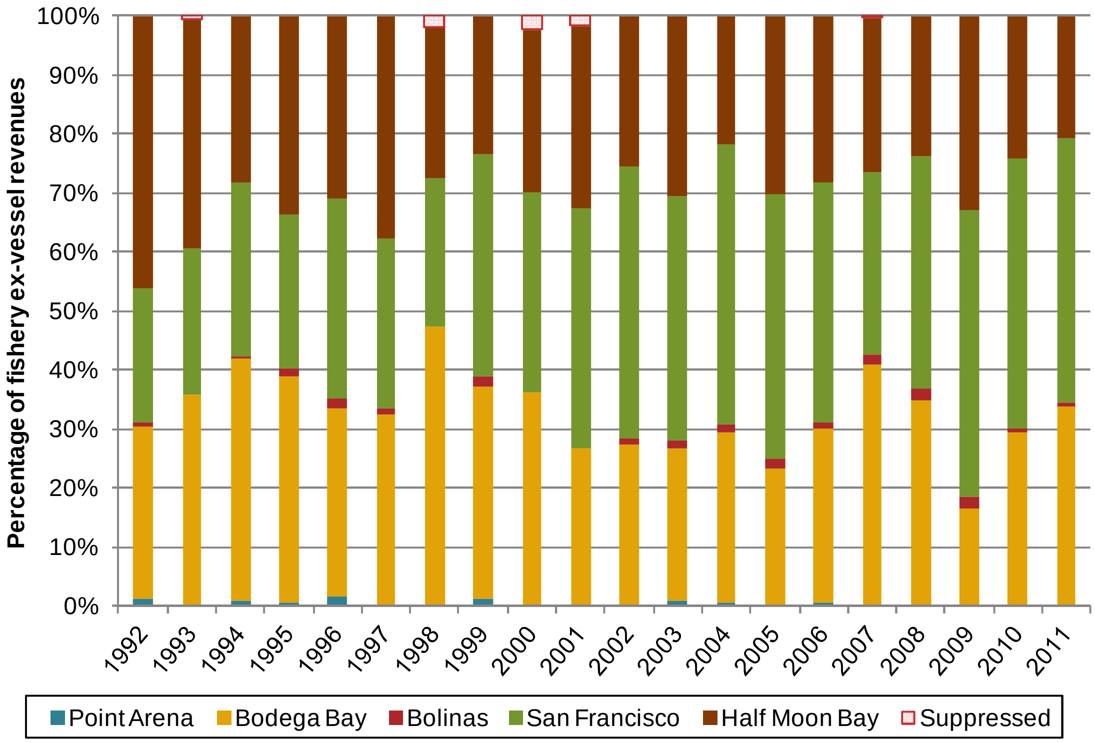
Figure 21 displays the commercial ex-vessel revenue for the Dungeness crab–trap fishery by North Central Coast region ports. Unlike other fisheries of interest, in which the majority of landings tend to be concentrated in one primary regional port, three North Central Coast ports landed constituted nearly a third each in total regional ex-vessel revenue annually: San Francisco (36.7 percent), Bodega Bay (32.1 percent), and Half Moon Bay (29.4 percent). Given the boom of the Dungeness crab–trap fishery over the study period, the relative consistency over the study period of the distribution of ex-vessel revenue among regional ports is especially interesting. That said, San Francisco's portion of ex-vessel revenue did increase over the study period, and constituted 44.8 percent of all ex-vessel revenue by 2011, while those of other regional ports declined.

Table 48. Dungeness crab–trap: Average annual percent change in commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

		Average annual percent change			
Level	**Ex-vessel revenue**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
North Central Coast region	Total	24.3%	63.8%	46.5%	44.3%
	Average per fisherman	22.7%	33.2%	27.5%	27.9%
State	Total	25.2%	29.6%	22.3%	27.0%
	Average per fisherman	23.4%	24.9%	16.5%	23.4%

Source: Landings data from CDFW

Figure 20. Dungeness crab–trap commercial ex-vessel revenue by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW.

The following four figures were created for the Dungeness crab–trap fishery profile to display what percent of ex-vessel revenue landed in the North Central Coast region is from different vessel home ports. To complete this analysis we matched the vessel ID to landings and homeport by year, data provided by CDFW, and summarized the landing values. The data underlying these figures below were based off of incomplete original landings entries that may result in some homeport assignments to be incomplete. However, this is the best available representation of where Dungeness crab–trap fishermen originate from and where they land their catch. The displayed areas contain the following ports, listed alphabetically:

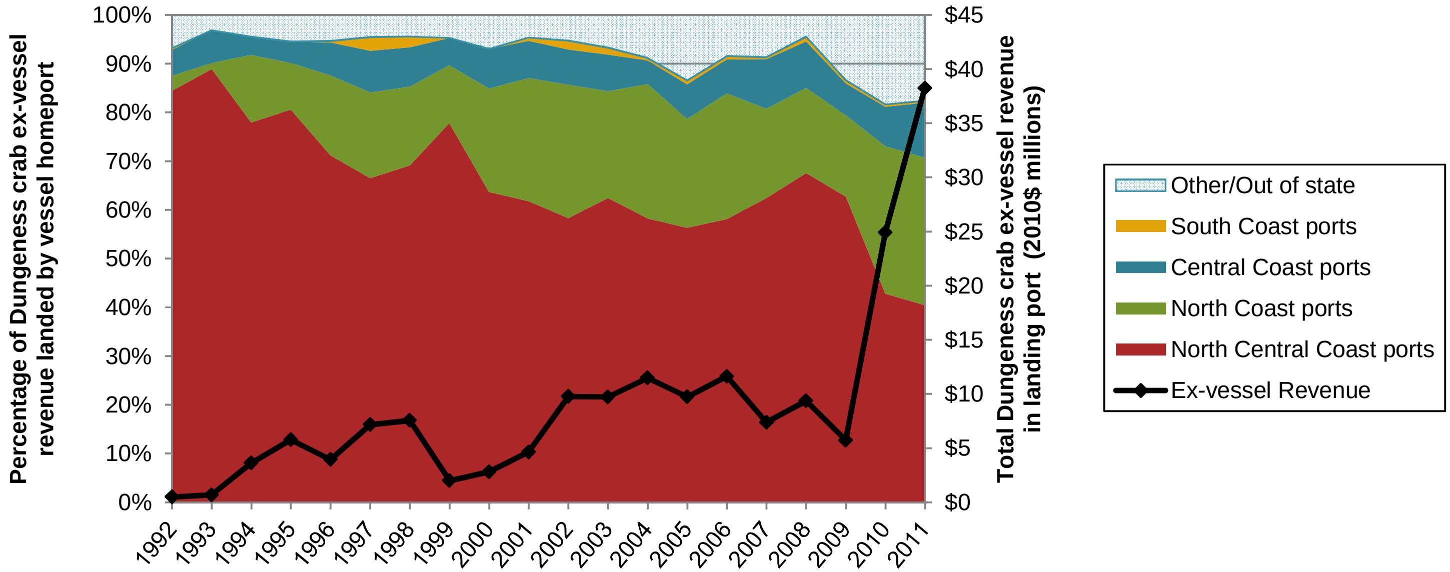
North Coast ports	North Central Coast ports	Central Coast ports	South Coast ports	Other/ Out of state
Albion	Bodega Bay	Avila-Port San Luis	Arroyo Grande	East of California
Crescent City	Bolinas	Baywood Park	Avalon	Westport
Douglas City	Half Moon Bay	Cambria	Dana Point	Unknown
Eureka	Point Arena	Freedom	Long Beach	
Fort Bragg	San Francisco	Monterey	Los Angeles	
Humboldt Bay		Morro Bay	North Shore	
King Salmon		Moss Beach	Oxnard	
Shelter Cove		Moss Landing	San Diego	
Trinidad		Salinas	San Pedro	
Willows		San Luis Obispo	Santa Barbara Harbor	
		Santa Cruz	Santa Cruz Island	
		Soquel	Ventura	

Figure 21 shows that on average, each year over the study period approximately 65.5 percent of all Dungeness crab–trap ex-vessel revenue landed in the North Central Coast region likely comes from vessels with homeports within the North Central Coast region itself. Over the study period, the portion of ex-vessel revenues made by regional vessels, however, has decreased by approximately half. In 1992, 84.4 percent of ex-vessel revenue was landed by regional vessels and in 2011, only 40.4 percent was. It appears as though vessels with home-ports in the North Coast have been landing an increasing share of Dungeness crab–trap in the North Central Coast region, approximately 3.1 percent in 1992 to 30.3 percent in 2011. This trend, of increased landings by out of state and North Coast ports was mentioned by fishermen in interviews, as well. Specifically, one fisherman from San Francisco mentioned this increased pressure began in the early 2000's.

As seen below in Figure 22, the decline in Dungeness crab–trap ex-vessel revenue landed by North Central Coast vessels is most apparent in the port of San Francisco. While in 1992 Other/Out of state vessels constituted 21.1 percent of ex-vessel revenue landed in the port, the remaining 78.9 percent accrued entirely to North Central Coast vessels, and in 1993, nearly 100 percent did. By 2011, this percentage dropped to 27.7 percent, while 42 percent accrued to North Coast port vessels, 21.9 percent to Other/Out of state vessels, and 8.4 percent to Central Coast port vessels.

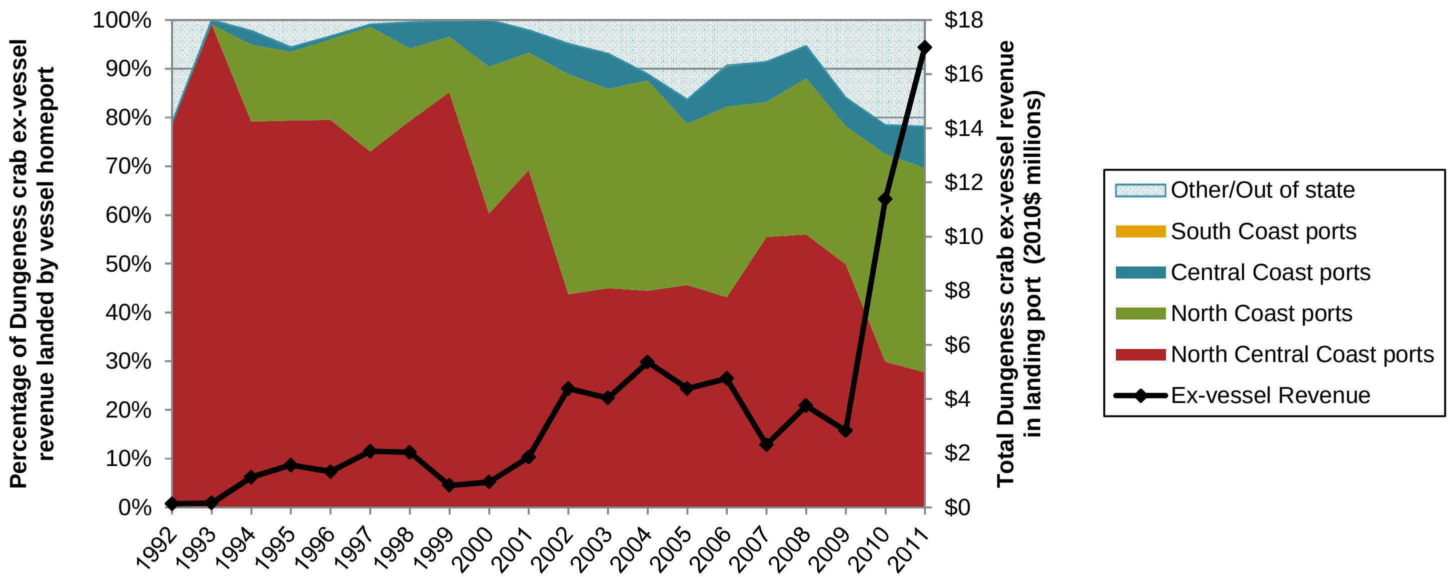
Similar figures are also available for Bodega Bay (Figure 23) and Half Moon Bay (Figure 24). Among the four Dungeness crab–trap ex-vessel revenue figures below, Half Moon Bay, the southernmost North Central Coast region port, displays the most percentage of ex-vessel revenue in this fishery accruing to both Central Coast port vessels, at most 22.9 percent in 2011, and to South Coast port vessels, which at most reached 7.1 percent in 2002.

Figure 21. Percentage of Dungeness crab–trap ex-vessel revenue landed in the North Central Coast region by vessel homeport



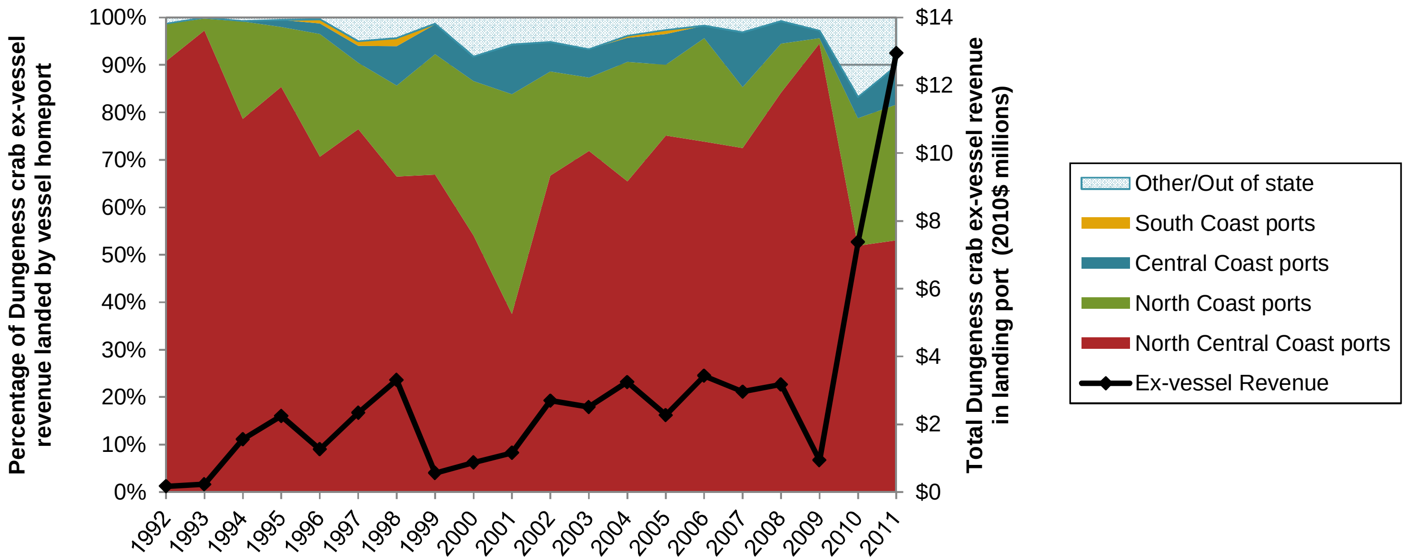
Source: Landings data from CDFW.

Figure 22. Percentage of Dungeness crab–trap ex-vessel revenue landed in San Francisco by vessel homeport



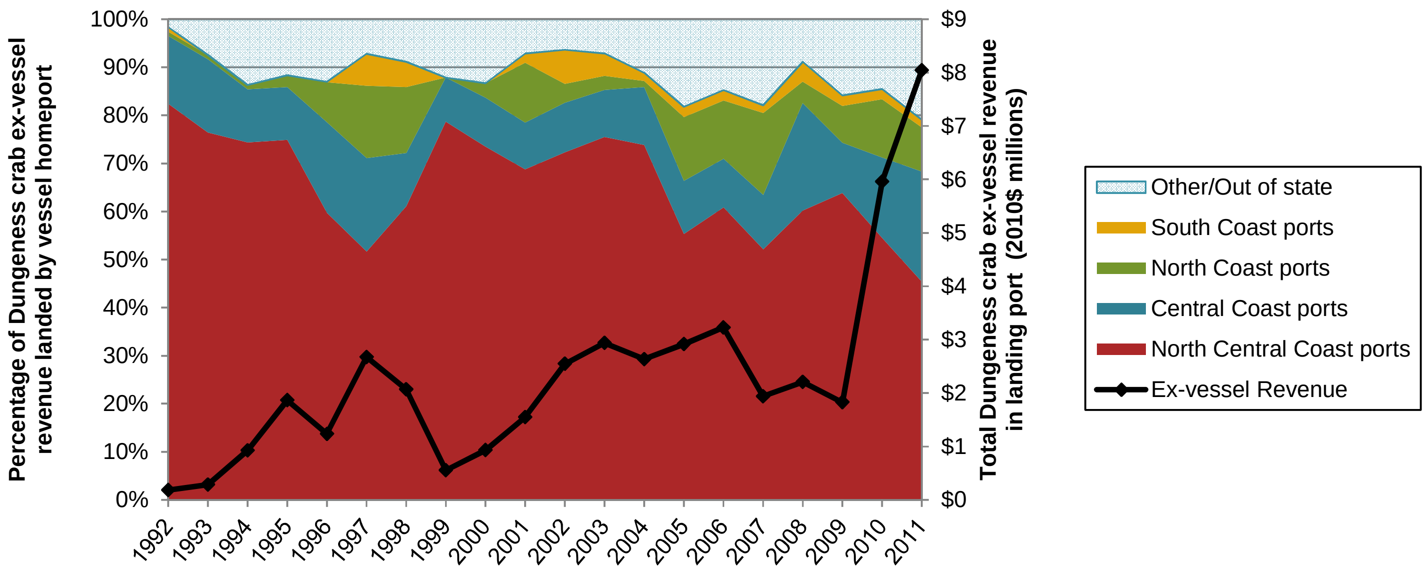
Source: Landings data from CDFW.

Figure 23. Percentage of Dungeness crab–trap ex-vessel revenue landed in Bodega Bay by vessel homeport



Source: Landings data from CDFW.

Figure 24. Percentage of Dungeness crab–trap ex-vessel revenue landed in Half Moon Bay by vessel homeport



Source: Landings data from CDFW.

We interviewed 63 Dungeness crab–trap fishermen whose stated homeport is in the North Central Coast study region and an additional 17 fishermen whose stated homeport is either north of the study region, south of the study region, or from out of state, for a total of 80 Dungeness crab–trap interviews. On average, respondents from north of the study region (but within California) were the oldest (55.4 years old) and had the most experience commercial fishing (33.9 years). The average ages and number of years of experience for each port and for respondents as a whole is shown below in Table. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in the Dungeness crab–trap fishery.

Table 49. Average age and years of experience commercial fishing, 2010, Dungeness crab–trap

	Age			Years of experience		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Point Arena	4	48.3	5.4	4	27.3	5.2
Bodega Bay	23	54.9	12.6	23	32.1	13.5
Bolinas	4	52.8	9.9	4	31.8	8.6
San Francisco	11	51.2	8.3	13	24.0	12.5
Half Moon Bay	17	53.5	9.4	19	28.4	12.5
South of study region	5	51.2	5.7	5	28.4	9.6
North of study region	10	54.5	9.8	10	33.9	10.5
Out of state	2	*	*	2	*	*
All respondents (unique individuals)	76	53.1	10.0	80	29.5	12.0

Source: Current study

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

On average Dungeness crab–trap fishermen interviewed saw a small decline (4.8) in the percent of their total personal income generated from commercial fishing from 2007 to 2010. This decline was most notable in Bolinas where percent of total income from commercial fishing decreased by 22.4 percent from 96.7 percent in 2007 to 75 percent in 2010. Additionally, on average respondents from north of the study region show a slight increase in income from fishing, a 2.6 percent increase from 2007 to 2010. Again as noted above, this question was not asked specifically regarding Dungeness crab–trap fishing, but rather pertaining to commercial fishing as a whole and the 2007 percent estimates were taken from the 2008 study conducted by Ecotrust. The most frequently reported reason for the decrease in the proportion of their income coming from commercial fishing was that they generated more income from other non-commercial fishing sources. Additionally, several Dungeness crab–trap fishermen typically target salmon–troll as well, and felt that due to the limited season in 2010 they generated less commercial fishing revenue. Additional responses are shown below in Table 51. Fishermen were also asked to identify additional sources of income they have other than commercial fishing, response can be found in Table 52.

Table 50. Percent change in income from overall commercial fishing from 2007 - 2010, Dungeness crab–trap

Ports		2007^		2010			
	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Percent change
Point Arena	5	96.0%	8.9%	4	76.3%	27.5%	-20.6%
Bodega Bay	37	89.1%	18.6%	23	86.1%	23.3%	-3.4%
Bolinas	3	96.7%	5.8%	4	75.0%	37.9%	-22.4%
San Francisco	21	89.9%	24.4%	13	81.9%	22.3%	-8.9%
Half Moon Bay	18	88.9%	25.2%	19	88.2%	20.2%	-0.8%
North of study region	16	94.1%	16.3%	10	96.5%	6.7%	2.6%
South of study region	—	—	—	5	82.4%	38.2%	n/a
Out of state	—	—	—	2	*	*	n/a
All respondents (unique individuals)	100	90.6%	20.1%	80	86.3%	22.7%	-4.8%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

Table 51. Cause in change in percent income from commercial fishing from 2007 - 2010, Dungeness crab–trap

	Response	Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	North of Study Region	South of Study Region	Out of State	All respondents (unique individuals)
		Number responding								
Reason for increase	Relied more on other sources of income in 2007	—	—	—	1	—	—	—	—	1
	Natural fluctuation in fish abundance/presence (worse in 2007)	—	—	—	1	2	—	—	—	3
	Fishing less actively in 2007	—	1	—	1	—	—	—	—	2
	Started fishing after 2007	—	—	—	1	—	—	—	—	1
Reason for decrease	Relied more on other sources of income in 2010	1	3	—	1	4	1	—	—	10
	Natural fluctuation in fish abundance/presence (worse in 2010)	—	—	—	1	—	—	—	—	1
	Fishing less actively in 2010	—	—	—	—	1	—	—	—	1
	Age health/worse in 2010	—	1	—	—	1	—	—	—	2
	Fishing was less profitable in 2010	—	—	—	—	—	—	—	—	—
	Not able to fish salmon in 2010 due to regulations	1	5	—	—	—	—	—	—	6
	Number of individuals responding	2	7	—	4	5	1	—	—	19

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 52. Other sources of income other than commercial fishing in 2010, Dungeness crab–trap

	Number responding								
Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**	**North of Study Region**	**South of Study Region**	**Out of State**	**All respondents (unique individuals)**
Construction/Contractor	—	—	—	—	—	—	—	—	—
Farming/Ranching	—	2	1	—	1	—	—	—	4
Fisheries research	1	3	—	1	2	—	—	—	7
Harbor/City job	1	—	—	—	1	—	—	—	2
Office work	—	—	—	—	—	—	—	—	—
Other fishing related work	—	—	—	—	—	—	—	—	—
Other specialized work	—	1	1	—	1	—	—	—	3
Property management	—	—	—	1	—	1	—	—	2
Retirement/Social Security/Investments	—	3	—	—	1	1	1	—	6
Salmon disaster relief	—	1	—	—	4	—	1	—	—
Skilled labor	1	1	1	1	—	—	—	—	4
Number of individuals responding	2	9	2	6	9	2	1	—	31

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Dungeness crab–trap fishermen reported that they spent on average 52.1 percent of their gross economic revenue (GER) on operating costs in 2011, which was a 7.3 percent increase from 2007. As with the question above regarding the proportion of GER from fishing, this was not asked for each specific fishery, but in regards to an individual's overall commercial fishing operation. In 2010 respondents whose homeports are north of the North Central Coast study region reported the largest percentage of their GER was spent on overall operating costs (60.6 percent) but those in San Francisco experienced the largest increase in overall operating costs from 2007 to 2010 (24.5 percent). It should be noted that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. Increasing fuel costs, followed by the general increase in expense costs were the primary reasons cited for the increase in costs (Table 54).

Table 53. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Dungeness crab–trap

	2007^			2010			
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
Point Arena	5	45.1%	24.1%	4	39.0%	23.3%	-13.5%
Bodega Bay	36	46.0%	16.6%	23	47.4%	10.6%	3.1%
Bolinas	3	50.0%	25.0%	4	50.8%	21.9%	1.5%
San Francisco	20	45.0%	13.7%	13	56.0%	12.3%	24.5%
Half Moon Bay	18	50.0%	23.9%	19	55.0%	24.7%	10.1%
North of study region	16	58.3%	18.7%	10	60.6%	13.8%	3.9%
South of study region	—	—	—	5	47.0%	19.2%	n/a
Out of state	—	—	—	2	*	*	n/a
All respondents (unique individuals)	98	48.6%	18.7%	80	52.1%	17.5%	7.3%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 54. Cause of change in percent of gross economic revenue used towards overall operating costs, Dungeness crab–trap

	Response	Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	North of Study Region	South of Study Region	Out of State	All ports (unique individuals)
		Number responding								
Reason for decrease	Large purchase or capital investment in 2007	1	—	—	—	1	—	—	—	2
	2007 was a bad fishing year	—	2	—	—	1	1	—	—	4
	Made less revenue in 2007	—	1	—	—	1	1	—	—	3
	Had more costs in 2007	—	—	—	—	—	1	—	—	1
Reason for increase	Large purchase or capital investment in 2010	1	—	—	1	6	—	—	—	8
	2010 was a bad fishing year	—	1	—	—	—	—	—	—	1
	Made less revenue in 2010	—	—	—	1	—	—	—	—	1
	Increased fuel prices in 2010	1	9	—	3	1	3	—	—	17
	More crew in 2010	—	1	—	1	1	—	—	—	3
	Fished out of multiple ports in 2010	1	—	—	—	—	—	—	—	1
	General cost increase in 2010	3	12	—	5	9	5	—	—	11
Number of individuals responding		3	12	—	5	9	5	—	—	34

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Fisherman whose homeports are north of the study region reported, on average, having the most experience in the Dungeness crab–trap fishery (29.7 years) while those whose homeports were south of the study region had the least experience (13.2 years). Those whose homeports are south of the north central coast study region spent, on average, the largest number of days targeting Dungeness crab in 2010, 88 days, compared to the regional average of 64.2 days. More information is found below in Table 55.

Table 55. Years of experience and number of days targeting Dungeness crab–trap, 2010

	Years of experience in fishery			Days spent targeting fishery		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
Point Arena	4	21.8	3.0	3	36.0	16.4
Bodega Bay	23	26.1	15.7	20	62.9	25.7
Bolinas	4	24.8	10.5	4	73.0	31.3
San Francisco	13	23.2	12.8	12	73.3	46.6
Half Moon Bay	19	24.4	12.1	19	52.7	25.7
North of study region	10	29.7	11.8	9	71.7	34.3
South of study region	5	13.2	8.6	5	88.0	66.0
Out of state	2	*	*	2	*	*
All respondents (unique individuals)	80	24.4	12.9	74	64.2	34.8

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

The average respondent indicated they used 2 crew members in the Dungeness crab–trap fishery, which is the most of any of the five target fisheries. On average those from north of the study region used the most crew (3) and those from Bolinas used the least (0.8). Despite averaging only 1.3 crew members, respondents from Point Arena spent the largest proportion of their GER on crew, 31.3 percent. This was only slightly higher than the average of all respondents, which was 28.3 percent. Dungeness crab–trap fishermen reported, on average, using a smaller percentage of their fishery specific GER on fuel than for any of the other target fisheries (11.4 percent of GER). Additional information can be found in Table 56, below.

Table 56. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Dungeness crab–trap

Ports	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
Point Arena	4	1.3	0.5	4	31.3%	11.8%	3	9.7%	4.7%
Bodega Bay	23	1.9	0.6	23	27.1%	11.0%	19	12.5%	7.4%
Bolinas	4	0.8	0.5	3	18.3%	16.1%	3	10.0%	—
San Francisco	13	2.2	0.8	12	29.2%	11.6%	11	10.5%	2.8%
Half Moon Bay	19	1.9	0.7	18	29.8%	8.3%	18	12.1%	7.2%
North of study region	10	3.0	1.6	10	30.3%	12.5%	7	10.7%	6.6%
South of study region	5	1.6	0.9	5	21.6%	12.2%	5	10.6%	5.5%
Out of state	2	*	*	2	*	*	2	*	*
All respondents (unique individuals)	80	2.0	1.0	77	28.3%	11.0%	68	11.4%	6.1%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Fishermen were asked if they added or dropped the Dungeness crab–trap fishery since 2007 or if they did not fish a fishery in 2010. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. Three individuals added the Dungeness crab–trap fishery after 2007, two of whom indicated they were new to commercial fishing as a whole or new to the fishery as they purchased a boat that came with a Dungeness crab permit. One respondent indicated he did not participate in the Dungeness crab-trap fishery in 2010, specifying he did not have enough time (Table 58).

Table 57. Dungeness crab–trap, added/dropped since 2007 or not fished in 2010

		Number responding		
Ports	**Number responding**	**Added**	**Dropped**	**Not fished in 2010**
Point Arena	4	—	—	—
Bodega Bay	23	2	—	—
Bolinas	4	—	—	—
San Francisco	13	1	—	1
Half Moon Bay	19	—	—	—
North of study region	10	—	—	—
South of study region	5	—	—	—
Out of state	2	—	—	—
All respondents (unique individuals)	80	3	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 58. Reason for adding/dropping a fishery since 2007 or not fishing in 2010, Dungeness crab–trap

	Number responding				
Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**
New to commercial fishing	—	1	—	—	—
Purchased boat with permit	—	1	—	—	—
Not enough time due to other work	—	—	—	1	—
Increased difficulty due to MPAs	—	—	—	—	—
Bad season	—	—	—	—	—
Number responding	—	2	—	1	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents were asked to compare his/her success in the Dungeness crab—trap fishery in 2010 to the previous five years. As shown in Table 59 below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked as an open ended question and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

Across the region, 77.5 percent of respondents across the study region indicated that it was significantly better, 15 percent indicated it was somewhat better, and 3.8 percent indicated it was the same (Table 59). Additionally, 3.8 percent indicated they did not target Dungeness crab–trap prior to 2010 and therefore could not make a comparison. The highest percentage of individuals responding that the fishery was doing significantly better was in Half Moon Bay, where 89.5 percent of those interviewed responded in this manner.

Respondents primarily reported environmental factors to explain what they felt had impacted the Dungeness crab–trap fishery (Table 60). Numerous respondents from all ports explained that the Dungeness crab populations fluctuate in a cyclical pattern and that the 2010-2011 season was the peak of this cycle resulting in an abundance of Dungeness crab. Additionally, a few respondents indicated that the price and the market for Dungeness crab were good as well (Table 61). As mentioned previously, fishermen also mentioned improved environmental and water quality of the San Francisco Bay which is an important Dungeness crab nursery ground as perhaps bolstering the increase in Dungeness crab populations. Additional factors that fishermen felt were impacting the long term growth of the fishery are mentioned above in conjunction with Figure 17 through Figure 19.

Table 59. Overall success in specific commercial fishery in 2010 compared to previous five years, Dungeness crab–trap

Ports	Number responding	Percent response: Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Point Arena	4	—	50.0%	25.0%	25.0%	—	—
Bodega Bay	23	—	82.6%	13.0%	4.3%	—	—
Bolinas	4	—	50.0%	50.0%	—	—	—
San Francisco	13	7.7%	69.2%	23.1%	—	—	—
Half Moon Bay	19	—	89.5%	10.5%	—	—	—
North of study region	10	10.0%	70.0%	10.0%	10.0%	—	—
South of study region	5	20.0%	80.0%	—	—	—	—
Out of state	2	*	*	*	*	—	*
All respondents (unique individuals)	80	3.8%	77.5%	15.0%	3.8%	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 60. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Dungeness crab–trap

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	North of the study region	South of the study region	Out of state
	Number responding	3	21	2	12	17	8	4	2
	Responses	**Count of responses**							
Better	Larger quantity of fish	2	10	2	8	14	8	4	*
	Peak of natural cycle	2	15	1	6	5	2	—	*
	Good weather	1	—	—	—	—	—	—	*
	Good ocean conditions	—	—	—	—	2	—	—	*
	Good quality fish	1	—	—	—	—	—	—	*
	More bait/feed in the ocean	—	—	—	—	—	—	—	*
Worse	Low quantity of fish	—	—	—	—	—	—	—	*
	Bad weather	—	—	—	—	—	—	—	*
	Poor ocean conditions	—	—	—	—	—	—	—	*
	Loss of salmon spawning grounds	—	—	—	—	—	—	—	*
	Red tide	—	—	—	—	—	—	—	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 61. Economic changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Dungeness crab–trap

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	North of study region	South of study region	Out of state
	Number responding	—	—	—	—	—	—	1	—
	Responses	**Count of responses**							
Better	Good price	—	—	—	—	—	—	1	—
	Good/new market	—	—	—	—	—	—	1	—
Worse	Increase in fuel costs	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

3.4.3. Nearshore Finfish–Live–Fixed Gear Commercial Fishery

The nearshore finfish fishery is a California state managed fishery and is comprised of 19 different species of groundfish found primarily in rocky reef or kelp habitat. Nearshore finfish were traditionally fished with gill net and trawl gear but these gear types have decreased in use as stricter regulations have been enacted such as the Rockfish Conservation Area and other depth and area restrictions on gill net and trawl gear (CDFG 2002). During the 1990s groundfish landings decreased by 60 percent largely from these restrictions and the use of hook and line, longline, and trap gear increased to target nearshore finfish. (For the purposes of this report, the fixed gear category refers to the combination of hook and line and longline gear types.) Since the late 1990s the nearshore fishery has shifted into the live fish fishery. The market for live finfish developed in response to Asian markets in the San Francisco and Los Angeles areas. Typically, buyers are willing to pay a much better price for high quality live fish (CDFG 2002). In interviews fishermen noted that the live fish fishery makes up the majority of the nearshore finfish catch now and often dead fish are landed only if they cannot be sold as live fish.

Nearshore fixed gear fisheries are highly regulated under a variety of different management structures. The California Nearshore Fishery Management Plan in 2002 established permits to fish in nearshore waters (e.g., nearshore rockfish or deeper nearshore rockfish permits); limited the number of permits issued in each management region in California, and set individual quota limits. Additionally, in 2002 the Rockfish Conservation Area was implemented, restricting the depth of fishable areas. Currently, the number of nearshore and deeper nearshore permits issued are above target management goals and thus fishermen wishing to enter the fishery must purchase two permits from existing fishermen within their management region and retire one permit

Nearshore Finfish–Live–Hook & Line

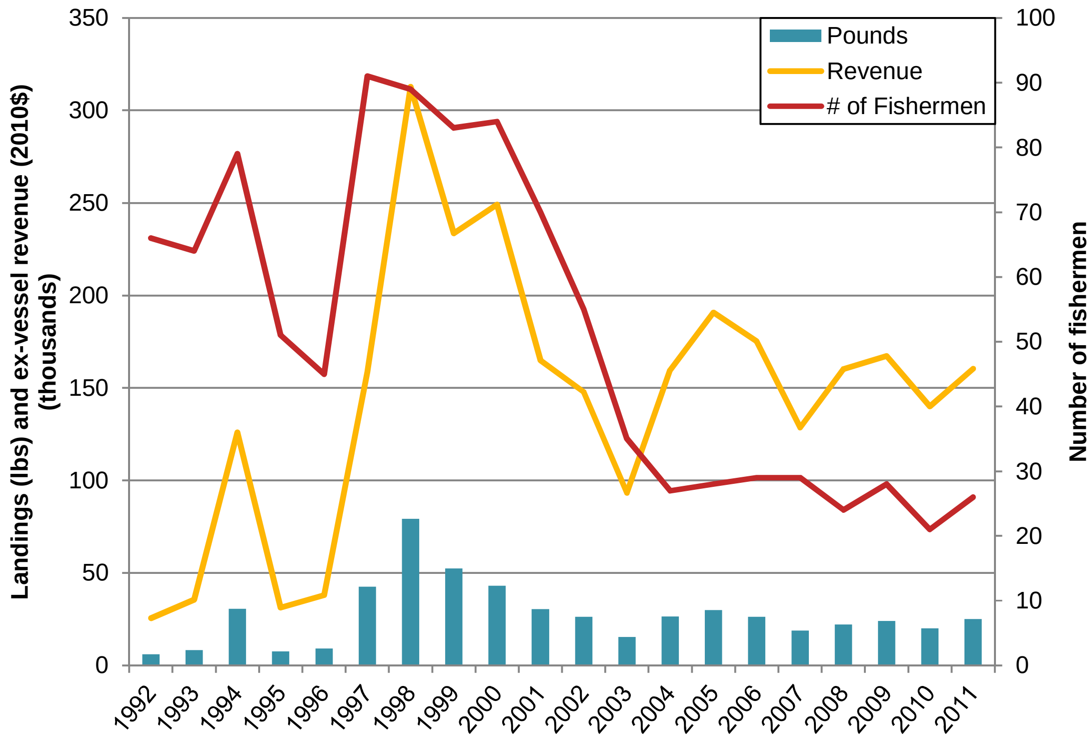
Despite being a relatively smaller fishery of interest, landings and ex-vessel revenue from the nearshore finfish–live–hook & line fishery increased notably from 1992–2011. The most prosperous period for this fishery occurred in 1998 with landings of 79,283 pounds and ex-vessel revenue of $312,875, approximately 12 times higher than those in 1992. After 1998 however, landings and ex-vessel revenue declined rather consistently until 2004, increasing again, but not by as much, to 25,046 pounds and $160,315 in ex-vessel revenue by the end of the study period.

In relation to total regional landings and ex-vessel revenue, nearshore finfish–live–hook & line fishery was only a very small contributor over the study period averaging only 0.2 percent of regional landings and 0.6 percent of ex-vessel revenue. This fishery is included here as it is a species likely to benefit from MPAs.

Over the study period, on average, a North Central Coast region nearshore finfish–live–hook & line fisherman landed an annual total 605 pounds for $3,571 in ex-vessel revenue, making 10 landings a year on average to do so, see Figure 26. Over the study period, the pounds landed, ex-vessel revenue, and count of landings per year per fisherman increased significantly. The average fisherman made four landings totaling 91 pounds and $387 in ex-vessel revenue in 1992, and 15 landings totaling 963 pounds and $6,166 in ex-vessel revenue in 2011.

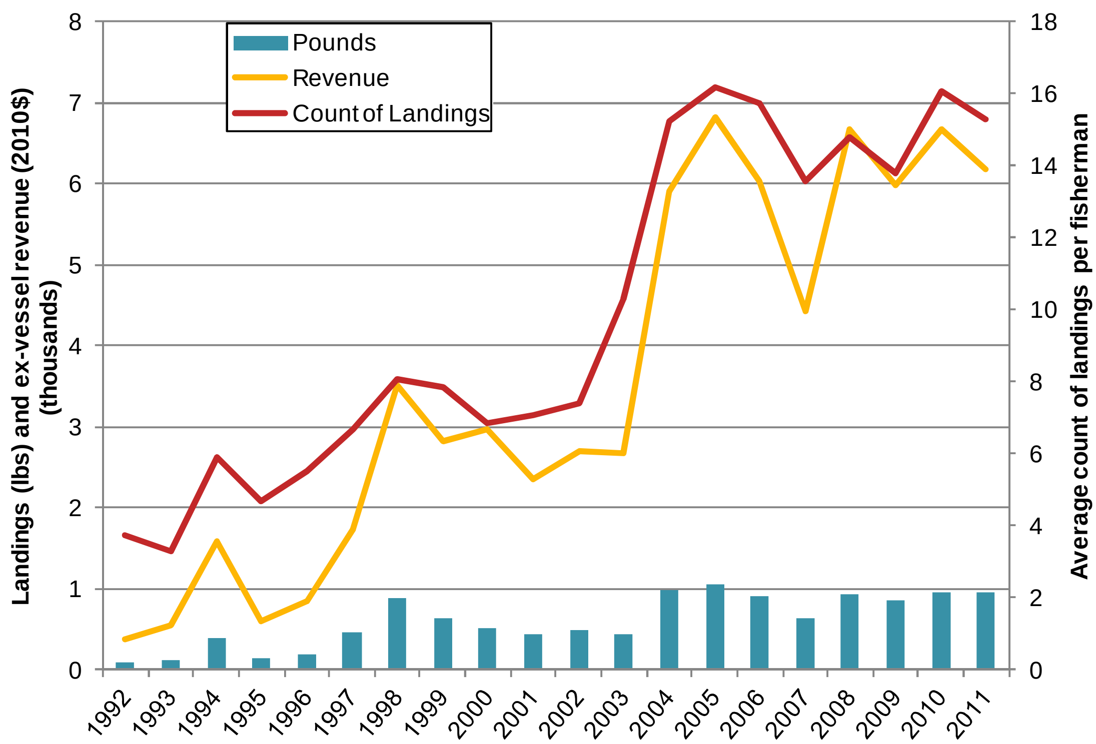
Average ex-vessel price per pound for the nearshore finfish–live–hook & line fishery rose 51.5 percent from 1992 ($4.22) to 2011 ($6.40), with the highest price occurring in 2008 at $7.24 per pound, see Figure 27. The average ex-vessel price per pound for the nearshore finfish–live–hook & line fishery over the entire study period was $5.48, and was the highest price among the six fisheries of interest in the North Central Coast.

Figure 25. Nearshore finfish–live–hook & line commercial landings, ex-vessel revenue, and number of fishermen in the North Central Coast region, 1992–2011



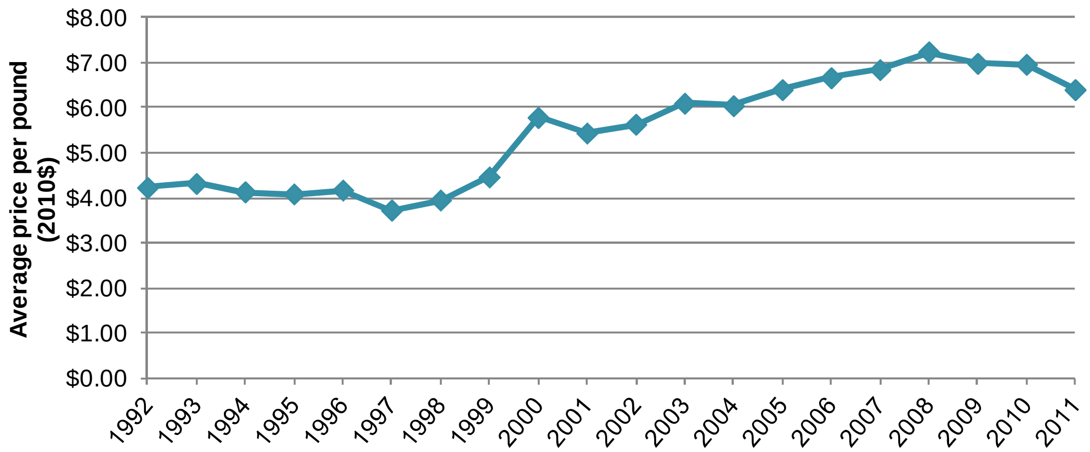
Source: Landings data from CDFW.-

Figure 26. Nearshore finfish–live–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, 1992–2011



Source: Landings data from CDFW.

Figure 27. Nearshore finfish–live–hook & line commercial fishery average ex-vessel price per pound in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

Table 62 displays the average annual percent change in ex-vessel revenue and average ex-vessel revenue per fisherman for the nearshore finfish–live–hook & line fishery over recent time periods organized into both pre and post-MPA implementation periods. Changes are presented for the North Central Coast region and compared with those observed in the fishery at the state level. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods. Over the years 2000–2011, overall ex-vessel revenue increased at only about 0.2 percent in the North Central Coast region and decreased by 0.5 percent in state on average annually. Over the same time, average per fisherman ex-vessel revenue increased 12.4 percent in the region and 10.7 percent in the state on average annually. The highest increases in average per fishermen ex-vessel revenue for both the region and the state in this fishery came during the pre-MPA period of 2000–2005, rising at 26 percent and 15 percent annually on average.

Figure 28 displays the commercial ex-vessel revenue for the nearshore finfish–live–hook & line by North Central Coast region ports. In this fishery, a shift in port dominance over time is clearly observable. In the early years of the study period, Half Moon Bay, San Francisco, and Bodega Bay landed the majority of nearshore finfish–live–hook & line. In 1992 alone, Half Moon Bay constituted 94.7 percent of total landings and ex-vessel revenue. However, beginning the late 90's, Point Arena entered the fishery, having had zero participation in previous years, and over time came to land 65.8 percent of total regional ex-vessel revenue by 2011.

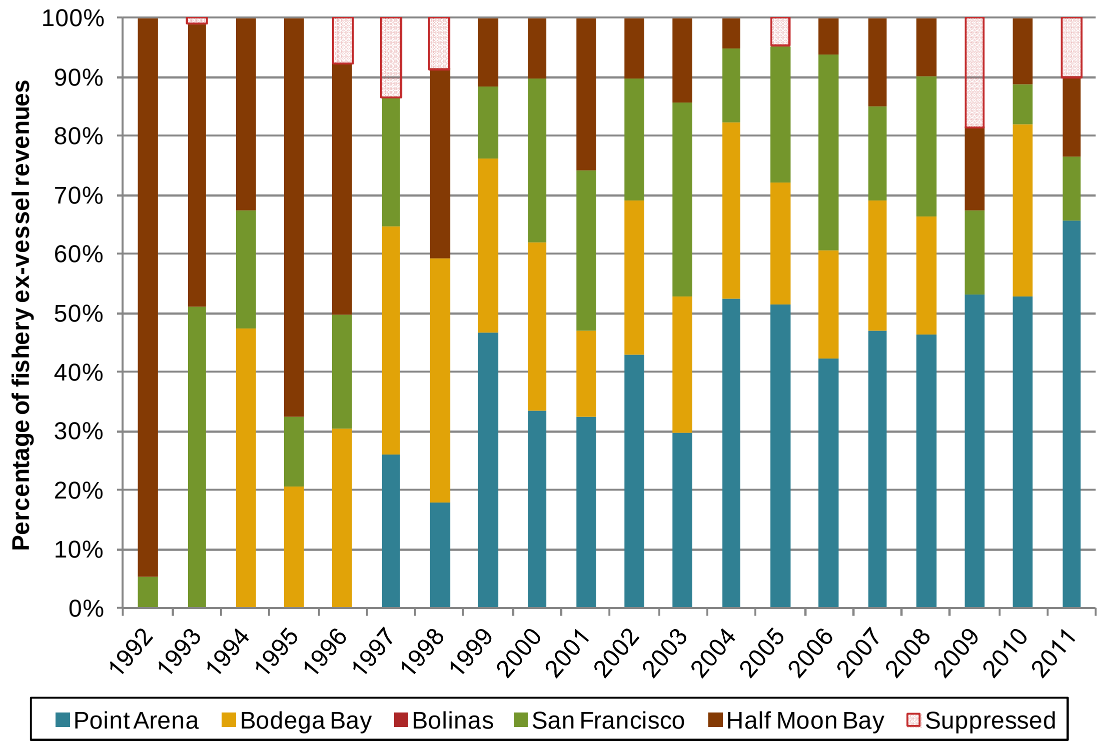
Point Arena is a small port compared to most others in the study region and well suited for the nearshore finfish–live–hook & line fishery. Additionally, while most other ports in the study region have experienced large growth in the Dungeness crab–trap fishery, growth has been less rapid in Point Arena. One possible explanation for this mentioned in meetings with fishermen is that boats in Point Arena are relatively smaller in size. This is due to the hoist style launching facility that can only handle boats under a certain size and thus the size of the landings in this port are also limited. The port's relatively isolated location and lack of infrastructure (such as an ice machine) also makes landing higher volumes of catch difficult. As such, the nearshore finfish–live–hook & line fishery remains an important fishery in Point Arena.

Table 62. Nearshore finfish–live–hook & line: Average annual percent change in commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

		Average annual percent change			
Level	Ex-vessel revenue	Pre-MPA (2000-2005)	Pre-MPA (2005-2010)	Post-MPA (2010-2011)	2000-2011
North Central Coast region	Total	1.9%	-4.4%	14.5%	0.2%
	Average per fisherman	26.0%	2.7%	-7.5%	12.4%
State	Total	-3.0%	0.4%	7.7%	-0.5%
	Average per fisherman	15.0%	6.9%	7.7%	10.7%

Source: Landings data from CDFW

Figure 28. Nearshore finfish–live–hook & line commercial ex-vessel revenue by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW.

Nearshore Finfish–Live–Longline

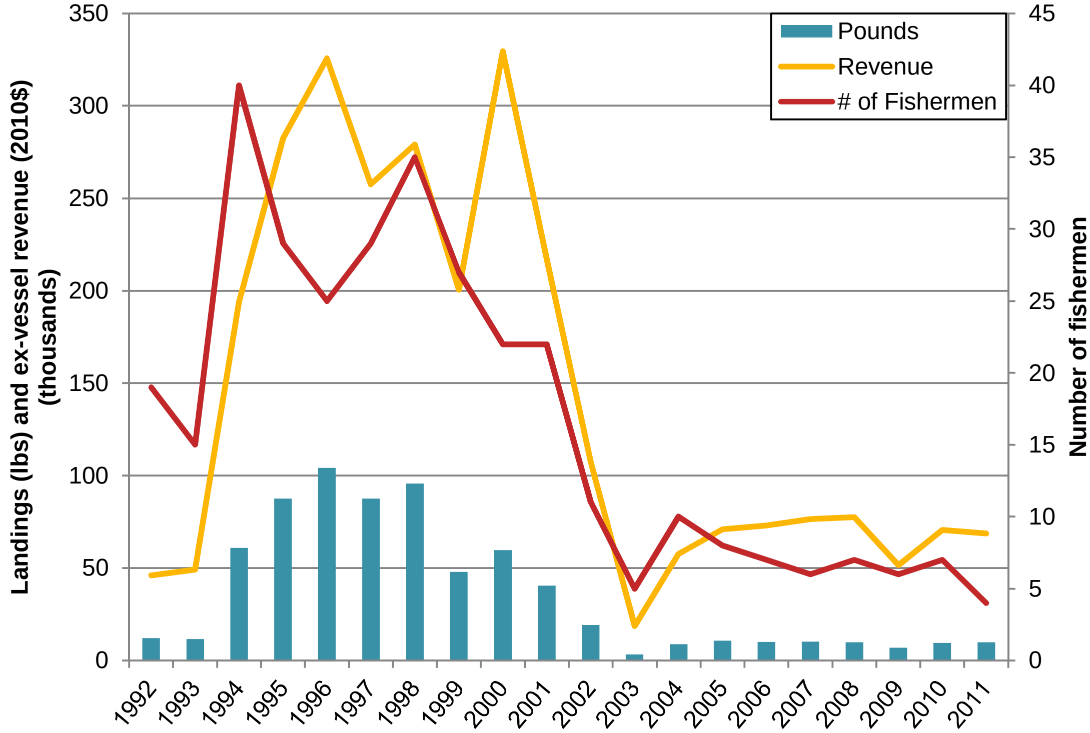
The nearshore finfish–live–longline fishery is the smallest fishery of interest in the North Central Coast region, with total landings in 2011 of 9,843 pounds and ex-vessel revenue of $68,668. However, the fishery was more significant in the earlier half of the study period, averaging landings of 73,028 pounds and $2.1 million in ex-vessel revenue over the years 1994-2001. The highest number of participating fishermen in the nearshore finfish–live–longline fishery over the study period was 40 fishermen, in 1994; by 2011 there were only 4 participating fishermen.

In relation to total regional landings and ex-vessel revenue, nearshore finfish–live–hook & line fishery was the least significant of all the fisheries of interest, averaging only 0.1 percent of regional landings and 0.5 percent of ex-vessel revenue over the study period. Again, this fishery is included here as it is a species likely to benefit from MPAs.

The average nearshore finfish–live–longline fisherman made 17 landings per year totaling 1,815 pounds and $9,034 in ex-vessel revenue overall from 1992–2011. The average trends per fisherman largely mirrored the overall fishery trends in the first half of the study period, increasing then decreasing accordingly. However after 2004, while total landings and ex-vessel revenue for the fishery remained relatively consistent in the region, increasing only 12.3 percent and 19.2 percent respectively, the average landings and ex-vessel revenue per fisherman increased 180.8 percent and 198.1 percent respectively. This is because over the same time period, the number of participating fishermen in the nearshore finfish–live–longline fishery decreased by 60 percent. The number of fishermen participating in both the nearshore finfish–live–longline and the nearshore finfish–live–hook and line fisheries is heavily influenced by regulations which require those who enter the fishery to acquire two nearshore rockfish permits, one of which must be retired. Additionally, fishermen mentioned that compounding regulations that limit available fishing grounds, such as the Rockfish Conservation Area and marine protected areas have made it more difficult for the fishery to remain economically viable and often opt out of the fishery in lieu of other more lucrative fisheries available to them.

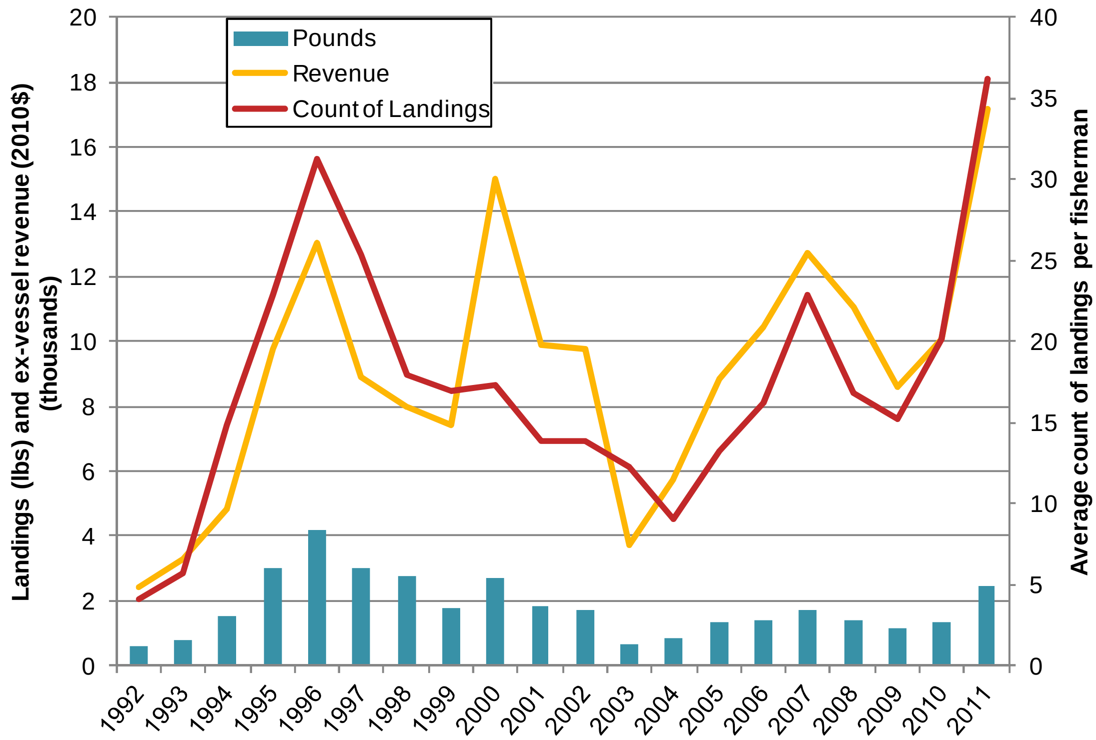
Ex-vessel prices for this fishery increased notably over the study period, the average price per pound observed for 2011 ($6.98) was 82.1 percent higher than that for 1992 ($3.83), see Figure 31. In fact, the highest ex-vessel price per pound for this fishery, occurring in 2008 at $7.83, was the highest annual average ex-vessel price per pound among the fisheries of interest in the North Central Coast region.

Figure 29. Nearshore finfish–live–longline commercial landings, ex-vessel revenue, and number of fishermen in the North Central Coast region, 1992–2011



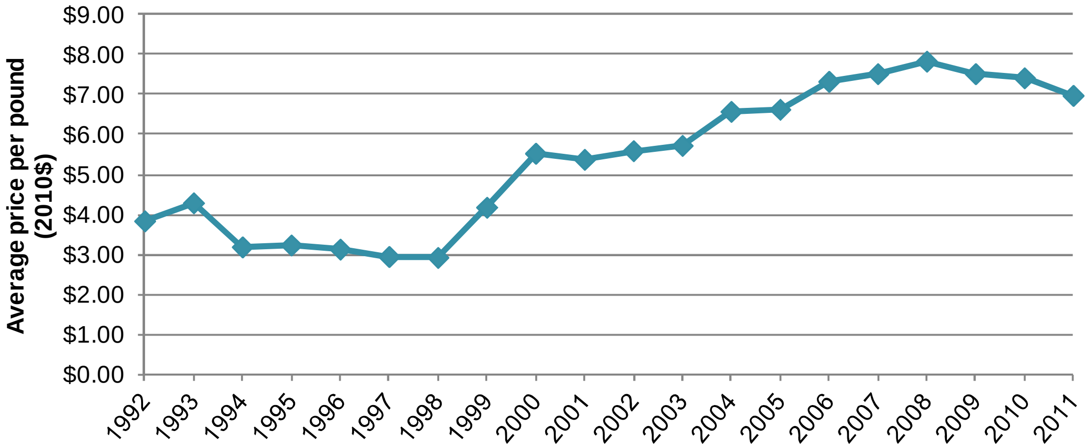
Source: Landings data from CDFW.

Figure 30. Nearshore finfish–live–longline: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, 1992–2011



Source: Landings data from CDFW.

Figure 31. Nearshore finfish–live–longline commercial fishery average ex-vessel price per pound in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

Table 63 displays the average annual percent change in ex-vessel revenue and average ex-vessel revenue per fisherman for the nearshore finfish–live–longline fishery over recent time periods organized into both pre and post-MPA implementation periods. Changes are presented for the North Central Coast region and compared with those observed in the fishery at the state level. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods. Regional and state trends appear to have gone in different directions during the pre-MPA period of 2000–2005 when regional ex-vessel revenue increased by 13.1 percent annually on average while state-wide decreasing by 16.9 percent annually on average. Post-MPA 2010–2011, both regional and state fishermen saw significant increases in the average per fishermen ex-vessel revenue, with regional fishermen experiencing higher gains (70 percent regionally and 24.6 percent statewide).

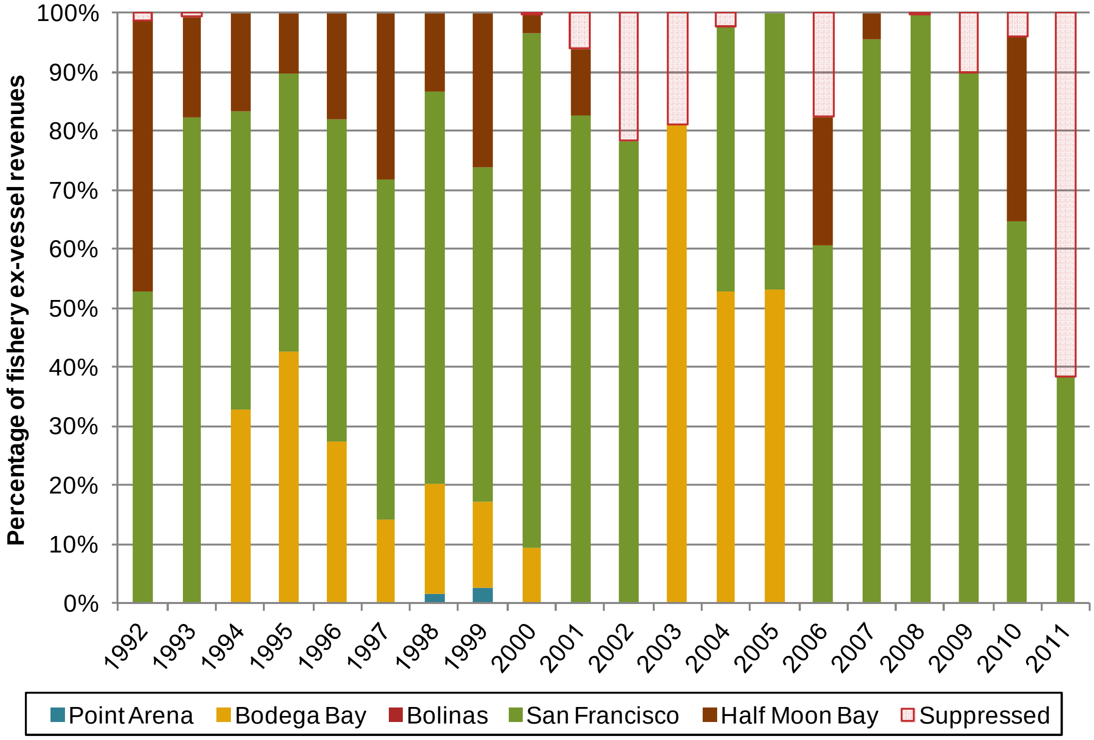
Figure 32 displays the commercial ex-vessel revenue for the nearshore finfish–live–longline by North Central Coast region ports. Landings were varied across ports over the study period. San Francisco's portion of ex-vessel revenue in one year (2008) reached 99.8 percent of total ex-vessel revenue, but fell to its lowest at 38.4 percent in 2011. On the other hand, in another year (2003), Bodega Bay constituted 81.1 percent of total regional ex-vessel revenue, and in other years landed nothing. Ex-vessel revenue in Half Moon Bay also varied, though not as greatly, constituting and an annual average of nearly 17.8 percent. Despite some random competition from Bodega Bay and some varied landings in Half Moon Bay, San Francisco remained the primary nearshore finfish–live–longline port in the North Central Coast region.

Table 63. Nearshore finfish–live–longline: Average annual percent change in commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

		Average annual percent change			
Level	**Ex-vessel revenue**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
North Central Coast region	Total	13.1%	2.5%	-2.9%	6.9%
	Average per fisherman	2.3%	4.4%	70.0%	9.4%
State	Total	-16.9%	-4.2%	3.1%	-9.3%
	Average per fisherman	-2.6%	11.3%	24.6%	6.2%

Source: Landings data from CDFW

Figure 32. Nearshore finfish–live–longline commercial ex-vessel revenue by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW.

The average nearshore finfish–live–fixed gear fisherman interviewed was 46.7 years old, which is younger than the average respondent (51.9 years old). Again, here the term fixed gear is meant to reference the combination of hook and line and longline gear types. The fishermen interviewed in this fishery also had slightly less experience commercial fishing overall, with 21.8 years of experience, compared to the regional average of 26.9 years of experience. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. On average fishermen interviewed in 2010 reported a lower percentage of their total personal income came from commercial fishing than fishermen interviewed in 2007, a decrease of 18.0 percent (Table 65). One respondent indicated that fishing in general was less profitable and thus they were fishing less actively and relying on other sources of income. Note that this question was also not asked specifically in regards to nearshore finfish–live–fixed gear, but rather in regards to commercial fishing as a whole and that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. As such, in Table 66 the individual who remarked that 2010 was a peak in natural cycles was referring to the Dungeness crab–trap fishery, which he targeted in 2010. Sources of income other than commercial fishing are listed in Table 67.

Table 64. Average age and years of experience commercial fishing, 2010, Nearshore finfish–live–fixed gear

	Age			Years of experience		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Point Arena	2	*	*	2	*	*
Bodega Bay	1	*	*	1	*	*
Bolinas	—	—	—	—	—	—
San Francisco	2	*	*	2	*	*
Half Moon Bay	5	51.6	5.9	5	24.0	8.4
All respondents (unique individuals)	10	46.7	7.1	10	21.8	8.1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 65. Percent change in income from overall commercial fishing from 2007 - 2010, Nearshore finfish–live–fixed gear

	2007^			2010			
Ports	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Percent Change
Point Arena	1	90.0%	14.1%	2	*	*	*
Bodega Bay	1	56.5%	51.2%	1	*	*	*
Bolinas	—	—	—	—	—	—	—
San Francisco	—	87.3%	14.7%	2	*	*	*
Half Moon Bay	2	*	*	5	49.8%	44.5%	*
All respondents (unique individuals)	5	70.0%	41.0%	10	57.4%	44.3%	-18.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 66. Cause in change in percent income from commercial fishing from 2007 - 2010, Nearshore finfish–live–fixed gear

		Number responding					
	Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**	**All respondents (unique individuals)**
Reason for increase	Relied more on other sources of income in 2007	*	*	—	—	—	—
	Natural fluctuation in fish abundance/presence (worse in 2007)	*	*	—	—	1	1
	Fishing less actively in 2007	*	*	—	—	—	—
	Started fishing after 2007	*	*	—	—	—	—
Reason for decrease	Relied more on other sources of income in 2010	*	*	—	—	—	—
	Natural fluctuation in fish abundance/presence (worse in 2010)	*	*	—	—	—	—
	Fishing less actively in 2010	*	*	—	—	1	1
	Age health/worse in 2010	*	*	—	—	—	—
	Fishing was less profitable in 2010	*	*	—	—	1	1
	Not able to fish salmon in 2010 due to regulations	*	*	—	—	—	—
	Number of individuals responding	*	*	—	—	2	2

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 67. Other sources of income other than commercial fishing in 2010, Nearshore finfish–live–fixed gear

	Number responding					
Response	Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	All respondents (unique individuals)
Construction/Contractor	—	*	—	—	—	1
Farming/Ranching	—	*	—	—	—	—
Fisheries research	—	*	—	—	—	—
Harbor/City job	—	*	—	—	1	2
Office work	—	*	—	—	—	—
Other fishing related work	—	*	—	—	—	—
Other specialized work	—	*	—	—	1	1
Property management	—	*	—	—	—	—
Retirement/Social Security/Investments	—	*	—	—	—	—
Salmon disaster relief	—	*	—	—	1	—
Skilled labor	—	*	—	—	2	2
Number of individuals responding	—	*	—	—	4	6

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

On average, fishermen who participated in the nearshore finfish–live–fixed gear fishery spent 34.6 percent of their overall commercial fishing gross economic revenue (GER) on operating costs in 2010. This was a 28.2 percent decrease from 2007 (Table 68). Here again, this question was asked regarding the fisherman's commercial fishing operations as a whole and not specifically about the nearshore finfish–live–fixed gear fishery. Again, the averages from 2007 were taken from the Ecotrust study conducted in 2008.

In general, most fishermen we spoke to in 2011 expressed that they felt that their operating expenses were higher in 2010 than in 2007. Indeed, considering just those individuals we interviewed in both 2007 and 2010, the percent of overall commercial fishing GER spent on operating costs in 2007 was 28.3 percent, which increased 29 percent in 2010 to 36.5 percent. These differing results may be due to fishermen who had higher percentages of operating costs dropping out of the fishery thus resulting in a drop in average percent of GER to operating costs. To further explore this and as mentioned in our lessons learned it would be useful to survey fishermen who have dropped out of specific fisheries or commercial fishing overall to investigate the reasons fishermen dropped out. This is outside the scope of our study but is an important population to consider in order to fully assess socioeconomic change in commercial fisheries.

As shown below in Table 69, respondents indicated that the price of fuel and other expenses had increased over the study period.

Table 68. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Nearshore finfish–live–fixed gear

	2007^			2010			
Ports	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Percent change
Point Arena	1	*	*	2	*	*	*
Bodega Bay	1	61.3%	29.0%	1	*	*	*
Bolinas	—	—	—	—	—	—	—
San Francisco	—	—	—	2	*	*	n/a
Half Moon Bay	2	*	*	5	41.2%	14.0%	*
All respondents (unique individuals)	26	48.2%	26.2%	10	34.6%	14.4%	-28.2%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 69. Cause of change in percent of gross economic revenue used towards overall operating costs, Nearshore finfish–live–fixed gear

		Number responding					
	Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**	**All ports (unique individuals)**
Reason for decrease	Large purchase or capital investment in 2007	*	—	—	—	—	—
	2007 was a bad fishing year	*	—	—	—	—	—
	Made less revenue in 2007	*	—	—	—	—	—
	Had more costs in 2007	*	—	—	—	—	—
Reason for increase	Large purchase or capital investment in 2010	*	—	—	—	1	1
	2010 was a bad fishing year	*	—	—	—	—	—
	Made less revenue in 2010	*	—	—	—	—	1
	Increased fuel prices in 2010	*	—	—	—	1	2
	More crew in 2010	*	—	—	—	—	—
	Fished out of multiple ports in 2010	*	—	—	—	—	—
	General cost increase in 2010	*	—	—	—	2	1
Number of individuals responding		*	—	—	—	2	3

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Respondents indicated they had 18 years of experience targeting the nearshore finfish–live–fixed gear fishery and they spent an average of 71.9 days per year targeting the fishery. Across the study region this was, on average, the most frequently targeted fishery.

Like most other fisheries besides Dungeness crab–trap, few nearshore finfish–live–fixed gear fishermen reported using a crew and therefore on average 4 percent of their gross economic revenue (GER) was spent on crew (those who did not spend revenue on crew are included in this average). Additionally, respondents averaged 23.6 percent of their GER on fuel in the nearshore finfish–live–fixed gear fishery, although this was slightly higher in Half Moon Bay (34.5 percent).

Table 70. Years of experience and number of days targeting Nearshore finfish–live–fixed gear, 2010

	Years of experience in fishery			Days spent targeting fishery		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
Point Arena	2	*	*	2	*	*
Bodega Bay	1	*	*	1	*	*
Bolinas	—	—	—	—	—	—
San Francisco	2	*	*	1	*	*
Half Moon Bay	5	23.2	10.3	4	90.0	91.3
All respondents (unique individuals)	10	18.0	10.0	8	71.9	70.8

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 71. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Nearshore finfish–live–fixed gear

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Point Arena	2	*	*	2	*	*	2	*	*
Bodega Bay	1	*	*	1	*	*	1	*	*
Bolinas	—	—	—	—	—	—	—	—	—
San Francisco	2	*	*	2	*	*	1	*	*
Half Moon Bay	5	0.2	0.4	5	3.0%	6.7%	4	34.5%	17.9%
All respondents (unique individuals)	10	0.2	0.4	10	4.0%	8.8%	8	23.6%	18.1%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Fishermen were asked if they added or dropped the nearshore finfish–live–fixed gear fishery since 2007 or if they did not fish it in 2010. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. One individual noted that he did not target nearshore finfish–live–fixed gear in 2010 (Table 72), but did not indicate why

Table 72. Nearshore finfish–live–fixed gear, added/dropped since 2007 or not fished in 2010

		Percent responding		
Ports	**Number responding**	**Added**	**Dropped**	**Not fished in 2010**
Point Arena	2	—	—	—
Bodega Bay	1	—	—	—
Bolinas	—	—	—	—
San Francisco	2	*	*	*
Half Moon Bay	5	—	—	—
All respondents (unique individuals)	10	—	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

All respondents were asked to compare his/her success in the nearshore finfish—live—hook & line fishery in 2010 to the previous five years. As shown below in Table 73, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in the fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

In Half Moon Bay, 60 percent of fishermen interviewed in the nearshore finfish–live–fixed gear fishermen said their success in this fishery was either significantly worse or somewhat worse, and 40 percent reported it was doing significantly better or somewhat better (Table 73). Respondents explained that the their fishing was doing worse due to MPAs (Table 74), low fish populations, red tides (Table 75),increases in the price of fuel (Table 76), and boat problems or breakdowns (Table 77).Those who reported that their success in the nearshore finfish–live–fixed gear fishery was doing better mentioned only environmental factors (Table 75), specifically they noted there was a larger quantity of fish, fish were of higher quality, and lastly, there was more bait fish in the ocean in 2010. Although results can only be shown for Half Moon Bay, we can note that no one interviewed in any other port indicated their success in this fishery was better compared to the last five years.

Table 73. Overall success in specific commercial fishery in 2010 compared to previous five years, Nearshore finfish–live–fixed gear

Ports	Number responding	Percent response: Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Point Arena	2	*	*	*	*	*	*
Bodega Bay	1	*	*	*	*	*	*
Bolinas	—	—	—	—	—	—	—
San Francisco	1	*	*	*	*	*	*
Half Moon Bay	5	—	20.0%	20.0%	—	40.0%	20.0%
All respondents (unique individuals)	9	—	11.1%	11.1%	22.2%	33.3%	22.2%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 74. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years Nearshore finfish–live–fixed gear

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	1	1	—	—	1
	Responses	**Count of responses**				
Worse	Regulated season too short	*	*	—	—	—
	MPAs	*	*	—	—	—
	No permit required	*	*	—	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 75. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Nearshore finfish–live–fixed gear

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	—	1	—	—	3
	Responses	**Count of responses**				
Better	Larger quantity of fish	—	—	—	—	2
	Peak of natural cycle	—	—	—	—	—
	Good weather	—	—	—	—	—
	Good ocean conditions	—	—	—	—	—
	Good quality fish	—	—	—	—	1
	More bait/feed in the ocean	—	—	—	—	1
Worse	Low quantity of fish	—	—	—	—	1
	Bad weather	—	—	—	—	—
	Poor ocean conditions	—	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	—	—
	Red tide	—	1	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 76. Economic changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Nearshore finfish–live–fixed gear

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	1	1	—	—	—
	Responses	**Count of responses**				
Better	Good price	*	*	—	—	—
	Good/new market	*	*	—	—	—
Worse	Increase in fuel costs	*	*	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 77. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Nearshore finfish–live–fixed gear

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	—	—	—	—	1
	Responses	**Count of responses**				
Better	Able to fish more frequently	—	—	—	—	—
	Becoming more experienced	—	—	—	—	—
Worse	Others changing fishery	—	—	—	—	—
	Boat problems/breakdowns	—	—	—	—	1
	No access to live bait	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

3.4.4. Salmon–Troll Commercial Fishery

The salmon–troll fishery has a long history along the Pacific coast and in California beginning in the late 1880s in Monterey Bay. Fishing efforts increased during World War II and peaked in the 1970s with nearly 5,000 vessels trolling for salmon statewide. The fishery became limited entry in 1983 and as of 2006 there were less than 500 vessels participating in the fishery (Petterson 2010, CDFG 2008). Although the type of gear used has changed very little since the commercial fishery began, technology such as GPS and sonar, have increased the efficiency of the fishery. A major issue in the California salmon fishery has been land based management practices associated with water rights in the Klamath Basin (CDFG 2008).

In recent years the salmon fishery has been severely restricted and was closed completely for the 2008 and 2009 season. The 2010 season was open for a limited duration, however, many fishermen noted that bad weather prohibited fishing during the first half of the season and that salmon were not present during the second half. Fishermen noted though that 2011 was a better salmon season. It should be noted that due to the nature of salmon fishing in which fishermen follow schools of salmon up and down along the coast—fishermen may land in several ports in California. Thus, the entire amount of revenue North Central Coast fishermen may be gaining from fishing salmon may not be fully reflected in the data presented for the region and conversely, fishermen from regions outside of the North Central Coast may be included in these landings.

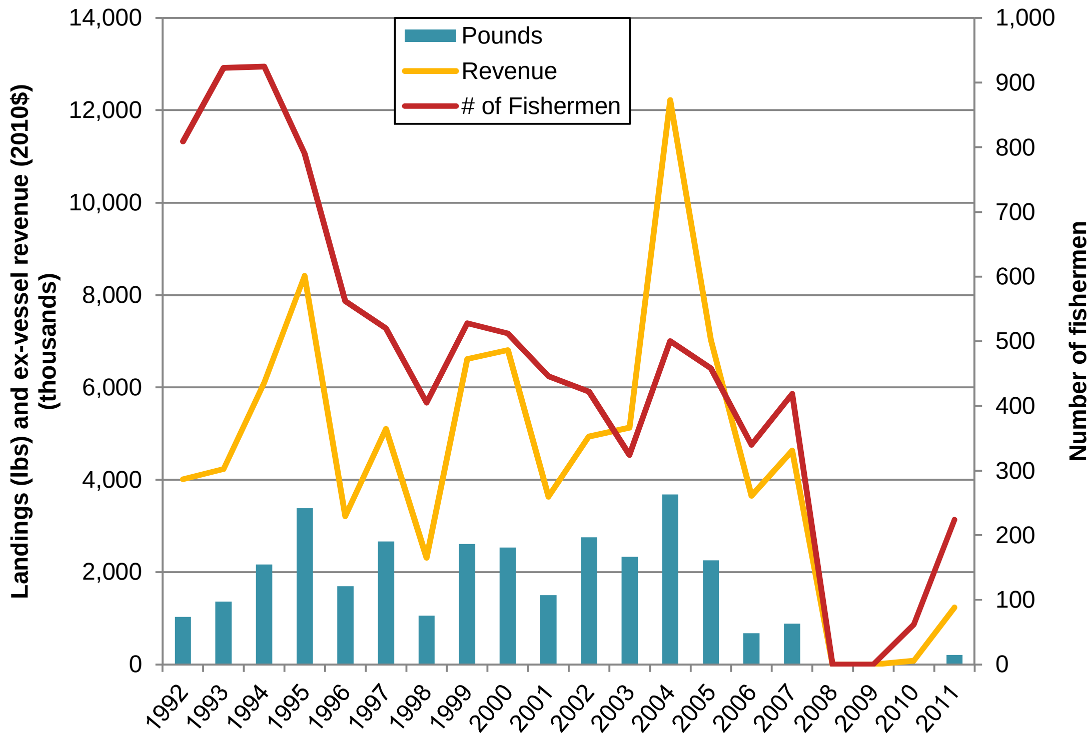
The salmon–troll fishery brought in significant ex-vessel revenue to the North Central Coast region during the majority of the study period. The highest number of pounds landed and maximum ex-vessel revenue occurred in 2004 with 3.7 million pounds landed for $12.2 million. Of course the lowest landings and ex-vessel revenue (at zero each) occurred over the years 2008–2009 when salmon fishing was closed. In the final year of the study period, 2011, salmon landings and ex-vessel revenue were at 209,060 pounds and $1.2 million respectively in the North Central Coast.

At most, in 2005, the salmon–troll fishery constituted 33.2 percent of ex-vessel revenue and 19.7 percent of total landings and ex-vessel revenue in the North Central Coast region, but generally averaged 7.6 percent and 17.1 percent in total regional landings and ex-vessel revenue annually. Before the closure of the fishery in 2008 and 2009, the salmon–troll fishery constituted the greatest percentage of individual fishing income on average, ranging from 27 percent to 53.1 percent annually. While the fishery's significance dropped significantly during the closure, it rose again quickly to 21.8 percent by 2011 (see Figure 11).

Over the study period, on average, a North Central Coast region salmon–troll fisherman landed an annual total 3,237 pounds for $8,896 in ex-vessel revenue, making seven landings a year on average to do so, see Figure 34. In 2011, the averages were at 933 pounds and $5,511 in ex-vessel revenue over five landings per fisherman.

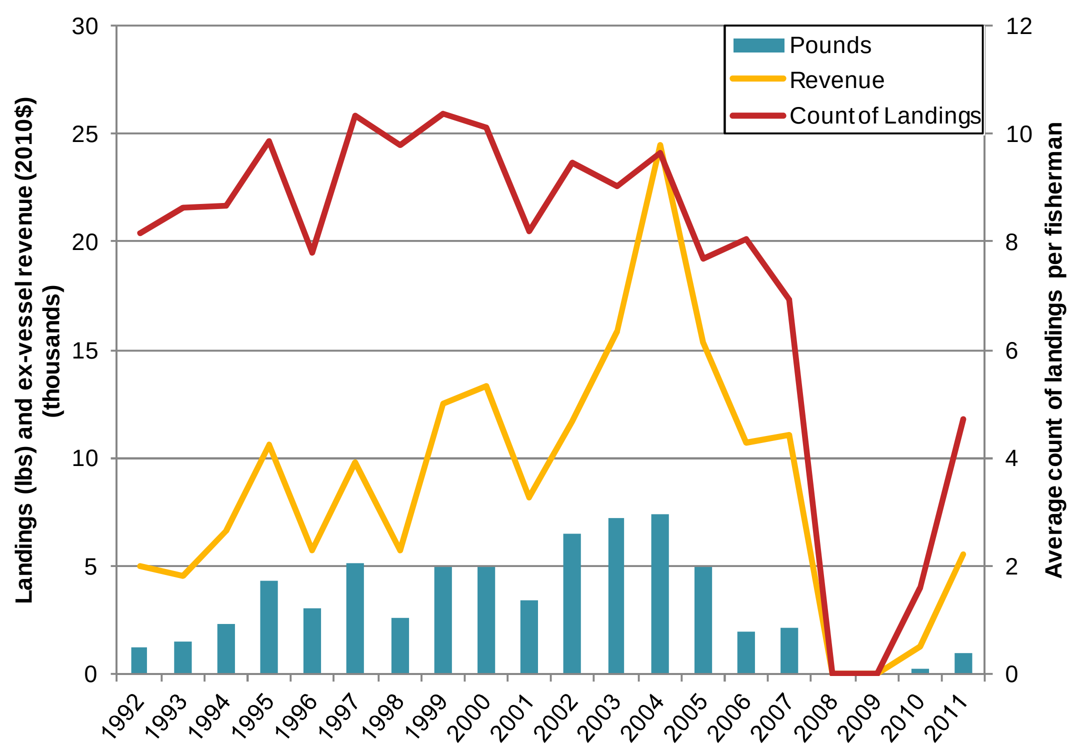
The average ex-vessel price per pound for the salmon–troll fishery was $3.20 over 1992–2001, at its lowest in 2002 at $1.79 per pound and reaching a high of $5.90 in 2011, see Figure 35. Fishermen noted that prices increased as catch decreased, noting that 2005 was the last 'good' fishing year but that prices have generally increased since then.

Figure 33. Salmon–troll commercial landings, ex-vessel revenue, and number of fishermen in the North Central Coast region, 1992–2011



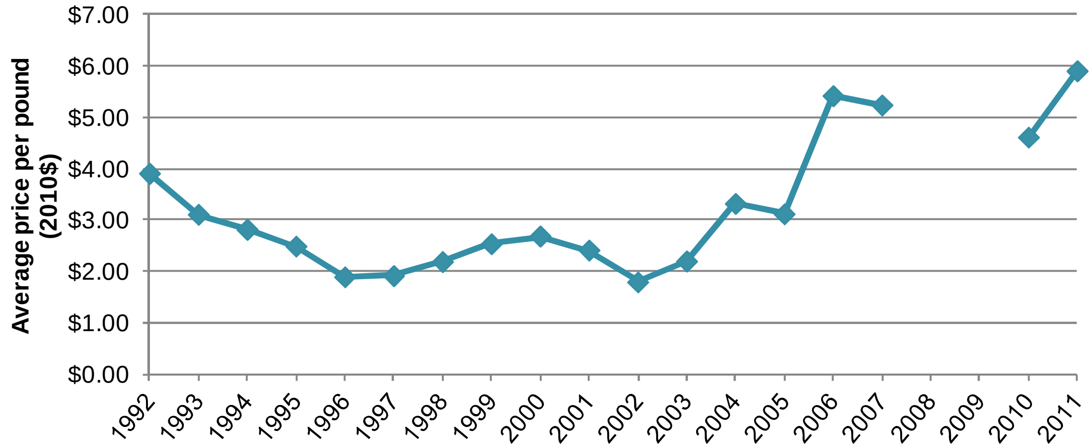
Source: Landings data from CDFW.

Figure 34. Salmon–troll: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, 1992–2011



Source: Landings data from CDFW.

Figure 35. Salmon–troll commercial fishery average ex-vessel price per pound in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

Table 78 displays the average annual percent change in ex-vessel revenue and average ex-vessel revenue per fisherman for the salmon–troll fishery over recent time periods organized into both pre and post-MPA implementation periods. Changes are presented for the North Central Coast region and compared with those observed in the fishery at the state level. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods. The North Central Coast regional salmon–troll fishery closely followed trends observed by the state fishery for most periods, see the similar average annual percentage increases and decreases for the regional and state levels for the pre-MPA periods of 2000–2005 and 2005–2010. The percentages in the post-MPA period 2010–2011 may be misleading, as the fishery had been closed over 2008–2009. Total overall salmon–troll ex-vessel revenue in the North Central Coast region was at its lowest (above zero) at $79,123 in 2010, increasing 1460.2% to its second lowest value over the study period (above zero) at $1.2 million in 2011. Furthermore, it should be noted that this large percentage increase observed from 2010 to 2011 skews the average annual percentage changes reported from 2000–2011, and that most years did not come close to increasing 158.7 percent over that time period (with the exception of 2004, please review Figure 33 for more context).

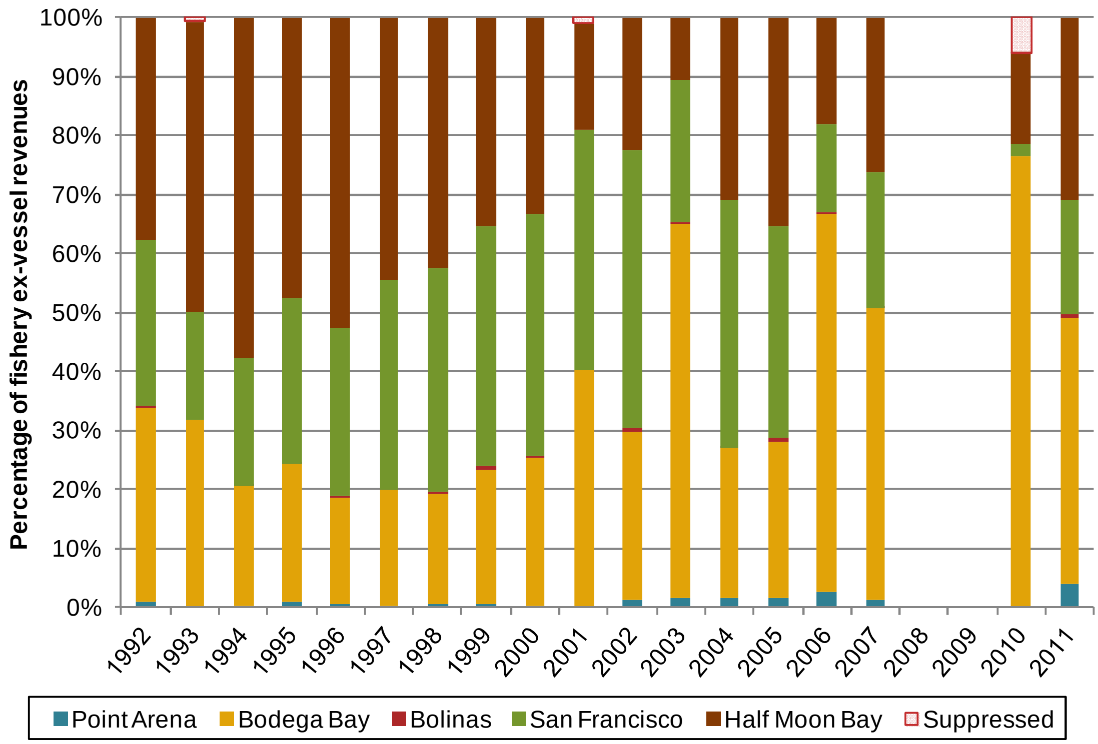
Figure 36 displays the commercial ex-vessel revenue for the salmon–troll by North Central Coast region ports. Salmon–troll ex-vessel revenue occurred in mainly three regional ports over the study period: Bodega Bay (an annual average of 35.1 percent), Half Moon Bay (33.8 percent), and San Francisco (29.4 percent). Over this time, Bodega Bay slowly came to land the majority of salmon–troll among the ports, with 45.1 percent of total regional ex-vessel revenue by 2011. Fishermen noted due to the nature of salmon fishing in which fishermen follow schools of salmon up and down along the coast that the location of salmon landings is indicative of where salmon were located in a particular year. They noted that in recent years salmon have been more concentrated in the northern part of the study region, near Bodega Bay and Point Arena. They further speculated that salmon were feeding on populations of pink shrimp found in this northern region.

Table 78. Salmon–troll: Average annual percent change in commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

		Average annual percent change			
Level	**Ex-vessel revenue**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
North Central Coast region	Total	17.8%	-40.4%	1460.2%	158.7%
	Average per fisherman	11.5%	-13.5%	331.8%	45.3%
State	Total	14.5%	-28.9%	303.3%	26.0%
	Average per fisherman	16.3%	-13.3%	76.9%	16.5%

Source: Landings data from CDFW

Figure 36. Salmon–troll commercial ex-vessel revenue by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW.

Due to the limited season in 2010 we did not specifically target fishermen with salmon landings, but rather included questions regarding the salmon fishery if a respondent we were already interviewing targeted this fishery in 2010. As a result, most of the salmon fishermen we spoke to were full time fishermen who considered salmon to be part of their fishing portfolio, but relied very little on it in 2010. With such a limited sample in 2010 the percent change of certain summary statistics from 2007 to 2010 are likely not be representative.

The average salmon–troll fisherman was 55.2 years old at the time of interview and had 29.6 years of experience as a commercial fisherman (Table 79). It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. Both of these averages are slightly higher than the averages for all respondents across the region.

Additionally, on average those interviewed reported that 88.9 of their total personal income came from overall commercial fishing in 2010, which was an increase of 18.2 percent from 2007(Table 80). Again, this question pertains to the percent of a fisherman's total personal income from commercial fishing as a whole, and not just from salmon–troll fishing. Averages from 2007 were taken from the 2008 study conducted by Ecotrust.

Four out of five respondents indicated that at least a portion of their non-fishing related income came from fishing related research, such as the West Coast Genetic Stock Identification (GSI) project (Table 81).

Table 79. Average age and years of experience commercial fishing, 2010, Salmon–troll

	Age			Years of experience		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Point Arena	2	*	*	2	*	*
Bodega Bay	6	61.2	8.4	6	32.7	13.0
Bolinas	—	—	—	—	—	—
San Francisco	3	44.0	7.2	3	14.0	10.4
Half Moon Bay	2	*	*	2	*	*
All respondents (unique individuals)	14	55.2	9.9	14	29.6	12.6

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 80. Percent change in income from overall commercial fishing from 2007 - 2010, Salmon–troll

Ports	2007^ Number responding	2007^ Average	2007^ Standard deviation	2010 Number responding	2010 Average	2010 Standard deviation	Percent Change
Point Arena	10	80.5%	33.0%	2	*	*	*
Bodega Bay	63	69.1%	36.8%	6	88.3%	20.4%	27.8%
Bolinas	6	78.3%	34.3%	—	—	—	n/a
San Francisco	30	80.8%	33.5%	3	90.0%	17.3%	
Half Moon Bay	2	78.1%	32.4%	2	*	*	*
All respondents (unique individuals)	138	75.2%	34.2%	14	88.9%	18.0%	18.2%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 81. Other sources of income other than commercial fishing in 2010, Salmon–troll

Response	Number responding: Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	All respondents (unique individuals)
Construction/Contractor	*	—	—	—	*	—
Farming/Ranching	*	—	—	—	*	—
Fisheries research	*	1	—	1	*	4
Harbor/City job	*	—	—	—	*	—
Office work	*	—	—	—	*	—
Other fishing related work	*	—	—	—	*	—
Other specialized work	*	1	—	—	*	1
Property management	*	—	—	—	*	—
Retirement/Social Security/Investments	*	2	—	—	*	2
Salmon disaster relief	*	—	—	—	*	—
Skilled labor	*	—	—	—	*	—
Number of individuals responding	*	2	—	1	*	5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Salmon–troll fishermen reported that 47.7 percent of their gross economic revenue (GER) went back into their operating costs in 2010, which was slightly lower that the average across all fisheries in the study region (51.9 percent). This number was higher in San Francisco (58.3 percent) than in Bodega Bay (45.7 percent). More information can be found in Table 82. Again these numbers do not pertain to the percent of GER that went into salmon–troll fishing related expenses, but rather, are the percent overall commercial fishing GER that salmon–troll fishermen spent on commercial fishing operating costs as a whole, which includes all other fisheries they may participate in. The most commonly reported reason for increased percent of GER spent on operating costs was the increase in fuel prices, followed by a general increase other operating expenses prices.

Table 82. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Salmon–troll

	2007^			2010			
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
Point Arena	10	46.1%	28.7%	2	*	*	*
Bodega Bay	62	47.7%	22.7%	6	45.7%	3.9%	-4.2%
Bolinas	6	38.3%	22.5%	—	—	—	n/a
San Francisco	29	43.9%	17.0%	3	58.3%	17.6%	33.0%
Half Moon Bay	14	52.1%	25.3%	2	*	*	*
All respondents (unique individuals)	135	45.6%	21.3%	14	47.7%	13.6%	4.6%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 83. Cause of change in percent of gross economic revenue used towards overall operating costs, Salmon–troll

	Response	Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	All ports (unique individuals)
		Number responding					
Reason for decrease	Large purchase or capital investment in 2007	*	—	—	—	*	—
	2007 was a bad fishing year	*	1	—	—	*	2
	Made less revenue in 2007	*	—	—	—	*	1
	Had more costs in 2007	*	—	—	—	*	—
Reason for increase	Large purchase or capital investment in 2010	*	—	—	—	*	1
	2010 was a bad fishing year	*	—	—	—	*	—
	Made less revenue in 2010	*	—	—	—	*	—
	Increased fuel prices in 2010	*	2	—	1	*	4
	More crew in 2010	*	—	—	1	*	1
	Fished out of multiple ports in 2010	*	—	—	—	*	1
	General cost increase in 2010	*	3	—	2	*	3
Number of individuals responding		*	3	—	2	*	8

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Fishermen interviewed in the salmon—troll fishery on average had the most years of experience in a specific fishery compared to other fisheries (29.6 years) and the average years of experience in the salmon—troll fishery in Bodega Bay was more than twice that in San Francisco (Table 84). On average, fishermen only spent 3.7 days targeting salmon–troll in 2010, which was far less than the average for all other fisheries. During interviews many respondents commented that the season was severely shortened and that only a few days were open for fishing. However, during those few days fishermen indicated that the weather was bad and that there were few salmon around.

Salmon–troll fishermen reported a higher proportion of their gross economic revenue went towards fuel than any of the other target fishery (24.7 percent) (Table 85). In general, salmon–troll tends to be fairly fuel intensive fishery because salmon can be found over a large range of area and additionally, some fishermen mentioned that because they caught so few salmon in 2010, they were unable to make up for fuel costs with revenue. This is likely the case in San Francisco, where fuel made up nearly half (48.3 percent) of the average respondents operating costs for this specific fishery.

Table 84. Years of experience and number of days targeting Salmon–troll, 2010

	Years of experience in fishery			Days spent targeting fishery		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
Point Arena	2	*	*	2	*	*
Bodega Bay	6	32.3	13.2	6	4.5	0.8
Bolinas	—	—	—	—	—	—
San Francisco	3	14.3	10.1	3	3.0	1.0
Half Moon Bay	2	*	*	1	*	*
All respondents (unique individuals)	14	29.6	12.7	13	3.7	9.6

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 85. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Salmon–troll

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Ports	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
Point Arena	2	*	*	2	*	*	2	*	*
Bodega Bay	5	0.6	0.5	6	9.2%	10.2%	6	10.2%	1.6%
Bolinas	—	—	—	—	—	—	—	—	—
San Francisco	3	0.3	0.6	3	4.0%	6.9%	3	48.3%	34.0%
Half Moon Bay	2	*	*	2	*	*	2	*	*
All respondents (unique individuals)	13	0.5	0.5	14	8.1%	8.7%	14	25.7%	29.9%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Fishermen were asked if they added or dropped the salmon-troll fishery since 2007 or if they did not fish the fishery in 2010. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. Two fishermen, both from San Francisco, reported they did not target salmon–troll at all in 2010 (Table 86). While many fishermen indicated they did not make any money targeting salmon in 2010, they did indicate they at least tried to salmon fish at least once and so are not included in the table below. One of the individuals who chose not to fish in 2010 indicated it was due to the poor season and the other reported it was because he did not have enough time due to other work (Table 87).

Table 86. Salmon–troll, added/dropped since 2007 or not fished in 2010

		Percent responding		
Port	**Number responding**	**Added**	**Dropped**	**Not fished in 2010**
Point Arena	2	—	—	—
Bodega Bay	6	—	—	—
Bolinas	—	—	—	—
San Francisco	3	—	—	2
Half Moon Bay	2	—	—	—
All respondents (unique individuals)	14	—	—	2

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 87. Reason for adding/dropping a fishery since 2007 or not fishing in 2010, Salmon–troll

	Number responding				
Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**
New to commercial fishing	—	—	—	—	—
Purchased boat with permit	—	—	—	—	—
Not enough time due to other work	—	—	—	1	—
Increased difficulty due to MPAs	—	—	—	—	—
Bad season	—	—	—	1	—
Number responding	—	—	—	2	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents were asked to compare his/her success in the salmon—troll fishery in 2010 to the previous five years. As shown in Table 88 below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked as an open ended question and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

All respondents in Bodega Bay and San Francisco reported that their success in this fishery was doing significantly worse. Many fishermen mentioned that the question was difficult to answer because the fishery was closed completely in 2008 and 2009. However, most fishermen indicated that the season in 2010 was poor and that pre-closure years were much more successful as can be seen from the landings data.

All responses regarding factors fishermen felt impacted the overall success in the fishery fell into either the regulatory (Table 89) or environmental (Table 90) categories. The primary regulatory factor that respondents mentioned was the limited number of days in the season. Respondents also indicated that when they were able to fish, there were few salmon to be caught and there was poor weather.

Table 88. Overall success in specific commercial fishery in 2010 compared to previous five years, Salmon–troll

		Percent response					
Ports	Number responding	Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Point Arena	2	*	*	*	*	*	*
Bodega Bay	6	—	—	—	—	—	100.0%
Bolinas	—	—	—	—	—	—	—
San Francisco	3	—	—	—	—	—	100.0%
Half Moon Bay	2	*	*	*	*	*	*
All respondents (unique individuals)	14	—	—	—	7.1%	7.1%	85.7%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 89. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Salmon–troll

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	2	6	—	2	1
	Responses	**Count of responses**				
Worse	Regulated season too short	*	6	—	2	*
	MPAs	*	1	—	—	*
	No permit required	*	—	—	—	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 90. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Salmon–troll

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	2	4	—	2	1
	Responses	**Count of responses**				
Better	Larger quantity of fish	—	—	—	—	—
	Peak of natural cycle	—	—	—	—	—
	Good weather	—	—	—	—	—
	Good ocean conditions	—	—	—	—	—
	Good quality fish	—	—	—	—	—
	More bait/feed in the ocean	—	—	—	—	—
Worse	Low quantity of fish	—	3	—	2	—
	Bad weather	2	1	—	1	—
	Poor ocean conditions	—	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	—	1
	Red tide	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

3.4.5. Urchin–Dive Commercial Fishery

The California fishery for red sea urchin *(Strongylocentritus franciscanus)* developed in the early 1970s in southern California. The fishery was developed as part of a program by the National Marine Fisheries Service to target underutilized fisheries as well as to protect kelp from urchin grazing. The fishery expanded into the north coast in the late 1970s and early 1980s from Half Moon Bay up to Crescent City. Landings in this region peaked in 1988 at 30.5 million pounds, but then began to quickly decline the following year (CDFG, 2004). During the early years of the urchin–dive fishery it was largely unregulated; however, in 1987 the Director's Sea Urchin Advisory Committee (later the Sea Urchin Fishery Advisory Committee) was established. In 1987 the committee created a moratorium on new permits, in 1988 they created a minimum size limit, in 1990 they restricted fishing to certain days within the calendar year, and also in 1900 they introduced a method to reduce effort by requiring new permit holders to acquire 10 permits in order to enter the fishery (CDFG, 2004). Currently, Point Arena and Bodega Bay are the only ports in the North Central Coast still supporting an urchin–dive fishery, although during interviews we learned that due to the recent MPA closures divers have mostly moved out of Bodega Bay. Those who have a small enough boat to be launched in Point Arena have moved there and others have found themselves rotating ports throughout the state.

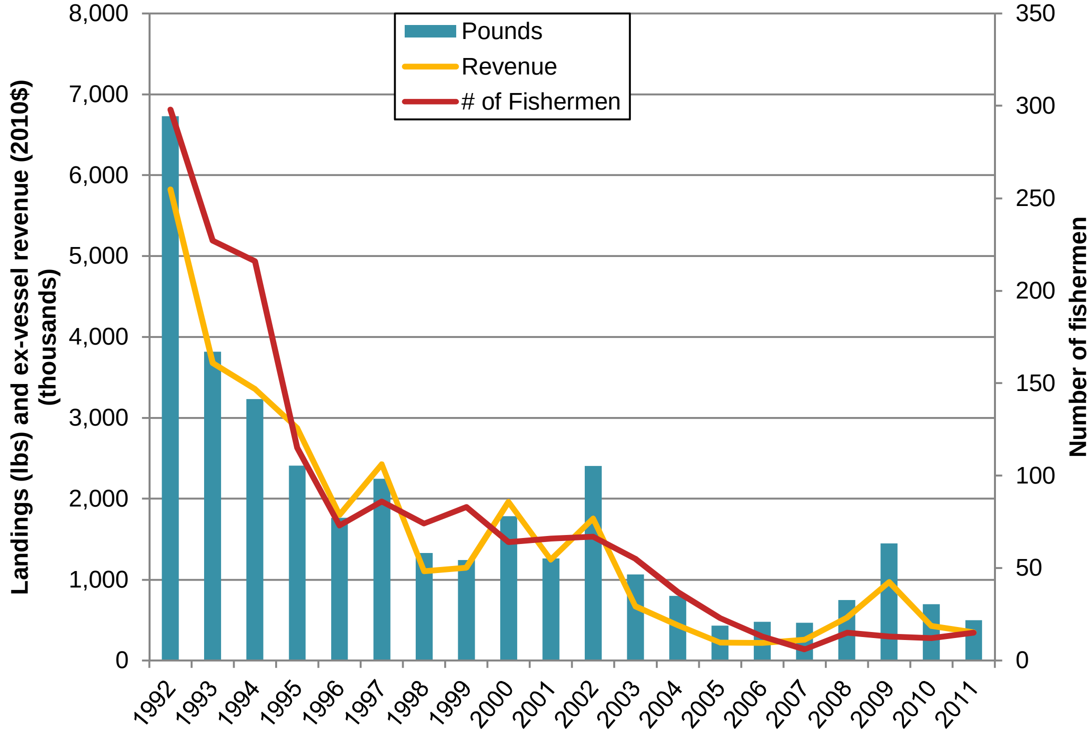
The urchin–dive fishery has consistently and significantly decreased over the study period, with highs of 6.7 million pounds landed, $5.8 million in ex-vessel revenue, and 298 fishermen in 1992, all decreasing nearly 100 percent to 498,908 pounds landed, $347,837 in ex-vessel revenue, and only 15 fishermen in 2011, see Figure 37. Fishermen noted that in the mid-2000s there was large kelp die off which severely limited the volume of urchin landings. Additionally, fishermen noted that 2009 produced a large quantity of high quality urchin. Lastly, fishermen mentioned that in 2010 and 2011 the MPAs limited them from targeting many of their prime urchin diving areas.

In relation to total regional landings and ex-vessel revenue in the North Central Coast, the urchin–dive fishery has decreased in significance from 14.4 percent in 1992 to 2.0 percent in 2011 of total regional landings, and from 15.9 percent in 1992 to 0.7 percent by 2011 in total regional ex-vessel revenue. Similarly, the significance of this fishery to individual fishing income has declined, from 12.2 percent in 1992 to 2.3 percent in 2011.

Despite these overall declines, the average urchin–dive fisherman experienced some increases in his annual pounds landed and ex-vessel revenue, from 22,583 pounds landed for $19,541 in 1992 to a high of 111,457 pounds landed for $74,726 in ex-vessel revenue in 2009. The average count of landings per fisherman per year follows landings trends rather closely, though appears to have decreased somewhat over time meaning that fishermen are landing slightly more pounds per landing (22 percent more) in 2011 than in 1992 on average.

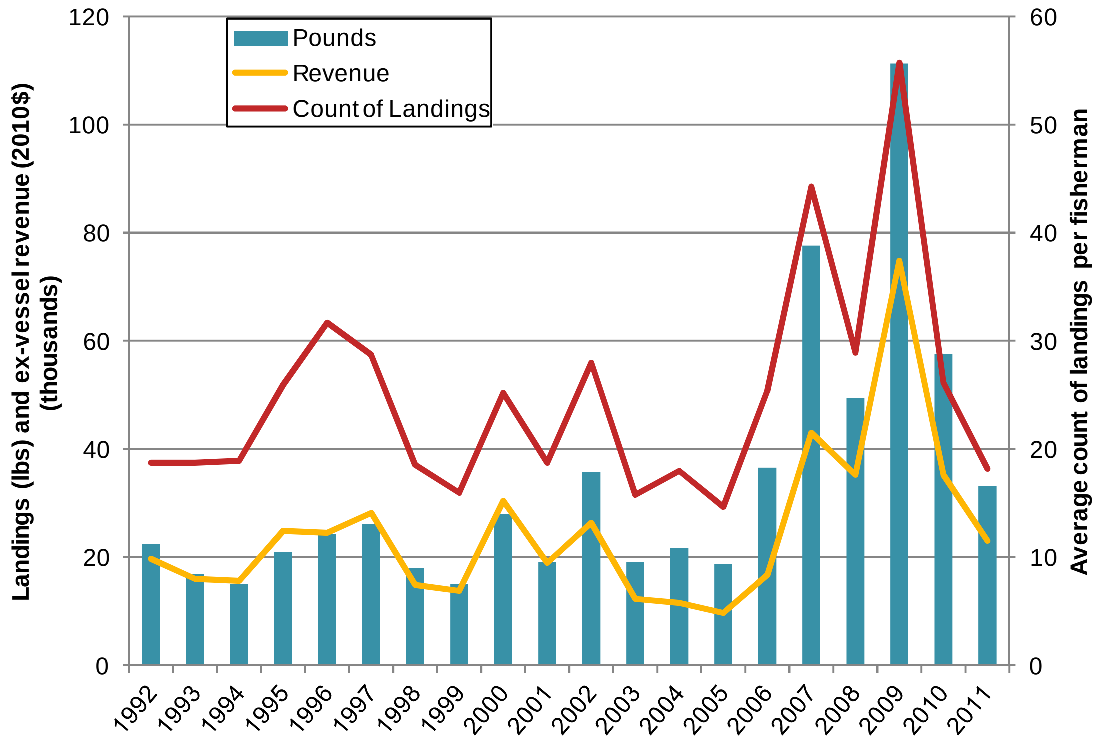
The average ex-vessel price per pound for the urchin-dive fishery also decreased overall over the study period, see Figure 39. The highest average price per pound for this fishery was $1.19 in 1995, and the lowest occurred in 2006 at $0.46 per pound, and averaged $0.81 per pound over the entire study period. The urchin–dive fisher was the lowest priced fishery among the six fisheries of interest examined in this report for the North Central Coast region. Fishermen noted that the price they receive is highly dependent on the quality of the urchin.

Figure 37. Urchin–dive commercial landings, ex-vessel revenue, and number of fishermen in the North Central Coast region, 1992–2011



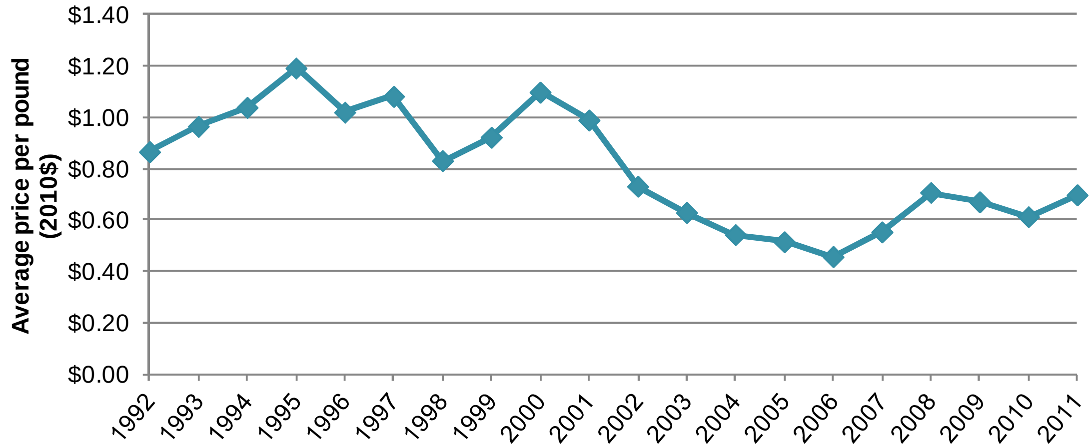
Source: Landings data from CDFW.

Figure 38. Urchin–dive: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, 1992–2011



Source: Landings data from CDFW.

Figure 39. Urchin–dive commercial fishery average ex-vessel price per pound in the North Central Coast region, 1992–2011



Source: Landings data from CDFW.

Table 91 displays the average annual percent change in ex-vessel revenue and average ex-vessel revenue per fisherman for the urchin–dive fishery over recent time periods organized into both pre and post-MPA implementation periods. Changes are presented for the North Central Coast region and compared with those observed in the fishery at the state level. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods. Regional and state averaged annual ex-vessel revenue trends, both overall and on an average per fisherman basis, differed for the urchin–dive fishery as the majority of urchin–dive fishing in the state of California occurs outside of the North Central Coast region. For example, in the pre-MPA period of 2005–2010 overall ex-vessel revenue increased by 29.9 percent on average annually in the North Central Coast region and in the state increased by 2.6 percent on average annually; this was even more pronounced at the average per fisherman level (at 54.5 percent and 5 percent respectively). In the post-MPA period, regional annual average ex-vessel revenue overall and per fisherman dropped (18 percent and 34.4 percent respectively) than did average annual state ex-vessel revenue overall (8.3 percent increase actually) and average per fisherman (1.7 percent decrease).

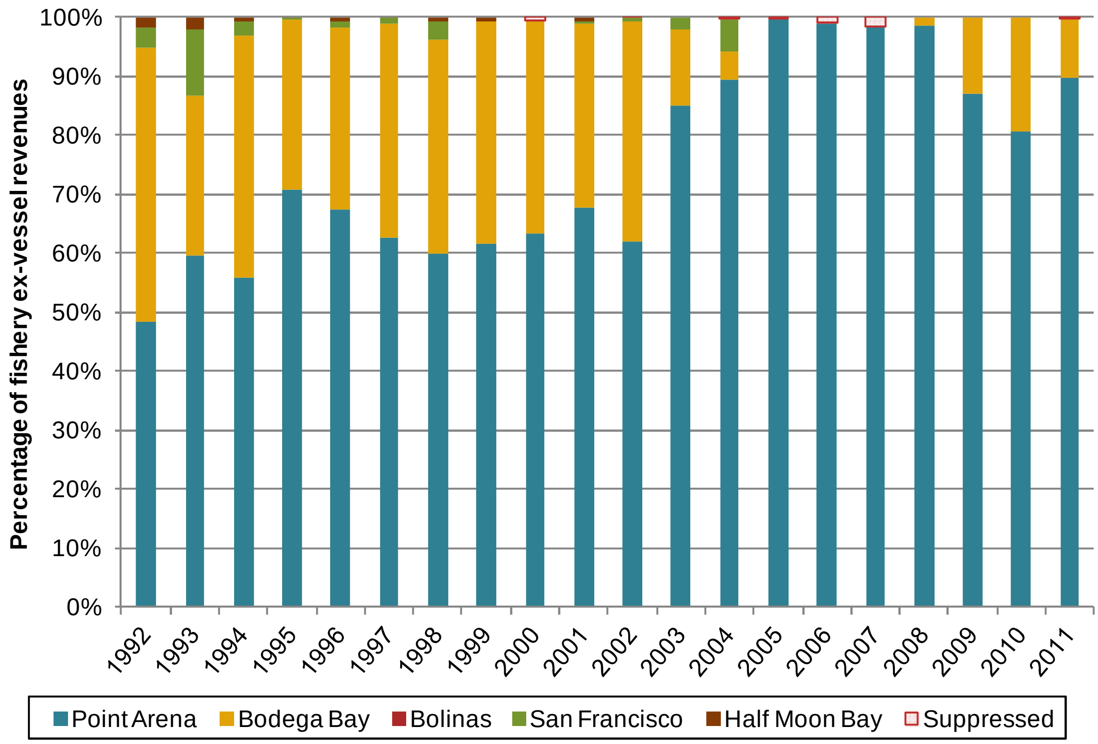
Figure 36 displays the commercial ex-vessel revenue for the urchin–dive by North Central Coast region ports. Point Arena dominates the urchin–dive fishery in the North Central Coast region, constituting 48.4 percent of total regional ex-vessel revenue in 1992, 89.7 percent in 2011, and a maximum of 99.7 percent in 2005. Despite San Francisco ex-vessel revenue of 11 percent in 1993, San Francisco, Half Moon Bay, and Bolinas had little urchin–dive ex-vessel revenue to speak of. Bodega Bay, on the other hand, supplied most of remaining regional urchin–dive ex-vessel revenue in the early half of the study period, dropping off in the later half, and represented only 10.2 percent of regional ex-vessel revenue in 2011.

Table 91. Urchin–dive: Average annual percent change in commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

Level	Ex-vessel revenue	Pre-MPA (2000-2005)	Pre-MPA (2005-2010)	Post-MPA (2010-2011)	2000-2011
		Average annual percent change			
North Central Coast region	Total	-28.3%	29.9%	-18.0%	-0.9%
	Average per fisherman	-15.0%	54.5%	-34.4%	14.8%
State	Total	-18.0%	2.6%	8.3%	-6.2%
	Average per fisherman	-7.1%	5.0%	-1.7%	-1.1%

Source: Landings data from CDFW

Figure 40. Urchin–dive commercial ex-vessel revenue by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW

In the North Central Coast fishermen dive for urchin primarily in the northern part of the region, in Point Arena and Bodega Bay. The average urchin diver that we interviewed in 2010 was 51.7 years old at the time of interview and had 27.7 years of experience as a commercial fisherman (Table 92). It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery.

Table 92. Average age and years of experience commercial fishing, 2010, Urchin–dive

	Age			Years of experience		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Point Arena	4	52.0	8.6	4	27.8	5.1
Bodega Bay	1	*	*	1	*	*
Bolinas	—	—	—	—	—	—
San Francisco	—	—	—	—	—	—
Half Moon Bay	—	—	—	—	—	—
All respondents (unique individuals)	6	51.7	6.8	6	27.7	4.2

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Fishermen who participated in the urchin–dive fishery reported that, on average, 97.5 percent of their total personal income came from commercial fishing in 2010. This was the highest average across all of the target fisheries and a 49.3 percent increase from 2007 (which was also the greatest increase over that time period across all target fisheries (Table 93). Again, these numbers do not pertain specifically to urchin diving, but rather to commercial fishing as whole.

Averages for 2007 were taken directly from the 2008 study conducted by Ecotrust and it should be noted that the large increase in the percent of total personal income from commercial fishing seen across 2007 and 2010 may be due to the fact that we interviewed many more divers in the North Coast region in our 2008 study than in our 2011 study. The North Coast region experienced a large kelp die off in the mid 2000's which impacted the fishery primarily in the North Coast, although somewhat in the North Central Coast as well. Due to the kelp die off many divers reported a very low percentage of their income came from commercial fishing. However, if we consider only those interviewed in both years these individuals reported an average of 91.6 percent of their income came from fishing in 2007 which would result in a 6.4 percent increase between 2007 and 2010. This is likely a more reasonable representation of the change in income from commercial fishing experienced by North Central Coast homeport based fishermen.

Only one respondent who participated in the urchin–dive fishery reported an additional source of income other than commercial fishing. As shown in Table 94, this was construction work.

Table 93. Percent change in income from overall commercial fishing from 2007 - 2010, Urchin–dive

	2007^			2010			
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
Point Arena	7	77.9%	30.0%	4	96.3%	7.5%	23.6%
Bodega Bay	6	65.8%	30.4%	1	*	*	*
Bolinas	—	—	—	—	—	—	—
San Francisco	1	—	—	—	—	—	—
Half Moon Bay	—	—	—	—	—	—	—
All respondents (unique individuals)	21	65.3%	36.6%	6	97.5%	6.1%	49.3%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

All respondents includes individuals from north and south of the study region

Table 94. Other sources of income other than commercial fishing in 2010, Urchin–dive

	Number responding					
Response	**Point Arena**	**Bodega Bay**	**Bolinas**	**San Francisco**	**Half Moon Bay**	**All respondents (unique individuals)**
Construction/Contractor	1	—	—	—	—	1
Farming/Ranching	—	—	—	—	—	—
Fisheries research	—	—	—	—	—	—
Harbor/City job	—	—	—	—	—	—
Office work	—	—	—	—	—	—
Other fishing related work	—	—	—	—	—	—
Other specialized work	—	—	—	—	—	—
Property management	—	—	—	—	—	—
Retirement/Social Security/Investments	—	—	—	—	—	—
Salmon disaster relief	—	—	—	—	—	—
Skilled labor	—	—	—	—	—	—
Number of individuals responding	1	—	—	—	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

The average urchin diver reported that he spent 43.2 percent of his gross economic revenue (GER) on commercial fishing operating costs in 2010 (Table 95). This was an 8.9 percent increase from 2007, which is just slightly less than the average increase across all target fisheries in the region (9.5 percent for the entire region). It should be noted that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. The most frequently cited reason for this increase was the general increase in the price of fuel (Table 96). Respondents averaged 26.5 years of experience in the urchin–dive fishery and said that in 2010 they spent an average of 57 days targeting urchins (Table 97). Few urchin divers reported using a crew (less than 1 per fisherman) and of those who did report a crew, no one indicated what percent of their fishery specific gross economic revenue was paid to crew. Across all ports, the average urchin diver spent 14 percent of their GER on fuel and this was slightly lower in Point Arena (Table 98). This is the second lowest percent of fishery specific GER used for fuel of all five target fisheries, after Dungeness crab–trap. No one in the urchin–dive fishery reported adding or dropping the fishery since 2007 or not fishing it in 2010 and so those tables are omitted.

Table 95. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Urchin–dive

	2007^			2010			
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
Point Arena	7	37.9%	22.4%	4	40.3%	23.5%	6.3%
Bodega Bay	6	46.3%	5.9%	1	*	*	*
Bolinas	—	—	—	—	—	—	—
San Francisco	1	*	*	—	—	—	n/a
Half Moon Bay	1	—	—	—	—	—	—
All respondents (unique individuals)	21	39.7%	15.7%	6	43.2%	17.9%	8.9%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

All respondents includes individuals from north and south of the study region

Table 96. Cause of change in percent of gross economic revenue used towards overall operating costs, Urchin–dive

	Response	Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay	All ports (unique individuals)
		Number responding					
Reason for decrease	Large purchase or capital investment in 2007	—	—	—	—	—	—
	2007 was a bad fishing year	—	—	—	—	—	—
	Made less revenue in 2007	—	—	—	—	—	1
	Had more costs in 2007	—	—	—	—	—	1
Reason for increase	Large purchase or capital investment in 2010	—	—	—	—	—	—
	2010 was a bad fishing year	—	—	—	—	—	—
	Made less revenue in 2010	1	—	—	—	—	1
	Increased fuel prices in 2010	2	—	—	—	—	3
	More crew in 2010	—	—	—	—	—	—
	Fished out of multiple ports in 2010	—	—	—	—	—	—
	General cost increase in 2010	1	—	—	—	—	1
Number of individuals responding		2	—	—	—	—	4

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Table 97. Years of experience and number of days targeting Urchin–dive, 2010

	Years of experience in fishery			Days spent targeting fishery		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
Point Arena	4	26.0	4.2	3	68.3	28.4
Bodega Bay	1	*	*	1	*	*
Bolinas	—	—	—	—	—	—
San Francisco	—	—	—	—	—	—
Half Moon Bay	—	—	—	—	—	—
All respondents (unique individuals)	6	26.5	3.7	5	57.0	27.5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Table 98. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Urchin–dive

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Ports	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Point Arena	4	0.3	0.5	3	—	—	2	12.5%	3.5%
Bodega Bay	1	*	*	1	*	*	1	*	*
Bolinas	—	—	—	—	—	—	—	—	—
San Francisco	—	—	—	—	—	—	—	—	—
Half Moon Bay	—	—	—	—	—	—	—	—	—
All respondents (unique individuals)	6	0.2	0.4	5	—	—	4	14.0%	5.2%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

Fishermen were asked for the urchin—dive fishery to compare his/her success in this fishery in 2010 to that of the last five years. As shown in the table below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. All urchin divers from Point Arena reported that the fishery was worse than it had been in previous years (Table 99).

Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other. Urchin divers said that MPAs were the main cause of a decline in their success in the fishery over this time period. In fact, this was the only factor they mentioned in response to this question (Table 100). Several urchin divers noted that because of the recently established MPAs they have been forced to switch homeports or have had to fish from multiple ports. For one fisherman in particular this meant having to travel away from his family for significant portions of the year to fish for urchins in southern California. Quality of life impacts, like this, may not be adequately accounted for in the economic or spatial analyses that are the primary objective of this study but are important to consider in order to understand the full range of impacts MPAs have had on fishermen and fishing communities.

Additionally, urchin divers mentioned that many of the areas remaining open to commercial urchin diving produce lower quality urchin than areas now closed to MPAs, often affecting the price they receive for their catch. Lastly, fishermen also noted that they are cautious to not deplete the resources in these open areas and would prefer to rotate them with the closed areas, which may become overgrown with urchins if not harvested.

Table 99. Overall success in specific commercial fishery in 2010 compared to previous five years, Urchin–dive

Ports	Number responding	Percent response: Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Point Arena	4	—	—	—	—	25.0%	75.0%
Bodega Bay	1	*	*	*	*	*	*
Bolinas	—	—	—	—	—	—	—
San Francisco	—	—	—	—	—	—	—
Half Moon Bay	—	—	—	—	—	—	—
All respondents (unique individuals)	6	—	—	—	16.7%	16.7%	66.7%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 100. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Urchin–dive

		Point Arena	Bodega Bay	Bolinas	San Francisco	Half Moon Bay
	Number responding	4	1	—	—	—
	Responses	**Count of responses**				
Worse	Regulated season too short	—	*	—	—	—
	MPAs	4	*	—	—	—
	No permit required	—	*	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All respondents includes individuals from north and south of the study region

4. NORTH CENTRAL COAST PORT PROFILES

The following port profiles detail commercial fishery trends on a port level for the five main ports in the North Central Coast region, including the landings (in pounds) and ex-vessel revenue over time for each fishery of interest (in 2010$). Furthermore, each port profile summarizes the survey data collected during interviews with commercial fishermen. We summarized data for the following ports in the North Central Coast Region, listed north to south:

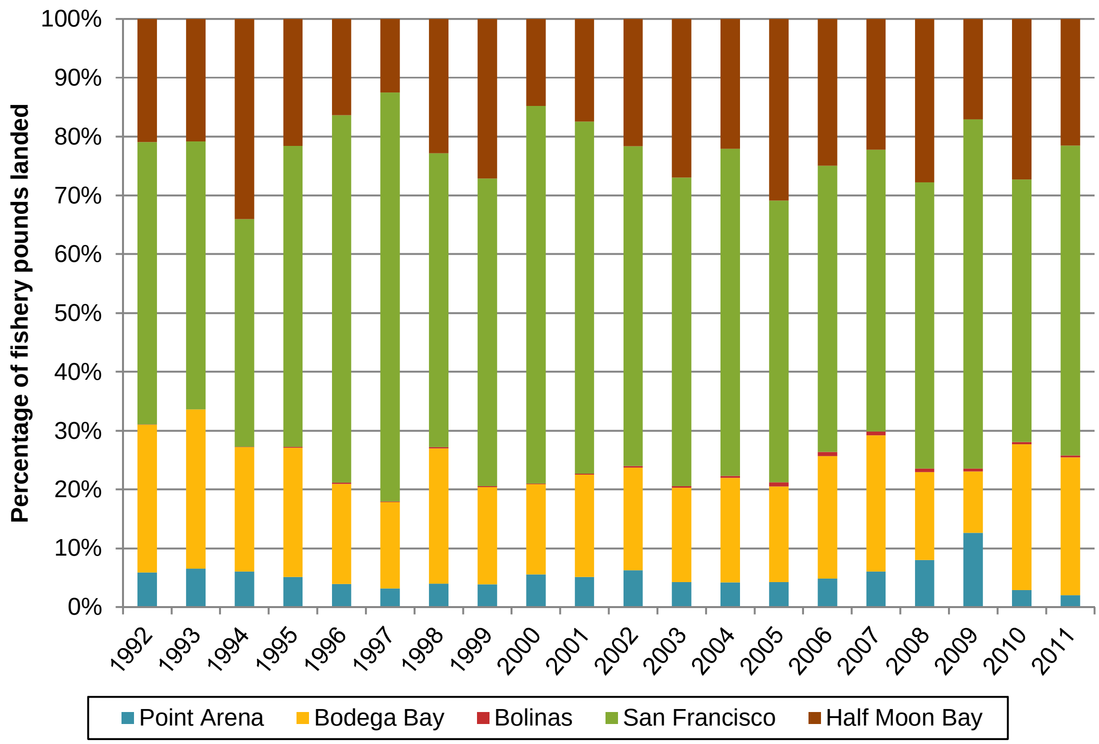
1. Point Arena
2. Bodega Bay
3. Bolinas
4. San Francisco
5. Half Moon Bay

Commercial landings and ex-vessel revenue for all fisheries were relatively dispersed among the North Central Coast region ports, see Figure 41 and Figure 42. San Francisco contributed a higher percentage of total regional landings and ex-vessel revenue than any other regional port for every year in the study period, except in 2007. In 2007, Bodega Bay contributed just 0.3 percent more in ex-vessel revenue to the North Central Coast region than San Francisco. San Francisco never contributed less than 35.2 percent (in 2007) and at its highest contributed 66.7 percent of total regional ex-vessel revenue (in 1996) over the study period. In summary, landings in San Francisco constituted an approximate average of 47.8 percent to total regional ex-vessel revenue annually. This port was followed by Bodega Bay at 23.9 percent on average annually, and Half Moon Bay at 23.3 percent on average annually. Bolinas was the smallest port, in terms of contribution to regional ex-vessel revenue totals, averaging 0.7 percent annually, while Point Arena contributed 4.4 percent on average annually.

Though landings have varied over the study period, most ports experienced an overall decline in total landings from 1992–2011, with the exception of Bolinas which experienced overall growth since 1992. Despite the declines observed in pounds landed, the ports of Bodega Bay, San Francisco, and Half Moon Bay all experienced jumps in ex-vessel revenue in the last two years of the study period, due to the increased ex-vessel revenue from the Dungeness crab–trap fishery during that time. Point Arena was the only North Central Coast region port in which ex-vessel revenue was lower in 2011 than it was in 1992.

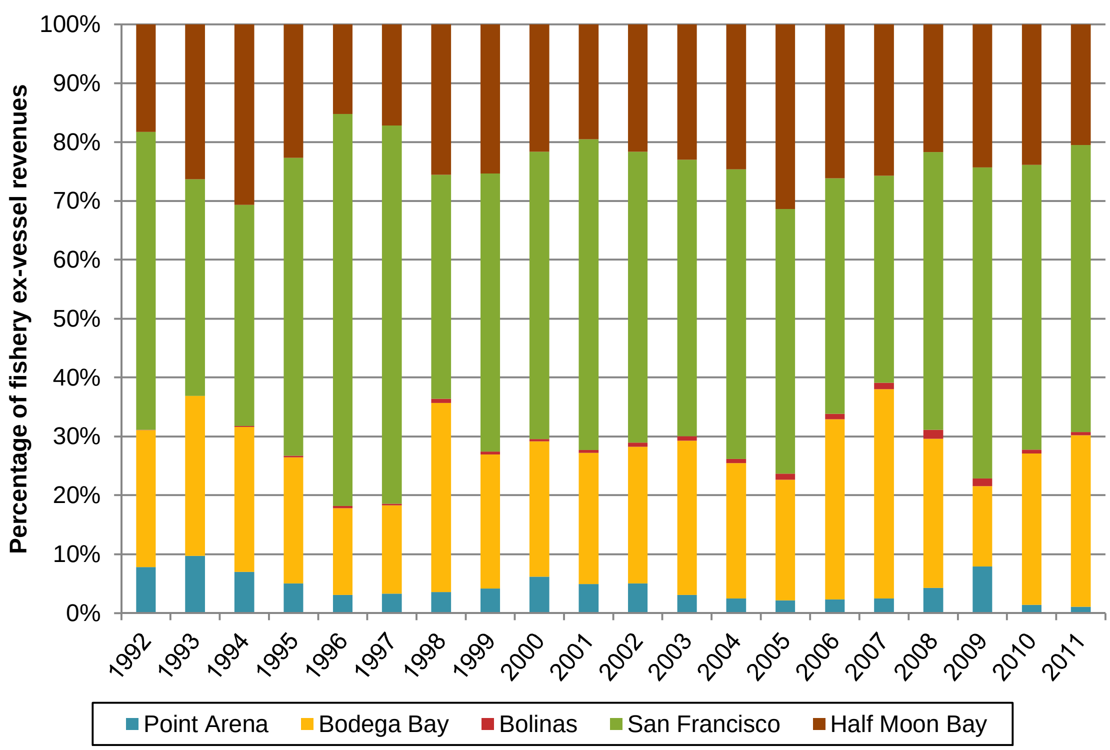
In some cases, due to confidentiality suppression among port-fishery combinations in certain years the display of non-suppressed data in adjacent years was affected in some figures below. In these instances, the affected non-suppressed and non-displaying data are noted in the respective figure's footnote.

Figure 41. All fisheries, commercial landings by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW

Figure 42. All fisheries, commercial ex-vessel revenue by North Central Coast region ports, 1992–2011



Source: Landings data from CDFW

4.1. Point Arena

Point Arena, in Mendocino County, is the northern most port in the North Central Coast region, (with the northern boundary being five miles north of Point Arena near Alder Creek). The area is thought to have been inhabited by Native Americans for over 10,000 years and is the original home of the Central and Western Pomo Indians (Norman et al. 2007). Permanent European settlers didn't arrive until the mid-1800's (Norman et al, 2007) and the first post office and store were established in 1858 and 1859, respectively (Durham 1998). According to the 2010 US Census, the population of Point Arena was officially 449 residents, and the estimated per capita income (2007-2011) was $17,615 with a mean household income of $49,189. The primary employment sector for the Point Arena area is 'arts, entertainment, recreation, accommodation and food service' (US Census Bureau 2010).

Popular tourist and recreation activities in the area are recreational fishing, diving, surfing, and boating opportunities. Additionally, the Point Arena Lighthouse, originally constructed in 1870, remains a popular tourist destination (Norman et al, 2007). The waters off of Point Arena are home to one of the strongest upwelling centers in the world and carries nutrient rich water to the entire NCC study region and out into the Farallon Islands and Cordell Banks (CDFG, 2007). Commercial fishing vessels are launched from a hoist off of the 330 foot Point Arena pier which was reconstructed in 1984 after the previous pier was destroyed by a storm (City of Point Arena 2013). The hoist is only able to launch boats up to five tons, thus limiting the size of fishing vessels that can operated out of Point Arena (California Coastal Commission, 2003).

4.1.1. Point Arena Commercial Fisheries Historical Trends and Initial Changes

Point Arena, contributed 5.2 percent of total regional landings and 4.4 percent of total regional ex-vessel revenue on average over 1992–2011. Landings and ex-vessel revenue, respectively peaking at 2.7 million pounds and $2.9 million in 1992, declined overall from 1992–2011 by approximately 80 percent, finishing out 2011 with 490,316 pounds landed and $532,609 in ex-vessel revenue, see Figure 43. The decrease in the number of fishermen, 89.2 percent from 1992 to 2011, was greater than in any other port in the North Central Coast region (the regional decrease over the same period was 72.5 percent). Again, all dollar values are presented in 2010 dollars unless otherwise noted.

Figure 44 and Figure 45 display the composition of landings and ex-vessel revenue for select fisheries of interest over 1992 to 2011 in Point Arena. Because these figures also display all other landings and ex-vessel revenue (including necessary suppressions from the fisheries of interest) in the category labeled 'other', it is possible to tell approximately what portion the six fisheries of interest represent of the port's total landings and ex-vessel revenue over the study period. For instance, in Point Arena, landings and ex-vessel revenue from the six fisheries of interest constituted an average of 99.4 percent and 98.9 percent respectively of total landings and ex-vessel revenue from all fisheries from 1992–2011. Among other North Central Coast ports, Point Arena displayed, by far, the highest portion of landings and ex-vessel revenue from the six fisheries of interest.

In Point Arena, it is quickly observable that this port was primarily an urchin–dive port as this fishery constituted an average of 94.5 percent of total landings and 79.4 percent of total ex-vessel revenue annually on average over the study period. However, the significance of the urchin–dive fishery in Point Arena gradually declined over the study period, reaching a low of 46.4 percent of total ex-vessel revenue in the port, as contributions from other fisheries, such as salmon–troll, nearshore finfish–live–hook & line, and Dungeness crab–trap, increased. After 2006, the urchin–dive portion of total ex-vessel revenue grew again to 88.4 percent of total ex-vessel revenue by 2009, but declined shortly after.

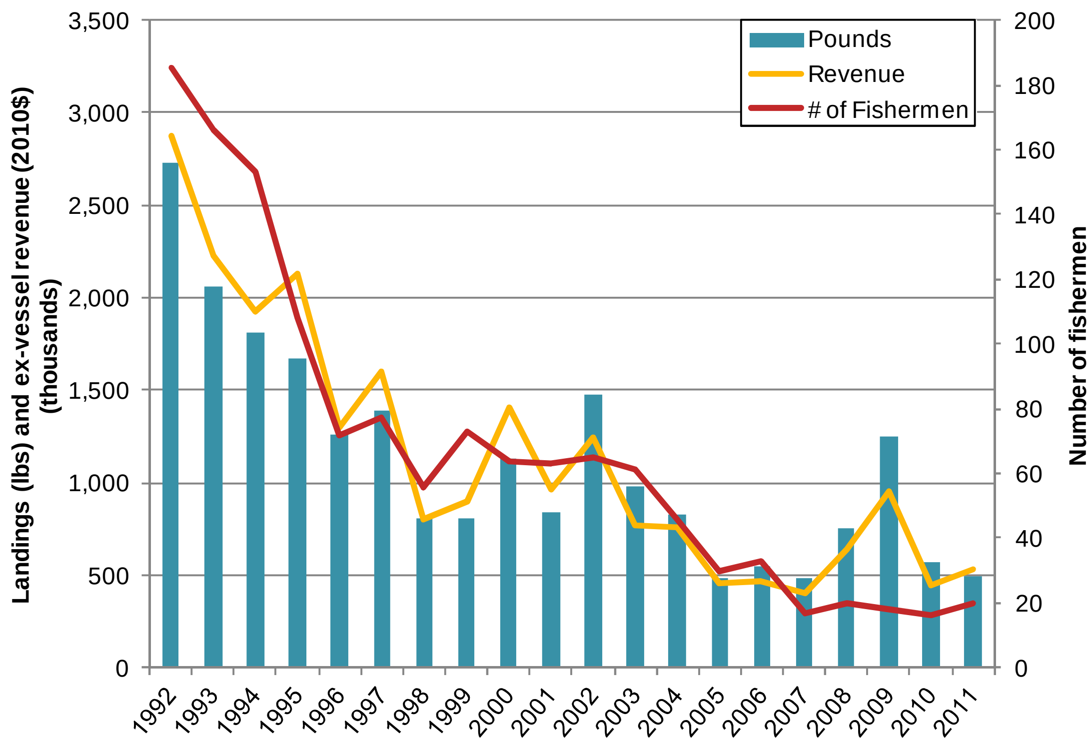
Notably, Point Arena is the only port in the North Central Coast region where the Dungeness crab–trap fishery hasn't experienced tremendous growth in terms of the percent of ex-vessel revenue as a percentage of total ex-vessel revenue from all fisheries port wide. Point Arena is a small port compared to most others in the study region and boats that make their homeports in Point Arena are limited in size by the hoist style launch facility and thus the size of their landings are also limited. The port's relatively isolated location and lack of infrastructure such as ice machines also makes landing higher volumes of catch difficult. Lastly, one Point Arena fishermen noted that fishermen who do not make their homeport in Point Arena rarely land their catch there.

The nearshore finfish–live–hook & line fishery, which for the first few years had zero landings in Point Arena, grew noticeably in significance over the study period, coming to represent 19.8 percent of total ex-vessel revenue by 2011 with landings of 15,520 pounds and ex-vessel revenue of $105,420.

Figure 46 displays the average percent contribution to fishing income for those fishermen who made landings in Point Arena over the study period from the six fisheries of interest, from other fisheries landed in Point Arena, and from landings from all fisheries landed in other North Central Coast region ports. This figure shows reliance on a fishery but also on a given port. This figure shows reliance on a fishery but also on a given port. Fishermen who landed in Point Arena derived an annual average of 88 percent of their total fishing income from Point Arena; this was the highest average percent in the region. And over the study period, Point Arena fishermen increased their share of landing in the port, and in 2011, 97.3 percent of all their regional ex-vessel revenue was landed here.

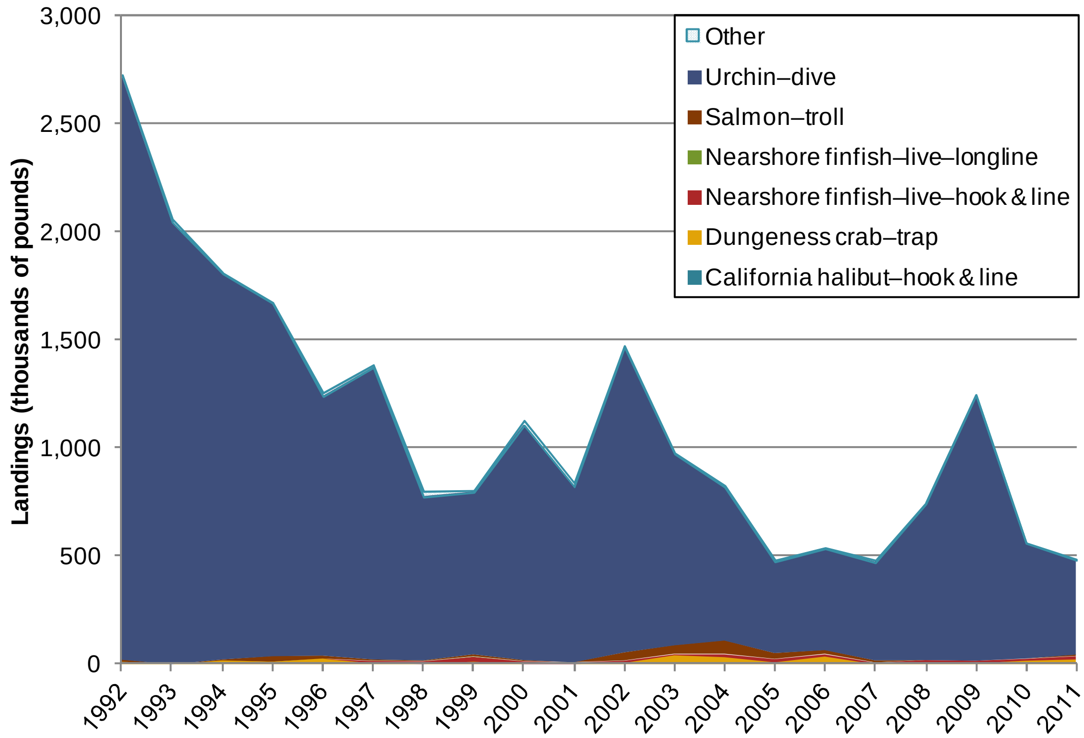
The urchin–dive fishery constituted a significant portion of average individual fishing incomes over the study period in Point Arena, averaging 61.9 percent annually, though declining over time. Among other North Central Coast region ports, fishermen landing nearshore finfish–live–hook & line in Point Arena relied upon ex-vessel revenue from this fishery more than those landing it at other ports, at most 13.7 percent in 2000. Similar to other North Central Coast region ports, Dungeness crab–trap ex-vessel revenue became increasingly significant to those landing in Point Arena over the study period, but to a lesser extent comparatively, reaching only 22.7 percent (in 2009) of the average individual's regional fishing income at most.

Figure 43. Point Arena total commercial landings, ex-vessel revenue, and number of fishermen, all fisheries, 1992–2011



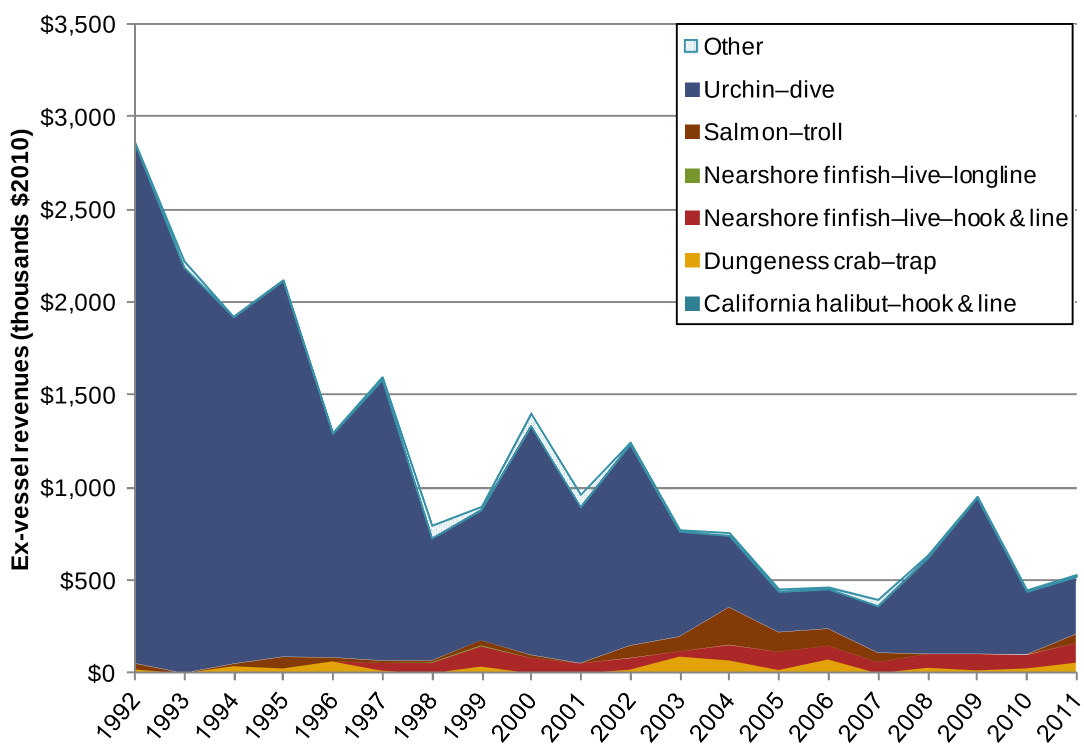
Source: Landings data from CDFW

Figure 44. Point Arena commercial landings for fisheries of interest, 1992–2011



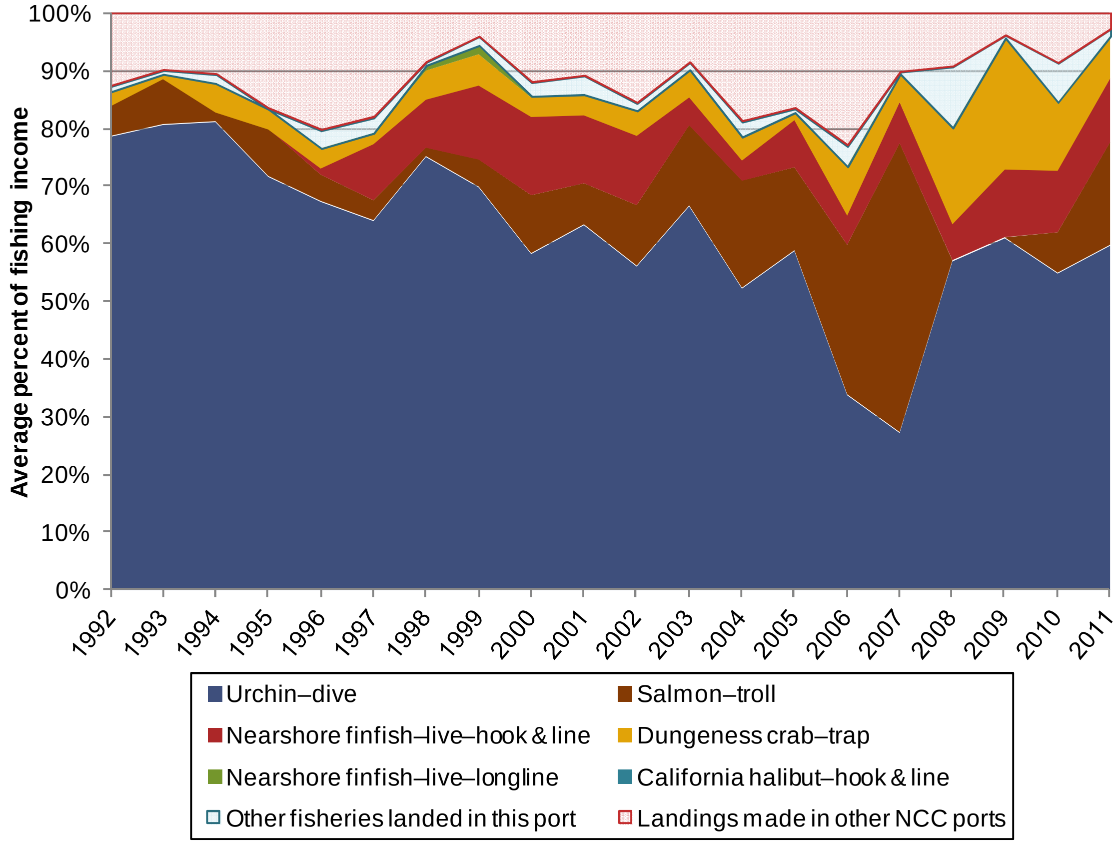
Source: Landings data from CDFW

Figure 45. Point Arena commercial ex-vessel revenue for fisheries of interest, 1992–2011



Source: Landings data from CDFW

Figure 46. Average percent of individual fishing income from commercial fisheries of interest, Point Arena, 1992–2011



Source: Landings data from CDFW

Table 101 displays the average annual percent change in total and average per fishermen ex-vessel revenue for each fishery in the port of Point Arena as compared with the respective changes in the North Central Coast region over the study period. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods.

Ex-vessel revenue for the urchin–dive fishery in Point Arena followed regional trends, and in fact likely influenced them greatly as landings from this port constitute the majority of all regional urchin–dive landings and ex-vessel revenue in the region. Ex-vessel revenue, overall and average per fishermen, declined in each sample period in the port and in the region except for over the pre-MPA period of 2005–2010. In the post-MPA period of 2010–2011 declines were less in Point Arena than in the region at 8.7 percent overall and 29.8 percent average per fisherman in the port and 18 percent overall and 34.4 percent average per fisherman in the region.

The nearshore finfish–live–hook & line fishery, in which Point Arena became a more significant regional port over the study period, fared better in the port than the region on average. Most notably, in the post–MPA period of 2010-2011, overall ex-vessel revenue increased by 42.7 percent in Point Arena while by on 14.5 percent in the North Central Coast region. Average annual per fishermen ex-vessel revenue increased over the 2000–2011 period by 36.7 percent in the port and less so in the region at 12.4 percent on average annually.

Table 101. Point Arena: Average annual percent change in total commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

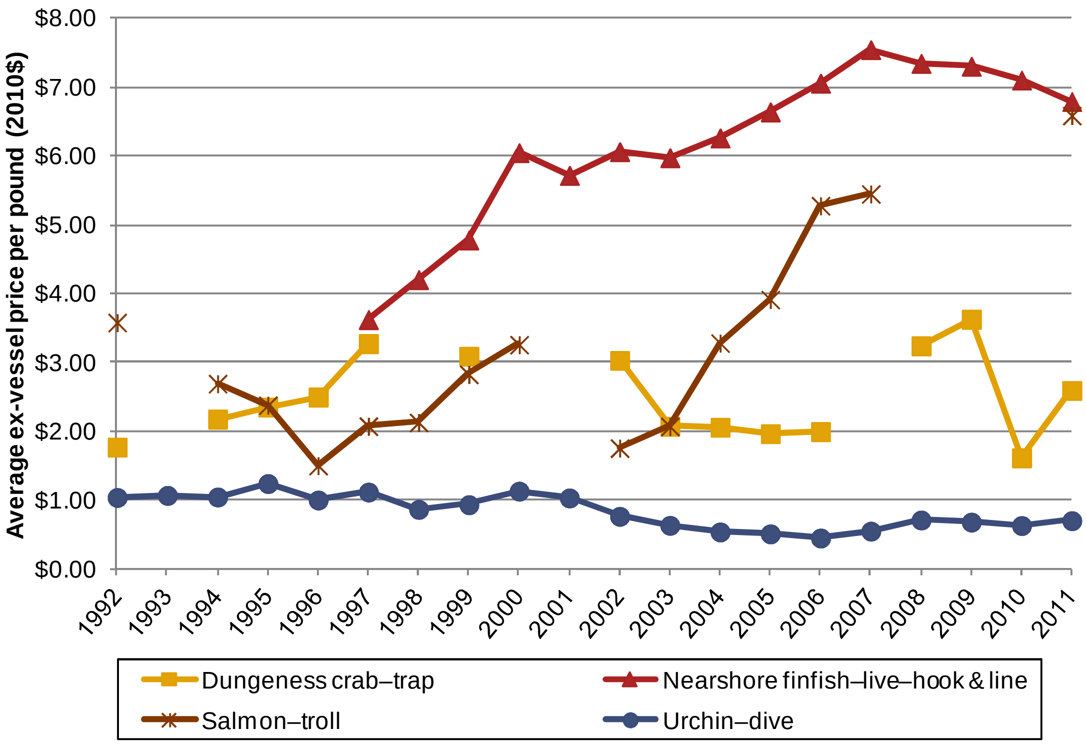
		Average annual percent change			
Fishery	**Commercial ex-vessel revenues**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
Dungeness crab–trap	Point Arena total	92.2%	108.1%	121.4%	103.2%
	Point Arena avg. per fisherman	166.8%	63.1%	195.3%	126.4%
	North Central Coast region total	24.3%	63.8%	46.5%	44.3%
	North Central Coast region avg. per fisherman	22.7%	33.2%	27.5%	27.9%
Nearshore finfish–live–hook & line	Point Arena total	29.2%	-3.5%	42.7%	15.6%
	Point Arena avg. per fisherman	69.3%	2.8%	42.7%	36.7%
	North Central Coast region total	1.9%	-4.4%	14.5%	0.2%
	North Central Coast region avg. per fisherman	26.0%	2.7%	-7.5%	12.4%
Salmon–troll	Point Arena total	42.4%	-52.6%	–	-5.1%
	Point Arena avg. per fisherman	33.2%	-35.4%	–	5.8%
	North Central Coast region total	17.8%	-40.4%	1460.2%	158.7%
	North Central Coast region avg. per fisherman	11.5%	-13.5%	331.8%	45.3%
Urchin–dive	Point Arena total	-25.1%	24.7%	-8.7%	-1.0%
	Point Arena avg. per fisherman	-14.2%	51.3%	-29.8%	14.2%
	North Central Coast region total	-28.3%	29.9%	-18.0%	-0.9%
	North Central Coast region avg. per fisherman	-15.0%	54.5%	-34.4%	14.8%

Source: Landings data from CDFW

— indicates zero value data in the sample years

Figure 47 displays the average ex-vessel prices for select fisheries of interest in Point Arena over the 1992–2011 study period. The urchin–dive ex-vessel price fell approximately 32.3 percent from 1992 to 2011 beginning at $1.04 per pound in 1992 and finishing 2011 at $0.71 per pound. The average ex-vessel prices for both the salmon–troll and nearshore finfish–live–hook & line fisheries increased notably over the study period, with salmon–troll finishing 2011 at $6.59 per pound and nearshore finfish–live–hook & line at $6.79 per pound. The highest average ex-vessel price commanded in Point Arena over the study period was by the nearshore finfish–live–hook & line fishery in 2007 for $7.54 per pound.

Figure 47. Average ex-vessel prices over time, target commercial fisheries, Point Arena, 1992–2011



Source: Landings data from CDFW

Figure 48 displays landings, ex-vessel revenue, and number of fishermen for the Dungeness crab–trap fishery in Point Arena over the study period. At most, there were nine fishermen active in the port, occurring earlier on in 1994. Maximum landings and revenue occurred nearly ten years later in 2003 at 43,424 pounds and $90,163 respectively. Trends for individual fishermen are presented as averages in Figure 49. The average Dungeness crab–trap fisherman in Point Arena made eight landings over which he landed an annual total of 3,77 pounds for $8,686 in ex-vessel revenue annually.

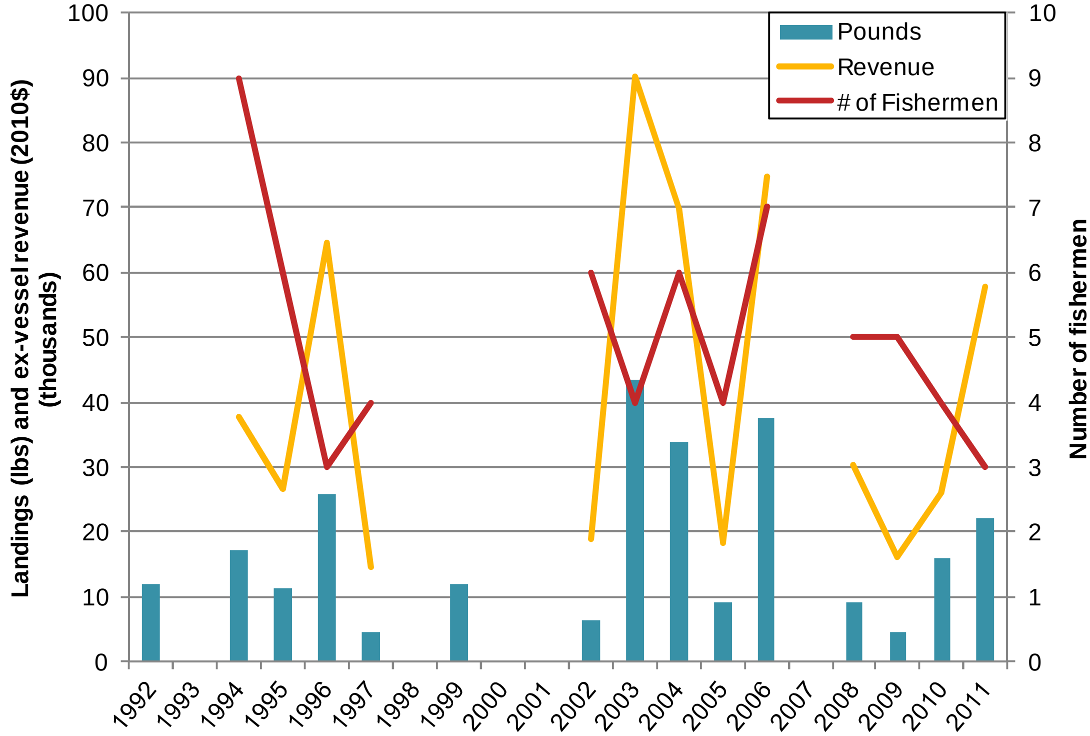
Figure 50 displays landings, ex-vessel revenue, and number of fishermen for the nearshore finfish–live–hook & line fishery in Point Arena over 1992–2011. Landings and ex-vessel revenue rose from zero in 1992 to 15,520 pounds and $105,420 by 2011. There were high numbers of fishermen in the first six years of the fishery (1997–2002), which dropped to only 3 fishermen for 2010 and 2011. With rising landings and decreasing number of fishermen, the average landings and ex-vessel revenue per fishermen increased significantly, see Figure 51. The average nearshore finfish–live–hook & line fisherman in Point Arena made 27 landings with an annual total of 5,173 pounds landed for $35,140 in ex-vessel revenue.

Figure 52 displays landings, ex-vessel revenue, and number of fishermen for the salmon–troll fishery in Point Arena over 1992–2011. The greatest salmon–troll landings made in this port over the study period occurred in 2004 with 61,810 pounds landed for $203,023 in ex-vessel revenue by a total of 14 fishermen. 2004 was also the year with the greatest average landings and ex-vessel revenue per fisherman, see Figure 53, at 4,415 pounds and $14,502 respectively, and each fisherman making a total count of 25 landings that year.

Figure 54 displays landings, ex-vessel revenue, and number of fishermen for the urchin–dive fishery in Point Arena over 1992–2011. The peak landings, ex-vessel revenue, and number of fishermen all occurred early on in 1992 at 2.7 million pounds, $2.8 million, and 166 fishermen respectively. Since 1992, the fishery saw decline with small increases occurring in the last few years of the fishery. The overall decrease in urchin–dive landings and ex-vessel revenue occurred not only in Point Arena, but all over the study period. Yet because this fishery remained significant in Point Arena, the port's share of total regional landings and ex-vessel revenue increased overall.

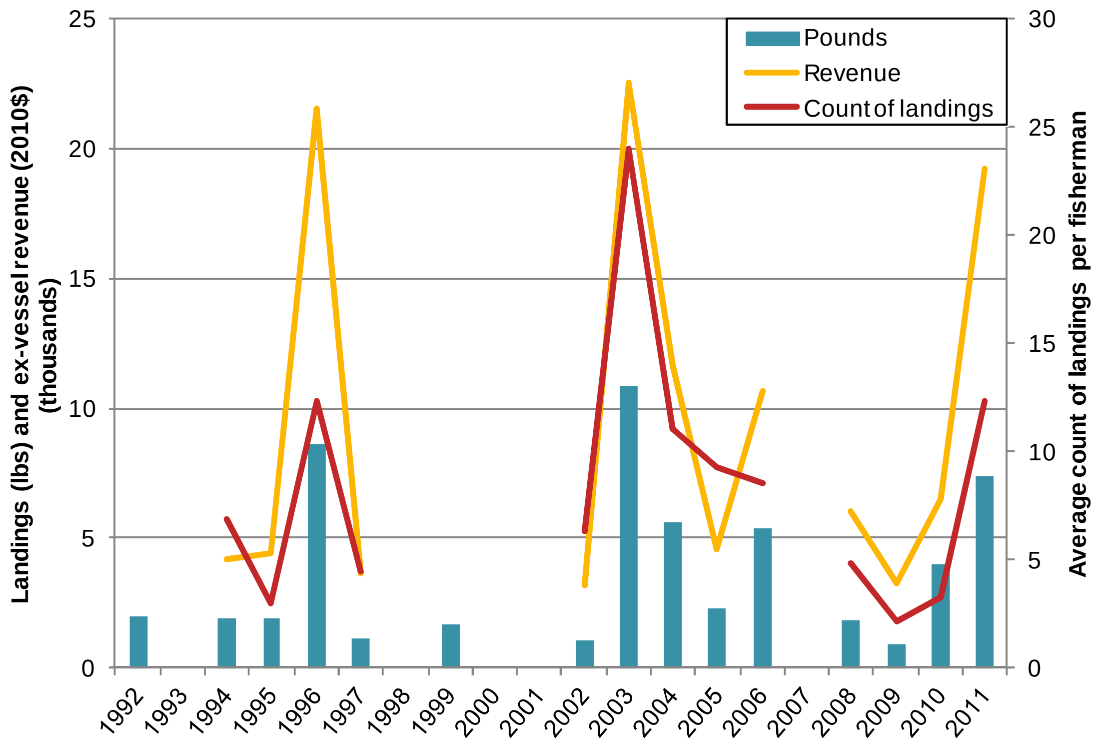
Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 55. While urchin–dive overall landings and ex-vessel revenue were decreasing in Point Arena over the study period, the average landings and ex-vessel revenue increased. Point Arena urchin–dive fishermen landed 108.8 percent more pounds for 41.3 percent more in ex-vessel revenue on average in 2011 than they did in 1992; there were also 92.2 percent less fishermen overall in 2011 than there were in 1992.

Figure 48. Dungeness crab–trap: Commercial landings, ex-vessel revenue, and number of fishermen, Point Arena, 1992–2011



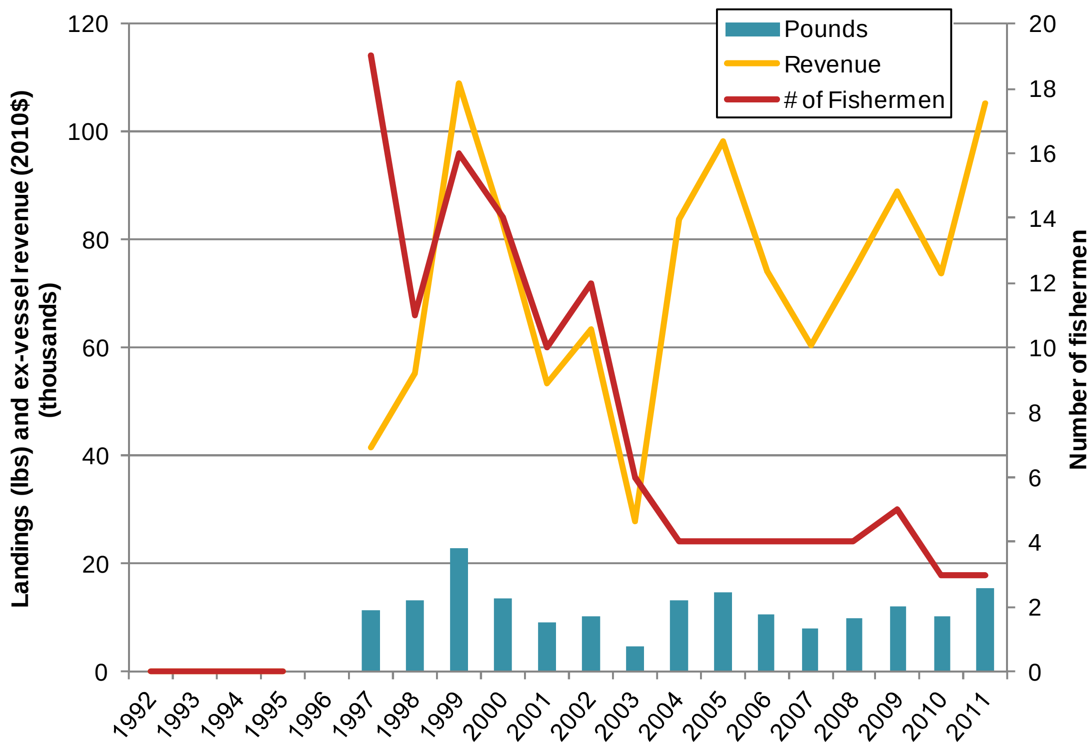
Source: Landings data from CDFW Year (Ex-vessel revenue - # of fishermen): 1992($21,272 - 6); 1999($36,917 - 7)

Figure 49. Dungeness crab–trap: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Point Arena, 1992–2011



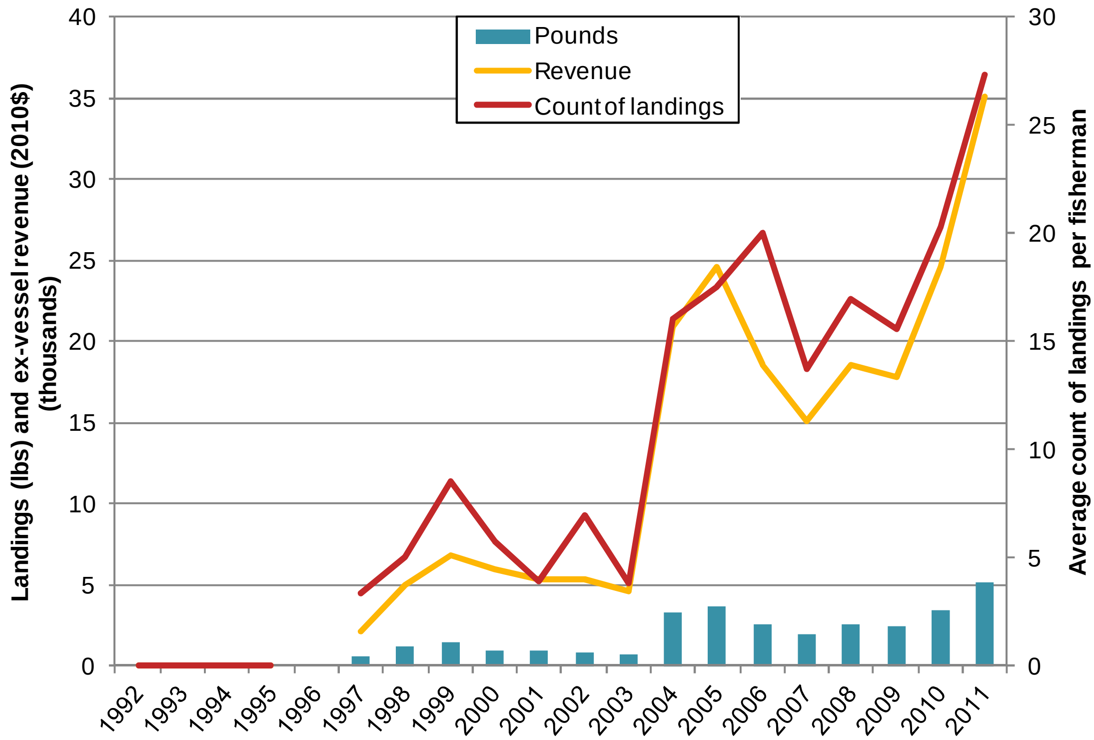
Source: Landings data from CDFW Year (Ex-vessel revenue - count of landings): 1992($3,545 - 5); 1999($5,274 - 7)

Figure 50. Nearshore finfish–live–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, Point Arena, 1992–2011



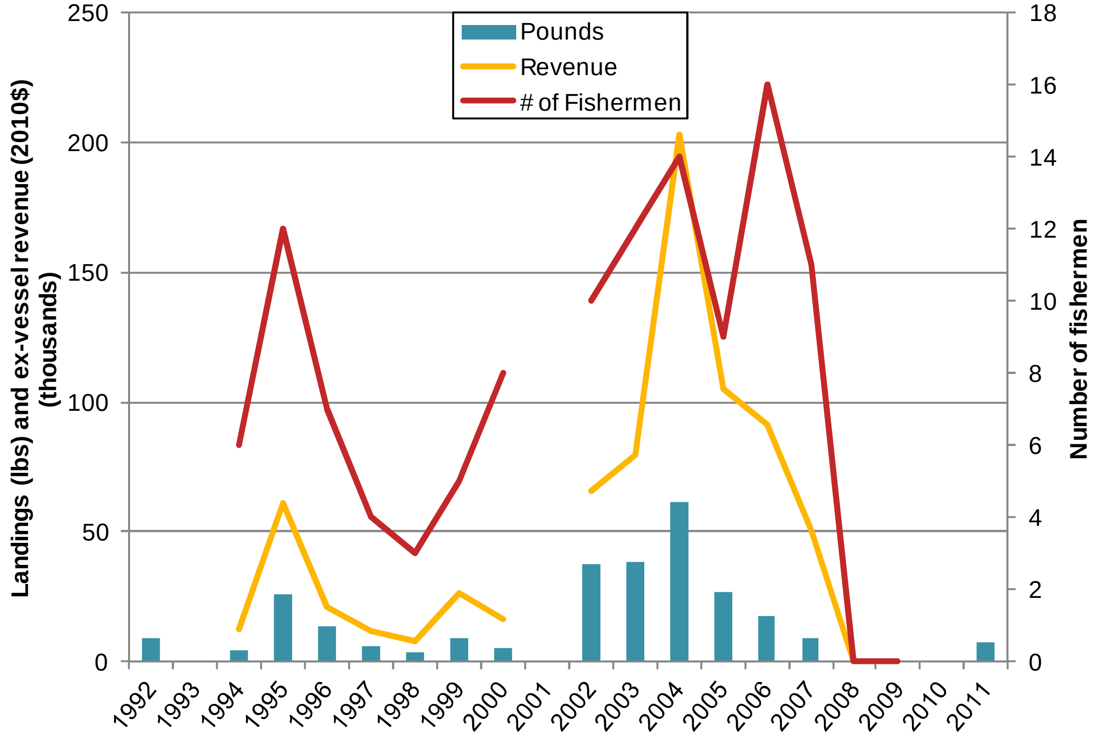
Source: Landings data from CDFW

Figure 51. Nearshore finfish–live–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Point Arena, 1992–2011



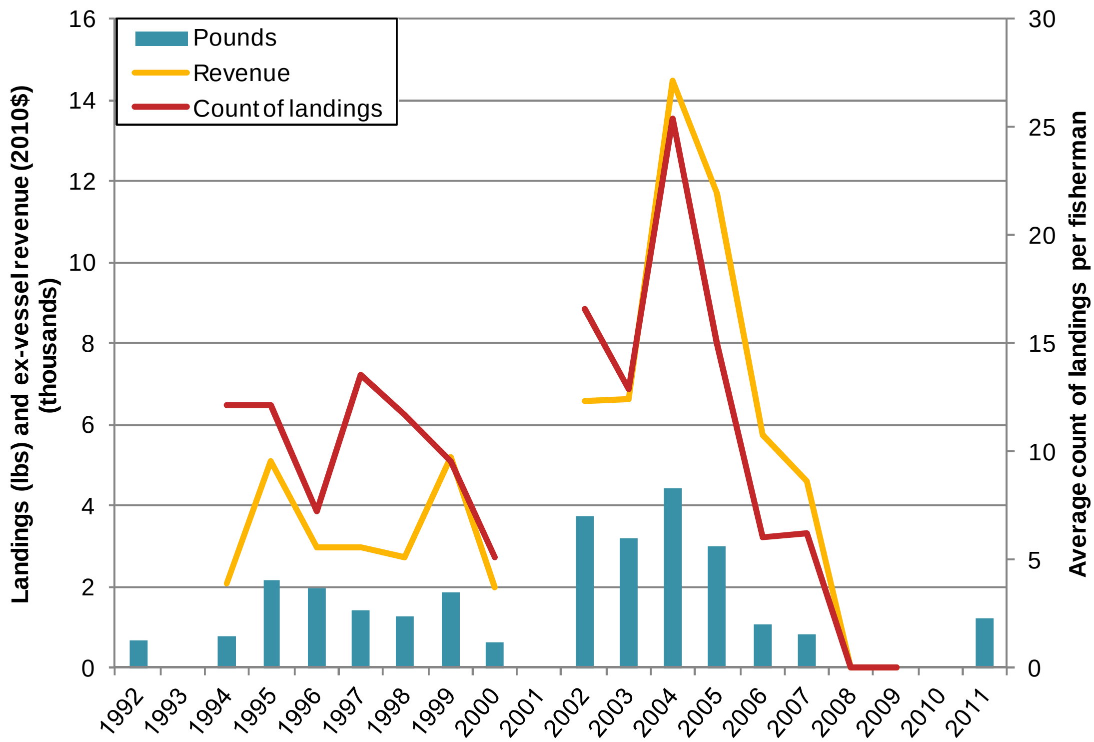
Source: Landings data from CDFW

Figure 52. Salmon–troll: Commercial landings, ex-vessel revenue, and number of fishermen, Point Arena, 1992–2011



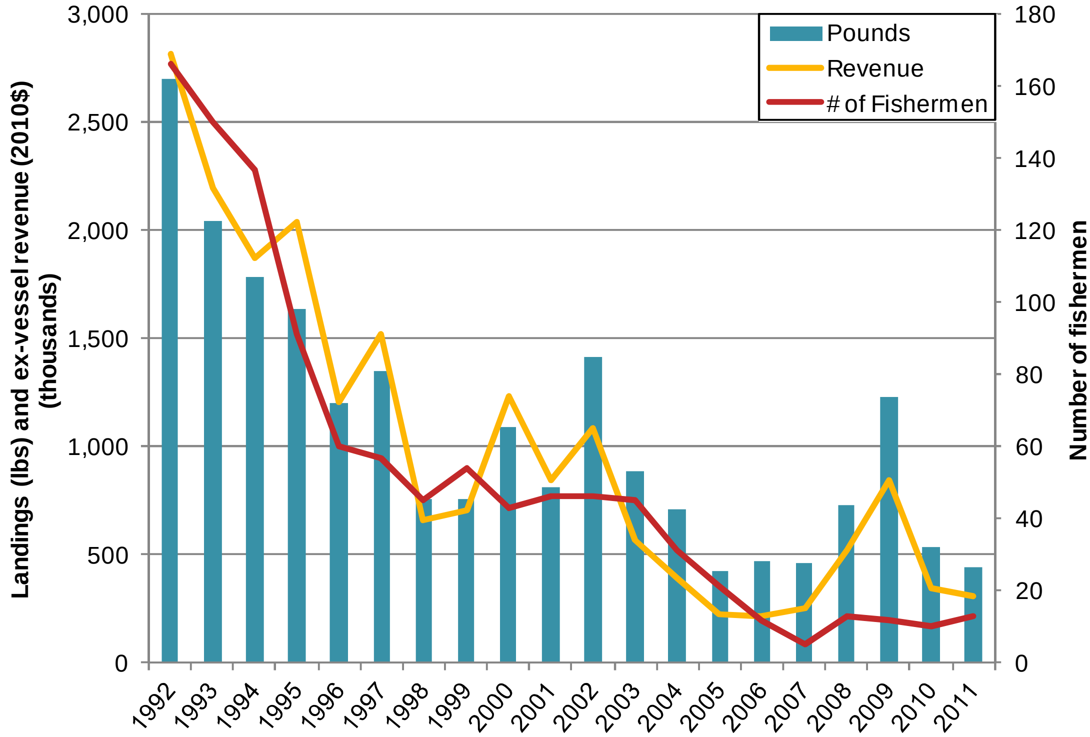
Source: Landings data from CDFW Year (Ex-vessel revenue - # of fishermen): 1992($32,762 - 13); 2011($47,570 - 6)

Figure 53. Salmon–troll: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Point Arena, 1992–2011



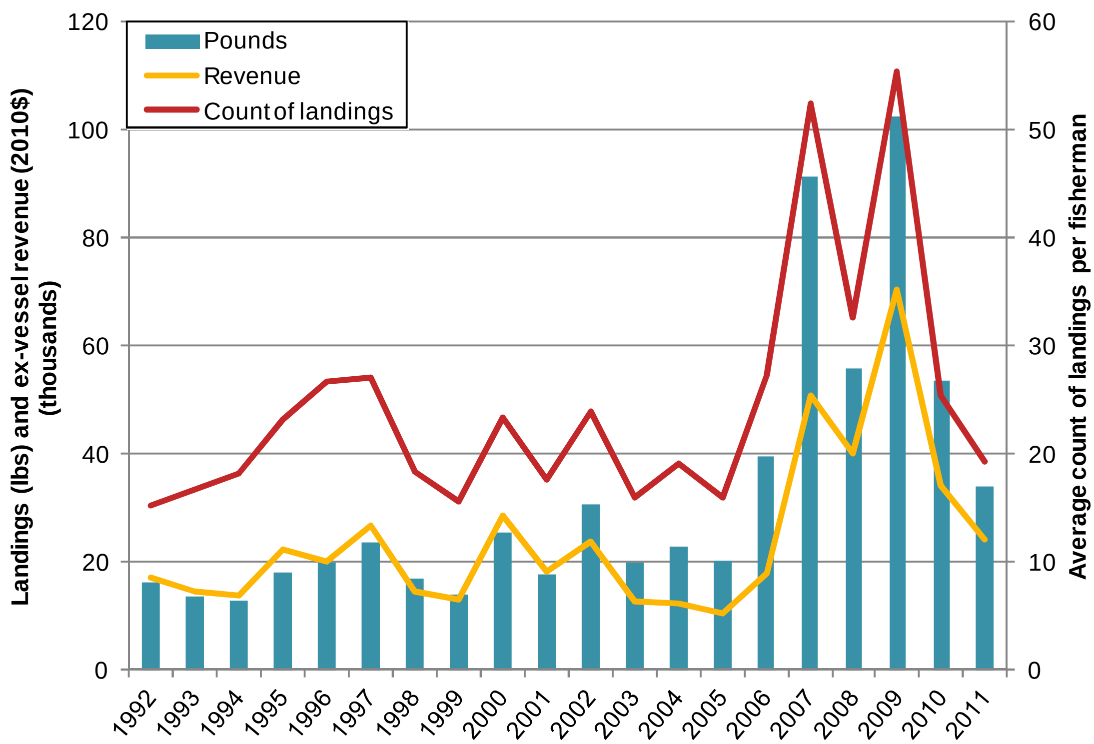
Source: Landings data from CDFW Year (Ex-vessel revenue – count of landings): 1992($2,520 - 8); 2011($7,928 - 8)

Figure 54. Urchin–dive: Commercial landings, ex-vessel revenue, and number of fishermen, Point Arena, 1992–2011



Source: Landings data from CDFW

Figure 55. Urchin–dive: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Point Arena, 1992–2011



Source: Landings data from CDFW

4.1.2. Point Arena Commercial Baseline Characterization

In 2010, 15 individuals made landings in one or more of the five target fisheries in Point Arena. Combined, they generated $446,227 in ex-vessel revenue, which is 1.6 percent of the 27.5 million dollars generated by the five target fisheries over the entire study region. The majority of the landings came from the urchin–dive fishery (76.6 percent) and this was the only port where Dungeness crab–trap did not bring in the most revenue compared to the other target fisheries. We interviewed seven fishermen from Point Arena (Table 102).

Table 102. Number of commercial fishermen interviews conducted and fishery ex-vessel revenue value, 2010, non-spatial survey, Point Arena

Fishery	2010 total ex-vessel revenue (2010$)	Total number of individuals in 2010 landings	Number interviewed
California halibut–hook & line	—	—	—
Dungeness crab–trap	$26,040	4	4
Nearshore finfish–live–fixed gear	$73,897	3	2
Salmon–troll	$4,614	2	2
Urchin–dive	$341,676	10	4
All target fisheries (unique individuals)	$446,227	15	7

Source: California Department of Fish and Wildlife, Current study

— indicates that the port/fishery was not sampled or a zero value data point

The average Point Arena fisherman that we interviewed was 50.4 years old and has 26.9 years of experience as a commercial fisherman (Table 103). Both of these averages were within one year of the regional average. Additionally, Point Arena fishermen on average made 81.7 percent of their total personal income from commercial fishing in 2010, an increase of 10 percent since 2007. Both of these averages were greater than the average fishermen overall in the region. It should be noted that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. As shown in Table 104, together those fishermen in the Dungeness crab–trap fishery actually reported a decrease in percent of total person income from commercial fishing and those in the urchin–dive fishery reported an increase. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. Sources of income besides commercial fishing are shown in Table 105.

Table 103. Average age and years of experience commercial fishing, 2010, Point Arena

Fisheries	Age: Number responding	Age: Average	Age: Standard deviation	Years of experience: Number responding	Years of experience: Average	Years of experience: Standard deviation
California halibut–hook & line	—	—	—	—	—	—
Dungeness crab–trap	4	48.3	5.4	4	27.3	5.2
Nearshore finfish–live–fixed gear	2	*	*	2	*	*
Salmon–troll	2	*	*	2	*	*
Urchin–dive	4	52.0	8.6	4	27.8	5.1
All target fisheries (unique individuals)	7	50.4	7.5	7	26.9	4.7

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 104. Percent change in income from overall commercial fishing from 2007 - 2010, Point Arena

Fisheries	2007^: Number responding	2007^: Average	2007^: Standard deviation	2010: Number responding	2010: Average	2010: Standard deviation	Percent Change
California halibut–hook & line	—	—	—	—	—	—	—
Dungeness crab–trap	5	96.0%	8.9%	4	76.3%	27.5%	-20.6%
Nearshore finfish–live–fixed gear	1	*	*	2	*	*	*
Salmon–troll	10	80.5%	33.0%	2	*	*	*
Urchin–dive	7	77.9%	30.0%	4	96.3%	7.5%	23.6%
All target fisheries (unique individuals)	13	74.2%	33.7%	6	81.7%	23.4%	10.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

Table 105. Other sources of income other than commercial fishing in 2010, Point Arena

	Number responding					
Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
Construction/Contractor	—	—	—	*	1	1
Farming/Ranching	—	—	—	*	—	—
Fisheries research	—	1	—	*	—	1
Harbor/City job	—	1	—	*	—	1
Office work	—	—	—	*	—	—
Other fishing related work	—	—	—	*	—	—
Other specialized work	—	—	—	*	—	—
Property management	—	—	—	*	—	—
Retirement/Social Security/Investments	—	—	—	*	—	—
Salmon disaster relief	—	—	—	*	—	—
Skilled labor	—	1	—	*	—	1
Number of individuals responding	—	2	—	*	1	3

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Unlike the average for the study region, Point Arena saw an average decrease (of 15.9 percent) in the percent of gross economic revenue (GER) that went towards overall commercial fishing operating costs in 2010 (regionally there was a 9.5 percent increase). However, only two individuals reported an actual decrease in costs, and one of them noted that they were working on a project in 2007 that required above average operating costs and the other noted that in 2007 he was fishing different fisheries in which he was less skilled and thus had a higher percent of operating costs. The other individuals in the study region either reported an increase in costs or did not provide a response for both years. Here again, 2007 averages were taken directly from the 2008 study conducted by Ecotrust.

Table 106. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Point Arena

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
California halibut–hook & line	—	—	—	—	—	—	—
Dungeness crab–trap	5	45.1%	24.1%	4	39.0%	23.3%	-13.5%
Nearshore finfish–live–fixed gear	1	*	*	2	*	*	*
Salmon–troll	10	46.1%	28.7%	2.00	*	*	*
Urchin–dive	7	37.9%	22.4%	4	40.3%	23.5%	6.3%
All target fisheries (unique individuals)	13	45.4%	25.0%	6	38.2%	20.2%	-15.9%

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

As shown below in Table 107, Dungeness crab–trap fishermen in Point Arena reported an average of only 36 days targeting that fishery. This is far less than the regional average of 64.2. Point Arena is also the only port in the study region where Dungeness crab was not the number one revenue generator of the target fisheries we studied. The questions in Table 107 and Table 108 were asked in regards to each specific fishery unlike those in
Table 104 through Table 106 above. Also, in the urchin–dive fishery, although some respondents reported using a crew, they did not provide information regarding what percent of their GER went to their crew.

Table 107. Years of experience and number of days targeting specific fisheries in 2010, Point Arena

	Years of experience in fishery			Days spent targeting fishery		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
California halibut–hook & line	—	—	—	—	—	—
Dungeness crab–trap	4	21.8	3.0	3	36.0	16.4
Nearshore finfish–live–fixed gear	2	*	*	2	*	*
Salmon–troll	2	*	*	1	*	*
Urchin–dive	4	26.0	4.2	3	68.3	28.4

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 108. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Point Arena

Fisheries	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut–hook & line	—	—	—	—	—	—	—	—	—
Dungeness crab–trap	4	1.3	0.5	4	31.3%	11.8%	3	9.7%	4.7%
Nearshore finfish–live–fixed gear	2	*	*	2	*	*	2	*	*
Salmon–troll	2	*	*	2	*	*	2	*	*
Urchin–dive	4	0.3	0.5	3	—	—	2	12.5%	3.5%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

No one in Point Arena indicated they had added or dropped a fishery since 2007, or did not fish a fishery in 2010 and so that table is omitted here.

Fishermen were asked for each fishery to compare his/her success in this fishery in 2010 to that of the last five years. As shown in the table below (Table 109), respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. All of the urchin–dive fishermen we spoke to in Point Area indicated the fishery was worse off in 2010 than it had been in the past five years and 75 percent of respondents specified that it was significantly worse. Alternatively, all fishermen who participated in 2010 Dungeness crab–trap fishery indicated it was better or the same, with 50 percent reporting it was significantly better.

Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other. Responses are shown below in Table 110 through Table 112. For the Dungeness crab–trap fishery most individuals reported environmental factors were responsible for the increased success in the fishery in 2010 than in the previous five years (Table 111). However, those in the urchin–dive fishery reported regulatory factors, specifically, MPAs, were responsible for reduced success in the fishery compared to previous years (Table 110).

Table 109. Overall success in specific commercial fishery in 2010 compared to previous five years, Point Arena

		Percent response					
Fisheries	**Number responding**	**Did not participate in previous seasons**	**Significantly better**	**Somewhat better**	**The same**	**Somewhat worse**	**Significantly worse**
California halibut–hook & line	—	—	—	—	—	—	—
Dungeness crab–trap	4	—	50.0%	25.0%	25.0%	—	—
Nearshore finfish–live–fixed gear	2	*	*	*	*	*	*
Salmon–troll	2	*	*	*	*	*	*
Urchin–dive	4	—	—	—	—	25.0%	75.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 110. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Point Arena

		California halibut–hook & line	**Dungeness crab–trap**	**Nearshore finfish–live–fixed gear**	**Salmon–troll**	**Urchin–dive**
	Number responding	—	—	1	2	4
	Responses	**Count of responses**				
Worse	Regulated season too short	—	—	*	*	—
	MPAs	—	—	*	*	4
	No permit required	—	—	*	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 111. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Point Arena

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	—	3	—	2	—
	Responses	**Count of responses**				
Better	Larger quantity of fish	—	2	—	*	—
	Peak of natural cycle	—	2	—	*	—
	Good weather	—	1	—	*	—
	Good ocean conditions	—	—	—	*	—
	Good quality fish	—	1	—	*	—
	More bait/feed in the ocean	—	—	—	*	—
Worse	Low quantity of fish	—	—	—	*	—
	Bad weather	—	—	—	*	—
	Poor ocean conditions	—	—	—	*	—
	Loss of salmon spawning grounds	—	—	—	*	—
	Red tide	—	—	—	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 112. Economic changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Point Arena

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live– fixed gear	Salmon–troll	Urchin–dive
	Number responding	—	—	1	—	—
	Responses	**Count of responses**				
Better	Good price	—	—	—	—	—
	Good/new market	—	—	—	—	—
Worse	Increase in fuel costs	—	—	1	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

4.2. Bodega Bay

Bodega Bay, in Sonoma County, is found between Bodega Head and the mouth of the Tomales Bay, approximately 67 miles north of San Francisco. Bodega Bay was inhabited by the Pomo and Miwok Indian Tribes when the first Euro-American settlers (Russian fur traders from Alaska) arrived in 1812. (Norman et al, 2007). The population was recorded during the 2010 US Census as 1,077, a decline form 2000 census reports. The estimated per capita income (2007-2011) was $52,512 with a mean household income of $96,668 (US Census Bureau 2010). In the mid nineteenth century Bodega Bay became a thriving commercial fishing port and in the 1870's a railroad line allowed the port to expand into the San Francisco market. The fishing industry in Bodega Bay, which was primarily focused on salmon continued to grow until the mid-1990s when salmon landings rapidly declined after peaking in the 1980s. Anthropogenic changes to the landscape and the subsequent loss of salmon spawning habitat are thought to have contributed significantly to this decline. Another threat to fishing in Bodega Bay has been the silting of the bay floor which has decreased the channel that vessels must transit through to reach the port. It was originally dredged in 1943 and again in 2004-2005 after some parts of the channel reached a depth of only five feet (Norman et al, 2007). The tourism industry began to boom in Bodega Bay during the 1980s, and today the primary employment sector is 'arts, entertainment, recreation, accommodation and food service' (CDFG 2007), although commercial fishing still remains a large part of the Bodega Bay economy and culture (Norman et al, 2007). The Spud Point Marina (county owned) is the largest and primary harbor area for commercial vessels and has 244 berths, an ice machine, repair yard, fuel dock, hoist, and a service dock. Several privately owned marinas and boat launches provide additional access and moorages for boaters (California Coastal Commission 2003).

4.2.1. Bodega Bay Commercial Fisheries Historical Trends and Initial Changes

Bodega Bay contributed 19.2 percent of total landings and 23.9 percent of total ex-vessel revenue to the North Central Coast region on average over 1992–2011. Landings peaked in 1992 at 11.7 million pounds while ex-vessel revenue peaked at $14 million in 2011, see Figure 56. In 2009 landings, ex-vessel revenue, and the number of fishermen were at their lowest over the study period at 1 million pounds, $1.7 million, and 90 fishermen respectively. During interviews fishermen did note that 2009 was an all-time low in Bodega Bay, citing the closure of the salmon fishery and a poor Dungeness crab season.

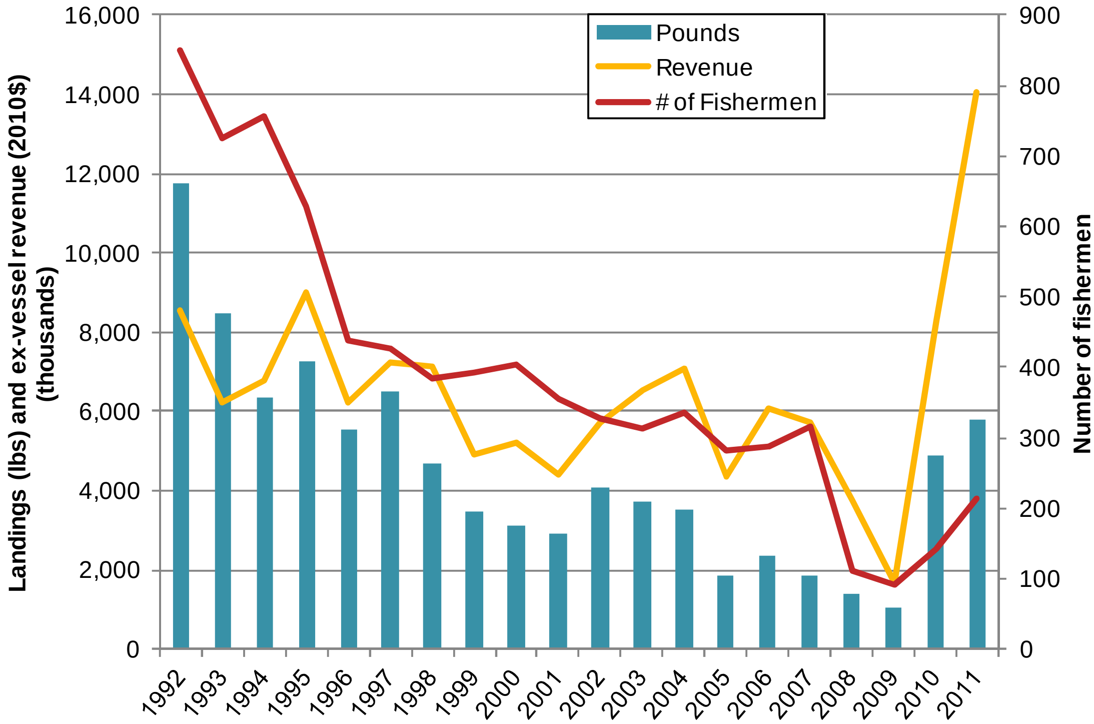
Ex-vessel revenue trends generally tended to follow landings trends in the first half of the study period, but departed in the last two years. This is likely due to Bodega Bay shifting away from the urchin–dive fishery, a lower value fishery, and the closure of the salmon–troll fishery in 2008 and 2009. Furthermore, Dungeness crab–trap became the predominant fishery for this port, constituting approximately 92 percent of its total ex-vessel revenue in both 2010 and 2011. This may explain the inconsistency in which landings and ex-vessel revenue peaked at opposite ends of the study period. The number of fishermen decreased 74.8 percent from 1992 to 2011.

Figure 57 and Figure 58 display the composition of landings and ex-vessel revenue for select fisheries of interest over 1992 to 2011 in Bodega Bay. Because these figures also display all other landings and ex-vessel revenue (including necessary suppressions from the fisheries of interest) in the category labeled 'other', it is possible to tell approximately what portion the six fisheries of interest represent of the port's total landings and ex-vessel revenue over the study period. From 1992–2011, landings and ex-vessel revenue from the six fisheries of interest constituted an average of 61.2 percent and 76.3 percent respectively of total landings and ex-vessel revenue from all fisheries in Bodega Bay. Averaging annually across the study period, the top five additional fisheries in Bodega Bay contributing to landings included groundfish–bottom trawl (averaging 20 percent), Pacific herring roe (5.2 percent), hagfishes (1.4 percent), longspine thornyhead (1.1 percent), and albacore tuna–jig (1.1 percent). In terms of average annual ex-vessel revenue, the top five additional fisheries in Bodega Bay were groundfish–bottom trawl (9.1 percent), Pacific herring roe (2.6 percent), swordfish (1.2 percent), bay shrimp (0.9 percent), and albacore tuna–jig 0.8 percent).

In the earlier half of the study period, Bodega Bay was a more diversified port, landing notable amounts of salmon-troll (up to 1.5 million pounds and $3.3 million in ex-vessel revenue in 2003, see Figure 69) and urchin–dive (up to 3.7 million pounds and $2.7 million in ex-vessel revenue in 1992, see Figure 71). After 2004, however, the primary two fisheries were Dungeness crab–trap and salmon–troll; and, as previously mentioned, after the salmon–troll fishery closure, Dungeness crab–trap constituted over 90 percent of total landings and ex-vessel revenue in the port.

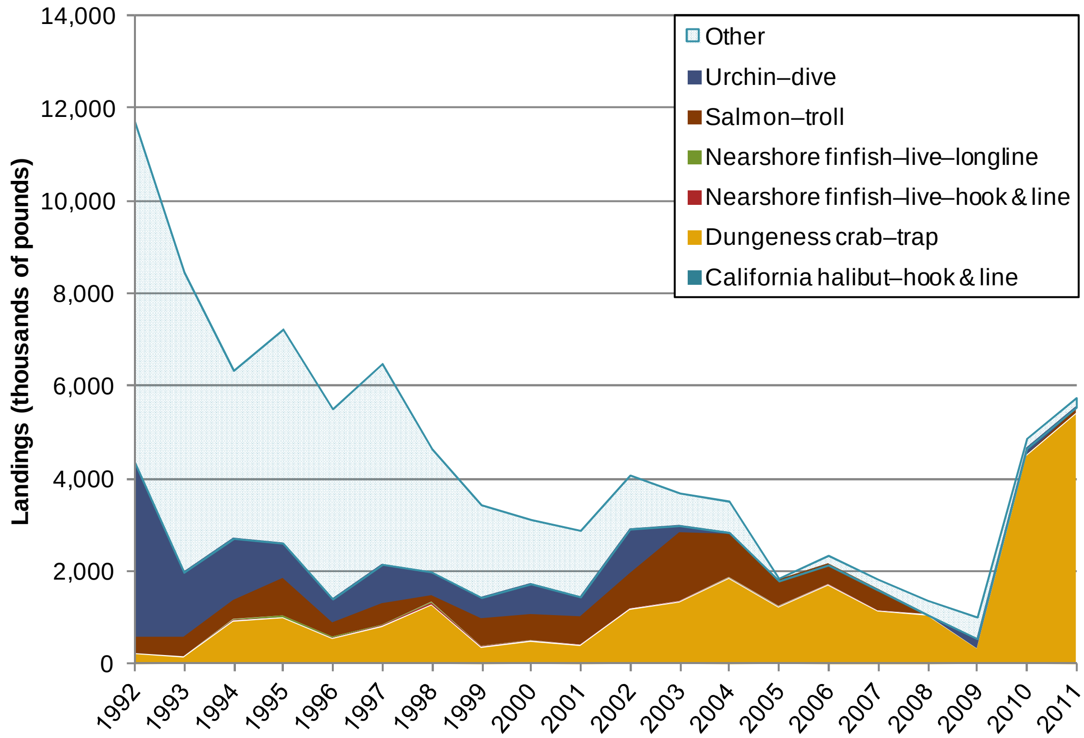
Figure 59 displays the average percent contribution to fishing income for those fishermen who made landings in Bodega Bay over the study period from the six fisheries of interest, from other fisheries landed in Bodega Bay, and from landings from all fisheries landed in other North Central Coast region ports. This figure shows reliance on a fishery but also on a given port. While the salmon–troll fishery constituted an average of 22.4 percent of total ex-vessel revenue in the port, ex-vessel revenue from this fishery was relied upon more by fishermen in Bodega Bay than any other fishery in the port for the majority of the study period, representing 32 percent of the average individual fishing income annually. During the closure, landings and ex-vessel revenue in the port plummeted, and the majority of Bodega Bay fishermen landed mostly Dungeness crab–trap and California halibut–hook & line. After the reopening of the fishery, salmon–troll ex-vessel revenue in Bodega Bay was again up to 32.3 percent of the average individual fishing income in the port.

Figure 56. Bodega Bay total commercial landings, ex-vessel revenue, and number of fishermen, all fisheries, 1992–2011



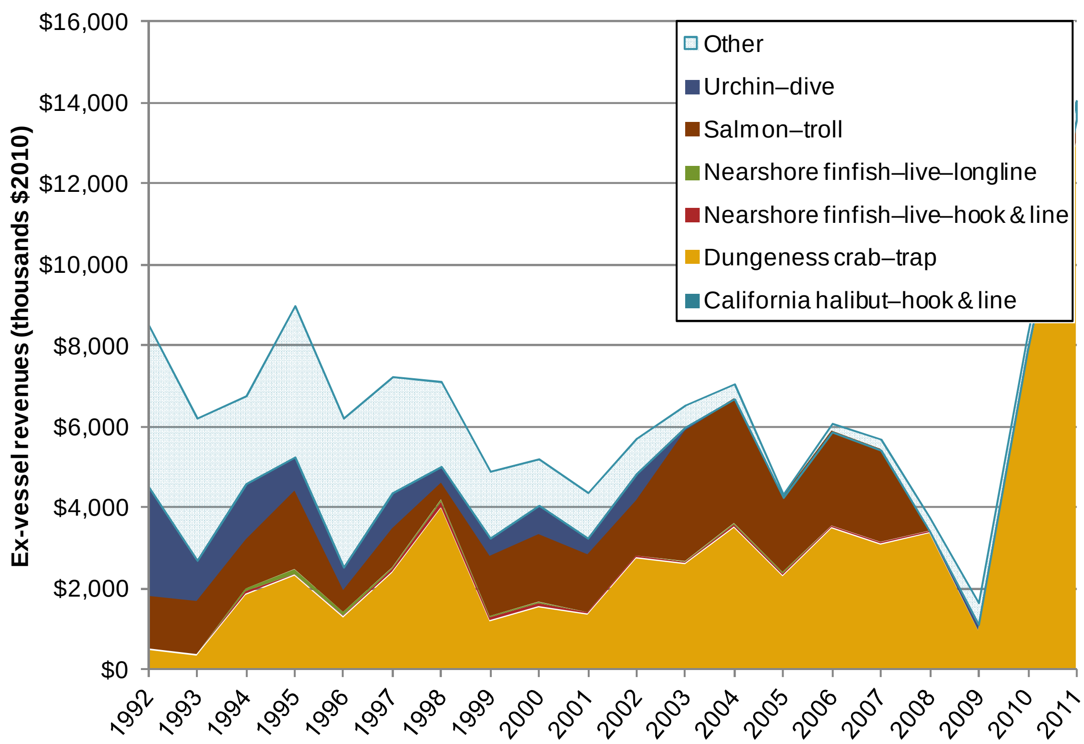
Source: Landings data from CDFW

Figure 57. Bodega Bay commercial landings for fisheries of interest, 1992–2011



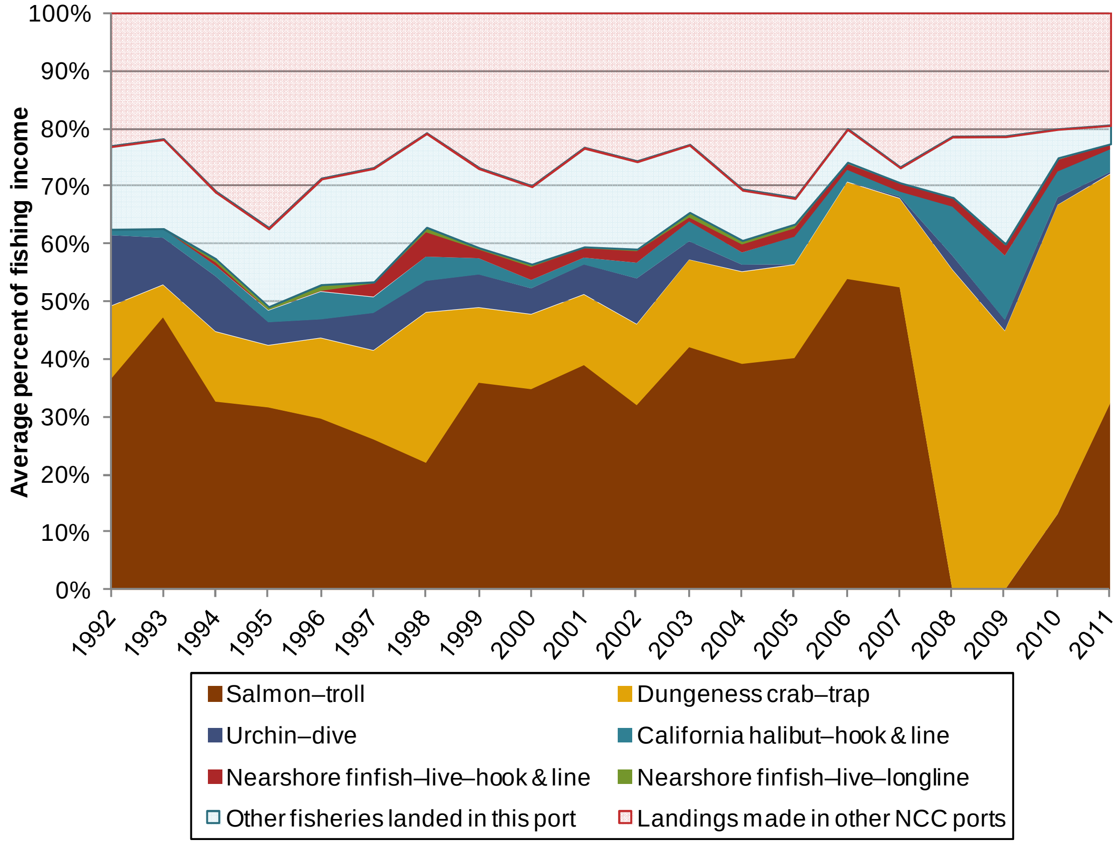
Source: Landings data from CDFW

Figure 58. Bodega Bay commercial ex-vessel revenue for fisheries of interest, 1992–2011



Source: Landings data from CDFW

Figure 59. Average percent of individual fishing income from commercial fisheries of interest, Bodega Bay, 1992–2011



Source: Landings data from CDFW

Table 113 displays the average annual percent change in total and average per fishermen ex-vessel revenue for each fishery in the port of Bodega Bay as compared with the respective changes in the North Central Coast region over the study period. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods.

Average annual ex-vessel revenue in the Dungeness crab–trap fishery in Bodega Bay were behind regional level increases in the initial pre-MPA sample period of 2000–2005, but were significantly higher in the pre-MPA period of 2005–2010 with overall increases of 136 percent in the port compared with 63.8 percent regionally. The acceleration lessened in the post-MPA period of 2010–2011, but still greater at 69 percent in Bodega Bay compared with 46.5 percent regionally.

Ex-vessel revenue for the Bodega Bay salmon–troll fishery decreased at an average annual percentage less than that observed in the region as a whole, at 25.4 percent overall and an increase of 1 percent average per fisherman in the port, compared with decreases of 40.4 percent overall and 13.5 percent per fisherman over the pre-MPA period of 2005–2009. Over 2000–2010, greater average annual gains were observed in the North Central Coast region, 158.7 percent overall and 45.3 percent per fisherman, than in Bodega Bay over the same time period, 90.3 percent overall and 29.3 percent per fisherman. Again, it should be noted that large percentage increases from 2010 to 2011 influenced the annual averages reported for the 2000–2011 period.

Table 113. Bodega Bay: Average annual percent change in total commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

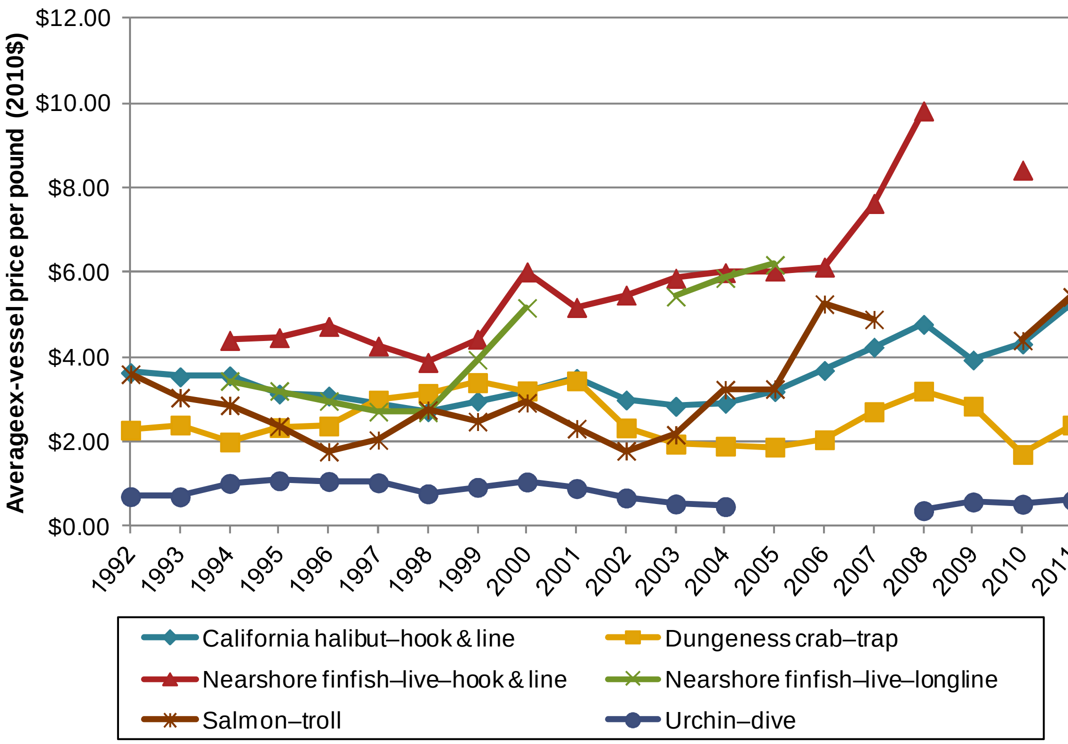
		Average annual percent change			
Fishery	**Commercial ex-vessel revenues**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
California halibut–hook & line	Bodega Bay total	11.9%	37.5%	-24.9%	20.2%
	Bodega Bay avg. per fisherman	3.7%	42.9%	-36.8%	17.8%
	North Central Coast region total	14.7%	27.6%	-16.2%	17.7%
	North Central Coast region avg. per fisherman	16.9%	1.6%	1.0%	8.5%
Dungeness crab–trap	Bodega Bay total	17.1%	136.0%	69.0%	75.9%
	Bodega Bay avg. per fisherman	20.4%	65.8%	57.3%	44.4%
	North Central Coast region total	24.3%	63.8%	46.5%	44.3%
	North Central Coast region avg. per fisherman	22.7%	33.2%	27.5%	27.9%
Nearshore finfish–live–hook & line	Bodega Bay total	10.9%	-5.3%	–	4.8%
	Bodega Bay avg. per fisherman	25.8%	45.7%	–	33.3%
	North Central Coast region total	1.9%	-4.4%	14.5%	0.2%
	North Central Coast region avg. per fisherman	26.0%	2.7%	-7.5%	12.4%
Nearshore finfish–live–longline	Bodega Bay total	62.5%	–	–	62.5%
	Bodega Bay avg. per fisherman	57.8%	–	–	57.8%
	North Central Coast region total	13.1%	2.5%	-2.9%	6.9%
	North Central Coast region avg. per fisherman	2.3%	4.4%	70.0%	9.4%
Salmon–troll	Bodega Bay total	13.9%	-25.4%	819.3%	90.3%
	Bodega Bay avg. per fisherman	15.3%	1.0%	155.4%	29.3%
	North Central Coast region total	17.8%	-40.4%	1460.2%	158.7%
	North Central Coast region avg. per fisherman	11.5%	-13.5%	331.8%	45.3%
Urchin–dive	Bodega Bay total	-34.7%	773.7%	-56.9%	193.1%
	Bodega Bay avg. per fisherman	-40.5%	1054.1%	-56.9%	269.9%
	North Central Coast region total	-28.3%	29.9%	-18.0%	-0.9%
	North Central Coast region avg. per fisherman	-15.0%	54.5%	-34.4%	14.8%

Source: Landings data from CDFW

— indicates zero value data in the sample years

Figure 60 displays the average ex-vessel prices over time for select fisheries of interest in Bodega Bay over the 1992–2011 study period. The Dungeness crab–trap ex-vessel price experienced gains in the first half of the study period, peaking at $3.40 per pound in 1999 before mostly declining again, and was at $2.40 per pound in 2011. From 1992 to 2011, the salmon–troll fishery average ex-vessel price in Bodega Bay increased 50.7 percent from $3.60 per pound to $5.43 per pound respectively. The largest gains over the study period, however, were made in the nearshore finfish–live–hook & line fishery, which more doubled from 1994 to 2008 (from $4.40 to $9.83 per pound).

Figure 60. Average ex-vessel prices over time, target commercial fisheries, Bodega Bay, 1992–2011



Source: Landings data from CDFW

Figure 61 displays landings, ex-vessel revenue, and number of fishermen for the California halibut–hook & line fishery in Bodega Bay over 1992–2011. Landings peaked, along with the number of fishermen (40), in 1996 at 11,349 pounds. Ex-vessel revenue, however, peaked in 2010 at $36,489. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 62, and consistently rose over the study period with fishermen in 2011 landing 275 pounds of California halibut–hook & line for $1,441 each on average.

Figure 63 displays landings, ex-vessel revenue, and number of fishermen for the Dungeness crab–trap fishery in Bodega Bay over 1992–2011. Ex-vessel revenue in this fishery was lowest in 1993 at $339,966, and increased nearly twenty-five times reaching $13 million by 2011, which was the highest year in the study period. Although landings and ex-vessel revenue consistently increased overall, the number of fishermen in the Dungeness crab–trap fishery in Bodega Bay declined 42 percent from 174 fishermen in 1992 to 101 in 2011. As such, trends for individual fishermen in this port and fishery over the study period rose significantly, see Figure 64. In 1992 the average fisherman landed 1,248 pounds for $2,846 in ex-vessel revenue making a total of 5 landings to do so. In 2011, these values increased to 53,434 pounds landed for $128,327 in ex-vessel revenue over a total of 17 landings per fisherman on average. While all regional Dungeness crab–trap fishermen experienced large gains in their average ex-vessel revenue from 1992 to 2011, those in Bodega Bay had the largest gains.

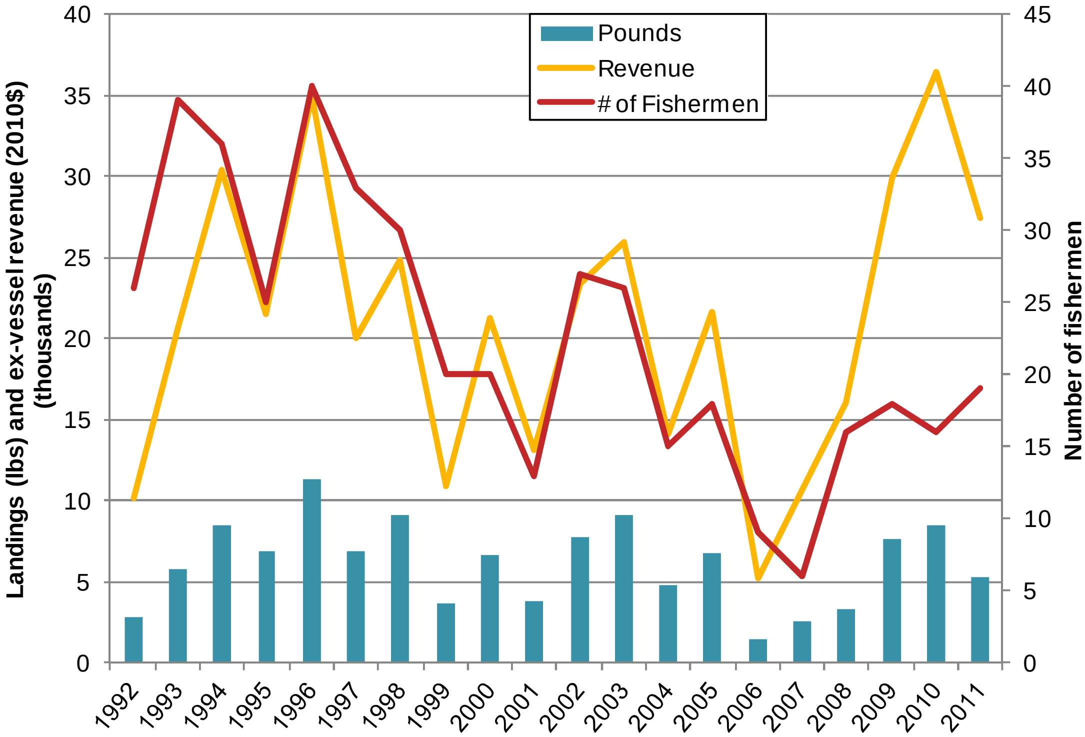
Figure 65 displays landings, ex-vessel revenue, and number of fishermen for the nearshore finfish–live–hook & line fishery in Bodega Bay over 1992–2011. Landings peaked at 33,363 pounds for $129,426 in ex-vessel revenue by 35 fishermen in 1998, which were the highest recorded from the study period starting from zero in 1992. On average, nearshore finfish–live–hook & line fishermen made 133.2 percent more each in 2010 ($8,157) than they did in 1992 ($3,498), see Figure 66.

Figure 67 displays landings, ex-vessel revenue, and number of fishermen for the nearshore finfish–live–longline fishery in Bodega Bay over 1992–2011. Landings and ex-vessel revenue peaked early in 1995 at 37,499 pounds and $120,242 before dropping off to zero in 2011. Similar trends were observed at the individual fishermen level, presented as averages in Figure 68.

Figure 69 displays landings, ex-vessel revenue, and number of fishermen for the salmon–troll fishery in Bodega Bay over 1992–2011. Over the study period, total landings averaged 485,074 pounds and ex-vessel revenue averaged $1.4 million annually. At most landings were at 1.5 million pounds for $3.3 million in ex-vessel revenue, which occurred in 2003. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 70. Over 1992–2011 the average salmon–troll fisherman in Bodega Bay landed seven times totaling 2,227 pounds and $6,265 in ex-vessel revenue annually. These values also peaked in 2003, at 7,321 pounds and $15,899 in ex-vessel revenue per fisherman made all over nine annual landings.

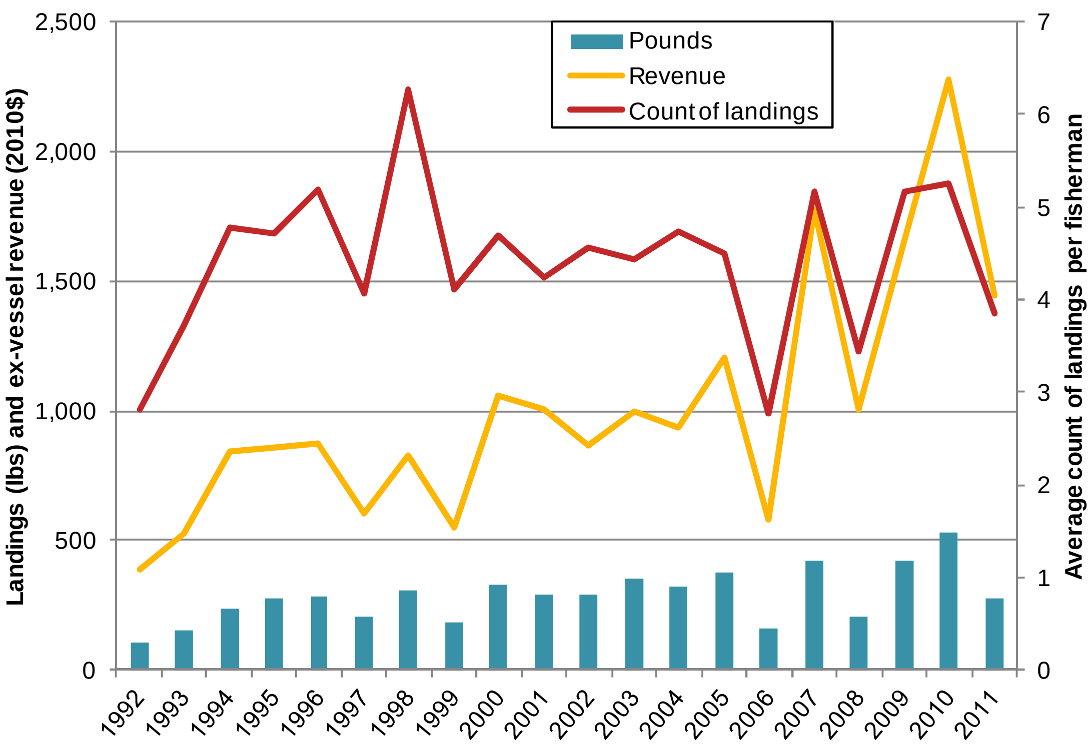
Figure 71 displays landings, ex-vessel revenue, and number of fishermen for the urchin–dive fishery in Bodega Bay over 1992–2011. This fishery was more popular at the beginning of the study period when a maximum of 3.8 million pounds for $2.7 million in ex-vessel revenue were landed in Bodega Bay by 165 fishermen in 1992. By 2011, there were only 3 urchin–dive fishermen in Bodega Bay, and total landings and ex-vessel revenue of 57,048 pounds and $35,549 respectively. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 72. While total landings and ex-vessel revenue had fallen to lower amounts by the end of the study period, the three active fishermen made more in 2009 on average than any other fishermen during the study period, landing 72,495 pounds for $42,424 in ex-vessel revenue over 20 landings each.

Figure 61. California halibut–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, Bodega Bay, 1992–2011



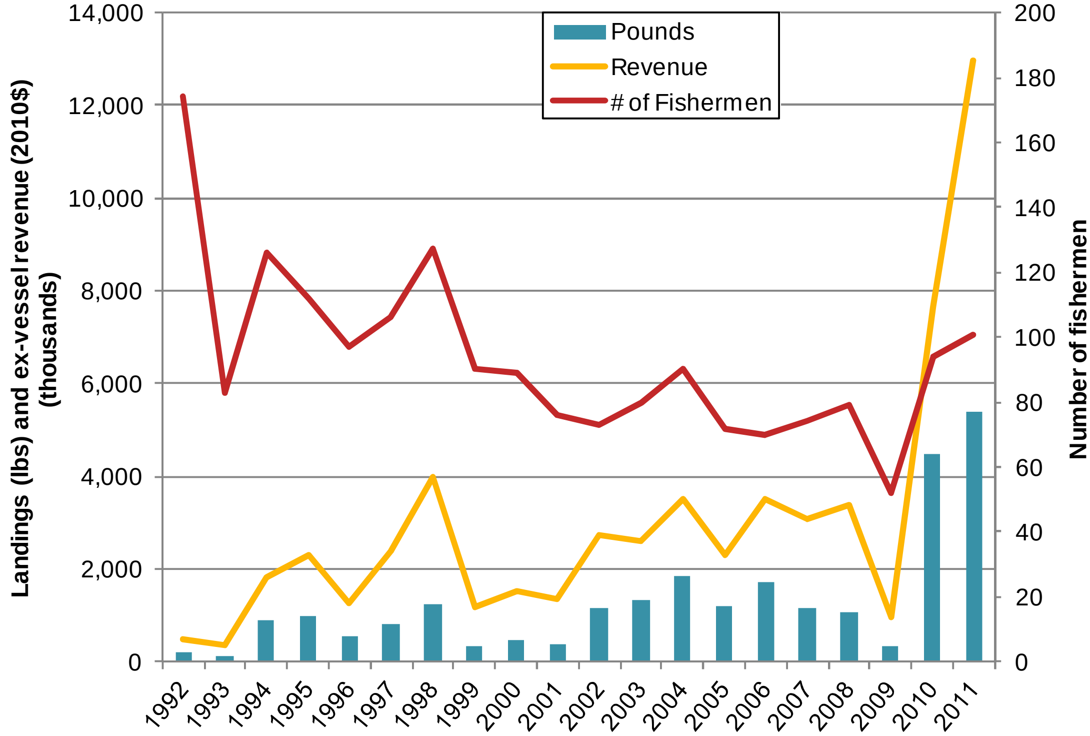
Source: Landings data from CDFW

Figure 62. California halibut–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bodega Bay, 1992–2011



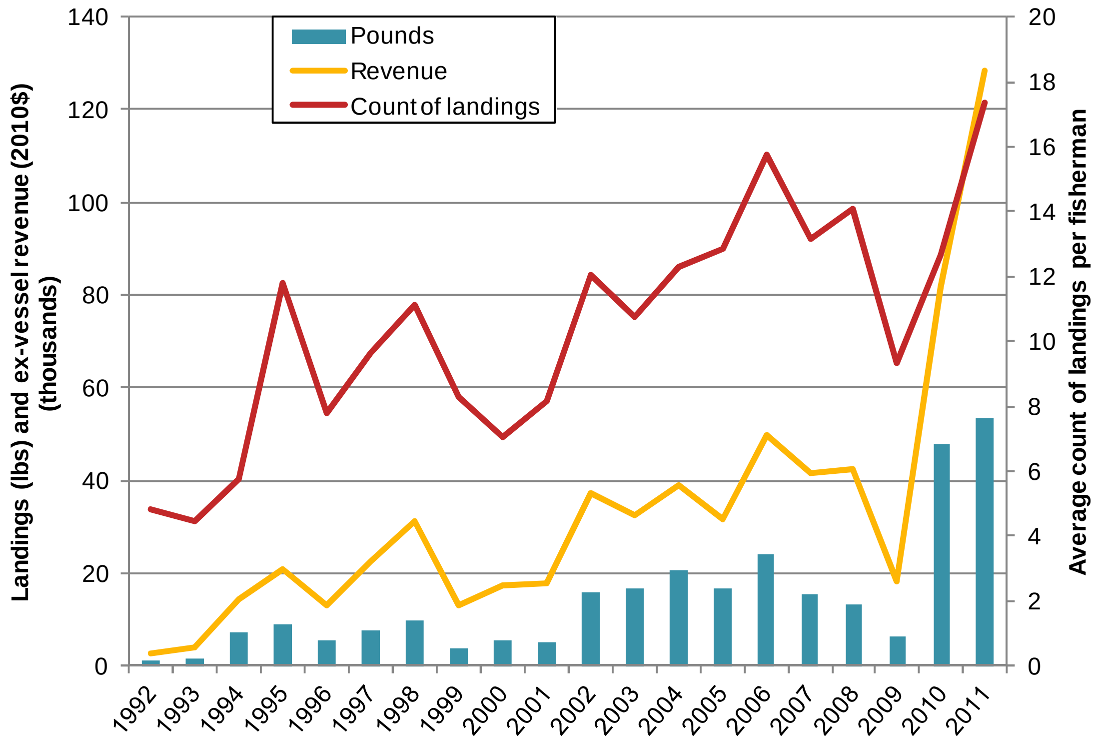
Source: Landings data from CDFW

Figure 63. Dungeness crab–trap: Commercial landings, ex-vessel revenue, and number of fishermen, Bodega Bay, 1992–2011



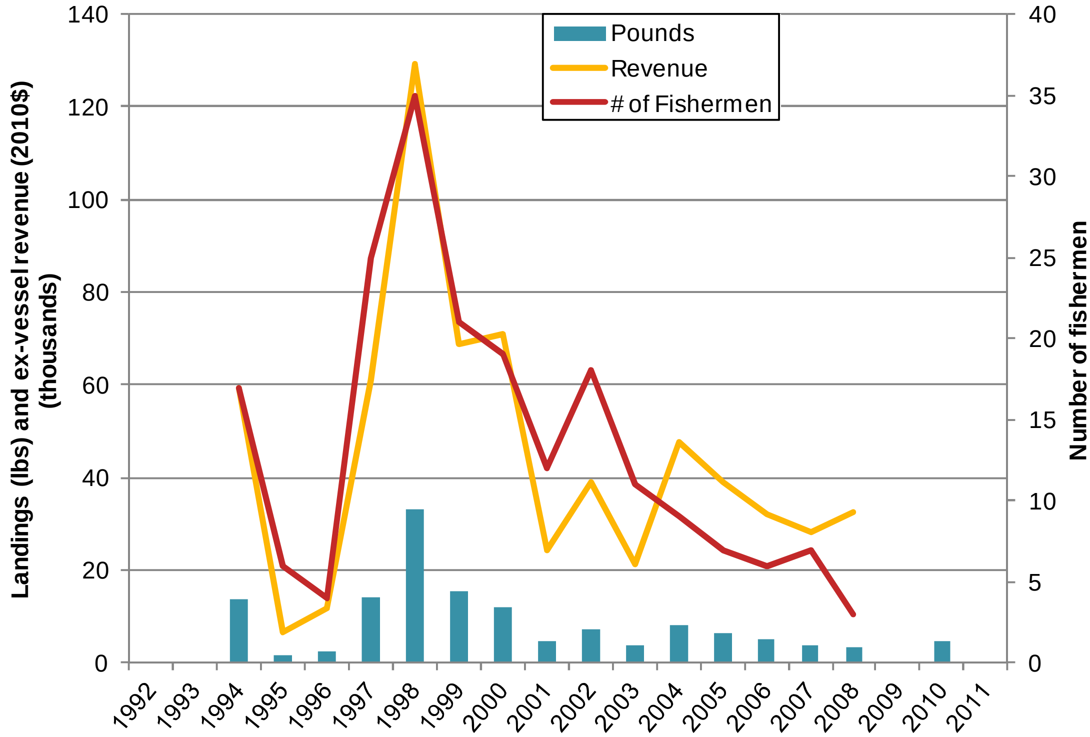
Source: Landings data from CDFW

Figure 64. Dungeness crab–trap: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bodega Bay, 1992–2011



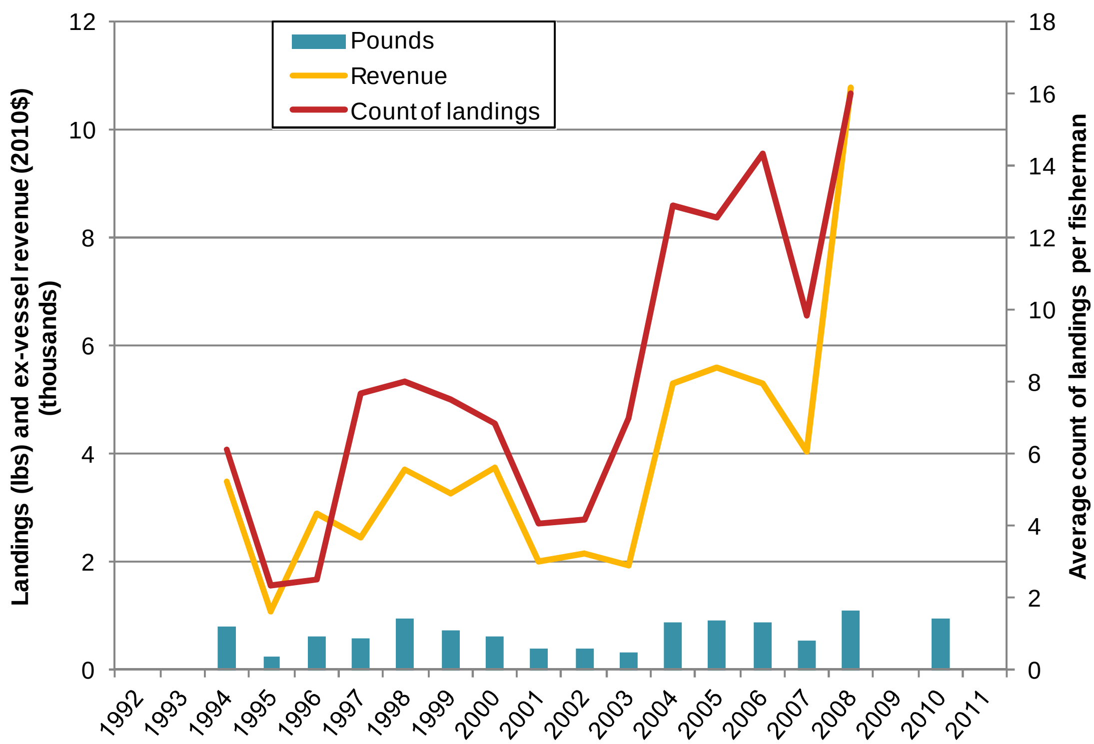
Source: Landings data from CDFW

Figure 65. Nearshore finfish–live–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, Bodega Bay, 1992–2011



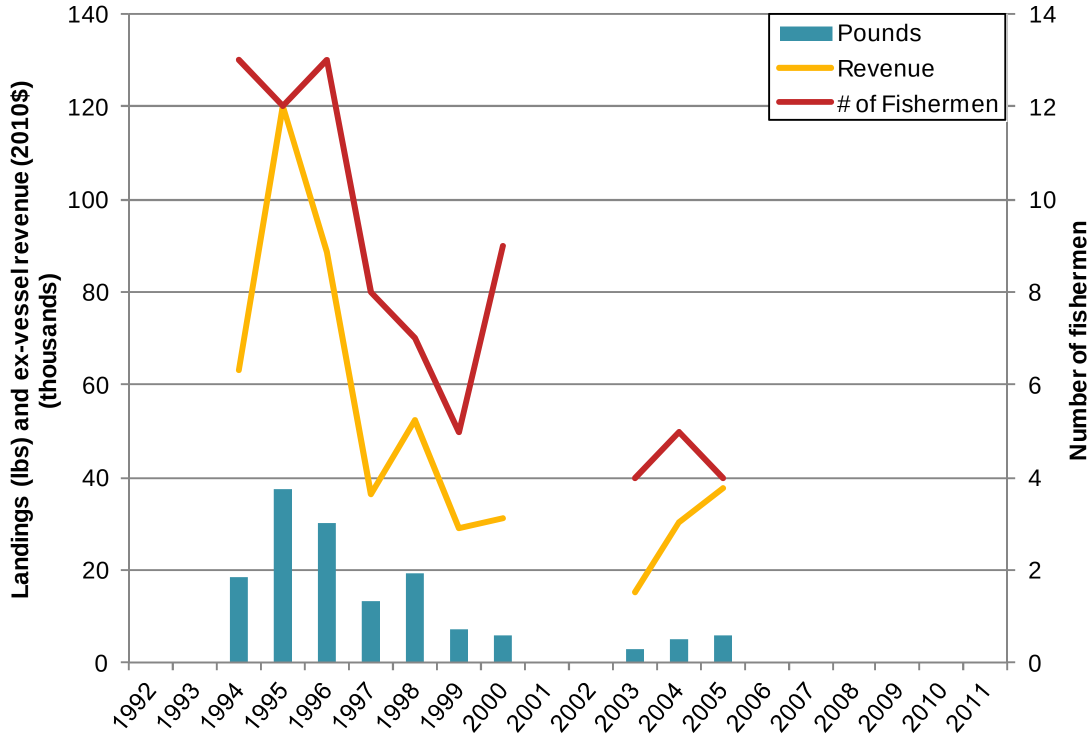
Source: Landings data from CDFW Year (Ex-vessel revenue - # of fishermen): 2010($40,783 – 5)

Figure 66. Nearshore finfish–live–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bodega Bay, 1992–2011



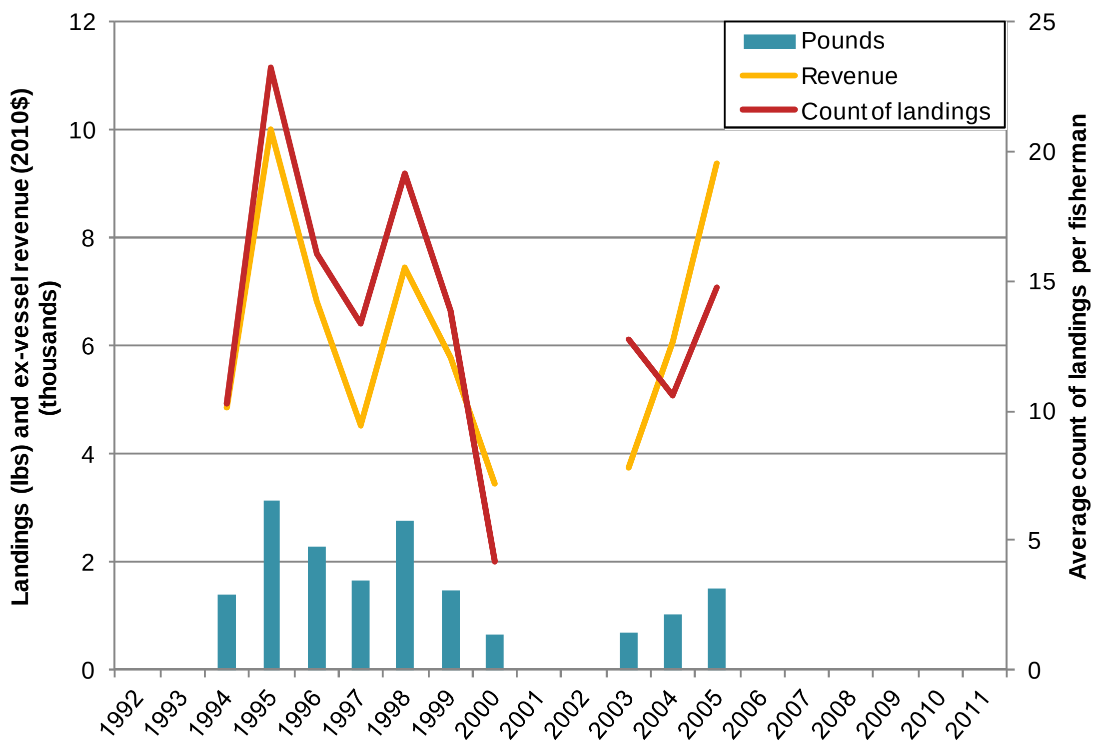
Source: Landings data from CDFW Year (Ex-vessel revenue – count of landings): 2010($8,157 - 11)

Figure 67. Nearshore finfish–live–longline: Commercial landings, ex-vessel revenue, and number of fishermen, Bodega Bay, 1992–2011



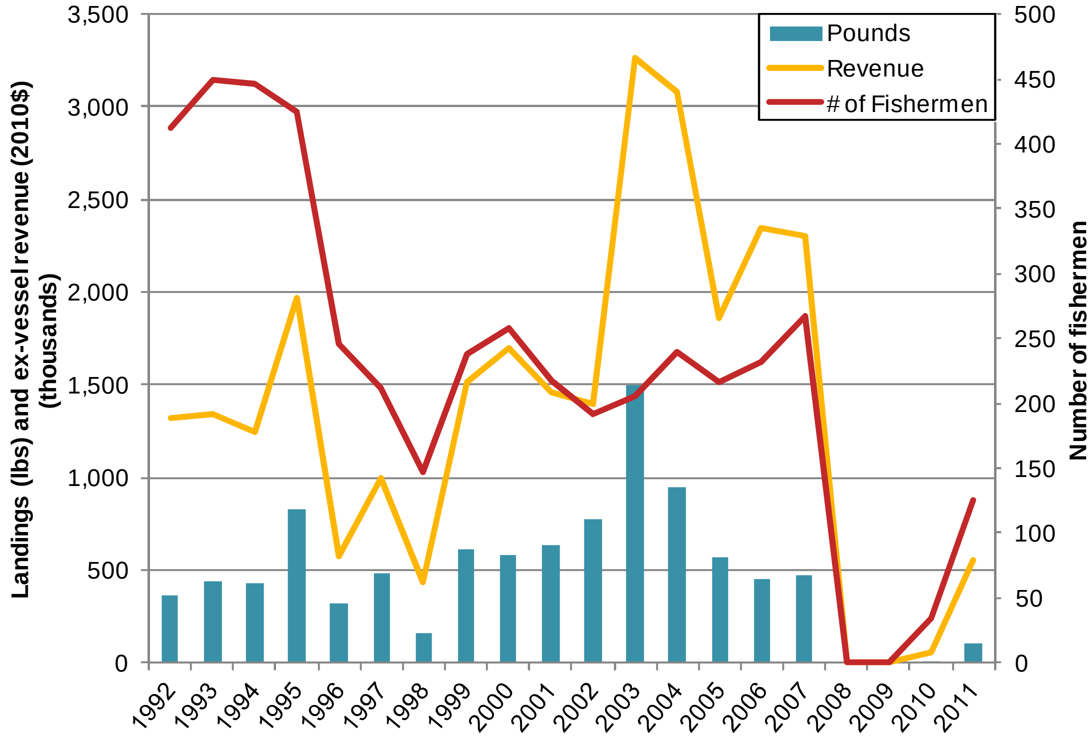
Source: Landings data from CDFW

Figure 68. Nearshore finfish–live–longline: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bodega Bay, 1992–2011



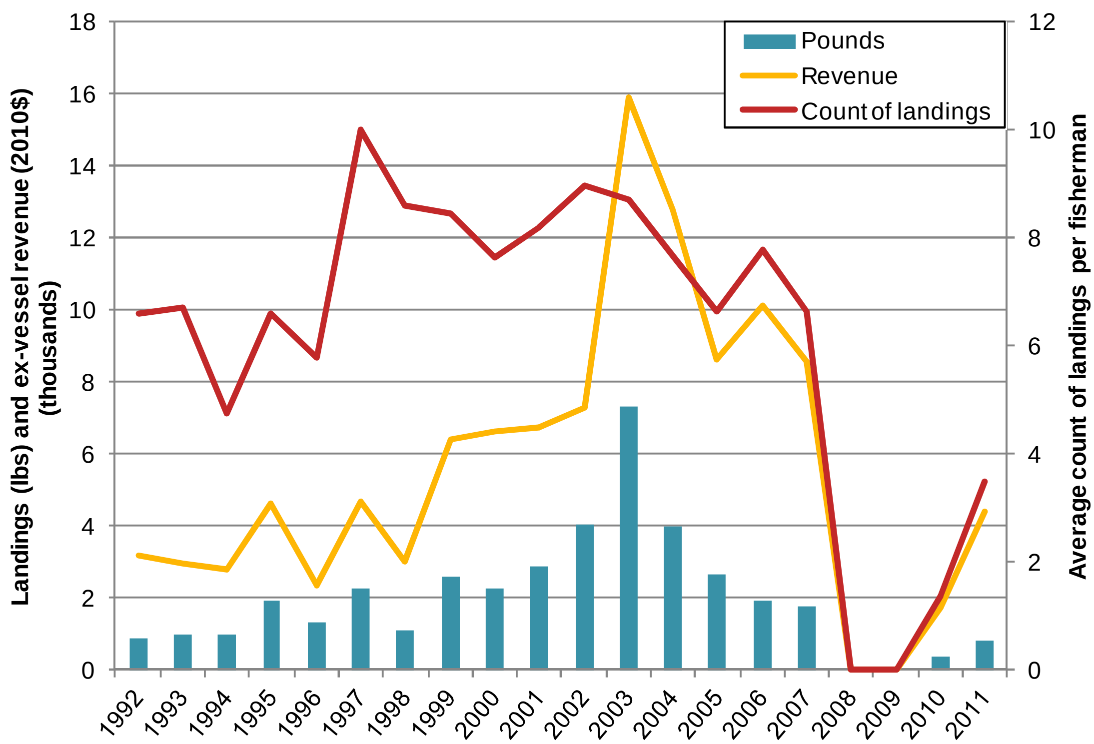
Source: Landings data from CDFW

Figure 69. Salmon–troll: Commercial landings, ex-vessel revenue, and number of fishermen, Bodega Bay, 1992–2011



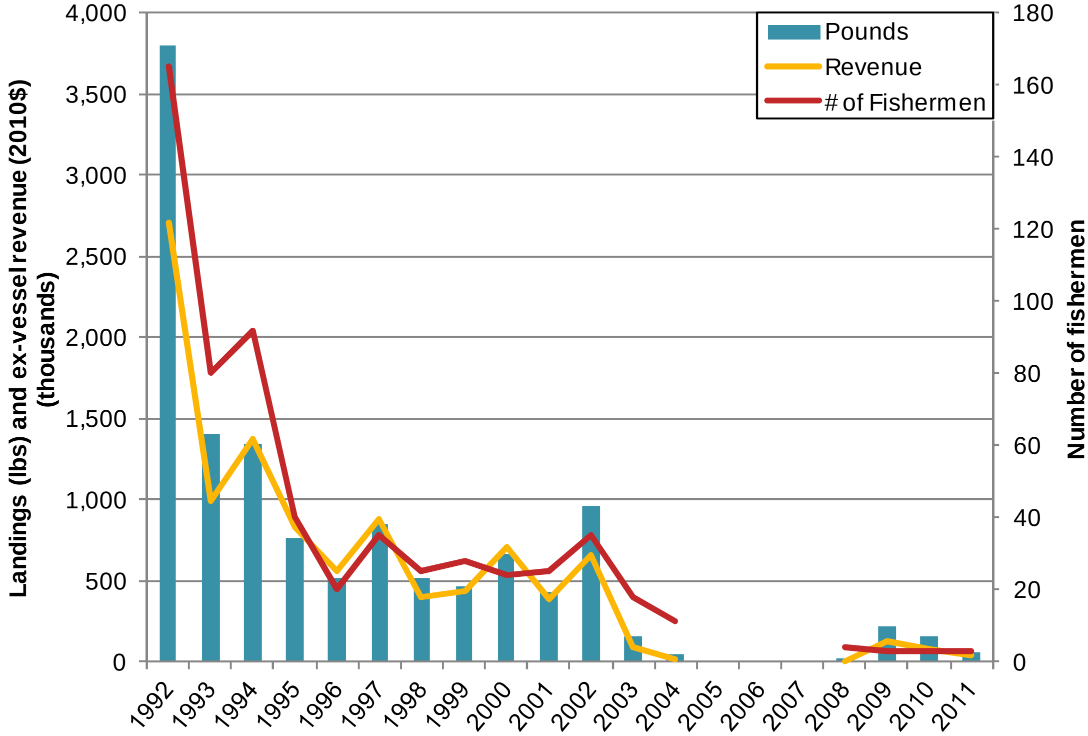
Source: Landings data from CDFW

Figure 70. Salmon–troll: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bodega Bay, 1992–2011



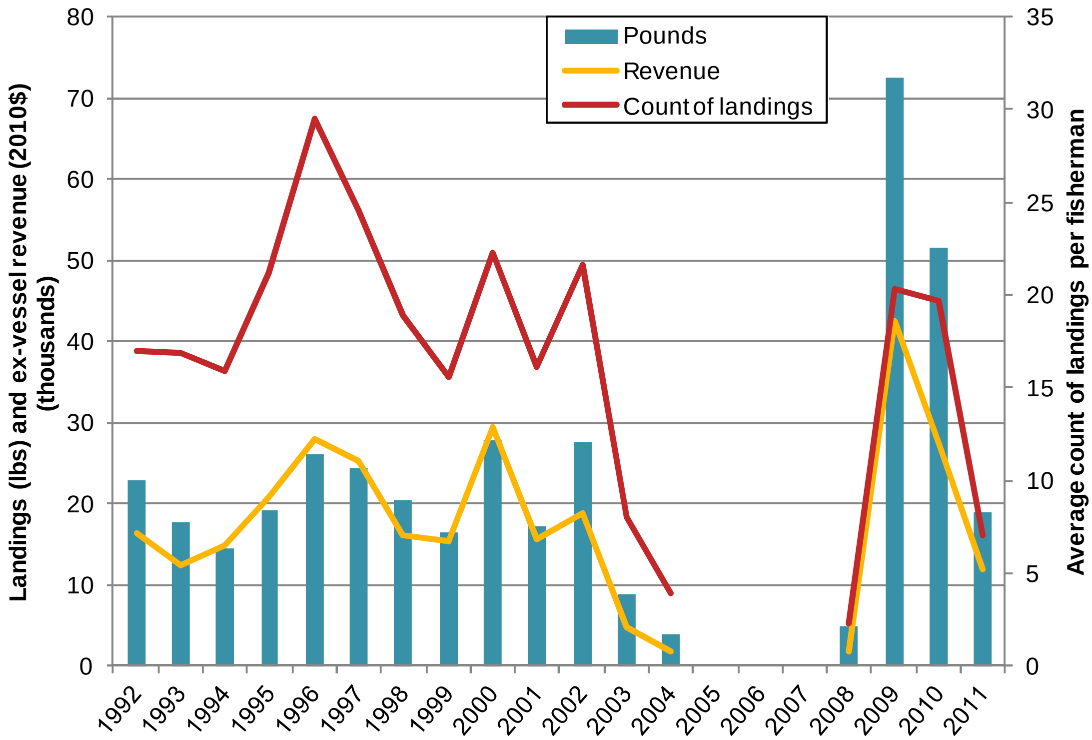
Source: Landings data from CDFW

Figure 71. Urchin–dive: Commercial landings, ex-vessel revenue, and number of fishermen, Bodega Bay, 1992–2011



Source: Landings data from CDFW

Figure 72. Urchin–dive: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bodega Bay, 1992–2011



Source: Landings data from CDFW

4.2.2. Bodega Bay Commercial Baseline Characterization

In 2010, fishermen landing in Bodega Bay generated approximately 7.9 million dollars of revenue across the five target fisheries, over 97 percent of which was from the Dungeness crab–trap fishery. Of the 132 fishermen who landed in at least one of the target fisheries, over 71 percent of them landed Dungeness crab. We interviewed 25 fishermen in Bodega Bay, 23 of who participated in the Dungeness crab–trap fishery.

Table 114. Number of commercial fishermen interviews conducted and fishery ex-vessel revenue value, 2010, non-spatial survey, Bodega Bay

Fishery	2010 total ex-vessel revenue (2010$)	Total number of individuals in 2010 landings	Number interviewed
California halibut–hook & line	$36,489	16	4
Dungeness crab–trap	$7,668,025	94	23
Nearshore finfish–live–fixed gear	$43,601	7	1
Salmon–troll	$60,596	35	6
Urchin–dive	$82,438	3	1
All target fisheries (unique individuals)	$7,891,150	132	25

Source: California Department of Fish and Wildlife, Current study

In Bodega Bay the average fisherman interviewed was 53.9 years old in 2010, which was slightly older than the regional average of 51.9 years old. Similarly, they had slightly more commercial fishing experience than the average fisherman in the region (30.5 years in Bodega Bay compared to the regional average of 26.9 years of experience). Those who participated in California halibut–hook & line had considerably less commercial fishing experience (9.5 years), on average, than those participating in other fisheries. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery.

Table 115. Average age and years of experience commercial fishing, 2010, Bodega Bay

	Age			Years of experience		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut–hook & line	4	46.3	8.0	4	9.5	6.4
Dungeness crab–trap	23	54.9	12.6	23	32.1	13.5
Nearshore finfish–live–fixed gear	1	*	*	1	*	*
Salmon–troll	6	61.2	8.4	6	32.7	13.0
Urchin–dive	1	49.0	*	1	25.0	*
All target fisheries (unique individuals)	25	53.9	12.5	25	30.5	14.2

Source: Current study

** indicates data were collected but cannot be shown due to confidentiality constraints*

Across all the ports in the study region, on average fishermen interviewed in Bodega Bay experienced the greatest increase in the percent of their total personal income from commercial fishing between 2007 and 2010 (21 percent). It should be noted that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. As shown in Table 116, an increase in the percent of total personal income from commercial fishing was particularly true in the salmon–troll fishery. This may have been due to the limited season in 2010 and that we did not specifically target fishermen with salmon landings, but rather included questions regarding the salmon fishery if a respondent we were already speaking to targeted it in 2010. As a result, most of the salmon fishermen we spoke to were full time fishermen who considered salmon to be part of their portfolio, but relied very little on it in 2010. Additionally, when the season is poor and heavily regulated it becomes harder for part time fishermen to make enough revenue to cover their costs in the little time available. Eleven respondents indicated they had an additional source of income besides commercial fishing .The most frequently reported sources were fishing related research and some combination of retirement, social security, and investments.

Table 116. Percent change in income from overall commercial fishing from 2007 - 2010, Bodega Bay

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent Change**
California halibut–hook & line	—	—	—	4	65.0%	43.6%	n/a
Dungeness crab–trap	37	89.1%	18.6%	23	86.1%	23.3%	-3.4%
Nearshore finfish–live–fixed gear	1	*	*	1	*	*	n/a
Salmon–troll	63	69.1%	36.8%	6	88.3%	20.4%	27.8%
Urchin–dive	6	65.8%	30.4%	1	*	*	*
All target fisheries (unique individuals)	70	68.5%	36.2%	24	82.9%	27.6%	21.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

Table 117. Other sources of income other than commercial fishing in 2010, Bodega Bay

	Number responding					
Response	**California halibut–hook & line**	**Dungeness crab–trap**	**Nearshore finfish–live–fixed gear**	**Salmon–troll**	**Urchin–dive**	**All fisheries (unique individuals)**
Construction/Contractor	—	—	*	—	—	—
Farming/Ranching	—	2	*	—	—	2
Fisheries research	—	3	*	1	—	3
Harbor/City job	—	—	*	—	—	1
Office work	—	—	*	—	—	—
Other fishing related work	—	—	*	—	—	—
Other specialized work	1	1	*	1	—	1
Property management	—	—	*	—	—	—
Retirement/Social Security/Investments	1	3	*	2	—	3
Salmon disaster relief	—	1	*	—	—	1
Skilled labor	1	1	*	—	—	2
Number of individuals responding	2	9	*	2	—	11

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

As indicated below in Table 118, Bodega Bay on average maintained a relatively similar percent of overall commercial fishing gross economic revenue (GER) used towards overall operating costs from 2007 to 2010. Respondents indicated that they had been fishing the salmon–troll fishery for the longest (32.3 years), while California halibut–hook & line was a relatively new fishery and on average had been fished for less than ten years. Dungeness crab–trap was the most frequently fished of the target fisheries (62.9 days in 2010) and salmon–troll was the least frequently fished (4.5 days in 2010) due to the short season in 2010. Also shown in Table 120, Dungeness crab–trap fishermen had more crew (1.9 people) on average across all respondents) and subsequently spent more of their gross economic revenue (GER) on crew (27.1 percent of their GER). California halibut–hook & line was the most proportionally fuel intensive fishery reported in Bodega Bay, with nearly a quarter of GER in the fishery going towards fuel alone.

Table 118. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Bodega Bay

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
California halibut–hook & line	—	—	—	4	32.3%	10.0%	n/a
Dungeness crab–trap	36	46.0%	16.6%	23	47.4%	10.6%	3.1%
Nearshore finfish–live–fixed gear	1	*	*	1	*	*	*
Salmon–troll	62	47.7%	22.7%	6	45.7%	3.9%	-4.2%
Urchin–dive	6	46.3%	5.9%	1	*	*	*
All target fisheries (unique individuals)	69	47.4%	21.7%	24	46.1%	12.0%	-2.8%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

Table 119. Years of experience and number of days targeting specific fisheries in 2010, Bodega Bay

	Years of experience in fishery			Days spent targeting fishery		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard Deviation
California halibut–hook & line	4	9.5	6.4	4	38.5	27.5
Dungeness crab–trap	23	26.1	15.7	20	62.9	25.7
Nearshore finfish–live–fixed gear	1	*	*	1	*	*
Salmon–troll	6	32.3	13.2	6	4.5	0.8
Urchin–dive	1	*	*	1	*	*

Source: Current study

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 120. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Bodega Bay

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut–hook & line	4	0.3	0.5	4	1.3%	2.5%	4	23.8%	20.6%
Dungeness crab–trap	23	1.9	0.6	23	27.1%	11.0%	19	12.5%	7.4%
Nearshore finfish–live–fixed gear	1	*	*	1	*	*	1	*	*
Salmon–troll	5	0.6	0.5	6	9.2%	10.2%	6	10.2%	1.6%
Urchin–dive	1	*	*	1	*	*	1	*	*

Source: Current study

** indicates data were collected but cannot be shown due to confidentiality constraints*

Fishermen were asked if they added or dropped fisheries since 2007 or if they did not fish a fishery in 2010. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. Of fishermen interviewed in 2011 there was little change in the composition of an individual's fisheries in Bodega Bay since 2007. One person added California halibut–hook & line, indicating he was new to commercial fishing since 2007. Additionally, two individuals added the Dungeness crab–trap fishery, one of whom was also new to commercial fishing since 2007 and the other noted he obtained a permit through the purchase of a new boat (Table 122) since 2007.

Table 121. Commercial fisheries added/dropped since 2007 or not fished in 2010, Bodega Bay

		Percent responding		
Fisheries	**Number responding**	**Added**	**Dropped**	**Not fished in 2010**
California halibut–hook and line	4	1	—	—
Dungeness crab–trap	23	2	—	—
Nearshore finfish	1	—	—	—
Salmon–troll	6	—	—	—
Urchin–dive	1	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 122. Reason for adding/dropping a fishery since 2007 or not fishing in 2010, Bodega Bay

	Number responding				
Response	**California halibut–hook & line**	**Dungeness crab–trap**	**Nearshore finfish–live– fixed gear**	**Salmon–troll**	**Urchin–dive**
New to commercial fishing	1	1	—	—	—
Purchased boat with permit	—	1	—	—	—
Not enough time due to other work	—	—	—	—	—
Increased difficulty due to MPAs	—	—	—	—	—
Bad season	—	—	—	—	—
Number responding	1	2	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Respondents were asked separately for each fishery to compare the success in his/her fishery in 2010 to that of the last five years. Fishermen were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in Table 124 through Table 126.

Both California halibut–hook & line and Dungeness crab–trap fishermen responded that they were doing better or the same than they had been in the previous five years (Table 123) and, like others across the region, noted that 2010 was a great year for the Dungeness crab–trap fishery due to natural fluctuations in the Dungeness crab population (Table 125). All respondents who participated in the salmon–troll fishery in 2010 indicated that their success in the fishery was significantly worse than it had been in years prior (Table 123). As shown in Table 124, the primary reason cited was that the regulated season was too short. Although data cannot be shown here for urchin divers due to confidentiality constraints, it should be noted that fishermen indicated that urchin divers have left Bodega Bay in over the past few years due to restrictions imposed by MPAs. As mentioned earlier, the one diver we were able to interview indicated that he now spends a large portion of the year fishing out of ports in southern California. Additionally, one fisherman we interviewed in Point Arena had moved to the port of Point Arena from Bodega Bay after the MPAs were implemented

Table 123. Overall success in specific commercial fishery in 2010 compared to previous five years, Bodega Bay

Fisheries	Number responding	Percent response: Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
California halibut–hook & line	4	—	25.0%	25.0%	50.0%	—	—
Dungeness crab - trap	23	—	82.6%	13.0%	4.3%	—	—
Nearshore finfish–live–fixed gear	1	*	*	*	*	*	*
Salmon–troll	6	—	—	—	—	—	100.0%
Urchin–dive	1	*	*	*	*	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 124. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Bodega Bay

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	—	—	1	6	1
	Responses	**Count of responses**				
Worse	Regulated season too short	—	—	*	6	*
Worse	MPAs	—	—	*	1	*
Worse	No permit required	—	—	*	—	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 125. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Bodega Bay

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	2	21	1	4	—
	Responses	**Count of responses**				
Better	Larger quantity of fish	1	10	*	—	—
	Peak of natural cycle	—	15	*	—	—
	Good weather	1	—	*	—	—
	Good ocean conditions	—	—	*	—	—
	Good quality fish	1	—	*	—	—
	More bait/feed in the ocean	—	—	*	—	—
Worse	Low quantity of fish	—	—	*	3	—
	Bad weather	—	—	*	1	—
	Poor ocean conditions	—	—	*	—	—
	Loss of salmon spawning grounds	—	—	*	—	—
	Red tide	—	—	*	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 126. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Bodega Bay

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	1	—	—	—	—
	Responses	**Count of responses**				
Better	Able to fish more frequently	1	—	—	—	—
	Becoming more experienced	—	—	—	—	—
Worse	Others changing fishery	—	—	—	—	—
	Boat problems/breakdowns	—	—	—	—	—
	No access to live bait	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

4.3. Bolinas

Bolinas, in Marin County, is located only 13 miles northwest of San Francisco, but can be over an hour drive. Bolinas was first settled as Rancho Las Baulines in 1846, through a Mexican land grant and its' first post office opened in 1863 (Durham 1998). According the 2010 US Census, Bolinas had a population of 1,620, an estimated per capita income (2007-2011) of $38,233, and a mean household income of $90,875 (US Census Bureau 2010). The primary employment sector is 'professional, scientific, management, administrative, and waste management' (CDFG 2007). In 1971, two oil tankers collided near the Golden Gate Bridge and spilled more than 800,000 gallons of oil into the area. Thousands of birds and millions of marine creatures near Bolinas bay, beaches, and lagoon were killed, and it took several years before tidal life was restored (Johnson 2007).

Fishermen in Bolinas are limited by the small size of the port and lack of available infrastructure. This has impacted their fisheries in a variety of ways. Fishermen mentioned that their historical fishing grounds for the nearshore finfish–fixed gear fishery were primarily the Farallon Islands; however, in order to reach the Farallons they must transit their rockfish catch through federal waters, which requires a federal vessel monitoring system (VMS). Fishermen explained that the VMS is not affordable for small boat fishermen with small amounts of nearshore rockfish quotas and that their port lacks electricity which would be required to maintain such systems. Fishermen also mentioned that the compounding limitations of this, in addition to the recently established MPAs in surrounding waters have led to overfishing of rockfish in the Bolinas area. As a result, fishermen in Bolinas have become more reliant on the Dungeness crab-trap and California halibut-hook & line fishery even as important California halibut fishing grounds were lost by MPA established in the Point Reyes area. This is further compounded by the increase in the number of fishermen participating in the California halibut-hook & line fishery. In particular, Bolinas fishermen mentioned the increase frequency of CPFV operators in the Bolinas area fishing for California halibut and the lack of access or ability of Bolinas fishermen to compete with the live bait used by CPFV operators. . Bolinas fishermen noted that if CPFV operators are fishing with live bait that California halibut will be less likely to be lured by their artificial bait and often have to move to other grounds which has been severely limited by MPAs.

4.3.1. Bolinas Commercial Fisheries Historical Trends and Initial Changes

Bolinas contributed an average of 0.3 percent of total landings and 0.7 percent of total ex-vessel revenue to the North Central Coast region annually over 1992–2011. Despite being the smallest port in the North Central Coast region, Bolinas was the only regional port to experience overall growth in landings and ex-vessel revenue while maintaining a relatively consistent number of fishermen over the study period, see Figure 73. In fact, the number of fishermen decreased only 16.7 percent from 1992 (12) to 2011 (10), which was far below the regional decrease over the same period (72.5 percent). That said, it must be noted that the total number of fishermen in this port never varied greatly, ranging from a minimum of 5 (in 2001) and a maximum of 15 (in 1996). Landings and ex-vessel revenue were at their lowest in 1992 at 8,432 pounds and $19,742 respectively, and peaked in 2011 at 81,229 pounds and $261,648 respectively. While these are still modest amounts in relation to other regional ports, landings and ex-vessel revenue were nearly nine and twelve times higher respectively than they were in 1992 by 2011.

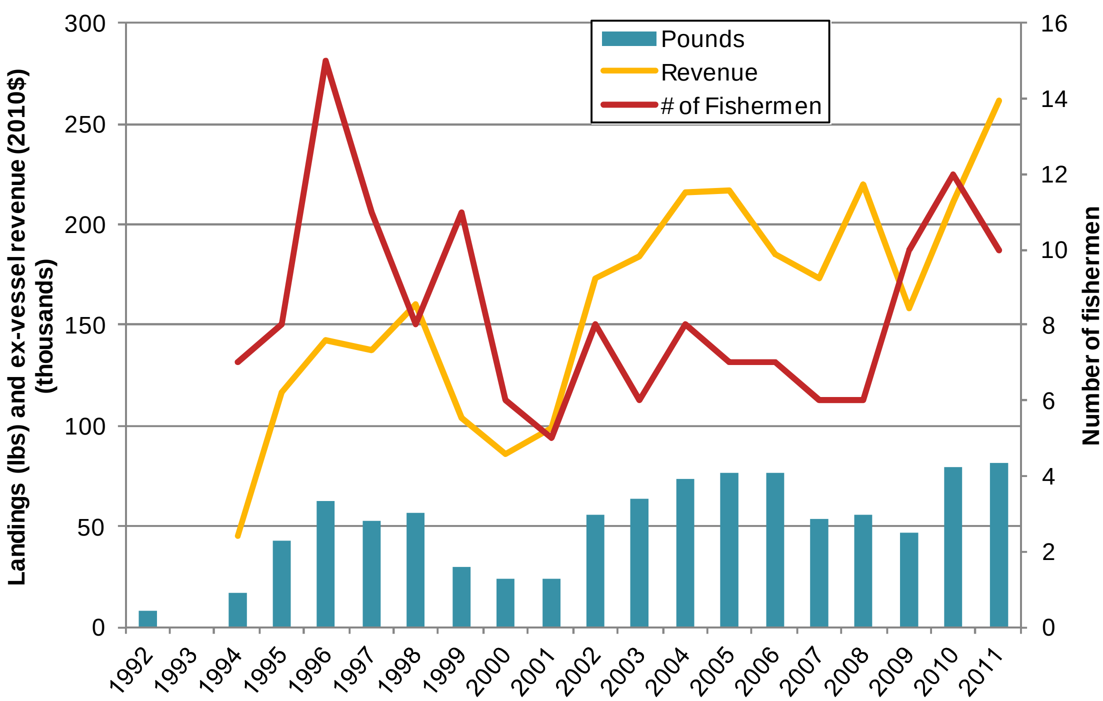
Figure 74 and Figure 75 display the composition of landings and ex-vessel revenue for select fisheries of interest over 1992 to 2011 in Bolinas. Because these figures also display all other landings and ex-vessel revenue (including necessary suppressions from the fisheries of interest) in the category labeled 'other', it is possible to tell approximately what portion the six fisheries of interest represent of the port's total landings and ex-vessel revenue over the study period. From 1992–2011, landings and ex-vessel revenue from the six fisheries of interest constituted an average of 86.9 percent and 93 percent respectively of total landings and ex-vessel revenue from all fisheries in Bolinas. Averaging annually across the study period, the top three additional fisheries in Bolinas contributing to landings and ex-vessel revenue over the study period included nearshore finfish–dead–hook & line (1 percent of landings and 0.6 percent of revenue), white croaker (0.7 percent and 0.3 percent), and lingcod–hook & line (0.5 percent and 0.25). The spike in 'other' landings and ex-vessel revenue in 2007 is mostly due to the nearshore–dead–hook & line fishery, which constituted 9.6 percent of total ex-vessel revenue in the port that year.

The majority of ex-vessel revenue in Bolinas, especially in the latter half of the study period, came from the Dungeness crab–trap fishery, constituting at most 91 percent of total ex-vessel revenue in the port over the study period, in 2008. The California halibut-hook & line fishery grew the most in the port and, among all other North Central Coast region ports, reached its greatest percentage of total port landings in Bolinas, even though Bolinas did not land the majority regional share in the California halibut-hook & line fishery (San Francisco did, see Figure 16). Beginning at only 2.6 percent of total ex-vessel revenue in Bolinas at $518, by 2011 ex-vessel revenue increased by over 65 times to reach $34,873 or 13.3 percent of total ex-vessel revenue in the port.

Figure 76 displays the average percent contribution to fishing income for those fishermen who made landings in Bolinas over the study period from the six fisheries of interest, from other fisheries landed in Bolinas, and from landings from all fisheries landed in other North Central Coast region ports. This figure shows reliance on a fishery but also on a given port. Again, the significance of the Dungeness crab–trap and California halibut-hook & line fisheries is evident, as they respectively constituted 37 percent and 23.1 percent of the average individual fishing income annually; this was the highest percentage observed due to the California halibut-hook & line fishery in the region.

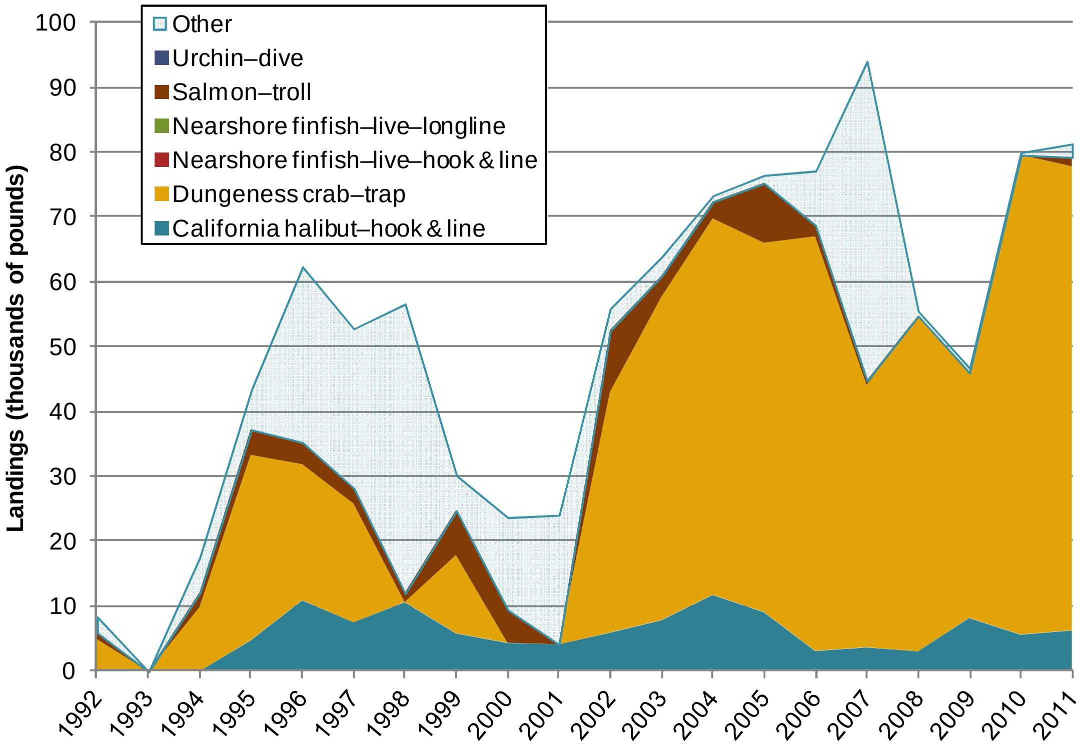
Over 1992–2011, the increasing reliance on ex-vessel revenue from Bolinas by fishermen who landed there is especially notable, and varied most in Bolinas relative to the other North Central Coast region ports. In 1992, fishermen who landed in Bolinas derived only 50 percent of their total regional fishing income on average from the port. This percentage increased to nearly 100 percent in 2007 at most, before declining again in the last few years of the study period. In 2011, fishermen who landed in Bolinas received 76.8 percent of their regional fishing income on average from landings made in that port.

Figure 73. Bolinas total commercial landings, ex-vessel revenue, and number of fishermen, all fisheries, 1992–2011



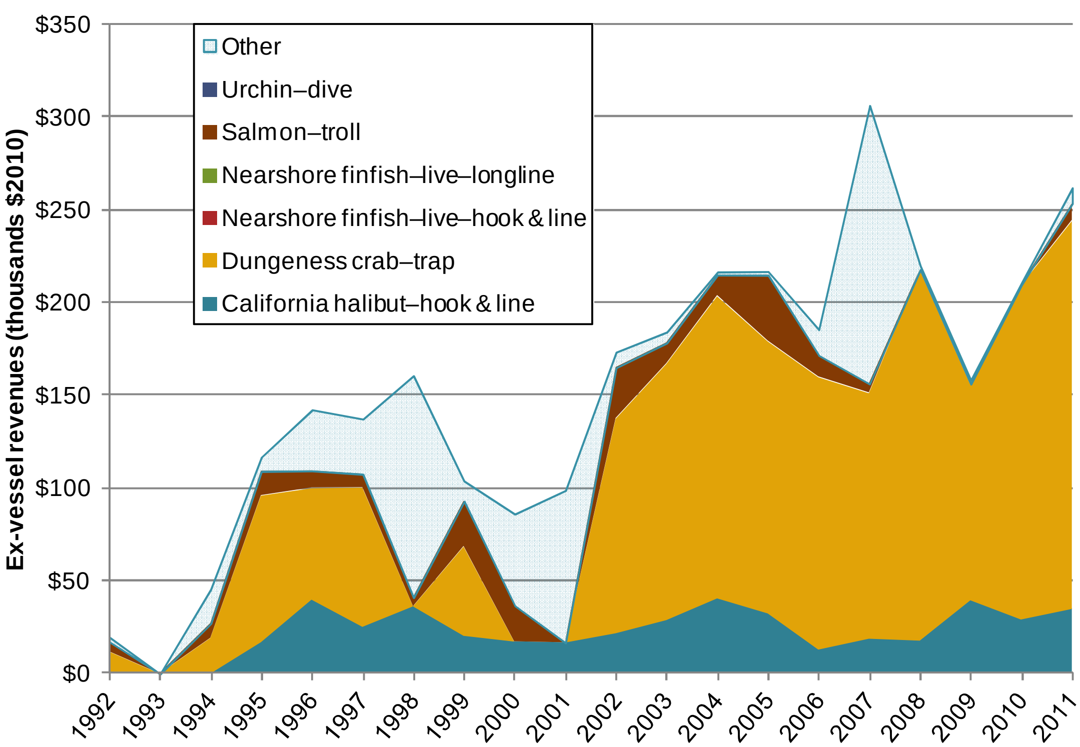
Source: Landings data from CDFW Year (Ex-vessel revenue - # of fishermen): 1992($19,742 - 12)

Figure 74. Bolinas commercial landings for fisheries of interest, 1992–2011



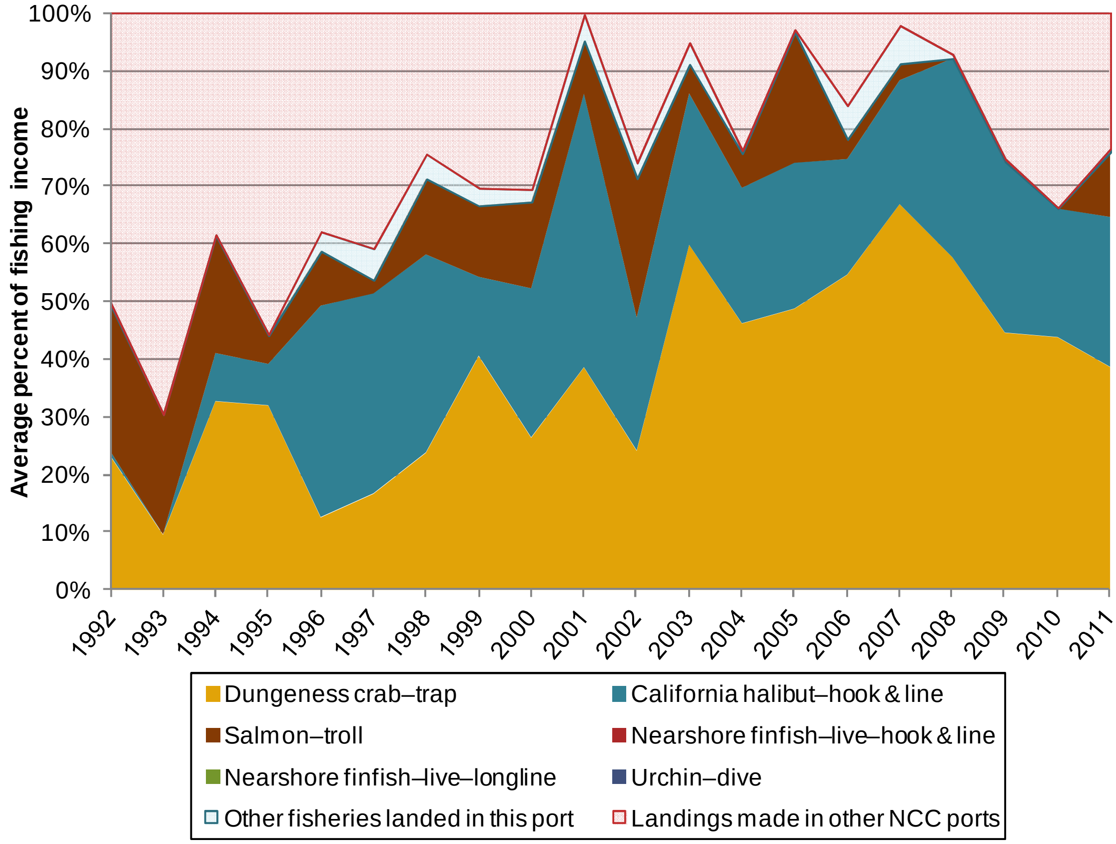
Source: Landings data from CDFW

Figure 75. Bolinas commercial ex-vessel revenue for fisheries of interest, 1992–2011



Source: Landings data from CDFW

Figure 76. Average percent of individual fishing income from commercial fisheries of interest, Bolinas, 1992–2011



Source: Landings data from CDFW

Table 127 displays the average annual percent change in total and average per fishermen ex-vessel revenue for each fishery in the port of Bolinas as compared with the respective changes in the North Central Coast region over the study period. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods.

The trends observed over the sample periods for the California halibut–hook & line fishery in Bolinas were similar to those observed at the regional level, though with less increase in the pre-MPA period of 2005–2009 (15.3 percent vs. 27.6 percent regionally overall) and an increase of 19.3 percent in the post-MPA period of 2010–2011 compared with a decrease of 16.2 percent regionally. Furthermore, in the post-MPA period Bolinas California halibut–hook & line fishermen saw their average ex-vessel revenue increase by 67 percent while regional fishermen saw only a 1 percent increase.

While the port of Bolinas also saw average annual increases in the Dungeness crab–trap fishery over the post-MPA period, the gains were more modest at 16.2 percent overall and 74.3 percent average per fisherman in the port compared with 46.5 percent and 27.5 percent respectively in the region. Despite being an important fishery within the port itself (82.8 percent of total port ex-vessel revenue over 2010–2011), Bolinas Dungeness crab–trap ex-vessel revenues averaged only 0.6 percent of total Dungeness crab–trap ex-vessel revenue in the North Central Coast region over the same period.

Table 127. Bolinas: Average annual percent change in total commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

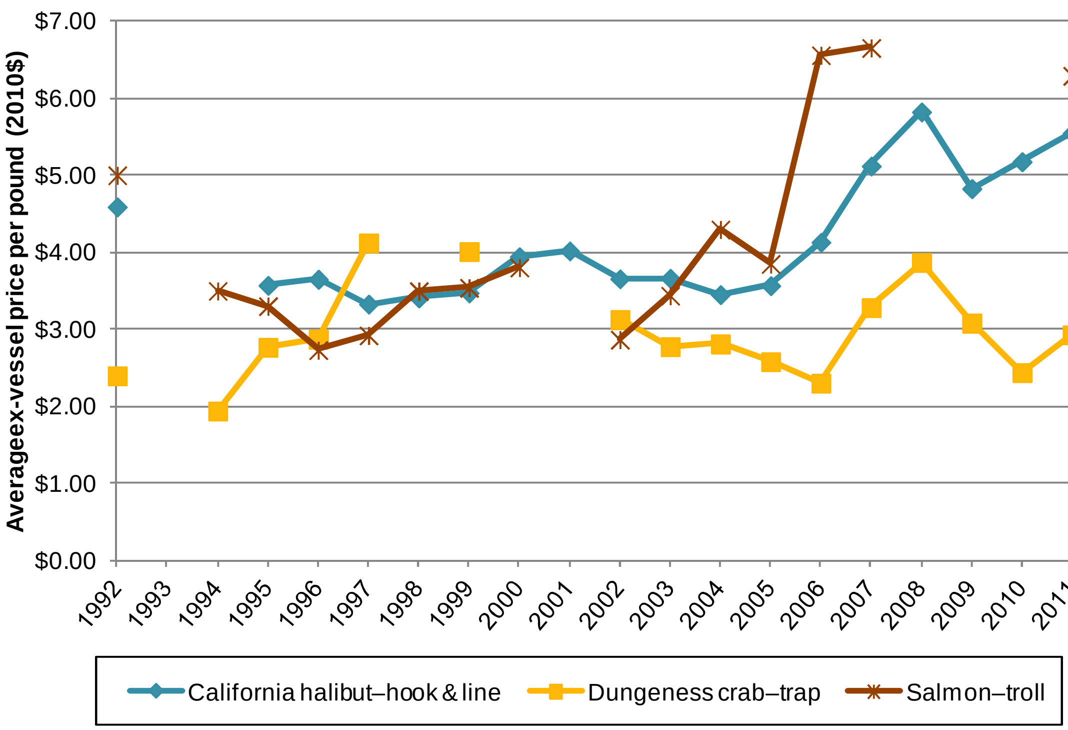
		Average annual percent change			
Fishery	**Commercial ex-vessel revenues**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
California halibut–hook & line	Bolinas total	16.1%	15.3%	19.3%	16.1%
	Bolinas avg. per fisherman	16.1%	2.2%	67.0%	14.4%
	North Central Coast region total	14.7%	27.6%	-16.2%	17.7%
	North Central Coast region avg. per fisherman	16.9%	1.6%	1.0%	8.5%
Dungeness crab–trap	Bolinas total	9.1%	10.9%	16.2%	10.9%
	Bolinas avg. per fisherman	-7.3%	9.1%	74.3%	10.9%
	North Central Coast region total	24.3%	63.8%	46.5%	44.3%
	North Central Coast region avg. per fisherman	22.7%	33.2%	27.5%	27.9%
Salmon–troll	Bolinas total	53.0%	-75.3%	–	-11.1%
	Bolinas avg. per fisherman	35.5%	-52.1%	–	0.5%
	North Central Coast region total	17.8%	-40.4%	1460.2%	158.7%
	North Central Coast region avg. per fisherman	11.5%	-13.5%	331.8%	45.3%

Source: Landings data from CDFW

— indicates zero value data in the sample years

Figure 77 displays the average ex-vessel prices over time for select fisheries of interest in Bolinas over the 1992–2011 study period. The average ex-vessel price per pound for the Dungeness crab–trap fishery varied over the study period, starting at $2.40 in 1992, peaking at $4.12 per pound in 1997, and finishing at $2.93 in 2011. Over the same time, the average ex-vessel price per pound for the California halibut–hook & line fishery increased 20.8 percent from 1992 to 2011, finishing 2011 at $5.55 per pound. The salmon–troll fishery average ex-vessel price per pound remained around $3–$4 per pound, before jumping up over $6 for 2006, 2007, and 2011.

Figure 77. Average ex-vessel prices over time, target commercial fisheries, Bolinas, 1992–2011



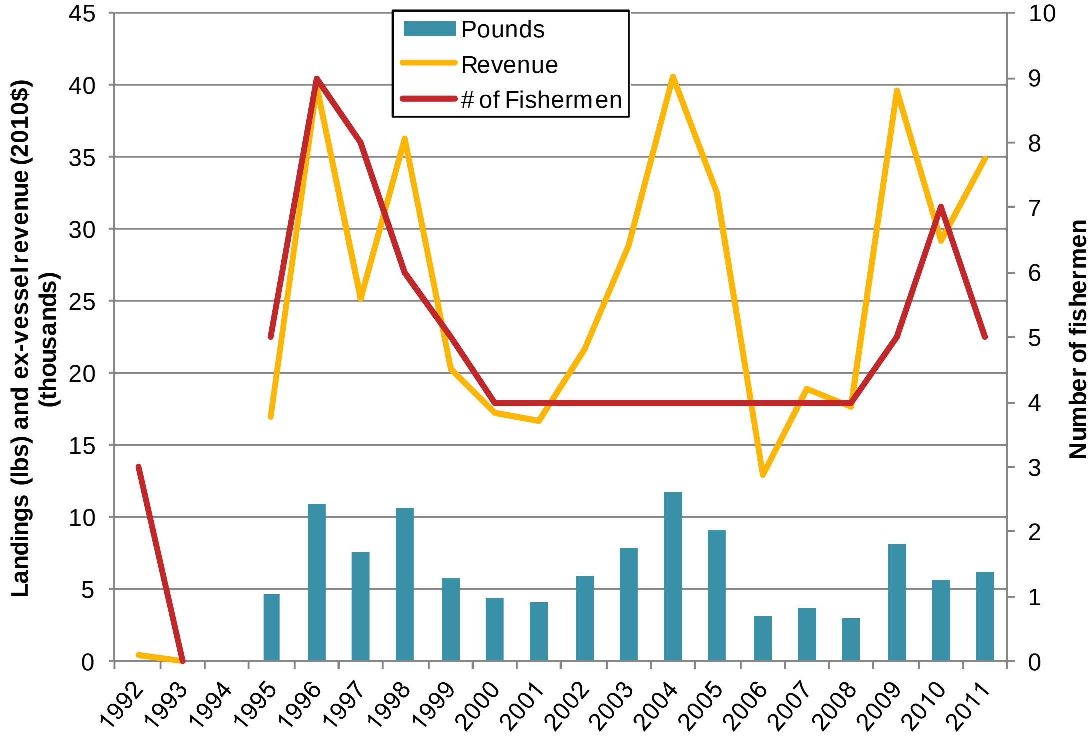
Source: Landings data from CDFW

Figure 78 displays landings, ex-vessel revenue, and number of fishermen for the California halibut–hook & line fishery in Bolinas over 1992–2011. As mentioned previously, this fishery experienced considerable growth in the port over the study period. For instance, in 1992 the average Bolinas fisherman landed three times totaling 38 pounds for $173, and in 2011 the average fisherman landed twenty times totaling 1,257 pounds for $6,975 in ex-vessel revenue, see Figure 79.

Figure 80 displays landings, ex-vessel revenue, and number of fishermen for the Dungeness crab–trap fishery in Bolinas over 1992–2011. Landings peaked in 2010 at 73,830 pounds, ex-vessel revenue peaked in 2011 at $209,300, and the number of fishermen ranged from 3 at least to 9 a most over the study period. In 2011 the average Dungeness crab–trap fisherman in Bolinas landed 31 times making an annual total of 11,906 pounds for $34,883 in ex-vessel revenue, see Figure 81.

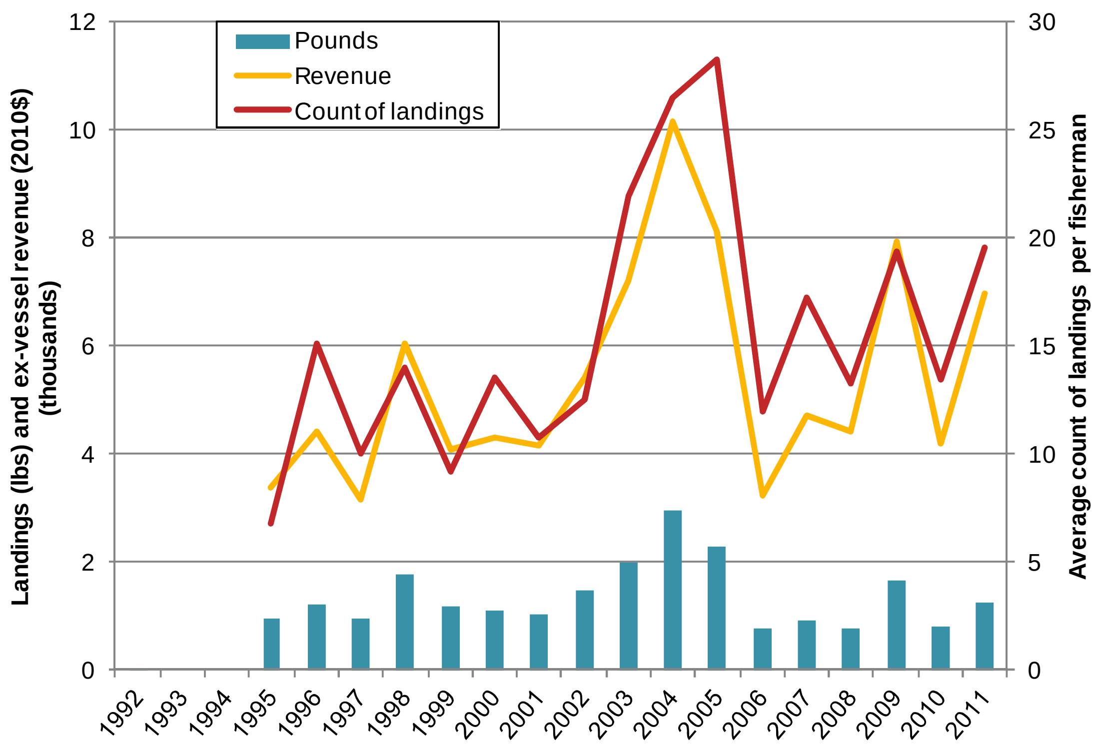
Figure 82 displays landings, ex-vessel revenue, and number of fishermen for the salmon–troll fishery in Bolinas over 1992–2011. Landings and ex-vessel revenue from this fishery varied, peaking at 9,562 pounds in 2002 and $35,451 in 2005 respectively. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 83, which also varied. Over 1992–2011, the average salmon–troll fisherman in Bolinas landed seven times a year with an annual total of 808 pounds for $3,009 in ex-vessel revenue. At most, landings and ex-vessel revenue per fishermen were about double the annual average, which occurred in 2000 (1,712 for $6,514).

Figure 78. California halibut–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, Bolinas, 1992–2011



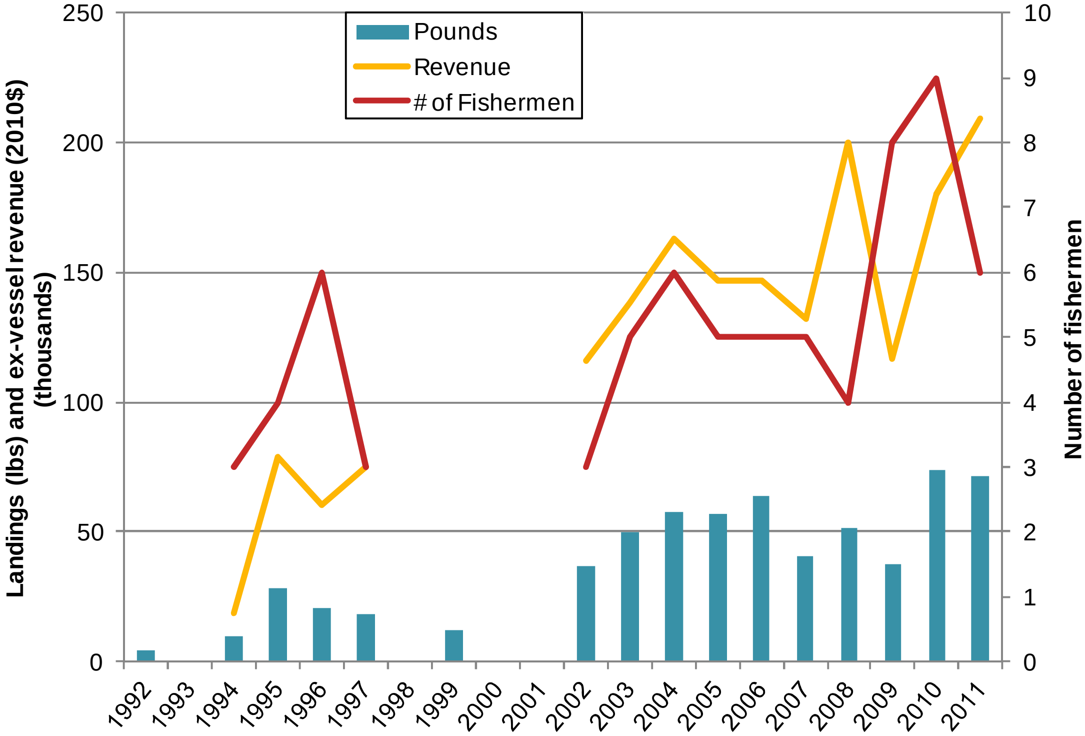
Source: Landings data from CDFW

Figure 79. California halibut–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bolinas, 1992–2011



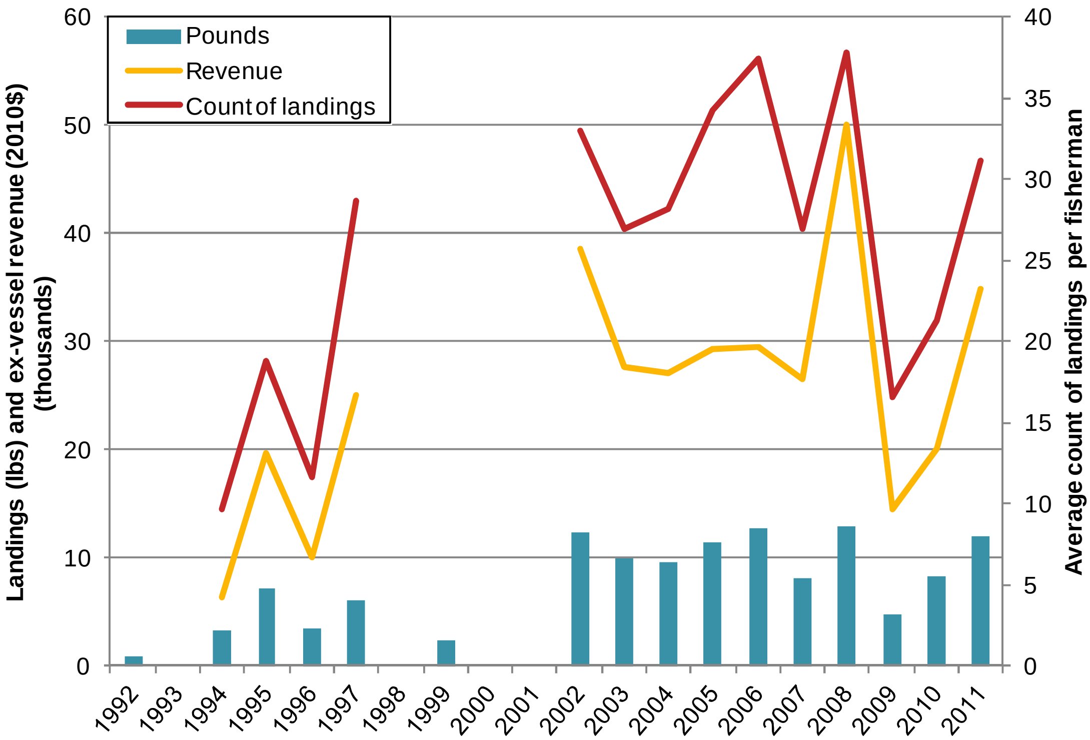
Source: Landings data from CDFW

Figure 80. Dungeness crab–trap: Commercial landings, ex-vessel revenue, and number of fishermen, Bolinas, 1992–2011



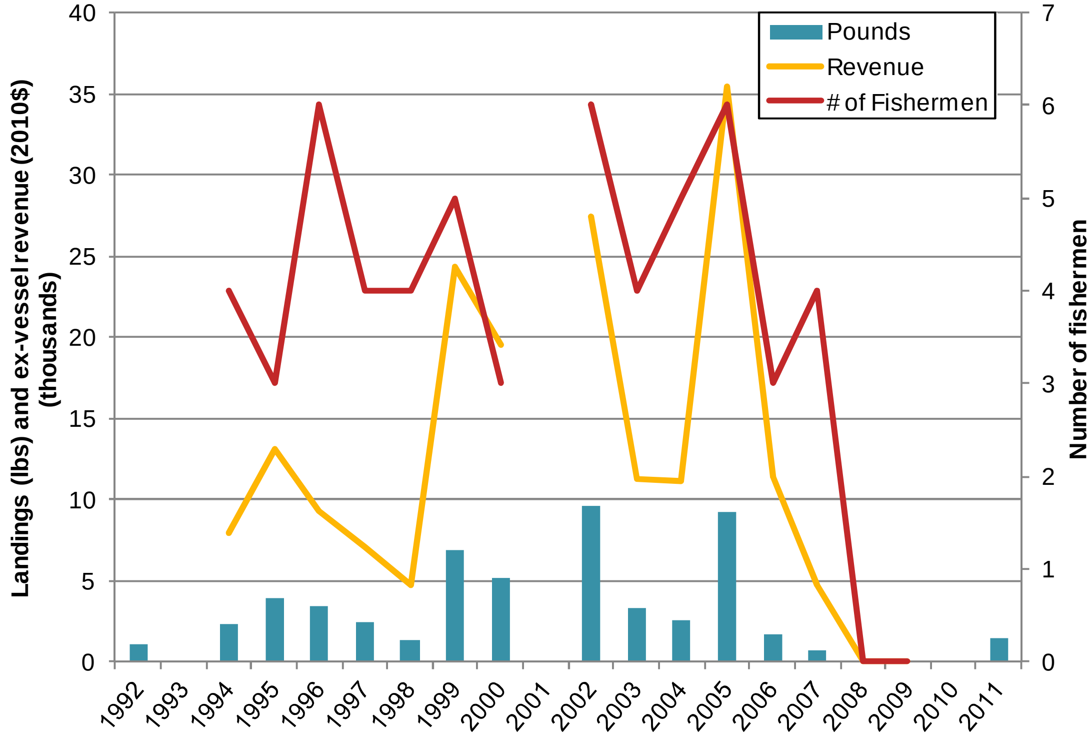
Source: Landings data from CDFW Year (Ex-vessel revenue - # of fishermen): 1992($11,474 - 6); 1999($48,224 - 5)

Figure 81. Dungeness crab–trap: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bolinas, 1992–2011



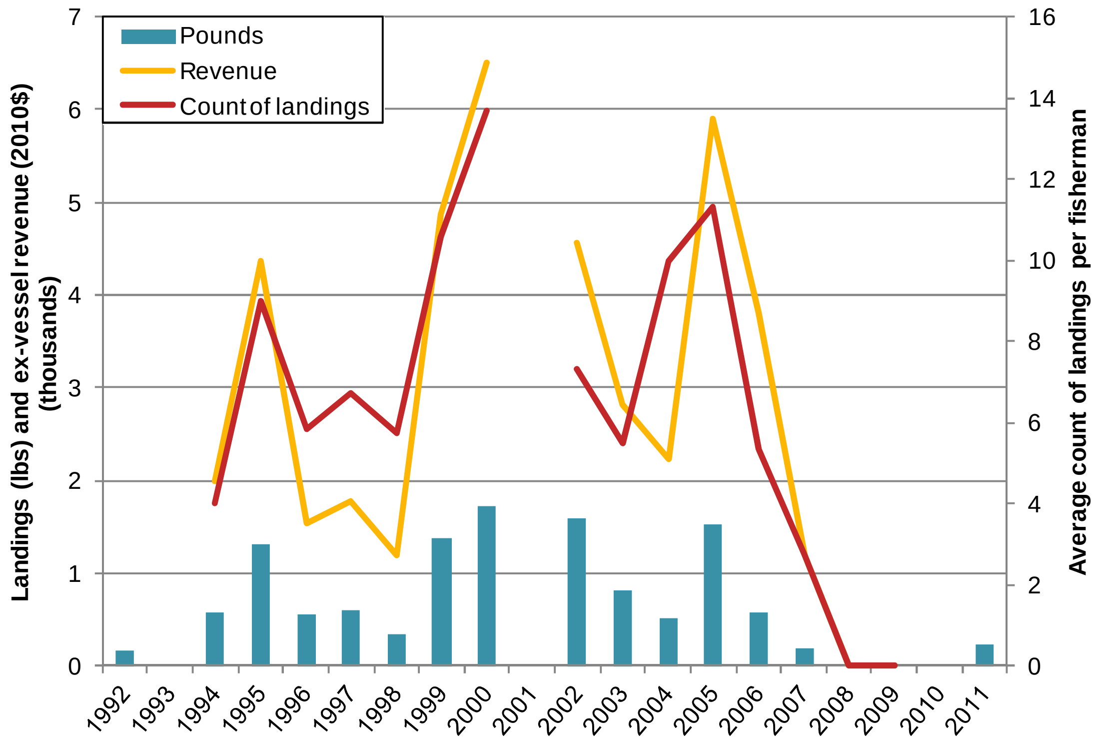
Source: Landings data from CDFW Year (Ex-vessel revenue – count of landings): 1992($1,912 - 6); 1999($9,645 - 14)

Figure 82. Salmon–troll: Commercial landings, ex-vessel revenue, and number of fishermen, Bolinas, 1992–2011



Source: Landings data from CDFW Year (Ex-vessel revenue - # of fishermen): 1992($5,255 - 6); 2011($8,959 - 6)

Figure 83. Salmon–troll: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Bolinas, 1992–2011



Source: Landings data from CDFW Year (Ex-vessel revenue – count of landings): 1992($876 - 5); 2011($1,493 - 6)

4.3.2. Bolinas Commercial Baseline Characterization

There were 12 fishermen who landed in at least one of the target fisheries in Bolinas in 2010, which generated a total of $209,405 (excluding salmon due to confidentiality constraints). As shown in Table 128, we interviewed five of these fishermen. Fishermen in Bolinas described that their historical fishing grounds for nearshore finfish–fixed gear were primarily the Farallon Islands; however, in order to reach the Farallons they must transit nearshore finfish through federal waters, which requires a federal vessel monitoring system (VMS). They explained that the VMS is not affordable for small boat fishermen with small amounts of nearshore rockfish quotas and that with the current MPAs the remaining nearshore fishing areas are being fished by many fishermen (including CPFV operators) in many other ports and have become over fished. As shown in Table 128 there were no landings of nearshore finfish–live—fixed gear in Bolinas in 2010.

Table 128. Number of commercial fishermen interviews conducted and fishery ex-vessel revenue value, 2010, non-spatial survey, Bolinas

Fisheries	2010 total ex-vessel revenue (2010$)	Total number of individuals in 2010 landings	Number interviewed
California halibut–hook & line	$29,234	7	3
Dungeness crab–trap	$180,170	9	4
Nearshore finfish–live–fixed gear	—	—	—
Salmon–troll	*	1	—
Urchin–dive	—	—	—
All target fisheries (unique individuals)	$209,405	12	5

Source: California Department of Fish and Wildlife, Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

The value of salmon–troll landings was removed from the total landings for all target fisheries so that values from the remaining fisheries could be shown without breaching confidentiality constraints.

The average fisherman from Bolinas is 51.8 years old and has 28.8 years of experience commercial fishing Table 129). It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. As shown in Table 130, in 2010 Bolinas respondents reported that an average of 72 percent of their personal income came from commercial fishing in 2010 which was an 8.1 percent decrease from 2007. It should be noted that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. Only one person provided more information regarding why they had seen a change in fishing related income, specifying that they were fishing less actively in 2010 than they were in 2007 (Table 131). The same individual indicated that part of the reason they were less active in 2010 was because they were unable to fish for salmon during 2010. Other sources of income are indicated below in Table 132.

Table 129. Average age and years of experience commercial fishing, 2010, Bolinas

	Age			Years of experience		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
California halibut–hook & line	3	48.3	10.5	3	28.3	13.3
Dungeness crab–trap	4	52.8	9.9	4	31.8	8.6
Nearshore finfish–live–fixed gear	—	—	—	—	—	—
Salmon–troll	—	—	—	—	—	—
Urchin–dive	—	—	—	—	—	—
All target fisheries (unique individuals)	5	51.8	8.8	5	28.8	10.0

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 130. Percent change in income from overall commercial fishing from 2007 - 2010, Bolinas

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent Change**
California halibut–hook & line	6	78.3%	34.3%	3	86.7%	23.1%	10.6%
Dungeness crab–trap	3	96.7%	5.8%	4	75.0%	37.9%	-22.4%
Nearshore finfish–live–fixed gear	—	—	—	—	—	—	—
Salmon–troll	6	78.3%	34.3%	—	—	—	n/a
Urchin–dive	—	—	—	—	—	—	—
All target fisheries (unique individuals)	6	78.3%	34.3%	5	72.0%	33.5%	-8.1%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

Table 131. Cause in change in percent income from commercial fishing from 2007 - 2010, Bolinas

	Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
		Number responding					
Reason for increase	Relied more on other sources of income in 2007	—	—	—	—	—	—
	Natural fluctuation in fish abundance/presence (worse in 2007)	—	—	—	—	—	—
	Fishing less actively in 2007	—	—	—	—	—	—
	Started fishing after 2007	—	—	—	—	—	—
Reason for decrease	Relied more on other sources of income in 2010	—	—	—	—	—	—
	Natural fluctuation in fish abundance/presence (worse in 2010)	—	—	—	—	—	—
	Fishing less actively in 2010	1	—	—	—	—	1
	Age health/worse in 2010	—	—	—	—	—	—
	Fishing was less profitable in 2010	—	—	—	—	—	—
	Not able to fish salmon in 2010 due to regulations	1	—	—	—	—	1
Number of individuals responding		1	—	—	—	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 132. Other sources of income other than commercial fishing in 2010, Bolinas

Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
	Number responding					
Construction/Contractor	—	—	—	—	—	—
Farming/Ranching	—	1	—	—	—	1
Fisheries research	—	—	—	—	—	—
Harbor/City job	—	—	—	—	—	—
Office work	—	—	—	—	—	—
Other fishing related work	—	—	—	—	—	—
Other specialized work	1	1	—	—	—	2
Property management	—	—	—	—	—	—
Retirement/Social Security/Investments	—	—	—	—	—	—
Salmon disaster relief	—	—	—	—	—	—
Skilled labor	1	1	—	—	—	2
Number of individuals responding	1	2	—	—	—	3

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 133 shows that the average respondent from Bolinas reported spending nearly half of their commercial fishing gross economic revenue (GER) on their overall commercial fishing related operating costs in 2010 (48.6 percent). This was 26.8 percent more than reported in 2007, which is a much greater increase than the region reported as a whole (12.1 percent). Please note that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. Respondents did not provide any additional reasons regarding this increase in operating costs.

Table 133. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Bolinas

	2007^			2010			
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Percent change
California halibut–hook & line	6	38.3%	22.5%	3	57.7%	15.3%	50.4%
Dungeness crab–trap	3	50.0%	25.0%	4	50.8%	21.9%	1.5%
Nearshore finfish–live–fixed gear	—	—	—	—	—	—	—
Salmon–troll	6	38.3%	22.5%	—	—	—	n/a
Urchin–dive	—	—	—	—	—	—	—
All target fisheries (unique individuals)	6	38.3%	22.5%	5	48.6%	19.6%	26.8%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

For each specific fishery an individual participated in respondents were asked how many years of experience they had in the fishery and how many days they spent targeting the fishery in 2010. Fishermen from Bolinas had more experience targeting the California halibut–hook & line fishery than respondents from the rest of the study region, 28 years compared to the regional average of 17.6 years. On average, respondents also reported spending more days per year targeting the Dungeness crab–trap fishery (73 days) than respondents across the entire study region (64.2 days) (Table 134). Some fishermen from Bolinas reported using a crew for the Dungeness crab–trap and California halibut–hook & line fisheries and on average they spent 18.3 and 13.3 percent of their fishery specific gross economic revenue (GER) on crew, respectively (Table 135). For both fisheries respondents reported that around 10 percent of their fishery specific GER went towards fuel. This was only slightly lower than the regional average for Dungeness crab–trap (11.4 percent), but much lower than the regional average for the California halibut–hook & line fishery (24.8 percent). No one in Bolinas reported dropping or adding a fishery since 2007 or not fishing a fishery in 2010.

Table 134. Years of experience and number of days targeting specific fisheries in 2010, Bolinas

	Years of experience in fishery			Days spent targeting fishery		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
California halibut–hook & line	3	28.0	12.8	3	60.0	45.8
Dungeness crab–trap	4	24.8	10.5	4	73.0	31.3
Nearshore finfish–live–fixed gear	—	—	—	—	—	—
Salmon–troll	—	—	—	—	—	—
Urchin–dive	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 135. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Bolinas

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
California halibut–hook & line	3	0.7	0.6	3	13.3%	15.3%	3	10.7%	8.1%
Dungeness crab–trap	4	0.8	0.5	3	18.3%	16.1%	3	10.0%	—
Nearshore finfish–live–fixed gear	—	—	—	—	—	—	—	—	—
Salmon–troll	—	—	—	—	—	—	—	—	—
Urchin–dive	—	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Fishermen were asked separately for each fishery to compare the success in his/her fishery in 2010 to the success in his/her fishery in the last five years. As shown in the table below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked in an open ended manner and responses were later coded, categorize, and divided into three types of categories: regulatory, environmental, and other as seen in Table 137, Table 138, and Table 139 (no respondents indicated economic factors).

All respondents indicated that their success in the Dungeness crab–trap fishery was better in 2010 than it had been in the previous five years. In the California halibut–hook & line fishery all respondents indicated they were either the same or worse off. Again, in Bolinas, as seen across the North Central Coast region, Dungeness crab–trap fishermen indicated it was a great Dungeness crab year and likely the peak year of a natural cyclical pattern seen in crab abundance. California halibut–hook & line fishermen attributed the downturn in success in the fishery to MPAs, increased number of fishermen in the California halibut–hook & line fishery, and a lack of being able to compete with live bait.

Table 136. Overall success in specific commercial fishery in 2010 compared to previous five years, Bolinas

		Percent response					
Fisheries	**Number responding**	**Did not participate in previous seasons**	**Significantly better**	**Somewhat better**	**The same**	**Somewhat worse**	**Significantly worse**
California halibut–hook & line	3	—	—	—	33.3%	33.3%	33.3%
Dungeness crab–trap	4	—	50.0%	50.0%	—	—	—
Nearshore finfish–live–fixed gear	—	—	—	—	—	—	—
Salmon–troll	—	—	—	—	—	—	—
Urchin–dive	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 137. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Bolinas

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	1	—	—	—	—
	Responses	**Count of responses**				
Worse	Regulated season too short	—	—	—	—	—
	MPAs	1	—	—	—	—
	No permit required	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 138. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Bolinas

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	—	2	—	—	—
	Responses	**Count of responses**				
Better	Larger quantity of fish	—	2	—	—	—
	Peak of natural cycle	—	1	—	—	—
	Good weather	—	—	—	—	—
	Good ocean conditions	—	—	—	—	—
	Good quality fish	—	—	—	—	—
	More bait/feed in the ocean	—	—	—	—	—
Worse	Low quantity of fish	—	—	—	—	—
	Bad weather	—	—	—	—	—
	Poor ocean conditions	—	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	—	—
	Red tide	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 139. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Bolinas

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	2	—	—	—	—
	Responses	**Count of responses**				
Better	Able to fish more frequently	—	—	—	—	—
	Becoming more experienced	—	—	—	—	—
Worse	Others changing fishery	1	—	—	—	—
	Boat problems/breakdowns	—	—	—	—	—
	No access to live bait	2	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

4.4. San Francisco

San Francisco, in San Francisco County, is the largest city in the North Central Coast study region, with 805,235 residents, as of the 2010 US Census. The estimated per capita income (2007-2011) was $46,777 with a mean household income of $105,753 (US Census Bureau 2010). The first European settlers arrived in 1769 from Spain. Prior to European settlement some 40 different tribal groups inhabited the San Francisco Bay area. The city of San Francisco was built up significantly during the California gold rush and as the gold rush slowed in the late 1840s people started to turn to commercial fishing (Norman et al. 2007).

Some of the first commercial fishermen in San Francisco were Chinese fishermen, in the mid 1850's followed by Italians in the 1860s (Norman et al, 2007). By 1892, 93% of California's commercial fisheries were centered in San Francisco (Love, 2006). In the early 1900's pollution of the San Francisco Bay and the advancement of fishing gear and vessels led to a shift from nearshore fisheries to offshore fisheries. The sardine fishery peaked in the 1930's and with it came the building of canneries through the region (Norman et al, 2007). Originally, Fisherman's Wharf was the center of commercial fishing in San Francisco and has been expanded several times as the fishing fleet has been built out, and new fisheries exploited. More recently, Fisherman's Wharf has turned into more of tourist destination, but does still serves several commercial fishermen, with full-service repair shop, dry docks, fuel, ice and other supplies. Pier 45 has become the hub of commercial fishing activity, home to the West coast's largest concentration of commercial fish processors and distributors (Norman et al 2007).

4.4.1. San Francisco Commercial Fisheries Historical Trends and Initial Changes

San Francisco contributed an annual average of 52.7 percent of total landings and 47.8 percent of total ex-vessel revenue to the North Central Coast region over 1992–2011, making it the largest port in the region over the study period. Landings and ex-vessel revenue peaked earlier in the study period in 1997 at 30.8 million pounds and $31.2 million respectively, see Figure 84. Landings and ex-vessel revenue fell over time to a low of 3.8 million pounds and $5.6 million respectively in 2007, before rising again and finishing out 2011 with 13 million pounds landed and $23.6 million in ex-vessel revenue. The number of fishermen fell by 68.2 percent from 1992 (932 fishermen) to 2011, with 296 fishermen making landings in the port in 2011.

Figure 85 and Figure 86 display the composition of landings and ex-vessel revenue for select fisheries of interest over 1992 to 2011 in San Francisco. Because these figures also display all other landings and ex-vessel revenue (including necessary suppressions from the fisheries of interest) in the category labeled 'other', it is possible to tell approximately what portion the six fisheries of interest represent of the port's total landings and ex-vessel revenue over the study period. From 1992–2011, landings and ex-vessel revenue from the six fisheries of interest constituted an average of 24.9 percent and 46.7 percent of total landings and ex-vessel revenue respectively from all fisheries in San Francisco.

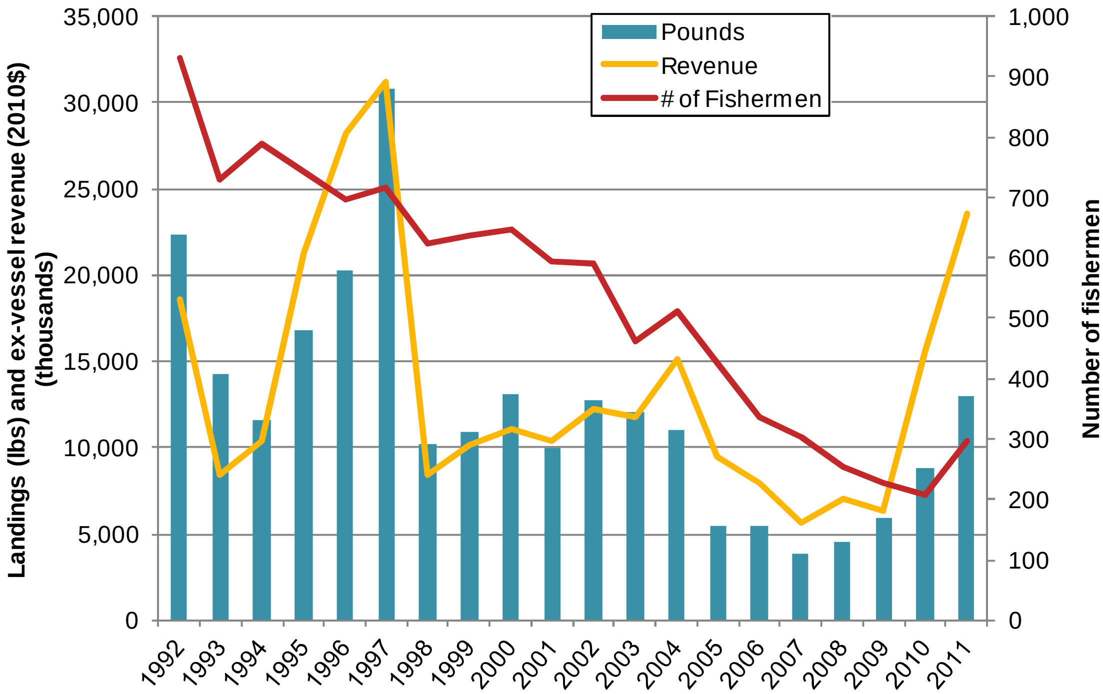
Compared with other North Central Coast region ports, the fisheries of interest constitute the lowest percentage of total port landings and ex-vessel revenue. Averaging annually across the study period, the top five additional fisheries in San Francisco contributing to landings included Pacific herring roe (31.3 percent), groundfish–bottom trawl (16.4 percent), Pacific herring (5.9 percent), brine shrimp (5.1 percent), and coastal pelagics–seine/net (2.2 percent). In terms of average annual ex-vessel revenue, the top five additional fisheries in San Francisco were Pacific herring roe (17.4 percent), groundfish–bottom trawl (9.1 percent), Pacific herring (4.4 percent), California halibut–bottom trawl (4.4 percent), and swordfish (3.2 percent).

As in other North Central Coast region ports, the Dungeness crab–trap fishery experienced great growth in its contribution to total ex-vessel revenue in the port. In 1992, landings and ex-vessel revenue from this fishery were at 165,518 pounds and $384,586 respectively, or only 0.7 percent of total landings and 2.1 percent of total ex-vessel revenue in San Francisco. By 2011, these values increased over 40 times to 7.3 million in landings and $17.3 million in ex-vessel revenue, constituting 56.1 percent of total landings and 73.1 percent of total ex-vessel revenue in San Francisco.

Fishermen in San Francisco attributed this dramatic increase in Dungeness crab landings to several possible reasons such as the cyclical nature of the fishery; recent efforts to clean up the San Francisco Bay which is an important Dungeness crab nursery ground; increased fishing efforts from larger sized vessels from out of state or northern California, a reduction in the trawl fishing fleet which lead to ex-trawlers shifting effort into the Dungeness crab–trap fishery. Additionally, fishermen mentioned the expansion of both domestic and international markets. Specifically, fishermen mentioned new markets in China for both live and canned Dungeness crab. Lastly, fishermen mentioned there has been a general increase in demand for Dungeness crab and the fleet has built larger more competitive operations to respond to that demand. Together these factors are likely contributing to the growth of the fishery.

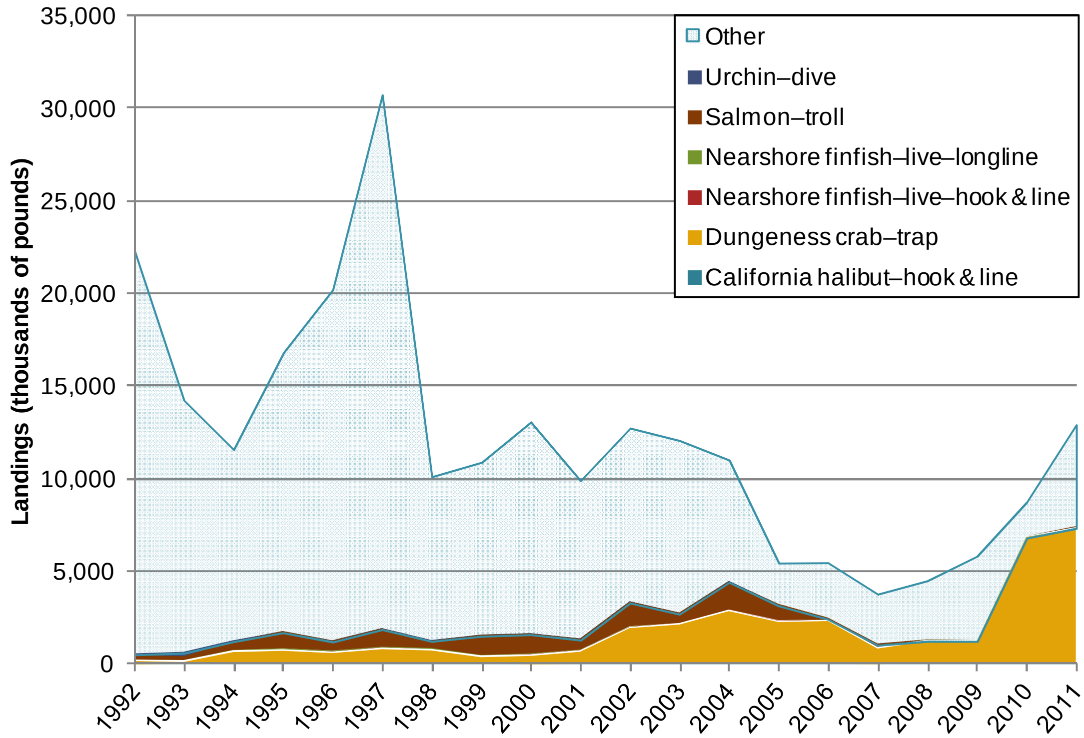
Figure 87 displays the average percent contribution to fishing income for those fishermen who made landings in San Francisco over the study period from the six fisheries of interest, other fisheries landed in San Francisco, and landings from all fisheries landed in other North Central Coast region ports. On average, and more than any other regional port, fishermen who landed in San Francisco derived most of their fishing income from other fisheries landed in the port rather than from the six fisheries of interest. However, this trend declined over time; in 1992 fishermen received an average of 58.6 percent of their individual fishing income from other fisheries landed in San Francisco and only 29.3 percent in 2011. Among fisheries of interest, the highest average annual contributions to San Francisco fishing incomes were salmon–troll (17.1 percent), Dungeness crab–trap (13.3 percent), and California halibut–hook & line (9.0 percent).

Figure 84. San Francisco total commercial landings, ex-vessel revenue, and number of fishermen, all fisheries, 1992–2011



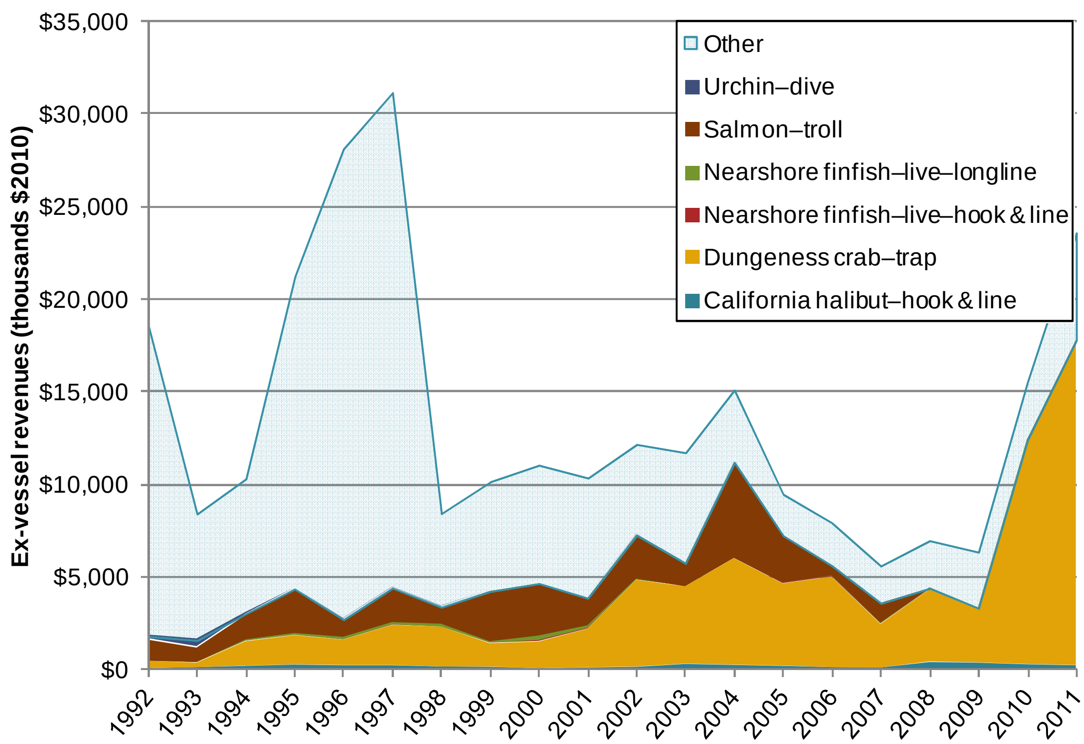
Source: Landings data from CDFW

Figure 85. San Francisco commercial landings for fisheries of interest, 1992–2011



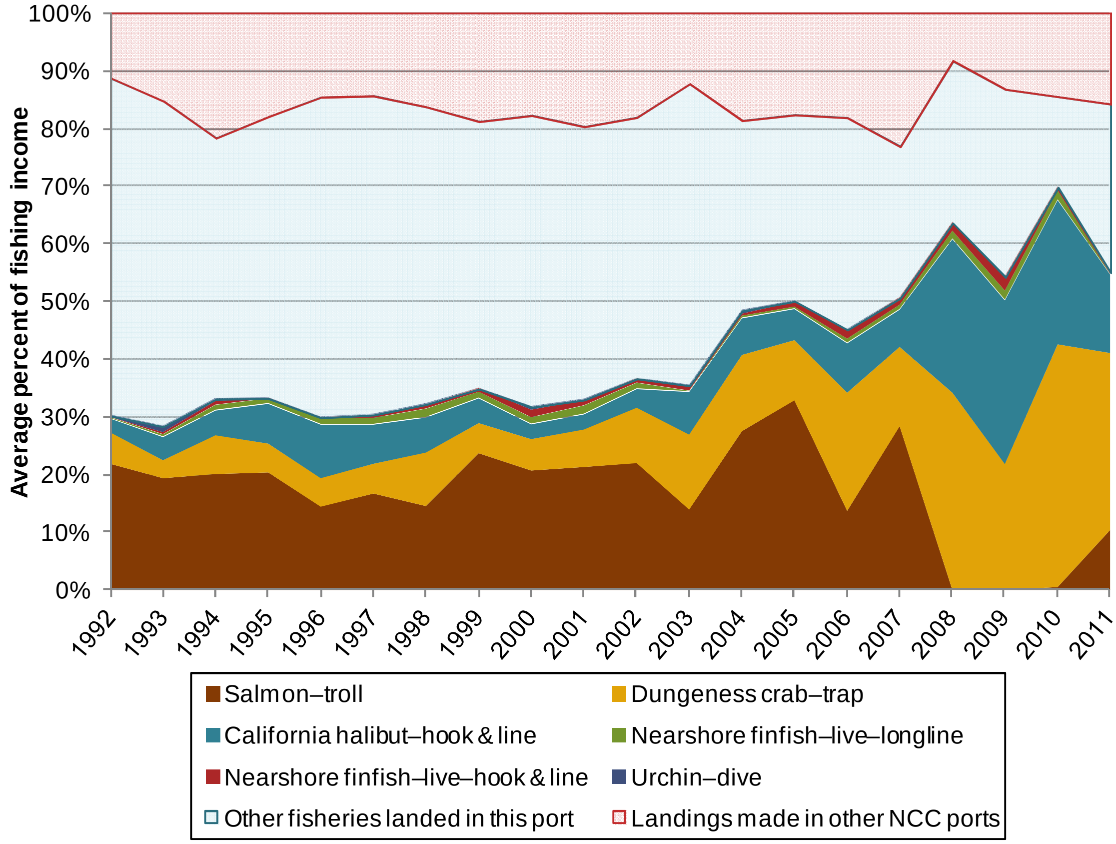
Source: Landings data from CDFW

Figure 86. San Francisco commercial ex-vessel revenue for fisheries of interest, 1992–2011



Source: Landings data from CDFW

Figure 87. Average percent of individual fishing income from commercial fisheries of interest, San Francisco, 1992–2011



Source: Landings data from CDFW

Table 140 displays the average annual percent change in total and average per fishermen ex-vessel revenue for each fishery in the port of San Francisco as compared with the respective changes in the North Central Coast region over the study period. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods.

Most fisheries of interest in San Francisco closely followed trends within the North Central Coast region closely. This is not surprising as San Francisco constituted approximately half of all regional landings and ex-vessel revenue over the study period, thus influencing regional trends more than any other North Central Coast port.

Exceptions include the nearshore finfish–live fisheries. In both the hook & line and the longline fisheries in the post-MPA period of 2010–2011. Over this time, San Francisco overall ex-vessel revenue increased above the regional increases at 81.8 percent vs.14.5 percent regionally for hook & line and decreased by 42.4 percent vs. 2.9 percent regionally for longline. During the post-MPA period of 2010-2011, Half Moon Bay and other ports landed an increasing share in the nearshore finfish–live–hook & line fishery, causing San Francisco's contribution to the region to decline compared with previous years.

Table 140. San Francisco: Average annual percent change in total commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

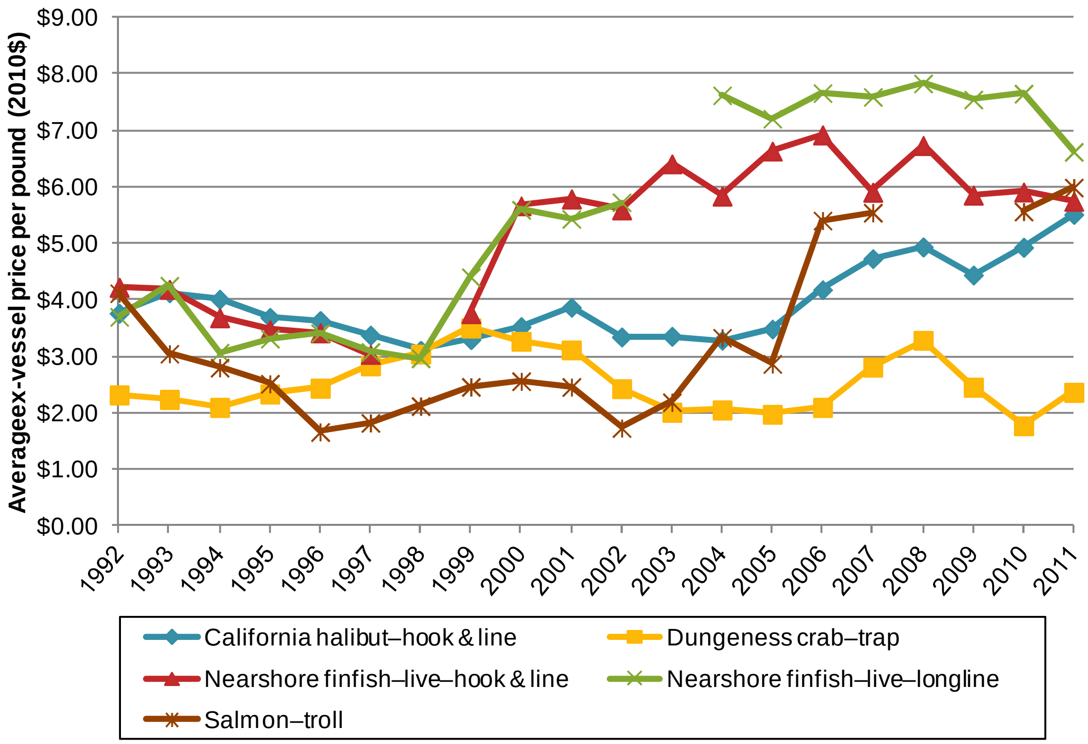
		Average annual percent change			
Fishery	**Commercial ex-vessel revenues**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
California halibut–hook & line	San Francisco total	23.2%	32.1%	-17.0%	23.6%
	San Francisco avg. per fisherman	20.9%	-4.5%	4.4%	7.9%
	North Central Coast region total	14.7%	27.6%	-16.2%	17.7%
	North Central Coast region avg. per fisherman	16.9%	1.6%	1.0%	8.5%
Dungeness crab–trap	San Francisco total	35.0%	63.1%	43.3%	48.5%
	San Francisco avg. per fisherman	31.4%	25.9%	35.9%	29.3%
	North Central Coast region total	24.3%	63.8%	46.5%	44.3%
	North Central Coast region avg. per fisherman	22.7%	33.2%	27.5%	27.9%
Nearshore finfish–live–hook & line	San Francisco total	3.9%	-8.7%	81.8%	5.2%
	San Francisco avg. per fisherman	21.1%	-10.0%	36.3%	8.4%
	North Central Coast region total	1.9%	-4.4%	14.5%	0.2%
	North Central Coast region avg. per fisherman	26.0%	2.7%	-7.5%	12.4%
Nearshore finfish–live–longline	San Francisco total	-20.8%	12.4%	-42.4%	-4.8%
	San Francisco avg. per fisherman	-24.9%	15.6%	0.8%	0.5%
	North Central Coast region total	13.1%	2.5%	-2.9%	6.9%
	North Central Coast region avg. per fisherman	2.3%	4.4%	70.0%	9.4%
Salmon–troll	San Francisco total	46.0%	-28.2%	16939.2%	1898.3%
	San Francisco avg. per fisherman	14.5%	-9.5%	1680.2%	216.7%
	North Central Coast region total	17.8%	-40.4%	1460.2%	158.7%
	North Central Coast region avg. per fisherman	11.5%	-13.5%	331.8%	45.3%
Urchin–dive	San Francisco total	45.8%	–	–	45.8%
	San Francisco avg. per fisherman	43.8%	–	–	43.8%
	North Central Coast region total	-28.3%	29.9%	-18.0%	-0.9%
	North Central Coast region avg. per fisherman	-15.0%	54.5%	-34.4%	14.8%

Source: Landings data from CDFW

— indicates zero value data in the sample years

Figure 88 displays average ex-vessel prices for select fisheries of interest in San Francisco over the 1992–2011 study period. Nearly all average ex-vessel prices rose in San Francisco from 1992 to 2011, with the greatest gains made in the nearshore finfish–live–longline fishery at 78.8 percent, followed by California halibut–hook & line at 46.4 percent, salmon–troll at 45.4 percent, nearshore finfish–live– hook & line at 36 percent, and finally Dungeness crab–trap at 2 percent. San Francisco, in fact, had the both the highest average annual ex-vessel price per pound for the nearshore finfish–live–longline fishery ($5.51) over the study period in the North Central Coast region, as well as the highest one year average ex-vessel price per pound at $7.83 in 2008.

Figure 88. Average ex-vessel prices over time, target commercial fisheries, San Francisco, 1992–2011



Source: Landings data from CDFW

Figure 89 displays landings, ex-vessel revenue, and number of fishermen for the California halibut–hook & line fishery in San Francisco over 1992–2011. In 1992, 28,645 pounds were landed in San Francisco for $107,948 in ex-vessel revenue by 46 fishermen. In 2011, 48,785 pounds were landed for $269,162 in ex-vessel revenue by 62 fishermen. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 90. Overall, the average amount of pounds landed and ex-vessel revenue per fishermen increased in the California halibut–hook & line fishery in San Francisco, with the average fisherman making 26.4 percent more landings and 85 percent more in ex-vessel revenue in 2011 as compared with 1992.

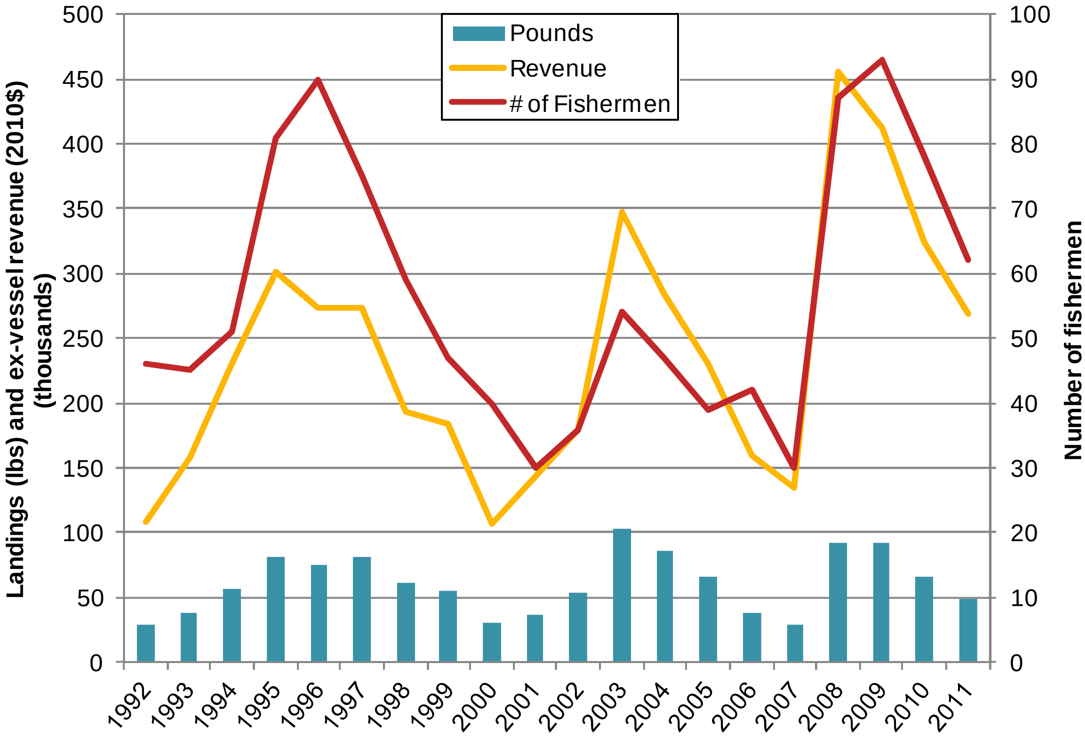
Figure 91 displays landings, ex-vessel revenue, and number of fishermen for the Dungeness crab–trap fishery in San Francisco over 1992–2011. Both overall and average per fishermen landings and ex-vessel revenue increased significantly in this fishery, see also Figure 92. Total landings, ex-vessel revenue, and number of fishermen peaked in the port in 2011 at 7.3 million pounds, $17.3 million, and 116 fishermen respectively. On average, each Dungeness crab–trap fisherman in San Francisco landed 62,746 pounds was for $148,756 in ex-vessel revenue in 2011 over a total of 14 landings throughout the year.

Figure 93 displays landings, ex-vessel revenue, and number of fishermen for the nearshore finfish–live–hook & line fishery in San Francisco over 1992–2011. Overall trends in this fishery varied over the study period, but were quite similar to average per fisherman trends more generally, see Figure 94. However, total landings and ex-vessel revenue peaked in 2000 at 12,314 pounds and $69,797, while average per fisherman landings and ex-vessel revenue peaked earlier in 1997 at 765 pounds and $2,326 respectively.

Figure 95 displays landings, ex-vessel revenue, and number of fishermen for the nearshore finfish–live–longline fishery in San Francisco over 1992–2011. This fishery was more prominent during the first half of the study period, averaging total landings of 34,132 pounds for $133,779 in ex-vessel revenue by 15 fishermen annually over 1992–2002. However, these numbers decreased significantly to 6,171 in landings and $46,527 in ex-vessel revenue by 5 fishermen annually on average over 2004–2011. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 96. While the average landings per fisherman also declined, the average ex-vessel revenue per fisherman actually grew slightly as there were less and less fishermen in San Francisco in the nearshore finfish–live–longline fishery.

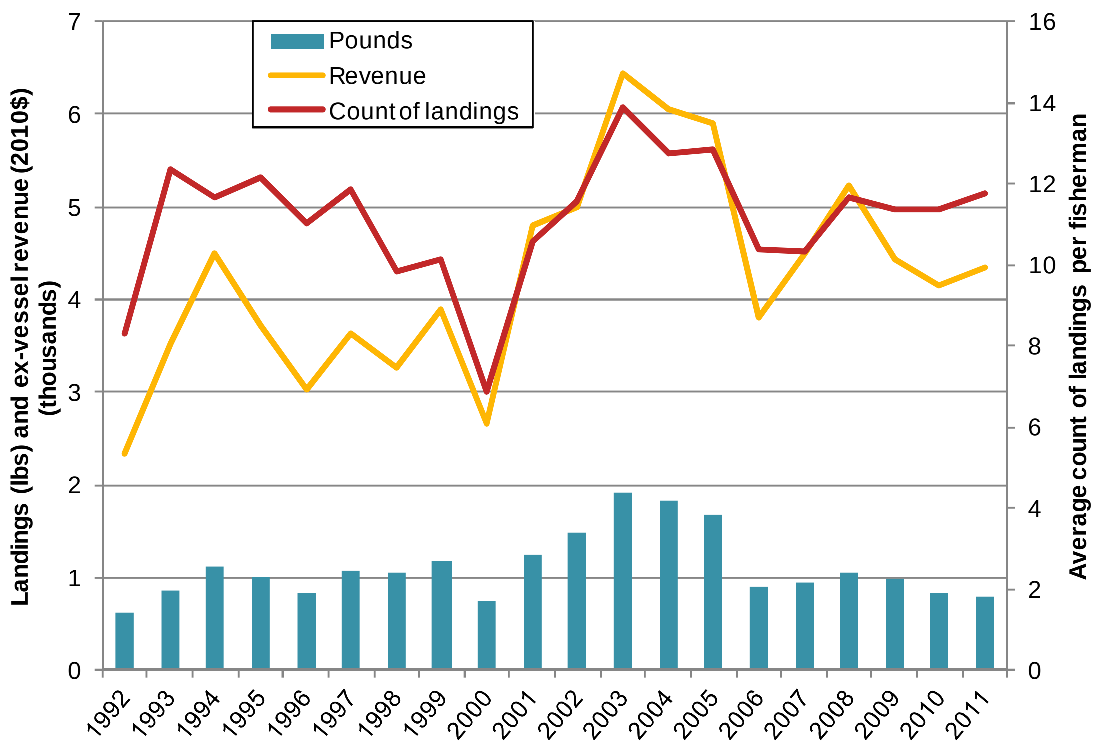
Figure 97 displays landings, ex-vessel revenue, and number of fishermen for the salmon–troll fishery in San Francisco over 1992–2011. Landings and ex-vessel revenue for this fishery peaked at 1.5 million pounds for $5.1 in ex-vessel revenue in 2004. Over the study period, the average salmon–troll fisherman in San Francisco landed 2,975 pounds for $7,763 in ex-vessel revenue over a total of 4 landings annually, see Figure 98.

Figure 89. California halibut–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, San Francisco, 1992–2011



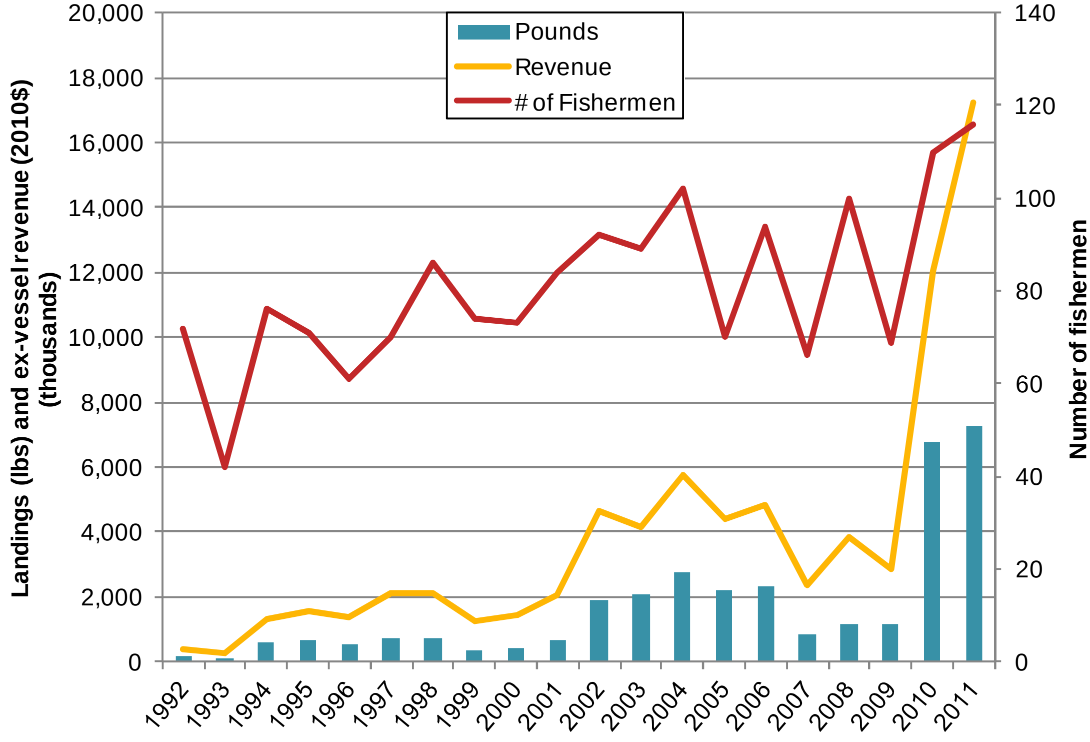
Source: Landings data from CDFW

Figure 90. California halibut–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, San Francisco, 1992–2011



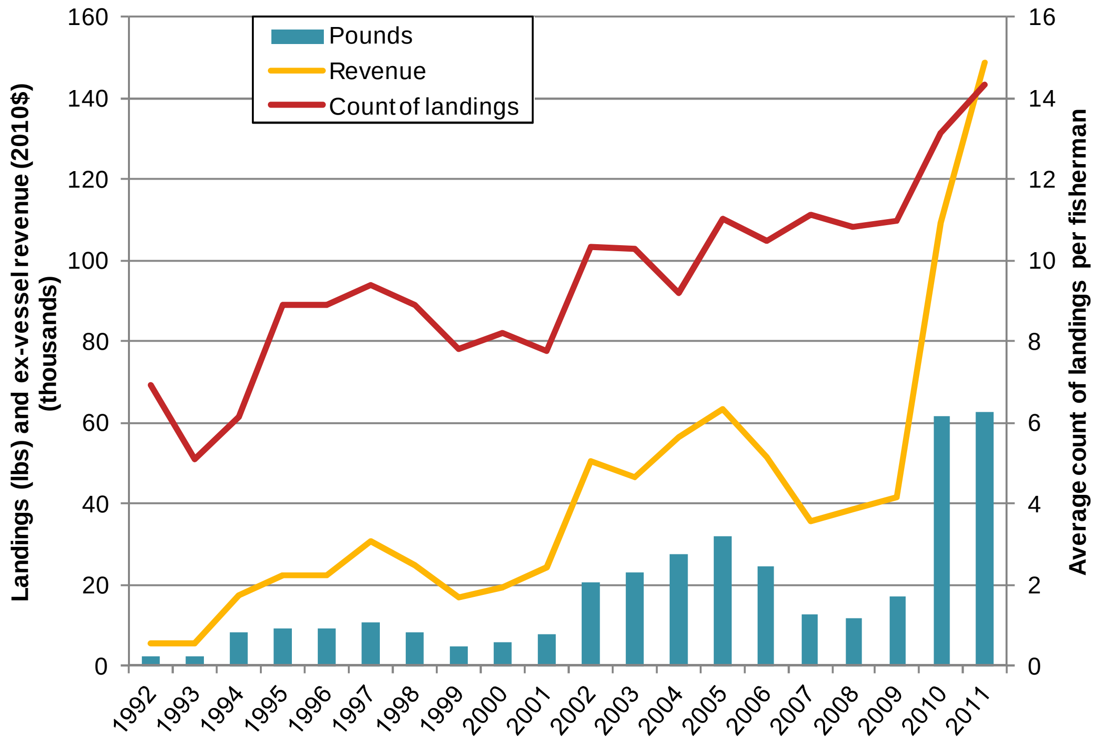
Source: Landings data from CDFW

Figure 91. Dungeness crab–trap: Commercial landings, ex-vessel revenue, and number of fishermen, San Francisco, 1992–2011



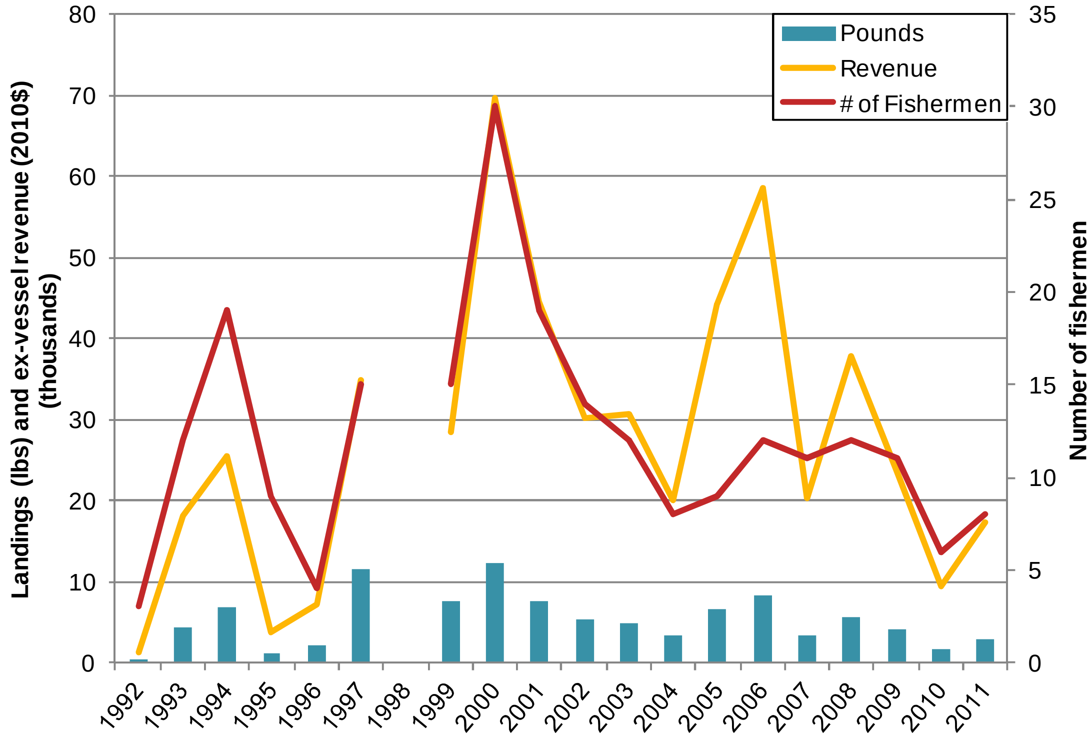
Source: Landings data from CDFW

Figure 92. Dungeness crab–trap: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, San Francisco, 1992–2011



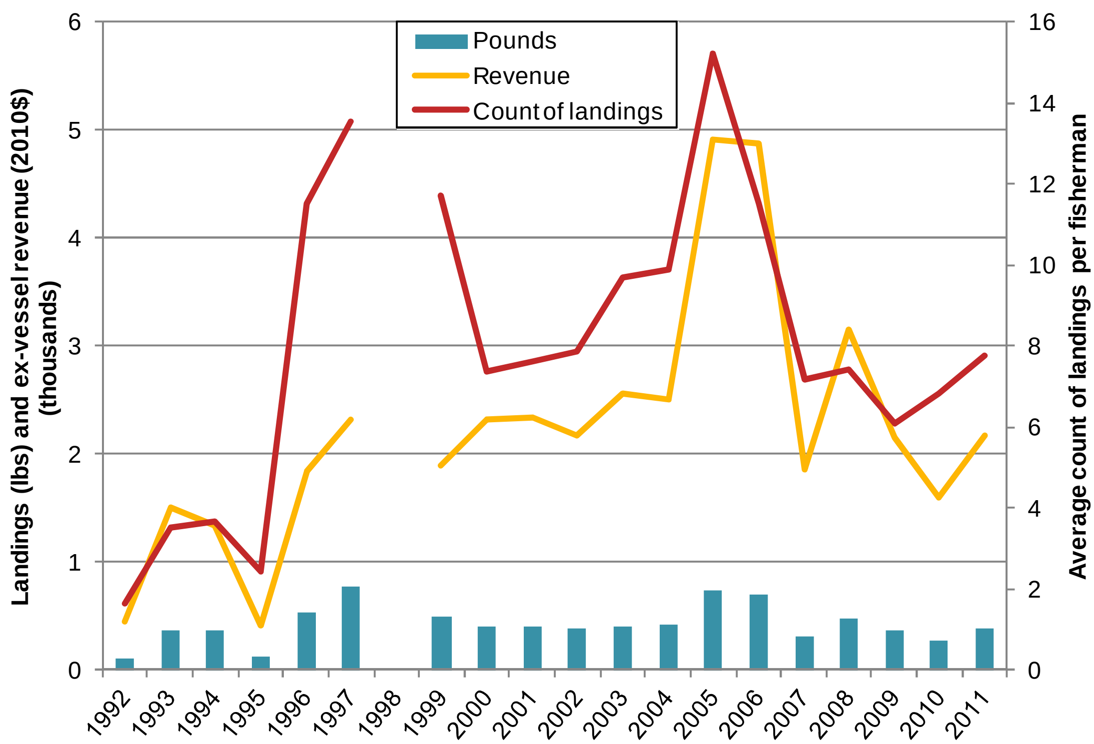
Source: Landings data from CDFW

Figure 93. Nearshore finfish–live–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, San Francisco, 1992–2011



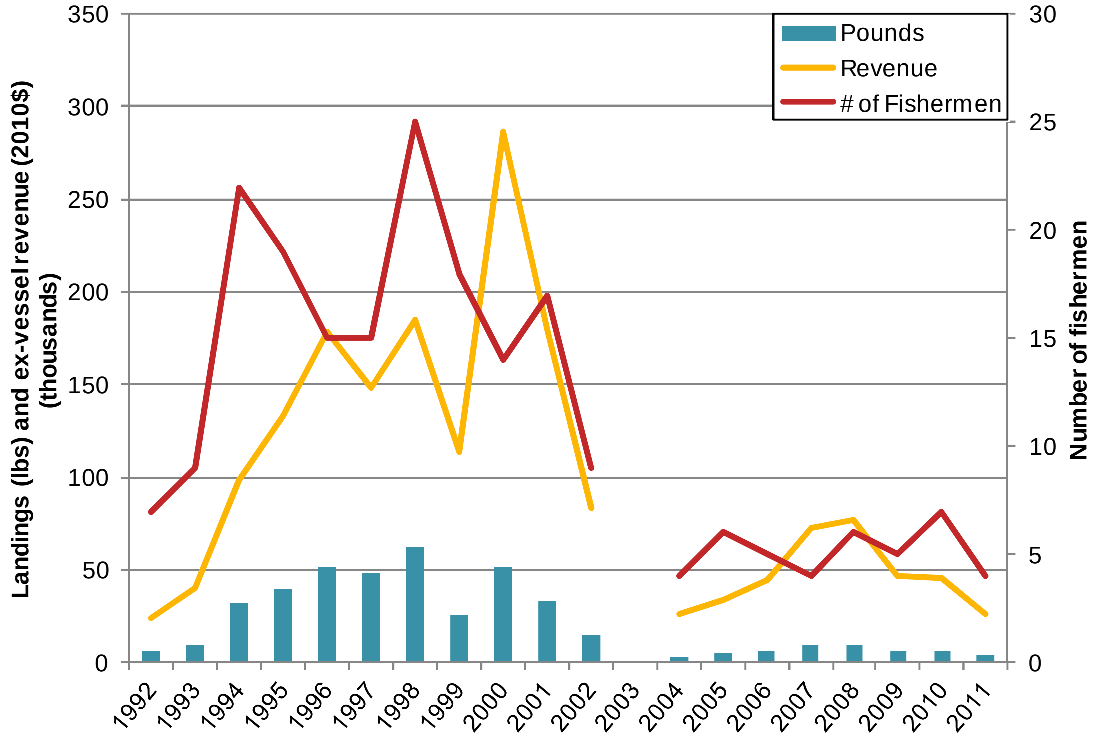
Source: Landings data from CDFW

Figure 94. Nearshore finfish–live–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, San Francisco, 1992–2011



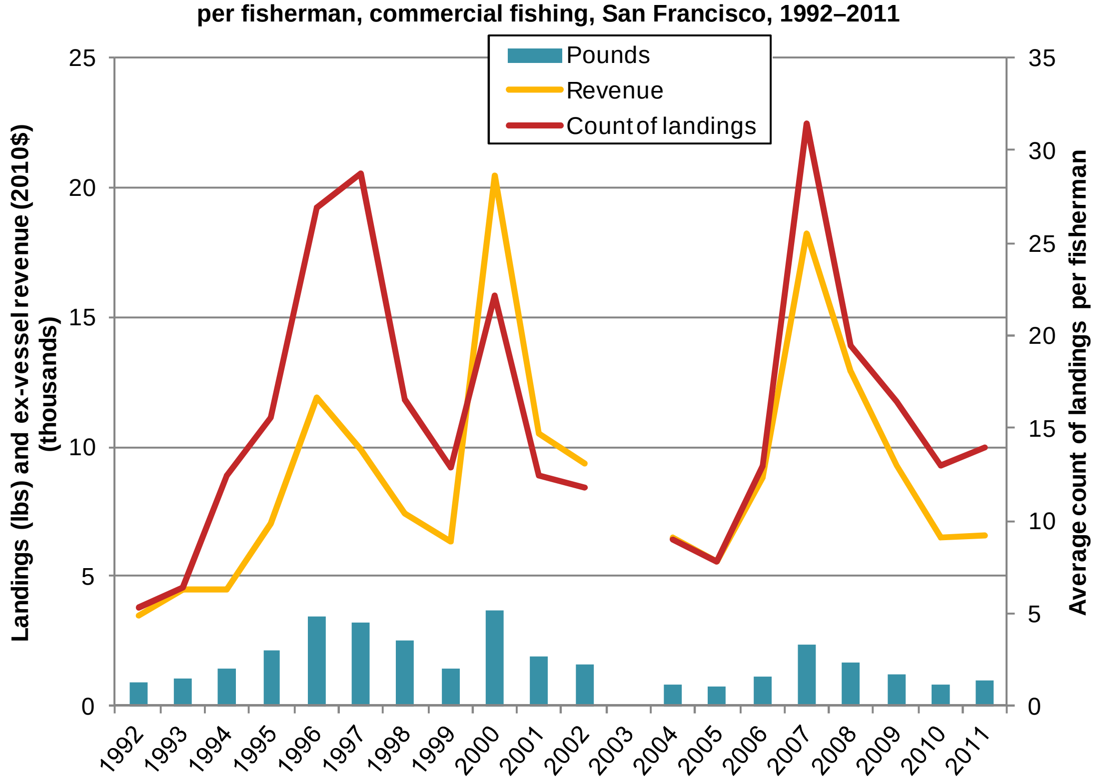
Source: Landings data from CDFW

Figure 95. Nearshore finfish–live–longline: Commercial landings, ex-vessel revenue, and number of fishermen, San Francisco, 1992–2011



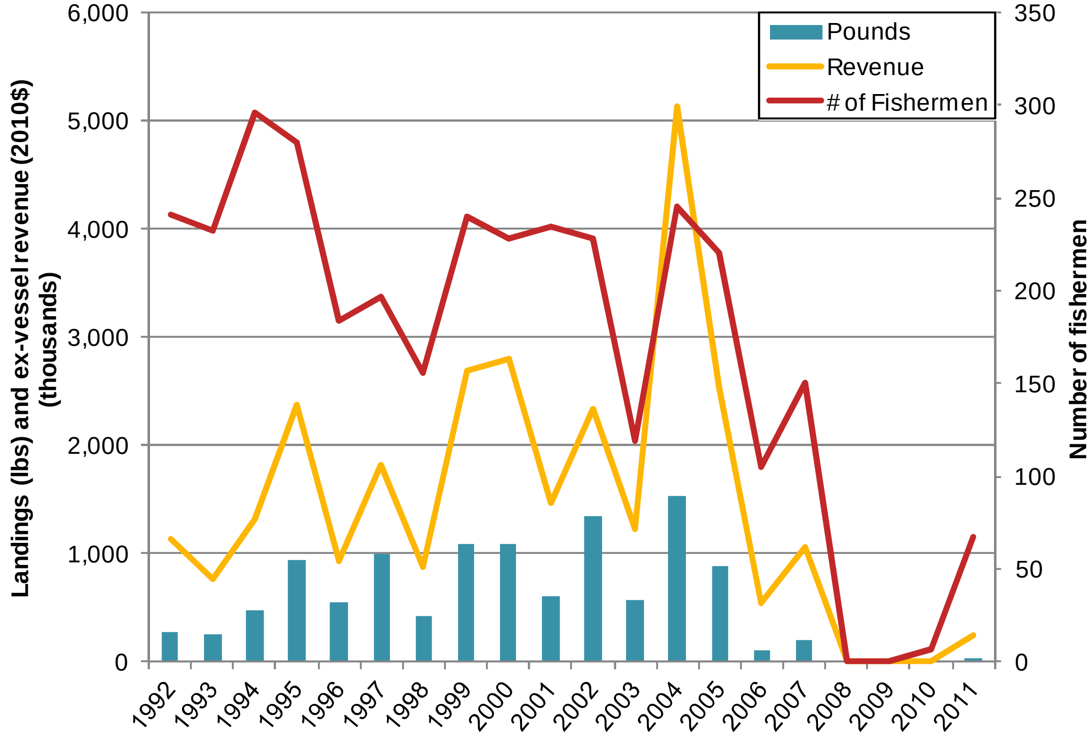
Source: Landings data from CDFW

Figure 96. Nearshore finfish–live–longline: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, San Francisco, 1992–2011



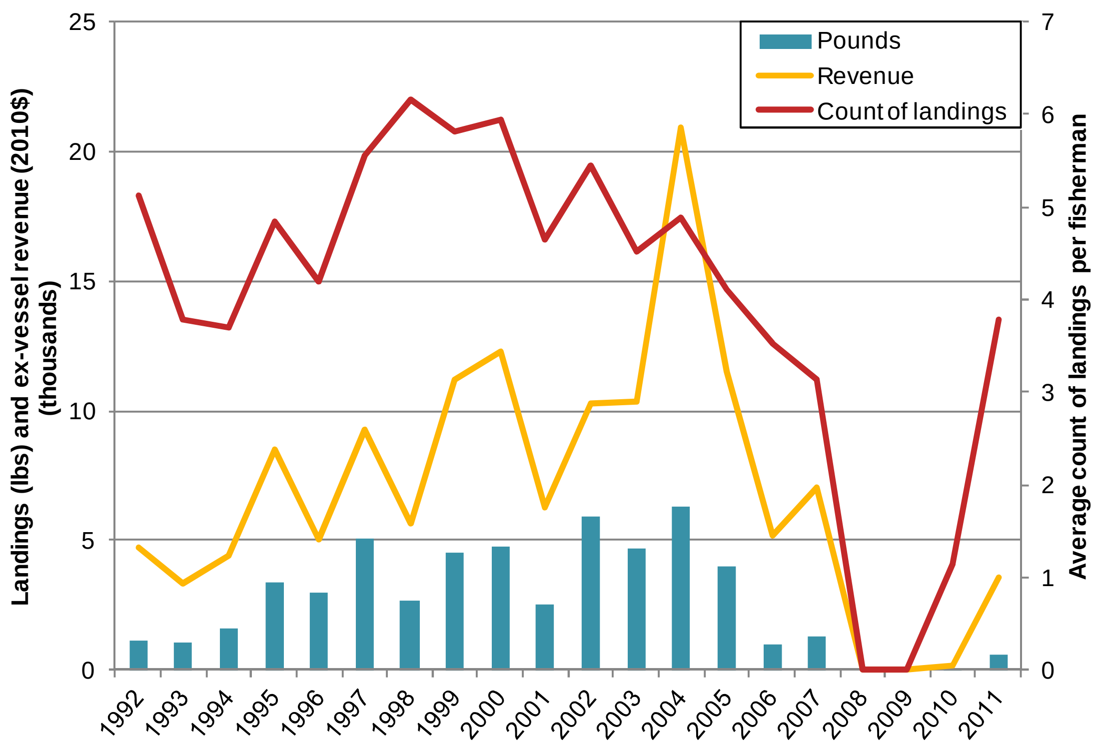
Source: Landings data from CDFW

Figure 97. Salmon–troll: Commercial landings, ex-vessel revenue, and number of fishermen, San Francisco, 1992–2011



Source: Landings data from CDFW

Figure 98. Salmon–troll: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, San Francisco, 1992–2011



Source: Landings data from CDFW

4.4.2. San Francisco Commercial Baseline Characterization

San Francisco generated more revenue than any of the other ports in the North Central Coast, with over 12.4 million dollars in ex-vessel revenue across the five target fisheries. This is more than 45 percent of the revenue generated in the entire study region by the five target fisheries. Also noteworthy is that 97 percent of the ex-vessel revenue landed in San Francisco was from the Dungeness crab–trap fishery. We interviewed a total of 23 respondents from San Francisco, including 11 California halibut–hook & line fishermen, the most of any port in the study region (Table 141). Additionally, just over 75 percent of the California halibut caught by hook & line in the North Central Coast region was landed in San Francisco.

Table 141. Number of commercial fishermen interviews conducted and fishery ex-vessel revenue value, 2010, non-spatial survey, San Francisco

Fishery	2010 total ex-vessel revenue (2010$)	Total number of individuals in 2010 landings	Number interviewed
California halibut–hook & line	$324,459	77	11
Dungeness crab–trap	$12,040,869	110	13
Nearshore finfish	$55,269	13	2
Salmon–troll	$1,409	7	3
Urchin–dive	—	—	—
All target fisheries (unique individuals)	$12,422,006	181	23

Source: California Department of Fish and Wildlife, Current study

— indicates that the port/fishery was not sampled or a zero value data point

The average fisherman we interviewed in San Francisco was 49 years old and had 20.2 years of experience as a commercial fisherman in 2010 (Table 142). It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. Both of these values were the lowest averages across all ports.

Table 142. Average age and years of experience commercial fishing, 2010, San Francisco

	Age			Years of experience		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut–hook & line	11	48.2	13.1	11	17.6	14.6
Dungeness crab–trap	11	51.2	8.3	13	24.0	12.5
Nearshore finfish–live–fixed gear	2	*	*	2	*	*
Salmon–troll	3	44.0	7.2	3	14.0	10.4
Urchin–dive	—	—	—	—	—	—
All target fisheries (unique individuals)	21	49.0	10.7	23	20.2	13.2

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Additionally, as shown below in Table 143, fishermen from San Francisco reported an average of 63.4 percent of their total personal income came from commercial fishing in 2010, an 18.4 percent decrease from 2007. Please note that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. Fishermen were asked to comment on why their fishing income had changed and their responses are shown below in Table 144. Fourteen individuals from San Francisco indicated they had a variety of additional sources of income besides commercial fishing in 2010 and these responses can be seen in Table 145.

Table 143. Percent change in income from overall commercial fishing from 2007 - 2010, San Francisco

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
California halibut–hook & line	7	56.0%	40.0%	11	46.8%	45.0%	-16.4%
Dungeness crab–trap	21	89.9%	24.4%	13	81.9%	22.3%	-8.9%
Nearshore finfish–live–fixed gear	—	—	—	2	*	*	n/a
Salmon–troll	30	80.8%	33.5%	3	90.0%	17.3%	11.4%
Urchin–dive	1	*	*	—	—	—	n/a
All target fisheries (unique individuals)	35	77.7%	35.3%	22	63.4%	39.0%	-18.4%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

Table 144. Cause in change in percent income from commercial fishing from 2007 - 2010, San Francisco

	Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
		Number responding					
Reason for increase	Relied more on other sources of income in 2007	1	1	—	*	—	1
	Natural fluctuation in fish abundance/presence (worse in 2007)	—	1	—	*	—	—
	Fishing less actively in 2007	—	1	—	*	—	1
	Started fishing after 2007	—	1	—	*	—	1
Reason for decrease	Relied more on other sources of income in 2010	—	1	—	*	—	1
	Natural fluctuation in fish abundance/presence (worse in 2010)	1	1	—	*	—	2
	Fishing less actively in 2010	—	—	—	*	—	—
	Age health/worse in 2010	—	—	—	*	—	—
	Fishing was less profitable in 2010	—	—	—	*	—	—
	Not able to fish salmon in 2010 due to regulations	—	—	—	*	—	—
	Number of individuals responding	1	4	—	*	—	4

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 145. Other sources of income other than commercial fishing in 2010, San Francisco

Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
	Number responding					
Construction/Contractor	1	—	*	—	—	1
Farming/Ranching	—	—	*	—	—	—
Fisheries research	—	1	*	1	—	1
Harbor/City job	—	—	*	—	—	—
Office work	1	—	*	—	—	1
Other fishing related work	—	—	*	—	—	—
Other specialized work	2	—	*	—	—	2
Property management	1	1	*	—	—	2
Retirement/Social Security/Investments	1	—	*	—	—	1
Salmon disaster relief	—	—	*	—	—	—
Skilled labor	2	1	*	—	—	2
Number of individuals responding	9	6	*	1	—	14

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

On average, fishermen in San Francisco spent 25.8 percent more of their total commercial fishing gross economic revenue (GER) on overall commercial fishing operating costs in 2010 than respondents in 2007 (Table 146). Please note that 2007 averages were taken directly from the 2008 study conducted by Ecotrust. This was a greater increase than other ports in the study region as well as the greatest percentage of operating costs in 2010. Similar to other ports in the region, fishermen from San Francisco noted increasing fuel costs as well as general increases in the cost of fishing related expenses as the primary cause for the rise in the proportion of their GER going towards operating costs (Table 147). Here, again the information compiled in these tables was not asked in regards to specific fisheries, but rather regarding their commercial fishing as a whole.

Table 146. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, San Francisco

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
California halibut–hook & line	7	45.4%	25.9%	11	57.9%	23.8%	27.4%
Dungeness crab–trap	20	45.0%	13.7%	13	56.0%	12.3%	24.5%
Nearshore finfish–live–fixed gear	—	—	—	2	*	*	n/a
Salmon–troll	29	43.9%	17.0%	3	58.3%	17.6%	33.0%
Urchin–dive	1	*	*	—	—	—	n/a
All target fisheries (unique individuals)	34	45.8%	18.1%	22	57.6%	18.4%	25.8%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

n/a indicates that the data point could not be calculated

Table 147. Cause of change in percent of gross economic revenue used towards overall operating costs, San Francisco

	Response	Number responding: California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live– fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
Reason for decrease	Large purchase or capital investment in 2007	—	—	—	—	—	—
	2007 was a bad fishing year	—	—	—	—	—	—
	Made less revenue in 2007	—	—	—	—	—	—
	Had more costs in 2007	—	—	—	—	—	—
Reason for increase	Large purchase or capital investment in 2010	—	1	—	—	—	1
	2010 was a bad fishing year	—	—	—	—	—	—
	Made less revenue in 2010	—	1	—	—	—	1
	Increased fuel prices in 2010	—	3	—	1	—	3
	More crew in 2010	—	1	—	1	—	1
	Fished out of multiple ports in 2010	—	—	—	—	—	—
	General cost increase in 2010	—	2	—	1	—	2
Number of individuals responding		—	5	—	2	—	5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Commercial fishermen from San Francisco reported targeting both the California halibut–hook & line and the Dungeness crab–trap fishery more frequently than the average respondent from any other port in the study region. They reported an average of 86.5 days targeting California halibut–hook & line, compared to the regional average of 68.5 and 73.3 days for Dungeness crab–trap, compared to the regional average of 64.2 (Table 148). Respondents in San Francisco used the most crew (2.2 members on average across all respondents) for the Dungeness crab–trap fishery and therefore also spent the largest proportion of their fishery specific gross revenue on crew for this fishery (29.2 percent). This is comparable to the study region as a whole, which reported an average crew of 2 members and paying them 28.3 percent of GER for the Dungeness crab–trap fishery. San Francisco salmon–troll fishermen reported spending nearly half of their fishery specific GER on fuel (48.3 percent, to be exact) compared to the 25.7 percent spent by the average regional respondent for this fishery. This is the highest reported proportion of fishery specific GER spent on fuel across all ports and all fisheries in study region. Some fishermen mentioned that because they caught so few salmon in 2010, they were unable to make up for fuel costs with revenue.

Table 148. Years of experience and number of days targeting specific fisheries in 2010, San Francisco

	Years of experience in fishery			Days spent targeting fishery		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
California halibut–hook & line	11	17.6	14.6	10	86.5	64.7
Dungeness crab–trap	13	23.2	12.8	12	73.3	46.6
Nearshore finfish–live–fixed gear	2	*	*	1	*	*
Salmon–troll	3	14.3	10.1	3	3.0	1.0
Urchin–dive	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 149. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, San Francisco

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut–hook & line	11	0.3	0.6	11	5.0%	15.0%	10	27.4%	12.1%
Dungeness crab–trap	13	2.2	0.8	12	29.2%	11.6%	11	10.5%	2.8%
Nearshore finfish–live–fixed gear	2	*	*	2	*	*	1	*	*
Salmon–troll	3	0.3	0.6	3	4.0%	6.9%	3	48.3%	34.0%
Urchin–dive	—	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Fishermen were asked if they added or dropped fisheries since 2007 or if they did not fish a fishery in 2010. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. Two salmon–troll fishermen reported they did not target salmon in 2010 (Table 150). One said this was because of the bad season and the other did not have enough time due to other work (Table 151). One fisherman indicated he did not target Dungeness crab–trap in 2010 and this was also due to lack of time.

Table 150. Commercial fisheries added/dropped since 2007 or not fished in 2010, San Francisco

Fisheries	Number responding	Percent responding		
		Added	Dropped	Not fished in 2010
California halibut–hook and line	11	—	—	—
Dungeness crab–trap	13	1	—	1
Nearshore finfish	2	*	*	*
Salmon–troll	3	—	—	2
Urchin–dive	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 151. Reason for adding/dropping a fishery since 2007 or not fishing in 2010, San Francisco

Response	Number responding				
	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live– fixed gear	Salmon–troll	Urchin–dive
New to commercial fishing	—	—	*	—	—
Purchased boat with permit	—	—	*	—	—
Not enough time due to other work	—	1	*	1	—
Increased difficulty due to MPAs	—	—	*	—	—
Bad season	—	—	*	1	—
Number responding	—	1	*	2	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Fishermen were asked for each fishery separately to compare the success in his/her fishery in 2011 to that of the last five years. As shown in the table below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into three categories: regulatory, environmental, and other as seen in the tables below. Responses in San Francisco followed trends similar to the study region as a whole. All Dungeness crab–trap fishermen said their success in the fishery was better than recent past years with 69.2 percent reporting that is was significantly better (Table 152) and primarily attributed this to an abundance of Dungeness crab and natural Dungeness crab abundance fluctuations. All three salmon–troll fishermen in San Francisco said the fishery was significantly worse due to regulations (shortened season), lack of fish, and bad weather (Table 153 and Table 154).

Table 152. Overall success in specific commercial fishery in 2010 compared to previous five years, San Francisco

Fisheries	Number responding	Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
		Percent response					
California halibut–hook & line	11	—	—	45.5%	—	18.2%	36.4%
Dungeness crab - trap	13	7.7%	69.2%	23.1%	—	—	—
Nearshore finfish–live–fixed gear	1	*	*	*	*	*	*
Salmon–troll	3	—	—	—	—	—	100.0%
Urchin–dive	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 153. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, San Francisco

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	3	—	—	2	—
	Responses	**Count of responses**				
Worse	Regulated season too short	1	—	—	2	—
Worse	MPAs	1	—	—	—	—
Worse	No permit required	1	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 154. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, San Francisco

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	4	12	—	2	—
	Responses	**Count of responses**				
Better	Larger quantity of fish	2	8	—	—	—
	Peak of natural cycle	1	6	—	—	—
	Good weather	—	—	—	—	—
	Good ocean conditions	—	—	—	—	—
	Good quality fish	—	—	—	—	—
	More bait/feed in the ocean	—	—	—	—	—
Worse	Low quantity of fish	1	—	—	2	—
	Bad weather	—	—	—	1	—
	Poor ocean conditions	1	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	—	—
	Red tide	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 155. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, San Francisco

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	3	—	—	—	—
	Responses	**Count of responses**				
Better	Able to fish more frequently	—	—	—	—	—
	Becoming more experienced	1	—	—	—	—
Worse	Others changing fishery	2	—	—	—	—
	Boat problems/breakdowns	—	—	—	—	—
	No access to live bait	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

4.5. Half Moon Bay

Half Moon Bay, in San Mateo County, is 30 miles south of San Francisco, on the Pacific coast of the San Francisco peninsula. According to the 2010 US Census, the population of Half Moon Bay was officially 11,324 residents, and the estimated per capita income (2007-2011) was $47,909 with a mean household income of $124,970 (US Census Bureau 2010), and the sector with the highest employment in 2006 was "educational, health and social service" (CDFG 2007). Like much of the surrounding region, the first European settlers arrived in 1769 from Spain. Prior to European settlement some 40 different tribal groups inhabited the San Francisco Bay area. Originally settled as a ranch during Mexican rule, the town of Half Moon Bay is the oldest in San Mateo County (Norman et al. 2007). The Pillar Point Harbor at the North end of Half Moon Bay is officially in a smaller town called Princeton and serves both commercial fishermen and CPFV operators. Additionally, a popular feature of the Harbor is that the public can buy fresh fish directly from fishermen selling from their boats. Located at this port is a boat ramp and 2000 pound hoist mainly for dinghies (Norman et al. 2007, California Coastal Commission 2003).

4.5.1. Half Moon Bay Commercial Fisheries Historical Trends and Initial Changes

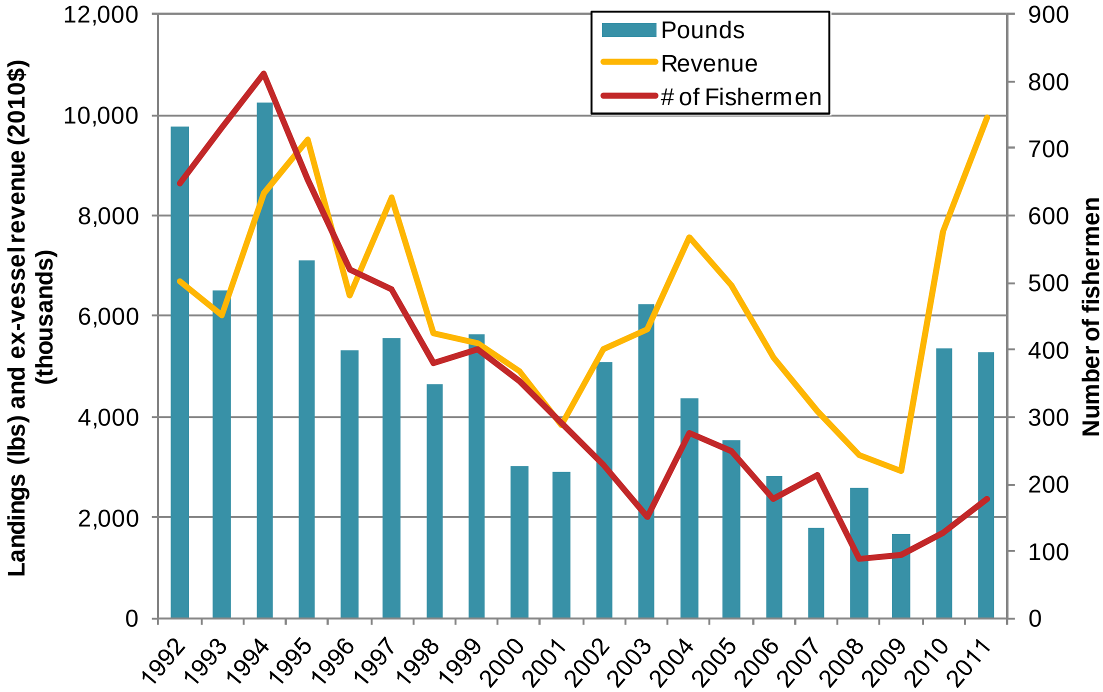
Half Moon Bay contributed 22.6 percent of total regional landings and 23.3 percent of total regional ex-vessel revenue on average over 1992–2011. Similar to Bodega Bay, landings peaked earlier on in the study period, at 10.2 million pounds in 1994, while ex-vessel revenue peaked at the end of the study period at $10 million in 2011, see Figure 99. This was due to the increased ex-vessel revenue in the Dungeness crab–trap fishery, which constituted approximately 80 percent of total ex-vessel revenue for the port in the years 2010 and 2011, as displayed below. The number of fishermen decreased 72.5 percent from 1992 to 2011.

Figure 100 and Figure 101 display the composition of landings and ex-vessel revenue for select fisheries of interest over 1992 to 2011 in Half Moon Bay. Because these figures also display all other landings and ex-vessel revenue (including necessary suppressions from the fisheries of interest) in the category labeled 'other', it is possible to tell approximately what portion the six fisheries of interest represent of the port's total landings and ex-vessel revenue over the study period. From 1992–2011, landings and ex-vessel revenue from the six fisheries of interest constituted an average of 37.1 percent and 66.9 percent respectively of total landings and ex-vessel revenue from all fisheries in Half Moon Bay. Averaging annually across the study period, the top five additional fisheries in Half Moon Bay that contributed to landings included groundfish–bottom trawl (24 percent), market squid–seine/net (18.6 percent), coastal pelagics–seine/net (8.7 percent), California halibut–bottom trawl (2.6 percent), and sablefish–longline (1.1 percent). In terms of average annual ex-vessel revenue, the top five additional fisheries in Half Moon Bay were groundfish–bottom trawl (10.9 percent), California halibut–bottom trawl (5.8 percent), market squid–seine/net (3.5 percent), abalone – red (3.1 percent), and sablefish–longline (1.6 percent).

The most prominent of the six fisheries of interest in Half Moon Bay over the study period were the Dungeness crab–trap and salmon–troll fisheries. The Dungeness crab–trap fishery began the study period in 1992 constituting only 2.8 percent of total landings (270,842 pounds) and 11.7 percent of total ex-vessel revenue ($785,541) in the port; these contributions increased by 2011 to 63.6 percent of total landings (3.4 million pounds) and 81.2 percent of total ex-vessel revenue ($8.1 million). Across the entirety of the study period, the salmon–troll fishery averaged 11.4 percent of total landings (571,493 pounds) and 24.1 percent of total ex-vessel revenue ($1.6 million) in Half Moon Bay annually.

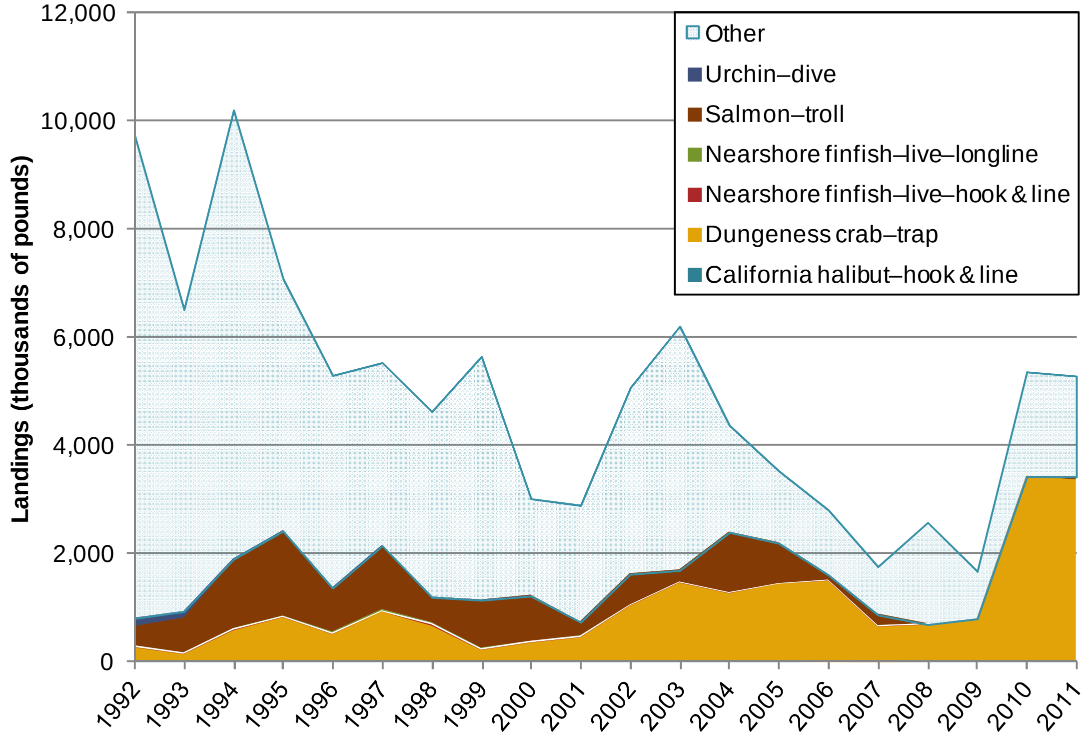
Figure 102 displays the average percent contribution to fishing income for those fishermen who made landings in Half Moon Bay over the study period from the six fisheries of interest, from other fisheries landed in Half Moon Bay, and from landings from all fisheries landed in other North Central Coast region ports. This figure shows reliance on a fishery but also on a given port. Landings made in Half Moon Bay contributed approximately 76.2 percent to fishing income on average annually to those making landings in the port; this percentage peaked in 2008 at 87.4 percent, and never fell below 67.4 percent (2001). The salmon–troll was the most significant fishery to those making landings in Half Moon Bay, and constituted nearly a third of fishermen's incomes on average annually over the study period.

Figure 99. Half Moon Bay total commercial landings, ex-vessel revenue, and number of fishermen, all fisheries, 1992–2011



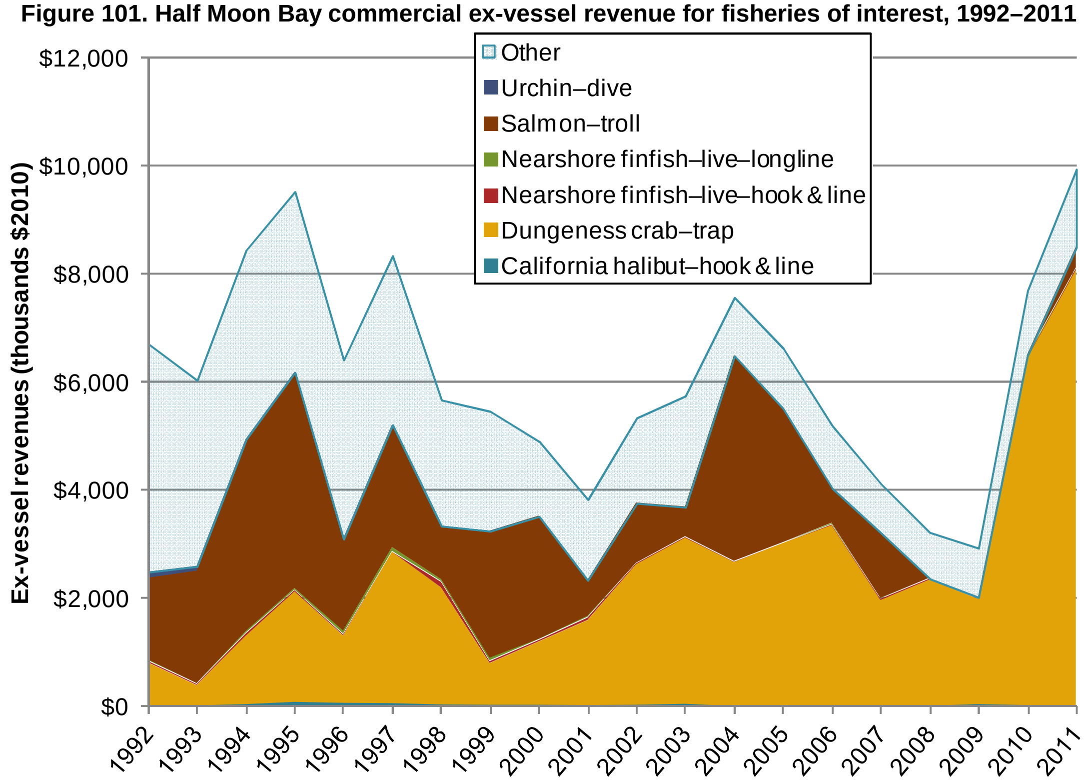
Source: Landings data from CDFW

Figure 100. Half Moon Bay commercial landings for fisheries of interest, 1992–2011



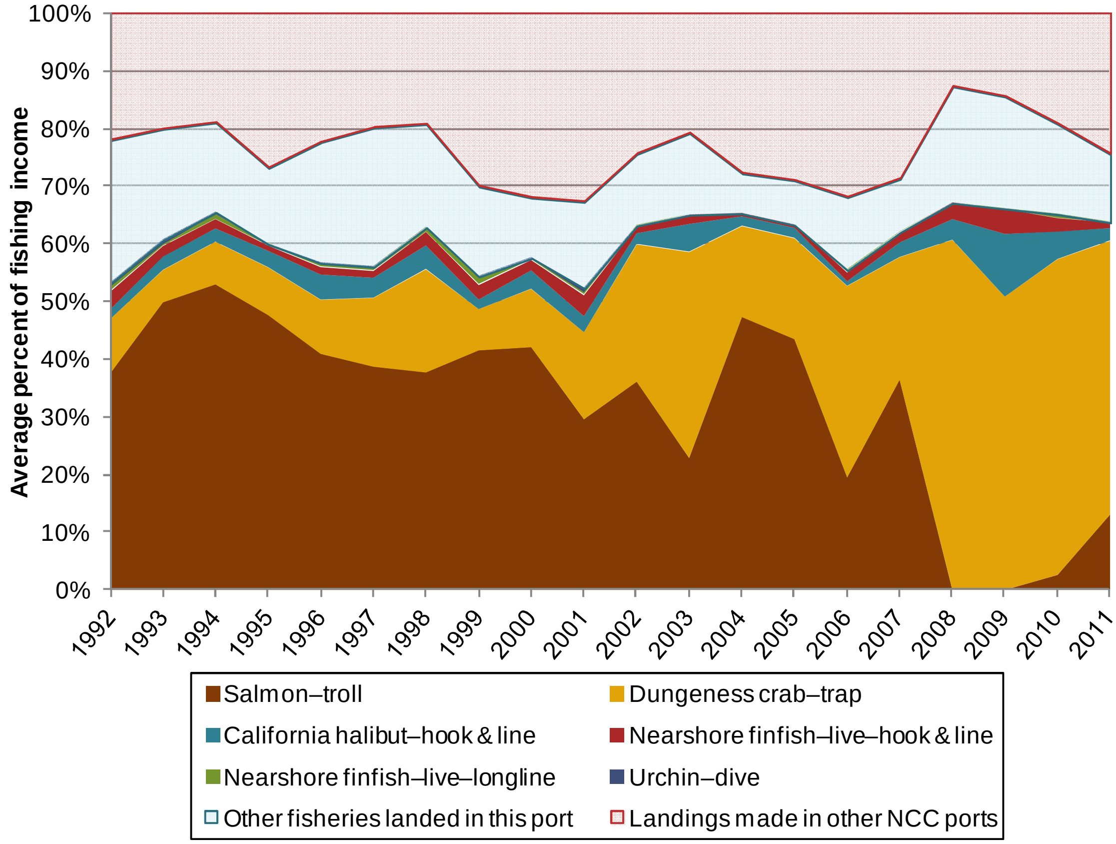
Source: Landings data from CDFW

Figure 101. Half Moon Bay commercial ex-vessel revenue for fisheries of interest, 1992–2011



Source: Landings data from CDFW

Figure 102. Average percent of individual fishing income from commercial fisheries of interest, Half Moon Bay, 1992–2011



Source: Landings data from CDFW

Table 156 displays the average annual percent change in total and average per fishermen ex-vessel revenue for each fishery in the port of Half Moon Bay as compared with the respective changes in the North Central Coast region over the study period. It is important to note that the post-MPA period of 2010–2011 examines only one year's worth of change among ex-vessel revenue while all the other sample periods average percent changes from year to year over five to eleven year periods.

In the pre-MPA period of 2000–2005, salmon–troll ex-vessel revenue increased at a higher average annual rate in Half Moon Bay (101.5 percent overall and 31.7 percent average per fisherman) than in the North Central Coast region (17.8 percent overall and 11.5 percent per fisherman). California halibut–hook & line ex-vessel revenue also increased at a higher rate than observed regionally, in the pre-MPA period of 2005–2010, at 71.1 percent annually on average in the port and 27.6 percent annually on average in the North Central Coast region. On the other hand, average annual ex-vessel revenue increases in the Dungeness crab–trap fishery per fishermen were at only 7.9 percent compared with the regional average of 27.5 percent per fisherman in the post–MPA period of 2010–2011.

Table 156. Half Moon Bay: Average annual percent change in total commercial ex-vessel revenue and average ex-vessel revenue per fisherman, 2000-2011

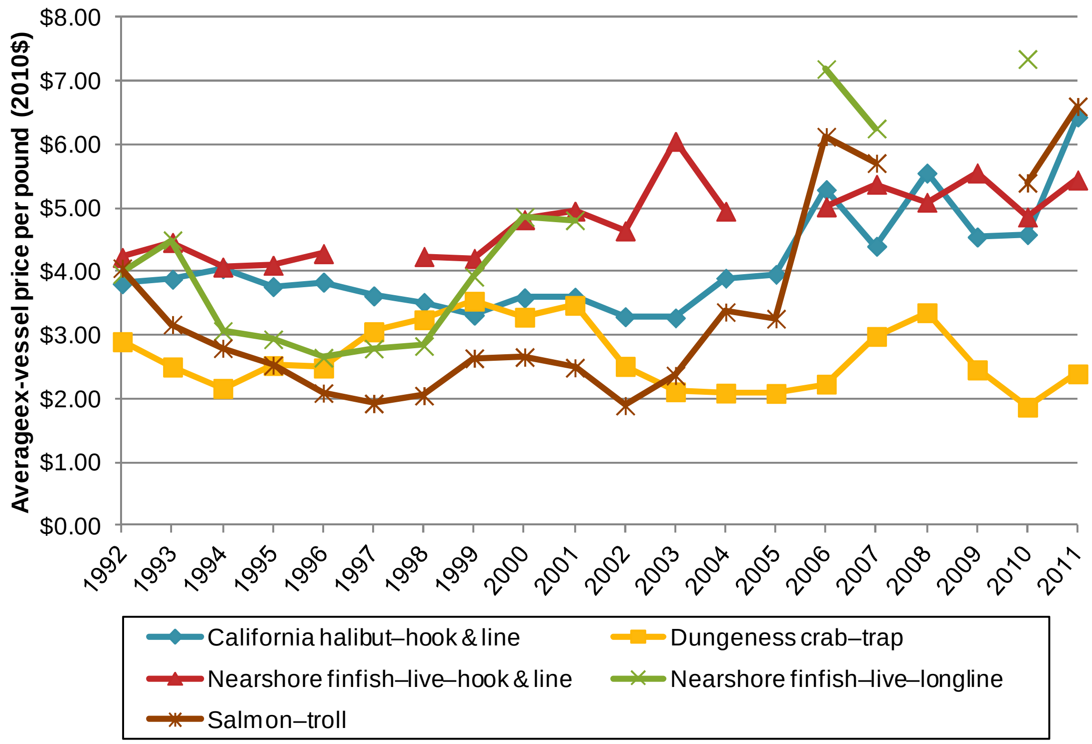
		Average annual percent change			
Fishery	**Commercial ex-vessel revenues**	**Pre-MPA (2000-2005)**	**Pre-MPA (2005-2010)**	**Post-MPA (2010-2011)**	**2000-2011**
California halibut–hook & line	Half Moon Bay total	-8.0%	71.1%	-28.1%	26.2%
	Half Moon Bay avg. per fisherman	13.9%	34.2%	3.3%	22.2%
	North Central Coast region total	14.7%	27.6%	-16.2%	17.7%
	North Central Coast region avg. per fisherman	16.9%	1.6%	1.0%	8.5%
Dungeness crab–trap	Half Moon Bay total	23.7%	40.3%	25.9%	31.4%
	Half Moon Bay avg. per fisherman	21.7%	19.2%	7.9%	19.3%
	North Central Coast region total	24.3%	63.8%	46.5%	44.3%
	North Central Coast region avg. per fisherman	22.7%	33.2%	27.5%	27.9%
Nearshore finfish–live–hook & line	Half Moon Bay total	-11.1%	19.9%	35.7%	7.9%
	Half Moon Bay avg. per fisherman	5.8%	34.1%	49.3%	23.2%
	North Central Coast region total	1.9%	-4.4%	14.5%	0.2%
	North Central Coast region avg. per fisherman	26.0%	2.7%	-7.5%	12.4%
Nearshore finfish–live–longline	Half Moon Bay total	120.2%	-77.7%	–	21.3%
	Half Moon Bay avg. per fisherman	10.1%	-77.7%	–	-33.8%
	North Central Coast region total	13.1%	2.5%	-2.9%	6.9%
	North Central Coast region avg. per fisherman	2.3%	4.4%	70.0%	9.4%
Salmon–troll	Half Moon Bay total	101.5%	-29.3%	2983.6%	378.1%
	Half Moon Bay avg. per fisherman	31.7%	-11.8%	553.0%	86.0%
	North Central Coast region total	17.8%	-40.4%	1460.2%	158.7%
	North Central Coast region avg. per fisherman	11.5%	-13.5%	331.8%	45.3%

Source: Landings data from CDFW

— indicates zero value data in the sample years

Figure 103 displays the average ex-vessel prices over time for select fisheries of interest in Half Moon Bay over the 1992–2011 study period. While an increasing share of Half Moon Bay total ex-vessel revenue accrued from the Dungeness crab–trap fishery, average ex-vessel prices per pound in that fishery were slightly less in 2011 ($2.39) than in 1992 ($2.90), and the lowest observed ex-vessel price occurred in 2010 at $1.87 per pound. The average salmon–troll ex-vessel price varied more greatly, from a low of $1.90 per pound (2002) to a high of $6.60 per pound (2011), averaging approximately $3 per pound annually over the study period. The California halibut–hook & line fishery average ex-vessel price per pound experienced the most growth in Half Moon Bay and was 68.8 percent higher in 2011 ($6.43) than in 1992 ($3.81). The nearshore finfish–live–longline fishery scored the highest ex-vessel price among all fisheries of interest displayed in Figure 103, at $7.35 per pound in 2010.

Figure 103. Average ex-vessel prices over time, target commercial fisheries, Half Moon Bay, 1992–2011



Source: Landings data from CDFW

Figure 104 displays landings, ex-vessel revenue, and number of fishermen for the California halibut–hook & line fishery in Half Moon Bay over 1992–2011. Landings and ex-vessel revenue in this fishery rose over 1992–1995 peaking in 1995 at 26,071 pounds for $98,196 before generally declining, finishing 2011 with 4,117 pounds landed for $26,485 in ex-vessel revenue. Trends for individual fishermen in this port and fishery rose for a long period from 1992–2003, before dropping to a low of 86 pounds for $455 in ex-vessel revenue per fisherman on average in 2006, and finished in 2011 at 257 pounds for $1,655 in ex-vessel revenue each on average, see Figure 105.

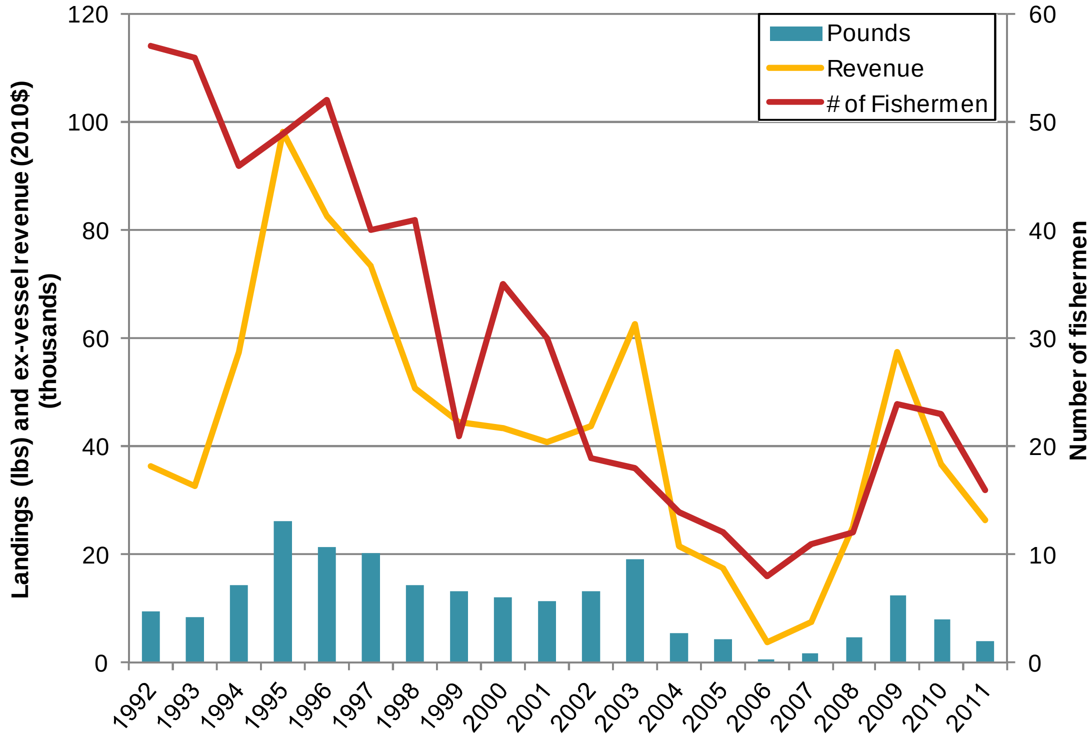
Figure 106 displays landings, ex-vessel revenue, and number of fishermen for the Dungeness crab–trap fishery in Half Moon Bay over 1992–2011. Total landings and ex-vessel revenue increased overall during the study period peaking in 2010 at 3.4 million pounds landing, and in 2011 in $8.1 million in ex-vessel revenue in 2011. Trends for individual fishermen in this port and fishery over the study period, presented as averages in Figure 107, also rose continuously over the study period. In 1992 the average Dungeness crab–trap fisherman made eight landings, landing a collective total of 2,531 pounds for $7,342 in ex-vessel revenue; by 2011 the average fisherman landed significantly more at 32,107 pounds for $76,842 in ex-vessel revenue over a total of 17 landings.

Figure 108 displays landings, ex-vessel revenue, and number of fishermen for the nearshore finfish–live–hook & line fishery in Half Moon Bay over 1992–2011. Landings and ex-vessel revenue peaked in 1998 at 23,780 pounds and $100,814, and decreased 83.5 percent to 3,928 pounds and 78.8 percent to $21,382 respectively by 2011. Trends for individual fishermen in this port and fishery were also highest in 1998 at 820 pounds for $3,476 in ex-vessel revenue on average, and overall increased significantly by 332.7 percent and 108.9 percent respectively over 1992–2011, see Figure 109.

Figure 110 displays landings, ex-vessel revenue, and number of fishermen for the nearshore finfish–live–longline fishery in Half Moon Bay over 1992–2011. On average, the fishery landed 11,004 pounds for $34,879 in ex-vessel revenue annually over the period 1992–2001 before dropping off in the latter half of the study period. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 111. The most the average fisherman landed in this fishery in Half Moon Bay over the study period was 2,170 pounds in 1997, peak average individual ex-vessel revenue occurred later at $7,384 in 2010.

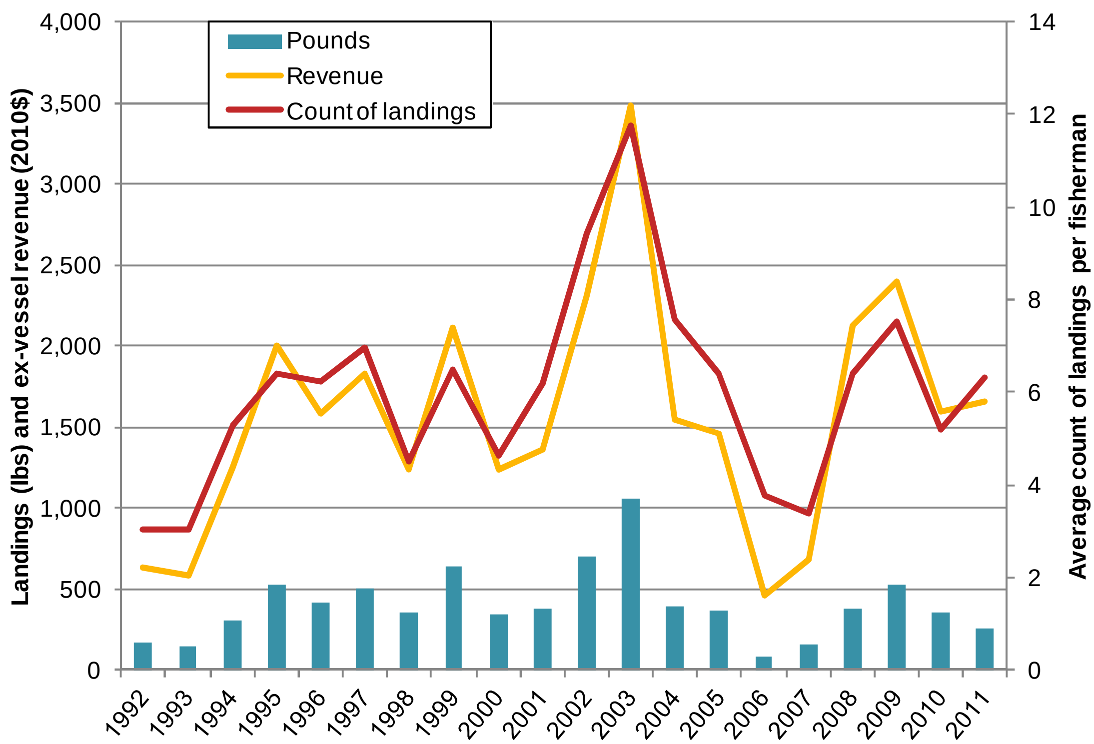
Figure 112 displays landings, ex-vessel revenue, and number of fishermen for the salmon–troll fishery in Half Moon Bay over 1992–2011. From 1992 to 2011 landings and ex-vessel revenue decreased 87.9 percent and 74.8 percent respectively, or from 373,256 pounds to 57,696 pounds and from $1.5 million to $380,780. Trends for individual fishermen in this port and fishery over the study period are presented as averages in Figure 113. As the number of fishermen decreased year after year, the average landings and ex-vessel revenue per fisherman increased, reaching a high of 5,089 pounds and $17,132 in ex-vessel revenue by 2004.

Figure 104. California halibut–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, Half Moon Bay, 1992–2011



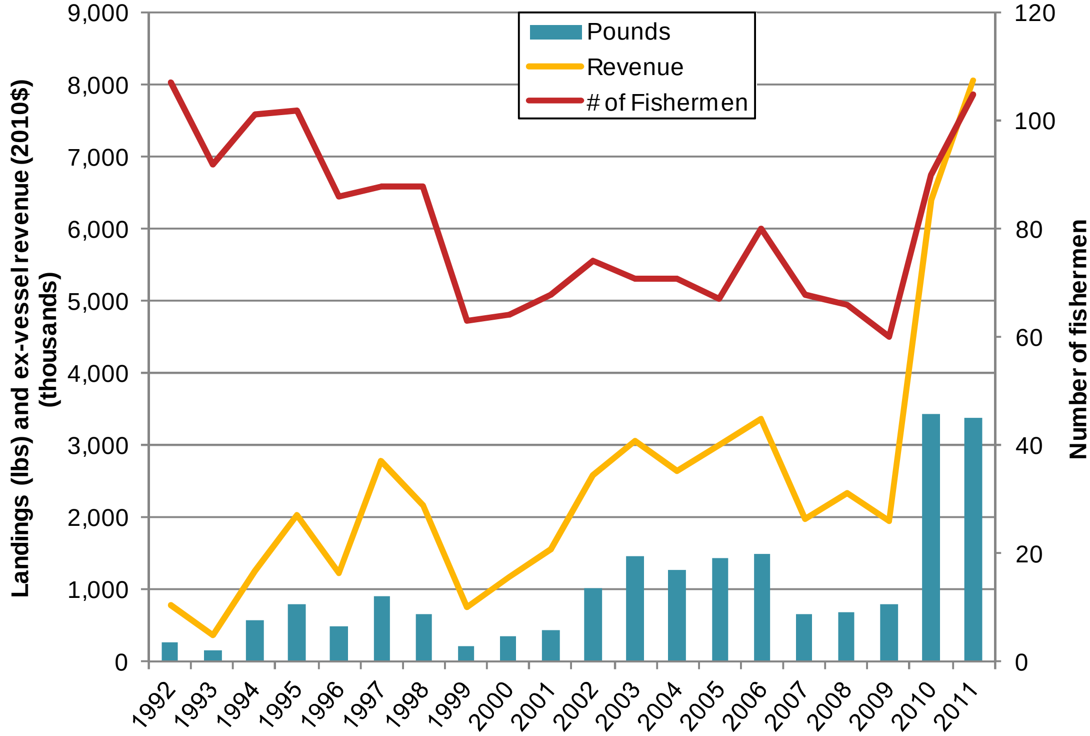
Source: Landings data from CDFW

Figure 105. California halibut–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Half Moon Bay, 1992–2011



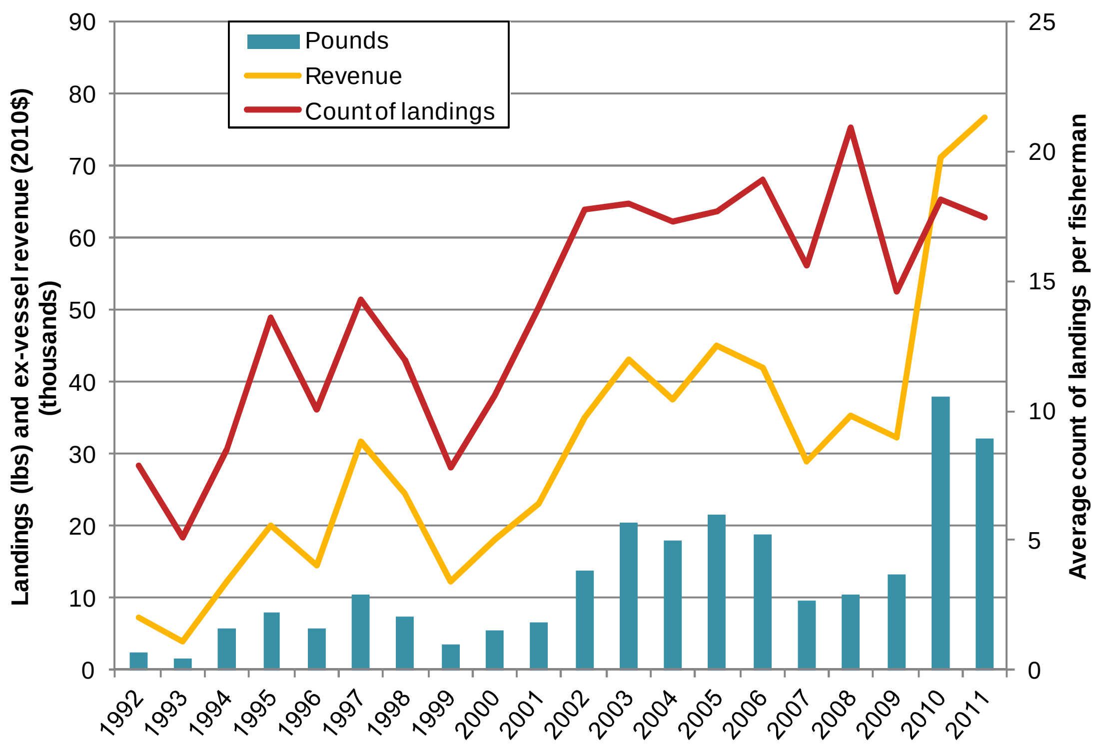
Source: Landings data from CDFW

Figure 106. Dungeness crab–trap: Commercial landings, ex-vessel revenue, and number of fishermen, Half Moon Bay, 1992–2011



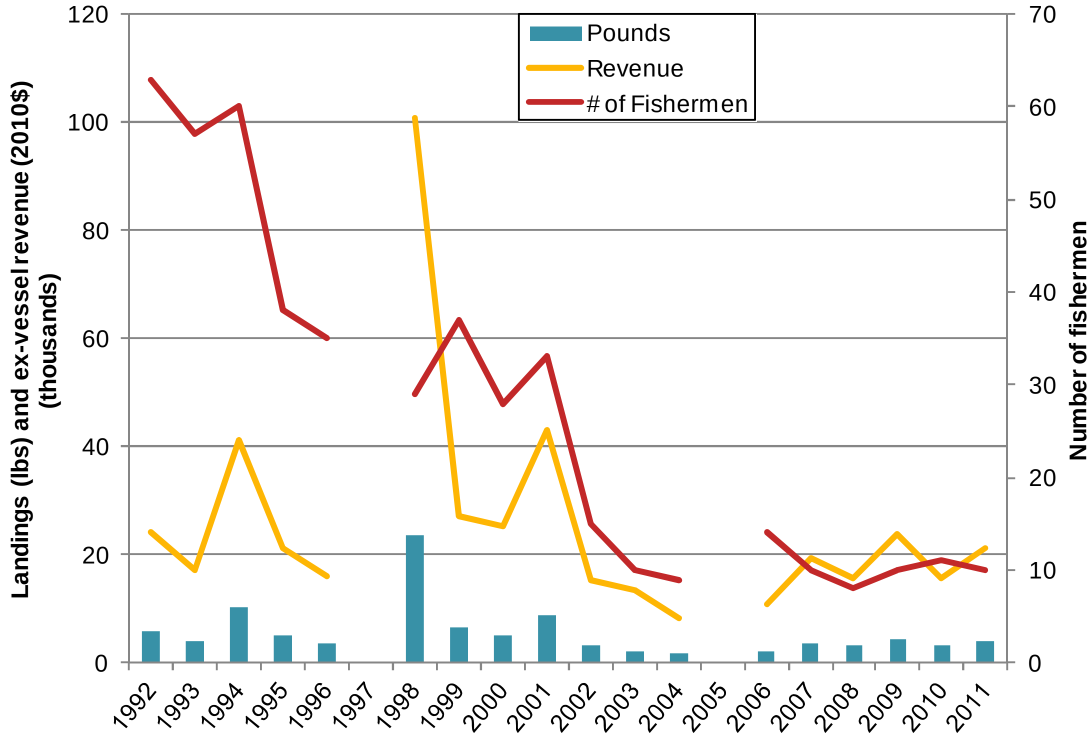
Source: Landings data from CDFW

Figure 107. Dungeness crab–trap: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Half Moon Bay, 1992–2011



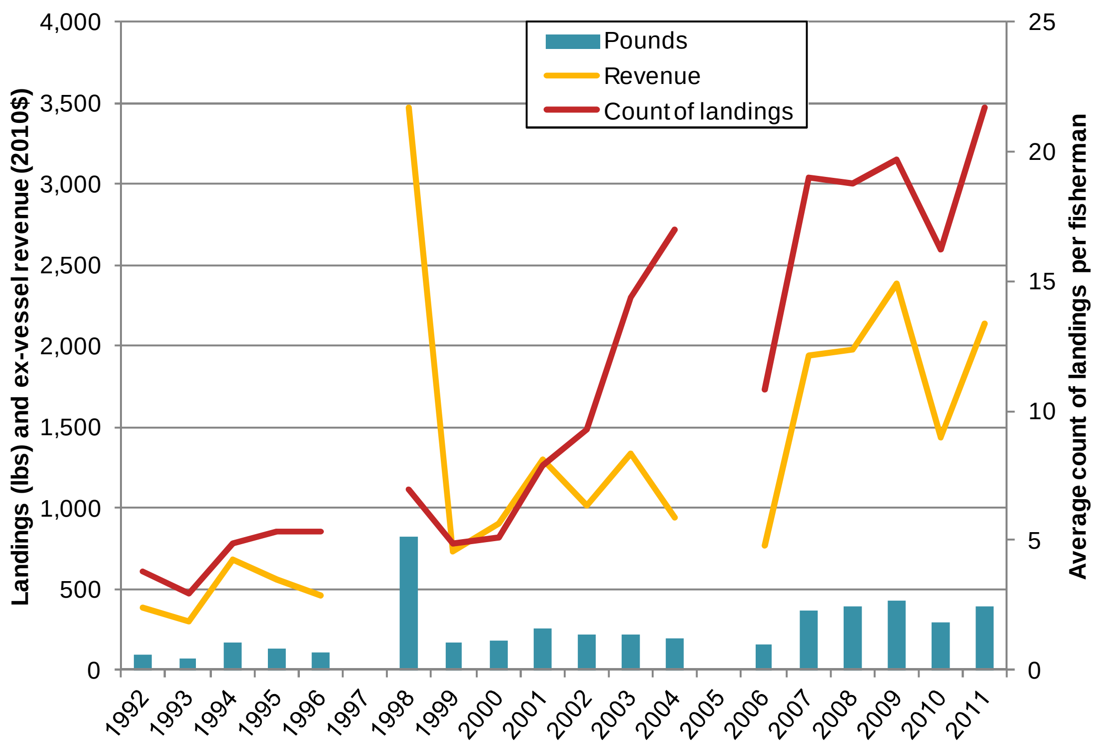
Source: Landings data from CDFW

Figure 108. Nearshore finfish–live–hook & line: Commercial landings, ex-vessel revenue, and number of fishermen, Half Moon Bay, 1992–2011



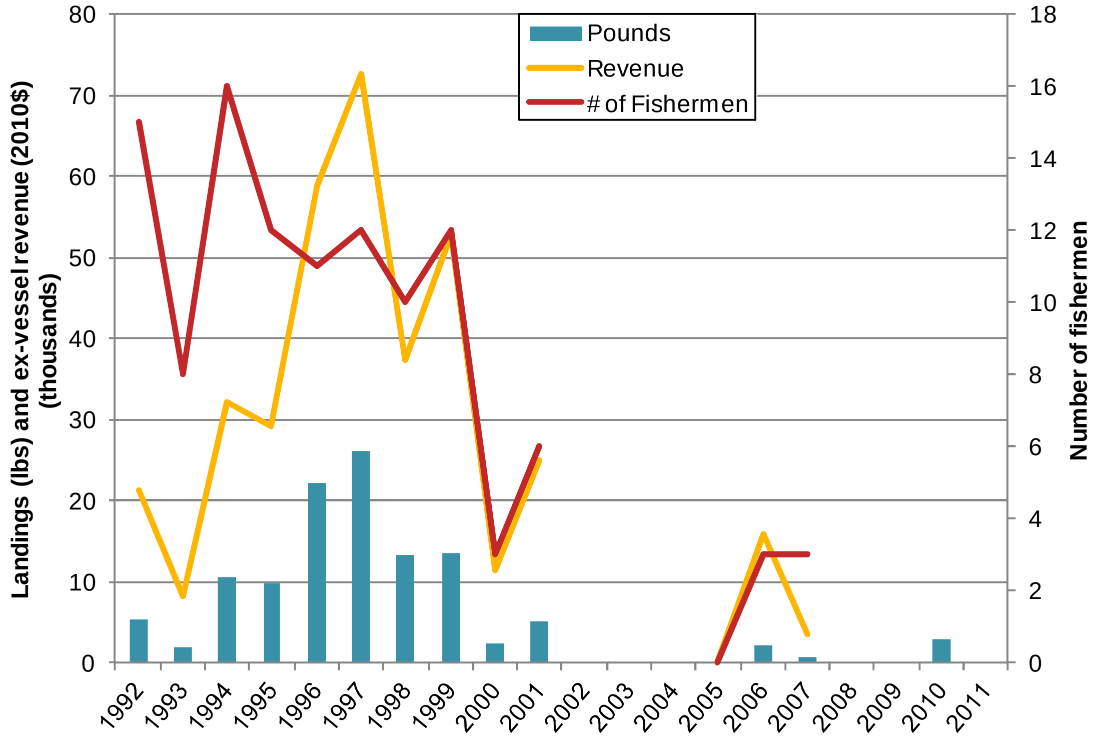
Source: Landings data from CDFW

Figure 109. Nearshore finfish–live–hook & line: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Half Moon Bay, 1992–2011



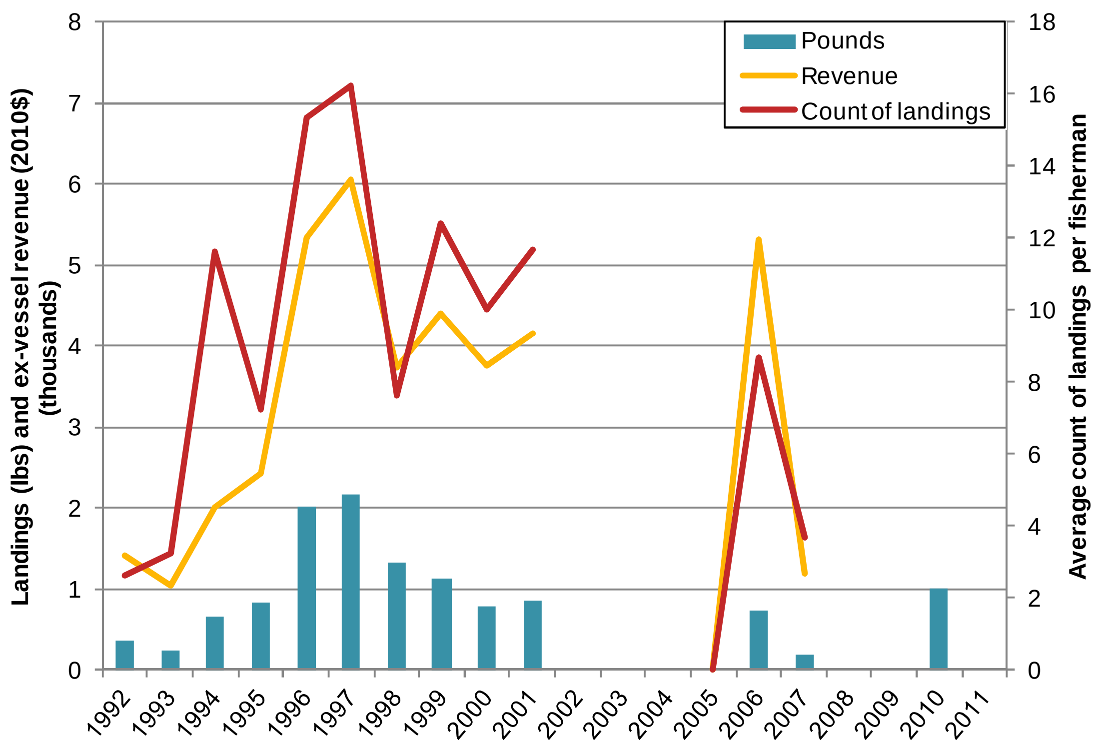
Source: Landings data from CDFW

Figure 110. Nearshore finfish–live–longline: Commercial landings, ex-vessel revenue, and number of fishermen, Half Moon Bay, 1992–2011



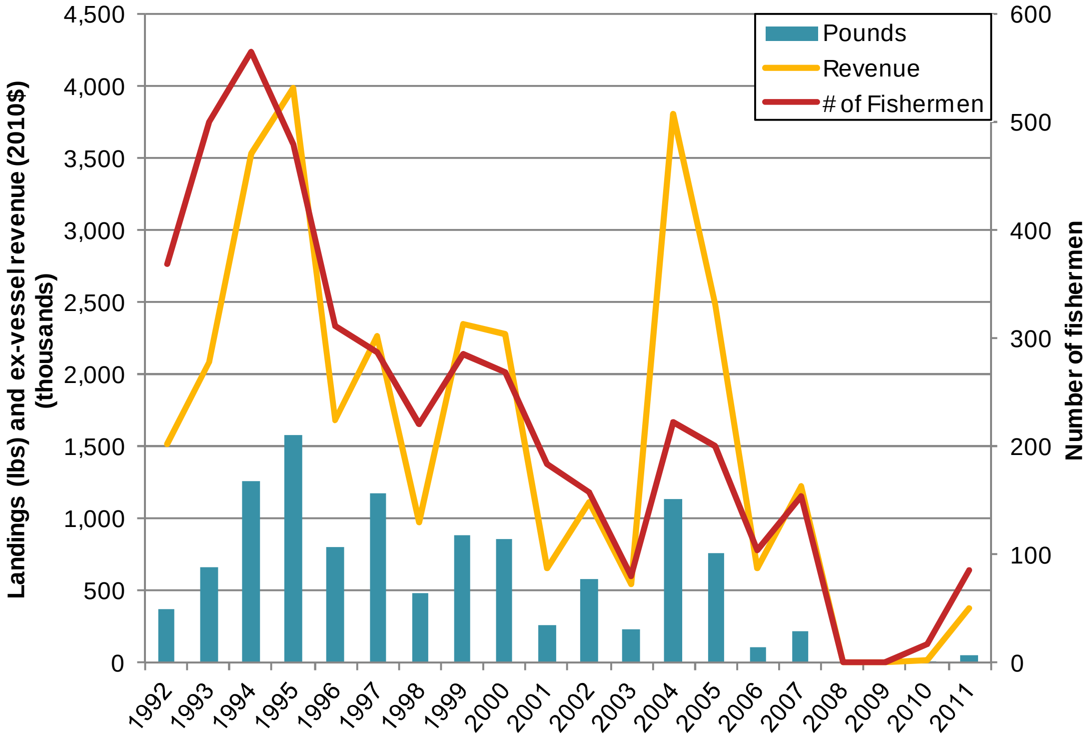
Source: Landings data from CDFW Year (Ex-vessel revenue - # of fishermen): 2010($22,153 - 3)

Figure 111. Nearshore finfish–live–longline: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Half Moon Bay, 1992–2011



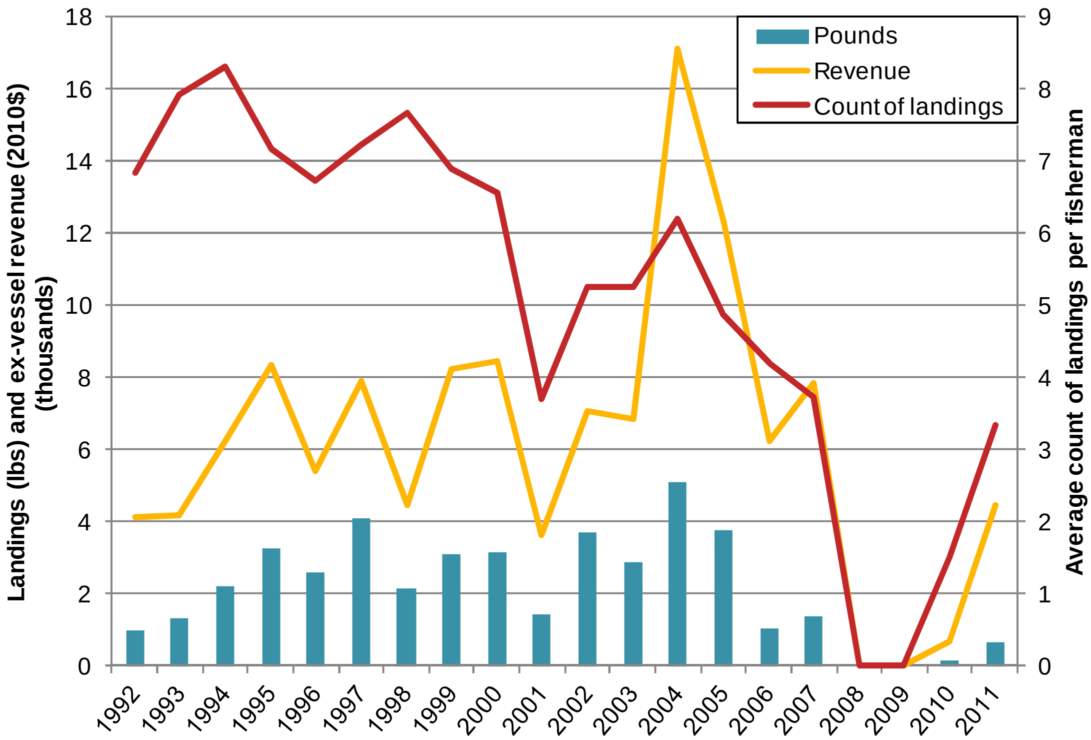
Source: Landings data from CDFW Year (Ex-vessel revenue – count of landings): 2010($7,384 - 15)

Figure 112. Salmon–troll: Commercial landings, ex-vessel revenue, and number of fishermen, Half Moon Bay, 1992–2011



Source: Landings data from CDFW

Figure 113. Salmon–troll: Average pounds landed, ex-vessel revenue, and count of landings per fisherman, commercial fishing, Half Moon Bay, 1992–2011



Source: Landings data from CDFW

4.5.2. Half Moon Bay Commercial Baseline Characterization

In Half Moon Bay the five target fisheries generated almost 6.5 million dollars in ex-vessel revenue in 2010 and nearly 99 percent of this revenue was from the Dungeness crab–trap fishery (Table 157). In total, 120 fishermen landed at least in one of the five target fisheries in Half Moon Bay and we interviewed 24 of them. All but five of the individuals we interviewed participated in the Dungeness crab–trap fishery.

Table 157. Number of commercial fishermen interviews conducted and fishery ex-vessel revenue value, 2010, non-spatial survey, Half Moon Bay

Fishery	2010 total ex-vessel revenue (2010$)	Total number of individuals in 2010 landings	Number interviewed
California halibut–hook & line	$36,838	23	4
Dungeness crab–trap	$6,406,701	90	19
Nearshore finfish–live–fixed gear	$37,905	14	5
Salmon–troll	$12,349	17	2
Urchin–dive	—	—	—
All target fisheries (unique individuals)	$6,493,793	120	24

Source: California Department of Fish and Wildlife, Current study

— indicates that the port/fishery was not sampled or a zero value data point

On average, respondents from Half Moon Bay were 52 years old and had 25.9 year of commercial fishing experience. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. Fishermen who participated in the California halibut–hook and line fishery were the youngest (44 years old on average) and reported the fewest number of years fishing commercially (15.8 years on average).

Table 158. Average age and years of experience commercial fishing, 2010, Half Moon Bay

	Age			Years of experience		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut–hook & line	4	44.0	8.5	4	15.8	9.2
Dungeness crab–trap	17	53.5	9.4	19	28.4	12.5
Nearshore finfish–live–fixed gear	5	51.6	5.9	5	24.0	8.4
Salmon–troll	2	*	*	2	*	*
Urchin–dive	—	—	—	—	—	—
All target fisheries (unique individuals)	22	52.0	9.8	24	25.9	12.5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

On average, there was a general decrease in the percent of total personal income from commercial fishing from 2007 to 2010 for commercial fishermen in Half Moon Bay. The 2007 averages were derived directly from the 2008 study conducted by Ecotrust. Those who fished for Dungeness crab reported that 88.2 percent of their total personal income came from commercial fishing in 2010, which was higher than the average respondent in the port (80.2 percent), yet still slightly less than was reported in 2007 across all fisheries in the port (85.4 percent) (Table 159).

Fishermen in Half Moon Bay noted that some individuals who primarily target the nearshore finfish–live–fixed gear fishery have to rely on other jobs to support themselves. He noted that many will only target nearshore finfish in the summer or on the weekends. This is indicated by the low proportion of income generated from overall commercial fishing by participants in the nearshore finfish–live–fixed gear fishery (49.8 percent in 2010). It should be noted, however, that some nearshore finfish–live–fixed gear fishermen are full time fishermen and target a variety of fisheries. For these fishermen, nearshore finfish–live–fixed gear is an important part of their fishing portfolio but due to the relatively small quota allocated to nearshore finfish and increasing regulations such as MPAs, fishermen who are able to are opting to fish other fisheries that are more economically viable.

Thirteen respondents reported they had additional sources of income separate from commercial fishing in 2010. Four of these individuals indicated that they relied more on their non-fishing income in 2010 than in previous years (Table 160). Five of these individuals indicated they had received salmon disaster relief funds in 2010 which was an additional source of income (Table 161).

Table 159. Percent change in income from overall commercial fishing from 2007 - 2010, Half Moon Bay

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent Change**
California halibut–hook & line	6	74.2%	40.1%	4	57.5%	47.3%	-22.5%
Dungeness crab–trap	18	88.9%	25.2%	19	88.2%	20.2%	-0.8%
Nearshore finfish–live–fixed gear	2	*	*	5	49.8%	44.5%	-36.0%
Salmon–troll	14	78.1%	32.4%	2	*	*	*
Urchin–dive	—	—	—	—	—	—	—
All target fisheries (unique individuals)	21	85.4%	28.2%	24	80.2%	30.3%	-6.1%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

Table 160. Cause in change in percent income from commercial fishing from 2007 - 2010, Half Moon Bay

	Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
		Number responding					
Reason for increase	Relied more on other sources of income in 2007	—	—	—	*	—	—
	Natural fluctuation in fish abundance/presence (worse in 2007)	—	2	1	*	—	2
	Fishing less actively in 2007	—	—	—	*	—	—
	Started fishing after 2007	—	—	—	*	—	—
Reason for decrease	Relied more on other sources of income in 2010	—	4	—	*	—	4
	Natural fluctuation in fish abundance/presence (worse in 2010)	—	—	—	*	—	—
	Fishing less actively in 2010	1	1	1	*	—	2
	Age health/worse in 2010	—	1	—	*	—	1
	Fishing was less profitable in 2010	1	—	1	*	—	1
	Not able to fish salmon in 2010 due to regulations	—	—	—	*	—	—
Number of individuals responding		1	5	2	1	—	6

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 161. Other sources of income other than commercial fishing in 2010, Half Moon Bay

	Number responding					
Response	**California halibut–hook & line**	**Dungeness crab–trap**	**Nearshore finfish–live–fixed gear**	**Salmon–troll**	**Urchin–dive**	**All fisheries (unique individuals)**
Construction/Contractor	—	—	—	*	—	—
Farming/Ranching	—	1	—	*	—	1
Fisheries research	—	2	—	*	—	2
Harbor/City job	1	1	1	*	—	2
Office work	—	—	—	*	—	—
Other fishing related work	—	—	—	*	—	—
Other specialized work	—	1	1	*	—	1
Property management	1	—	—	*	—	1
Retirement/Social Security/Investments	—	1	—	*	—	1
Salmon disaster relief	1	4	1	*	—	5
Skilled labor	2	—	2	*	—	3
Number of individuals responding	3	9	4	*	—	13

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

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Across all target fisheries, respondents in Half Moon Bay reported they spent, on average. 53.9 percent of their overall commercial fishing gross economic revenue (GER) on overall commercial fishing operating costs in 2010. This was a slight increase (2.9 percent) from the average Half Moon Bay respondent in 2007 (Table 162). This increase was greater across the entire study region (12.1 percent increase between the 2007 study to the 2010 study). It should be noted that 2007 averages were taken directly from the 2008 study conducted by Ecotrust.

As indicated below, the nearshore finfish–live–fixed gear fishermen we spoke to in 2010 reported an average of 41.2 percent of their commercial fishing GER went towards their overall commercial fishing operating costs. Unlike most other ports, the most commonly reported reason for the increase in operating costs across all fisheries, but primarily in the Dungeness crab-trap fishery was a large purchase or capital investment in 2010 (Table 163).

Table 162. Percent change in percent of gross economic revenue towards overall commercial fishing operating costs from 2007 - 2010, Half Moon Bay

	2007^			2010			
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Percent change**
California halibut–hook & line	6	54.2%	28.2%	4	52.5%	17.1%	-3.1%
Dungeness crab–trap	18	50.0%	23.9%	19	55.0%	24.7%	10.1%
Nearshore finfish–live–fixed gear	2	*	*	5	41.2%	14.0%	-33.7%
Salmon–troll	14	52.1%	25.3%	2	*	*	*
Urchin–dive	—	—	—	—	—	—	—
All target fisheries (unique individuals)	21	52.4%	24.6%	24	53.9%	22.8%	2.9%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^2007 data were taken from Scholz, A.J. et al 2008.

Table 163. Cause of change in percent of gross economic revenue used towards overall operating costs, Half Moon Bay

		Number responding					
	Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live– fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
Reason for decrease	Large purchase or capital investment in 2007	—	1	—	*	—	1
	2007 was a bad fishing year	—	1	—	*	—	1
	Made less revenue in 2007	—	1	—	*	—	1
	Had more costs in 2007	—	—	—	*	—	—
Reason for increase	Large purchase or capital investment in 2010	—	6	1	*	—	6
	2010 was a bad fishing year	—	—	—	*	—	—
	Made less revenue in 2010	—	—	—	—	—	—
	Increased fuel prices in 2010	1	1	1	*	—	2
	More crew in 2010	—	1	—	*	—	1
	Fished out of multiple ports in 2010	—	—	—	*	—	—
	General cost increase in 2010	—	1	—	*	—	1
Number of individuals responding		1	9	2	*	—	10

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In Half Moon Bay the most frequently targeted fishery was nearshore finfish–live–fixed gear, which respondents noted they fished an average of 90 days per year in 2010, which was greater than the regional average of 71.9 days for this fishery. Dungeness crab–trap fishermen reported using the most crew (1.9) and subsequently reported spending the highest proportion of their fishery specific gross economic revenue on their crew (29.8 percent). Dungeness crab–trap was also the least proportionally fuel intensive fishery (12.1 percent of GER was spent on fuel), while nearshore finfish–live–fixed gear was the most (34.5 percent) (Table 165).

Fishermen were asked if they added or dropped fisheries since 2007 or if they did not fish a fishery in 2010. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. Only one respondent reported adding a fishery between 2007 and 2010, California halibut–hook and line (Table 166) and noted that they were new to commercial fishing as a whole (Table 167).

Table 164. Years of experience and number of days targeting specific fisheries in 2010, Half Moon Bay

	Years of experience in fishery			Days spent targeting fishery		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard Deviation**
California halibut–hook & line	4	17.8	10.8%	4	60.0	61.6
Dungeness crab–trap	19	24.4	12.1%	19	52.7	25.7
Nearshore finfish–live–fixed gear	5	23.2	10.3%	4	90.0	91.3
Salmon–troll	2	*	*	—	*	*
Urchin–dive	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 165. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, Half Moon Bay

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut–hook & line	4	0.3	0.5	4	3.8%	7.5%	4	30.0%	16.3%
Dungeness crab–trap	19	1.9	0.7	18	29.8%	8.3%	18	12.1%	7.2%
Nearshore finfish–live–fixed gear	5	0.2	0.4	5	3.0%	6.7%	4	34.5%	17.9%
Salmon–troll	2	*	*	2	*	*	2	*	*
Urchin–dive	—	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 166. Commercial fisheries added/dropped since 2007 or not fished in 2010, Half Moon Bay

Fisheries	Number responding	Percent responding: Added	Dropped	Not fished in 2010
California halibut–hook and line	4	1	—	—
Dungeness crab–trap	19	—	—	—
Nearshore finfish	5	—	—	—
Salmon–troll	2	—	—	—
Urchin–dive	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 167. Reason for adding/dropping a fishery since 2007 or not fishing in 2010, Half Moon Bay

Response	Number responding: California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live– fixed gear	Salmon–troll	Urchin–dive
New to commercial fishing	1	—	—	—	—
Purchased boat with permit	—	—	—	—	—
Not enough time due to other work	—	—	—	—	—
Increased difficulty due to MPAs	—	—	—	—	—
Bad season	—	—	—	—	—
Number responding	1	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Fishermen were asked separately for each fishery they participated in to compare the success in his/her fishery in 2010 to the success in his/her fishery in the last five years. As shown in Table 168 below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

Similar to the rest of the study region, respondents in Half Moon Bay indicated that the Dungeness crab–trap fishery was doing either significantly better (89.5 percent) or somewhat better (10.5 percent). Responses for the remaining fisheries were more varied. Half Moon Bay was the only port where fishermen indicated that the nearshore finfish–live–fixed gear fishery was doing better than it had in the previous five years. The two fishermen who responded this way noted they felt there were more fish present and that they were of higher quality than previous years (Table 170). The remaining nearshore finfish–live–fixed gear fishermen felt the fishery was doing worse and cited MPAs (Table 169), a low quantity of fish (Table 170) and boat breakdowns (Table 171) as the reasons.

Table 168. Overall success in specific commercial fishery in 2010 compared to previous five years, Half Moon Bay

		Percent response					
Fisheries	**Number responding**	**Did not participate in previous seasons**	**Significantly better**	**Somewhat better**	**The same**	**Somewhat worse**	**Significantly worse**
California halibut–hook & line	4	25.0%	—	—	50.0%	25.0%	—
Dungeness crab–trap	19	—	89.5%	10.5%	—	—	—
Nearshore finfish–live–fixed gear	5	—	20.0%	20.0%	—	40.0%	20.0%
Salmon–troll	2	*	*	*	*	*	*
Urchin–dive	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 169. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Half Moon Bay

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	—	—	1	1	—
	Responses	**Count of responses**				
Worse	Regulated season too short	—	—	—	*	—
	MPAs	—	—	1	*	—
	No permit required	—	—	—	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 170. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Half Moon Bay

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	1	17	3	1	—
	Responses					
Better	Larger quantity of fish	—	14	2	*	—
	Peak of natural cycle	—	5	—	*	—
	Good weather	—	—	—	*	—
	Good ocean conditions	—	2	—	*	—
	Good quality fish	—	—	1	*	—
	More bait/feed in the ocean	—	—	—	*	—
Worse	Low quantity of fish	1	—	1	*	—
	Bad weather	—	—	—	*	—
	Poor ocean conditions	—	—	—	*	—
	Loss of salmon spawning grounds	—	—	—	*	—
	Red tide	—	—	—	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 171. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, Half Moon Bay

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	—	—	1	—	—
	Responses	**Count of responses**				
Better	Able to fish more frequently	—	—	—	—	—
	Becoming more experienced	—	—	—	—	—
Worse	Others changing fishery	—	—	—	—	—
	Boat problems/breakdowns	—	—	1	—	—
	No access to live bait	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

5. NORTH CENTRAL COAST COMMERCIAL FISHING SPATIAL BASELINE

In the following section we provide maps of baseline data depicting the spatial fishing patterns of specific commercial fisheries at the port and region level. The full detailed methodology of how these data were collected, analyzed, and reviewed can be found in Section 2 of this report. The GIS data layers with associated metadata of these spatial data sets are also available and were included in the deliverables package of this project which can be found on the OceanSpaces website: (http://oceanspaces.org).

The following map products and spatial data sets for North Central Coast region commercial fisheries for the post-MPA 2010 season are provided in Table 172 below along with the number of fishermen who contributed data in each map and the percent of ex-vessel revenue represented by these fishermen who participated in the mapping portion of the interview. The number of fishermen who participated in the mapping portion of the interview may differ from the number of fishermen who participated in the non-spatial portion of the survey (Table 4) as some fishermen opted to not provide fishing ground information. Only maps with 3 or more fishermen are available for use due to confidentiality protocols as indicated in the table below.

We would like to note that the maps for the salmon-troll fishery are not included here due to the very limited season in 2010, however, salmon-troll maps are provided for the full 2011 fishing grounds in the appendix of this report and as well as in the maps and data sets delivered as part of this project

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Table 172. Number of commercial fishermen interviews conducted and 2010 ex-vessel landings value represented in spatial survey

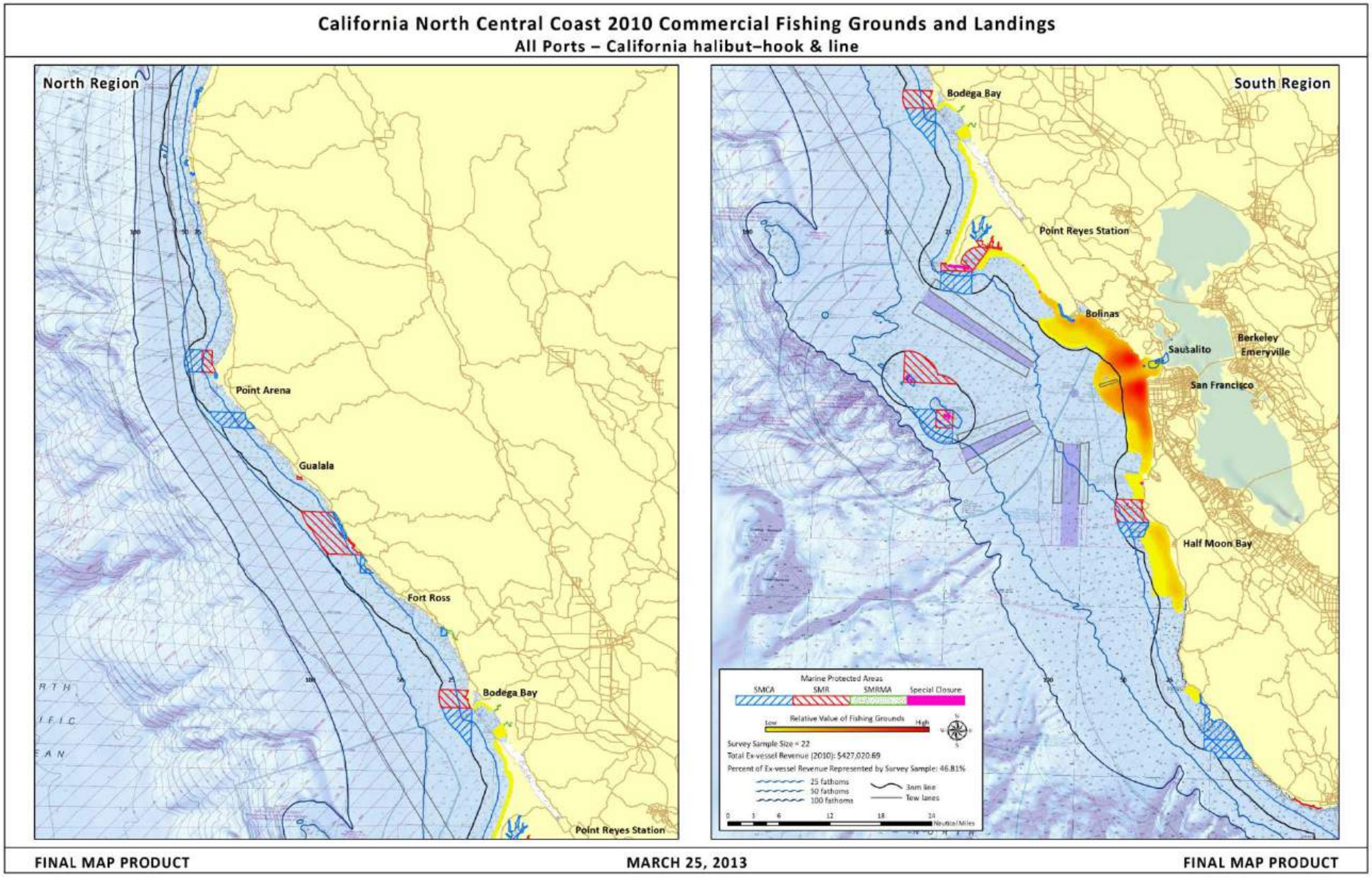
Port/Region	Fishery	2010 ex-vessel revenue (2010$)	Percent of ex-vessel revenue represented by interviews	Total number of individuals in 2010 landings	Number of fishermen who mapped	Map available
North Central Coast	California halibut – hook & line	$427,021	47%	105	22	YES
North Central Coast	Dungeness crab – trap	$26,321,805	47%	255	79	YES
North Central Coast	Nearshore finfish – fixed gear	$210,672	46%	26	9	YES
North Central Coast	Salmon–troll	$79,123	—	61	—	—
North Central Coast	Urchin–dive	$424,114	76%	12	6	YES
Point Arena	California halibut – hook & line	—	—	—	—	—
Point Arena	Dungeness crab – trap	$26,040	98%	4	3	YES
Point Arena	Nearshore finfish – fixed gear	$73,897	*	3	2	NO
Point Arena	Salmon–troll	$4,614	—	2	—	—
Point Arena	Urchin–dive	$341,676	70%	10	4	YES
Bodega Bay	California halibut – hook & line	$36,489	61%	16	5	YES
Bodega Bay	Dungeness crab – trap	$7,668,025	43%	94	29	YES
Bodega Bay	Nearshore finfish – fixed gear	$43,601	*	7	2	NO
Bodega Bay	Salmon–troll	$60,596	—	35	—	—
Bodega Bay	Urchin–dive	$82,438	*	3	2	NO
Bolinas	California halibut – hook & line	$29,234	75%	7	3	YES
Bolinas	Dungeness crab – trap	$180,170	83%	9	4	YES
Bolinas	Nearshore finfish – fixed gear	—	—	—	—	—
Bolinas	Salmon–troll	$154	—	1	—	—
Bolinas	Urchin–dive	—	—	—	—	—
San Francisco	California halibut – hook & line	$324,459	43%	77	14	YES
San Francisco	Dungeness crab – trap	$12,040,869	44%	110	25	YES
San Francisco	Nearshore finfish – fixed gear	$55,269	*	13	1	NO
San Francisco	Salmon–troll	$1,409	—	7	—	—
San Francisco	Urchin–dive	—	—	—	—	—
Half Moon Bay	California halibut – hook & line	$36,838	37%	23	4	YES
Half Moon Bay	Dungeness crab – trap	$6,406,701	55%	90	25	YES
Half Moon Bay	Nearshore finfish – fixed gear	$37,905	32%	14	5	YES
Half Moon Bay	Salmon–troll	$12,349	—	17	—	—
Half Moon Bay	Urchin–dive	—	—	—	—	—

Source: California Department of Fish and Wildlife, Current study

— indicates that the port/fishery was not sampled or a zero value data point

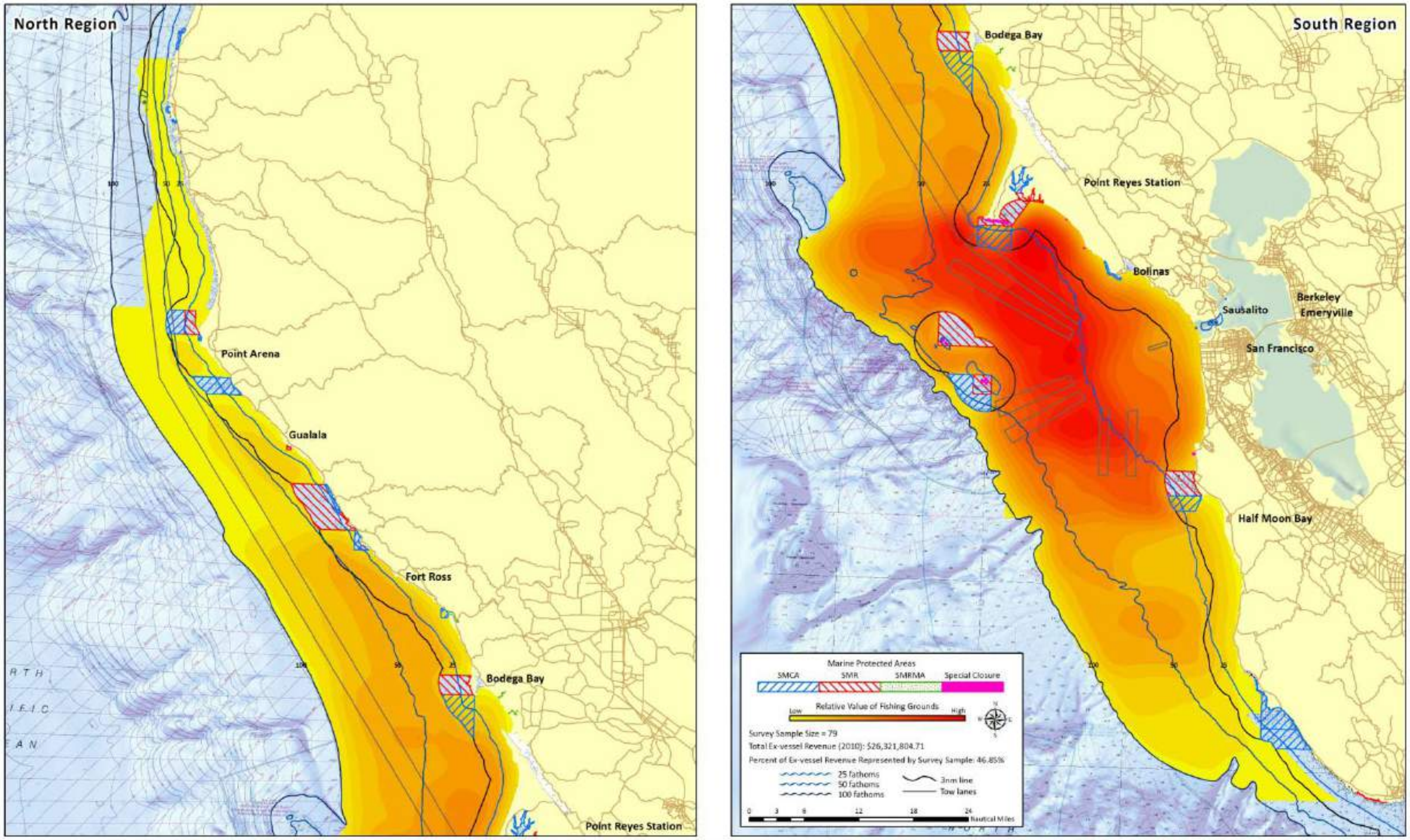
** indicates data were collected but cannot be shown due to confidentiality constraints*

5.1. North Central Coast Region Commercial Fishing Spatial Baseline



California North Central Coast 2010 Commercial Fishing Grounds and Landings

All Ports – Dungeness crab–trap



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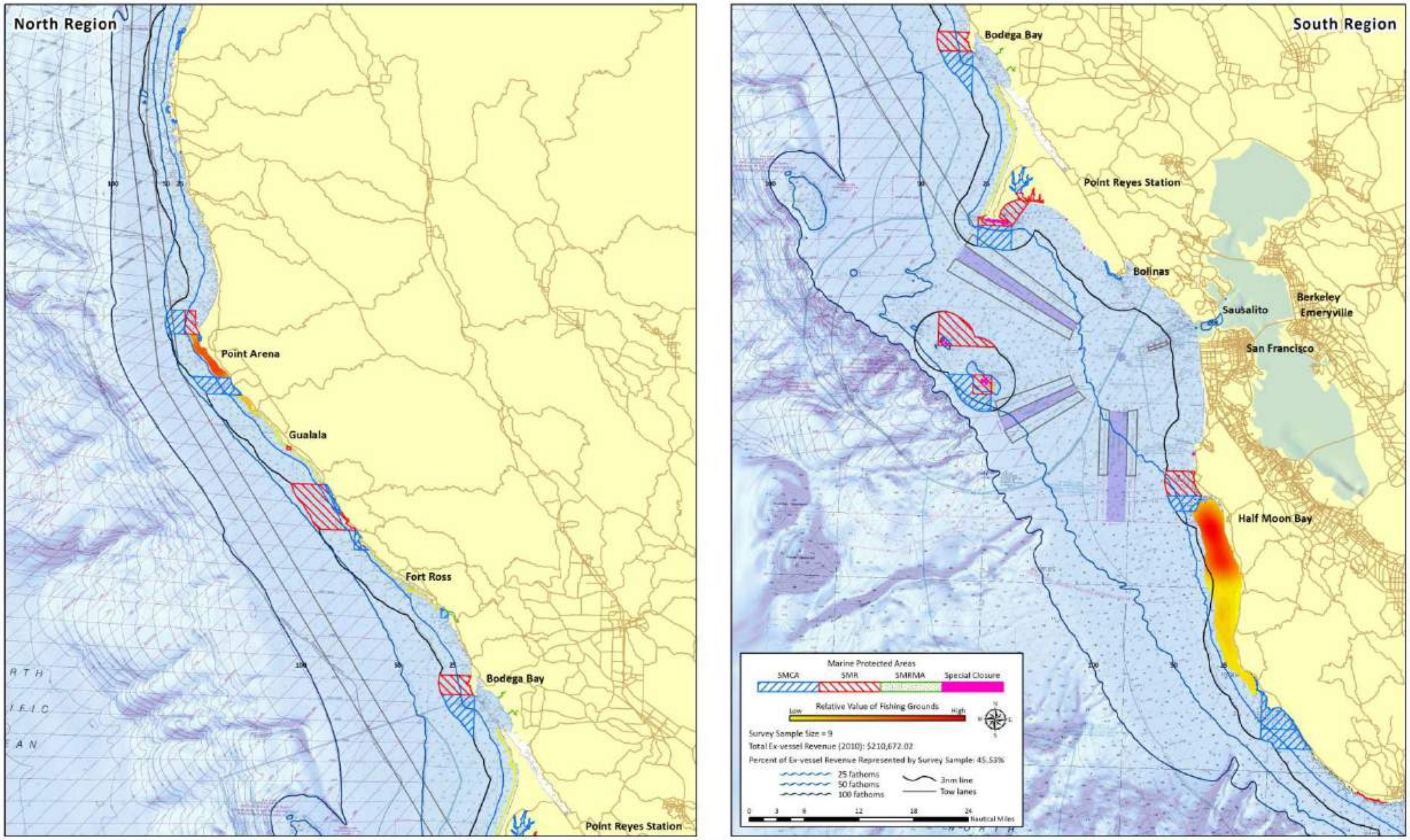
California North Central Coast 2010 Commercial Fishing Grounds and Landings
All Ports – Nearshore finfish–live–fixed gear



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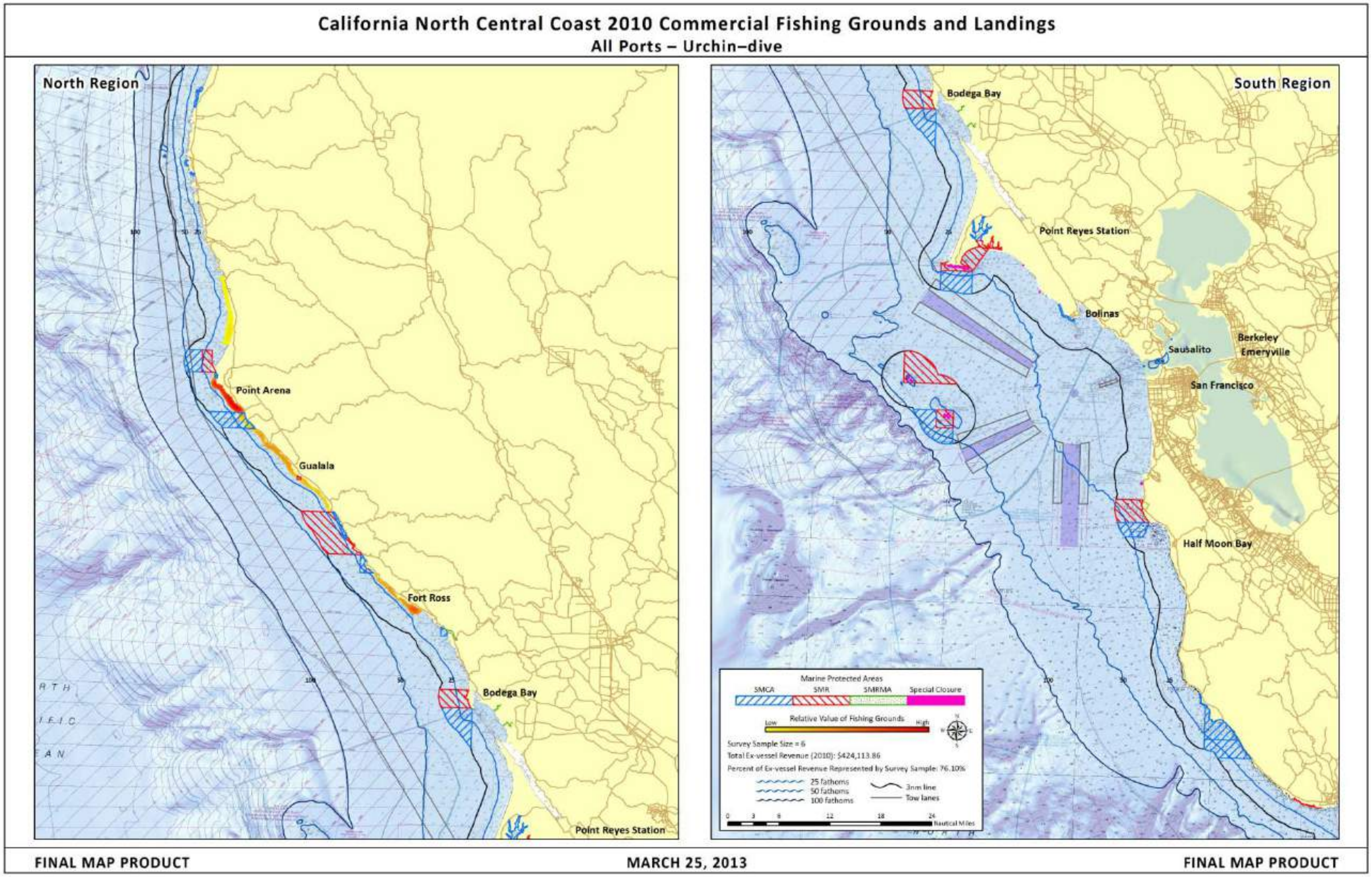
California North Central Coast 2010 Commercial Fishing Grounds and Landings
All Ports – Urchin–dive
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
South Region
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Relative Value of Fishing Grounds
Low
High
Survey Sample Size = 6
Total Ex-vessel Revenue (2010): $424,113.86
Percent of Ex-vessel Revenue Represented by Survey Sample: 76.10%
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
0 3 6 12 18 24
Nautical Miles
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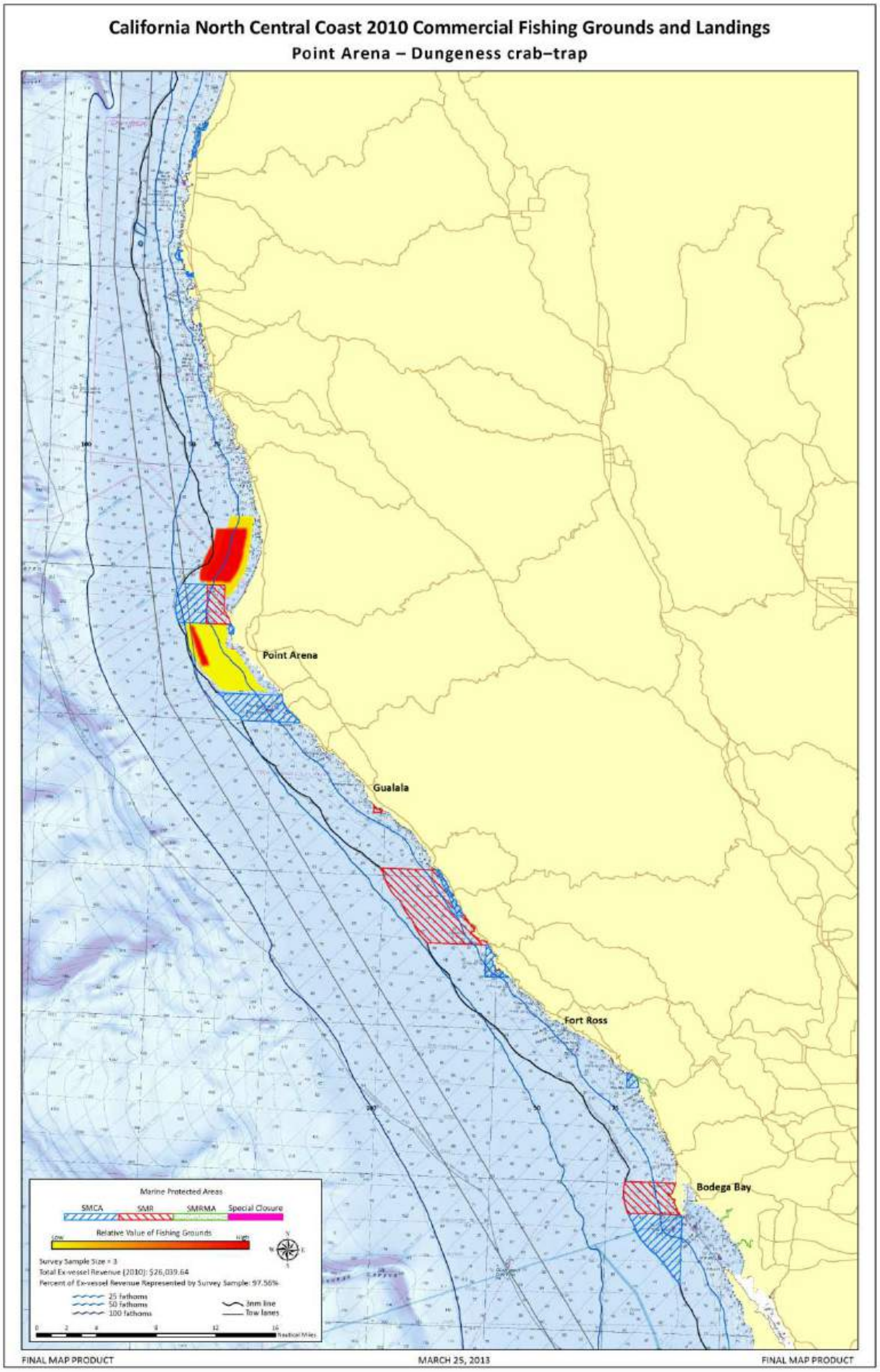
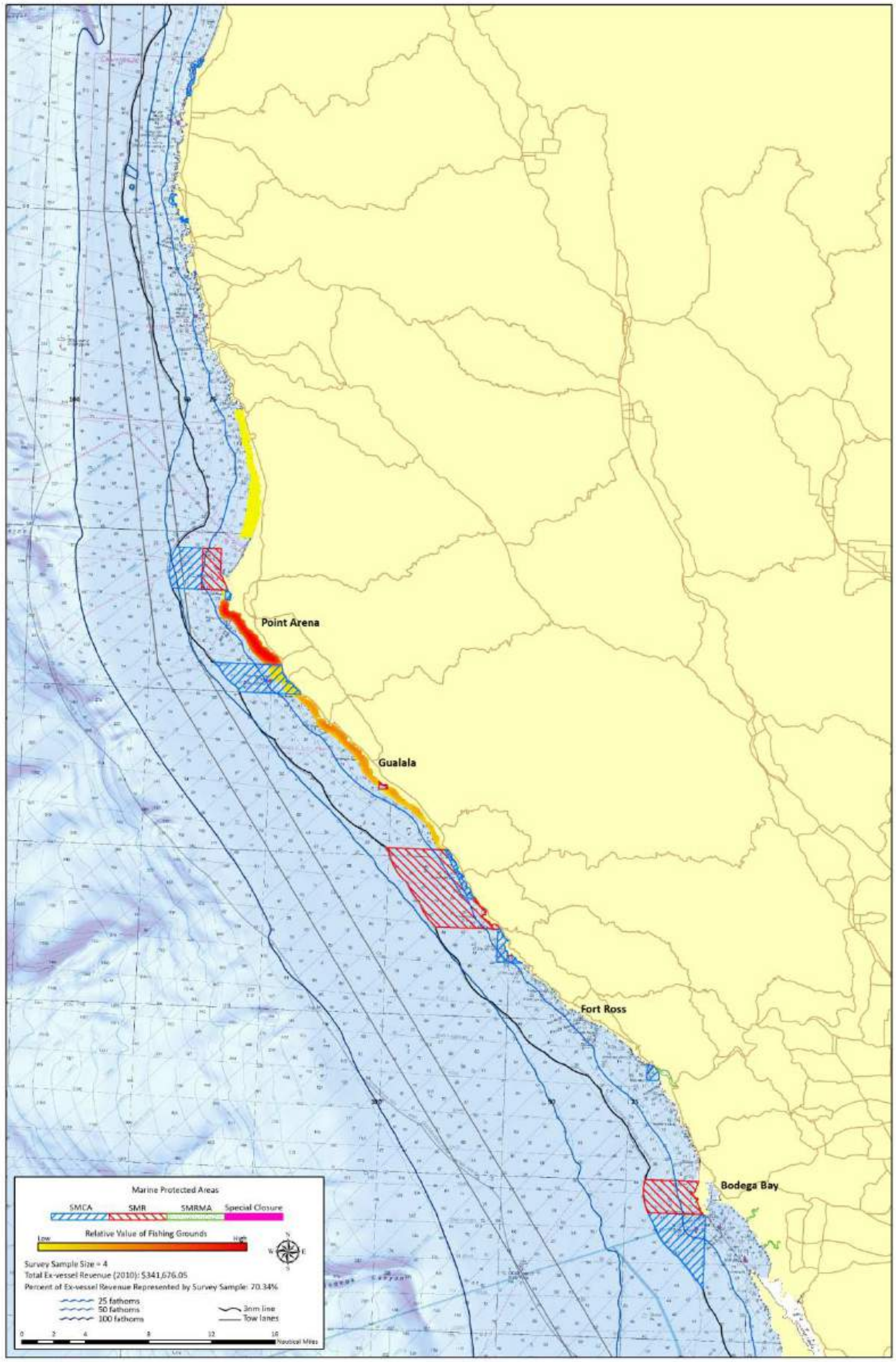
5.2. Point Arena Commercial Fishing Spatial Baseline



California North Central Coast 2010 Commercial Fishing Grounds and Landings

Point Arena – Urchin–dive



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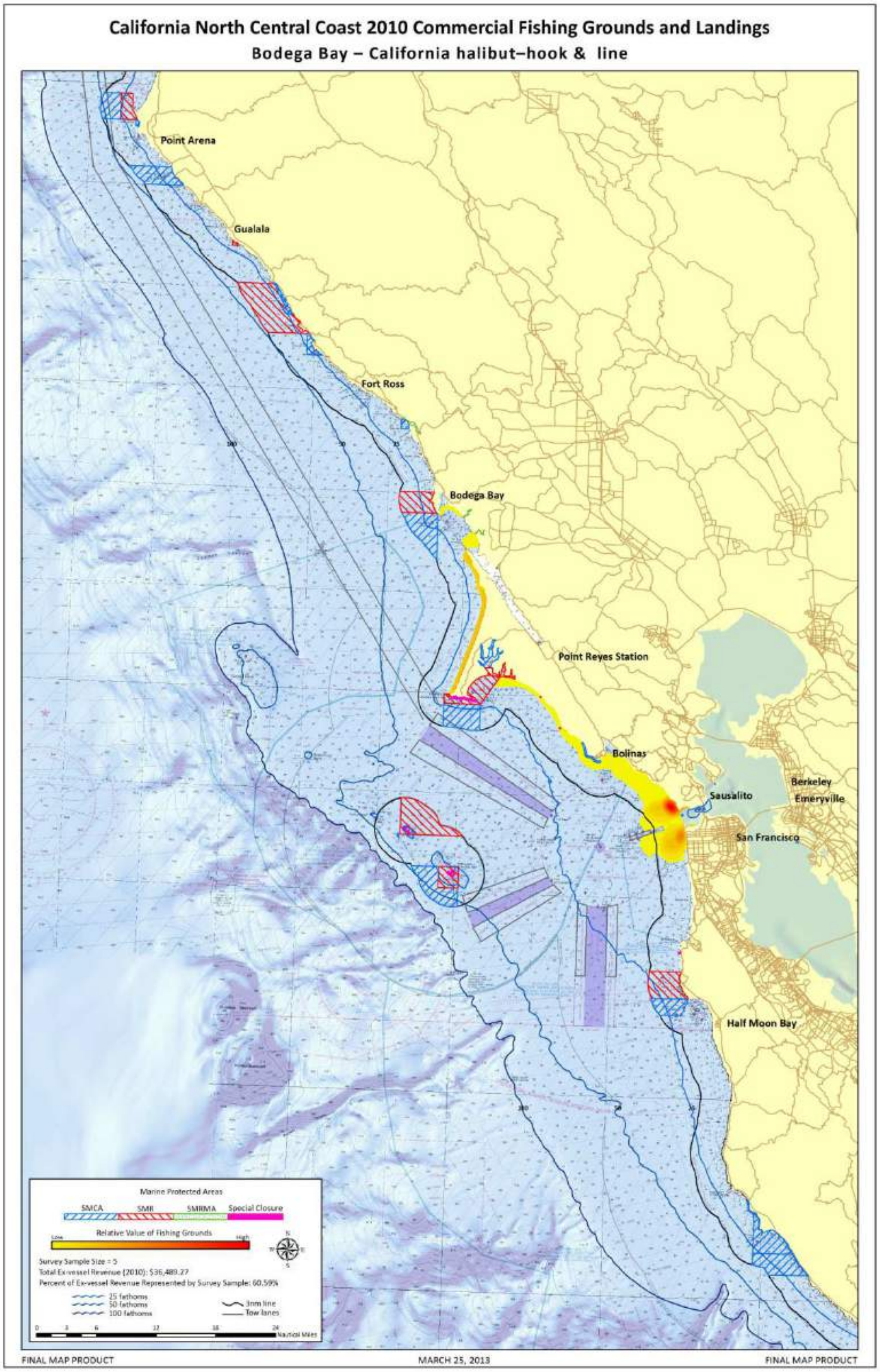
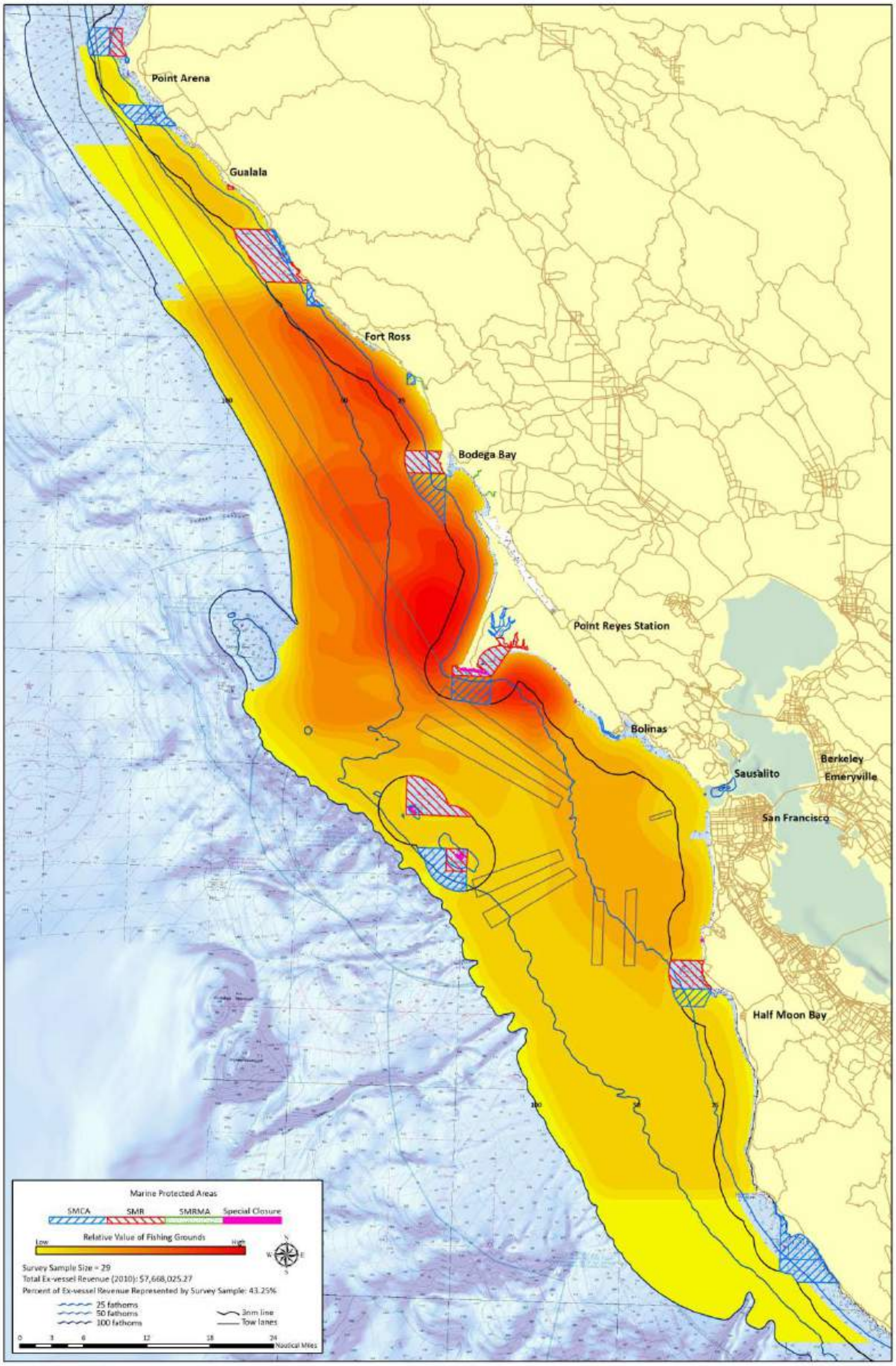
5.3. Bodega Bay Commercial Fishing Spatial Baseline



California North Central Coast 2010 Commercial Fishing Grounds and Landings

Bodega Bay – Dungeness crab–trap



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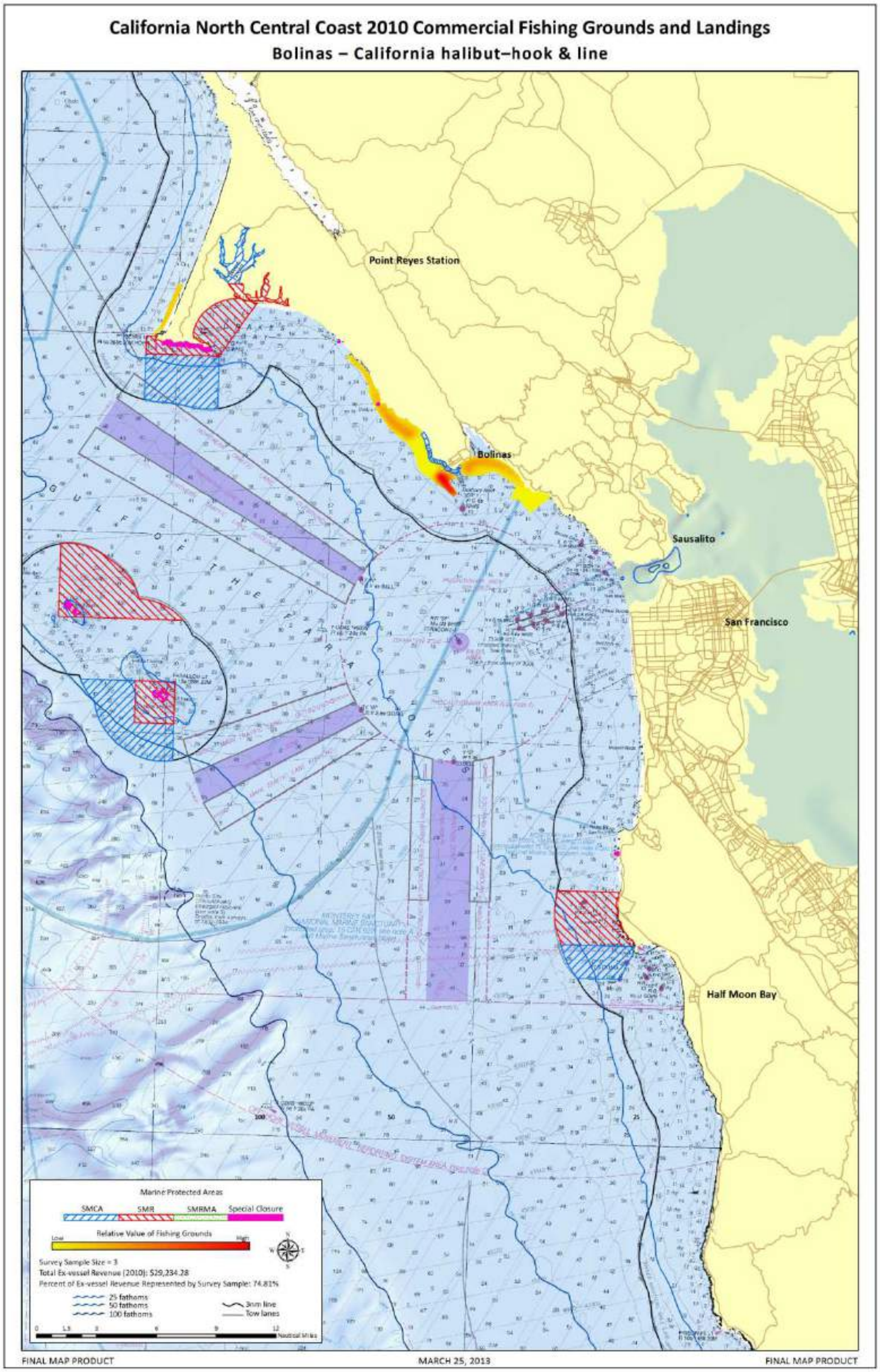
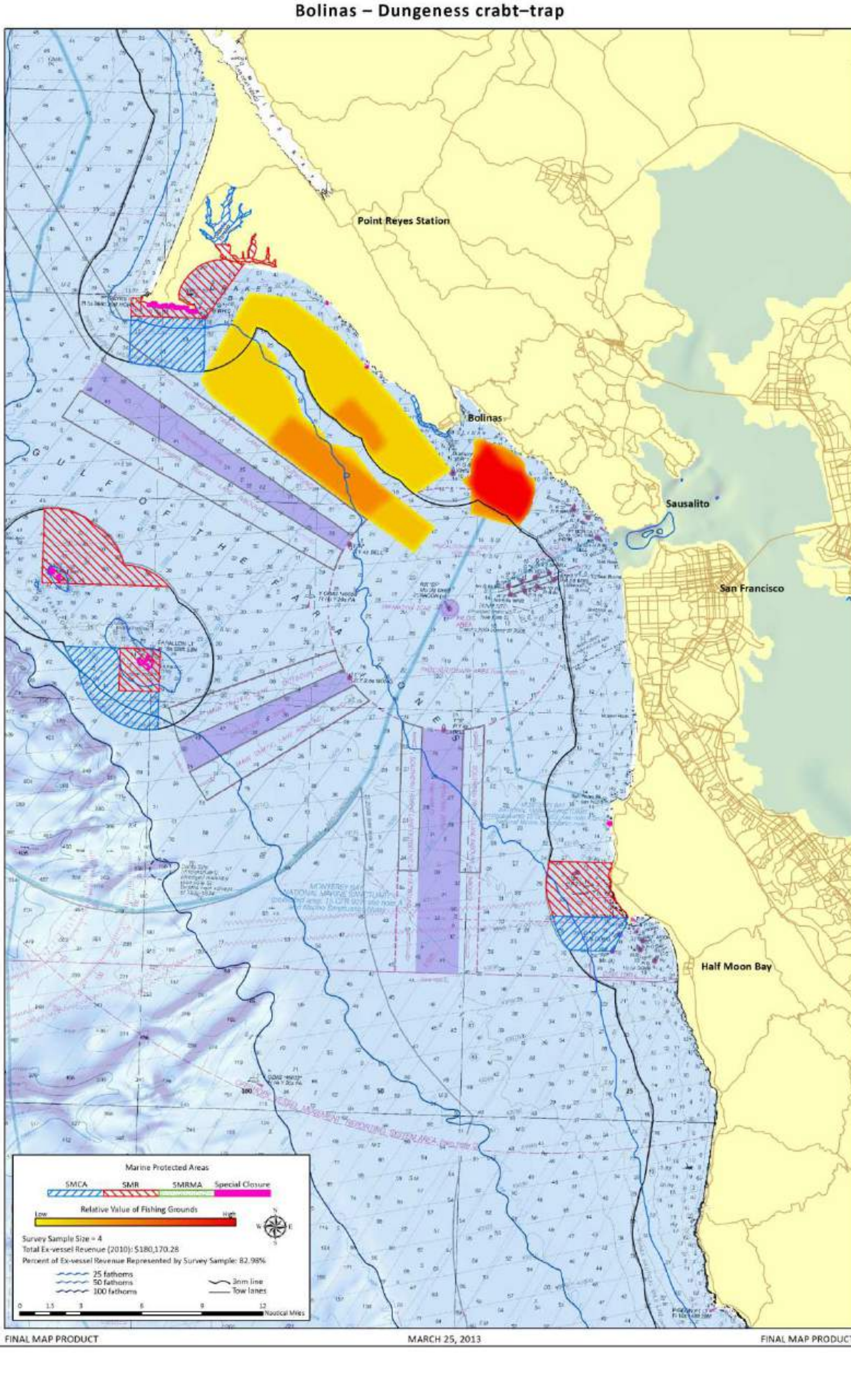
5.4. Bolinas Commercial Fishing Spatial Baseline



California North Central Coast 2010 Commercial Fishing Grounds and Landings

Bolinas – Dungeness crabt–trap



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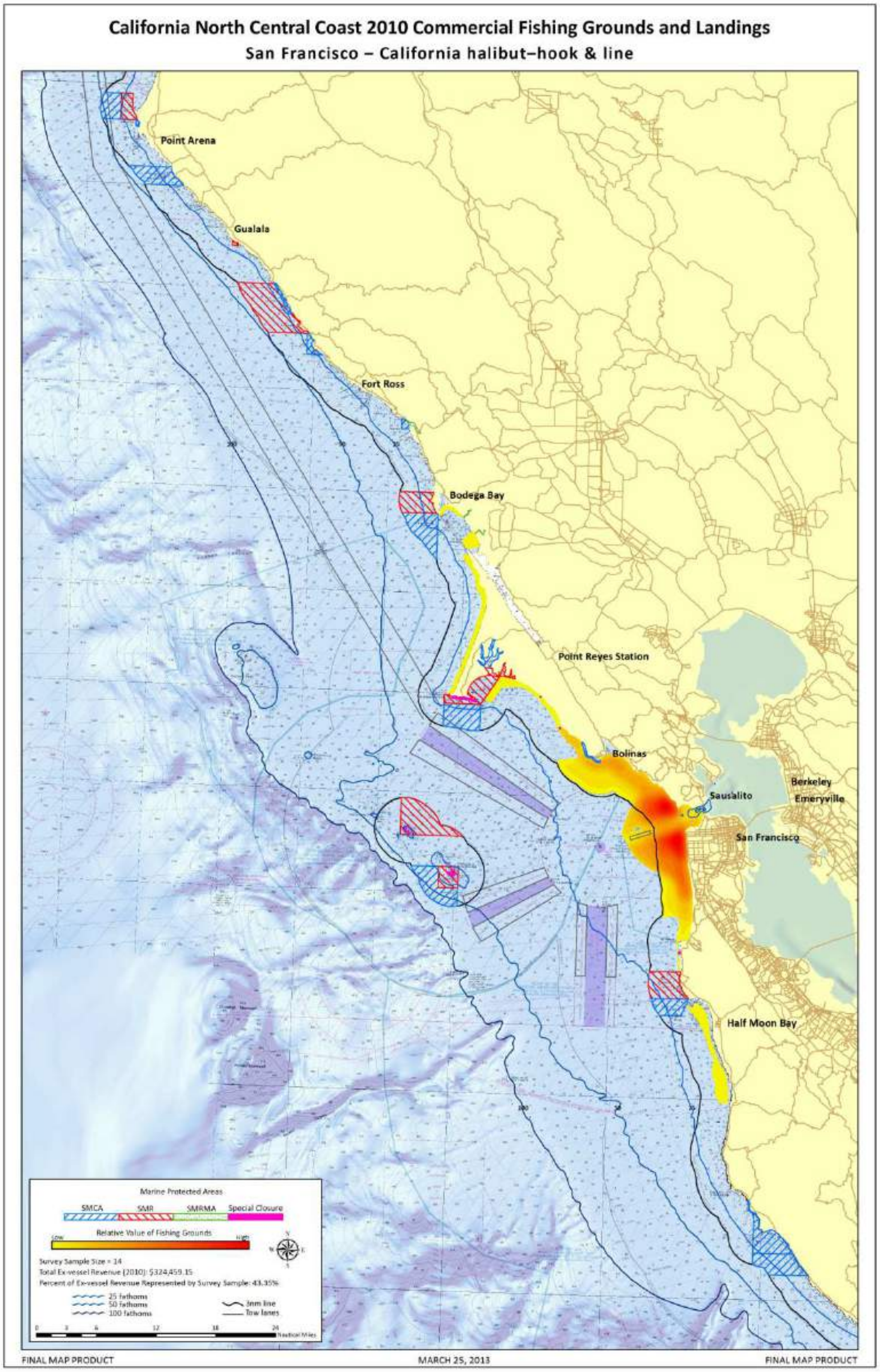
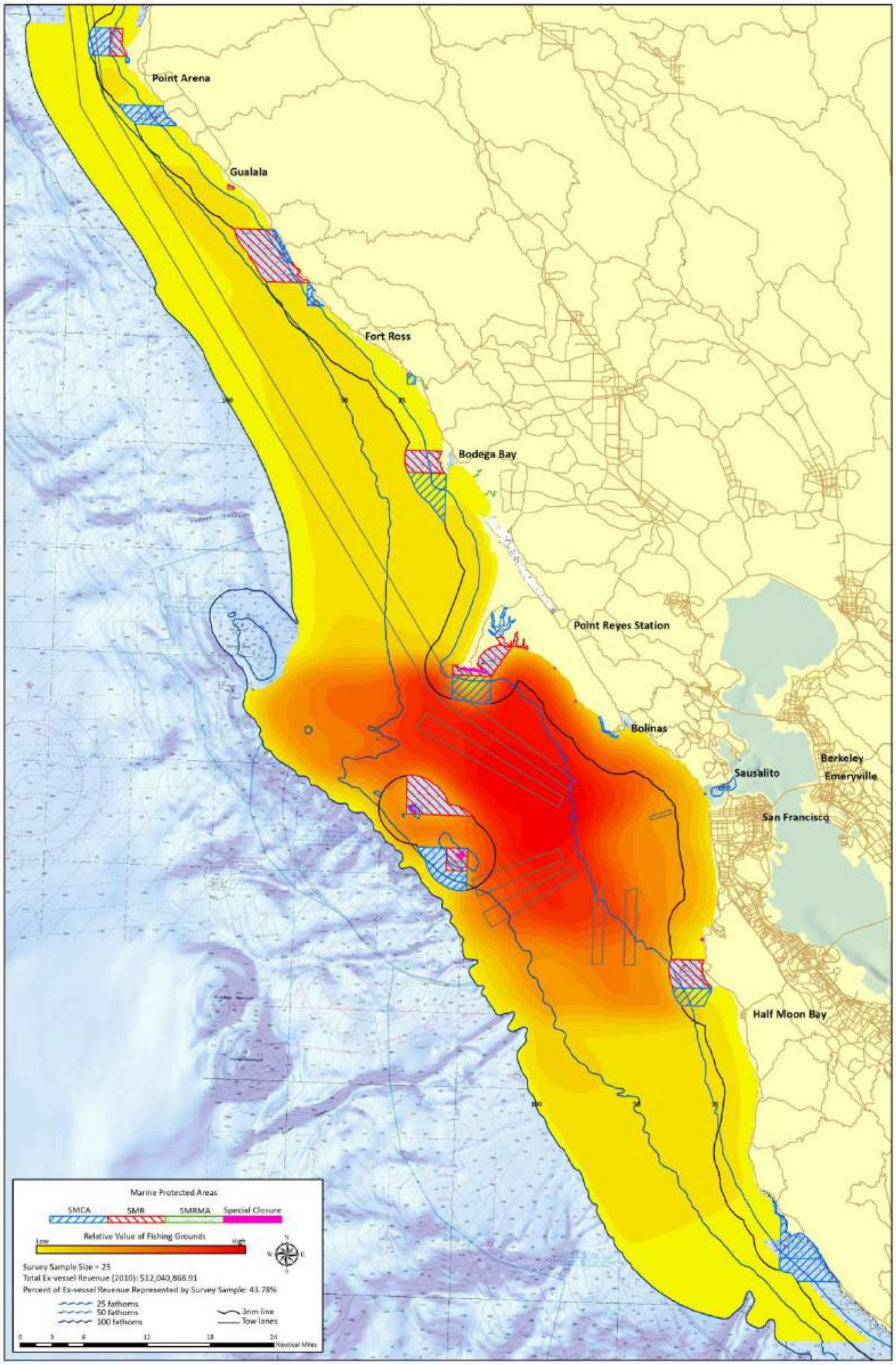
5.5. San Francisco Commercial Fishing Spatial Baseline



California North Central Coast 2010 Commercial Fishing Grounds and Landings

San Francisco – Dungeness crab–trap



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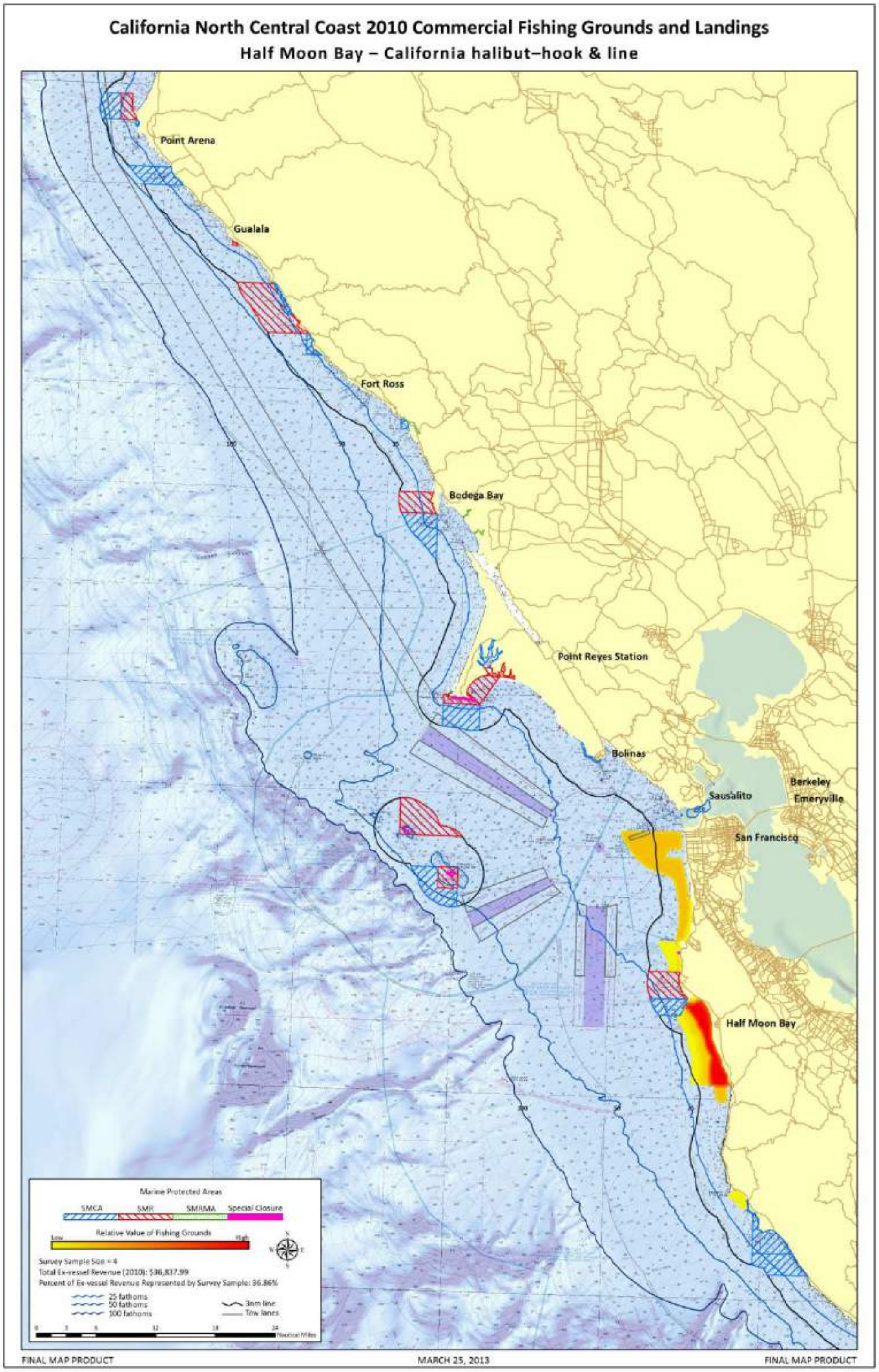
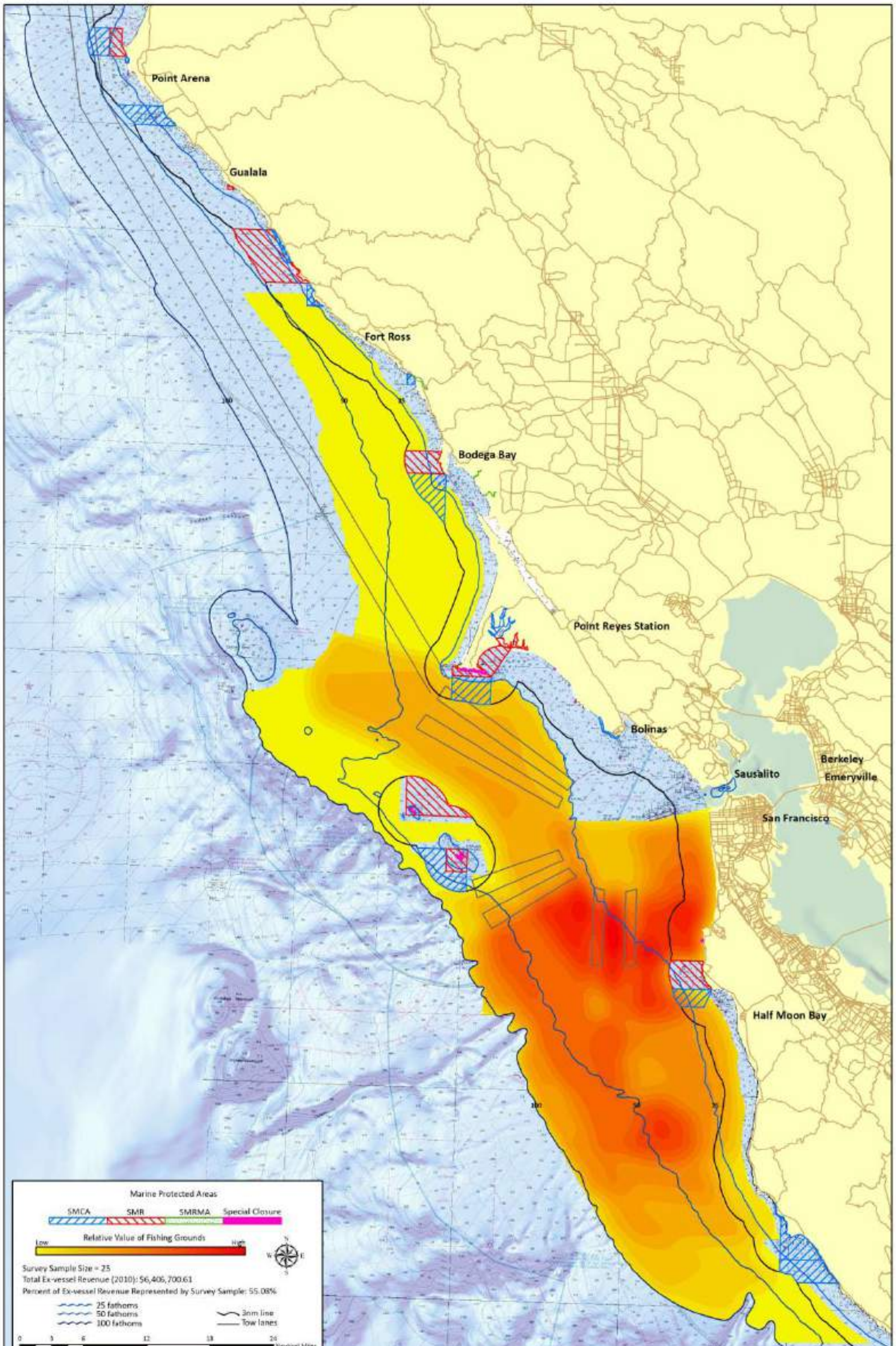
5.6. Half Moon Bay Commercial Fishing Spatial Baseline



California North Central Coast 2010 Commercial Fishing Grounds and Landings

Half Moon Bay – Dungeness crab–trap



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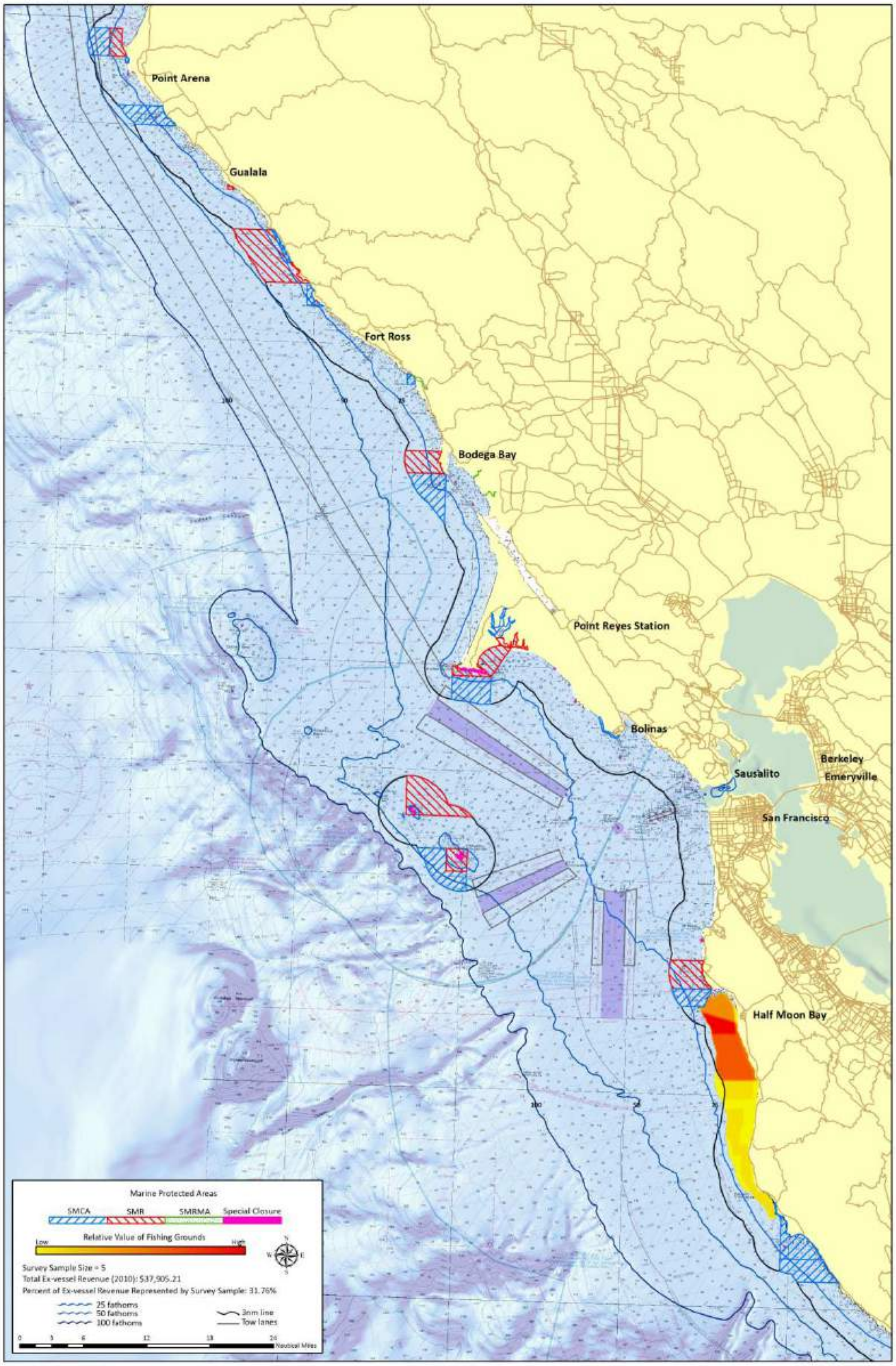
California North Central Coast 2010 Commercial Fishing Grounds and Landings

Half Moon Bay – Nearshore finfish–live–fixed gear



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6. INITIAL SPATIAL CHANGE IN COMMERCIAL FISHERIES

In this section we present an effort to examine change in the spatial extent and relative value of commercial fishing areas for the North Central Coast Region commercial fishing sector. To do this we utilized a pre-MPA spatial fishing dataset collected from commercial fishermen interviews in 2007 as part of the MLPA planning process. The pre-MPA dataset was collected by asking fishermen to map and value their fishing grounds based on their cumulative fishing experience and these individual data were then weighted using an average yearly gross revenue from 2000 to 2006. This differs slightly from the method in which the post-MPA data set was collected in which fishermen were asked to map his/her post-MPA fishing grounds for the year 2010 (for Dungeness crab fishermen mapped the fishery season which was from November 2010 to June 2011) and ex-vessel revenue from the year 2010 (ex-vessel revenue from November 2010 to June 2011 in the case of Dungeness crab) was used to weight the data. However, despite these differences we conceptualize these data sets as generally representative of pre and post MPA period fishing grounds and their relative stated value.

This analysis utilized the raster math functions in ArcGIS to calculate the difference between the pre-MPA and post-MPA data. To conduct this analysis we utilized a snap grid, which is a raster layer that provides the overarching spatial extent and a common structure to build our raster layer products. The snap grid gave us the structure to perform a cell by cell (100 meter square cell size) comparison. Each dataset was also analyzed as a relative dataset in which each data set was standardized to a 0 to 1 index, which supplied a common index of values allowing us to make direct comparisons between the raster layers. Below these series of maps illustrate the location in which fishing grounds have increased or decreased in relative value between the two survey efforts.

It is important to emphasize that these are maps depicting the spatial change in relative value and are not maps depicting spatial change in ex-vessel revenue. Only relative value surfaces (also known as a ‘heat map’) developed for the pre and post-MPA datasets were used in this analysis. Ex-vessel revenue was not applied to the ‘heat map’ value surfaces, however ex-vessel revenue was used to weight the aggregation of individual fishing grounds. We chose to utilize a relative value surface as spatial change in revenue levels may not yield useful information, especially when considering the large magnitudes of change in ex-vessel revenue (as seen in the Dungeness crab-trap fishery) that may overwhelm any analysis depicting spatial change in ex-vessel revenue levels. Thus, the results below are simply an examination of changes in the relative values/importance of fishing areas to a fishery—not spatial changes in revenue levels across the two datasets. For example, an area that depicts an increase in relative value does not directly translate to an increase in revenue derived from that area. The interpretation should be that the area has increased in relative value across pre and post MPA periods.

As is the case with all analyses, an unbiased and representative sample size across both data sets would improve the results and emerging trends could be more rigorously tested. Below in Table 173 we list the region-fishery and port-fishery combinations in which we were able to conduct a spatial change analysis for. Furthermore, we provide the number of fishermen interviewed and the percent ex-vessel revenue represented in the each spatial data set in pre and post MPA periods to help facilitate interpretation of the representativeness and reliability of spatial change analysis results. Of note, is the number of fishermen who participated in the mapping portion of the interviews in this project may differ from the number of fishermen who participated in the non-spatial portion of the survey (Table 4) as some fishermen opted to not provide fishing ground information.

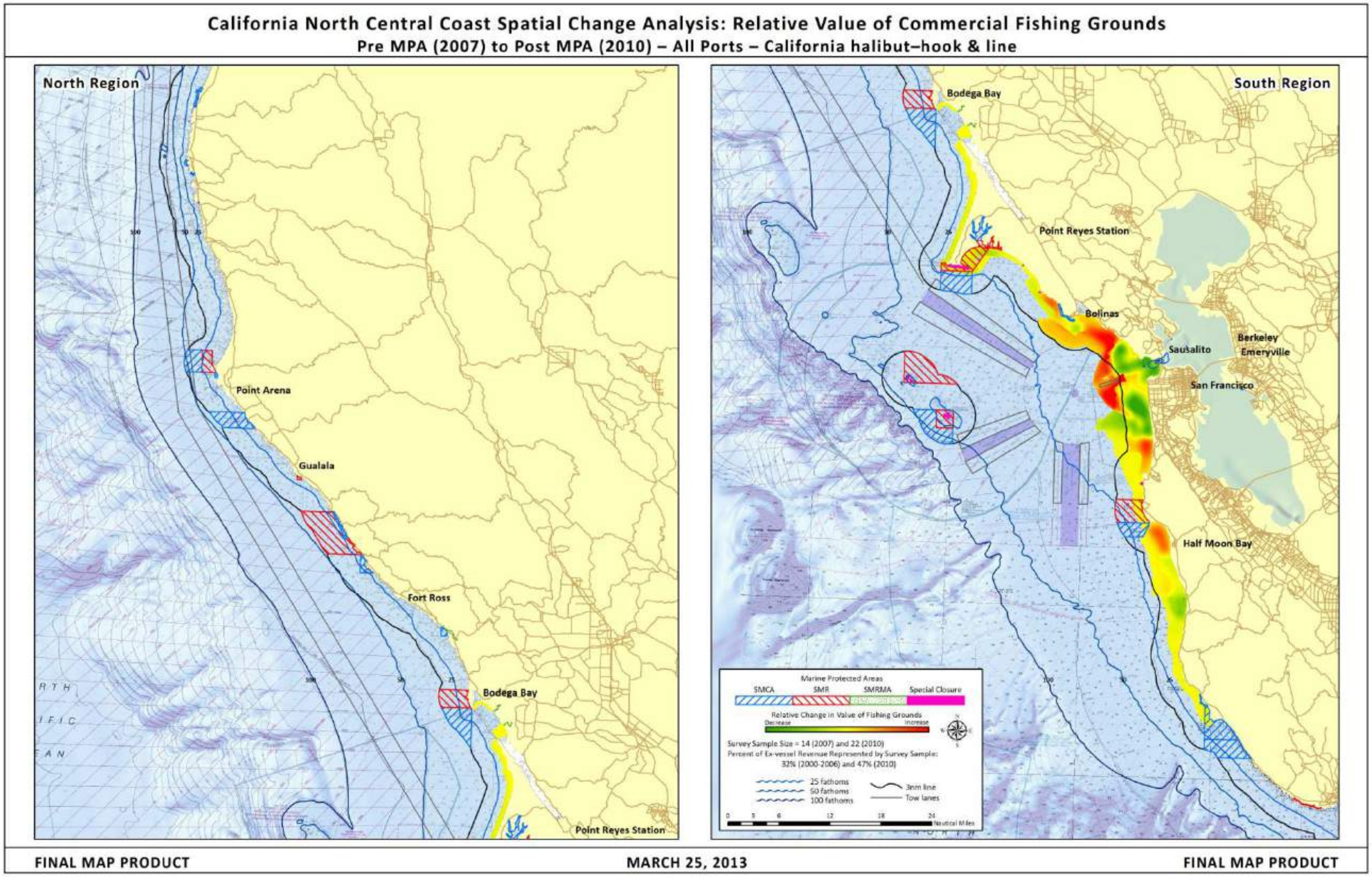
We would like to note that the spatial fishing data sets from collected in 2007 are not available to the public and thus are not provided here in this report. These data sets were collected as part of the MLPA planning processes for use only by the Regional Stakeholder Group and have not subsequently been approved for any public release.

Table 173. Count number of fishermen and percent of ex-vessel commercial fishing landings represented in interviews, spatial change analysis target fisheries, pre and post MPA

		Count of fishermen interviewed		Percent of average annual ex-vessel revenue represented (2000-2006)	Percent of 2010 ex-vessel revenue represented
Ports	**Fishery**	**Pre MPA**	**Post MPA**	**Pre MPA**	**Post MPA**
North Central Coast Region	California halibut - hook & line	14	22	32%	47%
	Dungeness crab - trap	89	79	46%	47%
	Nearshore finfish - live - fixed gear	9	9	47%	46%
	Urchin - dive	18	6	37%	76%
Point Arena	Dungeness crab - trap	6	3	97%	98%
	Urchin - dive	16	4	36%	70%
Bodega Bay	Dungeness crab - trap	41	29	54%	43%
Bolinas	California halibut - hook & line	4	3	100%	75%
	Dungeness crab - trap	3	4	81%	83%
San Francisco	California halibut - hook & line	9	14	29%	43%
	Dungeness crab - trap	43	25	41%	44%
Half Moon Bay	Dungeness crab - trap	22	25	45%	55%

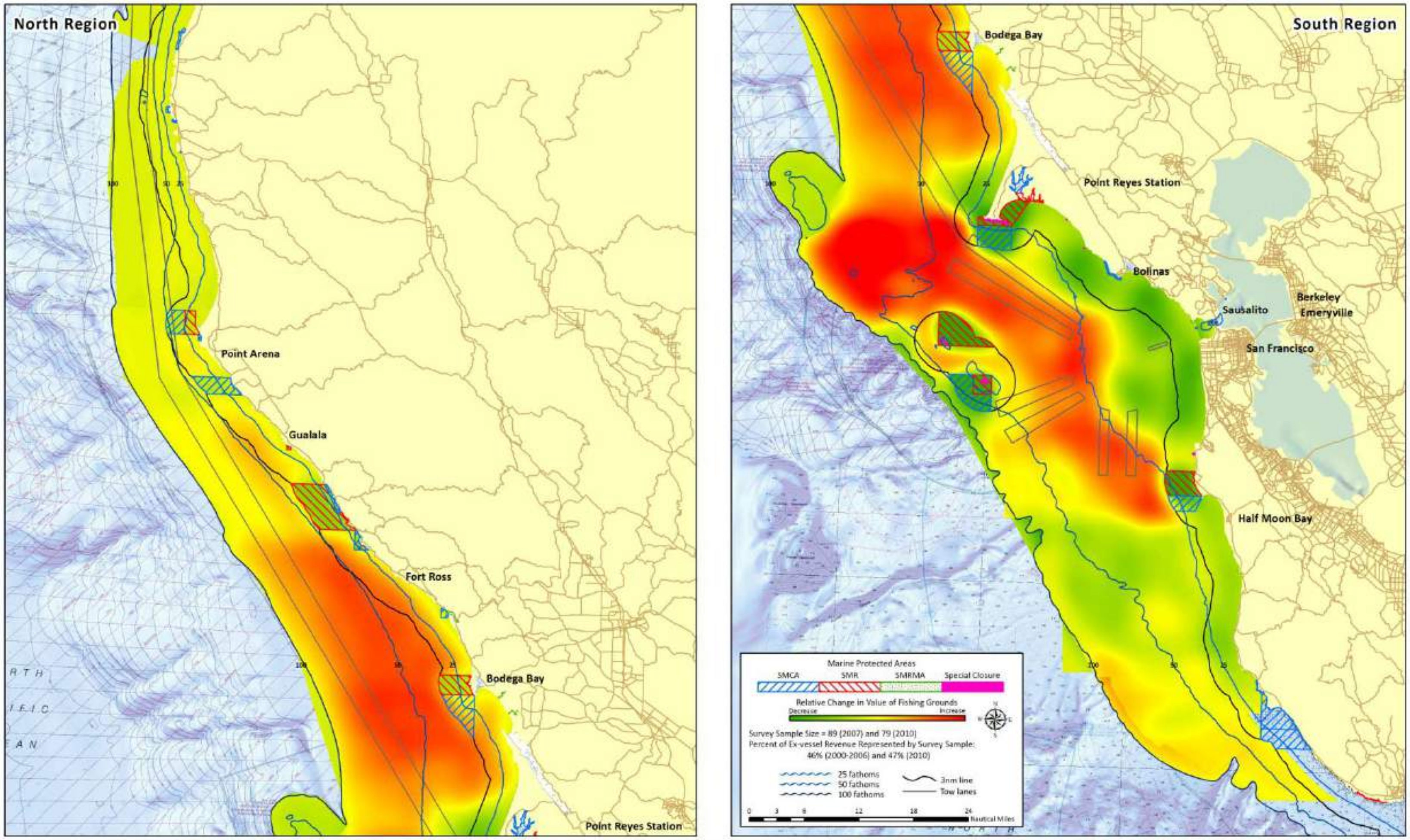
Source: Current study and landings data from CDFW

6.1. North Central Coast Region Commercial Fishing Initial Spatial Change



California North Central Coast Spatial Change Analysis: Relative Value of Commercial Fishing Grounds

Pre MPA (2007) to Post MPA (2010) – All Ports – Dungeness crab–trap



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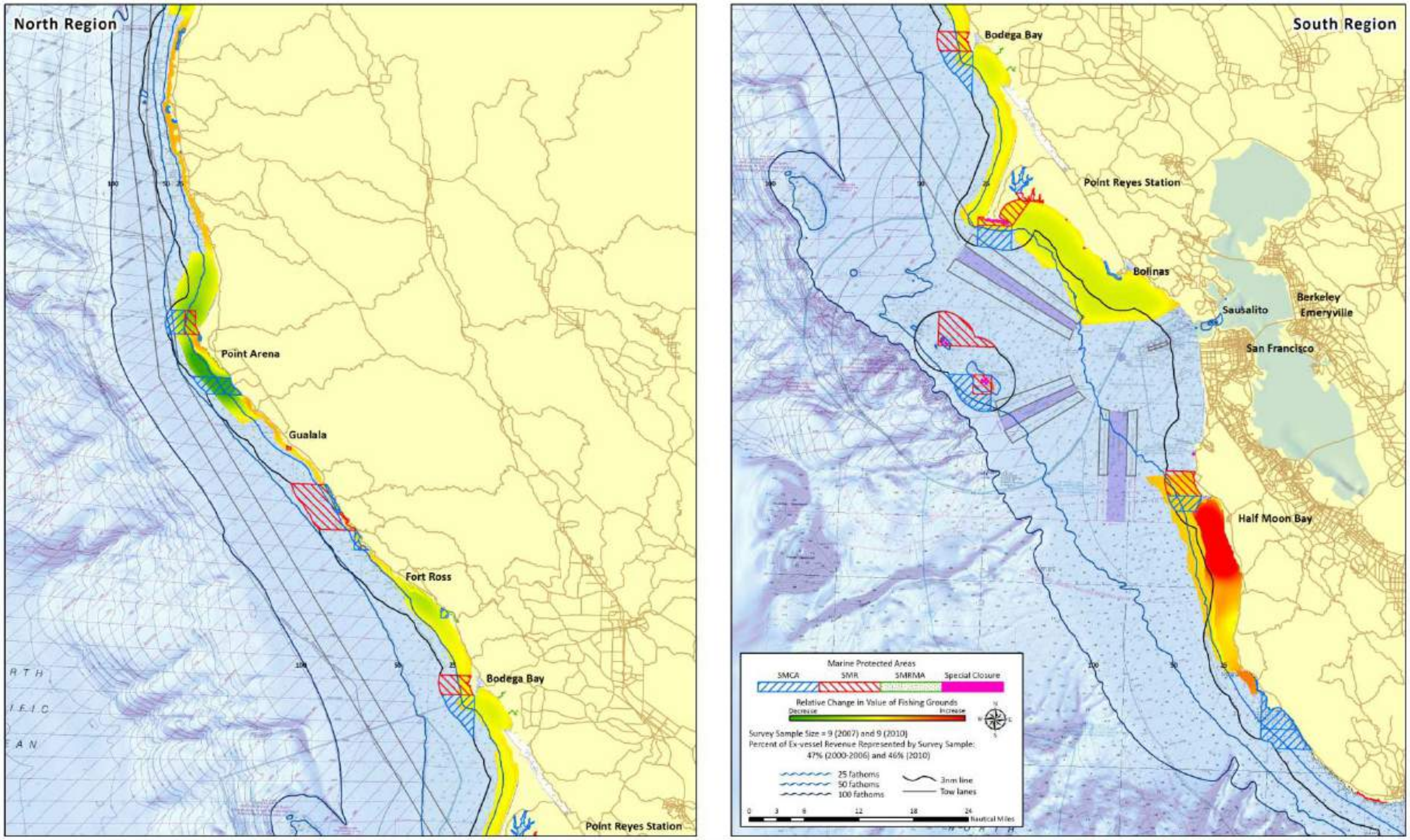
California North Central Coast Spatial Change Analysis: Relative Value of Commercial Fishing Grounds
Pre MPA (2007) to Post MPA (2010) – All Ports – Nearshore finfish–live–fixed gear



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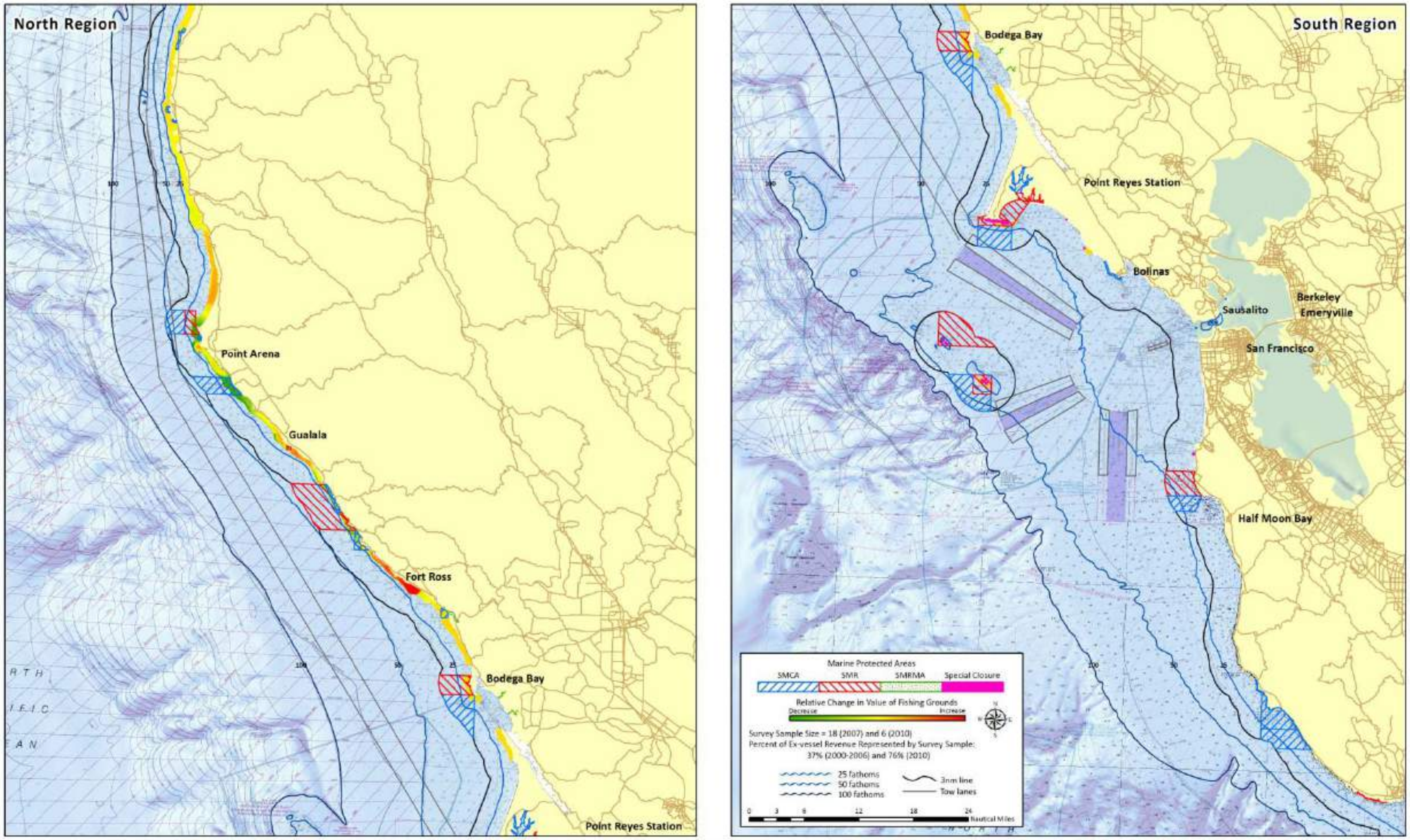
California North Central Coast Spatial Change Analysis: Relative Value of Commercial Fishing Grounds
Pre MPA (2007) to Post MPA (2010) – All Ports – Urchin–dive



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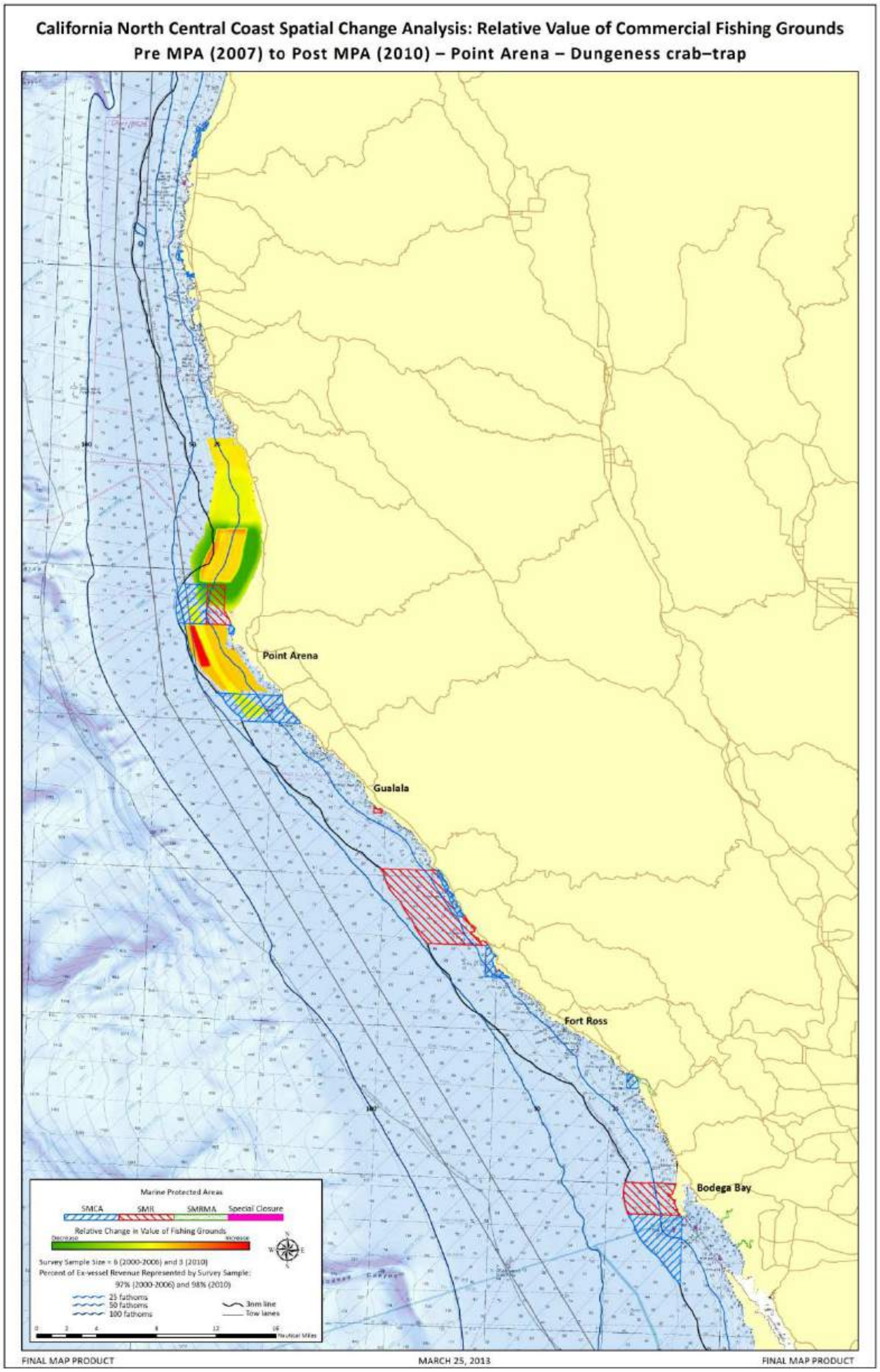
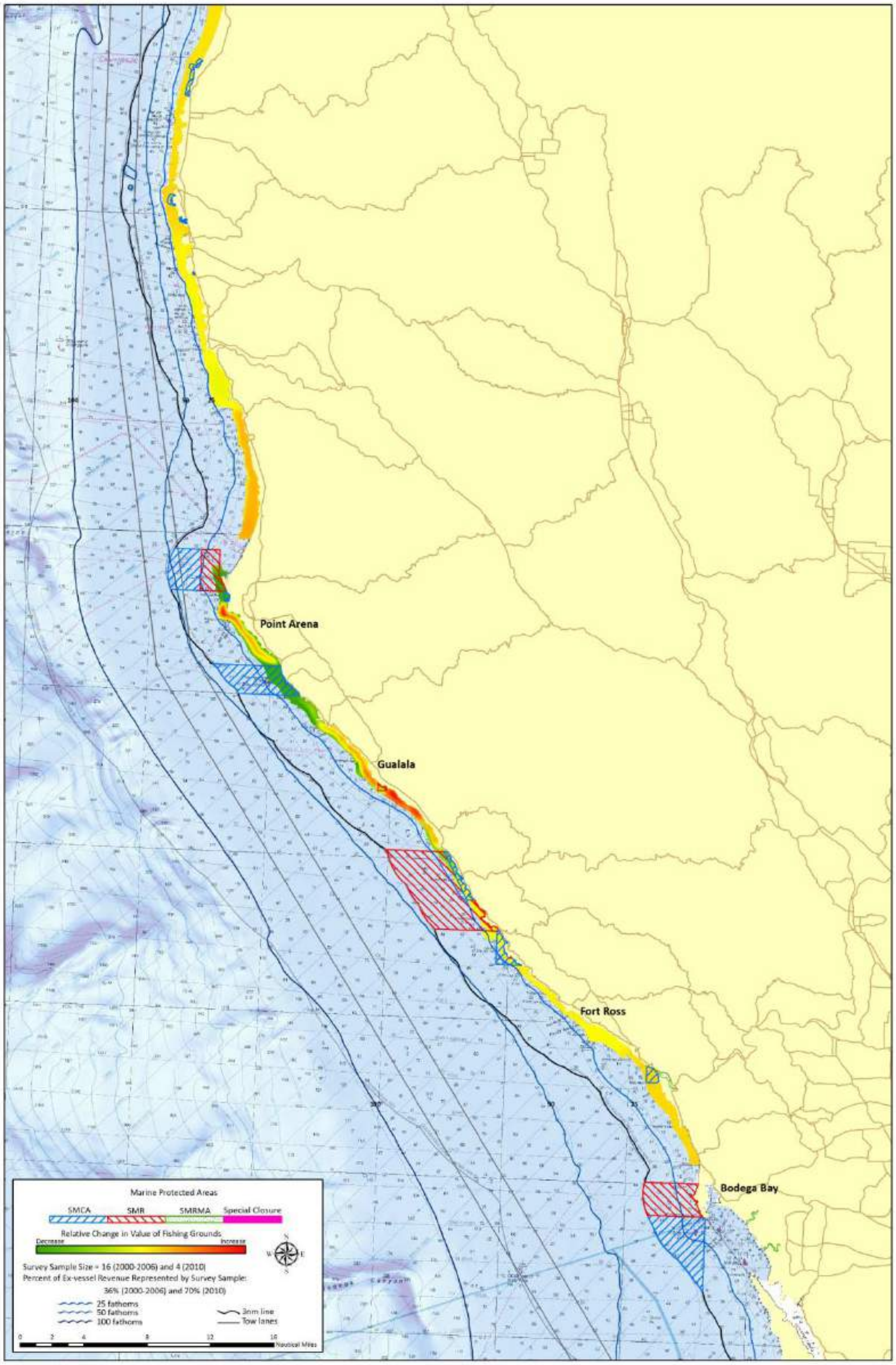
6.2. Point Arena Commercial Fishing Initial Spatial Change



California North Central Coast Spatial Change Analysis: Relative Value of Commercial Fishing Grounds
Pre MPA (2007) to Post MPA (2010) – Point Arena – Urchin–dive



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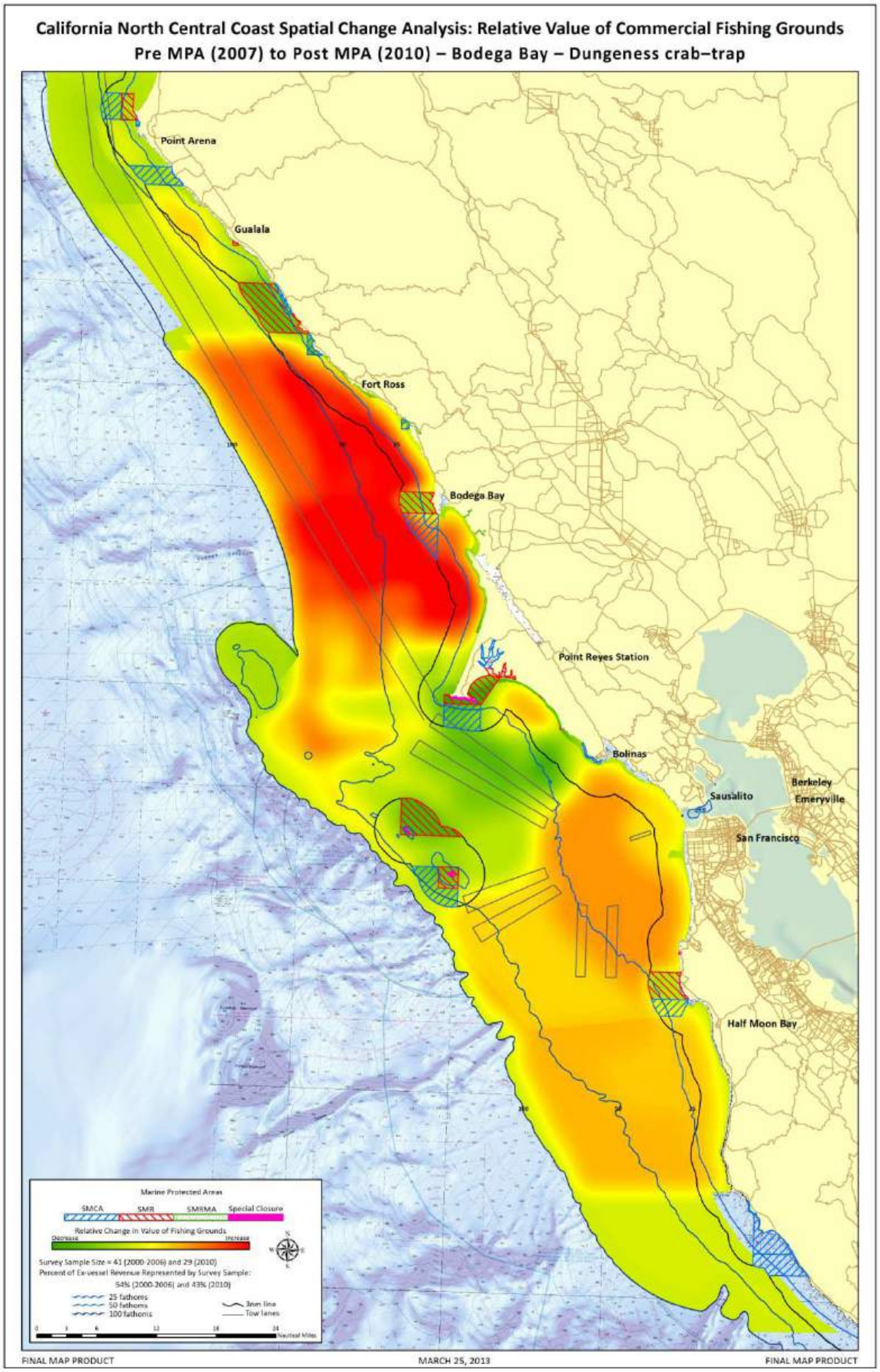
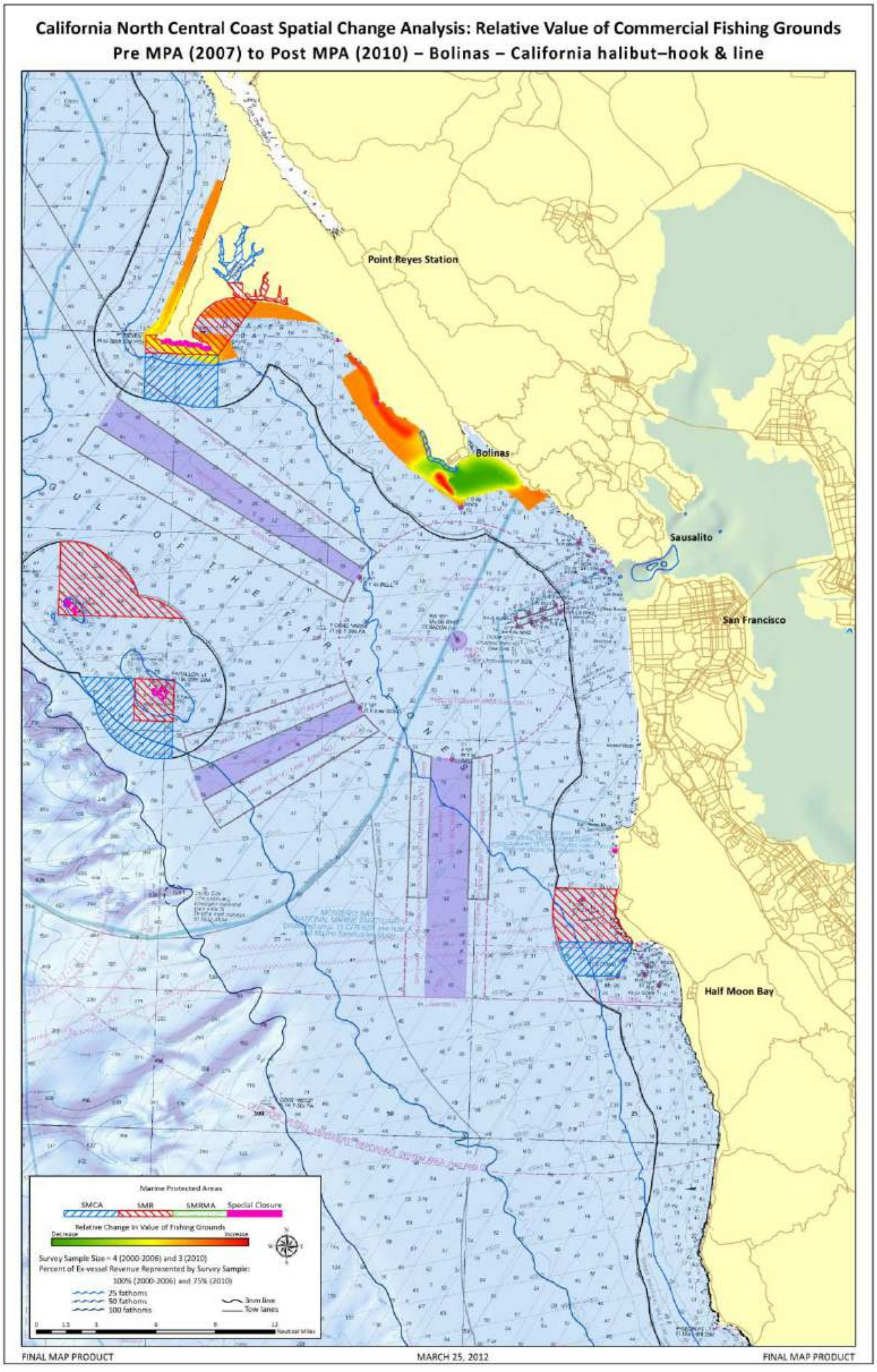
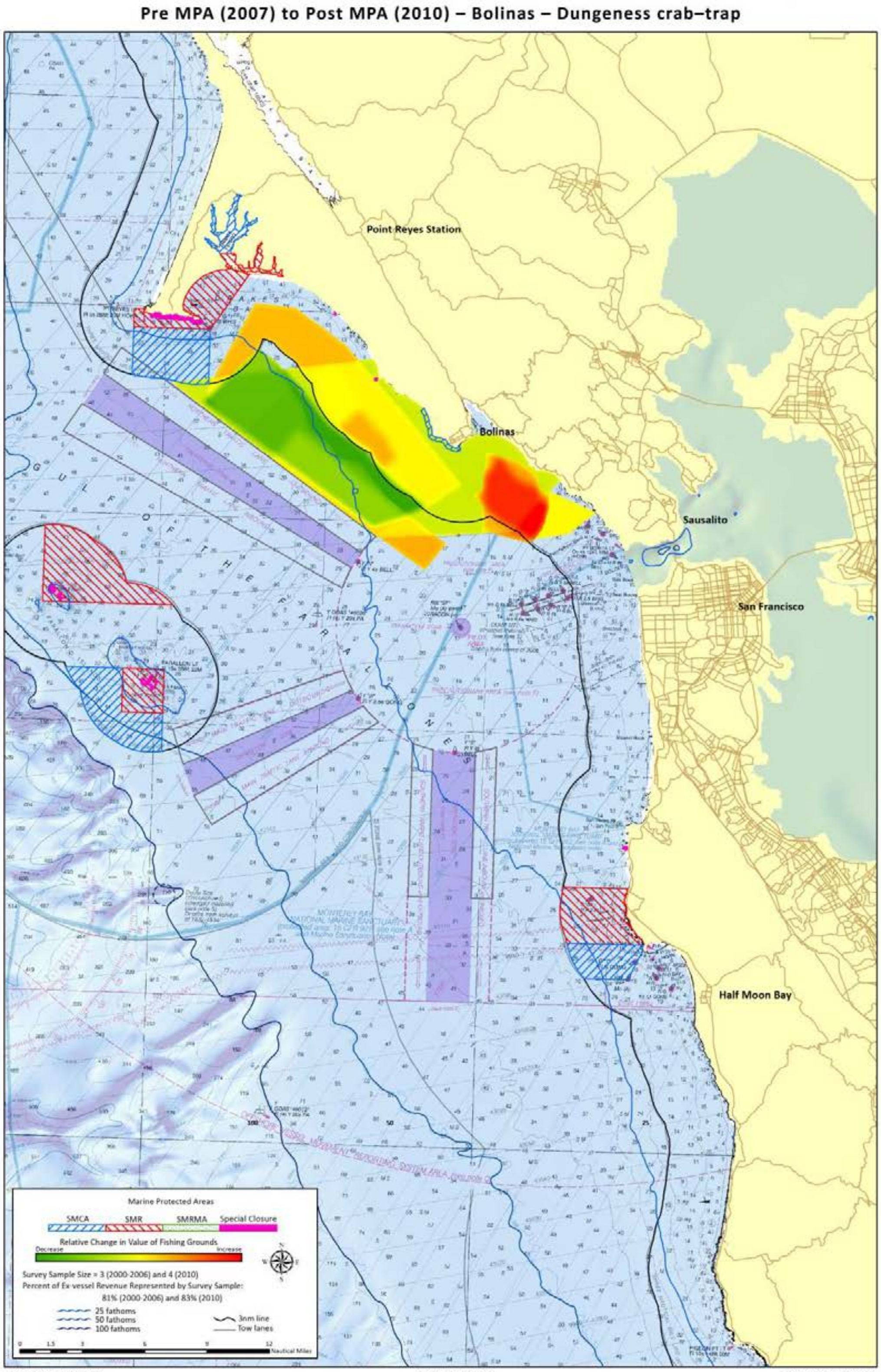
6.3. Bodega Bay Commercial Fishing Initial Spatial Change



6.4. Bolinas Commercial Fishing Initial Spatial Change



California North Central Coast Spatial Change Analysis: Relative Value of Commercial Fishing Grounds
Pre MPA (2007) to Post MPA (2010) – Bolinas – Dungeness crab–trap



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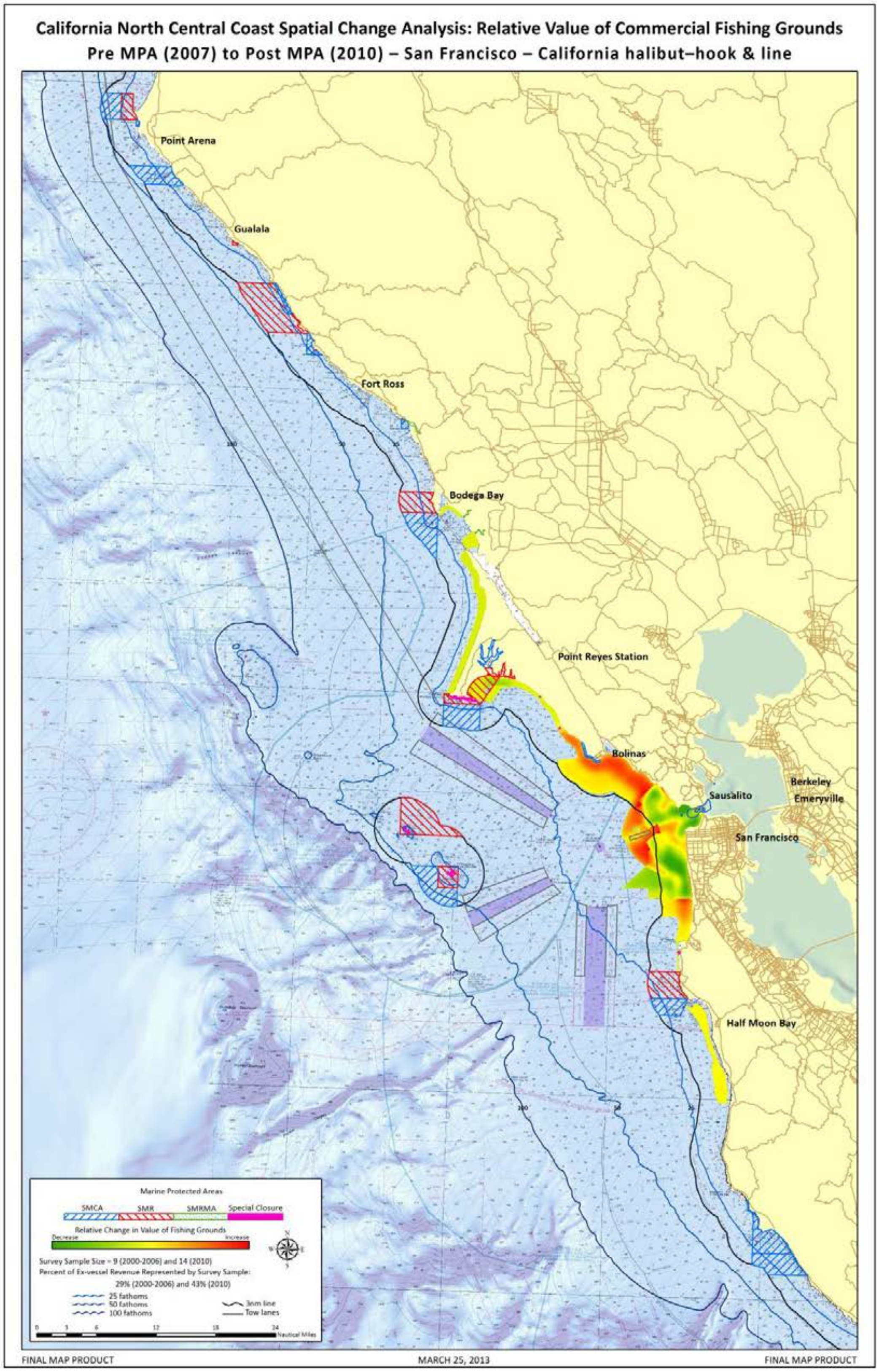
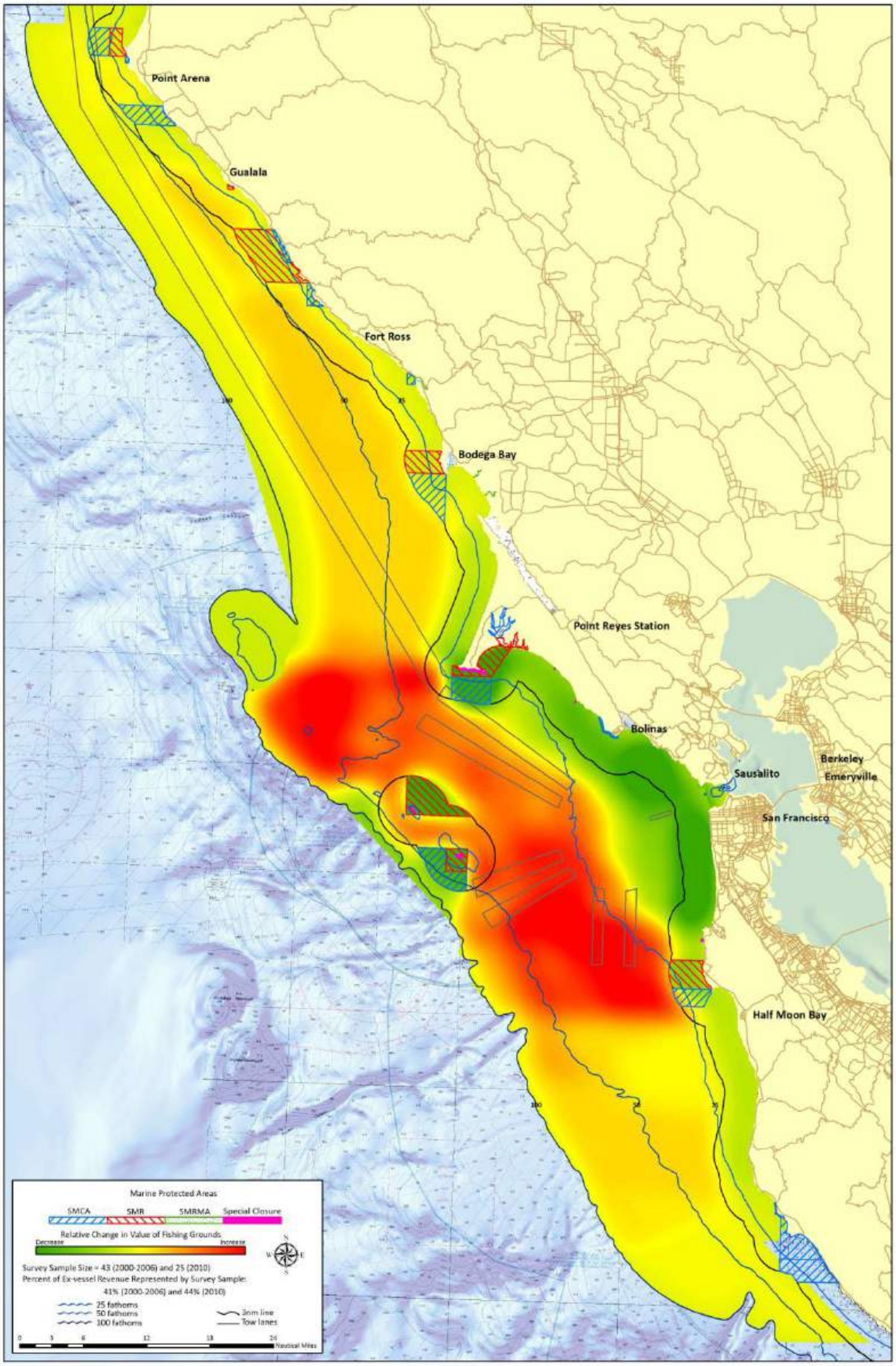
6.5. San Francisco Commercial Fishing Initial Spatial Change



California North Central Coast Spatial Change Analysis: Relative Value of Commercial Fishing Grounds
Pre MPA (2007) to Post MPA (2010) – San Francisco – Dungeness crab–trap



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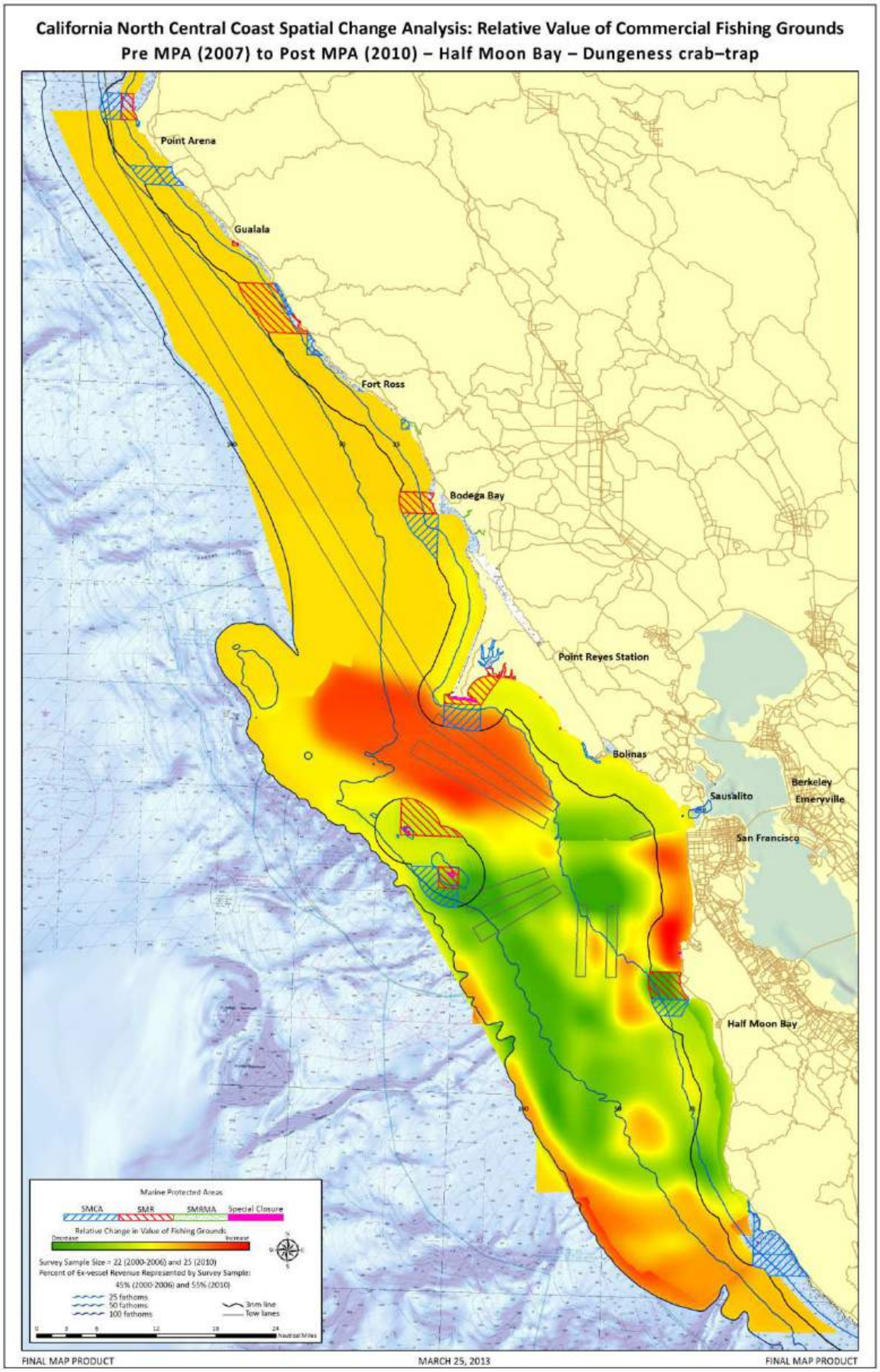
6.6. Half Moon Bay Commercial Fishing Initial Spatial Change



7. LESSONS LEARNED AND FUTURE RECOMMENDATIONS

This section reflects on several methodological and overall project lessons learned and recommendations to inform future long-term MPA monitoring efforts.

7.1. Lessons Learned/Future Recommendations

Community Engagement

Outreach efforts to port communities were initiated at the project's inception and continued throughout the project. Building trust and collaborating with fishing communities were important measures of success for our project; however, due to several factors such as: distrust in how information will be used; dissatisfaction with the MPA network planning process and its outcome; and unclear benefits and outcomes of participating in the project, many fishermen were reticent to participate in the project.

This reticence to participate in our project directly affected the survey sample size and thus the representativeness of the data collected. It also affected our ability to provide comprehensive interpretation of data analysis results. A wide base of community feedback and input to interpret project results is critical to add context, meaning, and identify possible drivers of change in the data we present. A good example of this is the interpretation of commercial fishing landings data such as historical and current trends on the number of fishermen, pounds landed, ex-vessel revenue, and fish price. Without the intimate knowledge of the fishing community we would only be able to provide a description of the data trends without insights of possible factors influencing observed changes which are important to understand the full landscape of factors (including MPAs) that affect change in commercial fishing and fishermen.

During the first year of data collection, we received a fairly reasonably representative sample as fishermen were largely interested in providing their information on how MPAs had impacted them. However, in the second year of data collection we experienced considerably more resistance to participating with interviews. Many fishermen noted that they felt that they gave all the information needed in the first year's interview (e.g., mapping of fishing grounds and information on how the fisherman has been impacted by MPAs) and that the information provided has not changed since that prior year's interview—questioning the utility of participating in an additional interview. Furthermore, when contacted to participate in the second year of interviews we experienced an increased level of overall frustration in the lack of understanding of how the spatial fishing data would be used and a belief that the data collected would somehow be used to harm fishermen or further restrict their fishing.

This presented a difficult challenge to the project, and the nature of these concerns listed above was difficult to address in a limited timeline and the limited scope of Ecotrust's role in the larger landscape of MPA management and monitoring. Despite this, Ecotrust increased outreach efforts, networked within the fishing community and attended fishermen meetings to disseminate information and answer questions as to the intentions of the project, and to the extent possible explain how data will be used to inform the 5-year management review of the North Central Coast MPA network. Furthermore, Ecotrust spent extensive efforts to keep the fishing community informed of project progress to develop transparency in our work and maintaining relationships in the North Central Coast Region. We hope to continue and maintain these relationships into the future.

In future projects, these issues of trust, project intentions, incentives to participate, and use of collected data may be better be addressed up front with strategic joint outreach efforts with state agencies responsible for MPA management and monitoring. Implementing efforts to engage fishermen early on, acknowledging and addressing to the extent possible their concerns, and incorporating fishermen in the overall MPA monitoring process is important in key to building the fishing community relationships necessary to conduct long-term socioeconomic studies. This can be done by meaningfully incorporating fishermen into MPA monitoring efforts such as project design, data review/analysis, and data dissemination which are important to build trust and transparency as well as foster a sense of ownership and legitimacy over the data, information, and process by the fishermen whose livelihood may be impacted.

A promising model of engaging the fishing community is currently being carried out in the North Coast region of California in which community engagement from citizens to county board of supervisors began early on and involves the agencies responsible for both managing the MPA network as well as the MPA monitoring effort. This developed interest and support in MPA monitoring efforts as the community was engaged in shaping the MPA monitoring effort from the grounds up and there was clear opportunity to develop community-based projects. This community-wide investment in MPA monitoring efforts from the beginning, even before the request for MPA monitoring proposals is developed, is critical to garnering the community investment and support needed to carry out effective MPA monitoring—especially socioeconomic MPA monitoring efforts.

Collect Data on Personal and Community Well-Being

The socioeconomic well-being of fishermen and fishing communities is a multi-dimensional concept that requires both quantitative and qualitative data to fully assess and track over time. This project collected primarily economic data; however, a future recommendation would be to also collect information and quantitative data on the personal and community well-being of fishing communities. It is important to understand that economic revenue levels do not translate as a measure of personal or community well-being. We have observed a key example of this with fishermen in the North Central Coast region in the form of scenarios in which fishermen are earning the same gross economic revenue but are spending more hours working, fishing, or travelling to fish—reducing his/her overall quality of life. This type of impact is not captured quantitatively in this project but rather only qualitatively in our survey questions asking generally how fishermen have been impacted by MPAs. However, well established personal well-being/quality of life measures and other measures such as sense of job satisfaction and job security can be applied to quantitatively measure these important aspects of socioeconomic health.

In addition to questions pertaining to personal well-being it is important to collect data on community well-being. This may initially include qualitatively exploring possible impacts to the fishing community as a whole which includes people such as crew members, fish buyers/processors, port infrastructure staff, and port managers amongst others to begin to explore and track any change in the complex relationships that make up the larger system of fishing beyond just fishermen. Qualitatively exploring community well- being helps to conceptualize the interconnections that make up the system that make fishing possible and thus what one must consider when quantitatively examining community impacts or impacts beyond individual fishermen.

Conduct More Analyses at the Individual Fisherman Level

In this report we largely utilize individual fisherman data in aggregation for port and region level analyses to establish a baseline data set. However, a future recommendation is to conduct more advanced analyses using individual fisherman data to explore typologies of fishermen or specific attributes of fishermen and how these types of fishermen are experiencing and coping with change over time. Specifically, some questions to explore with individual fisherman data include:

1. What type of fishermen are doing better or worse over time?
2. What attributes do these fishermen that are doing better or worse have in common—what do they fish for, how much do they fish, and what port are they from?
3. What type of fishermen have dropped out of commercial fishing or specific fisheries over time and why?

We know that the impacts of economic change do not unfold evenly across fishermen—some fishermen are more or less able to cope with change depending on their adaptive capacity. These questions above help explore fisherman attributes that may help us better understand what types of fishermen are successfully coping with change and why they are successful. Understanding this can lead to identifying target areas in which to focus policy efforts that help fishermen cope with economic change, such as the change that follows MPA establishment, in order to better maintain viable livelihoods.

7.2. Recommendations on Key Commercial Fishing Monitoring Metrics

Below are Ecotrust's recommendations for key metrics for long-term monitoring of the commercial fishing sector. To inform the existing monitoring plan structure we included the key monitoring metrics recommended for consumptive uses detailed in the North Central Coast and South Coast MPA monitoring plans and added additional metrics with an associated rationale.

Table 174. Recommendations for key monitoring metrics in the commercial fishing sector

Metric	Purpose	Source
Landings (pounds and ex-vessel revenue)	This metric is to monitor how many pounds of fish are being caught and how much revenue is being generated in key fisheries. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CDFW commercial landings data
Operating costs (average yearly percentages)	This metric is to monitor how operating costs may be changing over time. This may be increases/decreases in fuel costs, equipment costs, maintenance costs, crew costs, etc. From this information changes in net revenue for individual fishermen may be calculated. These operating cost percentages may also be used to help estimate secondary economic impacts upon commercial fishing support industries. It is recommended that operating costs be collected at the fishery level as some fisheries are more equipment intensive or require less/more fuel and crew.	Survey data
Total number of fishermen landing in key fisheries	This metric is to monitor how many fishermen are participating in key fisheries each year. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CDFW commercial landings data
Total number of trips in key fisheries	This metric is to monitor how many total trips fishermen are taking in key fisheries each year. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CDFW commercial landings data
Landings (pounds and ex-vessel revenue) and trips per fisherman	This metric is to monitor how landings (pounds and revenue) and fishing effort may be changing at the individual fisherman level for key fisheries	CDFW commercial landings data
Spatial value of fishing areas	This metric is to monitor changes in how coastal/ocean areas are being utilized and valued by fishermen. Data may be analyzed with previous spatial data sets to determine spatial shifts in the value of fishing areas for key fisheries	CDFW commercial landings data
Catch per unit effort (CPUE)	This metric is to monitor the average amount effort expended by fishermen in key fisheries. This data may be calculated by examining pounds/ex-vessel revenue per trip for key fisheries and	CDFW commercial landings data
Price per pound	This metric is to monitor changes in the average ex-vessel price received by fishermen in key fisheries. This metric may be calculated on average by dividing ex-vessel revenue by pounds landed.	CDFW commercial landings data
Average percent of fishing revenue from key fisheries	This metric is to monitor changes in the average proportion individual fishermen rely upon a fishery for their fishing income. This metric may be calculated by examining and averaging across the ex-vessel revenue portfolio of individual fishermen who make landings in a given port or region.	CDFW commercial landings data
Attitudes and perceptions	This information is to monitor and collect contextual information that may help identify key fishery issues and factors driving the change observed in the metrics listed above.	Survey data/focus groups
Job satisfaction/ Well-being/ Quality of life	These social metrics are important to monitor as economic metrics may not reveal changes in personal well-being. For example, a fisherman may be making the same amount of revenue from one year to the next, but his/her quality of life may decline in increased work hours or travel time in order to do so.	Survey data/focus groups

8. CONCLUSIONS

The intention of this report was to provide a baseline characterization and description of initial changes since MPA implementation of key target commercial fisheries and ports in the California North Central Coast Region. It should be noted that in this report we do not account for the secondary economic effects of changes in fishing revenue and how that may affect support industries such as fish processors/buyers, port workers, or crew which benefits and may rely on the business of commercial fishermen. Indeed, these industries are vital to the success and health of fishing communities and are important to account for in future monitoring efforts.

It is difficult to discern the specific effects of MPAs on fishing communities as they are confounded by a multitude of factors such as other regulatory constraints (e.g., fisheries management policies such as area based closures, quota limits, and limited entry fisheries) and general economic downturn, environmental variability/change, market variability, and increasing competition for marine space. However, advancing our understanding of how humans utilize, value, and rely upon marine space will be critical to unraveling these interconnections as well as monitor how MPAs are benefitting or impacting fishing communities into the future. This information may then be used in adaptive management measures to improve the performance of MPAs towards meeting ecological and socioeconomic goals. Similarly, it is our hope that the data collected/compiled and lessons learned through this project will be applied to future MPA monitoring efforts to build a time series data set on how human uses and the socioeconomic health of fishing communities are changing over time. Such a robust and longitudinal dataset that provides both socioeconomic characterization and spatial fishing patterns on consumptive human uses could be used for a wide array of marine spatial planning application including the monitoring of MPAs.

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Appendix A

CALIFORNIA NORTH CENTRAL COAST COMMERCIAL FISHING 2011 BASELINE CHARACTERIZATION

The 2010 data set is presented in the main body of this report as the survey sample in this first year of data collection was significantly more robust and thus more representative and reliable as a baseline characterization of the North Central Coast region commercial fishing fleet. Reasons as to why the second year of data collection (2011 fishing year) did not yield as robust of a survey sample is explained in detail in our lessons learned section in the main body of the report.

Here we present the data collected in the second year of the project (collected in 2012 inquiring about the entire 2011 fishing year) summarized at the study regional level below. Additional port and fishery specific data can be found in the accompanying data workbooks, maps, and spatial data sets included in the deliverables package of this project which can be found on the OceanSpaces website: (http://oceanspaces.org).

For interviews conducted in the second year of data collection for this project, the Dungeness crab–trap fishery had the most respondents (64) across the region, while Urchin–dive had the fewest (4). The number of respondents for each port/fishery combination is shown below in Table 1.

Table 1. Number of commercial fishermen interviews conducted, 2011, non spatial survey, North Central Coast Region

Port	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All target fisheries
Point Arena	—	3	1	3	3	5
Bodega Bay	3	24	1	17	1	26
Bolinas	2	1	—	1	—	2
San Francisco	5	10	1	6	—	14
Half Moon Bay	3	18	3	10	—	21
North of study region	—	6	—	3	—	6
South of study region	—	2	—	1	—	2
Total number of individuals	13	64	6	41	4	76

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

A total of 494 individual fishermen landed in at least one of the five target fisheries, generating 40.7 million dollars in ex-vessel revenue in the North Central Coast in 2011. Dungeness crab–trap was the largest revenue generator and made up nearly 95 percent of the regional revenue across target fisheries. Ex-vessel revenues from 2011 can be found for all target fisheries in Table 2.

Table 2. Number of commercial fishermen interviews conducted and fishery ex-vessel revenue value, 2011, non spatial survey, North Central Coast

Fishery	2011 ex-vessel revenue (2010$)	Total number of individuals in 2011 landings	Number interviewed
California halibut–hook & line	$357,908	86	13
Dungeness crab–trap	$38,552,188	292	64
Nearshore finfish–live–fixed gear	$228,984	28	6
Salmon–troll	$1,234,446	222	41
Urchin–dive	$347,837	15	4
All target fisheries (unique individuals)	$40,721,363	494	76

Source: California Department of Fish and Wildlife, Current study

Includes individuals from north and south of the study region

The average respondent we spoke to in 2012 was 52.6 years old and had 24.7 years experience as a commercial fisherman (Table 3). This average, for all target fisheries, is for unique individuals and includes each individual only once, regardless of how many fisheries they participated in. Those that participated in the California halibut–hook & line fisheries had slightly less experience commercial fishing (19.7 years) while those that participated in salmon–troll fishery had slightly more experience commercial fishing overall (26 years). It should be noted that this question inquired about the number of years experience an individual had commercial fishing as a whole, not the number of years experience they had in a specific fishery.

Table 3. Average age and years experience commercial fishing, 2011, North Central Coast

	Age			Years experience		
Fisheries	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
California halibut – hook & line	13	50.5	12.9	13	19.7	14.5
Dungeness crab – trap	63	53.1	10.8	64	25.5	13.7
Nearshore finfish–live–fixed gear	6	48.2	5.1	6	24.3	9.0
Salmon–troll	40	53.8	10.2	41	26.0	13.7
Urchin–dive	4	51.0	8.0	4	24.8	6.7
All target fisheries (unique individuals)	75	52.4	10.7	76	24.5	13.5

Source: Current study

Includes individuals from north and south of the study region

Respondents were asked what percent of their total personal income came from commercial fishing in 2011. Fishermen who participated in the urchin–dive fishery reported the largest percent of their personal income coming from commercial fishing (97.5 percent), while those in the California halibut–hook & line fishery reported that 57.3 percent of their total personal income came from commercial fishing (Table 4). Note that the percent of total income from overall commercial fishing is not necessarily related to the fishery indicated, but rather reflects the fisherman's commercial fishing income as a whole. Fishermen were then asked what factors they felt had impacted the percent of their income from fishing since 2010. Respondents were asked this as an open-ended question and notes were taken by the interviewer and then coded into the categories shown in Table 5.

Across all target fisheries three respondents indicated that they were making more revenue in 2011 than in 2010 because fishing was worse in 2010 and three respondents indicated they were making less revenue due to their increasing age and health problems. Respondents were then asked to identify any other sources of income other than commercial fishing that they had in 2011. The most frequent responses were retirement/social security/investments followed by construction/carpentry/industrial work and other fishing related work (such as building gear or running a CPFV vessel). Additional sources of revenue can be found in Table 6.

Table 4. Percent of overall income from fishing, 2011, North Central Coast

Fisheries	Number responding	Average	Standard deviation
California halibut – hook & line	13	57.3%	41.9%
Dungeness crab – trap	64	88.7%	20.2%
Nearshore finfish–live–fixed gear	6	68.3%	42.5%
Salmon–troll	41	88.0%	23.3%
Urchin–dive	4	97.5%	5.0%
All target fisheries (unique individuals)	76	83.4%	28.2%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Includes individuals from north and south of the study region

Table 5. Cause in change in percent income from commercial fishing, 2010-2011, North Central Coast

	Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
		Number responding					
Reason for increase	Relied more on other sources of income in 2010	—	1	—	1	—	1
	Natural fluctuation in fish abundance/presence (worse in 2010)	—	3	—	3	—	3
	Fishing less actively in 2010	1	1	—	1	—	2
	Prices are better in 2011 than 2010	1	1	—	1	—	1
Reason for decrease	Relied more on other sources of income in 2011	1	1	—	1	—	2
	Natural fluctuation in fish abundance/presence (worse in 2011)	1	1	1	1	—	2
	Fishing less actively in 2011	1	1	—	—	—	1
	Age health/worse in 2011	2	1	2	—	—	3
	Increased fishing related expenses in 2011	—	1	2	—	—	2
	Red tides in 2011	—	—	2	—	—	1
Number of individuals responding		4	9	3	7	—	12

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes individuals from north and south of the study region

Table 6. Other sources of income other than commercial fishing in 2011, North Central Coast

Response	Number responding: California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
Construction/Contractor/Industrial work	1	3	—	2	—	4
Farming/Ranching	—	2	—	1	—	2
Harbor/City job	—	1	—	1	—	1
Independent business	1	1	—	1	—	1
Oil spill settlement	1	—	—	—	—	1
Other fishing related work	2	2	1	1	—	4
Other specialized work	—	2	1	1	—	2
Property management	1	1	—	1	—	1
Retirement/Social Security/Investments	1	5	—	3	—	5
Skilled labor	2	3	1	3	—	4
Number of individuals responding	6	16	2	11	—	19

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes respondents from north and south of the study region

We asked respondents to estimate what percent of their gross economic revenue (GER) from commercial fishing went towards their overall commercial fishing related operating costs. Similar to the questions above, this was not asked in regards to a particular fishery, but rather about their commercial fishing as a whole. Those who participated in the California halibut – hook & line had the highest average, reporting that over 65 percent of commercial fishing GER went back into overall operating costs. Across all fisheries the average respondent in the North Central Coast reported spending 55.4 percent of their commercial fishing GER on operating costs (Table 7). As shown in Table 8, 49.2 percent of respondents felt that their 2010 operating costs were average compared to 2010, 42.6 percent felt operating costs were either somewhat or significantly higher in 2011 than 2010, and the remaining 8.2 percent felt they were operating costs in 2011 were somewhat lower than in 2010.

Table 7. Percent of gross economic revenue towards overall operating costs in 2011, North Central Coast

Fisheries	Number responding	Average	Standard deviation
California halibut – hook & line	13	65.6%	34.2%
Dungeness crab – trap	62	53.7%	19.9%
Nearshore finfish–live–fixed gear	6	54.8%	32.8%
Salmon–troll	39	50.2%	20.3%
Urchin–dive	4	58.3%	35.6%
All target fisheries (unique individuals)	74	55.4%	23.8%

Source: Current study

Includes respondents from north and south of the study region

Table 8. Perceived change in percent gross economic revenue towards overall operating costs, 2010 - 2011, North Central Coast

Fisheries	Number responding	Percent response: Significantly higher	Somewhat higher	Average	Somewhat lower	Significantly lower
California halibut–hook & line	13	23.1%	30.8%	38.5%	7.7%	—
Dungeness crab–trap	64	14.1%	28.1%	50.0%	7.8%	—
Nearshore finfish–live–fixed gear	5	20.0%	20.0%	60.0%	—	—
Salmon–troll	41	14.6%	29.3%	43.9%	12.2%	—
Urchin–dive	3	—	33.3%	66.7%	—	—
All fisheries (unique individuals)	61	13.1%	29.5%	49.2%	8.2%	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes respondents from north and south of the study region

Respondents were then asked to elaborate on what factors they felt had impacted the change in the percent of their gross economic revenue (GER) that went towards overall commercial fishing operating costs. Twenty-six out of 37 respondents indicated that they had experienced an increase in the price of fuel. Sixteen respondents indicated that there had been a general increase in the price of all operating costs. Additional reasons for the increase in costs can be found below in Table 9.

Table 9. Cause of change in percent gross economic revenue towards overall operating costs, 2010 - 2011, North Central Coast

	Response	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	All fisheries (unique individuals)
Reason for decrease	Making more revenue	1	4	—	4	—	4
Reason for increase	Making less revenue	1	2	—	2	—	3
	Increase in fuel price	6	21	2	15	1	26
	Large equipment (or vessel) purchase	1	8	—	3	—	8
	Overhaul/maintenance of vessel	—	5	—	3	—	5
	Have to travel further to fish	1	2	—	1	—	3
	Have more crew	—	2	—	1	—	2
	General price increase (gear, bait, insurance, berthing, etc.)	5	11	2	8	1	16
	Loss of fishing grounds	—	1	—	1	—	1
	Paying crew higher wage	1	1	—	—	1	1
Number of individuals responding		8	31	2	22	1	37

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes respondents from north and south of the study region

For each fishery they participated in, we asked each respondent the following questions; 1) how many years experience do you have; 2) how many days do you target this fishery; 3) on average how many crew do you use per trip; 4) what percent of your fishery specific gross revenue on average is paid to your crew; and, 5) what percent of your fishery specific gross revenue goes towards your fuel usage for that fishery? Salmon–troll fishermen reported the most experience (29.3 years) while California halibut–hook & line reported the least (16.1 years). Urchin divers reported spending 113.3 days per years targeting their fishery, the most of any of the target fisheries. Dungeness crab–trap fishermen reported using the most crew, (1.9 crew per trip on average) and subsequently reported the highest percentage of their fishery specific GER that went towards crew. Additionally, the lowest percent of GER going towards fuel was reported for the Dungeness crab fishery. These statistics for all target fisheries in the study region are shown below in Table 10 and Table 11.

Table 10. Years experience and number of days targeting specific fisheries in 2011, North Central Coast

	Years experience in fishery			Days spent targeting fishery		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
California halibut – hook & line	13	16.1	10.3	12	79.7	60.2
Dungeness crab – trap	63	23.6	13.9	62	68.4	46.3
Nearshore finfish–live–fixed gear	6	19.0	8.4	6	54.0	44.8
Salmon–troll	40	29.3	15.5	39	39.3	29.8
Urchin–dive	4	26.8	2.4	3	113.3	75.7

Source: Current study

Includes respondents from north and south of the study region

Table 11. Number of crew and percent of fishery specific gross economic revenue towards crew and fuel, 2010, North Central Coast

	Number of crew per trip			Percent GER to crew			Percent GER to fuel		
Fisheries	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
California halibut – hook & line	13	0.3	0.6	12	4.3%	14.4%	11	30.4%	23.6%
Dungeness crab – trap	63	1.9	0.8	63	29.2%	9.9%	57	12.8%	7.8%
Nearshore finfish–live–fixed gear	6	0.5	0.8	6	8.3%	13.3%	6	20.0%	16.4%
Salmon–troll	38	0.7	0.6	37	13.0%	10.9%	37	16.3%	11.1%
Urchin–dive	4	0.5	0.6	4	23.0%	38.4%	2	25.0%	21.2%

Source: Current study

Includes respondents from north and south of the study region

Fishermen were asked if they added or dropped fisheries since 2010 or if they did not fish a fishery in 2011. The reasoning behind this question was to investigate any underlying factor that may be driving socioeconomic change in specific fisheries. One respondent indicated he/she had added the Dungeness crab–trap fishery in 2011 (Table 12) and explained he/she did so in order to generate more revenue (Table 13). Additionally, four respondents added and one dropped the salmon–troll fishery in 2011, and two did not participate in the fishery in 2011.

Table 12. Commercial fisheries added/dropped since 2010 or not fished in 2011, North Central Coast

		Number responding		
Fisheries	**Number responding**	**Added**	**Dropped**	**Not fished in 2011**
California halibut–hook & line	13	—	—	—
Dungeness crab–trap	64	1	—	—
Nearshore finfish–live–fixed gear	6	—	—	—
Salmon–troll	41	4	1	2
Urchin–dive	4	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes respondents from north and south of the study region

Table 13. Reason for adding/dropping or not fishing a commercial fishery, North Central Coast

	Number responding				
Response	**California halibut–hook & line**	**Dungeness crab–trap**	**Nearshore finfish–live–fixed gear**	**Salmon–troll**	**Urchin–dive**
Purchased new boat	—	—	—	1	—
Wasn't worth it to fish in 2010	—	—	—	2	—
Needed more revenue	—	1	—	—	—
Respondent did not provide reason	—	—	—	4	—
Number responding	—	1	—	7	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

All respondents includes individuals from north and south of the study region

Fishermen were asked separately for each fishery they participated in to compare the success in his/her fishing in 2010 to the last five years. As shown in Table 14 below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 3) somewhat worse; and 4) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in his/her fishery. This question was asked in an open ended manner and responses were later coded, categorize, and divided into four types of categories: regulatory, environmental, economic, and other, as seen in the tables below.

Most Dungeness crab–trap fishermen indicated they were doing better in 2011 than in the previous five years (Table 14). Most of the reasons to which they attributed this were environmental; many individuals noted there was a larger quantity of crab and that the season was the peak of a natural cycle of crab abundance (Table 15). Additionally, many crabbers noted that in 2011 there was a good market and they received good prices for their crab (Table 16). Additionally, a few fishermen indicated that the peak of the crab cycle had already passed and was beginning to decline (Table 15).

All urchin divers reported their success in the fishery was either significantly worse (75 percent) or somewhat worse (25 percent) than it had been in previous years (Table 13). The only factors urchin divers mentioned as the cause of this were MPAs (Table 17) and bad prices (Table 16). More information for other fisheries can be found in the tables below.

Table 14. Overall success in specific commercial fishery in 2011 compared to previous five years, North Central Coast

Fisheries	Number responding	Percent response: Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
California halibut–hook & line	13	—	—	7.7%	15.4%	46.2%	30.8%
Dungeness crab–trap	64	—	54.7%	26.6%	7.8%	7.8%	3.1%
Nearshore finfish–live–fixed gear	6	—	—	—	50.0%	—	50.0%
Salmon–troll	38	7.9%	13.2%	34.2%	15.8%	18.4%	10.5%
Urchin–dive	4	—	—	—	—	25.0%	75.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes respondents from north and south of the study region

Table 15. Environmental changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live– fixed gear	Salmon–troll	Urchin–dive
	Number responding	7	49	1	14	—
	Responses	**Count of responding**				
Better	Peak of natural cycle	—	28	—	2	—
	Improvement in water quality	—	7	—	1	—
	Large quantity of fish	—	14	—	2	—
	Good ocean conditions	—	3	—	1	—
	Good weather	—	1	—	—	—
	Lack of predators	—	4	—	—	—
Worse	Low (or declining) natural cycle	2	5	—	1	—
	Poor water quality	1	—	—	—	—
	Low quantity of fish	4	1	—	7	—
	Poor ocean conditions	2	—	1	1	—
	Loss of spawning grounds due to inland water management	—	—	—	4	—
	Red tides	—	—	1	1	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes respondents from north and south of the study region

Table 16. Economic changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	2	13	1	3	1
	Responses			**Count of responding**		
Better	Good/new market	—	9	—	—	—
	Good price	—	8	—	3	—
Worse	Bad price	—	—	—	—	1
	Increase in costs	2	—	1	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 17. Regulatory changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	2	2	2	16	3
	Responses			**Count of responding**		
Better	Allowed to fish (limited) number of days	—	—	—	9	—
	Less trawling	—	2	—	—	—
Worse	Season limited	—	—	—	4	—
	General poor management methods	1	—	—	—	—
	MPAs	1	—	2	2	3
	Rockfish conservation areas	—	—	1	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 18. Other changes/factors influencing success in a specific commercial fishery in 2010 as compared to previous five years, North Central Coast

		California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive
	Number responding	7	2	2	1	—
	Responses	**Count of responding**				
Better	Good crew	—	1	—	—	—
Worse	Used fewer traps	—	1	—	—	—
	Others changing fishery	5	—	1	—	—
	Overcrowding	—	—	—	1	—
	Boat problems/breakdowns	1	—	—	—	—
	Draggers overfishing/poaching	2	—	—	—	—
	Personal health	1	—	—	—	—
	Sport fishing hurting population	1	—	1	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

North Central Coast Region MPAs and Commercial Fishing

Determining and measuring the impact of MPAs upon commercial fishermen is challenging to quantify and unravel from the multitude of environmental, regulatory, and economic factors influencing systems of fishing. Despite this, we sought to capture information from fishermen as to how they perceive they have been impacted by MPAs and the specific MPAs which are impacting their fisheries. This section provides information at the region and port levels and summarizes the response from the following three questions which were asked for each fishery during interviews:

1) Has your fishery been directly impacted by the recently established MPAs?;
2) If so, how have you been impacted?; and,
3) What MPAs have impacted your specific fishery?

Question one was posed as a simple yes or no response and questions two and three were open-ended questions in which responses were later coded and categorized into the tables below. Additionally, fishermen were given a map of the MPAs in the North Central Coast to aid in identifying and naming the MPAs impacting them. The questions above were asked for every fishery an individual participated in.

Across all fisheries 75.3 percent of respondents indicated they had been impacted in some way by MPAs (Table 19). The urchin–dive fishery reported the highest impacts (100 percent) followed by nearshore finfish–live–fixed gear. One nearshore finfish–live–fixed gear fisherman reported they were not impacted and the rest (85.7 percent) reported they were. The most frequently reported type of impacts was the loss of traditional fishing grounds, followed by spending more time fishing or at times traveling to fishing grounds. Additional impacts can be found below in Table 19.

There are 31 MPAs in the North Central Coast and at least one individual indicated being impacted by one of these (Table 20). Additionally, some individuals noted being impacted by an MPA from the Central Coast region, specifically Aña Nuevo. Stewarts Point SMR was indicated the most frequently across all fisheries for the entire study region followed by Point Reyes SMR. Many MPAs have an impact on fishermen from a specific port in the region and impacts on smaller or specific ports may not be well represented in this regional table. Please examine our port specific tables in the data workbook associated with this report for more information at the port level.

Table 19. Percent of individuals indicating specific direct impacts from MPAs in 2011 for each fishery, North Central Coast

	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number responding	13	64	7	41	4	76
Percent indicating direct impacts from MPAs	46.2%	76.6%	85.7%	78.0%	100.0%	82.9%
Response	**Percent responding**					
Loss of traditional fishing grounds	38.5%	68.8%	71.4%	70.7%	100.0%	76.3%
Spending more time fishing/traveling for fishing	7.7%	21.9%	57.1%	29.3%	100.0%	35.5%
Increased fishing pressure/crowding in open areas	15.4%	23.4%	42.9%	9.8%	50.0%	30.3%
Fishing more in areas with worse/less predictable weather	15.4%	10.9%	42.9%	4.9%	25.0%	15.8%
Open areas harder to access	—	1.6%	42.9%	2.4%	—	5.3%
Distress regarding unintended fishing infractions	—	1.6%	—	9.8%	—	6.6%
Can't access live bait	7.7%	1.6%	—	—	—	1.3%
Loss of highly productive area	—	—	—	7.3%	—	3.9%
Shift of fishing effort into other fisheries	15.4%	—	—	—	—	2.6%
Loss of revenue	—	1.6%	—	4.9%	—	3.9%
Loss of gear	—	3.1%	—	—	—	2.6%
Takes time to pull up gear to transit through closed areas	—	—	—	4.9%	—	2.6%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Includes respondents from north and south of the study region

Table 20. Percent of respondents indicating specific MPA impacting commercial fishery in 2011, North Central Coast

	Percent Responding					
MPAs	California halibut–hook & line	Dungeness crab–trap	Nearshore finfish–live–fixed gear	Salmon–troll	Urchin–dive	Unique individuals
Number responding	13	64	6	41	4	76
Bodega Head SMCA	7.7%	4.7%	—	4.9%	25.0%	6.6%
Bodega Head SMR	7.7%	23.4%	—	46.3%	25.0%	35.5%
Del Mar Landing SMR	7.7%	3.1%	33.3%	4.9%	25.0%	6.6%
Double Point/Stormy Stack SC	7.7%	3.1%	—	2.4%	—	2.6%
Drake's Estero SMCA	15.4%	3.1%	—	4.9%	—	3.9%
Duxbury Reef SMCA	30.8%	1.6%	—	4.9%	—	6.6%
Egg (Devil's Slide) Rock to Devil's Slide SC	15.4%	4.7%	—	2.4%	—	5.3%
Estero Americano SMRMA	15.4%	4.7%	—	2.4%	—	3.9%
Estero de Limantour SMR	15.4%	3.1%	—	2.4%	—	3.9%
Estero de San Antonio SMRMA	7.7%	3.1%	—	2.4%	—	2.6%
Gerstle Cove SMR	7.7%	6.3%	33.3%	7.3%	25.0%	9.2%
Montara SMR	15.4%	21.9%	33.3%	14.6%	—	23.7%
North Farallon Islands SC	7.7%	6.3%	16.7%	12.2%	50.0%	14.5%
North Farallon Islands SMR	7.7%	12.5%	16.7%	22.0%	50.0%	21.1%
Pillar Point SMCA	15.4%	7.8%	16.7%	2.4%	—	9.2%
Point Arena SMCA	7.7%	10.9%	16.7%	7.3%	50.0%	14.5%
Point Arena SMR	7.7%	12.5%	16.7%	26.8%	50.0%	23.7%
Point Resistance Rock SC	7.7%	1.6%	—	2.4%	—	1.3%
Point Reyes Headlands SC	15.4%	9.4%	—	7.3%	—	11.8%
Point Reyes SMCA	30.8%	7.8%	—	9.8%	—	13.2%
Point Reyes SMR	46.2%	39.1%	—	22.0%	—	43.4%
Russian River SMCA	7.7%	3.1%	—	2.4%	—	2.6%
Russian River SMRMA	7.7%	1.6%	—	2.4%	—	1.3%
Salt Point SMCA	7.7%	17.2%	50.0%	7.3%	100.0%	22.4%
Saunders Reef SMCA	7.7%	9.4%	16.7%	7.3%	25.0%	13.2%
Sea Lion Cove SMCA	7.7%	1.6%	—	4.9%	—	2.6%
Southeast Farallon Island SC	7.7%	3.1%	16.7%	7.3%	50.0%	9.2%
Southeast Farallon Island SMCA	7.7%	1.6%	16.7%	2.4%	50.0%	5.3%
Southeast Farallon Island SMR	7.7%	3.1%	16.7%	9.8%	50.0%	10.5%
Stewarts Point SMCA	7.7%	10.9%	50.0%	9.8%	100.0%	18.4%
Stewarts Point SMR	7.7%	28.1%	50.0%	56.1%	75.0%	46.1%
Other	—	4.7%	—	2.4%	—	3.9%
Total number of MPAs impacting fishery/region	31	32	15	32	15	32

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Includes respondents from north and south of the study region

North Central Coast Commercial Fishing 2011 Spatial Baseline

In the following section we provide maps of baseline data depicting the spatial fishing patterns of specific commercial fisheries at the port and region level. The full detailed methodology of how these data were collected, analyzed, and reviewed can be found in methods section in the main body of this report. The GIS data layers with associated metadata of these spatial data sets are also available and were included in the deliverables package of this project which can be found on the OceanSpaces website: (http://oceanspaces.org).

The following map products and spatial data sets for the North Central Coast region commercial fishing fleet for the full 2011 fishing year are provided in Table 21 below. The table below also provides the ex-vessel revenue for each port-fishery or region-fishery combination and indicates the percent of this ex-vessel represented by the fishermen who provided spatial fishing data to develop the map products listed. Only maps with 3 or more fishermen are available for use due to confidentiality protocols as indicated in the table below.

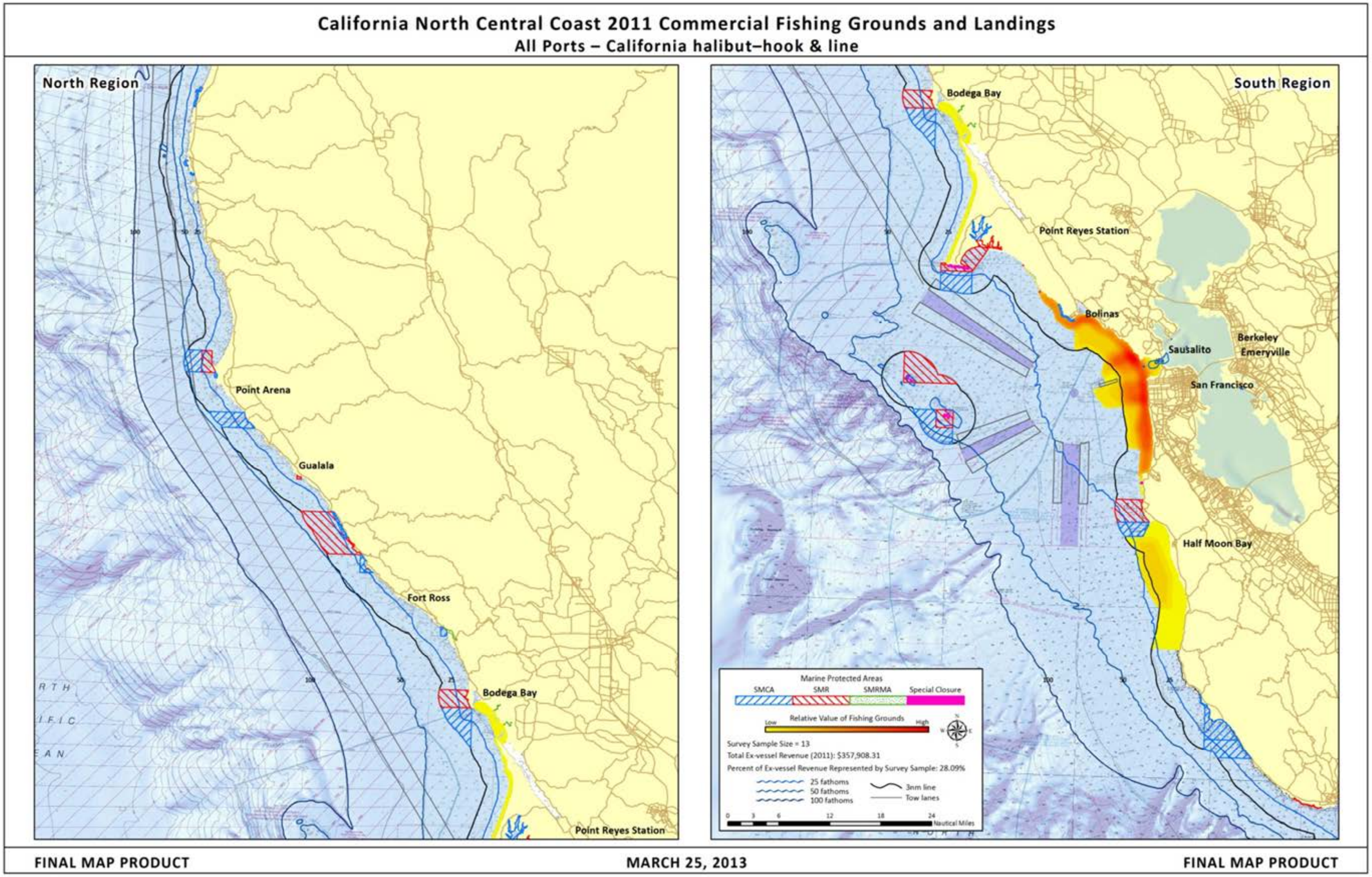
Table 21. Number of commercial fishermen interviews conducted and ex-vessel landings value represented in maps available to public, 2011, North Central Coast Region

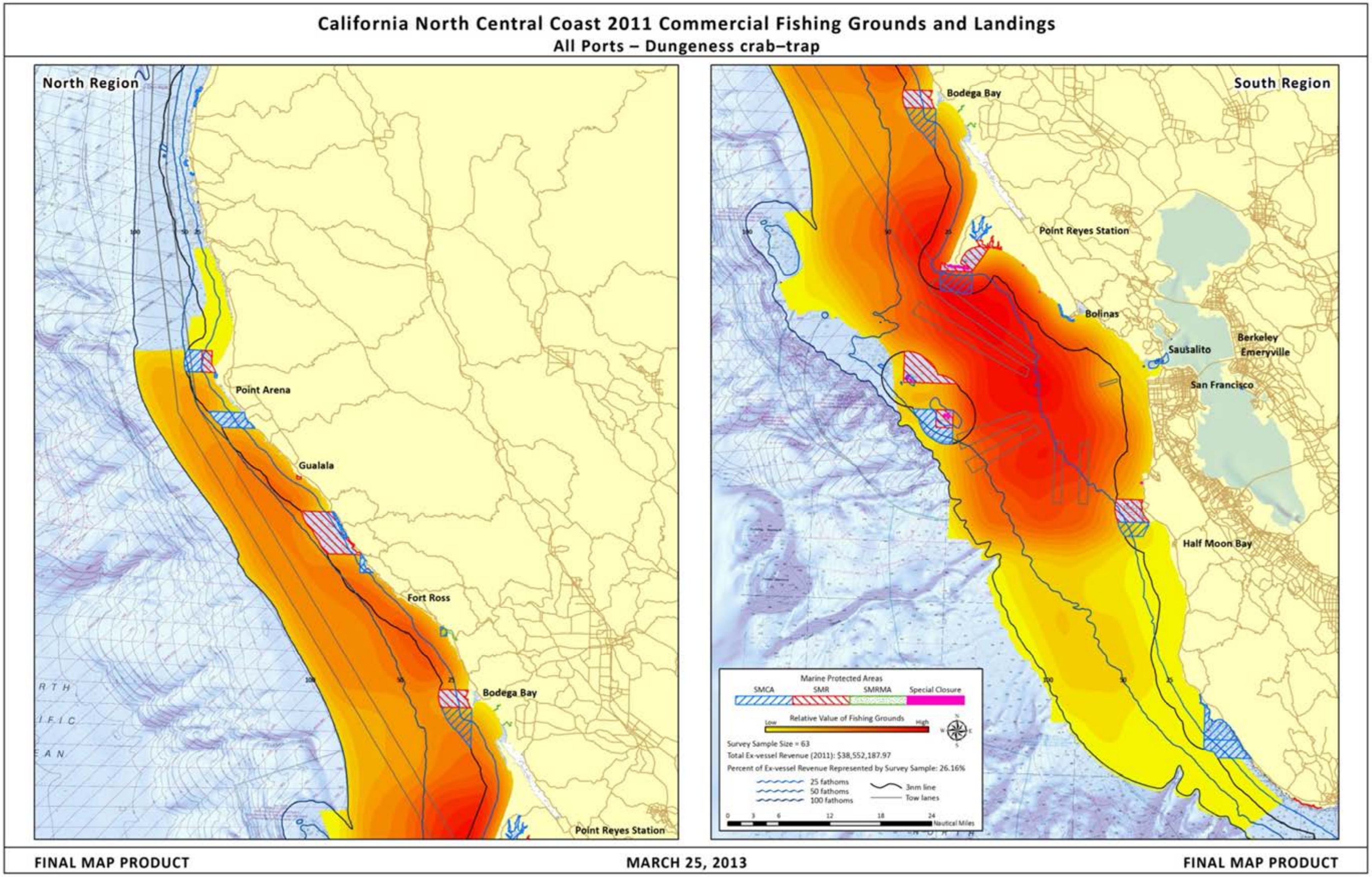
Port/Region	Fishery	2011 ex-vessel revenue (2010$)	Percent of ex-vessel revenue represented by interviews	Total number of individuals in 2011 landings	Number of fishermen who mapped	Map available
North Central Coast	California halibut – hook & line	$357,908	28%	86	13	YES
North Central Coast	Dungeness crab – trap	$38,552,188	26%	292	63	YES
North Central Coast	Nearshore finfish	$228,984	24%	28	6	YES
North Central Coast	Salmon–troll	$1,234,446	17%	222	30	YES
North Central Coast	Urchin–dive	$347,837	52%	15	4	YES
Point Arena	California halibut – hook & line	—	—	—	—	—
Point Arena	Dungeness crab – trap	$57,662	*	3	2	NO
Point Arena	Nearshore finfish	$105,420	*	3	1	NO
Point Arena	Salmon–troll	$47,570	*	6	2	NO
Point Arena	Urchin–dive	$311,852	47%	13	3	YES
Bodega Bay	California halibut – hook & line	$27,388	17%	18	4	YES
Bodega Bay	Dungeness crab – trap	$12,961,074	35%	100	29	YES
Bodega Bay	Nearshore finfish	$15,064	—	6	—	—
Bodega Bay	Salmon–troll	$557,055	17%	124	18	YES
Bodega Bay	Urchin–dive	$35,549	*	3	1	NO
Bolinas	California halibut – hook & line	$34,873	*	5	1	NO
Bolinas	Dungeness crab – trap	$209,300	*	6	1	NO
Bolinas	Nearshore finfish	19-Dec-02	*	2	—	—
Bolinas	Salmon–troll	$8,959	*	6	1	NO
Bolinas	Urchin–dive	—	—	—	—	—
San Francisco	California halibut – hook & line	$269,162	30%	61	8	YES
San Francisco	Dungeness crab – trap	$17,255,737	17%	116	14	YES
San Francisco	Nearshore finfish	$43,707	*	12	1	NO
San Francisco	Salmon–troll	$240,083	18%	67	8	YES
San Francisco	Urchin–dive	11-Mar-01	—	1	—	—
Half Moon Bay	California halibut – hook & line	$26,485	17%	16	3	YES
Half Moon Bay	Dungeness crab – trap	$8,068,415	31%	105	19	YES
Half Moon Bay	Nearshore finfish	$63,708	16%	12	3	YES
Half Moon Bay	Salmon–troll	$380,780	10%	85	7	YES
Half Moon Bay	Urchin–dive	—	—	—	—	—

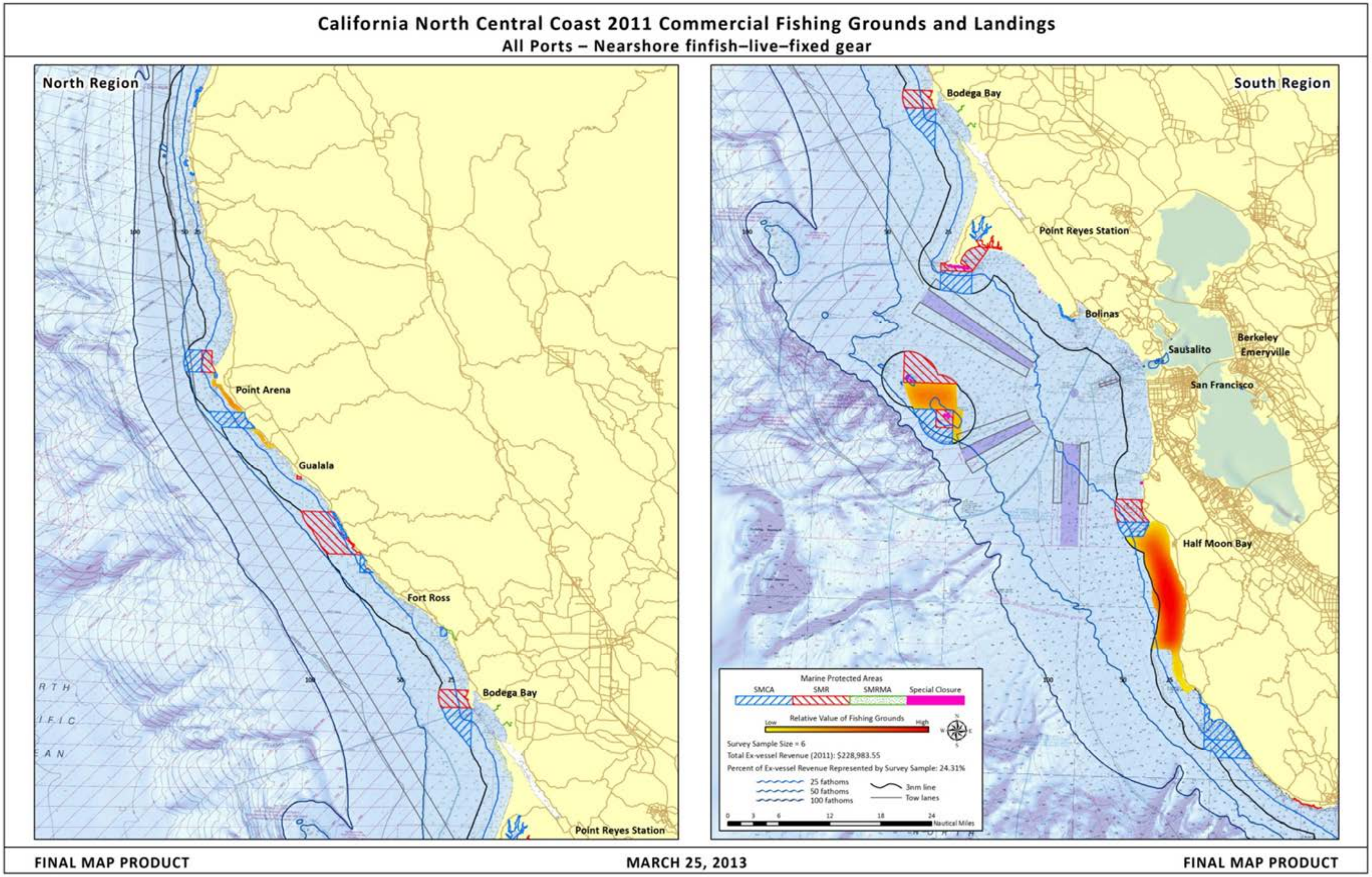
Source: California Department of Fish and Wildlife, Current study

— indicates that the port/fishery was not sampled or a zero value data point

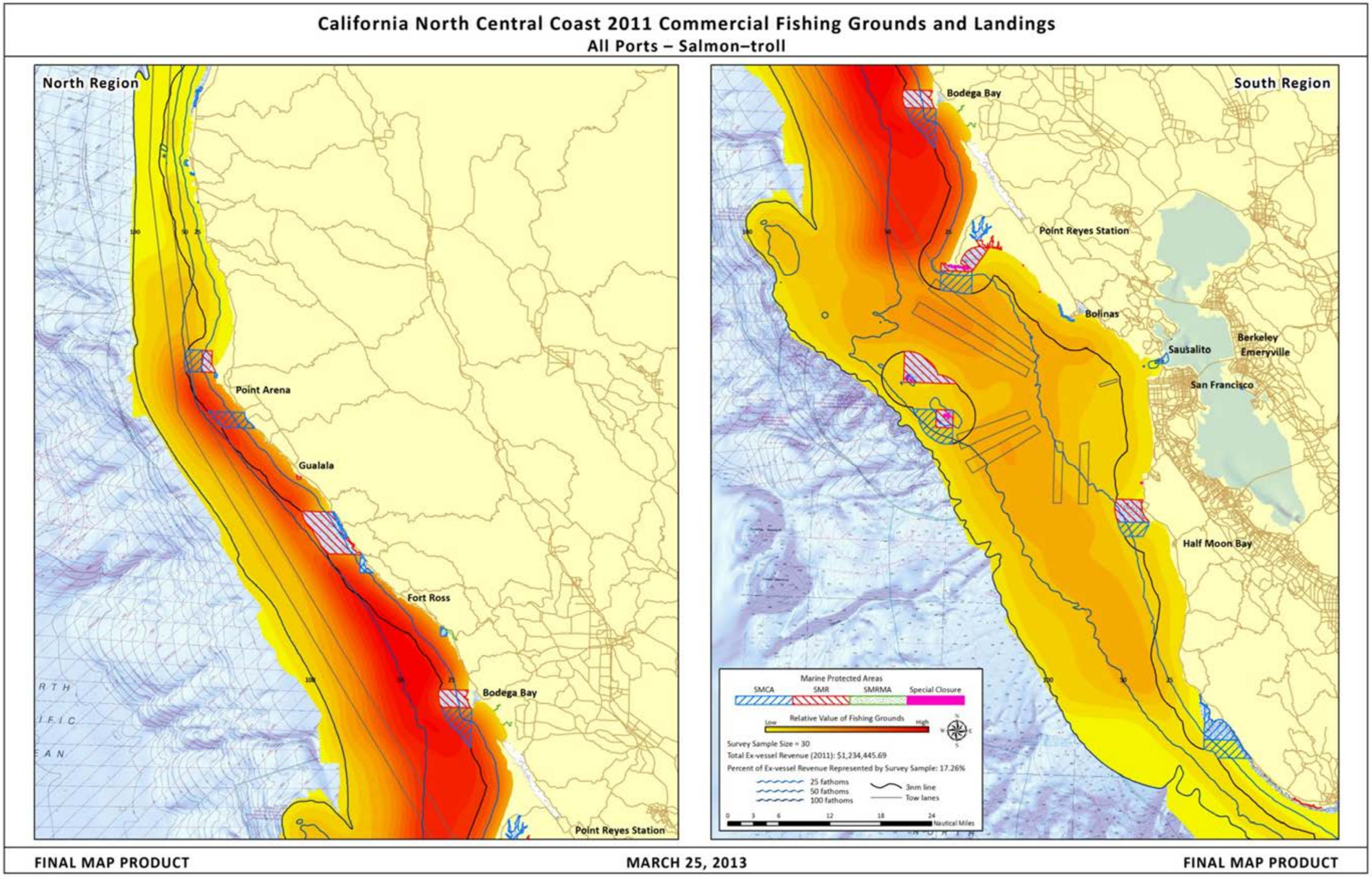
** indicates data were collected but cannot be shown due to confidentiality constraints*


California North Central Coast 2011 Commercial Fishing Grounds and Landings
All Ports – California halibut–hook & line
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
South Region
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Low
Relative Value of Fishing Grounds
High
Survey Sample Size = 13
Total Ex-vessel Revenue (2011): $357,908.31
Percent of Ex-vessel Revenue Represented by Survey Sample: 28.09%
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT

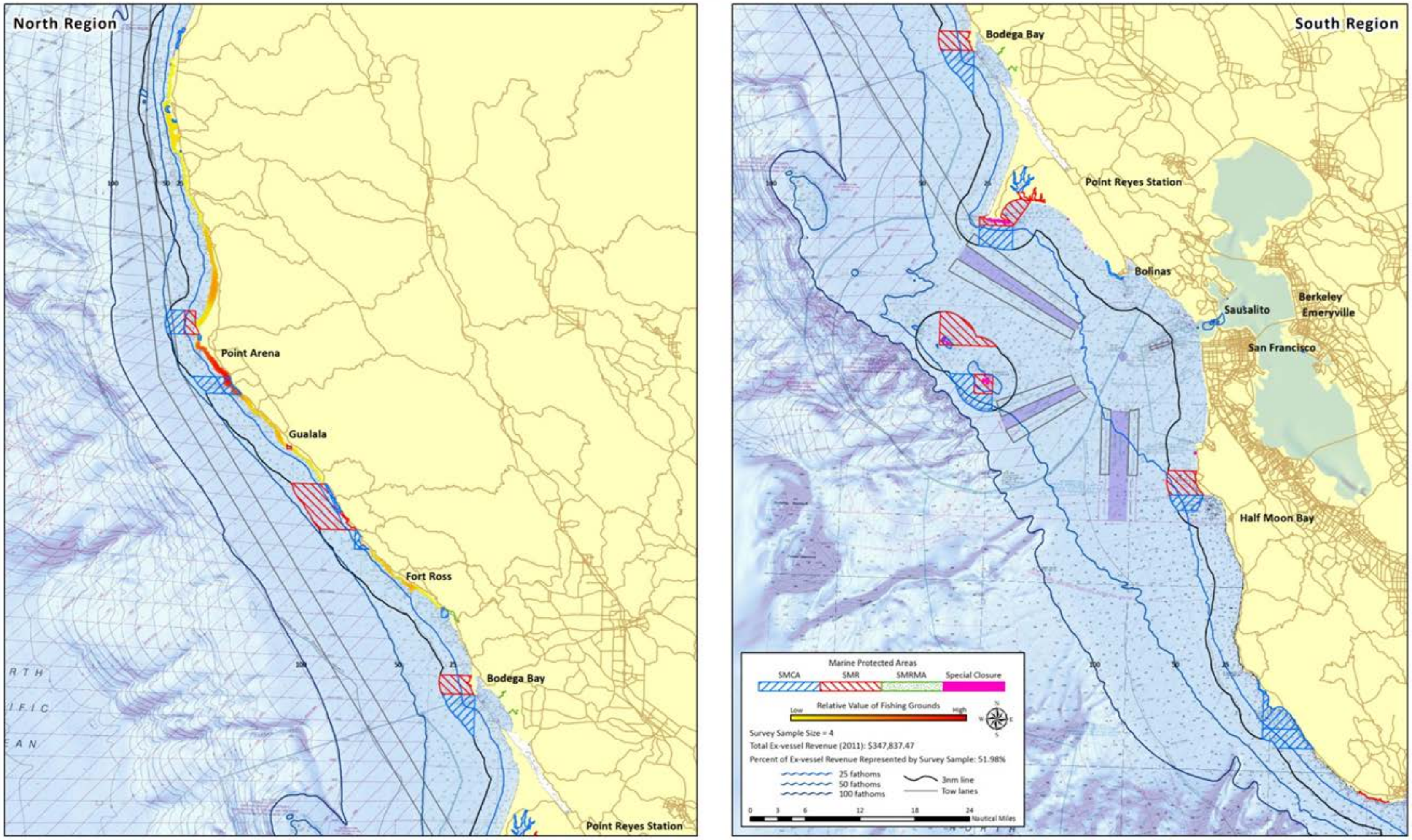

California North Central Coast 2011 Commercial Fishing Grounds and Landings
All Ports – Dungeness crab–trap
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
South Region
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Low
Relative Value of Fishing Grounds
High
Survey Sample Size = 63
Total Ex-vessel Revenue (2011): $38,552,187.97
Percent of Ex-vessel Revenue Represented by Survey Sample: 26.16%
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT



California North Central Coast 2011 Commercial Fishing Grounds and Landings
All Ports – Nearshore finfish–live–fixed gear
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
South Region
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Relative Value of Fishing Grounds
Low
High
Survey Sample Size = 6
Total Ex-vessel Revenue (2011): $228,983.55
Percent of Ex-vessel Revenue Represented by Survey Sample: 24.31%
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
0 3 6 12 18 24
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT


California North Central Coast 2011 Commercial Fishing Grounds and Landings
All Ports – Salmon–troll
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
South Region
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Relative Value of Fishing Grounds
Low
High
Survey Sample Size = 30
Total Ex-vessel Revenue (2011): $1,234,445.69
Percent of Ex-vessel Revenue Represented by Survey Sample: 17.26%
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
0 3 6 12 18 24
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT

California North Central Coast 2011 Commercial Fishing Grounds and Landings
All Ports – Urchin–dive



FINAL MAP PRODUCT | **MARCH 25, 2013** | **FINAL MAP PRODUCT**

Establishing a Spatial and Economic Baseline and Assessing Initial Changes in the California North Central Coast CPFV Fisheries

Report to the California Sea Grant College Program

In partial fulfillment of Grant No. #09-015
through the California Sea Grant College Program

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The North Central Coast MPA Baseline Program

This study is a part of a larger baseline marine protected areas monitoring effort, entitled the North Central Coast (NCC) MPA Baseline Program, tasked with characterizing the ecological and socioeconomic conditions within the NCC region. Specifically, this study addresses the Baseline Program objectives by describing human use patterns across the study region and establishing initial data points for long-term tracking of conditions and trends in the North Central Coast. This study is also a part of a four-part study conducted by Ecotrust to provide baseline estimates of the quantity, spatial distribution, and economic value of human uses—specifically human use in four specific sectors: coastal recreational, commercial fishing, commercial passenger fishing vessels, and the recreational abalone fishery in the NCC region.

Ecotrust

For more than 20 years, Ecotrust has converted $80 million in grants into more than $500 million in capital for local people, businesses, and organizations from Alaska to California. Ecotrust's Marine Consulting Initiative builds tools that help people make better decisions about the ocean. Our tools help visualize and map marine ecosystems and uses, bridge differing perspectives, and implement management decisions in a more inclusive and transparent way. The marine planning tools are part of Ecotrust's 20-year history of doing innovative things with knowledge, technology, and capital to create enhanced conservation and economic development for coastal communities on a global scale. Learn more at http://www.ecotrust.org.

Acknowledgements

Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the CPFV fishermen who provided guidance and feedback during this study as well as the countless other community members, state agency staff, and observers of this project. We are deeply thankful to the CPFV operators/owners who participated in this project and for making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us.

1. INTRODUCTION

The waters off the North Central Coast of California have long supported fishing activities that are integral to the cultural and economic history of the area. Fisheries exemplify the interdependencies between the natural environment and coastal communities that have characterized California since well before statehood. On May 1, 2010, as part of the Marine Life Protection Act (MLPA) Initiative, the California Fish and Wildlife Commission (CFWC) designated 31 marine protected areas (MPAs) which include six special closures within the North Central Coast state waters of California. The North Central Coast Region of California stretches from Alder Creek in the north to Pigeon Point in the south (see Map 1 and 2).

As part of the baseline marine protected area monitoring effort to characterize the ecological and socioeconomic conditions and changes within the North Central Coast Region since MPA implementation, this report provides three sets of primary findings:

1. A baseline characterization of spatial fishing patterns and economic status of commercial passenger fishing vessel (CPFV) operators in the North Central Coast region;
2. An assessment of historical economic trends and initial economic changes following MPA implementation; and
3. A qualitative investigation into the impact of MPAs on CPFV operators and the specific MPAs impacting CPFV fisheries at the port and region scale.

Establishing a baseline characterization of the CPFV fleet of the California North Central Coast provides a better understanding of the current economic health of the North Central Coast fishing communities and provides a benchmark of economic conditions and spatial fishing patterns against which future MPA impacts and benefits can be measured. Furthermore, assessing historical trends along with initial changes in economic conditions and spatial fishing patterns that followed MPA implementation will help inform how MPAs and other driving factors may interplay to influence observed changes.

This project will directly inform the 5-year management review of the North Central Coast MPAs in which the California Department of Fish and Wildlife (CDFW) will make management recommendation to the California Fish and Wildlife Commission based on findings from the baseline MPA monitoring projects and other sources of information. This project was developed in close coordination with the MPA Monitoring Enterprise (Monitoring Enterprise), a program of the California Ocean Science Trust, in partnership the California Department of Fish and Wildlife, and supported by the California Sea Grant College Program and the California Ocean Protection Council (OPC).

The primary goal of this project was to collect up-to-date information on historical trends, current economic conditions, and the spatial distribution and relative economic value of fishing grounds of the commercial passenger fishing vessel ("party-boat") fleet in the North Central Coast Region to inform future long-term monitoring efforts.

To accomplish this goal our research team conducted extensive community outreach in the region and developed and deployed an interactive, web browser-based interview instrument called Open OceanMap that was customized to the North Central Coast Region and project objectives. The survey instrument was utilized by field staff on laptop computers to collect geo-referenced information from CPFV fishermen about the extent and relative importance of California North Central Coast marine waters and related economic data. Data collection occurred during the summer and fall months of 2011 and 2012. The data were then compiled in aggregate form into spatial datasets (e.g., raster data layers, kernel density layers, pdf maps) and various excel workbooks and delivered to the California Sea Grant College Program and MPA Monitoring Enterprise. We would like to emphasize that no individual information was delivered only data in the aggregated form (with three or more fishermen in each data point) was delivered. This report details the approach and methods we used to collect, analyze, verify, and interpret the various data sets utilized in this project.

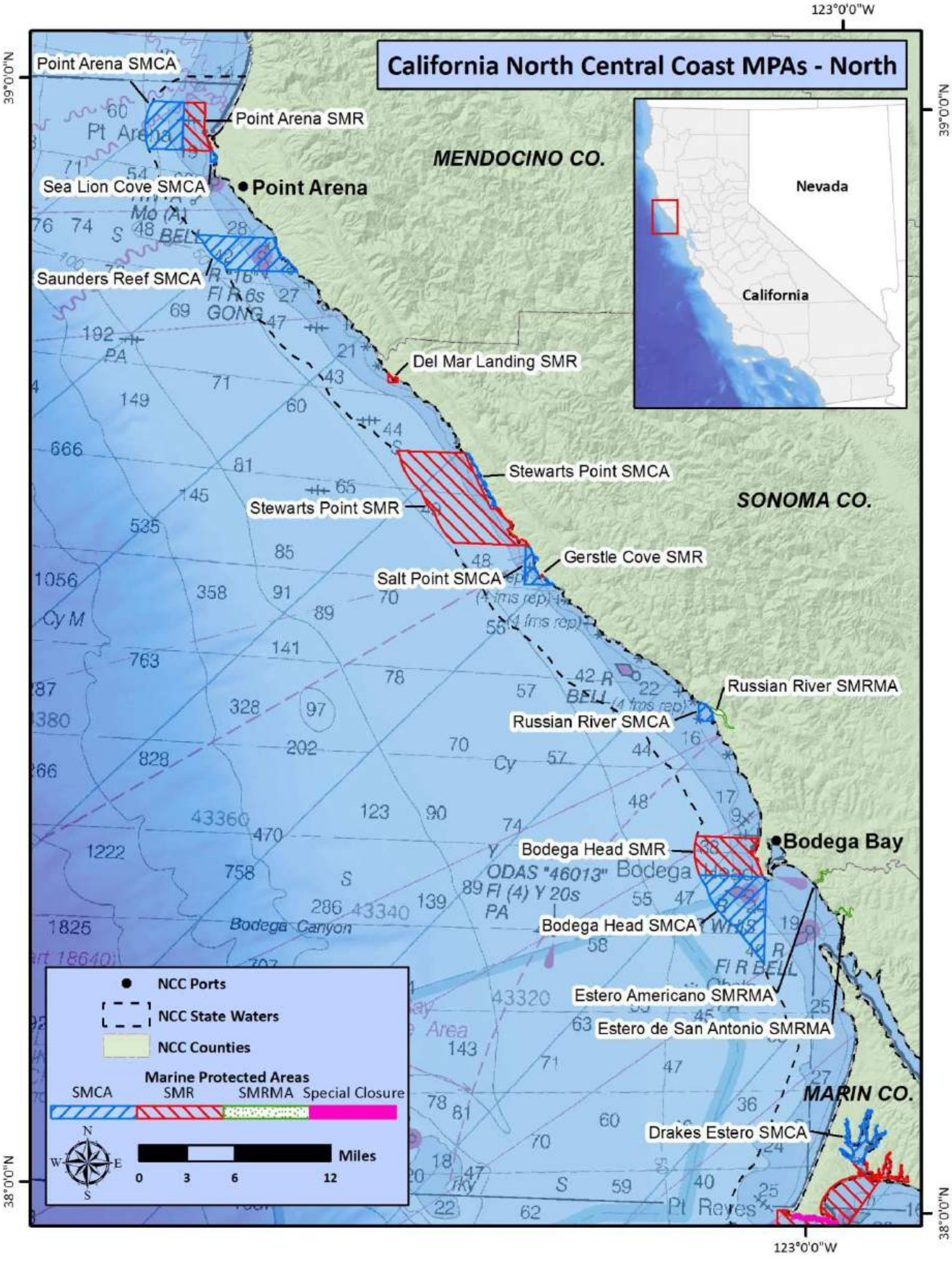
It should be noted that in the main body of this report we only report out on the first year of data collected (data collection conducted in 2011 inquiring about the post MPA 2010 fishing year). We chose to do this as the survey sample in the first year of data collection was significantly more robust and thus more representative and reliable as a baseline characterization of the North Central Coast region CPFV fleet. The regional results of the second year of data collection are provided in an appendix of this report and the summarized port level data are available in the Microsoft excel workbooks delivered as part of this project. Furthermore, throughout this report we do add information to the report narrative that may be of interest from the second year of data collection.

The main body of this report consists of two main sections—1) a region-wide profile of the CPFV fleet and 2) profiles for each port. To help better facilitate the use of the data presented in this report in accordance with the Monitoring Enterprises' monitoring framework, each sub-section is further broken out into the MPA monitoring framework components of 'initial changes' and 'baseline characterization'. Furthermore, a specific spatial baseline section is provided in this report to organize all the spatial baseline data into one section rather than distributing them throughout the report.

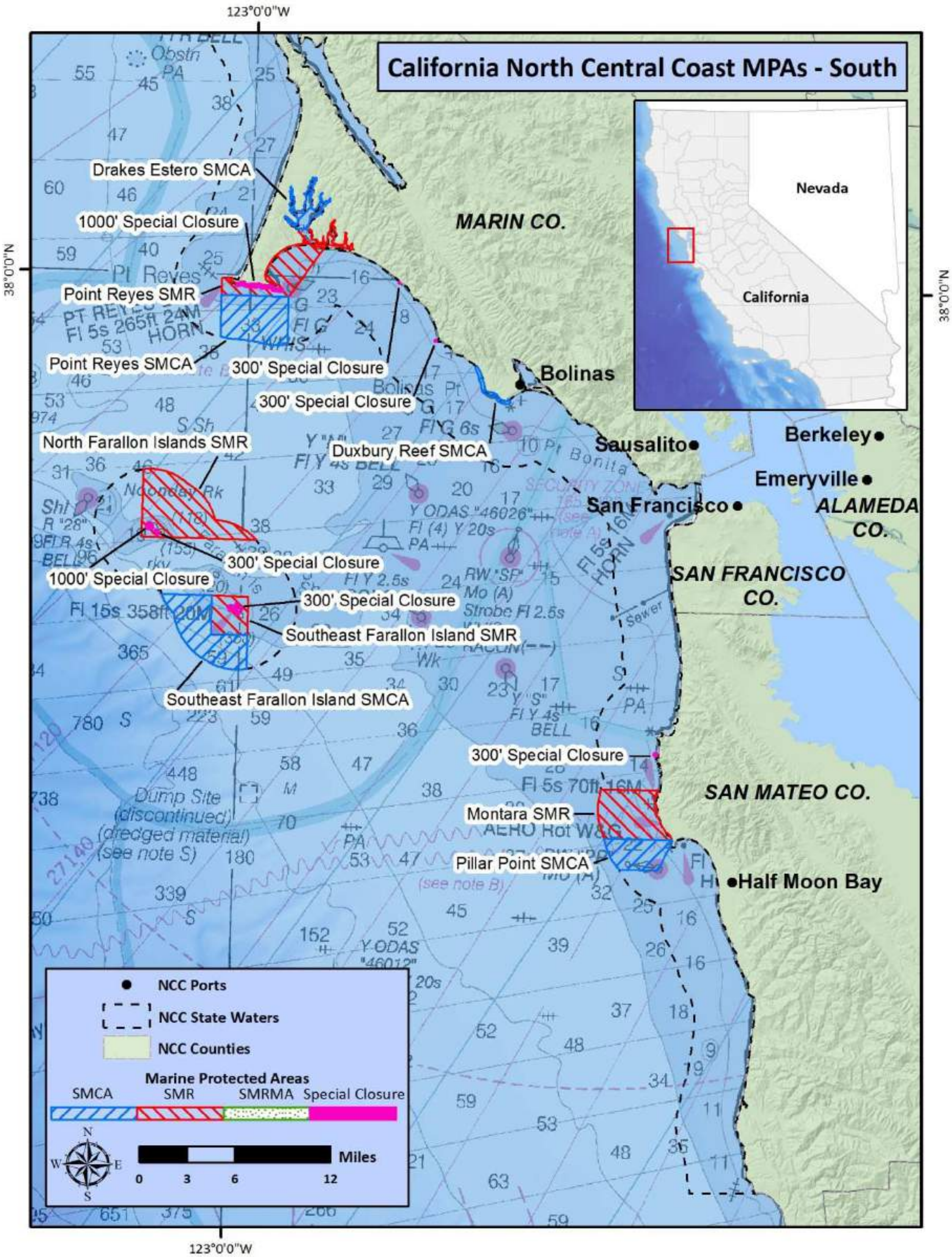
We would like to emphasize that the purpose of this report is not to measure or assess the economic impact of MPAs on the CPFV fleet in the region. To quantitatively measure the impact of MPAs requires robust long term economic data sets in both pre and post MPA periods that enable analyses to account or control for the complex interplay of regulatory, environmental, and economic factors that drive economic change in CPFV operations. Such a study was beyond the scope of this project but to provide insights into the possible impacts of MPAs we collected qualitative information from CPFV operators as to the ways in which MPAs are affecting their success as a CPFV operator. This information we have collected can be used to help better understand the complex system of CPFV operations and how MPAs may directly or indirectly be impacting a CPFV operator's success as well as inform future research efforts to possibly measure and quantify these impacts.

Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the CPFV fishermen who participated in this study as well as the countless other community members, agency staff, and observers of this project. We are deeply thankful to the CPFV operators/owners who participated in this project and for making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us.

Map 1. North Central Coast study region, ports, and marine protected areas – Northern portion



Map 2. North Central Coast study region, ports, and marine protected areas – Southern portion



2. SURVEY AND ANALYSIS METHODS

2.1. North Central Coast Region: Primary CPFV Fisheries and Ports of Interest

To focus efforts upon information which may be most useful and cost effective in informing a 5-year management review of the North Central Coast MPAs, this project identified the Commercial Passenger Fishing Vessel (CPFV) user group and associated fisheries in which to target our data collection and analysis efforts. For the CPFV sector, data were collected for the entire portfolio of activities conducted by CPFV operations—both consumptive and non-consumptive. According to California Department of Fish and Wildlife (CDFW) and CPFV operator interviews, the following are the primary fisheries and non-consumptive activities conducted in the North Central Coast Region from 2000 to 2011:

1. Albacore tuna – fishery
2. California halibut – fishery
3. Dungeness crab – fishery
4. Jumbo squid/Humboldt squid – fishery
5. Rockfish – fishery
6. Salmon – fishery
7. Sanddab and other flatfish – fishery
8. Striped bass – fishery
9. Funeral services - activity
10. Leisure cruises - activity
11. Whale watching – activity

The CPFV ports of interest for this project are listed below. These were identified by state agency partners and CPFV operators in the region as the primary CPFV ports in the region that fish in North Central Coast state waters (Map1 and Map 2):

1. Bodega Bay
2. Sausalito
3. Berkeley
4. Emeryville
5. San Francisco
6. Half Moon Bay

2.2. CDFW Logbook Data Analysis Methods

Under a non-disclosure agreement with the California Department of Fish and Wildlife (CDFW), the Commercial Passenger Fishing Vessel (CPFV) logbook data from 2000 to 2011 presented throughout this report was developed in collaboration with CDFW staff and was transmitted to Ecotrust in a summarized form in March 2013. CPFV logbook data is submitted by each CPFV vessel operator each year which documents the number of passengers, the number of fish caught, the block number they caught their fish, and other characteristics of each fishing trip they operate. It should be noted that the data provided in this report is only for fishing trips which fished in the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here. We chose to do this in order to present a more accurate understanding of the relationship between CPFV operators and the fisheries in the North Central Coast state waters.

Finally, following CDFW protocol we suppressed all data points with fewer than 3 CPFV operators—however, in the study period from 2000-2011 all data points for each port had 3 or more CPFV operators and thus we did not conduct any data suppression. We also strived to summarize the CPFV logbook data in the most compelling and visual formats. We have consistently color-coded fisheries and ports throughout the report and presented data in consistently formatted and scaled graphs in order to facilitate quick reference and comparison across ports. We avoid repetition whenever possible and recognize there are many more ways to query and analyze the data, however, throughout this report we aimed to present the most relevant and informative analyses possible.

2.3. Survey Data Collection and Analysis Methods

While the use of GIS technology and analysis in marine and fisheries management has expanded steadily over the past decade (Kruse et al. 2001; Breman 2002; Valavanis 2002; Fisher and Rahel 2004; Meaden 2009), its use for socioeconomic research is still somewhat limited. Nevertheless, a growing body of literature has examined GIS-enabled approaches to community-based MPA design and assessment (Aswani and Lauer 2006; Hall and Close 2006; St. Martin et al. 2007; Ban et al. 2009; Gleason et al. 2010) and there are several good examples to build on for improving the spatial specificity of the West Coast knowledge base and data landscape.

Some of the most pertinent applications of GIS technology to socioeconomic questions in marine fisheries concern the spatial extent and intensity of fishing effort (Caddy and Carocci 1999; Green and King 2003; Parnell et. al 2010; Lee et. al 2010) and the use of participatory methods similar to the ones employed here (Wedell et al. 2005; St. Martin 2004; 2005; 2006; Scholz et al. 2011a). We built on these approaches and adapted them for the California North Central Coast context, following best practices for the use of participatory GIS in natural resource management (Quan et al. 2001), as described in the remainder of this section.

Our project approach builds on methods developed in previous projects on the West Coast of the United States (Chen et al. 2012; Steinback et al. 2010; Scholz et al. 2004; 2005; 2006a; 2006b; 2008; 2010; 2011a; 2011b), which demonstrated novel approaches for collecting, compiling, and analyzing spatial fishing patterns and associated economic information at various geographic resolutions to aid the design and assessment of various marine spatial planning efforts (e.g., marine protected areas and wave energy siting). The successes and lessons learned in these projects were directly applied to the methods and tools deployed in this project. As Ecotrust continues to conduct MPA monitoring work in other regions in California we aim to help close existing coastal and marine use information gaps and provide a tested, consistent, and cost-effective method for long-term monitoring across California.

Specifically, Ecotrust's approach involved several steps that are designed to engage the fishing community throughout the project from project/survey design to the development of final products. These steps are generally categorized below:

1. Fishing community outreach/engagement;
2. Survey questions and survey tool design;
3. Data collection;
4. Data analysis;
5. Review and validation of data analysis results; and
6. Final reporting.

Ecotrust conducted a series of outreach meetings throughout the data collection period with key fishing community members and fishing organizations/associations prior to beginning interviews in the region and in each port. The objectives of these meetings were to provide a project overview, answer questions, develop relationships, gain insights into the current fishery issues/challenges, raise general awareness, and solicit potential interview participants. During these initial meetings Ecotrust also gathered feedback on its proposed project and survey design, such as on what types of information the fishing community felt were important to capture, and when possible the feedback received was incorporated into the data collection tool and data analysis plan.

2.3.1. Sampling Method

Ecotrust carried out two waves of field work in the summer and fall months of 2011 and 2012 to collected data on the 2010 post MPA fishing year and the entire 2011 fishing year. For the CPFV fleet, a comprehensive list of CPFV owner/captains was not available to Ecotrust and thus Ecotrust staff identified CPFV operators by networking in each port. Because of the need to advertise their services, CPFV operations are often highly visible in a harbor and widely known. Using this method, Ecotrust field staff compiled a list of CPFV operations in each port, and later confirmed and added to this list as it was reviewed with each CPFV operator interviewed. Ecotrust interviewed both CPFV operation owners and CPFV captains of each vessel in a port as often owners were more knowledgeable of revenue and operating cost information and also to gain a broader perspective.

To compare our survey sample characteristics to the study population characteristics we examined CPFV logbook data provided by CDFW. We examined the number of CPFV captains interviewed compared the number of CPFV vessels who submitted logbooks in 2010 and the survey response of CPFV captains interviewed compared to averages calculated from CDFW logbooks for select survey questions (Table 1).

As mentioned previously, we networked through port communities to identify and interview CPFV operators. Using this method it is likely we sampled more visible full-time CPFV operations in each port. Upon examining Table 1 below, the remaining vessels we did not interview may have been difficult to identify for interviews as they are CPFV vessels that either: 1) operate on a part-time basis overall; 2) are vessels the primarily operate fishing trips in the San Francisco bay but occasionally fish in the North Central Coast state waters; or 3) are vessels that primarily run non-consumptive trips but may occasionally run a fishing trip to the North Central Coast state waters.

The potential that our sample does not adequately represent part-time CPFV operators or CPFV operators that only occasionally fish in North Central Coast state waters is supported by the comparison of data on average number of trips per vessel reported by interview respondents compared to CDFW CPFV logbook data. On average, the vessel captains we interviewed operate more trips per year (thus being more visible in the port) than the vessel captains we did not interview. Lastly, interview respondents at the regional level reported an average of 12 anglers per trip while CDFW CPFV logbook data reported an average of 15 anglers per trip—indicating that perhaps the CPFV operators we did not interview were not necessarily smaller passenger capacity vessels (such as six-pack vessels) but instead operate similar sized vessels yet significantly fish less frequently in the NCC state waters.

Table 1. Comparison of survey sample data with CPFV logbook data

			Average number of trips per vessel (2010)		Average number of anglers per trip (2010)	
Port	**Number of CPFV captains interviewed**	**Number of vessels in CDFG logbook data (2010)**	**Interview Data**	**CDFW Logbook Data**	**Interview Data**	**CDFW Logbook Data**
Bodega Bay	5	9	124	40	8	12
Sausalito	5	4	36	33	13	10
Berkeley	4	10	118	37	15	19
Emeryville	5	13	63	22	16	15
San Francisco	4	12	70	14	13	12
Half Moon Bay	7	10	63	46	9	15
North Central Coast	30	N/A	79	30	12	15

Source: Current study and CDFW CPFV logbook data

2.3.2. Interview Protocol

Field Staff Training
Building upon our experience conducting large scale human use data collection projects with fishing communities Ecotrust has established rigorous field staff training procedures and interview protocols to ensure that:

1. Field staff are able to effectively engage in conversations with fisherman about the goals/objectives of this project and the larger MPA monitoring/assessment effort this project will inform;
2. Sensitive fishermen contact information is kept secure and confidential;
3. Fishermen are properly informed of the research project goals and possible risk and agreements on data use before the fishermen engages in an interview;
4. Fisherman data remains confidential and is securely stored, transmitted, and analyzed;
5. Interviews are conducted professionally and consistently; and
6. High quality data is consistently collected across interviews.

To accomplish this, Ecotrust staff trained in human subjects research protocols conducted extensive training with Ecotrust field staff on proper research protocols and interview approach and procedures. This training includes providing background on Ecotrust's project history with fishing communities, the Marine Life Protection Act planning process, the MPA monitoring program, and possible reservations fisherman may have to participate in interviews in order for field staff to effectively engage in meaningful conversations with fishermen to solicit interviews. Furthermore, field staff were trained in being aware and respectful of the sensitivities of collecting fishing data and were provided with human subjects research protocols to ensure field staff are aware of proper ways of presenting the research goals and risks to fishermen and that proper informed consent is obtained before interviews begin.

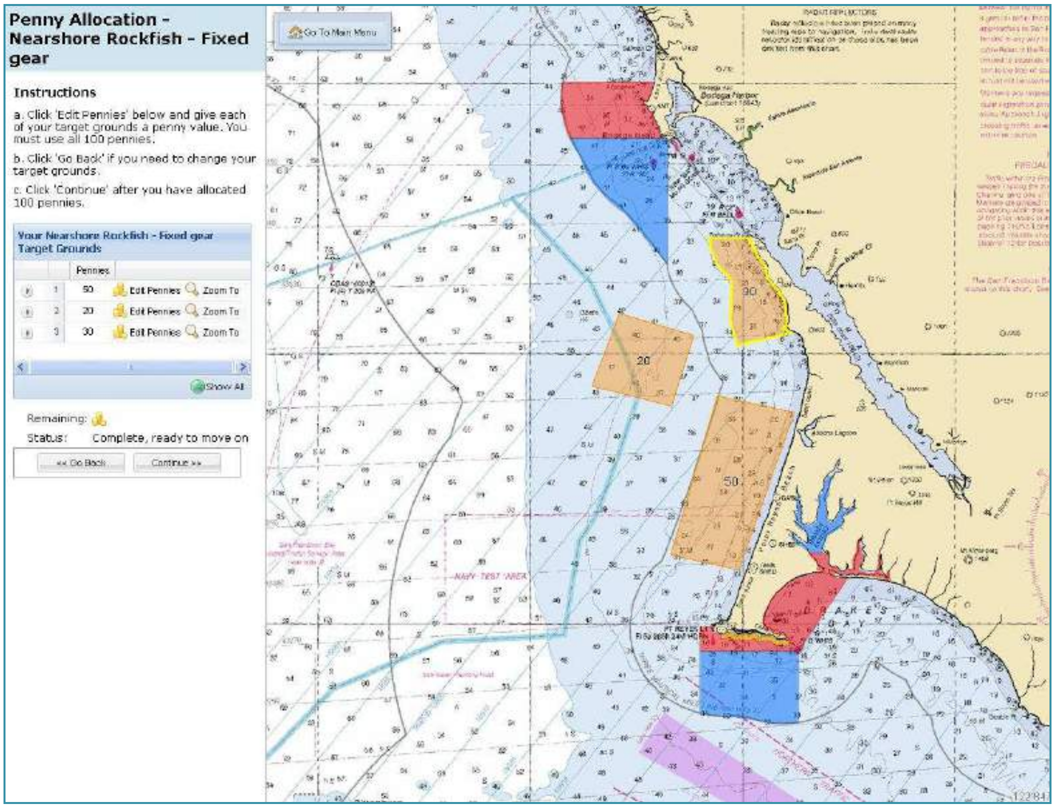
Strict procedures and mechanisms are put in place so that individual fisherman data is kept secure and confidential throughout the project from data collection, to transmission of the data, to data analysis, and subsequent storage of the data. Interviews were conducted under individual non-disclosure consent forms and all data were collected on password protected laptop computers. Data collection and analysis protocols were utilized which masks all names and identifying characteristics of an individual's fishing grounds.

Field staff are also fully trained in how to ask survey questions and capture responses in a consistent manner. The field staff coordinator initially conducted fisherman interviews with each field staff member to ensure the quality of interviews and periodically conducted fisherman interviews with field staff throughout the field season to ensure that interview quality was maintained. Survey data are checked as they are transmitted to the Ecotrust main office and reviewed by Ecotrust staff to ensure quality data are being captured consistently across field staff.

Interview Procedure
The data collection methods in this project were designed to complement existing data previously acquired from CPFV operations in the North Central Coast Region (see Scholz et al. 2008) before the MPA network was established. Interviews in this project were conducted in person using a one-on-one interview format. All interview data were entered directly into a spatially enabled, Open Source GIS survey tool developed by Ecotrust called Open OceanMap[1]. Field staff used Open OceanMap (Figure 1) to collect non-spatial survey data (e.g., demographics, basic operating information, descriptive fishing characteristics, impacts from MPAs and other factors, and associated qualitative questions) and to map areas representing a participant's fishing grounds. Open OceanMap's mapping component utilizes NOAA nautical charts which can be zoomed in and out to reveal more detailed nautical charts and moved directionally (similar to Google Maps) to allow fishermen to draw fishing areas in their natural sizes (polygons) rather than confining responses to a statistical grid or to political boundaries.

[1] For more information on Open OceanMap please see http://www.ecotrust.org/marineplanning/

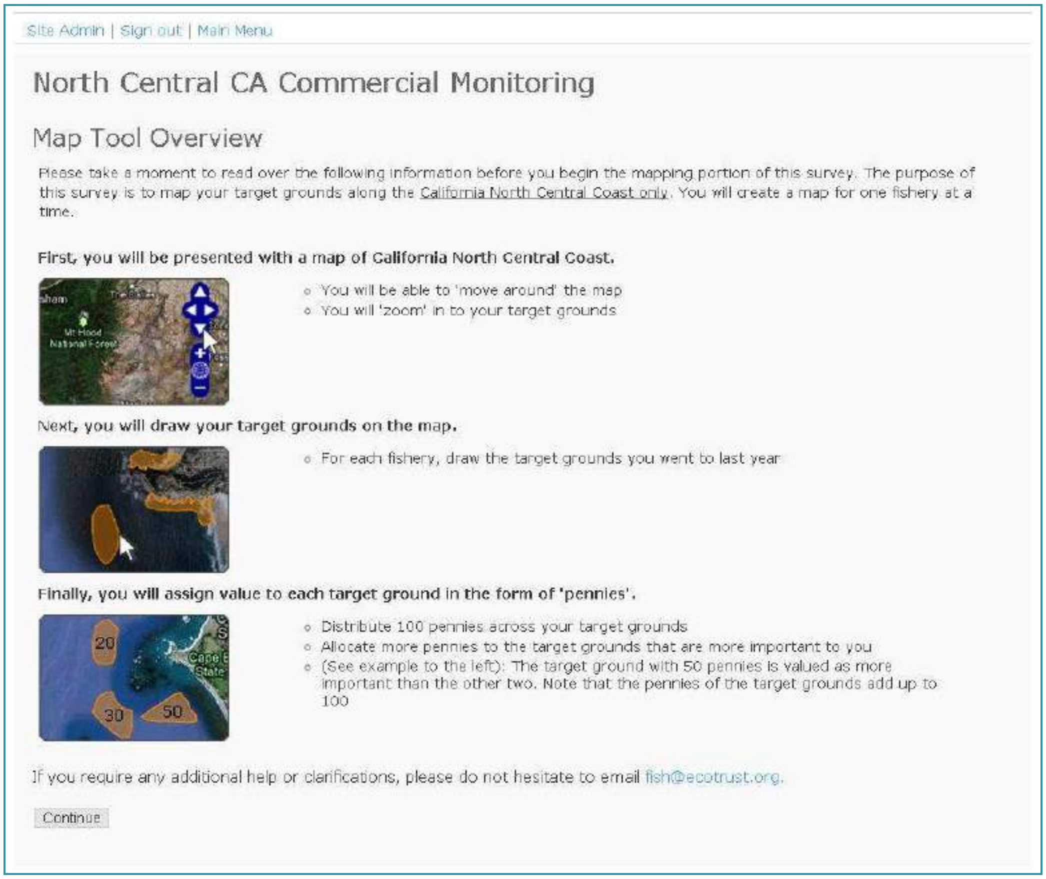
Figure 1. Screenshot of Open OceanMap mapping tool showing mock fishing ground



All interviews followed a shared protocol:

1. Interviews begin with an explanation of the project goals/objectives, the types of data collected, how data will be analyzed, possible risks of participating in the interview, and any other project information the fisherman would like to discuss.
2. The fisherman is presented an informed consent form agreement which allows Ecotrust to utilize interview data, however, the agreement legally binds Ecotrust to present data only in the aggregate form and to never release individual data or the identities of those interviewed.
3. Non-spatial survey data is collected on questions pertaining to individual fisherman characteristics and overall CPFV operations.
4. Non-spatial survey data is collected for each fishery/activity within a CPFV operator's portfolio.
5. Fishing grounds are mapped following these steps (see Figure 2). These steps are repeated to map each fishery separately:
    a. <u>Establish a maximum extent:</u> Using the electronic nautical charts embedded in Open OceanMap, fishermen were asked to identify the maximum extent north, south, east, and west they would target a fishery. This is done to orient the map to the full extent of their fishing area before fishermen were asked to identify/delineate specific fishing grounds.
    b. <u>Map fishing grounds:</u> Within this maximum extent, fishermen were then asked to delineate the area(s) they fish for a particular species/fishery last year. Under the guidance of the fisherman, field staff drew these fishing areas in the Open OceanMap survey tool and recorded associated boundary information for each area such as depth limits and geographic landmarks.
    c. <u>Assign value:</u> Fishermen were then asked to rank these fishing areas using a weighted percentage — in which they split and distribute 100 points or '100 pennies' over the various fishing areas based on their relative importance.

Figure 2. Screenshot of Open OceanMap mapping tool overview



We would like to note that for the first year of data collection (conducted in 2011 inquiring about 2010 fishing grounds) fishermen were asked to only map post-MPA fishing grounds in order to capture a post-MPA spatial baseline data. In the 2012 data collection wave we inquired about the full 2011 calendar fishing year but as mentioned before the 2010 data collected is from a much more robust sample than the 2011 data collected and therefore the 2010 data set is the focus of this report.

2.3.3. Data Review and Verification

There are several data review and verifications steps throughout this project. The following standard quality assurance and quality control (QAQC) steps were conducted:

1. Editing of spatial data by Ecotrust staff based on notes from interviews and when required to standardize the data (e.g. clipping a shape to the shoreline or specific depth);
2. Review by each participant of his/her individual maps and information; and
3. Review by fishing community, though group and individual meetings, to verify aggregated results.

The collection of spatial data has an inherent higher margin of error and thus several QAQC steps were implemented in our project to ensure the spatial data collected were of the highest quality possible. First, notes were taken on the boundaries of each fishing area drawn during an interview with a fisherman. Once spatial data are collected and transmitted to Ecotrust staff for analysis, each spatial dataset is checked against spatial data notes to ensure fishing areas are drawn to the indicated depth limits and spatial extent. If any spatial outliers are identified within a given fishery, individual fishermen are contacted to verify their spatial dataset is accurate. Second, each individual fisherman is mailed maps of his/her fishing grounds for each fishery they provided spatial information on to review/verify its accuracy. These individual maps are printed on security paper that cannot be photocopied and are mailed with a return addressed and stamped envelope and contact information so fisherman may easily communicate any changes to their spatial data. Third, once all spatial fishing data are aggregated, these maps are reviewed by the fishing community with Ecotrust staff.

These review meetings with the fishing community are complimentary to the individual interviews and take a synergistic approach that is important in several ways. Review meetings are an opportunity to review and verify map products as well as share other data analysis results such as having the fishing community assist in interpreting logbook data analysis results, review drafts of the project report, discuss project next steps, build trust within the fishing community, and continue established relationships.

For review meetings, each individual who participated in interviews was contacted to participate in the project results review. During these individual or group review meetings, map products were reviewed for errors. It should be emphasized that spatial data sets are not augmented based on the where an individual who reviews the map(s) thinks areas of importance should be. Instead, the purpose of reviewing the map products are to ensure there are no large errors in the data sets made during the collecting, editing, and compiling of the data. Example of errors include fishing areas that extend beyond regulatory depth limits or geographic areas in which the fishery occurs (e.g., nearshore finfish grounds extending into rockfish conservation area boundaries) or areas in which no-fishing is allowed. Based on our experience, having the community review these map products helps ground-truth the data sets, produce data sets that are of higher quality, and help establish transparency and trust between researchers and the fishing community.

To the extent possible, Ecotrust validated data collected during this project with independent data sets provided by CDFW. Data validation with independent data sets is an important step in providing rigorous research methods as data collected in any survey are liable to the inconsistencies of memory, subjective judgment, and possible deliberate falsification. Validating data sets may also reveal possible sample biases which can inform interpretation of survey results. Much of the data Ecotrust collected in this project are novel and thus similar data sets to our knowledge do not exist or are not readily accessible to compare survey results, however, in Table 1 above we were able to compare our survey results to CPFV logbook data from CDFW to reveal a possible sample bias in which we may have under sampled CPFV operators who operate only part-time, CPFV operators who mainly fish in the San Francisco bay and occasionally fish in the NCC state waters, or operators who primarily run non-consumptive trips but may occasionally run fishing trips in the NCC state waters.

To verify the spatial fishing data sets, CPFV logbook data could have been used, however this data is confidential at the individual level and would take considerable resources to compile and analyze at the aggregate level. The spatial scale in which data are collected with logbooks (10 square mile blocks) are at a much larger scale than Ecotrust's data, making it difficult to compare data sets.

In light of the difficulties in obtaining and analyzing existing data sets to compare our results, Ecotrust thoroughly reviewed all data sets with the fishing community to ensure all data products submitted were verified and accepted by the fishing community and are of the best quality possible.

2.3.4. Spatial Data Analysis Methods

In this section we further detail how spatial data were analyzed in this project. Ecotrust's methodology to analyze spatial fishing data collected was developed and refined through collaboration with fishing communities across California during the MLPA process (Scholz et al. 2011a). The analysis of the fishing grounds information is broadly comprised of two components: determination of the fishing grounds and determination of relative (economic) importance. Below we present a detailed methodology for how spatial data were weighted, analyzed, and aggregated for the CPFV sector's spatial fishing data.

As stated above all fishermen were asked to map fishing grounds for each fishery separately. For CPFV operators, spatial fishing data were weighted based on self-reported gross economic revenue from 2010 (or 2011 in the second season of data collection conducted in 2012) from each specific fishery/activity. To calculate gross economic revenue from each fishery/activity, CPFV operators/owners were first asked to approximate his/her gross economic revenue from CPFV operation for a given vessel (at times CPFV owners may own multiple CPFV vessels, however, in the NCC we did not interview any respondents who owned multiple vessels) and then were asked what percent of the vessel specific gross revenue was from each specific fishery/activity.

Spatial Analysis Methodology

The following is a detailed methodology of how we analyzed and aggregated individual spatial fishing data to create port and region level spatial data sets on the relative importance of fishing areas. We would like to emphasize that fishermen are asked to map each fishery separately and the spatial data analysis methodology detailed below is conducted for each fishery separately as well.

Step 1: Individual weighted fishing grounds

During the interview process, each fisherman was presented with a navigable nautical chart (e.g., interviewer could zoom in/out and move the map around) contained within the mapping portion of the Open OceanMap survey tool (Figure 1). Fishermen were then asked to direct field staff to draw polygons or areas that could be of any shape or size. To do this each fisherman was asked to identify his or her fishing grounds for a particular fishery when conducting CPFV fishing trips from their homeport in the North Central Coast region. This may include mapping areas outside the study region such as in the San Francisco bay or north or south of the study region. These fishing grounds could be one or more set of polygon/areas and together they comprise his or her total fishing grounds for a particular fishery.

Once the fishing area(s) were mapped, fishermen were then asked to allocate some portion of 100 pennies to each fishing area (or if there is only one fishing area all 100 pennies would be allocated to that area by default) such that the sum of the pennies allocated across his/her fishing areas for a particular fishery equals to 100. This is done to determine the relative important of fishing areas to each other.

Step 2: Standardize and apply economic value to individual fishing grounds

The second step is to apply economic value to the individual fishing areas and distribute that value spatially based on the proportion of pennies allocated to each fishing area. For CPFV operators we utilized the estimated gross economic revenue earned from a specific fishery and distributed that economic value across the fishing area(s) proportionally with the amount of pennies allocated to a specific fishing area. For example, if a CPFV operator’s gross economic revenue from rockfish was $50,000 and one fishing area was assigned 50 pennies we would allocate $25,000 in economic value to that specific fishing area. This allocation of economic value is applied to each individual spatial fishing data set.

To standardize each data set for aggregation we then converted each fisherman’s fishing ground data layer (polygon layer) for a particular fishery into a 100 x 100 meter cell size grid or raster layer. For fisheries where an individual mapped fishing grounds inside the San Francisco bay area we simply clipped those areas out of the analysis so that only fishing grounds outside the San Francisco bay were included. However, by using the above methodology the relative economic value of the fishing areas outside of the San Francisco bay remains intact.

Step 3: Aggregate individual fishing ground values to port level data set

To aggregate the individual fishing ground data layers (raster layers) we simply summarize the economic values in each cell across the individual raster data layers for all respondents in a given home port. The resulting data set is a ‘heat map’ depicting the relative value of fishing areas for a given fishery in a given port.

Step 4: Aggregate port level data sets to regional data sets

To create regional level data sets for a specific fishery each port data layer is further weighted by the port's total number fish caught for the specific fishery (for the given year of interest) which is provided by the California Department of Fish and Wildlife CPFV logbook data and then combined into a regional data layer. We apply the total number of fish caught to each port level data layer when combining data layers to control for any sample bias at the port level. For example, if we interviewed more CPFV operators in a given port it may not necessarily mean that the economic value of that port is greater than that of another port in which we interviewed less CPFV operators.

Applying this aggregation weight is done by distributing the total number of fish caught across the respective port level 'heat map' data layer proportionally by the value in each raster cell. Each of these port level raster data layers are then aggregated by summing the values in each raster cell across the port data layers in the region.

2.3.5. Non-spatial Data Analysis Methods

All non-spatial survey data were exported from Open OceanMap to an MS Access database and then imported into MS Excel files which were then summarized into tabular format primarily using pivot table queries. As emphasized above all data for ports or fisheries with fewer than three respondents have been withheld from publication to protect the confidentiality of the survey respondents. An asterisk, '*', can be found in the data tables in which data has been suppressed. A dash, '–', in the data tables indicates a zero or that data was not collected for a given port-fishery combination. Often if data were not collected in a given port-fishery combination the fishery does not occur or is not a significant fishery in a port (e.g., is not a target fishery).

The design of survey questions within this project was largely modeled from survey questions developed through the survey work Ecotrust conducted during the MLPA planning process (2005-20011). The survey was further refined through review with key informants within the North Central Coast fishing community to tailor the questions and select target fisheries specific to the North Central Coast Region. The survey questions were designed so that fishermen could easily provide answers/estimates from readily available knowledge commonly known by fishermen. For the instances in which fishermen were unable to provide answers using on-hand information, Ecotrust field staff later followed up with the individual to collect the information or the information was omitted when calculating averages.

3. NORTH CENTRAL COAST CPFV REGIONAL PROFILE

3.1. North Central Coast Region CPFV Historical Trends and Initial Changes

3.1.1. Introduction/Methods

Commercial Passenger Fishing Vessels (CPFV) are often called party-boats or charter fishing boats and make a business in taking members of the public to recreationally fish and, more recently, to enjoy non-consumptive types trips such as whale watching or leisure cruises. In a study conducted by Responsive Management in 2007, the majority of Californian's (84.0 percent) agree that CPFV opportunities are important to maintain as they provide opportunities for people to experience coastal resources who otherwise would not be able to as they cannot afford a boat of their own.

This section provides a summary and analysis of California Department of Fish and Wildlife (CDFW) CPFV logbook data from 2000 to 2011 to provide historical trends and initial changes in CPFV fishing characteristics since MPA implementation. Trips into the North Central Coast region by CPFV operators from ports outside the North Central Coast region were not included in the analyses in this report. The following types of information listed below are generally the analyses presented in the historical trends and initial change sections found at the region and port level throughout the report:

1. Total number of vessels, anglers, and trips
2. Average number of anglers per trip and per vessel
3. Average number of trips per vessel

4. Total number of fish caught for select species/fisheries
5. Total number of trips for each target species/fishery
6. Percent change in total number of vessels, trips, and anglers in pre and post MPA periods

CPFV operators are required to complete and submit a log to the CDFW for each fishing trip. This log includes information on the target species of the trip, catch (number caught by species) and effort (number of anglers) for each trip as well as the port of departure and the Fish and Wildlife Block in which most of the fishing occurs. Only a certain number of species are listed on the log. Operators can write in species that are not listed, or combine species into a group species category such as "Unidentified Rockfish." Some species, such as several of the nearshore rockfishes, are listed on the log, but operators may still choose to put these into a group category. Consequently, species summaries are provided at the most accurate level, which for the nearshore rockfish is the group rockfish.

For the CPFV logbook data presented here, data is provided only for fishing trips which fished from fishing blocks within the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here. Furthermore, the CPFV logbook data presented only includes data on fishing trips as logbook data does not include information on non-consumptive trips such as whale watching.

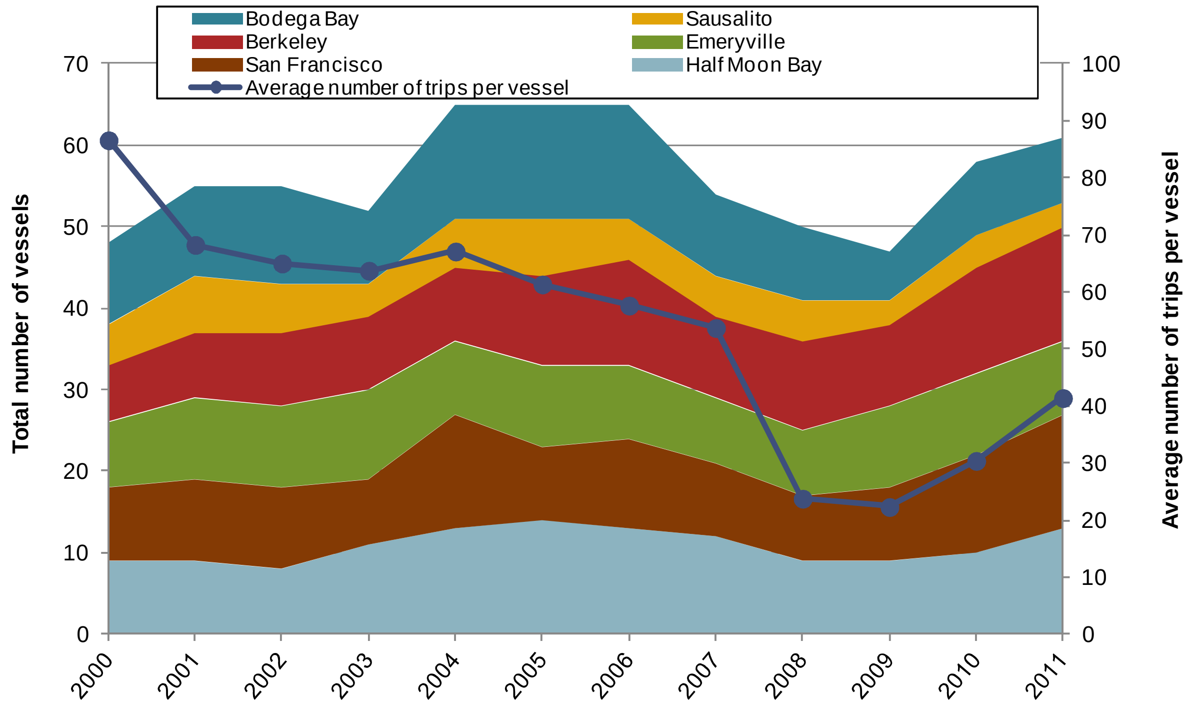
3.1.2. North Central Coast CPFV Historical Trends and Initial Changes

During the study period, 2000-2011, the ocean environment, the regulatory environment, and the socioeconomic environment experienced several changes. The California Current System at this time was transitioning from a warm to a cold water regime which affected the availability of certain kinds of fish targeted by anglers. Furthermore, a deep recession, which began in December 2007, and higher gas prices impacted people's livelihoods and discretionary monies. Major changes in regulations occurred for rockfish (season closures initiated in 2000 with the addition of depth closures starting in 2001) and salmon (in particular, closures in 2008 and 2009). In addition, the North Central Coast Marine Protected Areas (MPAs) were implemented in May, 2010. All of these factors affected fishing in the study area to various degrees; three of these factors (recession, salmon season closures, and the implementation of the MPAs) occurred together in a relatively short time period.

The total number of vessels working out of North Central California ports in 2011 was slightly higher than that in 2000 by approximately 21 percent (Figure 3). Decreases in vessels occurred between 2006 and 2009; increases then were observed at most ports between 2009 and 2011. Most ports experience an increase in the number of vessels operating between 2000 and 2011, except in the ports of Bodega Bay and Sausalito who each had two less vessels than reported in 2000. It should be noted that the number of vessels does not reveal the size of the vessel operation as this may range from small six-pack boats to larger vessel that can hold dozens of passengers.

The average number of trips per vessel has a steady decreasing trend between 2000 and 2007. However, in 2008 the average number of trips per vessel dropped significantly due to the closure of the salmon season and has only begun increasing starting in 2010 when the salmon season returned. However, the average number of trips per vessel has not returned to the same levels seen before 2008 (Figure 3).

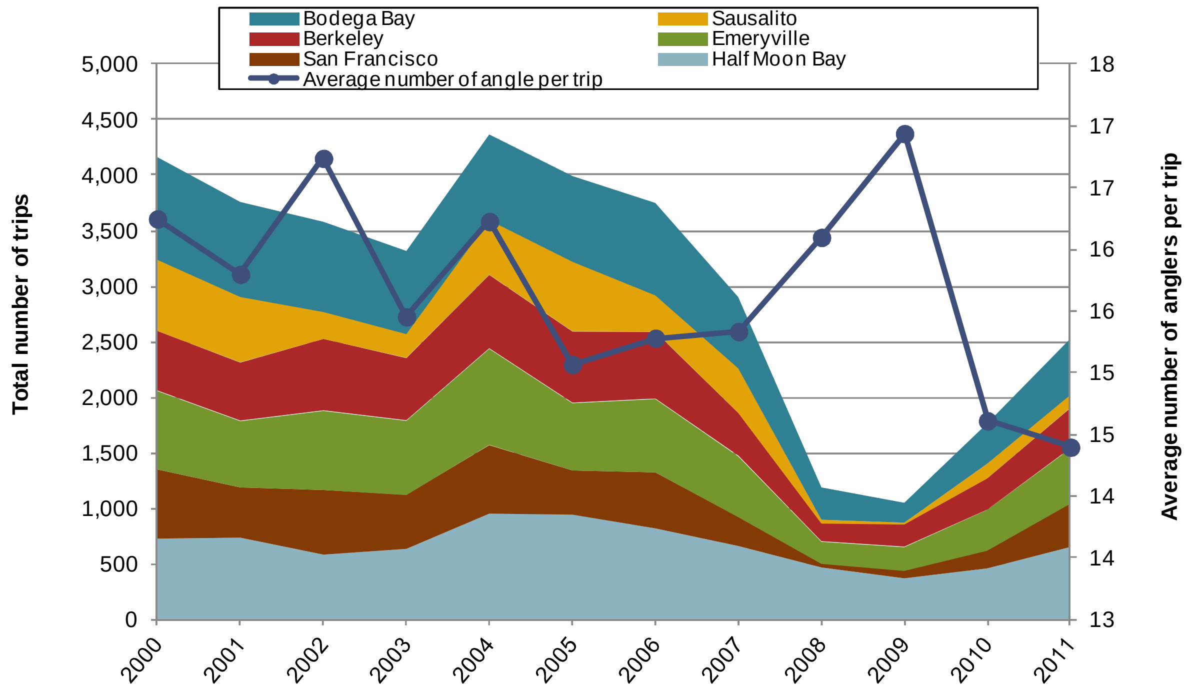
Figure 3. Total number of CPFV vessels and average number of trips per vessel, North Central Coast Region, 2000-2011



Source: CDFW CPFV logbook data

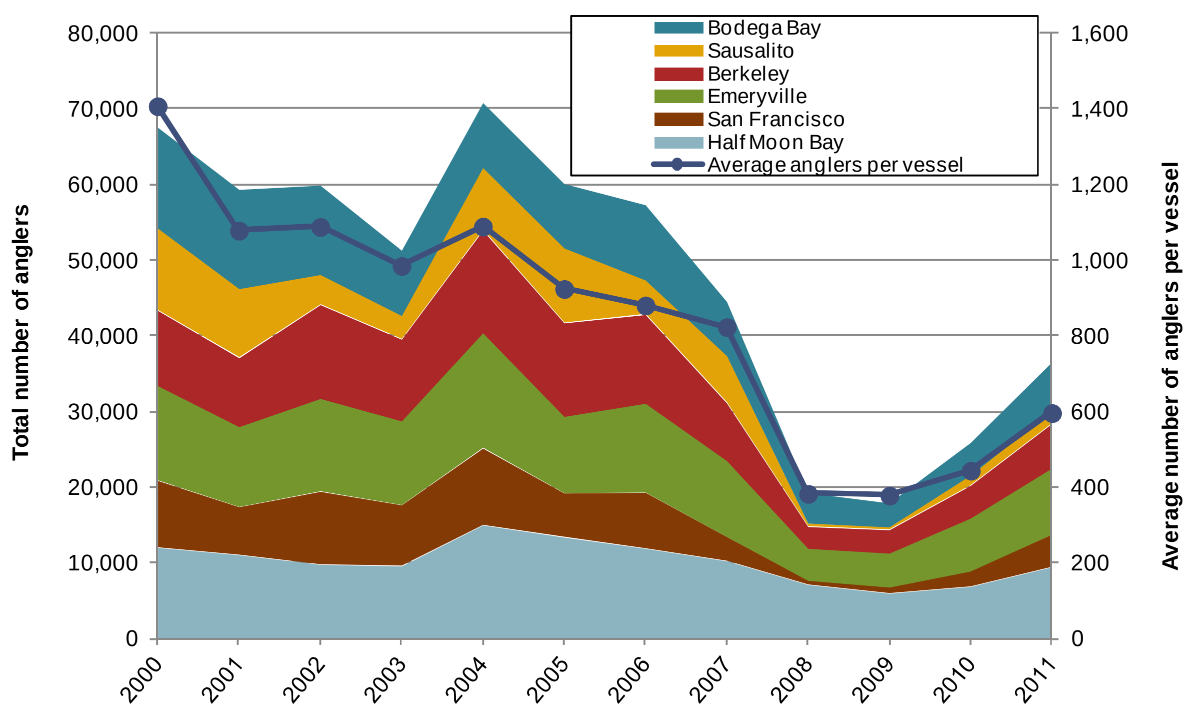
The total number of CPFV trips in the region has generally declined from 2000 to 2011 by about 39 percent (Figure 4) with the exception with a slight increase in 2004 which may have been due to a good salmon season (Figure 6). With the salmon season closed in 2008 and 2009 the total number of trips in the region declined sharply dropping by about 59 percent between 2007 and 2008. As we can observe below, during the salmon season closures the ports of San Francisco and Sausalito operated very few trips. In 2010 and 2011 the number of total trips began to rise again, however, they have not returned to levels seen before 2008. The total number of CPFV anglers also generally declined from 2000 to 2011 (Figure 5) and follows similar patterns to that of total number of CPFV trips (Figure 4). Of note is that in 2009 the average number of anglers per trip increased sharply—this may have been due to larger capacity vessels operating more frequently than smaller capacity vessels that often specialize in salmon fishing.

Figure 4. Total number of CPFV trips and average number of anglers per trip, North Central Coast Region, 2000-2011



Source: CDFW CPFV logbook data

Figure 5. Total number of CPFV anglers and average number of anglers per vessel, North Central Coast Region, 2000-2011

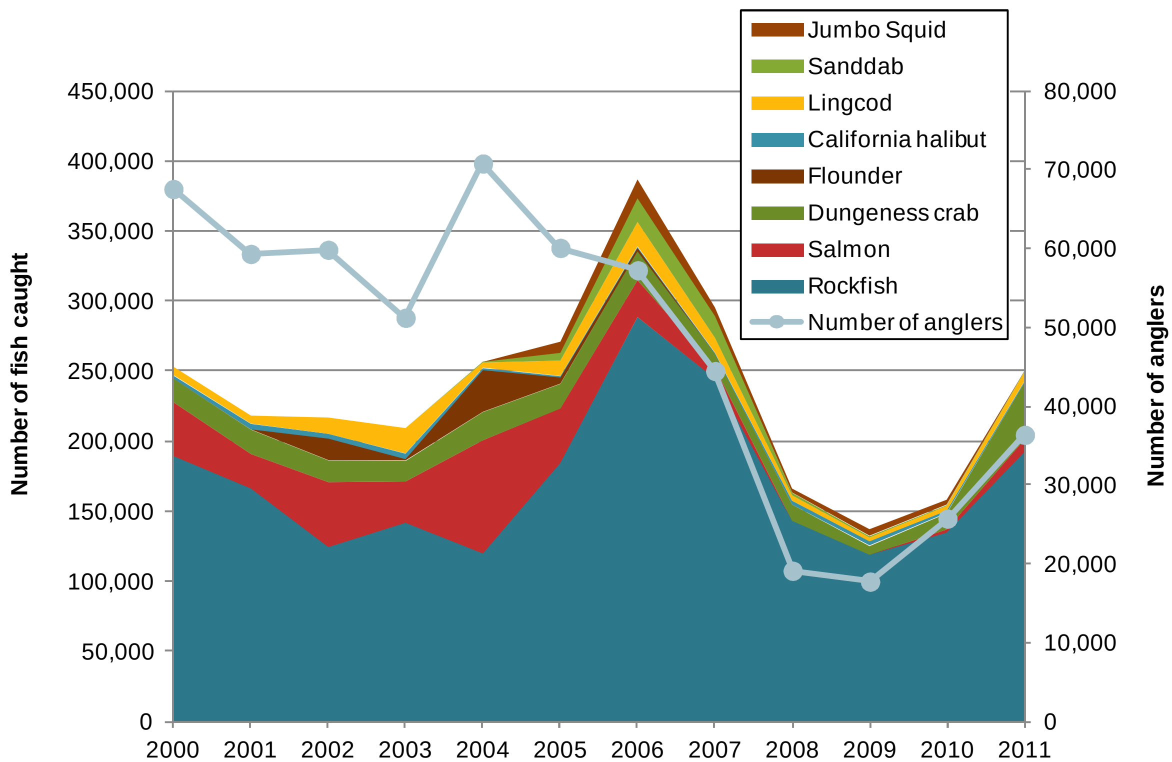


Source: CDFW CPFV logbook data

As seen in Figure 6 below, the majority of the number of fish caught in the region is rockfish (approximately 70.9 percent on average) followed by salmon (approximately 10.4 percent). The total number of fish caught was variable from 2000 to 2011, but peaked in 2006 with approximately 394,750 fish caught. This peak may be due to a shift in effort (number of trips) from the salmon fishery to the rockfish fishery (Figure 7) and also due to the larger bag limit of rockfish (in 2013 the limit was 10 rockfish) in comparison to salmon (in 2013 the limit was 2 salmon).

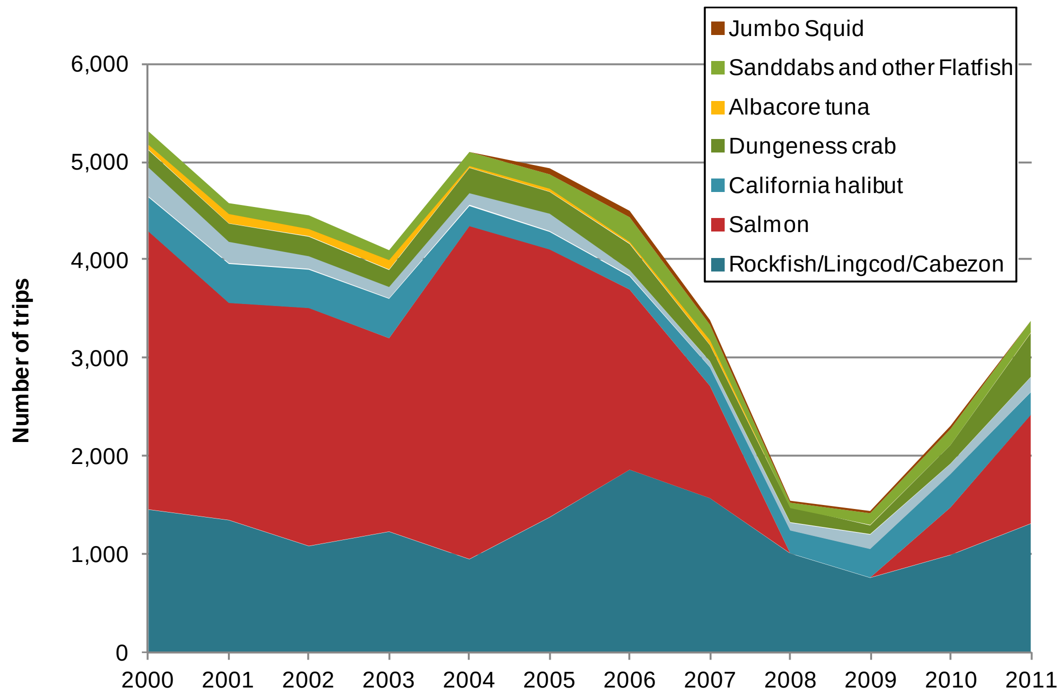
Even though the majority of the number of fish caught in the region is rockfish, from 2000 to 2011 approximate 45 percent of all CPFV trips primarily targeted salmon (despite the 2008 and 2009 season closures) and 33 percent of trips primarily targeted rockfish. Beginning in 2010 salmon trips resumed in the region, however, the number of salmon trips has not returned to level observed before the salmon closure in 2008.

Figure 6. CPFV total number of fish caught for each fishery, North Central Coast Region, 2000-2011



Source: CDFW CPFV logbook data

Figure 7. Total number of CPFV trips for each target fishery, North Central Coast Region, 2000-2011



Source: CDFW CPFV logbook data

Below we provide a table investigating average yearly change in the number of vessels, trips, and anglers over time. We separate time periods into two pre MPA time periods (2000 to 2005 and 2005 to 2010) and one post MPA time period (from 2010 to 2011). Since the MPAs went into effect in 2010 and we only have available 2011 data we were only able to assess change from 2010 to 2011 for the post MPA period.

As see in Table 2 below, the number of vessels across pre and post MPA years has remained relatively steady. However in pre MPA years (2005-2010) the number of trips and anglers sharply declined (-30 percent and -29 percent on average respectively) but have begun to slightly recover in the post MPA year of 2011. However, as seen in the above figures, the number of anglers and trips has not reached the same levels as observed before the 2008 and 2009 salmon season closures.

The ports of Sausalito and San Francisco have experienced the most change from 2000 to 2011. In particular the port of Sausalito which is largely a CPFV salmon port was hit hard by the salmon closures as seen in the average yearly percent change in trips and anglers (-222 percent and -349 percent respectively) from 2005 to 2010. Despite the return of the salmon season, Sausalito is still experiencing a decline in the number of vessel (-33 percent from 2010 to 2011) and number of trips (-12 percent from 2010 to 2011) and overall Sausalito has had an average yearly decline of -110 percent in the number of trips and an average yearly decline of -165 percent in the total number of anglers from 2000 to 2011.

We would like to note that these increases in the number of vessels, trips, and anglers in the post MPA period should not be interpreted as a direct impact of MPA establishment. As shown in the above figures, the increase in the post MPA period is attributed to return of the highly economically important salmon fishing season which was closed in 2008 and 2009 just before the MPA network was implemented in the North Central Coast region.

Table 2. Percent change in CPFV vessels, trips, and anglers per port and region wide, 2000-2011

Ports/Region		Average Yearly Change: Pre MPA (2000-2005)	Pre MPA (2005-2010)	Post MPA (2010-2011)	2000-2011
North Central Coast Study Region	Number of Vessels	5%	-3%	5%	1%
	Number of Trips	-2%	-30%	30%	-12%
	Number of Anglers	-4%	-29%	29%	-12%
Bodega Bay	Number of Vessels	4%	-14%	-13%	-5%
	Number of Trips	-4%	-31%	29%	-13%
	Number of Anglers	-10%	-21%	33%	-11%
Sausalito	Number of Vessels	2%	-16%	-33%	-10%
	Number of Trips	-17%	-222%	-12%	-110%
	Number of Anglers	-20%	-349%	21%	-165%
Berkeley	Number of Vessels	8%	2%	7%	5%
	Number of Trips	2%	-31%	22%	-11%
	Number of Anglers	3%	-38%	26%	-13%
Emeryville	Number of Vessels	3%	-1%	-11%	0%
	Number of Trips	-6%	-28%	26%	-13%
	Number of Anglers	-8%	-20%	20%	-11%
San Francisco	Number of Vessels	-6%	4%	14%	1%
	Number of Trips	-14%	-116%	58%	-54%
	Number of Anglers	-16%	-108%	53%	-52%
Half Moon Bay	Number of Vessels	7%	-8%	23%	2%
	Number of Trips	3%	-18%	30%	-4%
	Number of Anglers	0%	-16%	27%	-5%

Source: CDFW CPFV logbook data

3.2. North Central Coast Region CPFV Baseline Characterization

Establishing a baseline characterization of the North Central Coast Region CPFV fleet provides a benchmark of economic conditions and spatial fishing patterns in which future MPA impacts and benefits can be measured**.** In the CPFV baseline characterization sections found throughout this report we summarize the primary data collected from CPFV operator interviews carried out in the summer and fall of 2011. Data collected in 2012 is not discussed here but can be found at the regional level in the appendix at the end of this report. We chose not to include results from the second year of data collection in the main body of the report as we interviewed fewer respondents in 2012 but generally received similar responses both years.

In 2011 we interviewed 31 CPFV owners/operators as shown in Table 3**,** regarding their 2010 fishing year**.** One respondent was an owner only and 30 were either owner/operators or operators who knew enough about the business to answer all questions contained in the interview. There were no CPFV operations in Point Arena and the San Francisco bay area ports are split into the ports of Sausalito, Berkeley, Emeryville, and the city of San Francisco.

As shown in Table 4 the average individual we interviewed was 50.2 years old, has 19.7 years of experience owning a CPFV boat (if applicable) and 21.8 years of experience operating a CPFV vessel (if applicable). On average, respondents reported that 72.4 percent of their income came from operating and/or owning a CPFV vessel. Respondents were asked what other sources they had for additional income and 9 out of 16 respondents (56 percent) reported that they generated income from other fishing related work, such as commercial fishing or gear construction and sales. Additional sources of income are listed below in Table 5.

Table 3. Number of CPFV interviews completed, 2010 fishing year, North Central Coast Region

Port	Individuals interviewed
Bodega Bay	5
Sausalito	5
Berkeley	5
Emeryville	4
San Francisco	5*
Half Moon Bay	7
Grand Total	31

Source: Current study
** One individual interviewed in San Francisco is an owner only and provided revenue information for his operator.*

Table 4. CPFV survey response statistics, 2010, North Central Coast Region

	Response	Standard deviation	Number responding
Individuals interviewed	31	n/a	n/a
Owner only	1	n/a	n/a
Average age	50.2	12.4	30
Average number of years owning CPFV boat/s	19.7	10.3	29
Average number of years operating CPFV boat/s	21.8	10.9	28
Average percent income from CPFV operations in 2010	72.4%	32.9%	30

Source: Current study

Table 5. Sources of income in 2010 in addition to CPFV operation, North Central Coast Region

	Fishery					Activity				
Response	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^	All target fisheries/ activities (unique individuals)
Construction/Contractor	1	1	1	1	1	—	—	—	—	1
Harbor/City job	1	1	2	2	—	2	—	—	—	2
Other fishing/boating related work	4	2	7	6	4	1	2	2	2	9
Other specialized work	1	—	2	1	1	—	—	—	—	2
Property management	1	—	1	2	1	2	2	1	1	2
Retirement/Social Security/Investments	—	—	1	1	—	1	1	1	1	1
Skilled labor	—	—	1	—	—	1	1	1	—	1
Number of individuals responding	8	4	13	11	7	6	5	4	3	16

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

The average CPFV owner/operator in the North Central Coast reported earning a gross economic revenue (GER) of $105,423 in 2010. Additionally, respondents across the region reported they spent an average of 22.9 percent of their GER on fuel, 12.3 percent on crew, and 37.5 percent on other operational expenses. After costs, respondents in the region made an average net revenue of $28,708 in 2010.

Table 6. Average CPFV gross economic revenue (GER) to operating costs in 2010, North Central Coast Region

	Number responding	Average response	Standard deviation
Total GER 2011	26	$105,423	$77,444
% GER to fuel	26	22.9%	9.0%
% GER to crew	26	12.3%	12.2%
% GER to other operating costs	26	37.5%	22.6%

Source: Current study

All respondents operated consumptive trips in 2010, while 21 respondents operated non-consumptive trips (Table 7). On average, consumptive trips were conducted more frequently, were more expensive, had more crew, and had fewer passengers per trip than non-consumptive trips. As shown below in Table 8, rockfish was targeted by the largest number of respondents (28) and on average generated the largest percentage of gross economic revenue (35 percent) compared to other target fisheries and activities. The most commonly reported non consumptive trip type was funeral services, with ten respondents indicating they conducted funeral trips in 2010, followed by whale watching which eight respondents indicated they conducted. These trips generated an average of 9.1 percent and 12.9 percent of the average respondents' GER, respectively. CPFV captains also explained that non-consumptive trips are often priced by the boat load and not by the individual. Some respondents were able to estimate what the rate would be for the individual and others chose not to provide a response.

Table 7. CPFV trip statistics, 2010, North Central Coast Region

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	29	n/a	n/a	21	n/a
Average number of trips in 2010	26	78.9	46.5	18	35.4	54.1
Average number of passengers(per trip)	29	12.1	5.5	21	17.4	12.7
Average price per passenger (per trip)	29	$103	$28	13	$69	$44
Average number of crew (per trip)	27	1.2	0.8	17	1.0	0.6

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 8. Number of days targeting and percent of GER from fishery/activity in 2010, CPFV, North Central Coast Region

			Number of days targeting species (2010)			Percent of GER from fishery/activity (2010)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	California halibut	17	15	43.1	28.8	14	28.4%	21.1%
	Dungeness crab	9	9	37.0	28.3	9	15.4%	16.7%
	Rockfish	28	25	39.8	29.0	25	35.0%	22.2%
	Salmon	25	22	22.1	22.0	21	25.8%	27.7%
	Striped bass	12	10	37.2	33.1	9	17.4%	14.8%
Activity	Funeral services	10	8	27.1	50.0	8	9.1%	16.6%
	Leisure cruises	6	4	49.0	87.4	5	5.8%	5.8%
	Whale watching	8	7	10.0	11.4	7	12.9%	16.6%
	Other^	4	3	16.7	18.9	4	22.3%	22.2%

Source: Current study

^ includes bird watching, nature trips, and diving.

All CPFV operators were asked to compare their success in each of their target fisheries and non-consumptive activities in 2010 to that of the previous five years. As shown below in Table 9, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to change in success in their fishery/activity. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

Dungeness crab was the most improved fishery, with 66.7 of respondents reporting that their success in the fishery was significantly better and no one reported that they were doing worse in this fishery. For all other fisheries the majority of respondents said they were less successful than in previous years. Most non consumptive activities were divided more evenly as shown in Table 9. Environmental and regulatory factors were mentioned most frequently across fisheries and activities throughout the study region. MPAs were indicated by 20 individuals as being one of the primary factors impacting their overall success in the rockfish fishery (Table 10). Nineteen salmon fishermen indicated that there were fewer salmon than there had been in previous years (not including 2008 and 2009 when the fishery was closed) (Table 11). Another primary factor individuals mentioned as impacting their success in the salmon fishery was the short length of the regulated season (Table 10). Additionally, some fishermen explained that economic factors, such as a generally poor economy, lack of customers, and high fuel costs had a large impact on their success (Table 12). Lastly, a few fishermen mentioned impacts that did not fit into any of the above categories and they are shown below in Table 13.

Table 9. Overall success in CPFV fishery/activity in 2010 compared to past five years, North Central Coast Region

		Number responding	Percent responding: Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	17	5.9%	5.9%	17.6%	47.1%	23.5%
	Dungeness crab	9	66.7%	11.1%	22.2%	—	—
	Rockfish	28	3.6%	3.6%	21.4%	35.7%	35.7%
	Salmon	24	8.3%	4.2%	—	16.7%	70.8%
	Striped bass	11	—	—	36.4%	54.5%	9.1%
Activity	Funeral services	9	11.1%	11.1%	66.7%	11.1%	—
	Leisure cruises	6	—	16.7%	33.3%	16.7%	33.3%
	Whale watching	8	25.0%	25.0%	12.5%	12.5%	25.0%
	Other ^	4	25.0%	25.0%	25.0%	—	25.0%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

Table 10. Regulatory changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, North Central Coast Region

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other ^
	Number responding	5	1	21	15	4	—	—	—	1
	Response	**Count of responses**								
Negative	Regulated season too short	—	—	—	11	—	—	—	—	—
	MPAs	3	1	20	2	2	—	—	—	1
	More pressure on fishery	4	—	—	—	4	—	—	—	—
	Rockfish Conservation Areas	—	—	2	—	—	—	—	—	—
Positive	Fishery closed in previous seasons	—	—	—	6	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ Other includes: bird watching, recreational diving, and nature trips.

Table 11. Environmental changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, North Central Coast Region

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	10	7	11	20	3	—	—	4	—
	Response	**Count of responses**								
Positive	Large quantity of fish	2	6	1	1	—	—	—	1	—
	Peak of natural cycle	—	1	—	—	—	—	—	—	—
	Good ocean conditions	—	1	—	—	—	—	—	2	—
Negative	Low quantity of fish	5	—	5	19	3	—	—	—	—
	Low of natural cycle	1	—	—	—	—	—	—	—	—
	Bad weather	—	—	—	—	—	—	—	2	—
	Poor ocean conditions	3	—	1	1	—	—	—	—	—
	More bait/feed in water - causing fish to bite less	—	—	1	—	—	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	1	—	—	—	—	—
	Fish are smaller	—	—	4	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ Other includes: bird watching, recreational diving, and nature trips.

Table 12. Economic changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, North Central Coast Region

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	—	5	1	—	2	2	2	1
	Response	**Count of responses**								
Positive	Good/new market opportunity	—	—	—	—	—	—	—	—	1
Negative	Lack of customers	—	—	3	1	—	3	—	—	—
	Bad economy	—	—	2	—	—	2	2	2	—
	Fuel costs	—	—	1	—	—	1	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ Other includes: bird watching, recreational diving, and nature trips.

Table 13. Other changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, North Central Coast Region

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	3	—	3	1	—	2	2	2	2
	Response	**Count of responses**								
Positive	Diversifying portfolio of fisheries/activities	—	—	—	—	—	2	1	1	2
	Putting more effort into fishery/activity	—	—	—	1	—	—	—	—	—
Negative	Others are diversifying - adding competition to fishery/activity	—	—	—	—	—	—	1	—	—
	Putting less effort into fishery/activity	1	—	—	—	—	—	—	—	—
	Personal reasons	—	—	—	—	—	—	—	1	—
	Too many other boats/overcrowding	—	—	3	—	—	—	—	—	—
	Drag boats depleting resource	2	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ Other includes: bird watching, recreational diving, and nature trips.

3.3. North Central Coast Region MPAs and CPFV Operations

Determining and measuring the impact of MPAs upon CPFV operators is challenging to quantify and unravel from the multitude of environmental, regulatory, and economic factors influencing systems of fishing. Despite this, we sought to capture information from fishermen as to how they perceive they have been impacted by MPAs and the specific MPAs which are impacting their fisheries/activities. This section provides information at the region and port levels and summarizes the response from the following three questions which were asked for each fishery during interviews:

1) Has your fishery/activity been directly impacted by the recently established MPAs?;
2) If so, how have you been impacted?; and,
3) What MPAs have impacted your specific fishery/activity?

Question one was posed as a simple yes or no response and questions two and three were open-ended questions in which responses were later coded and categorized into the tables below. Additionally, fishermen were given a map of the MPAs in the North Central Coast to aid in identifying and naming the MPAs impacting them. The questions above were asked for every fishery/activity an individual participated in. We'd like to note that the data provided here is only from fishermen who are currently still fishing or participating in a fishery/activity. Fishermen who dropped out of CPFV operation or who dropped out of a specific fishery/activity since MPA implementation are not captured here.

Rockfish was the most impacted CPFV fishery, with all 28 fishermen who targeted rockfish indicating that their fishery had been directly impacted and that they had lost traditional fishing grounds. Additionally, half of these fishermen responded that they were spending more time fishing or traveling for fishing than they had in the past. For some this meant that it took longer to catch fish while others indicated it meant that they were spending more time on the water traveling to fishing spots. California halibut was the second most impacted fishery with 41.2 percent of respondents indicating their fishery had been impacted by MPAs and 35.3 percent indicating they could no longer fish for California halibut in a traditional fishing area (Table 14). We would like to note that as 2010 had a limited salmon season that we likely did not capture the full extent of how and which MPAs are impacting this fishery.

Respondents indicated fewer types of impacts on non-consumptive activities, but did note that these activities had also been impacted. The other category, which included bird watching, nature trips, and recreational diving, was the most highly impacted (75 percent of respondents indicated impacts in this category). Most of these individuals indicated they could not approach an area that was popular for wildlife viewing due to special closures. Additionally, one responded explained that in the past he had conducted non-consumptive diving and fishing combination trips and it no longer made sense for him to travel to a particular area if he could not do both activities. More information can be found below in Table 14.

All respondents were asked to identify particular MPAs that had impacted them for each fishery and activity in which they participate in. Respondents were provided with a map of the MPAs in order to more easily identify them and in order to place the correct name with the proper MPA. Throughout the study region and across all fisheries/activities, there were 24 MPAs (out of 31 MPAs which include special closures in the North Central Coast study region) that respondents indicated impacted them in some way (Table 15). Many MPAs have an impact on only fishermen from a specific port in the region and so impacts on smaller ports may not be well represent in this region level table. Port specific tables found in this section should be referenced for this. However, when considering the region as a whole the MPAs surrounding the Farallon Islands had the largest impact on CPFV fishermen across all fisheries. More information can be found below in Table 15.

Table 14. Percent of CPFV operators indicating direct impacts from MPAs for each fishery/activity, 2010, North Central Coast Region

	Percent responding								
	Fishery					Activity			
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	Unique individuals
Number responding	17	9	28	25	12	6	8	4	30
Percent indicating direct impacts from MPAs	41.2%	33.3%	100.0%	36.0%	16.7%	16.7%	25.0%	75.0%	93.3%
Response	**Percent responding**								
Loss of traditional fishing grounds	35.3%	33.3%	100.0%	36.0%	8.3%	—	—	25.0%	93.3%
Fishing at the borders of MPAs	11.8%	22.2%	60.7%	24.0%	—	—	—	—	60.0%
Spending more time fishing/traveling for fishing	5.9%	22.2%	50.0%	20.0%	—	—	—	—	46.7%
Fishing more in areas with worse/less predictable weather	11.8%	22.2%	35.7%	16.0%	—	—	—	—	40.0%
Increased fishing pressure/crowding in open areas	5.9%	—	39.3%	12.0%	—	—	—	—	36.7%
Shift of fishing effort into other fisheries	5.9%	—	14.3%	—	8.3%	—	—	—	16.7%
Loss of highly productive area	—	—	10.7%	8.0%	—	—	—	—	16.7%
Can't approach an area for viewing wildlife due to special closures	—	—	—	—	—	—	25.0%	50.0%	10.0%
Fishing less	—	—	10.7%	—	—	—	—	—	10.0%
Open areas less productive due to increased pressure	—	—	—	—	—	—	—	—	6.7%
Loss of revenue	—	—	3.6%	4.0%	—	—	—	—	6.7%
Increase in operating expenditures (fuel etc.)	—	—	3.6%	—	—	—	—	—	3.3%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

Table 15. MPAs impacting specific CPFV fisheries/activities in 2010, North Central Coast Region

	Percent Responding								
	Fishery					Activity			
MPA	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	Unique individuals
Number responding	17	9	28	25	12	6	8	4	30
Bodega Head SMCA	—	—	14.3%	12.0%	—	—	—	—	16.7%
Bodega Head SMR	5.9%	—	14.3%	20.0%	—	—	—	—	16.7%
Del Mar Landing SMR	—	—		—	—	—	—	—	6.7%
Double Point/Stormy Stack SC	5.9%	11.1%	3.6%	—	—	—	—	—	3.3%
Drake's Estero SMCA	11.8%	11.1%	—	—	—	—	—	—	10.0%
Duxbury Reef SMCA	11.8%	11.1%	7.1%	—	—	—	—	—	13.3%
Gerstle Cove SMR	—	—	3.6%	—	—	—	—	—	3.3%
Montara SMR	5.9%	11.1%	32.1%	16.0%	—	—	—	—	30.0%
North Farallon Islands SC	—	11.1%	64.3%	4.0%	—	—	12.5%	25.0%	60.0%
North Farallon Islands SMR	—	11.1%	64.3%	4.0%	—	—	12.5%	25.0%	60.0%
Pillar Point SMCA	—	—	17.9%	4.0%	—	—	—	—	16.7%
Point Resistance Rock SC	5.9%	—	—	—	—	—	—	—	3.3%
Point Reyes Headlands SC	17.6%	—	17.9%	4.0%	—	—	—	—	23.3%
Point Reyes SMCA	17.6%	—	25.0%	4.0%	—	—	—	—	26.7%
Point Reyes SMR	11.8%	—	21.4%	4.0%	—	—	—	—	23.3%
Russian River SMCA	—	—	10.7%	12.0%	—	—	—	—	13.3%
Russian River SMRMA	—	—	3.6%	12.0%	—	—	—	—	10.0%
Salt Point SMCA	—	—	7.1%	4.0%	—	—	—	—	6.7%
Saunders Reef SMCA	—	—	3.6%	—	—	—	—	—	3.3%
Southeast Farallon Island SC	—	—	71.4%	4.0%	—	—	—	50.0%	66.7%
Southeast Farallon Island SMCA	—	—	75.0%	4.0%	—	—	—	25.0%	70.0%
Southeast Farallon Island SMR	—	—	71.4%	4.0%	—	—	—	50.0%	66.7%
Stewarts Point SMCA	—	—	14.3%	4.0%	—	—	—	—	13.3%
Stewarts Point SMR	—	—	17.9%	4.0%	—	—	—	—	16.7%
Number of MPAs impacting fishery	9	6	22	18	—	—	2	5	24

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

In Bodega Bay, all respondents indicated that MPAs were impacting their rockfish and salmon fishery and that they had lost traditional fishing grounds. When targeting salmon all fishermen indicated they were fishing at the borders of MPAs and 80 percent indicated they were doing so when targeting rockfish. Additionally 80 percent of fishermen targeting rockfish mentioned spending more time fishing, more time traveling to reach fishing spots, and increased pressure and crowding in fishing areas that remained open. Additional types of impacts are found below in Table 16.

Seventeen of the 31 MPAs in the North Central Coast impacted the CPFV fishermen we interviewed in Bodega Bay (Table 17). Bodega Head SMR and SMCA had the greatest impacts on local CPFV operations. Fishermen noted that both of these MPAs are right outside the Bodega Harbor and offer a close safe place for recreational fishing. Despite Bodega Head SMCA being open for salmon fishing, some fishermen were unaware of this and avoided the area regardless. Some fishermen noted that they were generally unsure what they could and could not fish for in different MPAs and instead chose to avoid them all.

Stewarts Point SMR and SMCA also had a large impact on the rockfish fishery, impacting 100 percent and 80 percent of individuals, respectively. Impacts were also reported at Stewarts Point by one salmon fisherman. The Russian River SMCA and SMRMA were also noted as impacting both rockfish and salmon fishing; although impacts were higher for the salmon fishery. It should be noted that the Russian River and Stewarts Point SMCAs, unlike the Bodega Bay SMCA, do not allow for the recreational take of salmon.

Table 16. Percent of CPFV operators indicating direct impacts from MPAs for each fishery/activity, 2010, Bodega Bay

	Percent responding								
	Fishery					Activity			Unique individuals
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	
Number responding	3	4	5	5	1	—	—	—	5
Percent indicating direct impacts from MPAs	33.3%	—	100.0%	100.0%	—	—	—	—	100.0%
Response	**Percent responding**								
Loss of traditional fishing grounds	33.3%	—	100.0%	100.0%	—	—	—	—	100.0%
Fishing at the borders of MPAs	33.3%	—	80.0%	100.0%	—	—	—	—	100.0%
Spending more time fishing/traveling for fishing	—	—	80.0%	60.0%	—	—	—	—	80.0%
Fishing more in areas with worse/less predictable weather	—	—	40.0%	40.0%	—	—	—	—	60.0%
Increased fishing pressure/crowding in open areas	—	—	80.0%	40.0%	—	—	—	—	80.0%
Shift of fishing effort into other fisheries	—	—	—	—	—	—	—	—	—
Loss of highly productive area	—	—	—	40.0%	—	—	—	—	40.0%
Can't approach an area for viewing wildlife due to special closures	—	—	—	—	—	—	—	—	—
Fishing less	—	—	20.0%	—	—	—	—	—	20.0%
Open areas less productive due to increased pressure	—	—	—	—	—	—	—	—	20.0%
Loss of revenue	—	—	—	20.0%	—	—	—	—	20.0%
Increase in operating expenditures (fuel etc.)	—	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

Table 17. MPAs impacting specific CPFV fisheries/activities in 2010, Bodega Bay

MPA	Percent responding								
	Fishery					Activity			
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	Unique individuals
Number responding	3	4	5	5	1	—	—	—	5
Bodega Head SMCA	—	—	80.0%	60.0%	—	—	—	—	100.0%
Bodega Head SMR	33.3%	—	80.0%	100.0%	—	—	—	—	100.0%
Del Mar Landing SMR	—	—	40.0%	—	—	—	—	—	40.0%
Gerstle Cove SMR	—	—	20.0%	—	—	—	—	—	20.0%
North Farallon Islands SC	—	—	20.0%	—	—	—	—	—	20.0%
North Farallon Islands SMR	—	—	20.0%	—	—	—	—	—	20.0%
Point Reyes SMCA	—	—	20.0%	—	—	—	—	—	20.0%
Point Reyes SMR	—	—	20.0%	—	—	—	—	—	20.0%
Russian River SMCA	—	—	60.0%	60.0%	—	—	—	—	80.0%
Russian River SMRMA	—	—	20.0%	60.0%	—	—	—	—	60.0%
Salt Point SMCA	—	—	40.0%	20.0%	—	—	—	—	40.0%
Saunders Reef SMCA	—	—	20.0%	—	—	—	—	—	20.0%
Southeast Farallon Island SC	—	—	20.0%	—	—	—	—	—	20.0%
Southeast Farallon Island SMCA	—	—	40.0%	—	—	—	—	—	40.0%
Southeast Farallon Island SMR	—	—	20.0%	—	—	—	—	—	20.0%
Stewarts Point SMCA	—	—	80.0%	20.0%	—	—	—	—	80.0%
Stewarts Point SMR	—	—	100.0%	20.0%	—	—	—	—	100.0%
Number of MPAs impacting fishery	1	—	17	7	—	—	—	—	17

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

CPFV operators interviewed in Sausalito reported that MPAs were only impacting their rockfish grounds and 100 percent of those who fished for rockfish noted they had lost traditional grounds (Table 18). All three fishermen who we interviewed who targeted rockfish in 2010 reported that the five MPAs surrounding the Farallon Islands were the MPAs impacting them (Table 19).

Responses in Berkeley, which is just across the bay from Sausalito, were similar. All respondents in Berkeley indicated that rockfish had been impacted and that they had lost traditional fishing grounds. However, unlike Sausalito, in Berkeley one fisherman noted that his salmon grounds had been impacted (33 percent of those interviewed for this fishery in Berkeley) and two fishermen indicated that their California halibut grounds had also been impacted (50 percent of those interviewed for this fishery in Berkeley). One California halibut fishermen noted that because so many prime areas for fishing rockfish had been shut down, other fishermen were beginning to shift into the California halibut fishery (Table 20). Also similar to Sausalito fisherman, those in Berkeley reported that the MPAs surrounding the Farallon Islands had the largest impact on them when they were targeting rockfish. However, Berkeley respondents also indicated that Montara SMR near Half Moon Bay and the MPAs surrounding Point Reyes were also impacting their rockfish fishing. More information regarding which specific MPAs impacted fishermen from Berkeley can be found in Table 21.

Table 18. Percent of CPFV operators indicating direct impacts from MPAs for each fishery/activity, 2010, Sausalito

	Percent responding								
	Fishery					Activity			Unique individuals
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	
Number responding	3	—	3	5	3	1	1	—	5
Percent indicating direct impacts from MPAs	—	—	100.0%	—	—	—	—	—	60.0%
Response	**Percent responding**								
Loss of traditional fishing grounds	—	—	100.0%	—	—	—	—	—	60.0%
Fishing at the borders of MPAs	—	—	33.3%	—	—	—	—	—	20.0%
Spending more time fishing/traveling for fishing	—	—	—	—	—	—	—	—	—
Fishing more in areas with worse/less predictable weather	—	—	33.3%	—	—	—	—	—	20.0%
Increased fishing pressure/crowding in open areas	—	—	—	—	—	—	—	—	—
Shift of fishing effort into other fisheries	—	—	33.3%	—	—	—	—	—	20.0%
Loss of highly productive area	—	—	—	—	—	—	—	—	—
Can't approach an area for viewing wildlife due to special closures	—	—	—	—	—	—	—	—	—
Fishing less	—	—	—	—	—	—	—	—	—
Open areas less productive due to increased pressure	—	—	—	—	—	—	—	—	—
Loss of revenue	—	—	—	—	—	—	—	—	—
Increase in operating expenditures (fuel etc.)	—	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

Table 19. MPAs impacting specific CPFV fisheries/activities in 2010, Sausalito

	Percent responding								
	Fishery					Activity			Unique individuals
MPA	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	
Number responding	3	—	3	5	3	1	1	—	5
North Farallon Islands SC	—	—	100.0%	—	—	—	—	—	60.0%
North Farallon Islands SMR	—	—	100.0%	—	—	—	—	—	60.0%
Southeast Farallon Island SC	—	—	100.0%	—	—	—	—	—	60.0%
Southeast Farallon Island SMCA	—	—	100.0%	—	—	—	—	—	60.0%
Southeast Farallon Island SMR	—	—	100.0%	—	—	—	—	—	60.0%
Number of MPAs impacting fishery	—	—	5	—	—	—	—	—	5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

Table 20. Percent of CPFV operators indicating direct impacts from MPAs for each fishery/activity, 2010, Berkeley

	Percent responding								
	Fishery					Activity			Unique individuals
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	
Number responding	4	—	5	3	2	—	—	—	5
Percent indicating direct impacts from MPAs	50.0%	—	100.0%	33.3%	*	—	—	—	100.0%
Response	**Percent responding**								
Loss of traditional fishing grounds	25.0%	—	100.0%	33.3%	*	—	—	—	100.0%
Fishing at the borders of MPAs	—	—	60.0%	—	*	—	—	—	60.0%
Spending more time fishing/traveling for fishing	—	—	40.0%	33.3%	*	—	—	—	40.0%
Fishing more in areas with worse/less predictable weather	—	—	40.0%	33.3%	*	—	—	—	40.0%
Increased fishing pressure/crowding in open areas	—	—	20.0%	—	*	—	—	—	20.0%
Shift of fishing effort into other fisheries	25.0%	—	20.0%	—	*	—	—	—	40.0%
Loss of highly productive area	—	—	40.0%	—	*	—	—	—	40.0%
Can't approach an area for viewing wildlife due to special closures	—	—	—	—	*	—	—	—	—
Fishing less	—	—	—	—	*	—	—	—	—
Open areas less productive due to increased pressure	—	—	—	—	*	—	—	—	20.0%
Loss of revenue	—	—	—	—	*	—	—	—	—
Increase in operating expenditures (fuel etc.)	—	—	—	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 21. MPAs impacting specific CPFV fisheries/activities in 2010, Berkeley

MPA	Percent responding								
	Fishery					Activity			Unique individuals
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	
Number responding	4	—	5	3	2	—	—	—	5
Drake's Estero SMCA	25.0%	—	—	—	—	—	—	—	20.0%
Duxbury Reef SMCA	25.0%	—	—	—	—	—	—	—	20.0%
Montara SMR	—	—	20.0%	33.3%	—	—	—	—	20.0%
North Farallon Islands SC	—	—	80.0%	—	—	—	—	—	80.0%
North Farallon Islands SMR	—	—	80.0%	—	—	—	—	—	80.0%
Point Resistance Rock SC	25.0%	—	—	—	—	—	—	—	20.0%
Point Reyes Headlands SC	25.0%	—	20.0%	33.3%	—	—	—	—	40.0%
Point Reyes SMCA	25.0%	—	20.0%	33.3%	—	—	—	—	40.0%
Point Reyes SMR	25.0%	—	20.0%	33.3%	—	—	—	—	40.0%
Southeast Farallon Island SC	—	—	100.0%	—	—	—	—	—	100.0%
Southeast Farallon Island SMCA	—	—	100.0%	—	—	—	—	—	100.0%
Southeast Farallon Island SMR	—	—	100.0%	—	—	—	—	—	100.0%
Number of MPAs impacting fishery	6	—	9	4	—	—	—	—	12

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

In addition to impacts on the rockfish fishery (which were indicated by all fishermen who targeted the fishery), CPFV operators in Emeryville mentioned the California halibut and Dungeness crab fisheries were impacted by MPAs. Additionally, some respondents indicated that their non-consumptive activities had been negatively impacted. These impacts, like those for Dungeness crab cannot be shown below in Table 22, due to confidentiality constraints. All those targeting rockfish indicated they could not fish in traditional fishing grounds, 75 percent indicated they were fishing at the borders of MPAs, spending more time fishing/traveling to reach a fishing area, and fishing more frequently in areas with worse or less predictable weather. Additionally, 50 percent of individuals targeting rockfish in Emeryville mentioned they had experienced an increase in fishing pressure and overcrowding in areas that remained open to fishing. Those targeting the California halibut fishery indicated the same type of impacts as those targeting rockfish and the percentage indicating each type can be found below in Table 22.

Similar to Sausalito and Berkeley, CPFV operators in Emeryville reported the highest impacts from the MPAs surrounding the Farallon Islands. One respondent indicated that the areas just offshore of the Farallon Islands provided a safe and well protected fishing area and now they are forced to fish further out in open water. California halibut fishermen reported impacts from the MPAs near Point Reyes as well as Double Point, Duxbury Reef, and Montara. More information can be found in Table 23.

Table 22. Percent of CPFV operators indicating direct impacts from MPAs for each fishery/activity, 2010, Emeryville

	Percent responding								
	Fishery					Activity			Unique individuals
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	
Number responding	3	2	4	4	3	1	2	1	4
Percent indicating direct impacts from MPAs	66.7%	*	100.0%	—	—	—	*	*	100.0%
Response	**Percent responding**								
Loss of traditional fishing grounds	66.7%	*	100.0%	—	—	—	*	*	100.0%
Fishing at the borders of MPAs	33.3%	*	75.0%	—	—	—	*	*	75.0%
Spending more time fishing/traveling for fishing	33.3%	*	75.0%	—	—	—	*	*	75.0%
Fishing more in areas with worse/less predictable weather	66.7%	*	75.0%	—	—	—	*	*	75.0%
Increased fishing pressure/crowding in open areas	33.3%	*	50.0%	—	—	—	*	*	50.0%
Shift of fishing effort into other fisheries	—	*	—	—	—	—	*	*	—
Loss of highly productive area	—	*	—	—	—	—	*	*	—
Can't approach an area for viewing wildlife due to special closures	—	*	—	—	—	—	*	*	25.0%
Fishing less	—	*	—	—	—	—	*	*	—
Open areas less productive due to increased pressure	—	*	—	—	—	—	*	*	—
Loss of revenue	—	*	—	—	—	—	*	*	—
Increase in operating expenditures (fuel etc.)	—	*	—	—	—	—	*	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 23. MPAs impacting specific CPFV fisheries/activities in 2010, Emeryville

	Percent responding								
	Fishery					Activity			
MPA	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	Unique individuals
Number responding	3	2	4	4	3	1	2	1	4
Double Point/Stormy Stack SC	33.3%	*	25.0%	—	—	*	*	*	25.0%
Drake's Estero SMCA	—	*	—	—	—	*	*	*	25.0%
Duxbury Reef SMCA	33.3%	*	—	—	—	*	*	*	25.0%
Montara SMR	33.3%	*	25.0%	—	—	*	*	*	25.0%
North Farallon Islands SC	—	*	100.0%	—	—	*	*	*	100.0%
North Farallon Islands SMR	—	*	100.0%	—	—	*	*	*	100.0%
Point Reyes Headlands SC	66.7%	*	50.0%	—	—	*	*	*	75.0%
Point Reyes SMCA	66.7%	*	75.0%	—	—	*	*	*	75.0%
Point Reyes SMR	33.3%	*	50.0%	—	—	*	*	*	50.0%
Southeast Farallon Island SC	—	*	75.0%	—	—	*	*	*	75.0%
Southeast Farallon Island SMCA	—	*	75.0%	—	—	*	*	*	75.0%
Southeast Farallon Island SMR	—	*	75.0%	—	—	*	*	*	75.0%
Number of MPAs impacting fishery	6	5	10	—	—	—	2	5	12

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

In San Francisco, just across the bay from Emeryville, all respondents reported that their rockfish fishery had been impacted by MPAs, 50 percent of respondents indicated their California halibut fishery had been impacted, and 33.3 percent of striped bass fisherman indicated impacts from MPAs. Like most others in the North Central Coast study region, all fishermen indicating impacts reported not being able to fish in traditional fishing grounds. Additionally, 50 percent of the operators who targeted rockfish in 2010 reported that due to the MPAs they rarely, if ever, target rockfish anymore and have shifted effort into other fisheries. Lastly one respondent indicated fishing rockfish at the borders of MPAs and one indicated experiencing increased fishing pressure and overcrowding in areas that remained open to rockfish fishing.

Like the rest of the Bay Area ports, most fishermen (75 percent) in San Francisco reported impacts on rockfish from the MPAs surrounding the Farallon Islands. They also mentioned the MPAs near Point Reyes and Duxbury Reef. Additionally, one California halibut fishermen reported impacts from Drake's Estero SMCA. Additional information is found below in Table 25.

Table 24. Percent of CPFV operators indicating direct impacts from MPAs for each fishery/activity, 2010, San Francisco

	Percent responding								
	Fishery					Activity			
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	Unique individuals
Number responding	4	—	4	2	3	1	1	—	4
Percent indicating direct impacts from MPAs	50.0%	—	100.0%	—	33.3%	*	—	—	100.0%
Response	**Percent responding**								
Loss of traditional fishing grounds	50.0%	—	100.0%	—	33.3%	*	—	—	100.0%
Fishing at the borders of MPAs	—	—	25.0%	—	—	*	—	—	25.0%
Spending more time fishing/traveling for fishing	—	—	—	—	—	*	—	—	—
Fishing more in areas with worse/less predictable weather	—	—	—	—	—	*	—	—	—
Increased fishing pressure/crowding in open areas	—	—	25.0%	—	—	*	—	—	25.0%
Shift of fishing effort into other fisheries	—	—	50.0%	—	—	*	—	—	50.0%
Loss of highly productive area	—	—	—	—	—	*	—	—	—
Can't approach an area for viewing wildlife due to special closures	—	—	—	—	—	*	—	—	—
Fishing less	—	—	50.0%	—	—	*	—	—	50.0%
Open areas less productive due to increased pressure	—	—	—	—	—	*	—	—	—
Loss of revenue	—	—	—	—	—	*	—	—	—
Increase in operating expenditures (fuel etc.)	—	—	—	—	—	*	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 25. MPAs impacting specific CPFV fisheries/activities in 2010, San Francisco

MPA	Percent responding								
	Fishery					Activity			
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	Unique individuals
Number responding	4	—	4	2	3	1	1	—	4
Drake's Estero SMCA	25.0%	—	—	—	—	—	—	—	25.0%
Duxbury Reef SMCA	—	—	50.0%	—	—	—	—	—	50.0%
North Farallon Islands SC	—	—	75.0%	—	—	—	—	—	75.0%
North Farallon Islands SMR	—	—	75.0%	—	—	—	—	—	75.0%
Point Reyes Headlands SC	—	—	50.0%	—	—	—	—	—	50.0%
Point Reyes SMCA	—	—	50.0%	—	—	—	—	—	50.0%
Point Reyes SMR	—	—	50.0%	—	—	—	—	—	50.0%
Southeast Farallon Island SC	—	—	75.0%	—	—	—	—	—	75.0%
Southeast Farallon Island SMCA	—	—	75.0%	—	—	—	—	—	75.0%
Southeast Farallon Island SMR	—	—	75.0%	—	—	—	—	—	75.0%
Number of MPAs impacting fishery	1	—	9	—	—	—	—	—	10

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

All respondents in Half Moon Bay indicated they targeted rockfish in 2010 and all of them indicated they had been directly impacted by MPAs. All of these fishermen reported they had lost traditional fishing grounds, 71.4 percent indicated they were fishing at the borders of the MPAs and were spending more time fishing or having to travel further distances to reach fishing areas, and 42.9 percent indicated that there was an increase in fishing pressure and overcrowding in fishing areas that remained open to rockfish fishing. Additionally, 66.7 percent of respondents who targeted Dungeness crab in 2010 indicated it had been impacted by MPAs and 50 percent of respondents indicated their salmon fishery had been impacted. CPFV fishermen from Half Moon Bay also indicated that some of their non-consumptive activities had been negatively impacted by MPAs. Specifically, 28.6 percent of respondents mentioned they could not approach an area that was popular for wildlife viewing due to special closures. Additional information regarding the percentage of respondents indicating they were impacted by MPAs for each fishery and activity, as well as the different types of impacts they experienced can be found below in Table 26.

All fishermen we interviewed in Half Moon Bay indicated they had been impacted by Montara SMR, which is located just outside of the Half Moon Bay Harbor and is closed to all commercial and recreational fishing. Montara SMR had the largest impact on the rockfish fishery although some respondents indicated it had also impacted the Dungeness crab and salmon fisheries. Pillar Point SMCA, which is located just south of Montara SMR, impacted 71.4 percent of respondents. Despite this area being open to the recreational take of salmon by trolling; one individual indicated his salmon fishing had been impacted. In general, some fishermen were unaware of regulations for specific MPAs and chose to avoid all areas designated as a protection area.

Aside from the areas right outside of their harbor, fishermen from Half Moon Bay indicated the MPAs surrounding the Farallon Islands also impacted their fishing. Again, these impacts were primarily on the rockfish fishery, although one fisherman indicated his salmon fishing grounds had also been impacted. The MPAs surrounding the South Farallon Island impacted a larger percentage of fishermen (71.4) than those surrounding the North Farallon Island (42.9). Additional information regarding the specific MPAs that impacted each of the CPFV fisheries and activities can be found below in Table 27.

Table 26. Percent of CPFV operators indicating direct impacts from MPAs for each fishery/activity, 2010, Half Moon Bay

	Percent responding								
	Fishery					Activity			
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	Unique individuals
Number responding	—	3	7	6	—	3	4	3	7
Percent indicating direct impacts from MPAs	—	66.7%	100.0%	50.0%	—	—	25.0%	66.7%	100.0%
Response	**Percent responding**								
Loss of traditional fishing grounds	—	66.7%	100.0%	50.0%	—	—	—	—	100.0%
Fishing at the borders of MPAs	—	33.3%	71.4%	16.7%	—	—	—	—	71.4%
Spending more time fishing/traveling for fishing	—	33.3%	71.4%	16.7%	—	—	—	—	71.4%
Fishing more in areas with worse/less predictable weather	—	33.3%	28.6%	16.7%	—	—	—	—	42.9%
Increased fishing pressure/crowding in open areas	—	—	42.9%	16.7%	—	—	—	—	42.9%
Shift of fishing effort into other fisheries	—	—	—	—	—	—	—	—	—
Loss of highly productive area	—	—	14.3%	—	—	—	—	—	14.3%
Can’t approach an area for viewing wildlife due to special closures	—	—	—	—	—	—	25.0%	66.7%	28.6%
Fishing less	—	—	—	—	—	—	—	—	—
Open areas less productive due to increased pressure	—	—	—	—	—	—	—	—	—
Loss of revenue	—	—	14.3%	—	—	—	—	—	14.3%
Increase in operating expenditures (fuel etc.)	—	—	14.3%	—	—	—	—	—	14.3%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 27. MPAs impacting specific CPFV fisheries/activities in 2010, Half Moon Bay

MPA	Percent responding								
	Fishery					Activity			Unique individuals
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Leisure cruises	Whale watching	Other^	
Number responding	—	3	7	6	—	3	4	3	32
Montara SMR	—	33.3%	100.0%	50.0%	—	—	—	—	100.0%
North Farallon Islands SC	—	—	42.9%	16.7%	—	—	—	—	42.9%
North Farallon Islands SMR	—	—	42.9%	16.7%	—	—	—	—	42.9%
Pillar Point SMCA	—	—	71.4%	16.7%	—	—	—	—	71.4%
Southeast Farallon Island SC	—	—	71.4%	16.7%	—	—	—	33.3%	71.4%
Southeast Farallon Island SMCA	—	—	71.4%	16.7%	—	—	—	—	71.4%
Southeast Farallon Island SMR	—	—	71.4%	16.7%	—	—	—	33.3%	71.4%
Number of MPAs impacting fishery	0	1	7	7	0	0	0	2	7

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

4. NORTH CENTRAL COAST CPFV PORT PROFILES

4.1. Bodega Bay

The port of Bodega Bay is located in Northern California's Sonoma County and is 67 miles north of San Francisco on California Highway 1. Bodega Bay was inhabited by the Pomo and Miwok Indian Tribes when the first Euro-American settlers (Russian fur traders from Alaska) arrived in 1812. (Norman et al, 2007). The population of Bodega Bay was recorded during the 2010 U.S. Census as 1,077 people, which was a decline from 2000 U.S. Census reports. The estimated per capita income (2007-2011) was $52,512 with a mean household income of $96,668 (US Census Bureau 2010). In the mid nineteenth century Bodega Bay became a thriving commercial fishing port and in the 1870's a railroad line allowed the port to enter into the San Francisco market (Norman et al. 2007). The fishing industry in Bodega Bay, which was primarily focused on salmon continued to grow until the early 1990s when salmon landings rapidly declined after peaking in the 1980s. Anthropogenic changes to the landscape and the subsequent loss of salmon spawning habitat are thought to have contributed significantly to this decline. Another threat to fishing in Bodega Bay has been the silting of the bay floor which has decreased the channel size that vessels must transit through to reach the port. It was originally dredged in 1943 and again in 2004-2005 after some parts of the channel reached a depth of only five feet. The tourism industry began to boom in Bodega Bay during the 1980s and today the primary employment sector is 'arts, entertainment, recreation, accommodation and food service' which includes CPFV operations (US Census Bureau 2010).

Targeted species on CPFV trips vary and can include various rockfish, lingcod, salmon, Dungeness crab, and albacore tuna amongst others. In Bodega Bay, a range of vessels (40-65 ft) can accommodate a range of customers (18-40 persons) and take reservations for large groups or individuals. Prices can range from $50 per passenger for whale watching, to $85 for nearshore rockfish trips, and up to $275 for the 30-40 miles offshore albacore tuna trips (USA Sport Fishing 2013 and Bodega Bay Charters 2013).

4.1.1. Bodega Bay CPFV Fisheries Historical Trends and Initial Changes

This section provides a summary and analysis of California Department of Fish and Wildlife (CDFW) CPFV logbook data from 2000 to 2011 to provide historical trends and initial changes in CPFV fishing characteristics since MPA implementation. Trips into the North Central Coast region by CPFV operators from ports outside the North Central Coast region were not included in the analyses provided. The following types of information listed below are found in the port level section:

1. Total number of vessels, anglers, and trips
2. Average number of anglers per trip and per vessel
3. Average number of trips per vessel
4. Total number of fish caught for select species/fisheries
5. Total number of trips for each target species/fishery

CPFV operators are required to complete and submit a log to the CDFW for each fishing trip. This log includes information on the catch (number caught by species) and effort (number of anglers) for each trip as well as the port of departure and the Fish and Wildlife Block in which most of the fishing occurs. Only a certain number of species are listed on the log. Operators can write in species that are not listed, or combine species into a group species category such as "Unidentified Rockfish." Some species, such as several of the nearshore rockfishes, are listed on the log, but operators may still choose to put these into a group category. Consequently, species summaries are provided at the most accurate level, which for the nearshore rockfish is the group rockfish.

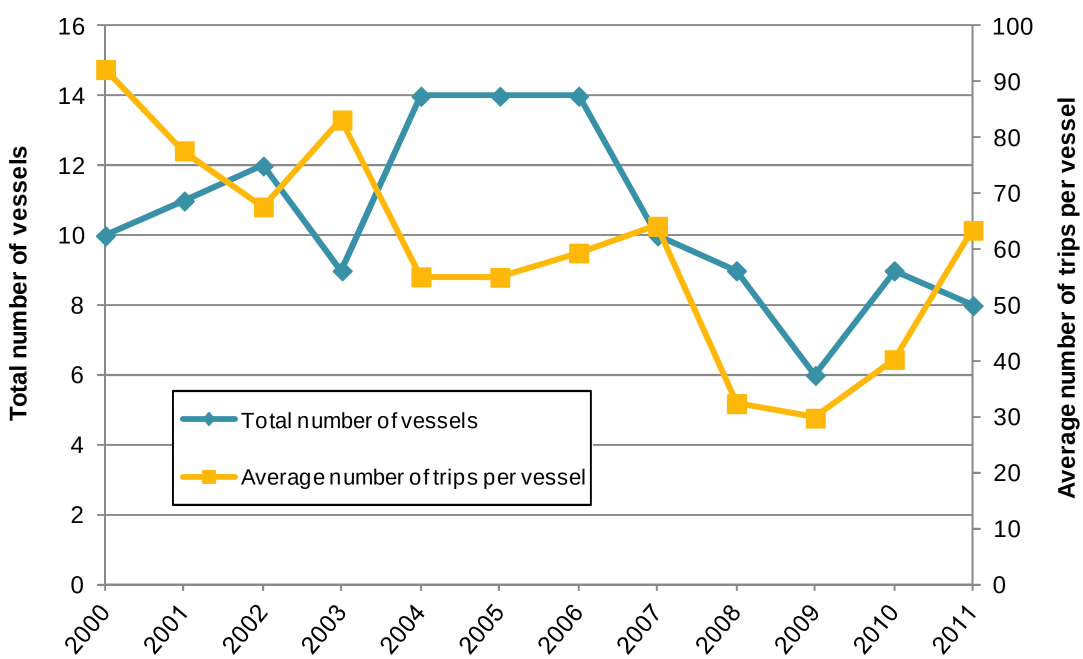
As noted in our methods sections, the data provided here is only for fishing trips which fished in the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here.

The number of vessels operating out of Bodega Bay has been variable from 2000 to 2011 with a max of 14 vessels operating in the region (2004 to 2006) to a low of 6 vessels (2009). In 2011 there were 8 vessels operating in the port a 20 percent decline from the number of vessels in 2000 (Figure 8). The average number of trips per vessel has also been variable but started at a peak in 2000 of an average of 92 trips per vessel to a low of 30 trips per vessel in 2009 during the salmon season closure and increasing to an average of 64 trips per vessel in 2011. The average of 64 trips per vessel in 2011 is higher than the study region average of 41 trips per vessel.

The total number of CPFV fishing trips from Bodega Bay was relatively steady from 2000 to 2006 but from 2006 to 2008 decreased dramatically by approximately 78.4 percent. Since the salmon season was opened again in 2010 the number of trips has begun to increase again, but not to level seen before the salmon closures (Figure 9). However, the average number of anglers per trip has been relatively steady from 2000 to 2011 with a slight increase in 2008 and 2009 during the salmon closures. This increase in 2008 and 2009 may be due to the fact that remaining vessels operating in the port during those years were on average higher capacity vessels.

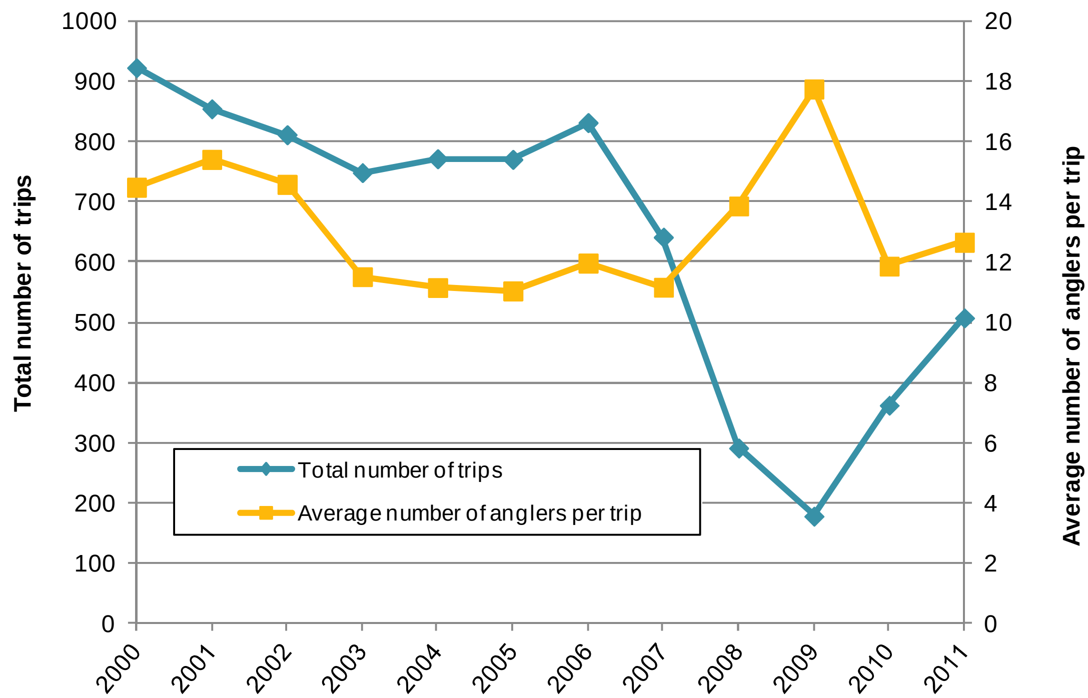
The total number of CPFV anglers in Bodega Bay as well as the average number of anglers per vessel followed similar generally decreasing trends from 2000 to 2011. The total number of anglers was at its highest point in the study period in 2000 (13,378 anglers) and at its lowest in 2009 (3,178 anglers). Since salmon has reopened the total number of angler has been increasing but has not returned to level seen before 2008 (Figure 10).

Figure 8. Total number of CPFV vessels and average number of trips per vessel, Bodega Bay, 2000-2011



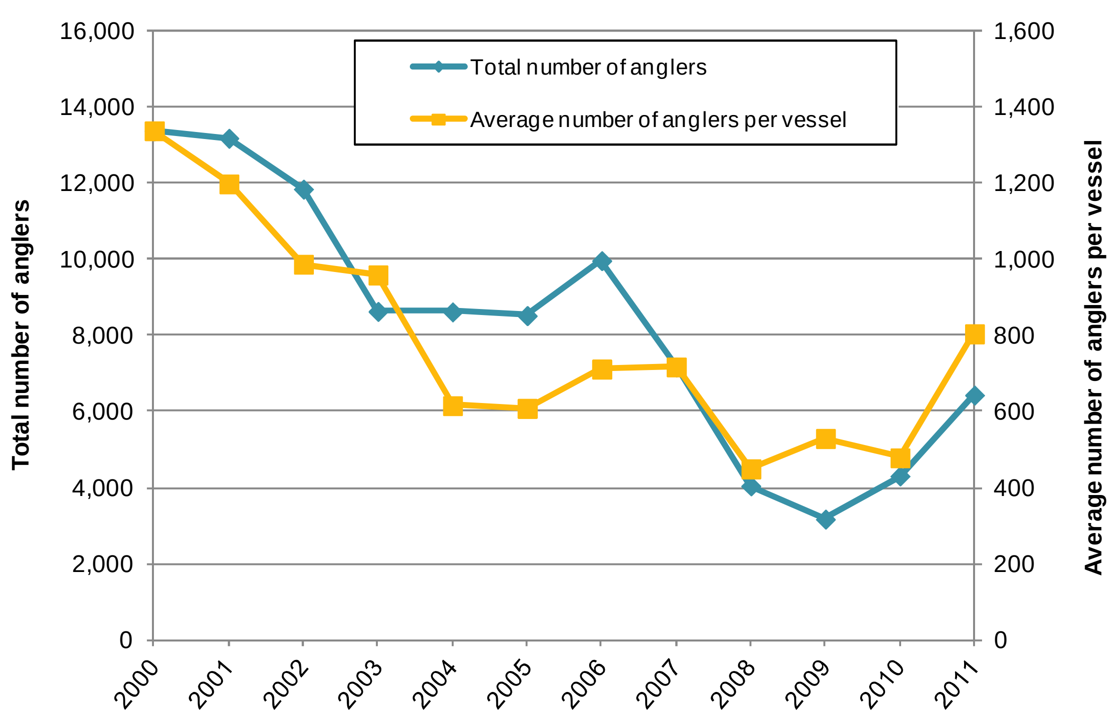
Source: CDFW CPFV logbook data

Figure 9. Total number of CPFV trips and average number of anglers per trip, Bodega Bay, 2000-2011



Source: CDFW CPFV logbook data

Figure 10. Total number of CPFV anglers and average number of anglers per vessel, Bodega Bay, 2000-2011

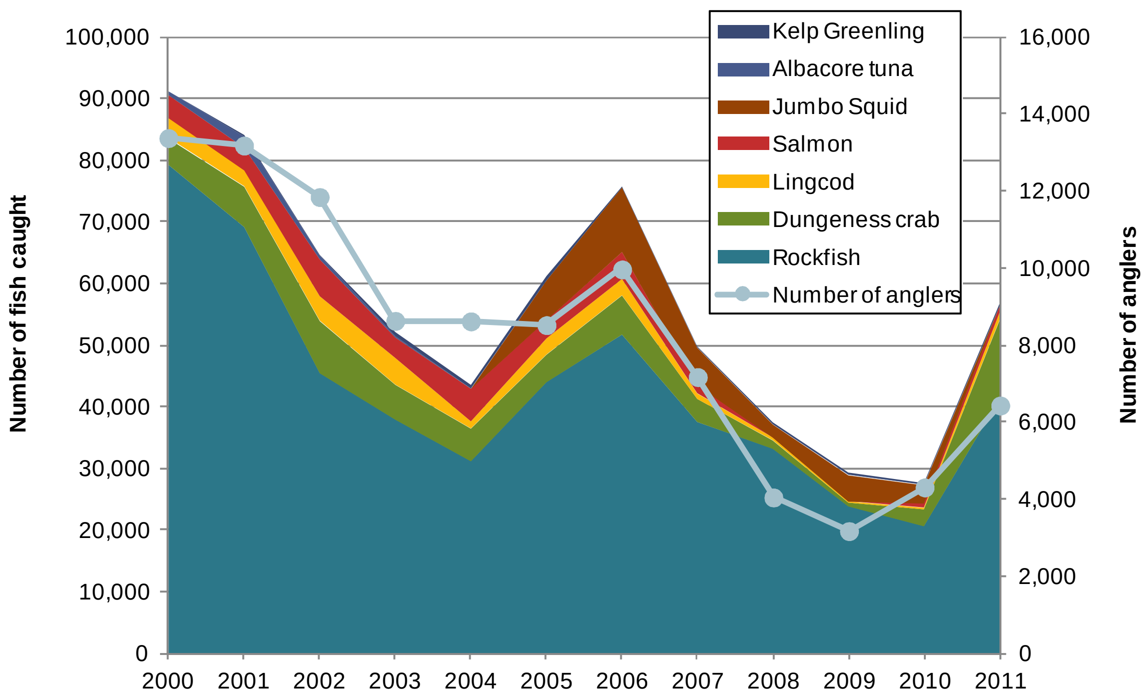


Source: CDFW CPFV logbook data

As seen in Figure 11 the vast majority of the total number of fish caught in Bodega Bay are rockfish (approximately 75.9 percent of total fish caught from 2000 to 2011) followed by Dungeness crab (9.2 percent of total fish caught from 2000 to 2011), salmon (4.9 percent), and Jumbo squid/Humboldt squid (4.9 percent) . The total number of fish caught has been generally decreasing from its peak in 2000 with 92,714 number of fish caught to a secondary peak in 2006 with 77,123 fish caught to approximately 56,755 fish caught in 2011.

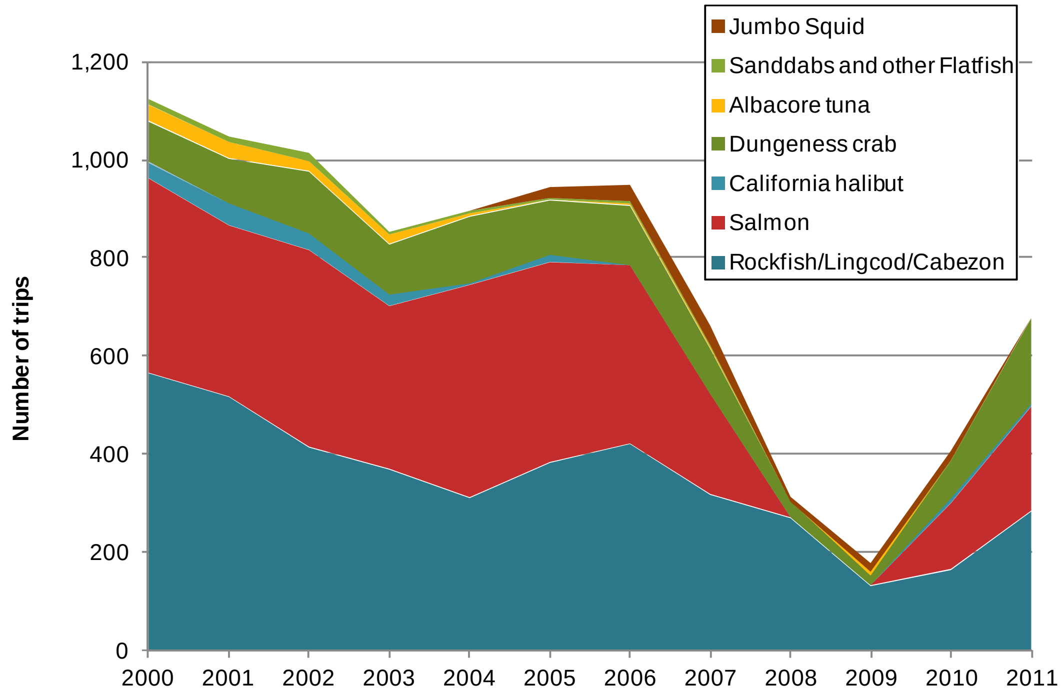
Despite rockfish's dominance in the total number of fish caught, approximately 36 percent of CPFV trips primarily target salmon while 46 percent of trips primarily target rockfish. As with most other trends in this port, the total number of CPFV trips has been declining from 2000 to 2011, starting with a peak in 2000 and a major decline in 2008 and 2009. In 2010 and 2011 salmon trips begin to be operated again and the number of salmon trips in 2011 was slightly above those in 2007. We'd like to note that during the years of a closed salmon season the port also had a decline in the number of rockfish trips as well—demonstrating the impact regulations on a single fishery may have on overall CPFV operations and economics.

Figure 11. CPFV total number of fish caught for each fishery, Bodega Bay, 2000-2011



Source: CDFW CPFV logbook data

Figure 12. Total number of CPFV trips for each target fishery, Bodega Bay, 2000-2011



Source: CDFW CPFV logbook data

4.1.2. Bodega Bay CPFV Fisheries Baseline Characterization

As shown in Table 28 the average individual we interviewed was 52.8 years old, has 16 years of experience owning a CPFV vessel (if applicable) and 21.8 years of experience operating a CPFV vessel. On average, respondents reported that 89 percent of their income came from operating and/or owning a CPFV vessel, which is higher than the regional average of 72.4 percent. Only two CPFV operators indicated they had an additional source of income besides their CPFV operation. One indicated he had a job with the harbor and another mentioned construction work (Table 29).

Table 28. CPFV survey response statistics, 2010, Bodega Bay

	Response	Standard deviation	Number responding
Individuals interviewed	5	n/a	n/a
Owner only	—	n/a	n/a
Average age	52.8	8.4	5
Average number of years owning CPFV boat/s	16.0	10.9	5
Average number of years operating CPFV boat/s	21.8	12.7	4
Average percent income from CPFV operations in 2010	89.0%	16.0%	5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

.

Table 29. Sources of income in 2010 in addition to CPFV operation, Bodega Bay

	Fishery					Activity				
Response	**California halibut**	**Dungeness crab**	**Rockfish**	**Salmon**	**Striped bass**	**Funeral services**	**Leisure cruises**	**Whale watching**	**Other^**	**All target fisheries/ activities (unique individuals)**
Construction/Contractor	1	1	1	1	*	—	—	—	—	1
Harbor/City job	1	1	1	1	*	1	—	—	—	1
Other fishing/boating related work	—	—	—	—	*	—	—	—	—	—
Other specialized work	—	—	—	—	*	—	—	—	—	—
Property management	—	—	—	—	*	—	—	—	—	—
Retirement/Social Security/Investments	—	—	—	—	*	—	—	—	—	—
Skilled labor	—	—	—	—	*	—	—	—	—	—
Number of individuals responding	2	2	2	2	*	1	—	—	—	2

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

The average CPFV owner/operator in Bodega Bay reported earning a gross economic revenue (GER) of $91,800 in 2010, lower than the regional average of $105,423. Additionally, respondents in Bodega Bay reported they spent an average of 19.3 GER on fuel, 1.5 percent on crew, and 50.8 percent on all other operating costs. Expenses for fuel and crew in Bodega Bay were lower than the study region as a whole (22.9 percent and 12.3 percent, respectively, across the region) but higher for other operating costs (37.5 for the entire study region). After costs, respondents in Bodega Bay made an average of $26,163 in 2010.

Table 30. Average CPFV gross economic revenue (GER) to operating costs in 2010, Bodega Bay

	Number responding	Average response	Standard deviation
Total GER 2011	5	$91,800	$63,216
% GER to fuel	4	19.3%	8.6%
% GER to crew	4	1.5%	3.0%
% GER to other operating costs	4	50.8%	29.8%

Source: Current study

All five respondents conducted consumptive fishing trips in 2010 but only four conducted non-consumptive trips. The average fishing trip out of Bodega Bay was $127 and had 8.4 passengers on board while the average non-consumptive trip was $53 per passenger and had 11.8 passengers on board. Additional information regarding consumptive and non-consumptive trips can be found below in Table 31.

Table 31. CPFV trip statistics, 2010, Bodega Bay

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	5	n/a	n/a	4	n/a
Average number of trips in 2010	5	124.0	32.9	3	8.7	3.1
Average number of passengers(per trip)	5	8.4	6.5	4	11.8	12.2
Average price per passenger (per trip)	5	$127	$23	2	$53	$4
Average number of crew (per trip)	5	0.6	0.9	2	0.5	0.7

Source: Current study

For each fishery and activity they targeted in 2010, CPFV fishermen were asked how many days they spent targeting that fishery/activity and what percent of their GER they earned from that fishery/activity (Table 32). The highest percentage of GER attributed to a single fishery in Bodega Bay was 34.8 percent, which came from rockfish. Respondents indicated targeting salmon 52.5 days out of the year, which generated the second highest percent of GER (32 percent) attributed to a single fishery in Bodega Bay. The only non-consumptive activity reported in Bodega Bay was funeral services and on average respondents reported conducting trips 8.7 days per year for an average of 3 percent of their GER.

Table 32. Number of days targeting and percent of GER from fishery/activity in 2010, CPFV, Bodega Bay

			Number of days targeting species (2010)			Percent of GER from fishery/activity (2010)		
	Fishery/activity	Number interviewed	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
Fishery	California halibut	3	3	26.7	20.8	3	14.3%	22.2%
	Dungeness crab	4	4	33.3	22.7	4	13.5%	8.1%
	Rockfish	5	4	43.8	18.9	5	34.8%	17.1%
	Salmon	5	4	52.5	28.7	5	32.0%	17.9%
	Striped bass	1	1	*	*	1	*	*
Activity	Funeral services	3	3	8.7	3.1	3	3.0%	2.0%
	Leisure cruises	—	—	—	—	—	—	—
	Whale watching	—	—	—	—	—	—	—
	Other^	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

All CPFV operators were asked to compare the success in each of their target fisheries and non-consumptive activities in 2010 to the previous five years. As shown below in Table 33, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the change in success in their fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

In general, trends in Bodega Bay were similar to average trends across the study region (see Table 33). Most fishermen indicated that their success in the rockfish fishery was either significantly worse (40 percent of respondents) or somewhat worse (20 percent of respondents) and the remaining individuals noted it was the same (40 percent of respondents). All those who targeted salmon in 2010 expressed that their success in the fishery was either significantly worse (40 percent) or somewhat worse (20 percent) except for one fisherman who indicated it was significantly better. This fisherman explained that he was making more revenue on salmon trips than he had in previous years, but also mentioned that he was putting more effort into the fishery than he had before the 2008 and 2009 closures (Table 37). Fishermen indicated that the overall success in both the salmon and rockfish fishery had been impacted by the MPAs (Table 34). Additional reasons that fishermen cited as impacting the overall success in their different fisheries can be found in Table 34 through Table 37.

Table 33. Overall success in CPFV fishery/activity in 2010 compared to past five years, Bodega Bay

Fisheries		Number responding	Percent responding: Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	3	—	33.3%	—	33.3%	33.3%
	Dungeness crab	4	50.0%	25.0%	25.0%	—	—
	Rockfish	5	—	—	40.0%	20.0%	40.0%
	Salmon	5	20.0%	—	—	20.0%	60.0%
	Striped bass	1	*	*	*	*	*
Activity	Funeral services	3	—	—	100.0%	—	—
	Leisure cruises	—	—	—	—	—	—
	Whale watching	—	—	—	—	—	—
	Other ^	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 34. Regulatory changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Bodega Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	1	—	2	3	*	—	—	—	—
	Response	**Count of responses**								
Negative	Regulated season too short	—	—	—	1	*	—	—	—	—
	MPAs	1	—	2	2	*	—	—	—	—
	More pressure on fishery	—	—	—	—	*	—	—	—	—
	Rockfish Conservation Areas	—	—	—	—	*	—	—	—	—
Positive	Fishery closed in previous seasons	—	—	—	1	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 35. Environmental changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Bodega Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	2	3	2	4	*	—	—	—	—
	Response	**Count of responses**								
Positive	Large quantity of fish	1	2	—	1	*	—	—	—	—
	Peak of natural cycle	—	1	—	—	*	—	—	—	—
	Good ocean conditions	—	—	—	—	*	—	—	—	—
Negative	Low quantity of fish	1	—	—	3	*	—	—	—	—
	Low of natural cycle	—	—	—	—	*	—	—	—	—
	Bad weather	—	—	—	—	*	—	—	—	—
	Poor ocean conditions	—	—	—	—	*	—	—	—	—
	More bait/feed in water - causing fish to bite less	—	—	—	—	*	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	—	*	—	—	—	—
	Fish are smaller	—	—	2	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 36. Economic changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Bodega Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	—	2	—	*	—	—	—	—
	Response	**Number responding**								
Positive	Good/new market opportunity	—	—	—	—	*	—	—	—	—
Negative	Lack of customers	—	—	1	—	*	—	—	—	—
	Bad economy	—	—	—	—	*	—	—	—	—
	Fuel costs	—	—	1	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 37. Other changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Bodega Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	—	—	1	*	—	—	—	—
	Response	**Number responding**								
Positive	Diversifying portfolio of fisheries/activities	—	—	—	—	*	—	—	—	—
	Putting more effort into fishery/activity	—	—	—	1	*	—	—	—	—
Negative	Others are diversifying - adding competition to fishery/activity	—	—	—	—	*	—	—	—	—
	Putting less effort into fishery/activity	—	—	—	—	*	—	—	—	—
	Personal reasons	—	—	—	—	*	—	—	—	—
	Too many other boats/overcrowding	—	—	—	—	*	—	—	—	—
	Drag boats are depleting resource	—	—	—	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

4.2. Sausalito

Sausalito, in Marin County, is directly north of San Francisco across from the Golden Gate Bridge. The area was originally inhabited by the Coastal Miwok. In the late 1700s Spanish explorers arrived and later Sausalito was resettled in 1838 through a Mexican land grant (City of Sausalito, 2013; Sausalito Historical Society, 2010). According to the 2010 US Census, Sausalito had 7,061 residents, and the estimated per capita income was $84,618 (2007-2011) with a mean household income of $147,374 (US Census Bureau, 2010). Following the end of World War II, many of the city's docks and industrial areas were repurposed as marinas and harbors. Today there are several of these facilities and CPFV operators run out of various marinas and offer fishing trips, leisure cruises, and other activities both inside the San Francisco Bay and in the open ocean (City of Sausalito, 2013).

Sausalito CPFV operators mainly target the recreational salmon fishery; however CPFV operators also target various other species including rockfish, lingcod, striped sea bass, and albacore tuna. The vessels operating out of Sausalito generally range from 43 to 56 feet and can accommodate a range of customers (up to 32 persons) and take reservations for large groups or individuals. Fishing rods and tackle can be rented on most vessels, but customers are expected to bring state issued recreational fishing licenses and appropriate stamps (San Francisco Sport Fishing, 2013).

4.2.1. Sausalito CPFV Fisheries Historical Trends and Initial Changes

This section provides a summary and analysis of California Department of Fish and Wildlife (CDFW) CPFV logbook data from 2000 to 2011 to provide historical trends and initial changes in CPFV fishing characteristics since MPA implementation. Trips into the North Central Coast region by CPFV operators from ports outside the North Central Coast region were not included in the analyses provided. The following types of information listed below are found in the port level section:

1. Total number of vessels, anglers, and trips
2. Average number of anglers per trip and per vessel
3. Average number of trips per vessel
4. Total number of fish caught for select species/fisheries
5. Total number of trips for each target species/fishery

CPFV operators are required to complete and submit a log to the CDFW for each fishing trip. This log includes information on the catch (number caught by species) and effort (number of anglers) for each trip as well as the port of departure and the Fish and Wildlife Block in which most of the fishing occurs. Only a certain number of species are listed on the log. Operators can write in species that are not listed, or combine species into a group species category such as “Unidentified Rockfish.” Some species, such as several of the nearshore rockfishes, are listed on the log, but operators may still choose to put these into a group category. Consequently, species summaries are provided at the most accurate level, which for the nearshore rockfish is the group rockfish.

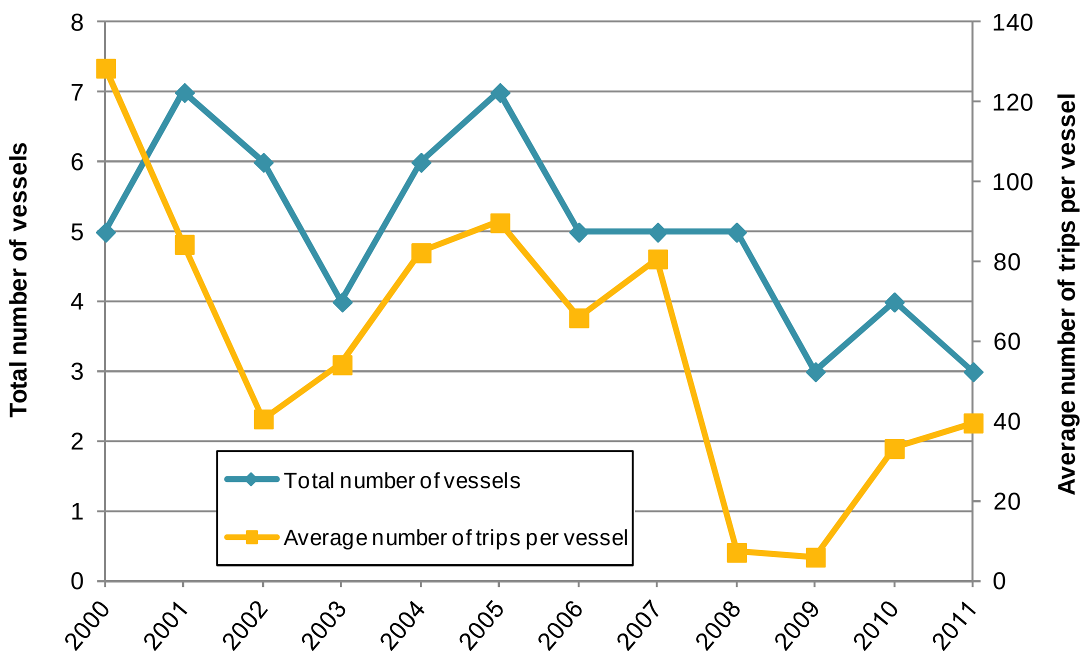
As noted in our methods sections, the data provided here is only for fishing trips which fished in the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here.

The number of vessels operating out of Sausalito has been variable from 2000 to 2011 with a max of 7 vessels operating in the region (in 2001 and 2005) to a low of 3 vessels (in 2009 and 2011). In 2011 there were 3 vessels operating in the port a 40 percent decline from the number of vessels in 2000 (Figure 13). The average number of trips per vessel has also been variable but has significantly declined across the study period. The average number of trips per vessel started at a peak in 2000 of an average of 129 trips per vessel to a low of 6 trips per vessel in 2009 during the salmon season closure and increasing to an average of 40 trips per vessel in 2011 which is on par with the study region average of 41 trips per vessel.

As the Sausalito port is largely a CPFV salmon port its economic health is closely tied to that of the health of the salmon populations. The total number of CPFV fishing trips from Sausalito was highly variable from 2000 to 2011 and decreased dramatically in 2002-2003 and again in 2008 and 2009. Overall, the number of CPFV fishing trips has declined approximately 81.4 percent from 2000 to 2011. Since the salmon season was opened again in 2010 the number of trips has begun to increase since its low of 18 trips in 2008, but not to level seen before the salmon closures (Figure 14). However, the average number of anglers per trip has been relatively steady from 2000 to 2011.

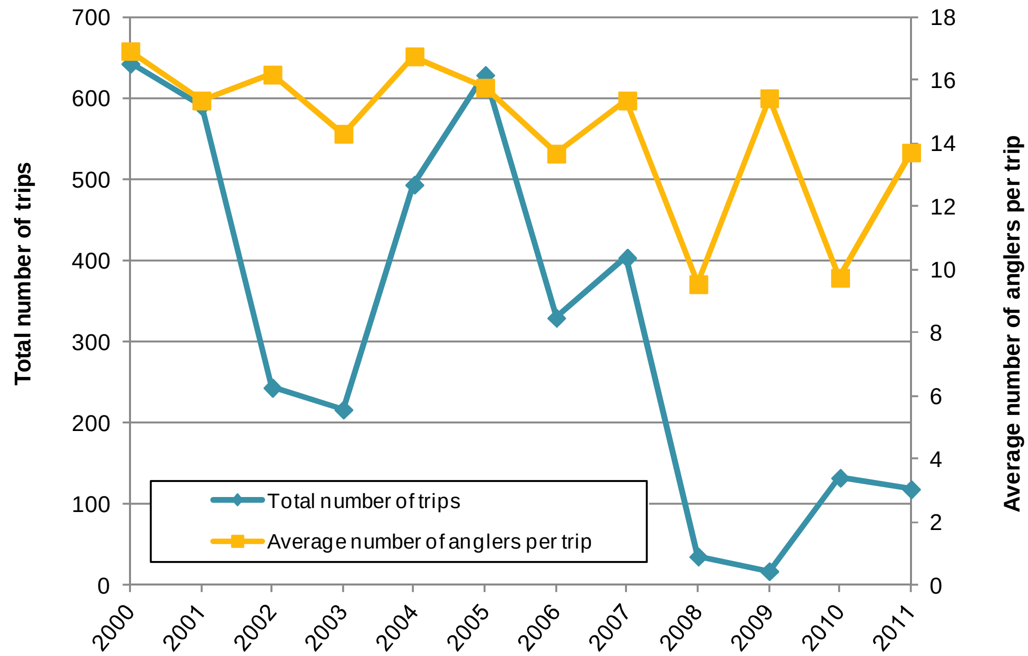
The total number of CPFV anglers in Sausalito as well as the average number of anglers per vessel followed similar variable but sharply decreasing trends from 2000 to 2011. The total number of anglers was at its highest point in the beginning of the study period in 2000 (10,889 anglers) and at its lowest in 2009 (278 anglers). Since salmon has reopened the total number of anglers has been increasing but not to the numbers seen before 2008. In 2011 the number of anglers was approximately 73.7 percent less than the number of anglers in 2007 (Figure 15).

Figure 13. Total number of CPFV vessels and average number of trips per vessel, Sausalito, 2000-2011



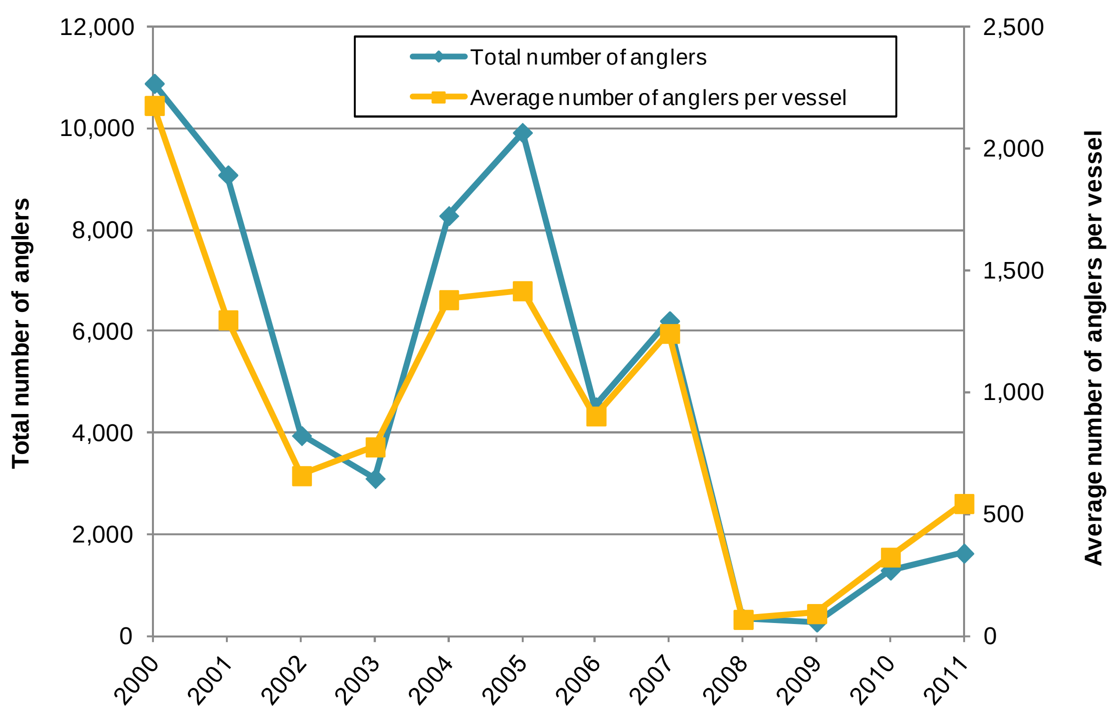
Source: CDFW CPFV logbook data

Figure 14. Total number of CPFV trips and average number of anglers per trip, Sausalito, 2000-2011



Source: CDFW CPFV logbook data

Figure 15. Total number of CPFV anglers and average number of anglers per vessel, Sausalito, 2000-2011

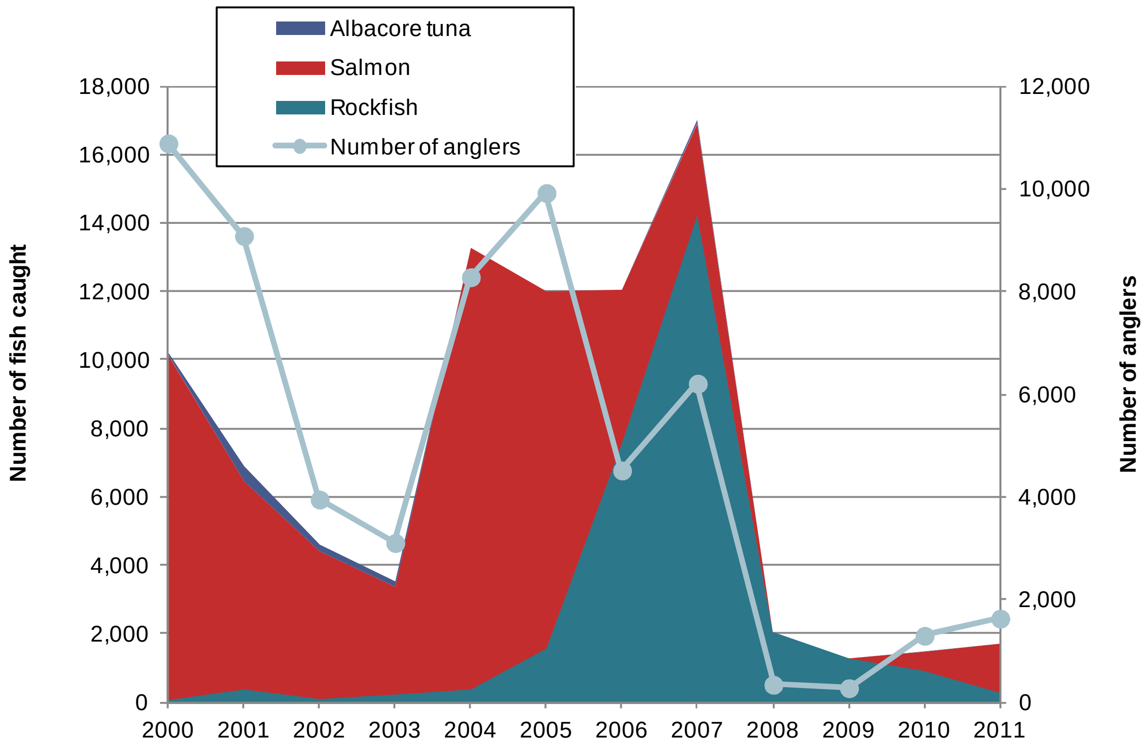


Source: CDFW CPFV logbook data

As seen in Figure 16 the vast majority of the total number of fish caught in Sausalito is salmon (approximately 62.9 percent of total fish caught from 2000 to 2011) followed by Rockfish (32.5 percent of total fish caught from 2000 to 2011. The total number of fish caught has decreased from 2000 to 2011 by approximately 82.8 percent but has been variable during this time with peaks in catch from 2003 to 2007—with a peak in 2007 with 17,468 fish caught. Although Sausalito is primarily a salmon CPFV port during the peak in 2007 approximately 81.4 of the catch was rockfish and 15.4 percent was salmon.

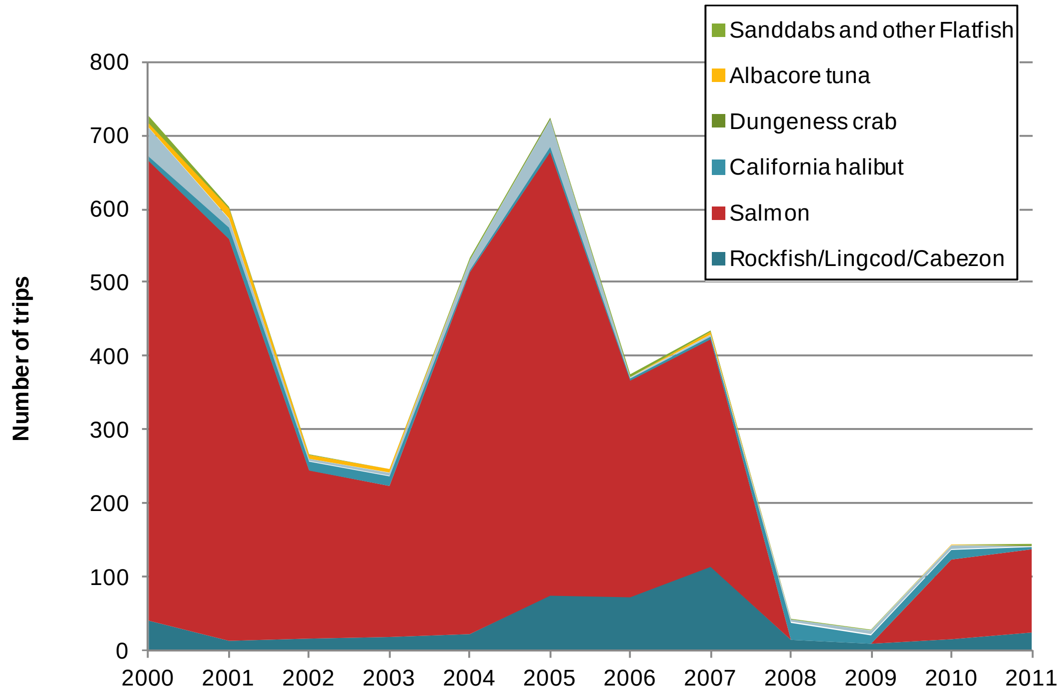
Despite the abundance of rockfish caught in 2006 and 2007 approximately 83% of all CPFV trips from 2000 to 2011 in Sausalito are trips that primarily target salmon. As with most trends in this port, the total number of CPFV trips has been declining from 2000 to 2011 by approximately 80.1 percent, starting with a peak in 2000 with 730 trips and a major decline in 2002 and 2003 with significant increases in 2004 to 2005 but then declining drastically in 2008 and 2009. In 2010 and 2011 salmon trips begin to be operated again but not to levels seen before 2008.

Figure 16. CPFV total number of fish caught for each fishery, Sausalito, 2000-2011



Source: CDFW CPFV logbook data

Figure 17. Total number of CPFV trips for each target fishery, Sausalito, 2000-2011



Source: CDFW CPFV logbook data

4.2.2. Sausalito CPFV Fisheries Baseline Characterization

We interviewed five owner/operators in Sausalito who reported making an average of 60 percent of their income from CPFV operations, which was less than the regional average of 72.4 percent. On average respondents in Sausalito were 55.8 years old in 2010 at the time of interview, had owned CPFV boats for 25.8 years and operated them for 26.4 years (Table 38). Three individuals from Sausalito indicated they had other sources of income (Table 39), two of whom said the income came from another fishing related job, such as commercial fishing or gear sales, and one indicated he worked in property management.

Table 38. CPFV survey response statistics, 2010, Sausalito

	Response	Standard deviation	Number responding
Individuals interviewed	5	n/a	n/a
Owner only	—	n/a	n/a
Average age	55.8	15.3	5
Average number of years owning CPFV boat/s	25.8	12.6	5
Average number of years operating CPFV boat/s	26.4	13.2	5
Average percent income from CPFV operations in 2010	60.0%	41.8%	5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 39. Sources of income in 2010 in addition to CPFV operation, Sausalito

	Fishery					Activity				
Response	**California halibut**	**Dungeness crab**	**Rockfish**	**Salmon**	**Striped bass**	**Funeral services**	**Leisure cruises**	**Whale watching**	**Other^**	**All target fisheries/ activities (unique individuals)**
Construction/Contractor	—	—	—	—	—	*	*	*	—	—
Harbor/City job	—	—	—	—	—	*	*	*	—	—
Other fishing/boating related work	1	—	1	2	1	*	*	*	—	2
Other specialized work	—	—	—	—	—	*	*	*	—	—
Property management	1	—	—	1	1	*	*	*	—	1
Retirement/Social Security/Investments	—	—	—	—	—	*	*	*	—	—
Skilled labor	—	—	—	—	—	*	*	*	—	—
Number of individuals responding	2	—	1	3	2	*	*	*	—	3

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

The average CPFV owner/operator in Sausalito reported earning a gross economic revenue (GER) of $87,000 in 2010, which is lower than the regional average of $105,423. Additionally, respondents in Sausalito reported they spent an average of 17.4 percent of their gross GER on fuel, 14 percent on crew, and 48 percent on other operational expenses. Expenses for fuel were lower in Sausalito than the study region as a whole (22.9 percent for the region) and higher for crew and other operating costs (12.3 and 37.5 percent, respectively). After costs, respondents in Sausalito made an average net revenue of $17,922 in 2010.

Table 40. Average CPFV gross economic revenue (GER) to operating costs in 2010, Sausalito

	Number responding	Average response	Standard deviation
Total GER 2011	5	$87,000	$24,393
% GER to fuel	5	17.4%	8.0%
% GER to crew	5	14.0%	12.0%
% GER to other operating costs	5	48.0%	29.5%

Source: Current study

The five Sausalito operator/owners interviewed all operated fishing trips in 2010 and two of them operated non-consumptive trips. On average respondents from Sausalito conducted fewer consumptive trips than the rest of the study region (36.2 compared to 78.9 for the region), but slightly more non-consumptive trips (37.3 compared to 35.4 for the region). Fishing trips from Sausalito averaged $99 per trip per person and had 12.1 passengers while non-consumptive trips were an average of $90 per trip per person but had an average of 19.5 passengers on board. Additional information can be found below in Table 41.

Table 41. CPFV trip statistics, 2010, Sausalito

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	5	n/a	n/a	4	n/a
Average number of trips in 2010	5	36.2	14.7	4	37.3	25.8
Average number of passengers(per trip)	5	13.4	2.3	4	19.5	12.8
Average price per passenger (per trip)	5	$99	$3	2	$90	$14
Average number of crew (per trip)	5	1.2	0.4	3	1.0	1.0

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Respondents in Sausalito reported that nearly two thirds of their GER came from salmon trips in 2010 (64.3 percent) and that they targeted salmon an average of 32 days per year. Additionally, they reported only generating 2.7 percent of their GER from rockfish, targeting it only 3 days per year. This is different than the region as a whole, which reported 22.1 days salmon fishing for 25.8 percent of GER and 39.8 days fishing for rockfish, generating 35 percent of the average respondents GER. Additional information regarding the number of days targeting a specific fishery and the percent of gross economic revenue generated from each fishery in Sausalito can be found below in Table 42.

Table 42. Number of days targeting and percent of GER from fishery/activity in 2010, CPFV, Sausalito

			Number of days targeting species (2010)			Percent of GER from fishery/activity (2010)		
	Fishery/activity	Number interviewed	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
Fishery	California halibut	3	2	6.5	2.1	2	2.5%	0.7%
	Dungeness crab	—	—	—	—	—	—	—
	Rockfish	3	3	3.0	2.0	3	2.7%	2.1%
	Salmon	5	4	32.0	15.6	4	64.3%	38.5%
	Striped bass	3	2	6.5	2.1	2	1.5%	0.7%
Activity	Funeral services	1	—	—	—	—	—	—
	Leisure cruises	1	—	—	—	—	—	—
	Whale watching	1	1	*	*	1	*	*
	Other	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

All CPFV operators were asked to compare the success in each of their target fisheries and non-consumptive activities in 2010 to the previous five years. As shown below in Table 43, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the change in success in their fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

Sausalito indicated that their level of success was either worse or the same across all fisheries they participated in (Table 43). Four out of five respondents indicated that the salmon fishery was significantly worse and the fifth salmon operator did not respond to the question. For the salmon fishery they indicated that the season was short and there was a low quantity of fish, while for rockfish they mentioned poor oceanic conditions and regulations such as MPAs and the Rockfish Conservation Areas (Table 44 and Table 45).

Table 43. Overall success in CPFV fishery/activity in 2010 compared to past five years, Sausalito

Fisheries		Number responding	Percent responding: Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	3	—	—	33.3%	33.3%	33.3%
	Dungeness crab	—	—	—	—	—	—
	Rockfish	3	—	—	—	33.3%	66.7%
	Salmon	4	—	—	—	—	100.0%
	Striped bass	3	—	—	33.3%	33.3%	33.3%
Activity	Funeral services	1	*	*	*	*	*
	Leisure cruises	1	*	*	*	*	*
	Whale watching	1	*	*	*	*	*
	Other ^	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 44. Regulatory changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Sausalito

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	—	2	2	—	*	*	*	—
	Response	**Count of responses**								
Negative	Regulated season too short	—	—	—	2	—	*	*	*	—
	MPAs	—	—	1	—	—	*	*	*	—
	More pressure on fishery	—	—	—	—	—	*	*	*	—
	Rockfish Conservation Areas	—	—	1	—	—	*	*	*	—
Positive	Fishery closed in previous seasons	—	—	—	—	—	*	*	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 45. Environmental changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Sausalito

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	2	—	2	4	1	*	*	*	—
	Response	**Count of responses**								
Positive	Large quantity of fish	—	—	—	—	—	*	*	*	—
	Peak of natural cycle	—	—	—	—	—	*	*	*	—
	Good ocean conditions	—	—	—	—	—	*	*	*	—
Negative	Low quantity of fish	2	—	—	4	1	*	*	*	—
	Low of natural cycle	—	—	—	—	—	*	*	*	—
	Bad weather	—	—	—	—	—	*	*	*	—
	Poor ocean conditions	—	—	1	—	—	*	*	*	—
	More bait/feed in water - causing fish to bite less	—	—	1	—	—	*	*	*	—
	Loss of salmon spawning grounds	—	—	—	—	—	*	*	*	—
	Fish are smaller	—	—	—	—	—	*	*	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: Bird watching, recreational diving, and nature trips.

4.3. Berkeley

Berkeley, in northern Alameda County, was originally inhabited by an indigenous group, now called the Ohlone. The first Europeans came to the San Francisco Bay area in the late 1700s from Spain (Wollenberg, 2002). According to the 2010 US Census, Berkeley had 112,580 residents, and the estimated per capita income (2007-2011) was $38,887 with a mean household income of $93,550 (US Census Bureau, 2010). In 1926, the city wharf was built out and became Berkeley Pier which originally extended 3.5 miles into San Francisco Bay leading to a ferry dock. When the Bay Bridge was built the ferry was discontinued and the pier became a popular recreational fishing spot (Todd 2010). The Berkeley Harbor now offers over 1,000 berths up to 110 feet long and a number of recreational facilities including a number of CPFV operations (City of Berkeley 2013).

Berkeley CPFV operators target various species including rockfish, lingcod, salmon, Dungeness crab, and albacore tuna. The CPFV operators out of Berkeley also offer 'potluck' fishing at a fixed rate, which is fishing for whatever the season and day's conditions dictate. A fleet of vessels (43-56 feet) can accommodate a range of customers (up to 49 persons) and take reservations for large groups or individuals. Prices can vary on the type and length of trip. Fishing rods and tackle can be rented on most vessels, but customers are expected to bring state issued recreational fishing licenses and appropriate stamps (Berkeley Marina Sportfishing 2013).

4.3.1. Berkeley CPFV Fisheries Historical Trends and Initial Changes

This section provides a summary and analysis of California Department of Fish and Wildlife (CDFW) CPFV logbook data from 2000 to 2011 to provide historical trends and initial changes in CPFV fishing characteristics since MPA implementation. Trips into the North Central Coast region by CPFV operators from ports outside the North Central Coast region were not included in the analyses provided. The following types of information listed below are found in the port level section:

1. Total number of vessels, anglers, and trips
2. Average number of anglers per trip and per vessel
3. Average number of trips per vessel
4. Total number of fish caught for select species/fisheries
5. Total number of trips for each target species/fishery

CPFV operators are required to complete and submit a log to the CDFW for each fishing trip. This log includes information on the catch (number caught by species) and effort (number of anglers) for each trip as well as the port of departure and the Fish and Wildlife Block in which most of the fishing occurs. Only a certain number of species are listed on the log. Operators can write in species that are not listed, or combine species into a group species category such as "Unidentified Rockfish." Some species, such as several of the nearshore rockfishes, are listed on the log, but operators may still choose to put these into a group category. Consequently, species summaries are provided at the most accurate level, which for the nearshore rockfish is the group rockfish.

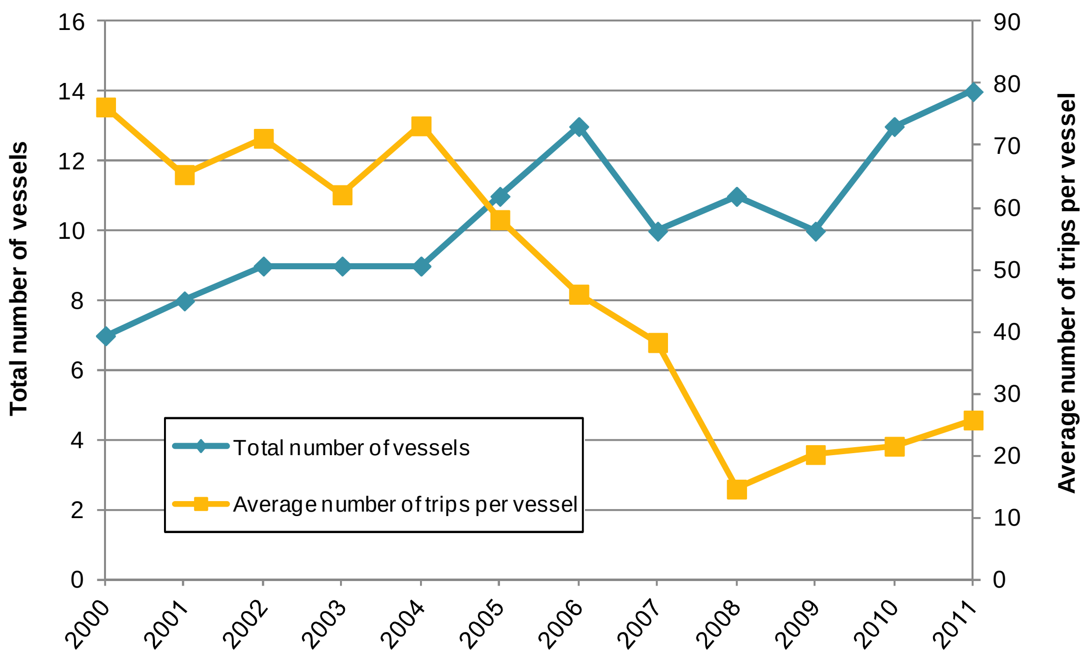
As noted in our methods sections, the data provided here is only for fishing trips which fished in the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here.

The number of vessels operating out of Berkeley has been increasing from 2000 to 2011 starting from its lowest of 7 vessels in 2000 to a peak of 14 vessels in 2011 (Figure 18). The average number of trips per vessel however, saw a significant decline starting in 2004 and reached its lowest point in 2008 an average of 15 trips per vessel—an 80 percent decline from averages in 2004. Although the number of vessels increased over time, vessels may have been operating less due to several reasons such as economic decline and increasing fishery regulations. Since 2007 the average number of trips per vessel has increased slightly to approximately 26 trips per vessel—however this is significantly lower than the study region average in 2011 of 41 trips per vessel.

Indeed, the total number of trips follows similar trends to that of the average number of trips per vessel in that the number of trips was relatively steady from 2000 to 2006 (with a peak in 2004 of 659 trips) until a significant decline in 2007 and 2008 (Figure 19). In 2008 the total number of trips reached its lowest point in the study period with 161 total trips. The total number of trips has increased since its low in 2008 however has not recovered to the number of trips seen before 2008.

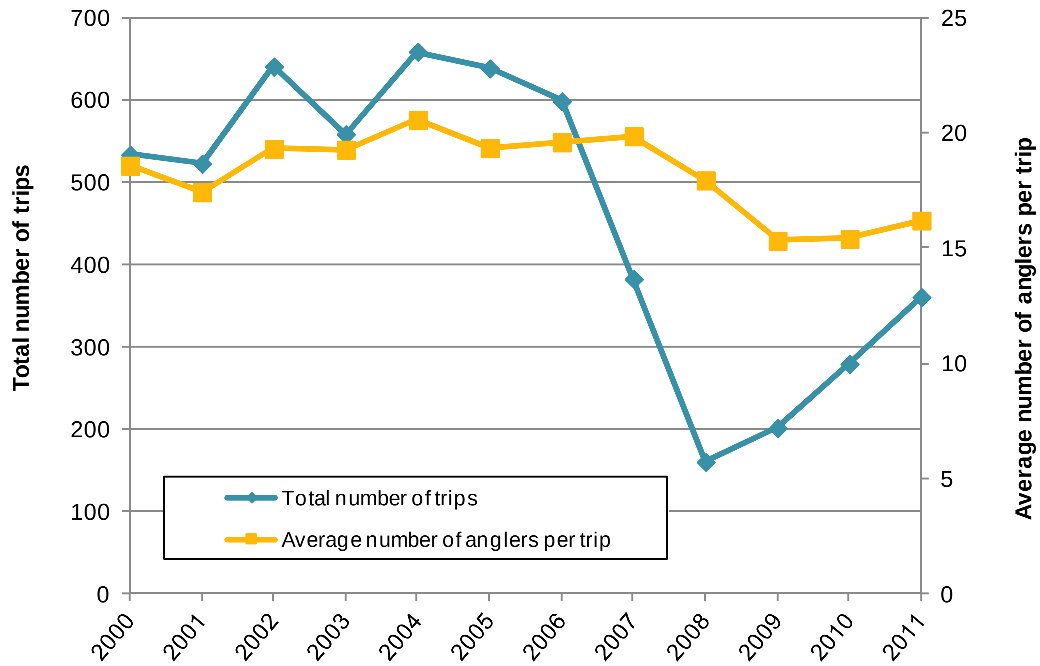
The total number of CPFV anglers in Berkeley as well as the average number of anglers per vessel followed similar generally decreasing trends from 2000 to 2011. The total number of anglers was at its highest point in the study period in 2004 (13,562 anglers) and at its lowest in 2008 (2,891 anglers). Since salmon has reopened the total number of angler has been increasing but has not returned to level seen before 2008 (Figure 20).

Figure 18. Total number of CPFV vessels and average number of trips per vessel, Berkeley, 2000-2011



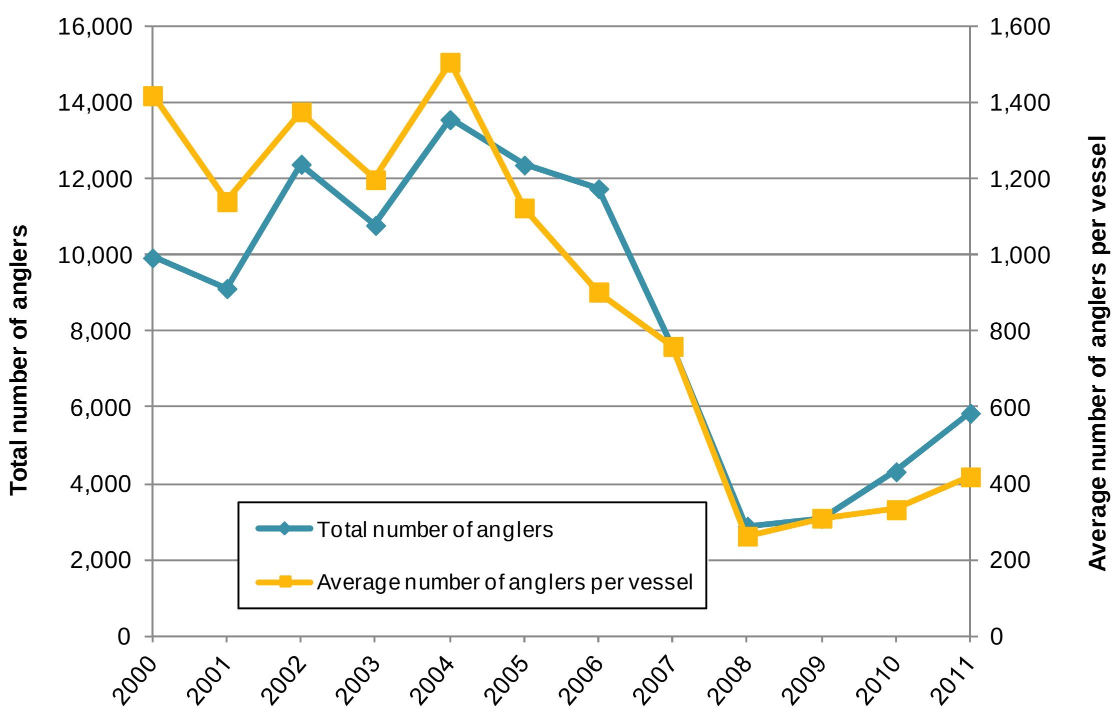
Source: CDFW CPFV logbook data

Figure 19. Total number of CPFV trips and average number of anglers per trip, Berkeley, 2000-2011



Source: CDFW CPFV logbook data

Figure 20. Total number of CPFV anglers and average number of anglers per vessel, Berkeley, 2000-2011



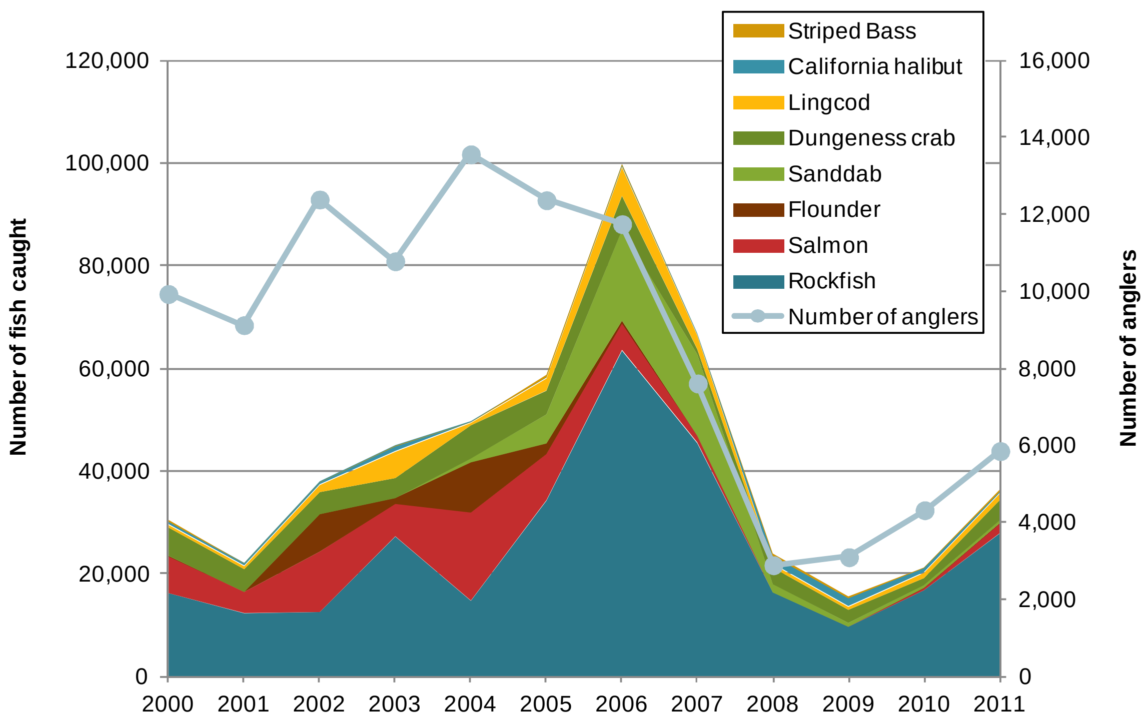
Source: CDFW CPFV logbook data

As seen in Figure 21 the vast majority of the total number of fish caught in Berkeley are rockfish (approximately 61.6 percent of total fish caught from 2000 to 2011) followed by salmon (13.4 percent of total fish caught from 2000 to 2011), and Dungeness crab (10 percent). The total number of fish caught has been highly variable with a peak in 2006 with approximately 87,482 fish caught.

It is interesting to examine Figure 21 alongside Figure 22 as one can observe the large gap between the number of anglers and the total number of fish caught from 2000 to 2005. However, when examining Figure 22 one can see that most trips targeted the salmon fishery which corroborates the results seen in Figure 21 as the salmon fishery has significantly lower bag/catch limits than the rockfish fishery.

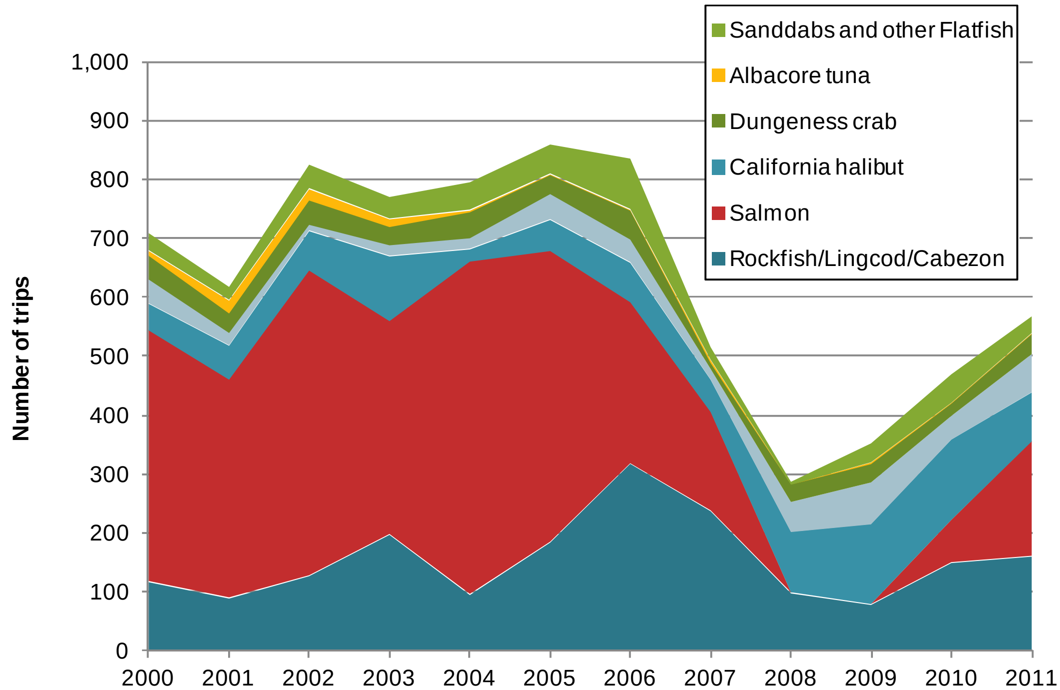
As see in Figure 22, the port of Berkeley conducted a large number of trips targeting the salmon fishery consisting of approximately 45.4 percent of all trips from 2000 to 20011, the rockfish fishery was the second most popular trip with 24.3 percent of all trips, and California halibut trips consisted of 12.3 percent of all trips. Trends in the number of CPFV trips follow those similar to the total number of anglers with a steady number of trips from 2000 to 2006 until a significant decline in 2008 to 2009 during the salmon fishery closures. Since then the total number of trips have begun to recover, with notably relatively more California halibut trips operated.

Figure 21. CPFV total number of fish caught for each fishery, Berkeley, 2000-2011



Source: CDFW CPFV logbook data

Figure 22. Total number of CPFV trips for each target fishery, Berkeley, 2000-2011



Source: CDFW CPFV logbook data

4.3.2. Berkeley CPFV Fisheries Baseline Characterization

We interviewed five CPFV owner/operators in Berkeley and they reported making an average of 94 percent of their total personal income from CPFV fishing. This was higher than the regional average of 72.4 percent and the highest percent of any port in the region. Additionally, as shown in Table 46, the average CPFV operator from Berkeley is 52.3 years old, has 23.4 years of experience owning a CPFV vessel and has 24.2 years of experience operating a CPFV vessel. Only one person we spoke to indicated they had an additional source of income in addition to CPFV operations and that was another type of fishing related work (Table 47).

Table 46. CPFV survey response statistics, 2010, Berkeley

	Response	Standard deviation	Number responding
Individuals interviewed	5	n/a	n/a
Owner only	—	n/a	n/a
Average age	52.3	11.5	4
Average number of years owning CPFV boat/s	23.4	9.2	5
Average number of years operating CPFV boat/s	24.2	8.9	5
Average percent income from CPFV operations in 2010	94.0%	13.4%	5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 47. Sources of income in 2010 in addition to CPFV operation, Berkeley

	Fishery					Activity				
Response	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^	All target fisheries/ activities (unique individuals)
Construction/Contractor	—	—	—	—	*	—	—	—	—	—
Harbor/City job	—	—	—	—	*	—	—	—	—	—
Other fishing/boating related work	1	—	1	—	*	—	—	—	—	1
Other specialized work	—	—	—	—	*	—	—	—	—	—
Property management	—	—	—	—	*	—	—	—	—	—
Retirement/Social Security/Investments	—	—	—	—	*	—	—	—	—	—
Skilled labor	—	—	—	—	*	—	—	—	—	—
Number of individuals responding	1	—	1	—	*	—	—	—	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

The average CPFV owner/operator in Berkeley reported earning a gross economic revenue (GER) of $169,000 in 2010, higher than the regional average of $105,423 (and the highest of any port). Additionally, respondents in Berkeley reported they spent an average of 27.3 percent of their GER on fuel, 13 percent on crew, and 20.5 percent on other operational expenses. Expenses for fuel were lower in Berkeley than the study region as a whole (22.9 percent for the region) but higher for crew and other operating costs (12.3 percent and 37.5 respectively for the region). After costs, respondents in Berkeley made an average net revenue of $66,332 in 2010

Table 48. Average CPFV gross economic revenue (GER) to operating costs in 2010, Berkeley

	Number responding	Average response	Standard deviation
Total GER 2011	3	$169,000	$107,764
% GER to fuel	4	27.3%	6.8%
% GER to crew	4	13.0%	4.8%
% GER to other operating costs	4	20.5%	4.2%

Source: Current study

As shown below in Table 49, in 2010 all respondents from Berkeley conducted consumptive trips and two reported non consumptive trips. The average fishing trip from Berkeley was $95, which was less than the regional average of $103. However, fishing trips were more frequent (118.9 trips per year compared the regional average of 78.9), had more passengers (15.4 per trip compared to the regional average of 12.1), and had more crew (1.8 crew members per trip compared to the regional average of 1.2). Non-consumptive trips were less frequent than the regional average, occurring in Berkeley 4.5 times during the year compared to 35.4 trips per year on average across the study region.

Table 49. CPFV trip statistics, 2010, Berkeley

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	5	n/a	n/a	2	n/a
Average number of trips in 2010	4	118.8	53.0	2	4.5	0.7
Average number of passengers(per trip)	5	15.4	4.2	2	15.0	7.1
Average price per passenger (per trip)	5	$95	$5	2	$70	$42
Average number of crew (per trip)	5	1.8	0.4	2	1.0	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

As show in Table 50, California halibut and rockfish were the most frequently targeted CPFV fisheries in Berkeley (63.8 and 41.6 days, respectively) and similarly generated the highest percent of gross economic revenue (41.3 percent and 32.5 percent, respectively).

Table 50. Number of days and percent GER targeting fishery/activity in 2010, CPFV, Berkeley

			Number of days targeting species (2010)			Percent of GER from fishery/activity (2010)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	California halibut	4	4	63.8	22.9	4	41.3%	14.4%
	Dungeness crab	—	—	—	—	—	—	—
	Rockfish	5	5	41.6	29.6	4	32.5%	10.4%
	Salmon	3	3	20.7	9.3	2	15.0%	7.1%
	Striped bass	2	2	65.0	35.4	2	30.0%	—
Activity	Funeral services	—	—	—	—	—	—	—
	Leisure cruises	—	—	—	—	—	—	—
	Whale watching	—	—	—	—	—	—	—
	Other^	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

All CPFV operators were asked to compare their success in each of their target fisheries and non-consumptive activities in 2010 to that of the previous five years. As shown below in Table 33, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the change in success in their fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

In Berkeley, no one indicated in any fishery that they were doing better than in the previous five years. One individual indicated that their success in the California halibut was the same, and all other individuals indicated that their success in specific fisheries was somewhat or significantly worse than the previous five years (Table 51). Similarly to other CPFV ports in the region respondents from Berkeley mentioned mostly regulatory (Table 52) and environmental (Table 53) factors for the decrease in success. All five respondents indicated that MPAs were one of the largest factors impacting their overall success in the rockfish fishery. A few additional economic and other factors are also shown below in Table 54 and Table 55.

Table 51. Overall success in CPFV fishery/activity in 2010 compared to past five years, Berkeley

Fisheries		Number responding	Percent responding: Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	4	—	—	25.0%	50.0%	25.0%
	Dungeness crab	—	—	—	—	—	—
	Rockfish	5	—	—	—	40.0%	60.0%
	Salmon	3	—	—	—	—	100.0%
	Striped bass	1	*	*	*	*	*
Activity	Funeral services	—	—	—	—	—	—
	Leisure cruises	—	—	—	—	—	—
	Whale watching	—	—	—	—	—	—
	Other ^	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 52. Regulatory changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Berkeley

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	2	—	5	1	*	—	—	—	—
	Response	**Count of responses**								
Negative	Regulated season too short	—	—	—	1	*	—	—	—	—
	MPAs	1	—	5	—	*	—	—	—	—
	More pressure on fishery	2	—	—	—	*	—	—	—	—
	Rockfish Conservation Areas	—	—	—	—	*	—	—	—	—
Positive	Fishery closed in previous seasons	—	—	—	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 53. Environmental changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Berkeley

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	3	—	1	3	*	—	—	—	—
	Response	**Count of responses**								
Positive	Large quantity of fish	—	—	—	—	*	—	—	—	—
	Peak of natural cycle	—	—	—	—	*	—	—	—	—
	Good ocean conditions	—	—	—	—	*	—	—	—	—
Negative	Low quantity of fish	1	—	—	3	*	—	—	—	—
	Low of natural cycle	—	—	—	—	*	—	—	—	—
	Bad weather	—	—	—	—	*	—	—	—	—
	Poor ocean conditions	2	—	—	—	*	—	—	—	—
	More bait/feed in water - causing fish to bite less	—	—	—	—	*	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	—	*	—	—	—	—
	Fish are smaller	—	—	1	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 54. Economic changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Berkeley

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	—	1	1	*	—	—	—	—
	Response	**Number responding**								
Positive	Good/new market opportunity	—	—	—	—	*	—	—	—	—
Negative	Lack of customers	—	—	1	1	*	—	—	—	—
	Bad economy	—	—	—	—	*	—	—	—	—
	Fuel costs	—	—	—	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 55. Other changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Berkeley

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	1	—	—	—	*	—	—	—	—
	Response	**Number responding**								
Positive	Diversifying portfolio of fisheries/activities	—	—	—	—	*	—	—	—	—
	Putting more effort into fishery/activity	—	—	—	—	*	—	—	—	—
Negative	Others are diversifying - adding competition to fishery/activity	—	—	—	—	*	—	—	—	—
	Putting less effort into fishery/activity	—	—	—	—	*	—	—	—	—
	Personal reasons	—	—	—	—	*	—	—	—	—
	Too many other boats/overcrowding	—	—	—	—	*	—	—	—	—
	Drag boats are depleting resource	1	—	—	—	*	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

4.4. Emeryville

Emeryville, in Alameda County, lies adjacent to the Bay Bridge between the cities of Oakland and Berkeley. The area was originally inhabited by an indigenous group, now called the Ohlone. The first Europeans came to the San Francisco Bay area in 1769 from Spain and in 1859 an American, Joseph Emery, purchased large land tracts and began to develop the city of Emeryville. Emeryville began as an industrial town, for shipping, meat packing, paint, and ironworks, but these industries have been replaced in present day by software and biotech companies (City of Emeryville 2013). The 2010 US Census reports Emeryville's population as 10,080 residents, and the estimated per capita income was $52,258 (2007-2011) with a mean household income of $89,385 (US Census Bureau 2010). In the 1970s, the city began building what is now Marina Park, which is home to two marinas, one public and one private. The marina features a public ramp, fuel dock, and is near vessel haul out and maintenance services. Several CPFV operators run out of this marina and offer trips both in and outside the bay.

Emeryville CPFV operators target various species including rockfish, lingcod, salmon, Dungeness crab, sturgeon, Jumbo/Humboldt squid, and albacore tuna. Additionally, they also offer 'potluck' fishing at a fixed rate, which is fishing for whatever the season and day's conditions dictate. The fleet of vessels (30-57 feet) can accommodate a range of customers (up to 35 persons) and take reservations for large groups or individuals. Prices can vary on the type and length of trip, but generally range from $85 to $350 per person. Fishing rods and tackle can be rented on most vessels, but customers are expected to bring state issued recreational fishing licenses and appropriate stamps (Emeryville Sport Fishing 2013).

4.4.1. Emeryville CPFV Fisheries Historical Trends and Initial Changes

This section provides a summary and analysis of California Department of Fish and Wildlife (CDFW) CPFV logbook data from 2000 to 2011 to provide historical trends and initial changes in CPFV fishing characteristics since MPA implementation. Trips into the North Central Coast region by CPFV operators from ports outside the North Central Coast region were not included in the analyses provided. The following types of information listed below are found in the port level section:

1. Total number of vessels, anglers, and trips
2. Average number of anglers per trip and per vessel
3. Average number of trips per vessel
4. Total number of fish caught for select species/fisheries
5. Total number of trips for each target species/fishery

CPFV operators are required to complete and submit a log to the CDFW for each fishing trip. This log includes information on the catch (number caught by species) and effort (number of anglers) for each trip as well as the port of departure and the Fish and Wildlife Block in which most of the fishing occurs. A limited number of species are listed on the log. Operators can write in species that are not listed, or combine species into a group species category such as "Unidentified Rockfish." Some species, such as several of the nearshore rockfishes, are listed on the log, but operators may still choose to put these into a group category. Consequently, species summaries are provided at the most accurate level, which for the nearshore rockfish is the group rockfish.

As noted in our methods sections, the data provided here is only for fishing trips which fished in the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here.

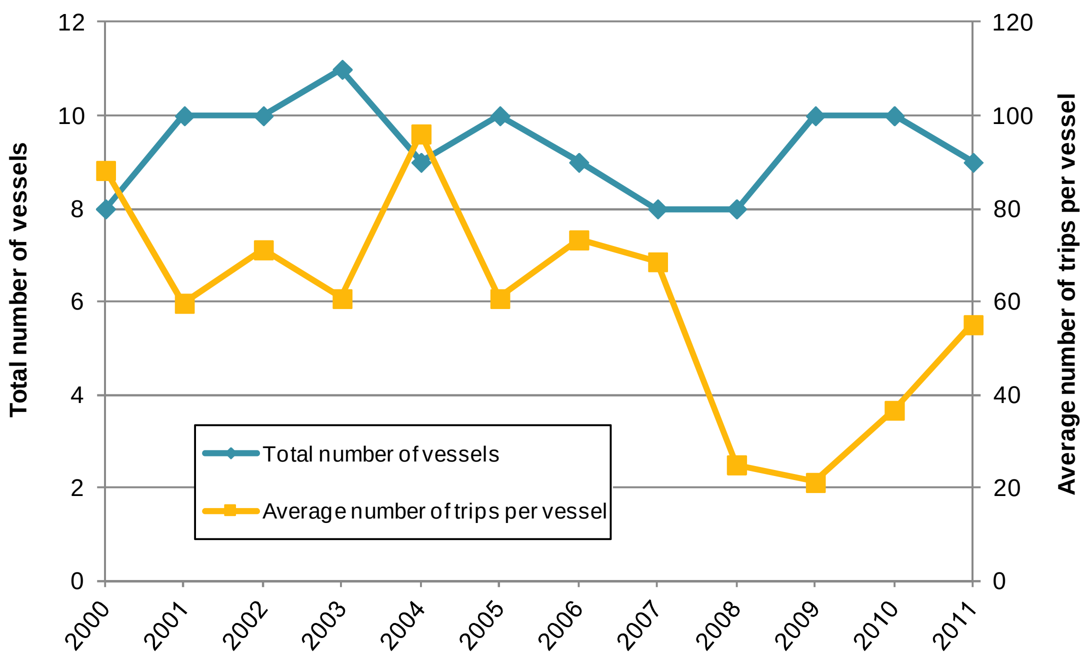
The number of vessels operating out of Emeryville has been relatively steady from 2000 to 2011 starting from one of its lowest of 8 vessels in 2000 to a peak of 11 vessels in 2003 to 9 vessels in 2011 (Figure 23). The average number of trips per vessel however has been highly variable with a peak in 2004 of an average of 96 trips per vessel to a low of 21 trips per vessel in 2009 due to the salmon closures. The average number of trips per vessel has begun to recover again in 2010 but as of 2011 the average number of trips per vessel has not returned to level seen before the salmon closures of 2008 and 2009.

However, in 2011 the average vessel in Emeryville conducts 55 trips, while the regional average is 41 trips.

Indeed, the total number of trips follows similar trends to that of the average number of trips per vessel in that the number of trips was relatively steady from 2000 to 2007 (with a peak in 2004 of 865 trips) until a significant decline in 2008 and 2009 (Figure 24). In 2008, the total number of trips reached its lowest point in the study period with 200 trips total. The total number of trips has increased since its low in 2008 however has not recovered to the number of trips seen before 2008.

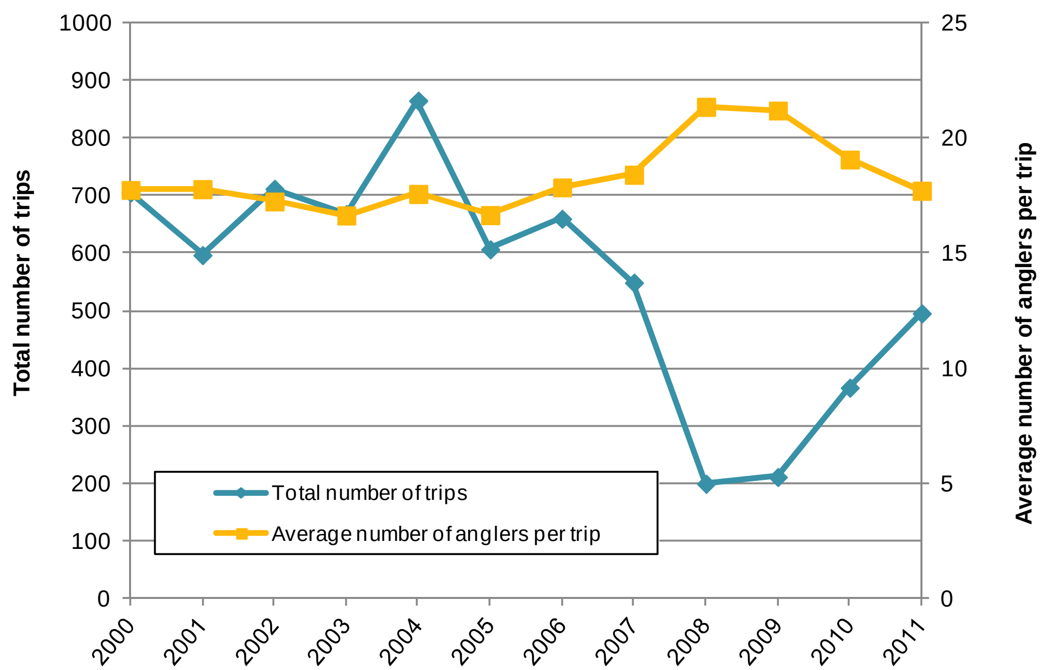
The total number of CPFV anglers in Emeryville as well as the average number of anglers per vessel followed similar variable but generally decreasing trends from 2000 to 2011. The total number of anglers was at its highest point in the study period in 2004 (15,204 anglers) and at its lowest in 2008 (4,271 anglers). Since salmon has reopened the total number of angler has been increasing but has not returned to level seen before 2008 (Figure 25).

Figure 23. Total number of CPFV vessels and average number of trips per vessel, Emeryville, 2000-2011



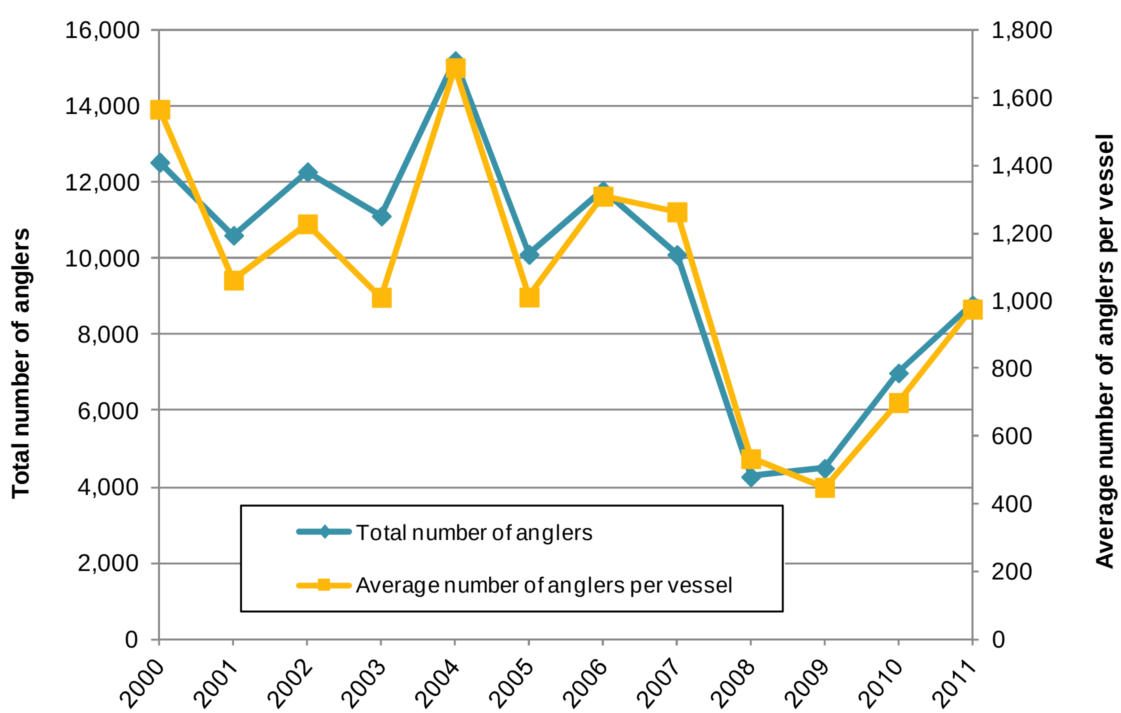
Source: CDFW CPFV logbook data

Figure 24. Total number of CPFV trips and average number of anglers per trip, Emeryville, 2000-2011



Source: CDFW CPFV logbook data

Figure 25. Total number of CPFV anglers and average number of anglers per vessel, Emeryville, 2000-2011

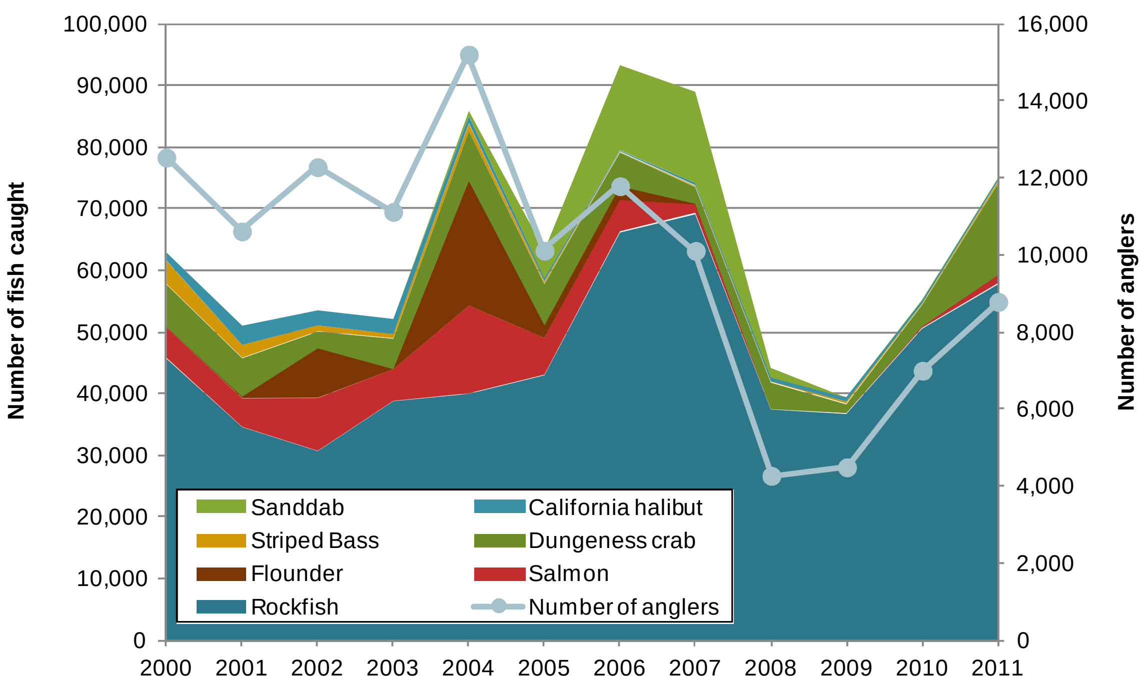


Source: CDFW CPFV logbook data

As seen in Figure 26 the vast majority of the total number of fish caught in Emeryville are rockfish (approximately 67.7 percent of total fish caught from 2000 to 2011) followed by Dungeness crab (8.34 percent of total fish caught from 2000 to 2011), and salmon (6.33 percent. The total number of fish caught has been highly variable but not as variable as other ports as Emeryville perhaps due to its relatively more diversified fisheries portfolio. The total number of fish caught peaked in 2005 with 102,859 fish caught and a low of 40,602 fish caught in 2009.

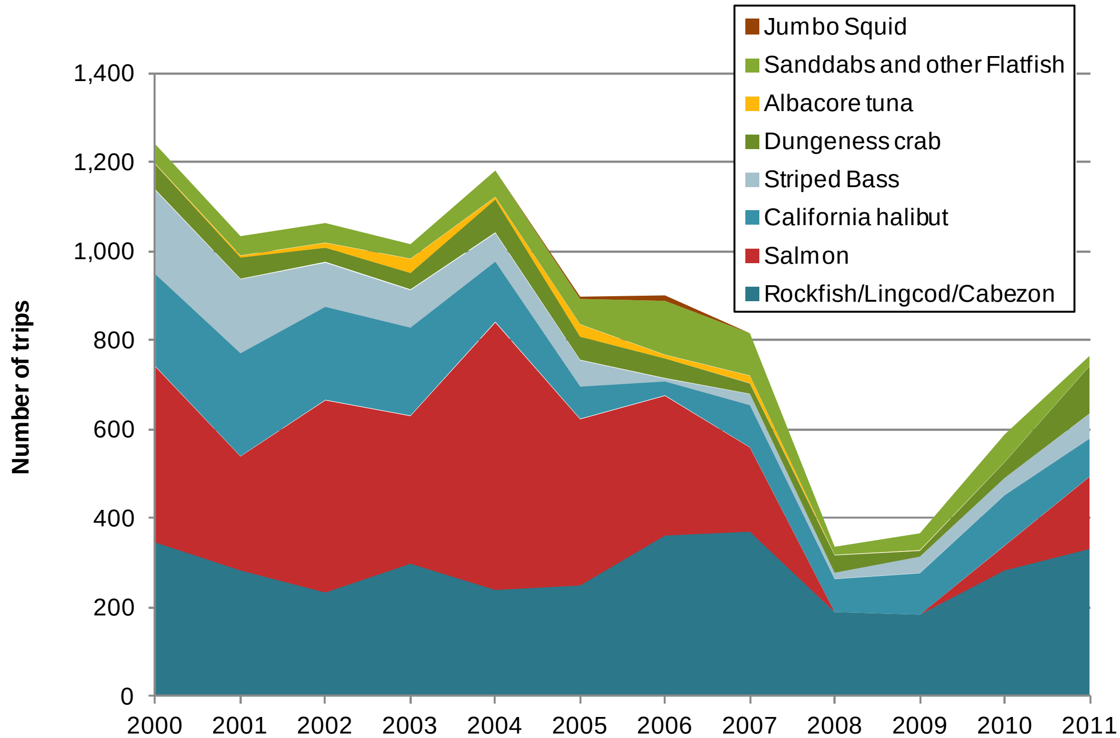
Despite rockfish's dominance in the total number of fish caught, approximately 33 percent of CPFV trips primarily target rockfish while 30.5 percent of trips primarily target salmon, 15.2 percent of trips targeted California halibut, and 8.2 percent of trips targeted striped bass. As with most other trends in the region, the total number of CPFV trips has been declining from 2000 to 2011, starting with a peak in 2000 (1,242 trips) with a major decline in 2008 (334 trips) and 2009 (365 trips) and moderate increases to approximately 764 trips in 2011.

Figure 26. CPFV total number of fish caught for each fishery, Emeryville, 2000-2011



Source: CDFW CPFV logbook data

Figure 27. Total number of CPFV trips for each target fishery, Emeryville, 2000-2011



Source: CDFW CPFV logbook data

4.4.2. Emeryville CPFV Fisheries Baseline Characterization

We interviewed four owner/operators from Emeryville who were, on average 49.5 years old. On average, they indicated they had 17.7 years of experience owning and 19.8 years of experience operating a CPFV vessel. They reported, on average, making 78.8 percent of their personal income from CPFV operations, slightly more than the regional average of 72.4 percent (Table 56). Only two respondents indicated they had sources of income other than CPFV operation and that these jobs were related in some way to the fishing industry (Table 57).

Table 56. CPFV survey response statistics, 2010, Emeryville

	Response	Standard deviation	Number responding
Individuals interviewed	4	n/a	n/a
Owner only	—	n/a	n/a
Average age	49.5	3.1	4
Average number of years owning CPFV boat/s	17.7	6.1	3
Average number of years operating CPFV boat/s	19.8	6.5	4
Average percent income from CPFV operations in 2010	78.8%	25.3%	4

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 57. Sources of income in 2010 in addition to CPFV operation, Emeryville

Response	Fishery					Activity				
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^	All target fisheries/ activities (unique individuals)
Construction/Contractor	—	*	—	—	—	—	*	*	*	—
Harbor/City job	—	*	—	—	—	—	*	*	*	—
Other fishing/boating related work	1	*	2	2	1	—	*	*	*	2
Other specialized work	—	*	—	—	—	—	*	*	*	—
Property management	—	*	—	—	—	—	*	*	*	—
Retirement/Social Security/Investments	—	*	—	—	—	—	*	*	*	—
Skilled labor	—	*	—	—	—	—	*	*	*	—
Number of individuals responding	1	*	2	2	1	—	*	*	*	2

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

The average CPFV owner/operator in Emeryville reported earning a gross economic revenue (GER) of $126,667 in 2010 (Table 58), which is higher than the regional average of $105,423. Additionally, respondents in Emeryville reported they spent an average of 24.3 percent of their GER on fuel, 11 percent on crew, and 23.7 percent on other operational expenses. All of the expenses listed above were lower than the study region as a whole (22.9 percent, 12.3 percent, and 37.5 respectively for the region). After costs, respondents in Emeryville made an average net revenue of $51,933 in 2010

Table 58. Average CPFV gross economic revenue (GER) to operating costs in 2010, Emeryville

	Number responding	Average response	Standard deviation
Total GER 2011	3	$126,667	$64,291
% GER to fuel	3	24.3%	7.5%
% GER to crew	3	11.0%	4.6%
% GER to other operating costs	3	23.7%	5.5%

Source: Current study

Three of the four respondents who reported fishing trips in Emeryville also reported operating non-consumptive trips in 2012. Fewer fishing trips were reported in 2010 in Emeryville than on average elsewhere in the region (63.3 trips per year compared to the regional average of 78.9) but they averaged a higher number of passengers (16.3 passengers per trip compared to the regional average of 12.1).

Table 59. CPFV trip statistics, 2010, Emeryville

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	4	n/a	n/a	3	n/a
Average number of trips in 2010	3	63.3	41.6	2	25.0	28.3
Average number of passengers(per trip)	4	16.3	7.5	3	16.0	13.5
Average price per passenger (per trip)	4	$104	$38	1	$150	n/a
Average number of crew (per trip)	4	0.8	0.5	3	0.7	0.6

Source: Current study

Similar to Berkeley, California halibut accounted for the largest percent of the average Emeryville respondents' CPFV related gross economic revenue (51.5 percent) and was also the most frequently targeted fishery (53 days per year). This is the highest percent of GER attributed to California halibut of all ports across the study region. Additionally, salmon was only targeted an average of 6.8 days per year in Emeryville and generated only 3.7 percent of the average individuals' gross economic revenue. This is less than the regional average of 22.1 days per year and 25.8 percent of the average individuals' gross economic revenue. More information can be found below in Table 60.

Table 60. Number of days and percent GER targeting fishery/activity in 2010, CPFV, Emeryville

			Number of days targeting species (2010)			Percent of GER from fishery/activity (2010)		
	Fishery/activity	Number interviewed	Number responding	Average	Standard deviation	Number responding	Average	Standard deviation
Fishery	California halibut	3	3	53.0	19.9	2	51.5%	16.3%
	Dungeness crab	2	2	*	*	2	*	*
	Rockfish	4	4	44.3	20.6	3	29.0%	3.6%
	Salmon	4	4	6.8	5.5	3	3.7%	2.3%
	Striped bass	3	3	36.3	25.1	2	11.0%	12.7%
Activity	Funeral services	—	—	—	—	—	—	—
	Leisure cruises	1	1	*	*	1	*	*
	Whale watching	2	2	4.0	2.8	2	5.0%	4.2%
	Other^	1	1	*	*	1	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

All CPFV operators were asked to compare their success in each of their target fisheries and non-consumptive activities in 2010 to the previous five years. As shown below in Table 61, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the change in success in their fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

One Emeryville respondent explained that he felt his success in the 2010 salmon fishery was somewhat better but noted that 2007 was a poor salmon year and that the fishery was closed all together in 2008 and 2009. Others said that 2010 was generally worse than the previous five years even though they were allowed a limited season (Table 62). All respondents indicated their success in the striped bass, rockfish, and California halibut fisheries were worse or the same. Three fishermen noted that MPAs were one of the primary factors impacting their overall success in the rockfish fishery (Table 62) and one mentioned there was a low quantity of rockfish available (Table 63).

Table 61. Overall success in CPFV fishery/activity in 2010 compared to past five years, Emeryville

		Number responding	Percent responding: Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	3	—	—	—	100.0%	—
	Dungeness crab	2	*	*	*	*	*
	Rockfish	4	—	—	50.0%	25.0%	25.0%
	Salmon	4	—	25.0%	—	50.0%	25.0%
	Striped bass	3	—	—	33.3%	66.7%	—
Activity	Funeral services	—	—	—	—	—	—
	Leisure cruises	1	*	*	*	*	*
	Whale watching	2	*	*	*	*	*
	Other ^	1	*	*	*	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 62. Regulatory changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Emeryville

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	*	3	3	—	—	*	*	*
	Response	**Count of responses**								
Negative	Regulated season too short	—	*	—	2	—	—	*	*	*
	MPAs	—	*	3	—	—	—	*	*	*
	More pressure on fishery	—	*	—	—	—	—	*	*	*
	Rockfish Conservation Areas	—	*	—	—	—	—	*	*	*
Positive	Fishery closed in previous seasons	—	*	—	2	—	—	*	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 63. Environmental changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Emeryville

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	2	*	1	2	2	—	*	*	*
	Response	**Count of responses**								
Positive	Large quantity of fish	—	*	—	—	—	—	*	*	*
	Peak of natural cycle	—	*	—	—	—	—	*	*	*
	Good ocean conditions	—	*	—	—	—	—	*	*	*
Negative	Low quantity of fish	1	*	1	2	2	—	*	*	*
	Low of natural cycle	1	*	—	—	—	—	*	*	*
	Bad weather	—	*	—	—	—	—	*	*	*
	Poor ocean conditions	1	*	—	—	—	—	*	*	*
	More bait/feed in water - causing fish to bite less	—	*	—	—	—	—	*	*	*
	Loss of salmon spawning grounds	—	*	—	1	—	—	*	*	*
	Fish are smaller	—	*	—	—	—	—	*	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 64. Economic changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Emeryville

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	*	1	—	—	—	*	*	*
	Response	**Number responding**								
Positive	Good/new market opportunity	—	*	—	—	—	—	*	*	*
Negative	Lack of customers	—	—	—	—	—	—	*	*	*
	Bad economy	—	—	1	—	—	—	*	*	*
	Fuel costs	—	—	—	—	—	—	*	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 65. Other changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Emeryville

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	1	*	—	—	—	—	*	*	*
	Response	**Number responding**								
Positive	Diversifying portfolio of fisheries/activities	—	*	—	—	—	—	*	*	*
	Putting more effort into fishery/activity	—	*	—	—	—	—	*	*	*
Negative	Others are diversifying - adding competition to fishery/activity	—	*	—	—	—	—	*	*	*
	Putting less effort into fishery/activity	1	*	—	—	—	—	*	*	*
	Personal reasons	—	*	—	—	—	—	*	*	*
	Too many other boats/overcrowding	—	*	—	—	—	—	*	*	*
	Drag boats are depleting resource	—	*	—	—	—	—	*	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

4.5. San Francisco

San Francisco, in San Francisco County, is the largest city in the North Central Coast study region, with 805,235 residents, as of the 2010 US Census. The estimated per capita income (2007-2011) was $46,777 with a mean household income of $105,753 (US Census Bureau 2010). The first European settlers arrived in the San Francisco Bay area in 1769 from Spain. Prior to European settlement some 40 different tribal groups inhabited the San Francisco Bay area. The city of San Francisco was built up significantly during the California gold rush and as the gold rush slowed in the late 1840s people started to turn to commercial fishing (Norman et al 2007). Some of the first commercial fishermen in San Francisco were Chinese fishermen in the mid-1850s, followed by Italians in the 1860s (Norman et al, 2007). By 1892, 93% of California's commercial fisheries were centered in San Francisco (Love, 2006). In the early 1900's pollution of the San Francisco Bay and the advancement of fishing gear and vessels led to a shift from nearshore fisheries to offshore fisheries. The sardine fishery peaked in the 1930s and with it came the building of canneries through the region (Norman et al, 2007). Originally, Fisherman's Wharf was the center of commercial fishing in San Francisco and has been expanded several times as the fishing fleet has been built out, and new fisheries exploited. More recently, Fisherman's Wharf has turned into more of a tourist destination, but does still serve several commercial fishermen, with full-service repair shop, dry docks, fuel, ice and other supplies. Pier 45 has become the hub of commercial fishing activity, home to the West coast's largest concentration of commercial fish processors and distributors (Norman et al, 2007).

Many CPFV operators are currently located at Fisherman's Wharf and this serves as the departure point for fishing trips and non-consumptive activities both in the bay and the open ocean. Several CPFV operators line the main street adjacent to Fisherman's Wharf and offer passing tourists opportunities to join 1 to 2 hour leisure cruises. CPFV operators in San Francisco thus largely run non-consumptive trips and the less frequently conduct fishing trips. CPFV operators often have to wait many years for boat slips in this area of Fisherman's Wharf to open up as non-consumptive trips offer a steadier and more reliable revenue stream than fishing trips.

San Francisco CPFV operators largely target the recreational salmon fishery but also target various other species including rockfish, lingcod, Dungeness crab, Jumbo/Humboldt squid, and albacore tuna. Additionally, they also offer 'potluck' fishing at a fixed rate, which is fishing for whatever the season and day's conditions dictate. From Fisherman's Wharf, a fleet of vessels (30-65 feet) can accommodate a range of customers (up to 40 persons) and take reservations for large groups or individuals. Prices can vary on the type and length of trip. Fishing rods and tackle can be rented on most vessels, but customers are expected to bring state issued recreational fishing licenses and appropriate stamps (San Francisco Sport Fishing 2013).

4.5.1. San Francisco CPFV Fisheries Historical Trends and Initial Changes

This section provides a summary and analysis of California Department of Fish and Wildlife (CDFW) CPFV logbook data from 2000 to 2011 to provide historical trends and initial changes in CPFV fishing characteristics since MPA implementation. Trips into the North Central Coast region by CPFV operators from ports outside the North Central Coast region were not included in the analyses provided. The following types of information listed below are found in the port level section:

1. Total number of vessels, anglers, and trips
2. Average number of anglers per trip and per vessel
3. Average number of trips per vessel
4. Total number of fish caught for select species/fisheries
5. Total number of trips for each target species/fishery

CPFV operators are required to complete and submit a log to the CDFW for each fishing trip. This log includes information on the catch (number caught by species) and effort (number of anglers) for each trip as well as the port of departure and the Fish and Wildlife Block in which most of the fishing occurs. Only a certain number of species are listed on the log. Operators can write in species that are not listed, or combine species into a group species category such as “Unidentified Rockfish.” Some species, such as several of the nearshore rockfishes, are listed on the log, but operators may still choose to put these into a group category. Consequently, species summaries are provided at the most accurate level, which for the nearshore rockfish is the group rockfish.

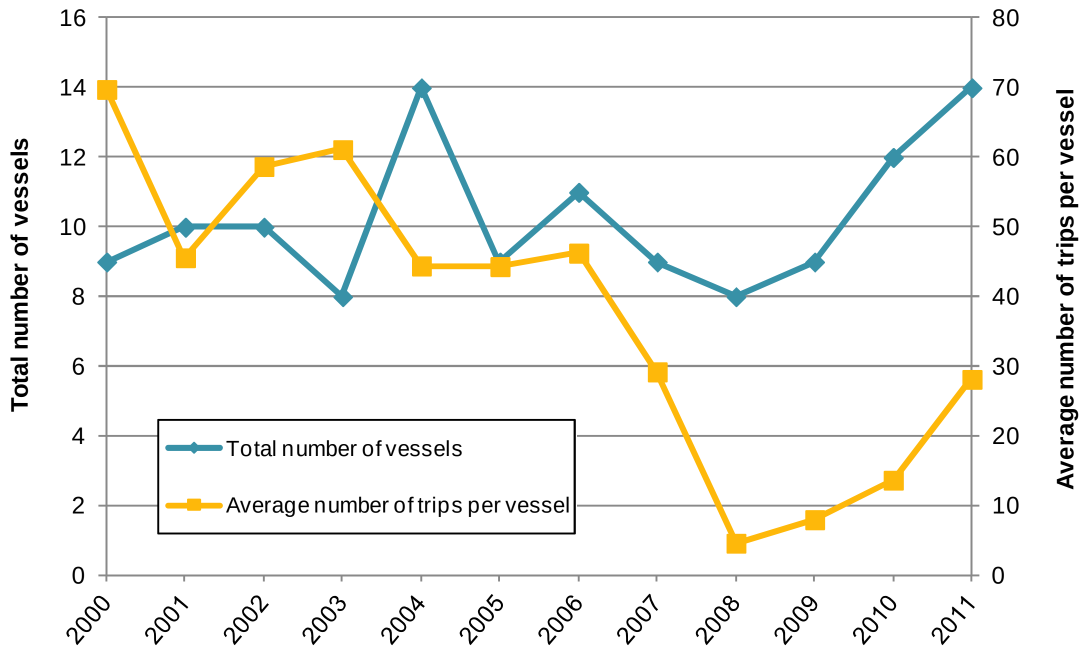
As noted in our methods sections, the data provided here is only for fishing trips which fished in the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here.

The number of vessels operating out of San Francisco has been variably increasing from 2000 to 2011 starting with 9 vessels operating in the port to a peak of 14 vessels in 2011 (Figure 28). The average number of trips per vessel however has been significantly decreasing with its peak in 2000 of an average of 70 trips per vessel to a low in 2008 of 5 trips per vessel increasing to approximately 28 trips per vessel in 2011. The average number of trips per vessel in 2011 for San Francisco is significantly lower than the regional average of 41 trips per vessel. This may be due to the fact that CPFV operators in San Francisco may also conduct a significant amount of non-consumptive trips to accommodate San Francisco tourists.

The total number of trips follows similar trends to that of the average number of trips per vessel in that the number of trips was variably steady from 2000 to 2007 (with a peak in 2004 of 622 trips) until a significant decline in 2008 and 2009 (Figure 29). In 2008, the total number of trips reached its lowest point in the study period with 37 trips total. The total number of trips has increased since its low in 2008 however has not recovered to the number of trips seen before 2008.

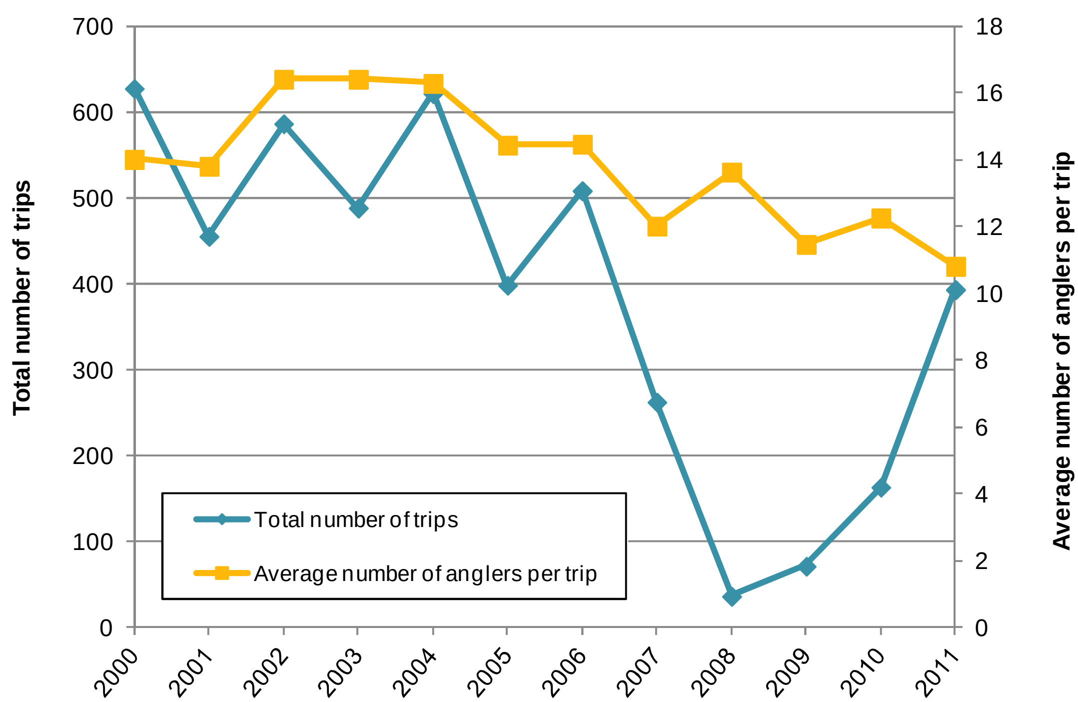
The total number of CPFV anglers in San Francisco as well as the average number of anglers per vessel followed similar variable but generally decreasing trends from 2000 to 2011. The total number of anglers was at its highest point in the study period in 2004 (10,149 anglers) and at its lowest in 2008 (505 anglers). Since salmon has reopened the total number of angler has been increasing but has not returned to levels seen before 2008 (Figure 30).

Figure 28. Total number of CPFV vessels and average number of trips per vessel, San Francisco, 2000-2011



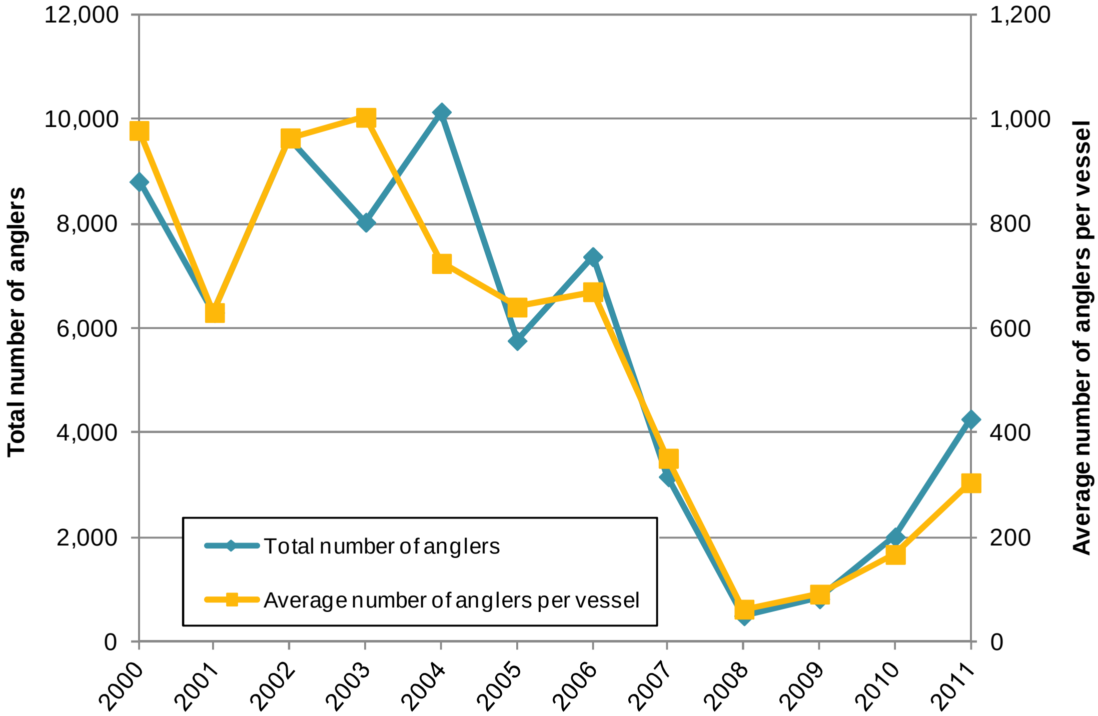
Source: CDFW CPFV logbook data

Figure 29. Total number of CPFV trips and average number of anglers per trip, San Francisco, 2000-2011



Source: CDFW CPFV logbook data

Figure 30. Total number of CPFV anglers and average number of anglers per vessel, San Francisco, 2000-2011

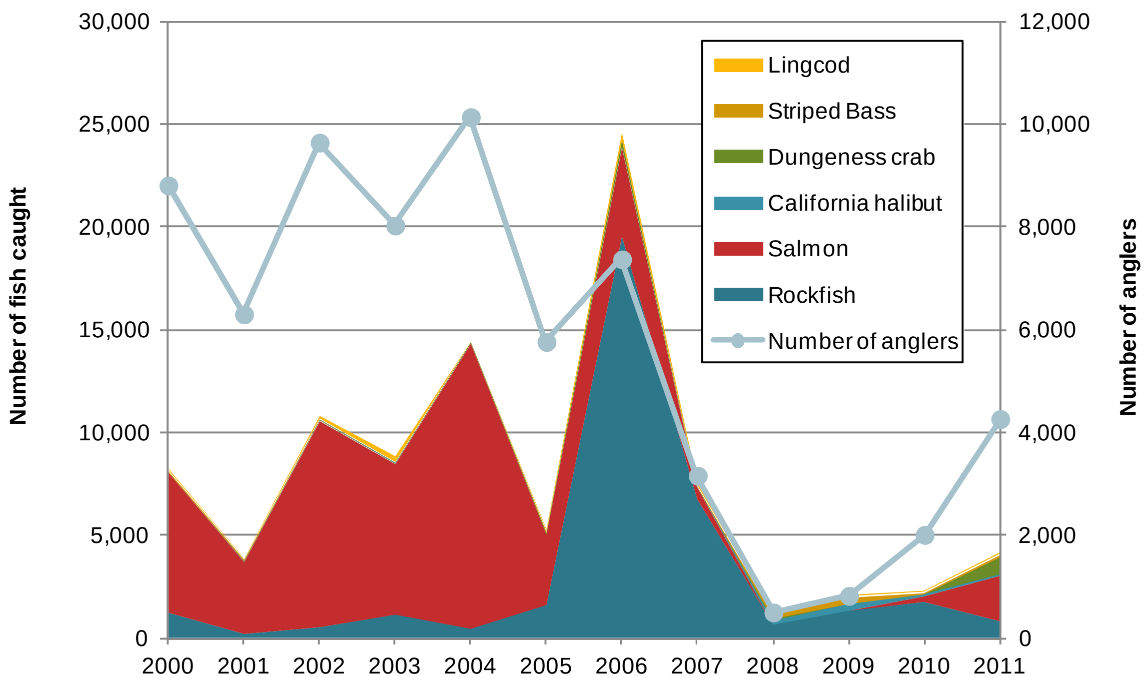


Source: CDFW CPFV logbook data

As seen in Figure 31 the two major fish caught by CPFV anglers in San Francisco are salmon (55.1 percent of catch) and rockfish (37.8 percent of catch). The CPFV port of San Francisco and Sausalito are similar in that both these ports rely heavily on the salmon fishery. The total number of fish caught has been variable with a peak of 25,036 fish caught in 2006 and a low of 1,294 fish caught in 2008. Since the salmon closures in 2008 and 2009 the number of fish caught has remained at levels generally lower than those observed before 2008 (with the exception of 2001).

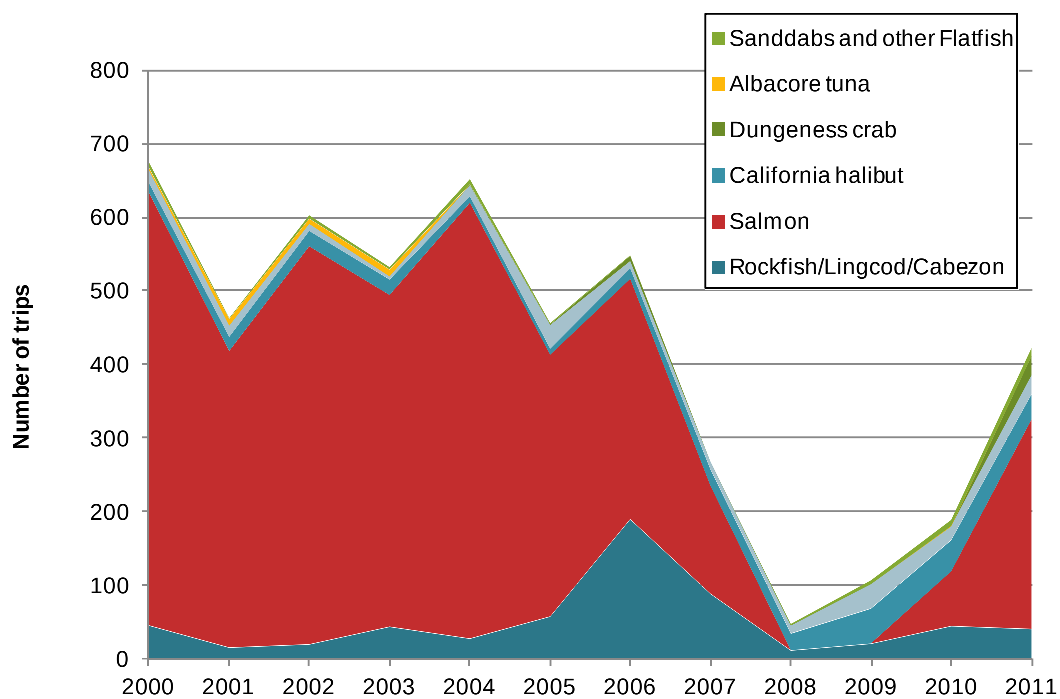
From Figure 32 is clear that the majority of trips (75.6 percent of trips from 2000 to 2011) operated from San Francisco are targeting the salmon fishery. The total number of trips in 2000 peaked with 674 total trips declined drastically in 2008 to 49 total trips. Since the salmon closures in 2008 and 2009 the total number of trips has increased with 423 total trips in 2011.

Figure 31. CPFV total number of fish caught for each fishery, San Francisco, 2000-2011



Source: CDFW CPFV logbook data

Figure 32. Total number of CPFV trips for each target fishery, San Francisco, 2000-2011



Source: CDFW CPFV logbook data

4.5.2. San Francisco CPFV Fisheries Baseline Characterization

We interviewed five individuals in San Francisco, three of which were owner/operators, one of whom was an owner only, and lastly, one operator that worked for the owner. Table 66 and Table 67 include responses from both the owner and operator as well as the owner/operators, however the rest of the tables in this section include responses from the three owner/operators and *either* the owner or the operator of the remaining operation.

The average CPFV respondent in San Francisco was 39.2 years old in 2010 which is younger than the average respondent across the study region (50.2 years). Respondents from San Francisco indicated that an average of 57.5 percent of their total personal income came from CPFV fishing in 2010. This was the lowest average of any port in the study region. More information can be found below in Table 66.

Table 66. CPFV survey response statistics, 2010, San Francisco

	Response	Standard deviation	Number responding
Individuals interviewed	5	n/a	n/a
Owner only	1	n/a	n/a
Average age	39.2	16.0	5
Average number of years owning CPFV boat/s	20.3	4.5	4
Average number of years operating CPFV boat/s	14.0	12.5	3
Average percent income from CPFV operations in 2010	57.5%	29.9%	4

Source: Current study

As shown below in Table 67, three of the five respondents indicated they had other sources of income aside from CPFV operations. Two indicated this additional source was related in some way to the fishing industry and the other mentioned specialized work (we defined this as something that requires a special degree or license).

Table 67. Sources of income in 2010 in addition to CPFV operation, San Francisco

Response	Fishery: California halibut	Fishery: Dungeness crab	Fishery: Rockfish	Fishery: Salmon	Fishery: Striped bass	Activity: Funeral services	Activity: Leisure cruises	Activity: Whale watching	Activity: Other^	All target fisheries/ activities (unique individuals)
Construction/Contractor	—	—	—	*	—	—	*	*	—	—
Harbor/City job	—	—	—	*	—	—	*	*	—	—
Other fishing/boating related work	1	—	1	*	1	—	*	*	—	2
Other specialized work	1	—	1	*	1	—	*	*	—	1
Property management	—	—	—	*	—	—	*	*	—	—
Retirement/Social Security/Investments	—	—	—	*	—	—	*	*	—	—
Skilled labor	—	—	—	*	—	—	*	*	—	—
Number of individuals responding	2	—	2	*	2	—	*	*	—	3

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

The average CPFV owner/operator in San Francisco reported earning a gross economic revenue (GER) of $75,000 in 2010, which is lower than the regional average of $105,423. Additionally, respondents in San Francisco reported they spent an average of 16.7 percent of their GER on fuel, 18.3 percent on crew, and 30.7 percent on other operational expenses. Expenses for crew in San Francisco were higher than the study region as a whole (12.3 percent for the region) but lower for fuel and other operating costs (22.9 percent and 37.5 percent for the entire study region). After costs, respondents in San Francisco made an average net revenue of $25,750 in 2010.

Table 68. Average CPFV gross economic revenue (GER) to operating costs in 2010, San Francisco

	Number responding	Average response	Standard deviation
Total GER 2011	3	$75,000	$35,000
% GER to fuel	3	16.7%	4.2%
% GER to crew	3	18.3%	20.2%
% GER to other operating costs	3	30.7%	16.2%

Source: Current study

The average respondent operated 70 fishing trips with 12.7 passengers at a price of $115 per passenger and had two crew members on board. Additional information is shown below in Table 69. The two respondents who indicated they operated non-consumptive trips reported an average of 91.5 trips per year, much higher than the regional average of 35.4 trips. However, these trips averaged only $28 per passenger per trip, which is much lower than the regional average of $69. Lastly, in San Francisco, the average non-consumptive trip has 42 passengers on board while the regional average was only 17.4 passengers. Additional information is found below in Table 69.

Table 69. CPFV trip statistics, 2010, San Francisco

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	3	n/a	n/a	2	n/a
Average number of trips in 2010	3	70.0	35.0	2	91.5	125.2
Average number of passengers(per trip)	3	12.7	5.9	2	42.0	9.9
Average price per passenger (per trip)	3	$115	$52	2	$28	$18
Average number of crew (per trip)	2	2.0	—	2	2.0	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

San Francisco was the only port in the region where striped bass was the mostly frequently targeted fishery (57 days) and generated the largest proportion of revenue (33.5 percent) compared to other fisheries. When considering the entire study region striped bass was only targeted 37.2 days per year and generated 17.4 percent of gross economic revenue (the second least of all fisheries at the regional level). Additionally, in San Francisco, rockfish was targeted 24.7 days and generated the least amount of gross economic revenue (22 percent). Conversely, across the entire North Central Coast study region rockfish was the second most frequently targeted fishery (39.8 days per year) and generated the largest proportion of gross economic revenue (35 percent). For more information regarding the number of days respondents spent targeting each fishery and the percent of gross economic revenue attributed to each fishery, see Table 70 below.

Table 70. Number of days and percent GER targeting fishery/activity in 2010, CPFV, San Francisco

			Number of days targeting species (2010)			Percent of GER from fishery/activity (2010)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	California halibut	4	3	46.3	37.8	3	27.3%	10.8%
	Dungeness crab	—	—	—	—	—	—	—
	Rockfish	4	3	24.7	30.7	3	22.0%	2.6%
	Salmon	2	2	16.5	12.0	1	*	*
	Striped bass	3	2	57.0	46.7	2	33.5%	2.1%
Activity	Funeral services	—	—	—	—	—	—	—
	Leisure cruises	1	1	*	*	1	*	*
	Whale watching	1	1	*	*	—	—	—
	Other^	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

All CPFV operators were asked to compare their success in each of their target fisheries and non-consumptive activities in 2010 to that of the previous five years. As shown below in Table 71, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 3) somewhat worse; and 4) significantly worse. Respondents were then asked what factors they felt had contributed to the change in success in their fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

Aside from one respondent who indicated that his success in the California halibut fishery was significantly better, all respondents in San Francisco indicated that their success in specific fisheries were either the same or worse (Table 71). The individual who expressed that their success in the California halibut fishery was better specified that there was a large quantity of fish present in 2010 (Table 73). Those who indicated their success was worse mentioned that there was more pressure on the California halibut fishery due to salmon closures and that the MPAs had impacted their overall success (Table 72). The two fishermen who indicated they felt their success in the striped bass fishery was somewhat worse than in the previous five years mentioned MPAs and that they felt more people were targeting the fishery in 2010 (Table 72).

Table 71. Overall success in CPFV fishery/activity in 2010 compared to past five years, San Francisco

			Percent responding				
Fisheries		**Number responding**	**Significantly better**	**Somewhat better**	**The same**	**Somewhat worse**	**Significantly worse**
Fishery	California halibut	4	25.0%	—	25.0%	25.0%	25.0%
	Dungeness crab	—	—	—	—	—	—
	Rockfish	4	—	—	25.0%	25.0%	50.0%
	Salmon	2	*	*	*	*	*
	Striped bass	3	—	—	33.3%	66.7%	—
Activity	Funeral services	—	—	—	—	—	—
	Leisure cruises	1	*	*	*	*	*
	Whale watching	1	*	*	*	*	*
	Other ^	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 72. Regulatory changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, San Francisco

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	2	—	4	1	2	—	*	*	—
	Response	**Count of responses**								
Negative	Regulated season too short	—	—	—	—	—	—	*	*	—
	MPAs	1	—	4	—	1	—	*	*	—
	More pressure on fishery	2	—	—	—	2	—	*	*	—
	Rockfish Conservation Areas	—	—	—	—	—	—	*	*	—
Positive	Fishery closed in previous seasons	—	—	—	1	—	—	*	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 73. Environmental changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, San Francisco

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	1	—	1	*	—	—	*	*	—
	Response	**Count of responses`**								
Positive	Large quantity of fish	1	—	—	*	—	—	*	*	—
	Peak of natural cycle	—	—	—	*	—	—	*	*	—
	Good ocean conditions	—	—	—	*	—	—	*	*	—
Negative	Low quantity of fish	—	—	1	*	—	—	*	*	—
	Low of natural cycle	—	—	—	*	—	—	*	*	—
	Bad weather	—	—	—	*	—	—	*	*	—
	Poor ocean conditions	—	—	—	*	—	—	*	*	—
	More bait/feed in water - causing fish to bite less	—	—	—	*	—	—	*	*	—
	Loss of salmon spawning grounds	—	—	—	*	—	—	*	*	—
	Fish are smaller	—	—	—	*	—	—	*	*	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 74. Other changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, San Francisco

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	1	*	—	—	—	—	*	*	*
	Response	**Number responding**								
Positive	Diversifying portfolio of fisheries/activities	—	*	—	—	—	—	*	*	*
	Putting more effort into fishery/activity	—	*	—	—	—	—	*	*	*
Negative	Others are diversifying - adding competition to fishery/activity	—	*	—	—	—	—	*	*	*
	Putting less effort into fishery/activity	1	*	—	—	—	—	*	*	*
	Personal reasons	—	*	—	—	—	—	*	*	*
	Too many other boats/overcrowding	—	*	—	—	—	—	*	*	*
	Drag boats are depleting resource	—	*	—	—	—	—	*	*	*

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

4.6. Half Moon Bay

Half Moon Bay, in San Mateo County, is 30 miles south of San Francisco, on the Pacific coast of the San Francisco peninsula. According to the 2010 US Census, the population of Half Moon Bay was 11,324 residents, and the estimated per capita income (2007-2011) was $47,909 with a mean household income of $124,970 (US Census Bureau 2010), and the sector with the highest employment in 2006 was 'educational, health and social services' (CDFG 2007). Like much of the surrounding region, the first European settlers arrived in 1769 from Spain. Prior to European settlement some 40 different tribal groups inhabited the San Francisco Bay area. Originally settled as a ranch during Mexican rule, the town of Half Moon Bay is the oldest in San Mateo County (Norman et al, 2007). The Pillar Point Harbor at the north end of Half Moon Bay is officially in a smaller town called Princeton and serves both commercial fishermen and CPFV operators. Additionally, a popular feature of the Harbor is that the public can buy fresh fish directly from fishermen selling from their boats. Located at this port is a boat ramp and 2000 pound hoist mainly for dinghies (Norman et al. 2007, California Coastal Commission 2003).

Half Moon Bay CPFV operators target various species including rockfish, lingcod, salmon, Dungeness crab, Jumbo/Humboldt squid, and Albacore tuna. From Pillar Point Harbor, a fleet of vessels (30-65 feet) can accommodate a range of customers (up to 40 persons) and take reservations for large groups or individuals. Prices can vary depending on the type and length of trip. Fishing rods and tackle can be rented on most vessels, and some vessels can provide fishing licenses on board (San Francisco Sport fishing 2013 and Huli Cat 2013).

4.6.1. Half Moon Bay CPFV Fisheries Historical Trends and Initial Changes

This section provides a summary and analysis of California Department of Fish and Wildlife (CDFW) CPFV logbook data from 2000 to 2011 to provide historical trends and initial changes in CPFV fishing characteristics since MPA implementation. Trips into the North Central Coast region by CPFV operators from ports outside the North Central Coast region were not included in the analyses provided. The following types of information listed below are found in the port level section:

1. Total number of vessels, anglers, and trips
2. Average number of anglers per trip and per vessel
3. Average number of trips per vessel
4. Total number of fish caught for select species/fisheries
5. Total number of trips for each target species/fishery

CPFV operators are required to complete and submit a log to the CDFW for each fishing trip. This log includes information on the catch (number caught by species) and effort (number of anglers) for each trip as well as the port of departure and the Fish and Wildlife Block in which most of the fishing occurs. Only a certain number of species are listed on the log. Operators can write in species that are not listed, or combine species into a group species category such as "Unidentified Rockfish." Some species, such as several of the nearshore rockfishes, are listed on the log, but operators may still choose to put these into a group category. Consequently, species summaries are provided at the most accurate level, which for the nearshore rockfish is the group rockfish.

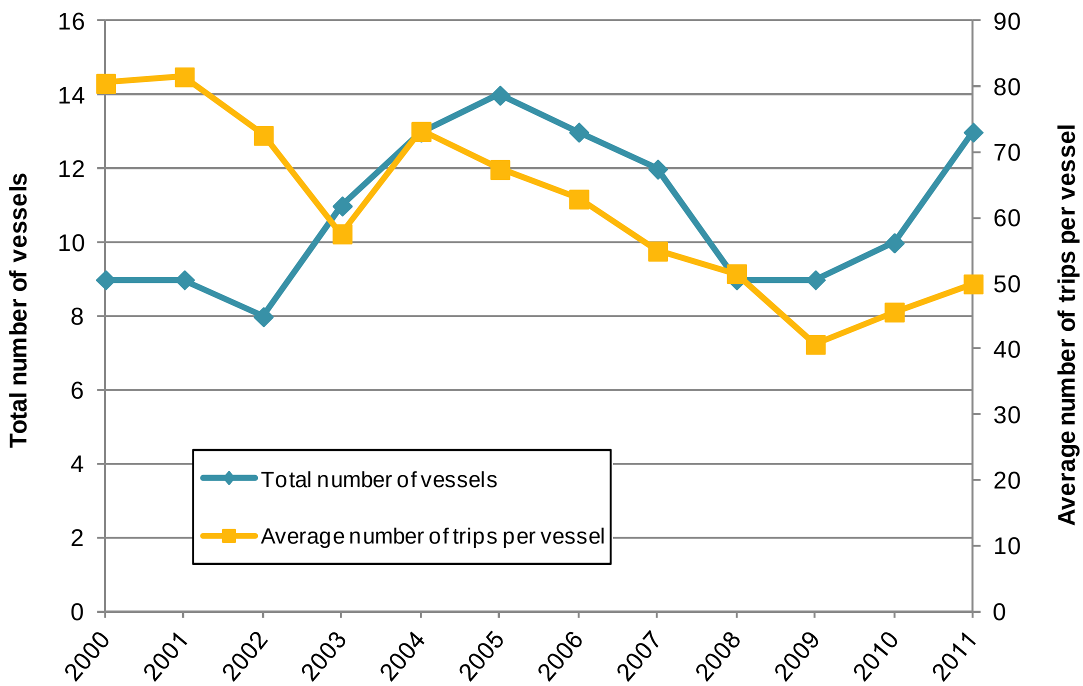
As noted in our methods sections, the data provided here is only for fishing trips which fished in the North Central Coast region which does not include the San Francisco Bay. Thus, fishing trips which wholly fished from the San Francisco bay are not included in the CFPV logbook data results provided here.

The number of vessels operating out of Half Moon Bay has been variably increasing from 2000 to 2011 starting with 9 vessels operating in the port to a peak of 14 vessels in 2005 and in 2011 with 13 vessels in operation (Figure 33). The average number of trips per vessel however has been decreasing with its peak in 2001 of an average of 82 trips per vessel to a low in 2009 of 41 trips per vessel increasing to approximately 50 trips per vessel in 2011. It is interesting to note that in 2009 (during the second salmon season closure in the study period) that the regional average number of trips per vessel was 22 trips as compared to the Half Moon Bay average of 41 trips. As see in Figure 37 below, Half Moon Bay CPFV operators were able to operate CPFV well above the regional average during the salmon season closures as they also operate a large amount of rockfish fishing trips as well.

The total number of trips in Half Moon Bay is variable from 2000 to 2011 with a peak in 2004 with 952 trips to a low in 2009 with 367 trips. Since the salmon fishery closures the number of trips have increased to 650 trips in 2011 (Figure 34). The average number of anglers per trip has been highly variable oscillating between average of between 14 and 17 anglers per trip from 2000 to 2011.

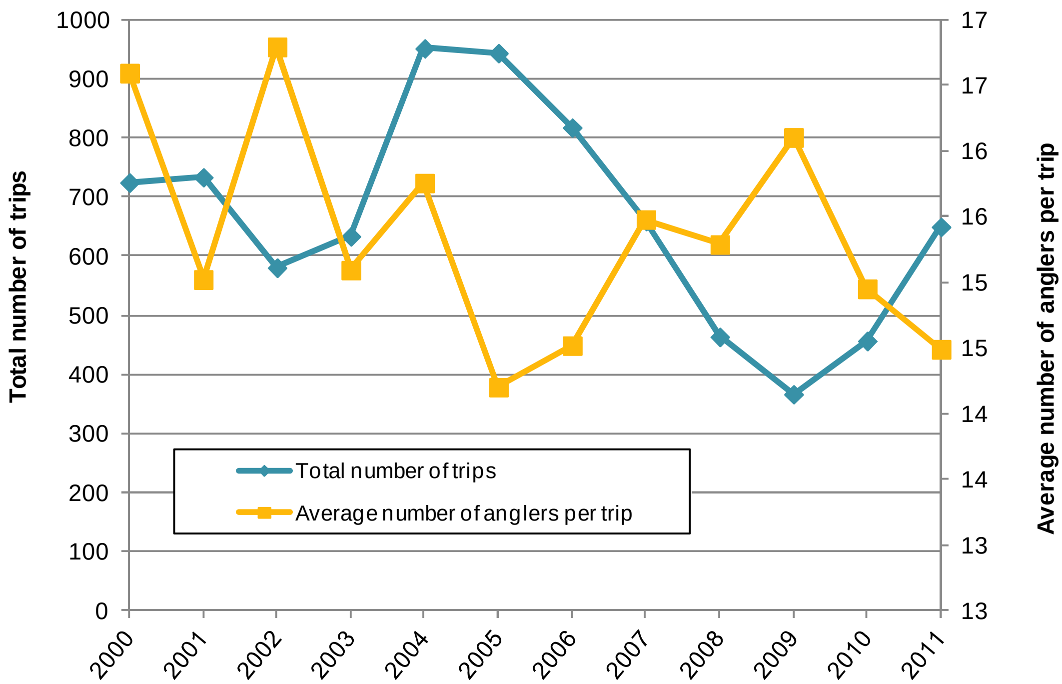
The total number of CPFV anglers in Half Moon Bay follows a variable but generally decreasing trend in which the total number of anglers peaked in 2004 with 15,002 anglers and reached is lowest in 2009 with 5,911 anglers and increased slightly to 9,421 anglers in 2011. The total number of anglers is increasing since the salmon closures of 2008 and 2009; however, it has not returned to levels seen before 2008. The average number of anglers per vessel also follows a generally decreasing trend with a peak of 1,337 anglers per vessel in 2000 to a low of 657 anglers per vessel in 2009, with a slight increase since to 723 anglers per vessel in 2011 (Figure 35).

Figure 33. Total number of CPFV vessels and average number of trips per vessel, Half Moon Bay, 2000-2011



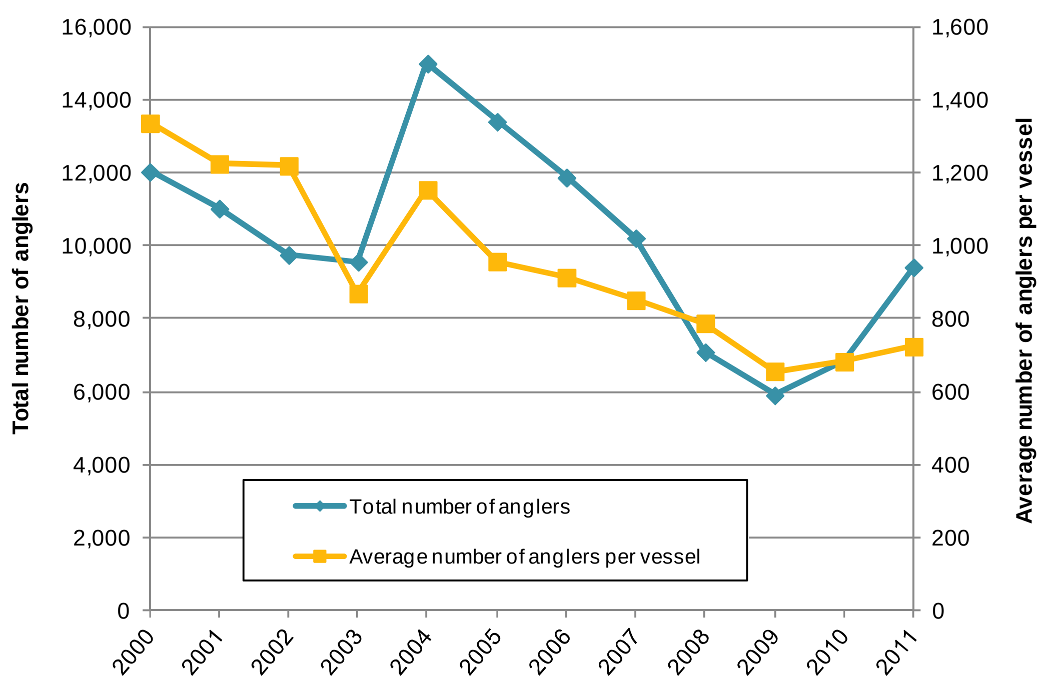
Source: CDFW CPFV logbook data

Figure 34. Total number of CPFV trips and average number of anglers per trip, Half Moon Bay, 2000-2011



Source: CDFW CPFV logbook data

Figure 35. Total number of CPFV anglers and average number of anglers per vessel, Half Moon Bay, 2000-2011

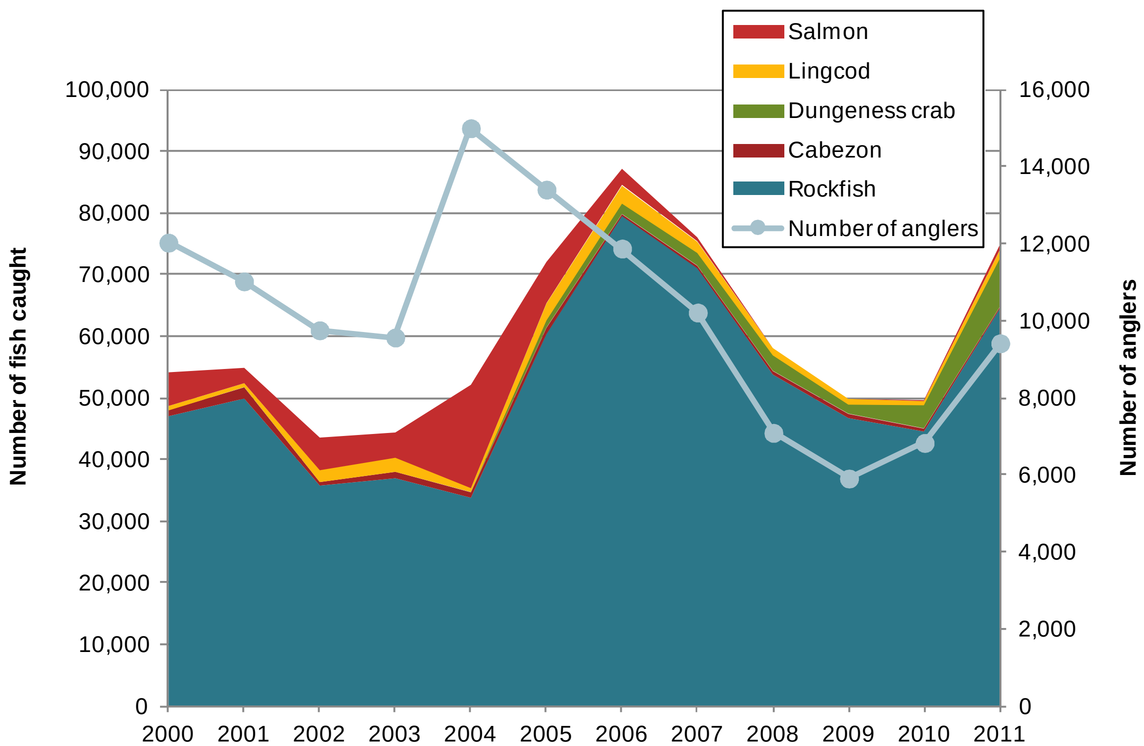


Source: CDFW CPFV logbook data

As seen in Figure 31 the two major fish caught by CPFV anglers in Half Moon Bay are rockfish (84.8 percent of fish caught) and salmon (6.13 percent of fish caught). The total number of fish caught has been variable with a peak of 89,411 fish caught in 2006 and a low of 44,323 fish caught in 2002. This is the only CPFV port in the region in which 2008 or 2009 (salmon fishery closure years) were not the lowest years of total fish caught in the study period.

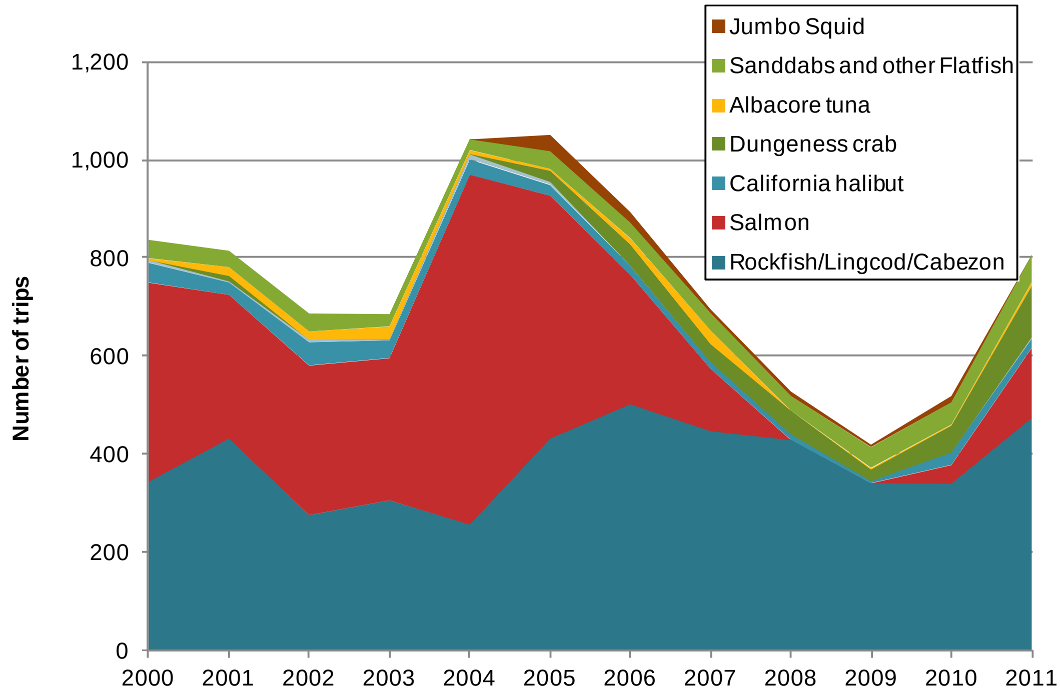
From Figure 37 we can see a more balanced mix of CPFV trips targeting either rockfish (50.9 percent of trips from 2000 to 2011) or salmon (34.2 percent of trips). The total number of trips peaked in 2005 with 1,052 total trips and reached a low in 2009 with 420 trips and has increased significantly to 810 trips total in 2011.

Figure 36. CPFV total number of fish caught for each fishery, Half Moon Bay, 2000-2011



Source: CDFW CPFV logbook data

Figure 37. Total number of CPFV trips for each target fishery, Half Moon Bay, 2000-2011



Source: CDFW CPFV logbook data

4.6.2. Half Moon Bay CPFV Fisheries Baseline Characterization

Seven CPFV operator/owners were interviewed in Half Moon Bay, who, on average, were 51.4 years old and made 58.7 percent of their total personal income from CPFV operations. This was lower than the regional average of 72.4 percent income from CPFV operations. Additionally, as shown below in Table 75, in 2010 CPFV operators we interviewed in Half Moon Bay had an average of 16 years of experience owning CPFV boats and 21.3 years of experience operating CPFV boats.

Five of the seven respondents from Half Moon Bay indicated that they had another source of income besides CPFV fishing in 2010 and some of them indicated they had more than one additional source of income. The only source of income that more than one individual reported was another type of fishing related work, such as commercial fishing. Additional responses are shown in Table 76.

Table 75. CPFV survey response statistics, 2010, Half Moon Bay

	Response	Standard deviation	Number responding
Individuals interviewed	7	n/a	n/a
Owner only	—	n/a	n/a
Average age	51.4	12.5	7
Average number of years owning CPFV boat/s	16.0	12.8	7
Average number of years operating CPFV boat/s	21.3	12.7	7
Average percent income from CPFV operations in 2010	58.7%	43.2%	7

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Table 76. Sources of income in 2010 in addition to CPFV operation, Half Moon Bay

	Fishery					Activity				
Response	**California halibut**	**Dungeness crab**	**Rockfish**	**Salmon**	**Striped bass**	**Funeral services**	**Leisure cruises**	**Whale watching**	**Other^**	**All target fisheries/ activities (unique individuals)**
Construction/Contractor	—	—	—	—	—	—	—	—	—	—
Harbor/City job	—	—	1	1	—	1	—	—	—	1
Other fishing/boating related work	—	1	2	2	—	1	—	1	1	2
Other specialized work	—	—	1	1	—	—	—	—	—	1
Property management	—	—	1	1	—	1	1	1	1	1
Retirement/Social Security/Investments	—	—	1	1	—	1	1	1	1	1
Skilled labor	—	—	1	—	—	1	1	1	—	1
Number of individuals responding	—	1	5	4	—	4	2	3	2	5

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, nature trips, and diving.

The average CPFV owner/operator in Half Moon Bay reported earning an average gross economic revenue (GER) of $105,000 in 2010, only slightly lower than the regional average of $105,423. Additionally, respondents in Half Moon Bay reported they spent an average of 28.4 percent of their GER on fuel, 15 percent on crew, and 41.1 percent on all other operational expenses. All of the expenses reported above were higher in Half Moon Bay than across the study region as a whole (22.9 percent, 12.3 percent, and 37.5 percent, respectively). After costs, respondents in Half Moon Bay made an average of $16,170 in net revenue. It should be noted that three respondents reported that 100 percent of their GER went back into their operating costs in 2010.

Table 77. Average CPFV gross economic revenue (GER) to operating costs in 2010, Half Moon Bay

	Number responding	Average response	Standard deviation
Total GER 2011	7	$105,000	$114,564
% GER to fuel	7	28.4%	10.5%
% GER to crew	7	15.0%	16.1%
% GER to other operating costs	7	41.1%	21.4%

Source: Current study

All but one of the CPFV fishermen in Half Moon Bay reported conducting non-consumptive trips in addition to consumptive fishing trips in 2010. The average fishing trip cost $89 per passenger and had nine passengers aboard and the average non-consumptive trip cost $68 and had 13.2 passengers aboard. More information regarding these trips is found below in Table 78.

Table 78. CPFV trip statistics, 2010, Half Moon Bay

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	7	n/a	n/a	6	n/a
Average number of trips in 2010	6	62.5	35.6	5	44.2	71.2
Average number of passengers(per trip)	7	9.0	3.7	6	13.2	7.7
Average price per passenger (per trip)	7	$89	$31	4	$68	$57
Average number of crew (per trip)	6	1.3	0.8	5	1.0	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Rockfish was the most frequently targeted fishery in Half Moon Bay (58.8 days in 2010) and generated the most revenue (58.6 percent of GER). This is the second largest proportion of revenue generated by any single fishery throughout the study region (fishermen in Half Moon Bay attributed 64.3 percent of their GER to salmon). Salmon trips and funeral services generated similar percentages of GER (10.7 and 12.8 percent respectively), but salmon was only targeted an average of 5.4 days as compared to funeral services which were operated an average of 38.2 days in 2010. More information regarding this information is found below in Table 79.

Table 79. Number of days and percent GER targeting fishery/activity in 2010, CPFV, Half Moon Bay

			Number of days targeting species (2010)			Percent of GER from fishery/activity (2010)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	California halibut	—	—	—	—	—	—	—
	Dungeness crab	3	3	45.0	39.1	3	25.3%	27.0%
	Rockfish	7	6	58.8	32.8	7	58.6%	21.0%
	Salmon	6	5	5.4	3.0	6	10.7%	7.8%
	Striped bass	—	—	—	—	—	—	—
Activity	Funeral services	6	5	38.2	62.9	5	12.8%	20.9%
	Leisure cruises	3	2	5.5	4.9	3	3.0%	3.5%
	Whale watching	4	3	8.0	6.2	4	7.5%	2.9%
	Other^	3	2	6.0	5.7	3	14.0%	18.2%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

All CPFV operators were asked to compare their success in each of their target fisheries and non-consumptive activities in 2010 to that of the previous five years. As shown below in Table 80, individuals were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 3) somewhat worse; and 4) significantly worse. Respondents were then asked what factors they felt had contributed to the change in success in their fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the Table 81 through Table 84 below.

The fishermen who felt that their success in the rockfish fishery was somewhat better specified that there was a large quantity of fish (Table 82), but that this was only the case near Half Moon Bay. Additionally, the individual who felt their success in the salmon fishery was better noted that although the 2010 season what shortened the 2008 and 2009 season had been closed completely.

Table 80. Overall success in CPFV fishery/activity in 2010 compared to past five years, Half Moon Bay

		Number responding	Percent responding: Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	—	—	—	—	—	—
	Dungeness crab	3	100.0%	—	—	—	—
	Rockfish	7	—	14.3%	14.3%	57.1%	14.3%
	Salmon	6	16.7%	—	—	16.7%	66.7%
	Striped bass	—	—	—	—	—	—
Activity	Funeral services	5	20.0%	—	60.0%	20.0%	—
	Leisure cruises	3	—	—	33.3%	—	66.7%
	Whale watching	4	25.0%	25.0%	—	—	50.0%
	Other ^	3	33.3%	33.3%	—	—	33.3%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ includes bird watching, nature trips, and diving.

Table 81. Regulatory changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Half Moon Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	1	5	5	—	—	—	—	1
	Response	**Count of responses**								
Negative	Regulated season too short	—	—	—	5	—	—	—	—	—
Negative	MPAs	—	1	5	—	—	—	—	—	1
Negative	More pressure on fishery	—	—	—	—	—	—	—	—	—
Negative	Rockfish Conservation Areas	—	—	1	—	—	—	—	—	—
Positive	Fishery closed in previous seasons	—	—	—	2	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 82. Environmental changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Half Moon Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	3	4	5	—	—	—	3	—
	Response	**Count of responses**								
Positive	Large quantity of fish	—	3	1	—	—	—	—	—	—
	Peak of natural cycle	—	—	—	—	—	—	—	—	—
	Good ocean conditions	—	1	—	—	—	—	—	1	—
Negative	Low quantity of fish	—	—	3	5	—	—	—	—	—
	Low of natural cycle	—	—	—	—	—	—	—	—	—
	Bad weather	—	—	—	—	—	—	—	2	—
	Poor ocean conditions	—	—	—	1	—	—	—	—	—
	More bait/feed in water - causing fish to bite less	—	—	—	—	—	—	—	—	—
	Loss of salmon spawning grounds	—	—	—	—	—	—	—	—	—
	Fish are smaller	—	—	1	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 83. Economic changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Half Moon Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	—	1	—	—	2	2	2	1
	Response	**Number responding**								
Positive	Good/new market opportunity	—	—	—	—	—	1	—	—	1
Negative	Lack of customers	—	—	1	—	—	—	—	—	—
	Bad economy	—	—	1	—	—	1	2	2	—
	Fuel costs	—	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

Table 84. Other changes/factors influencing success in specific CPFV fishery/activity in 2010 compared to previous five years, Half Moon Bay

		Fishery					Activity			
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Funeral services	Leisure cruises	Whale watching	Other^
	Number responding	—	—	3	—	—	1	—	—	2
	Response	**Number responding**								
Positive	Diversifying portfolio of fisheries/activities	—	—	—	—	—	1	—	—	2
	Putting more effort into fishery/activity	—	—	—	—	—	—	—	—	—
Negative	Others are diversifying - adding competition to fishery/activity	—	—	—	—	—	—	—	—	—
	Putting less effort into fishery/activity	—	—	—	—	—	—	—	—	—
	Personal reasons	—	—	—	—	—	—	—	—	—
	Too many other boats/overcrowding	—	—	3	—	—	—	—	—	—
	Drag boats are depleting resource	—	—	—	—	—	—	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

^ Other includes: bird watching, recreational diving, and nature trips.

5. NORTH CENTRAL COAST CPFV SPATIAL BASELINE

In the following section we provide maps of baseline data depicting the spatial fishing patterns of specific CPFV fisheries at the port and region level. The full detailed methodology of how these data were collected, analyzed, and reviewed can be found in Section 2 of this report. The GIS data layers with associated metadata of these spatial data sets are also available and were included in the deliverables package of this project which can be found on the OceanSpaces website: (http://oceanspaces.org). The following map products and spatial data sets for the North Central Coast region CPFV fleet for the post-MPA 2010 season are provided in Table 85 below. Only maps with 3 or more fishermen are available for use due to confidentiality protocols as indicated in the table below. We would like to note that due to the very limited salmon season in 2010 the 2011 data set (see appendix) is likely a more representative post-MPA spatial baseline.

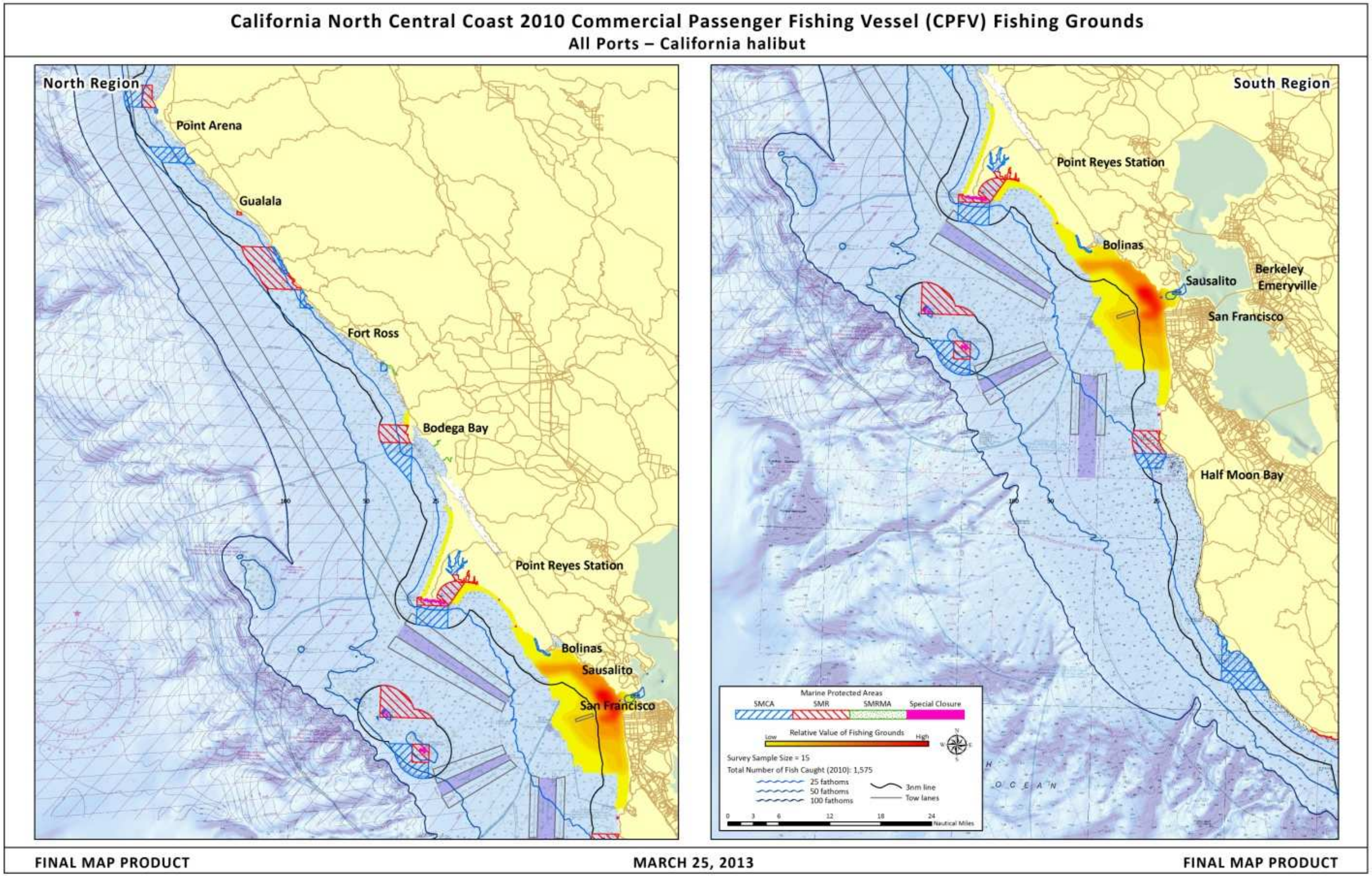
Table 85. 2010 Map products and spatial data sets developed and available

Port/Region	Fishery	Number of fish caught by CPFV operations	Number of fishermen who mapped	Map available
North Central Coast	California halibut	1,575	15	YES
North Central Coast	Dungeness crab	10,078	8	YES
North Central Coast	Rockfish	135,049	28	YES
North Central Coast	Salmon	2,277	25	YES
North Central Coast	Striped bass	356	10	YES
Bodega Bay	California halibut	46	3	YES
Bodega Bay	Dungeness crab	2,757	3	YES
Bodega Bay	Rockfish	20,648	5	YES
Bodega Bay	Salmon	695	5	YES
Bodega Bay	Striped bass	—	—	—
Sausalito	California halibut	16	2	NO
Sausalito	Dungeness crab	—	—	—
Sausalito	Rockfish	908	3	YES
Sausalito	Salmon	565	5	YES
Sausalito	Striped bass	8	2	NO
Berkeley	California halibut	898	4	YES
Berkeley	Dungeness crab	—	—	—
Berkeley	Rockfish	16,689	5	YES
Berkeley	Salmon	396	3	YES
Berkeley	Striped bass	122	2	NO
Emeryville	California halibut	482	3	YES
Emeryville	Dungeness crab	3,490	2	NO
Emeryville	Rockfish	50,566	4	YES
Emeryville	Salmon	178	4	YES
Emeryville	Striped bass	168	3	YES
San Francisco	California halibut	133	4	YES
San Francisco	Dungeness crab	—	—	—
San Francisco	Rockfish	1,752	4	YES
San Francisco	Salmon	273	2	NO
San Francisco	Striped bass	58	3	YES
Half Moon Bay	California halibut	—	—	—
Half Moon Bay	Dungeness crab	3,831	3	YES
Half Moon Bay	Rockfish	44,486	7	YES
Half Moon Bay	Salmon	170	6	YES
Half Moon Bay	Striped bass	—	—	—

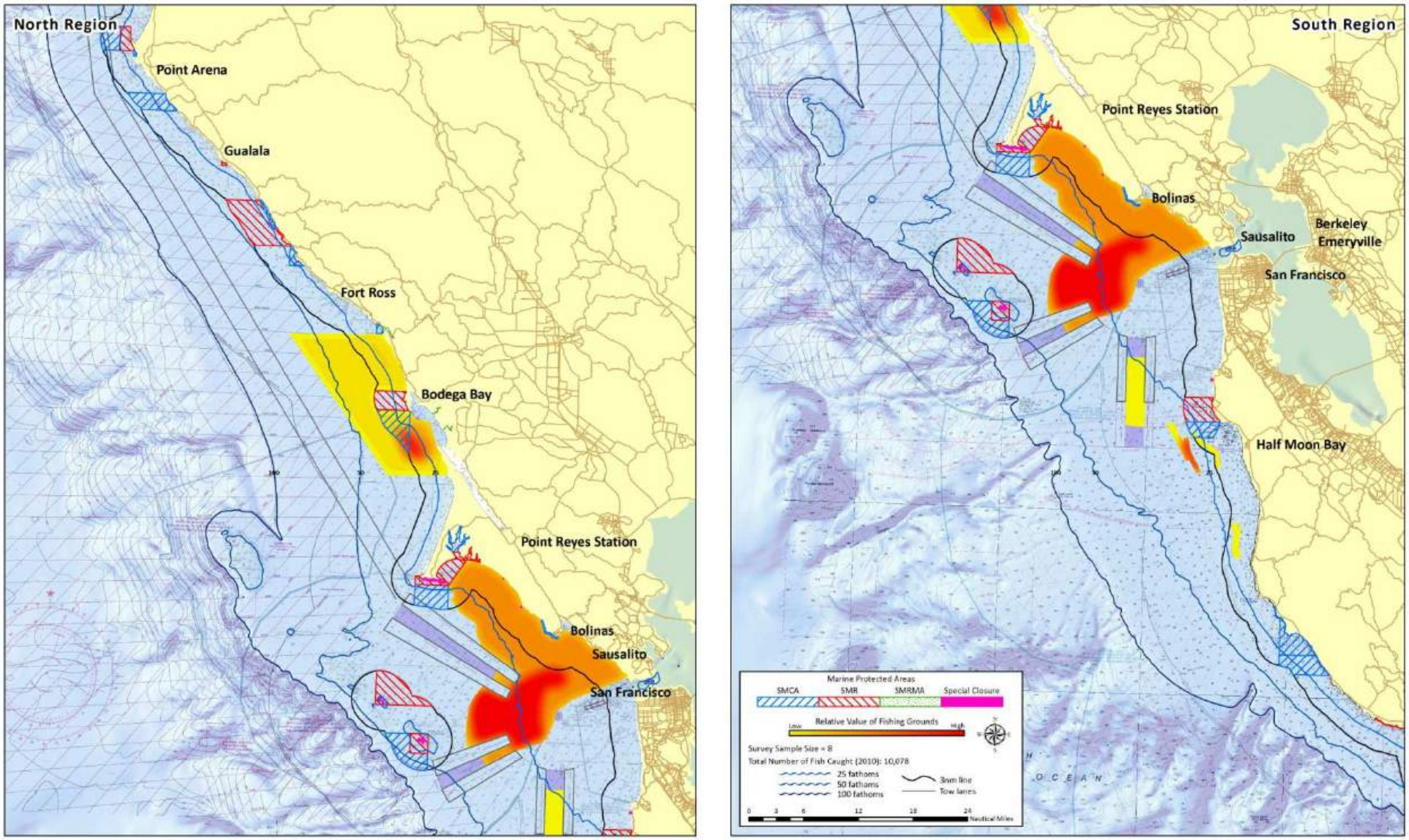
Source: California Department of Fish and Wildlife, Current study

— indicates that the port/fishery was not sampled or a zero value data point

5.1. North Central Coast Region CPFV Spatial Baseline



California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
All Ports – Dungeness crab



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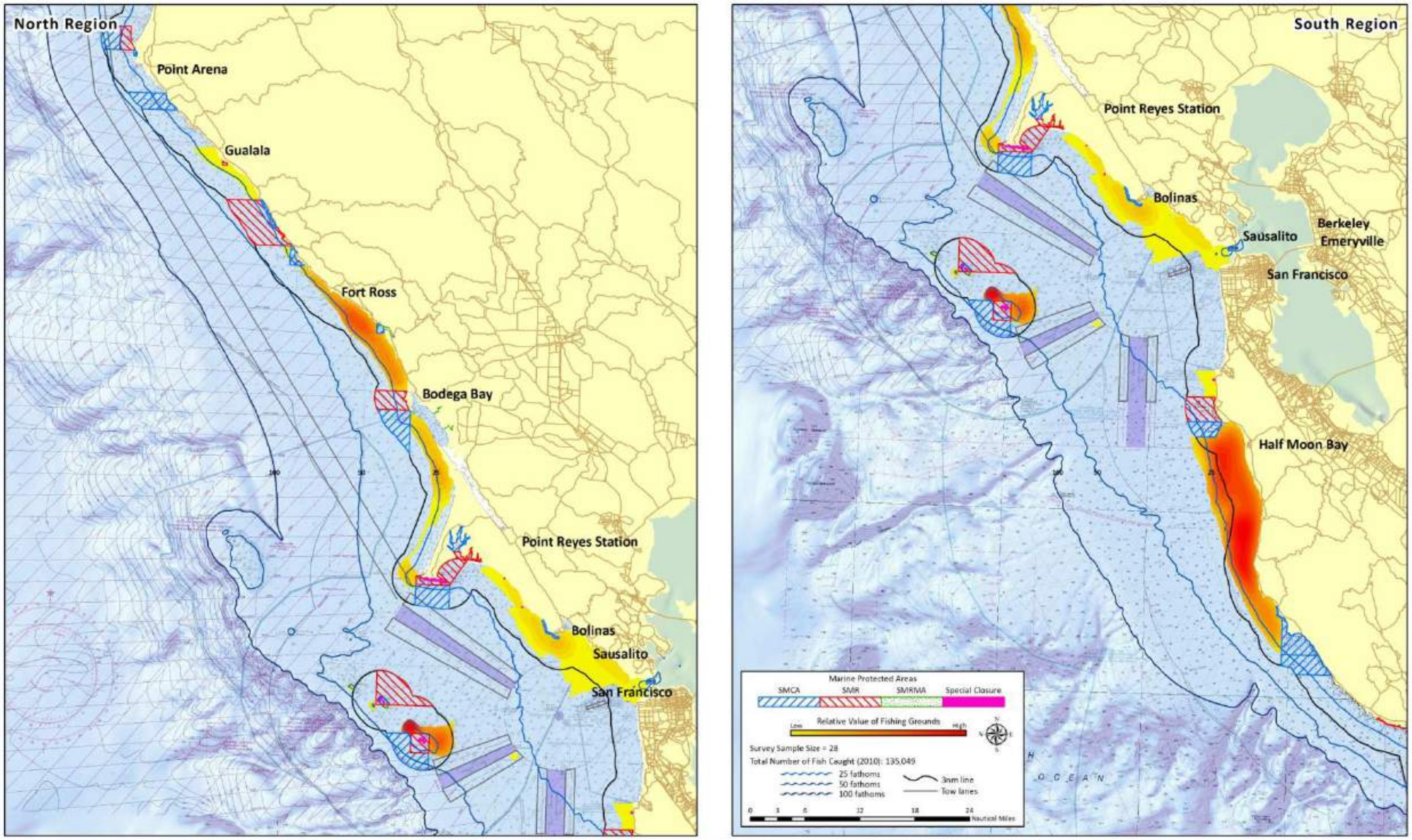
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
All Ports – Rockfish



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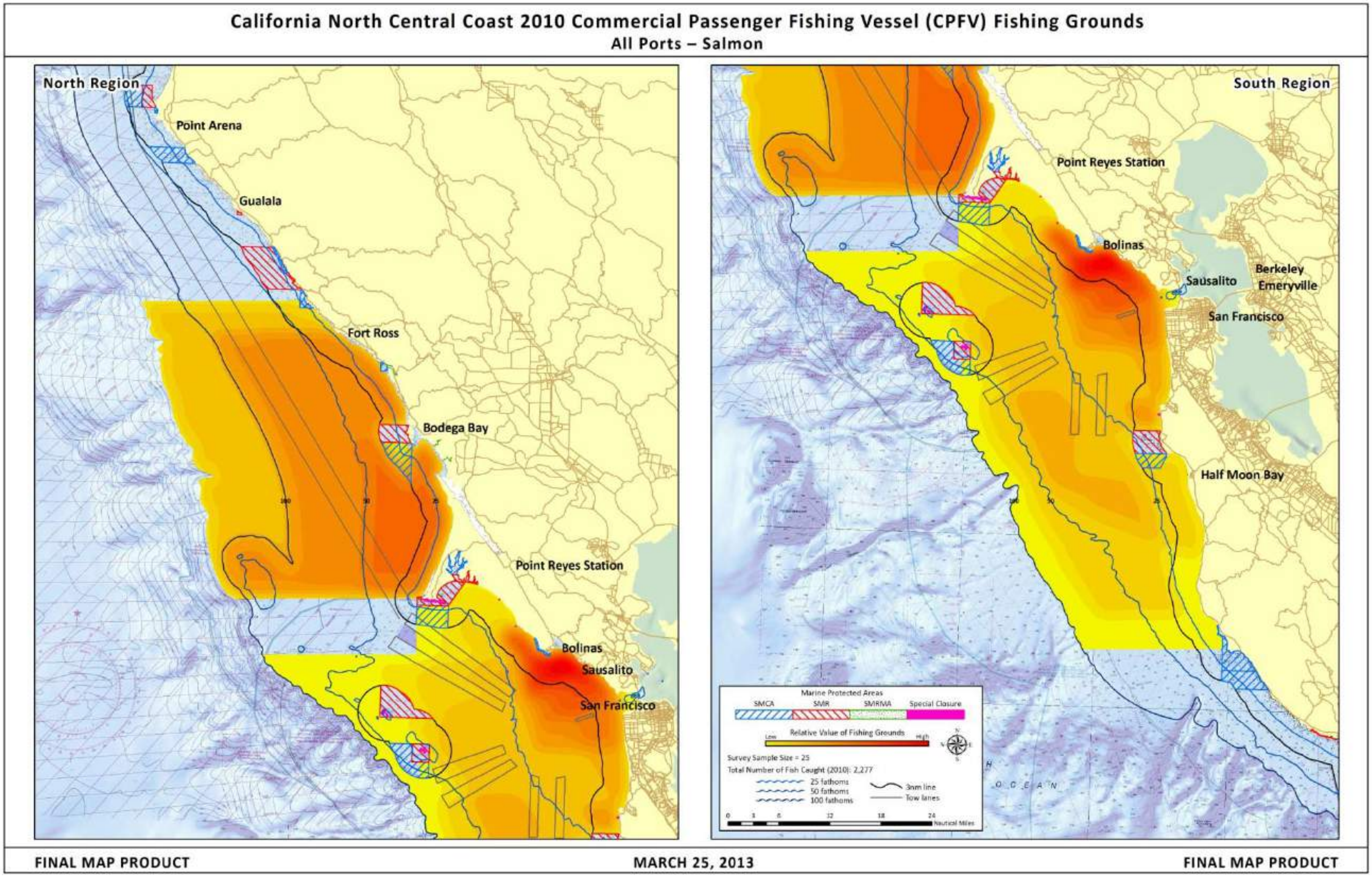
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
All Ports – Salmon
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
San Francisco
South Region
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Low
Relative Value of Fishing Grounds
High
Survey Sample Size = 25
Total Number of Fish Caught (2010): 2,277
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
Nautical Miles
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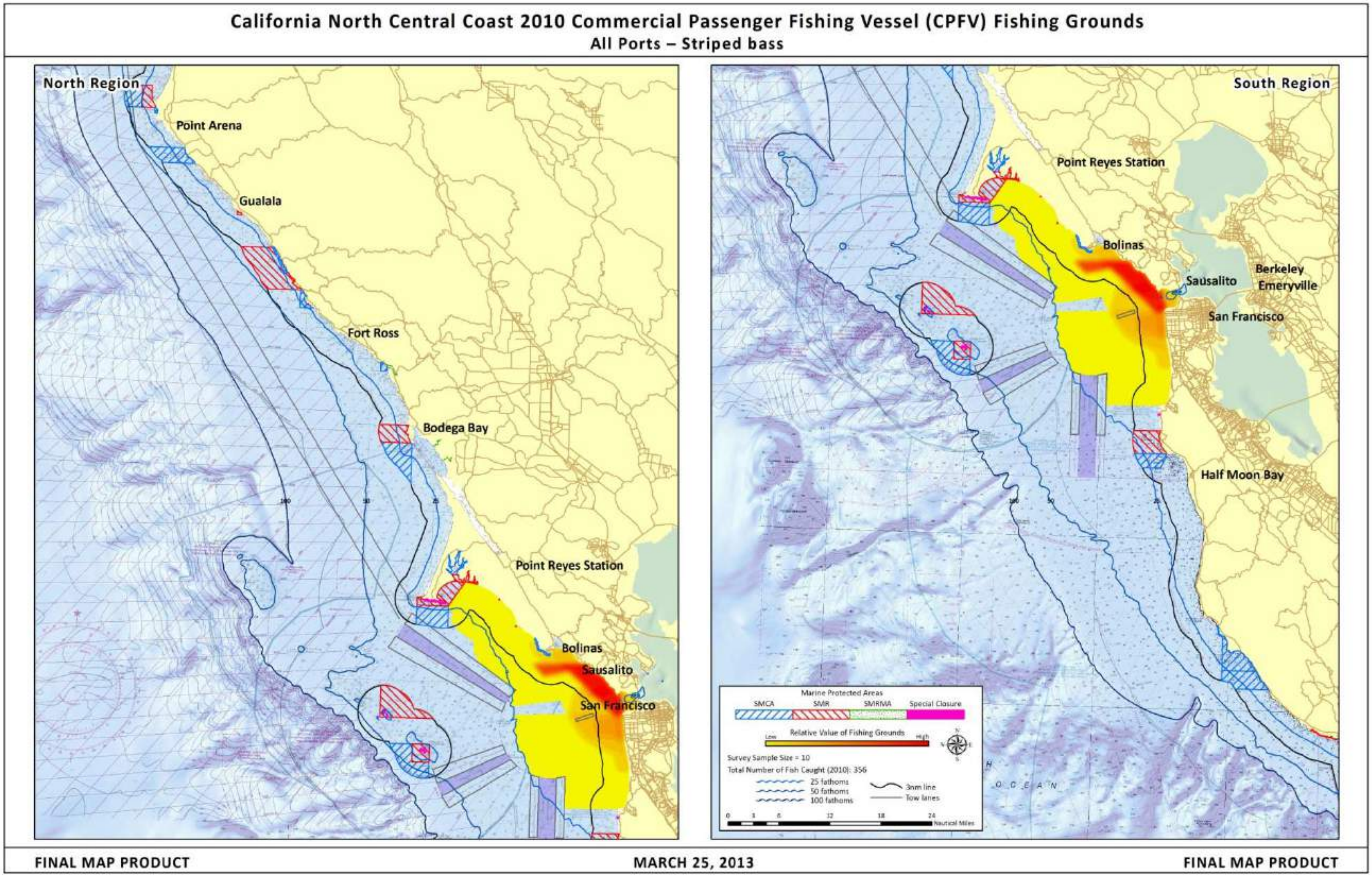
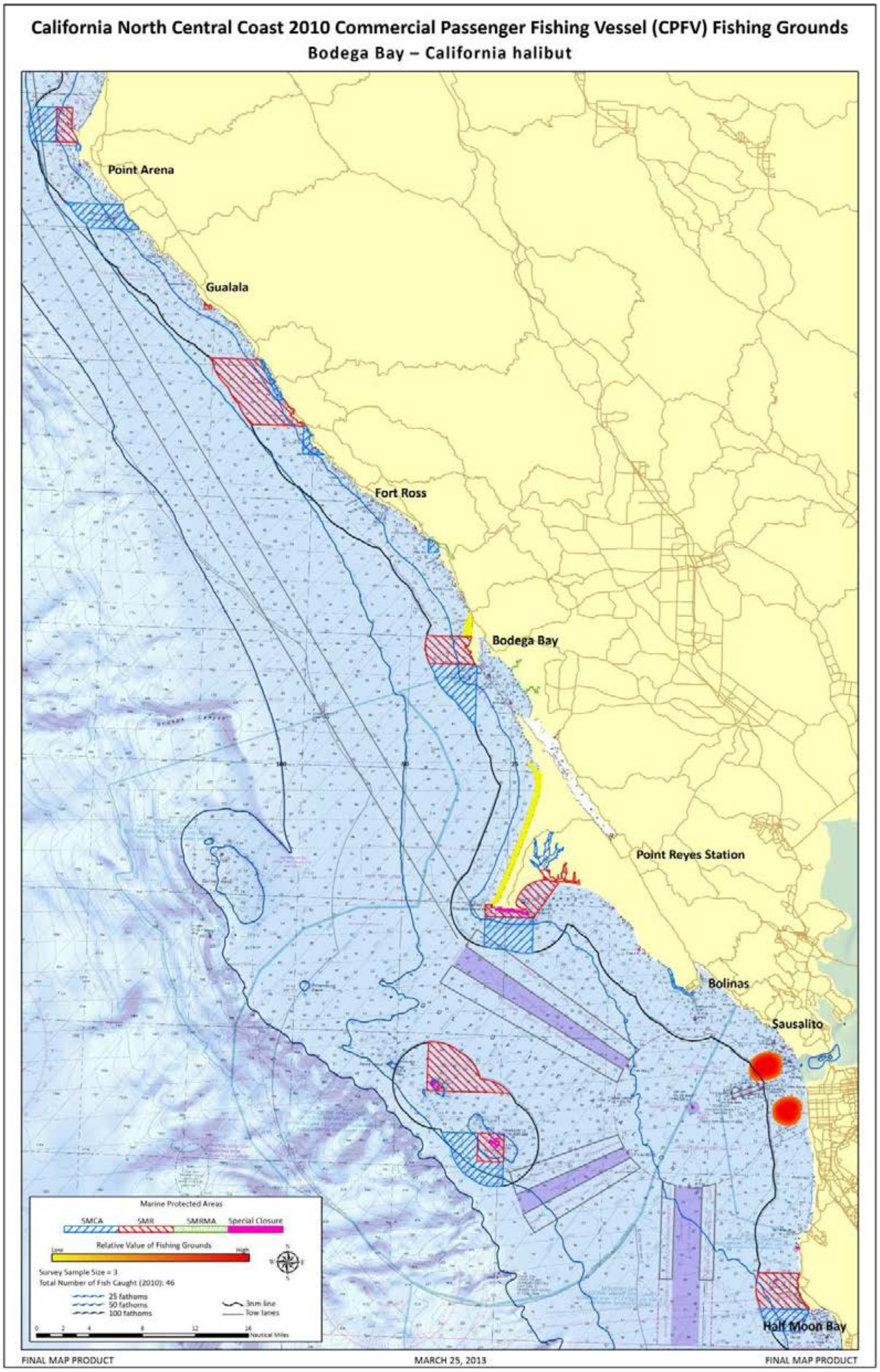


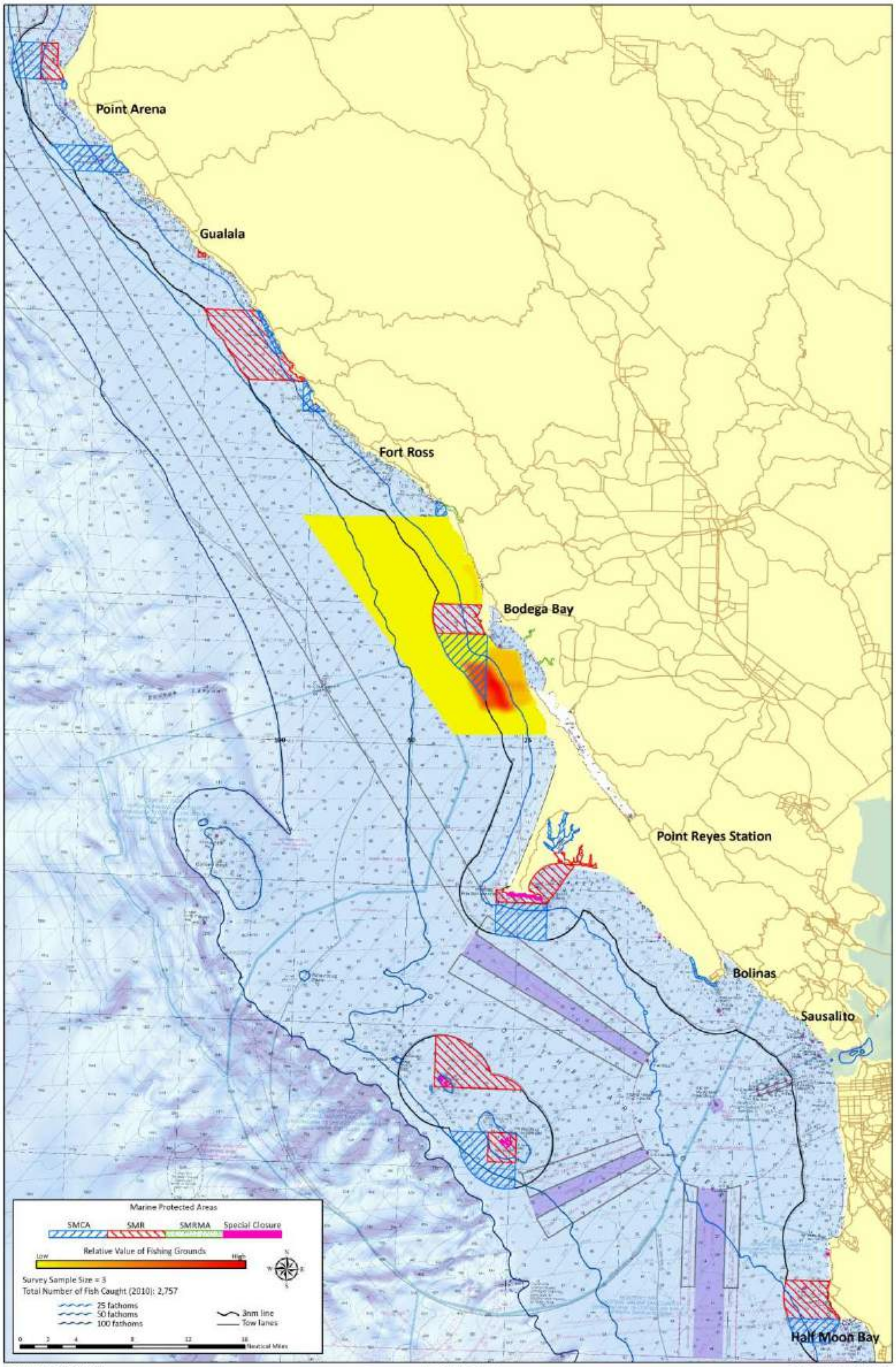
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
All Ports – Striped bass
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
San Francisco
South Region
Berkeley
Emeryville
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Low
Relative Value of Fishing Grounds
High
Survey Sample Size = 10
Total Number of Fish Caught (2010): 356
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT

5.2. Bodega Bay CPFV Spatial Baseline



California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

Bodega Bay – Dungeness crab



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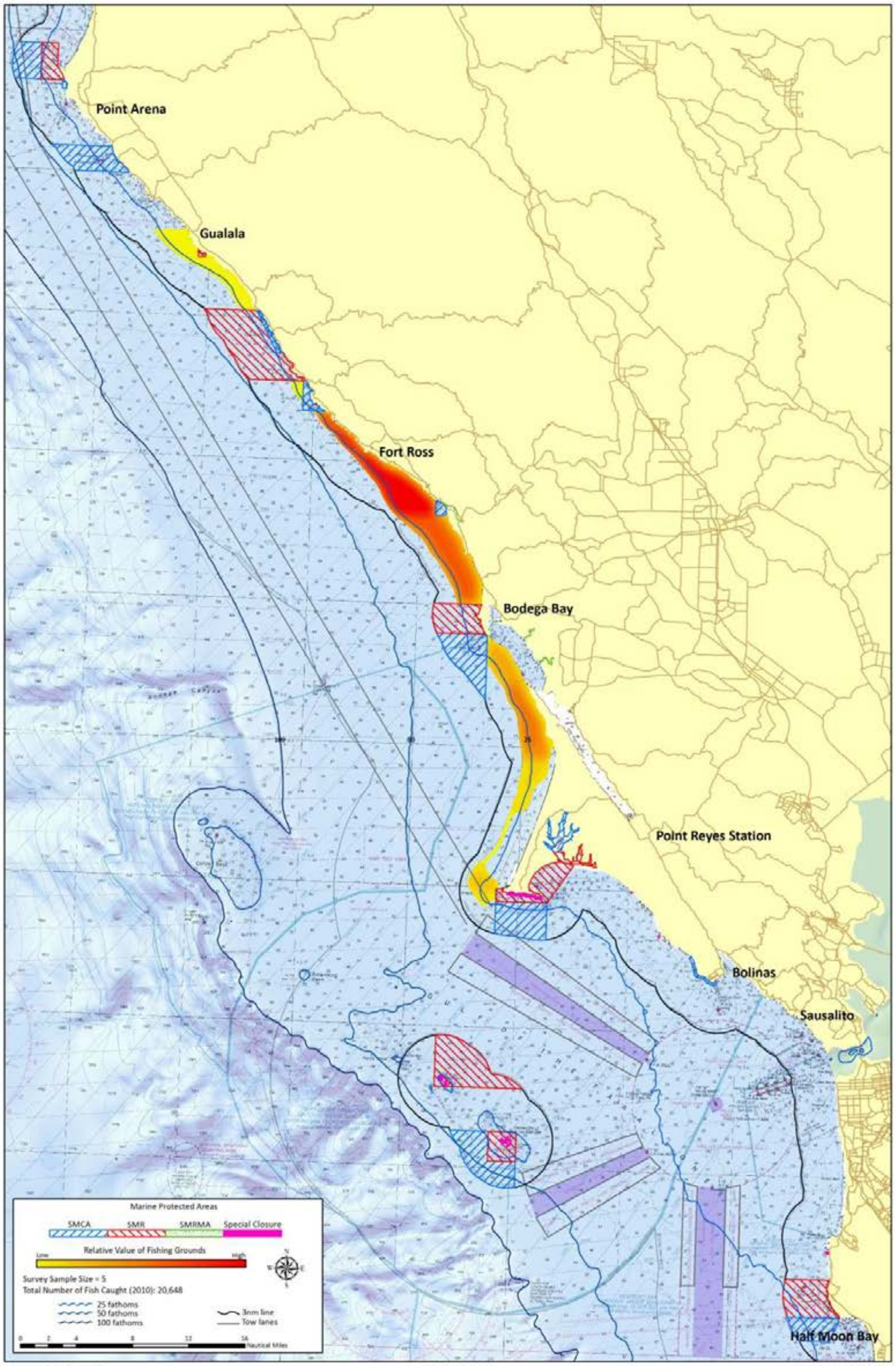
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
Bodega Bay – Rockfish



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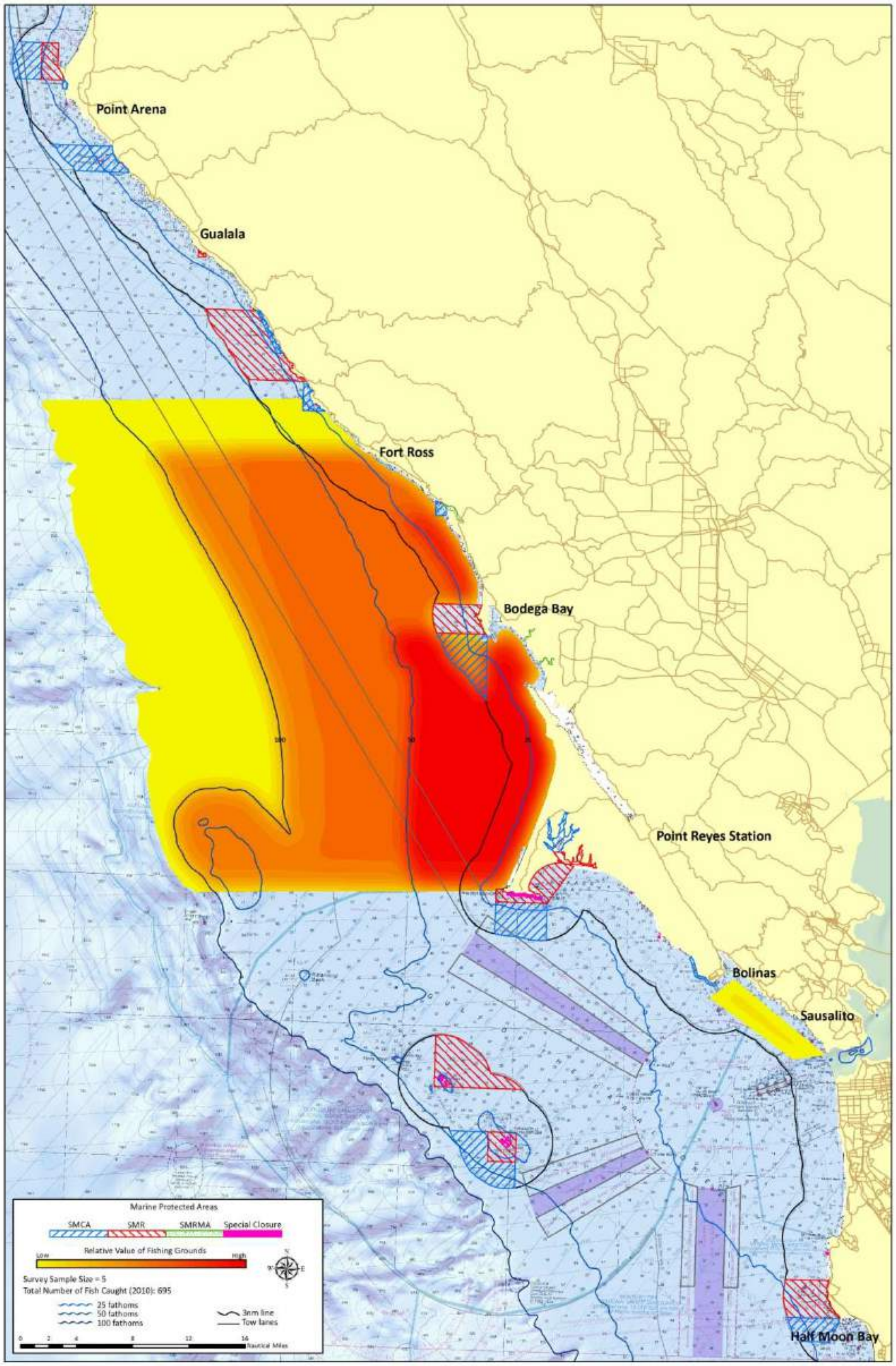
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
Bodega Bay – Salmon



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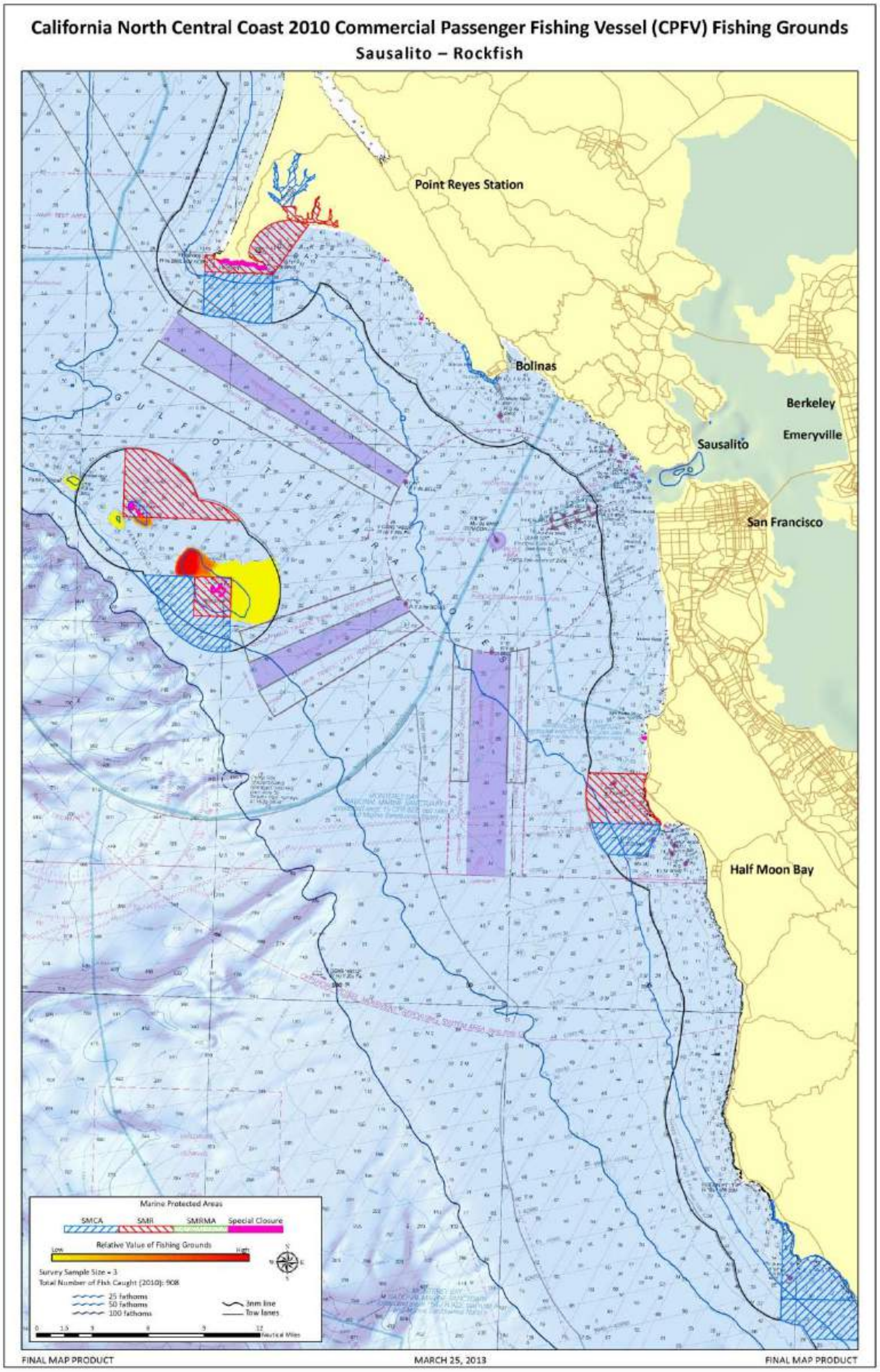
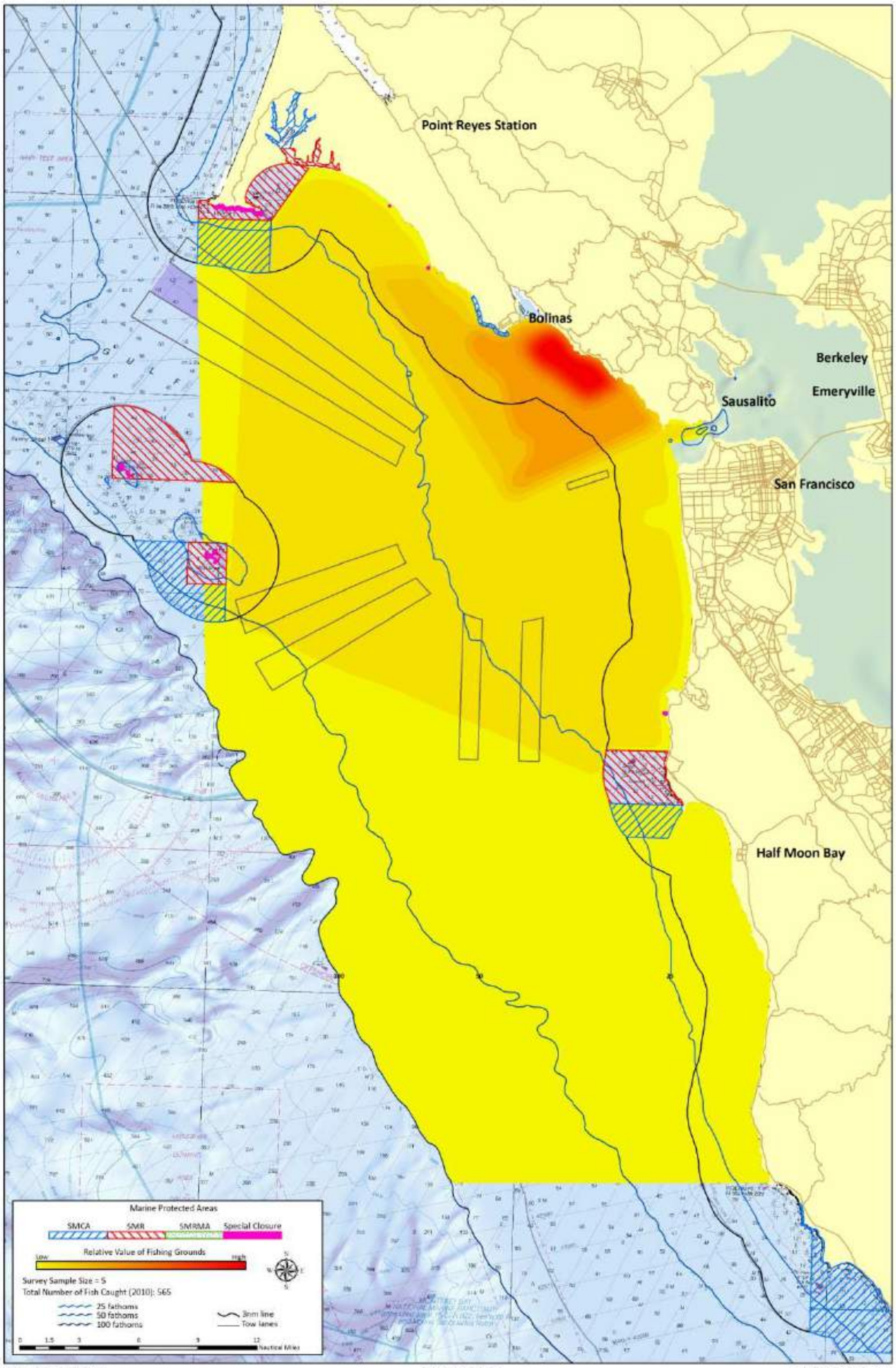
5.3. Sausalito CPFV Spatial Baseline



California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

Sausalito – Salmon



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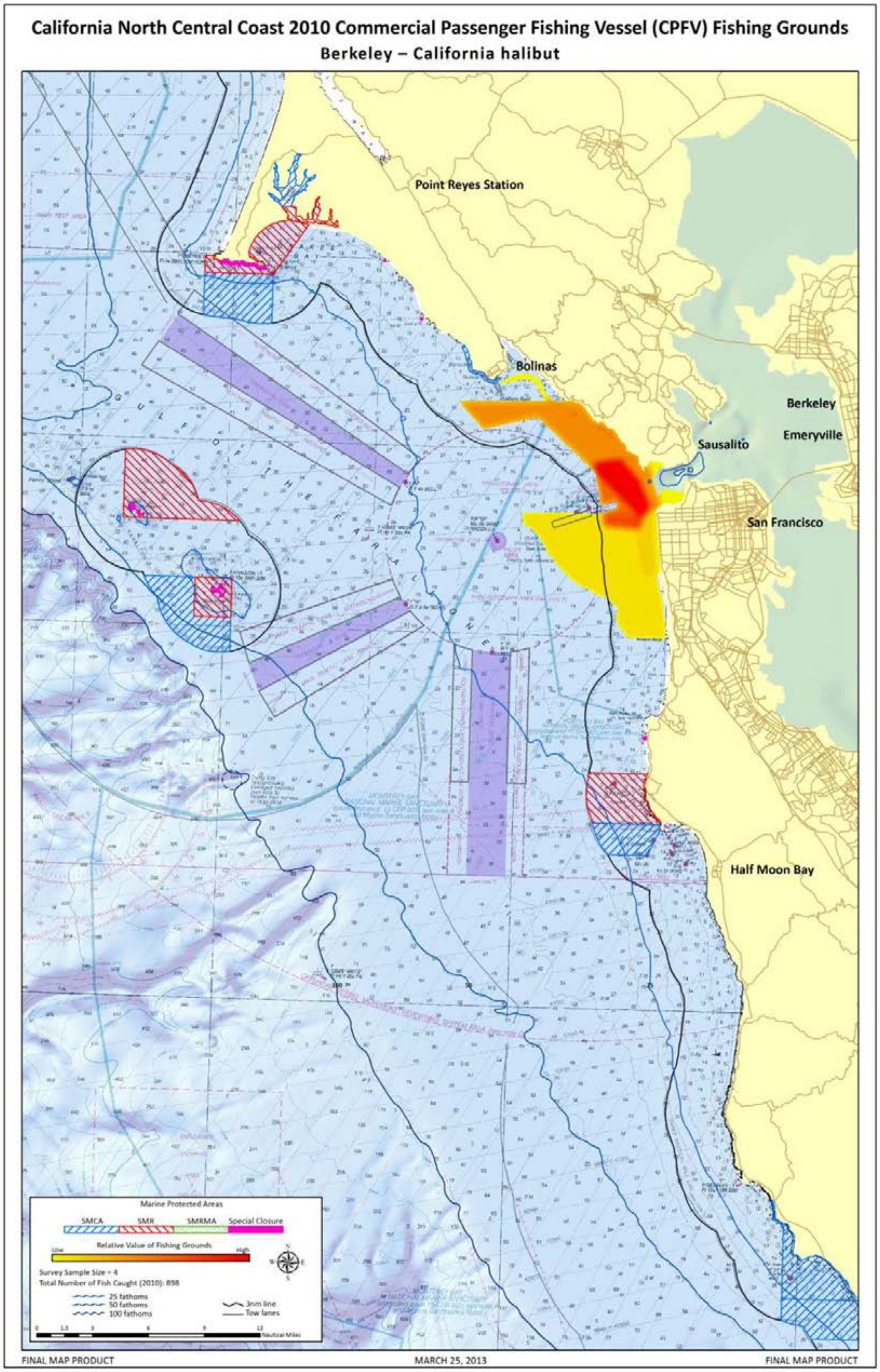
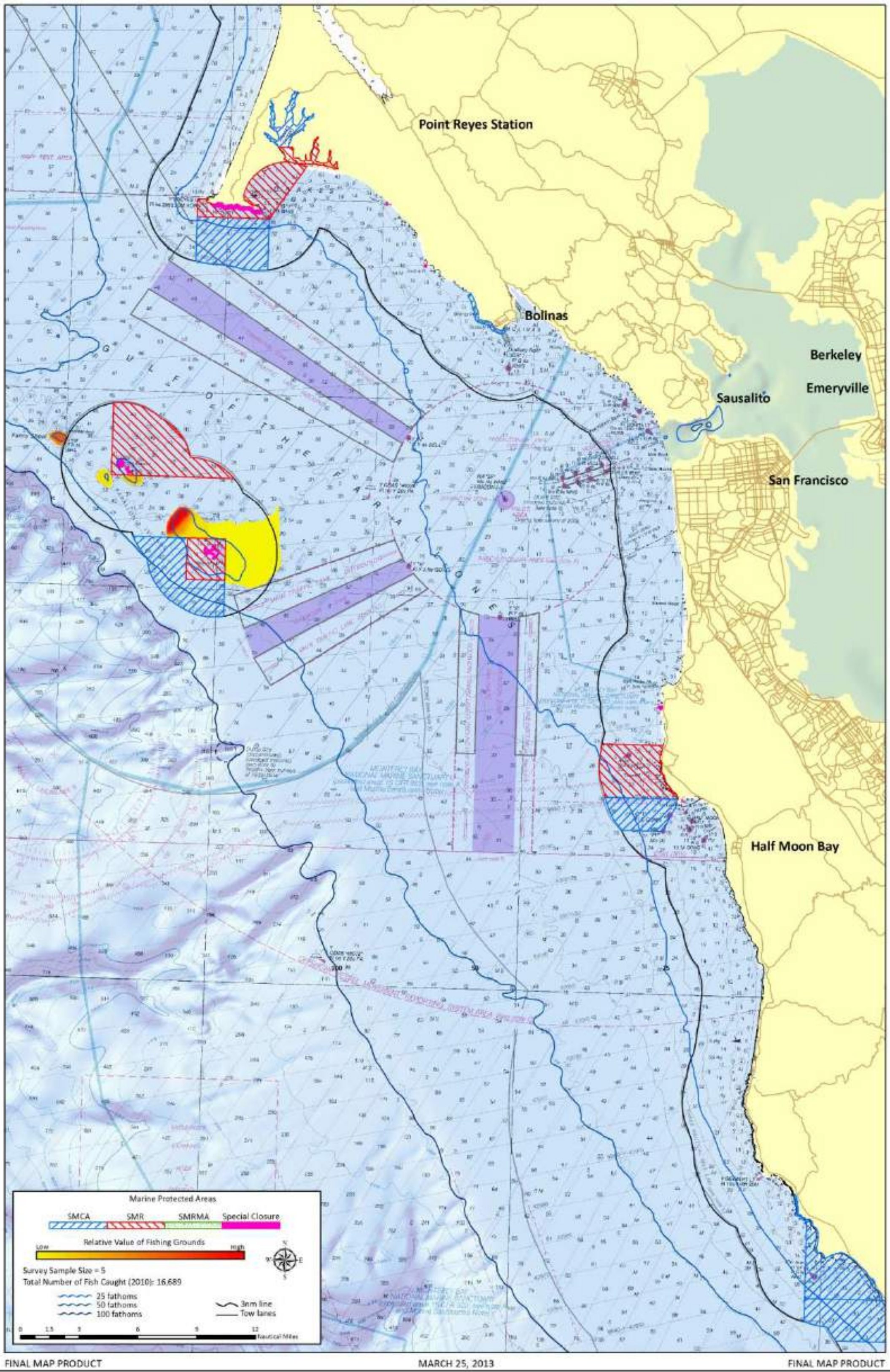
5.4. Berkeley CPFV Spatial Baseline



California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

Berkeley – Rockfish



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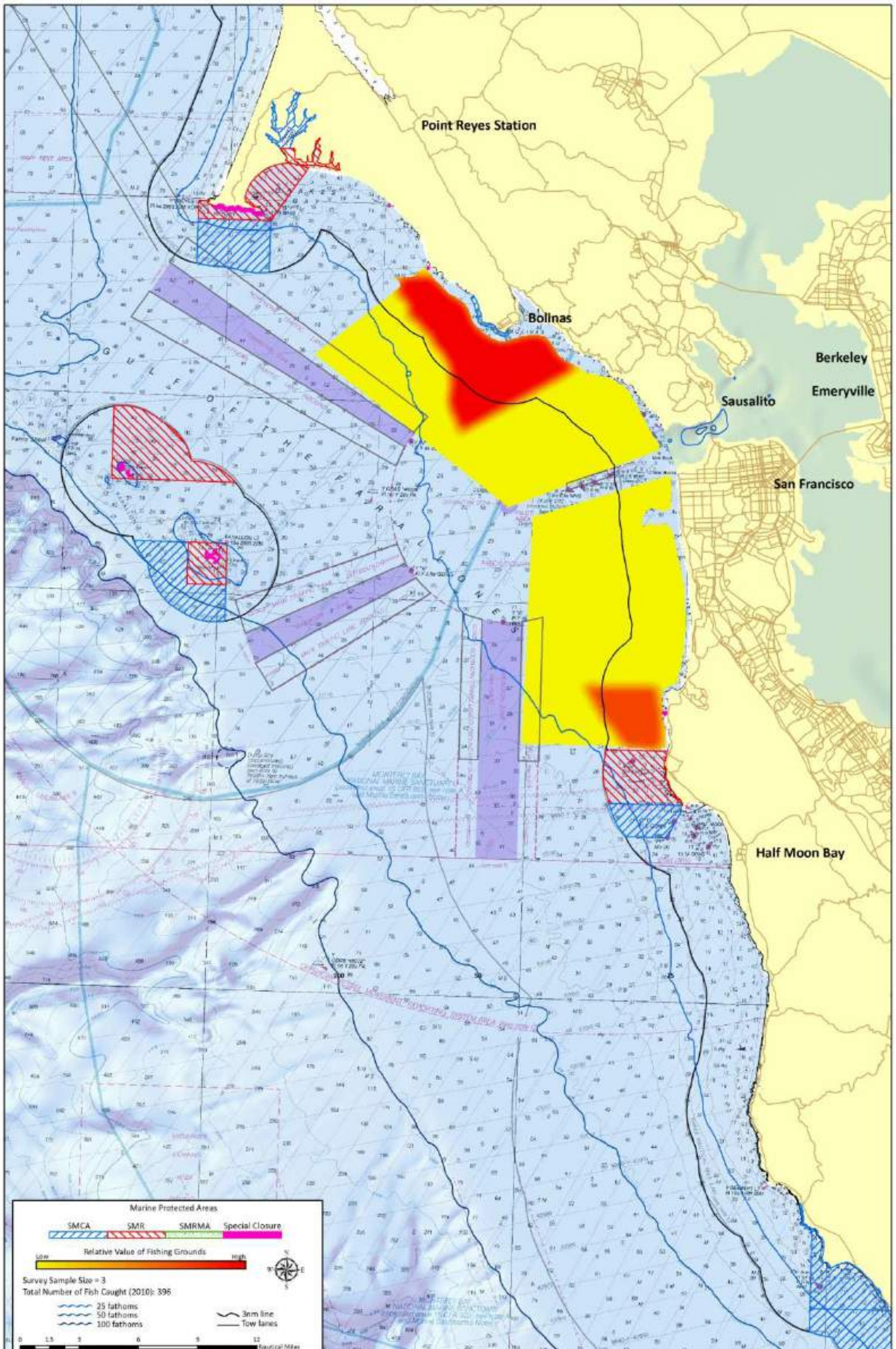
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

Berkeley – Salmon



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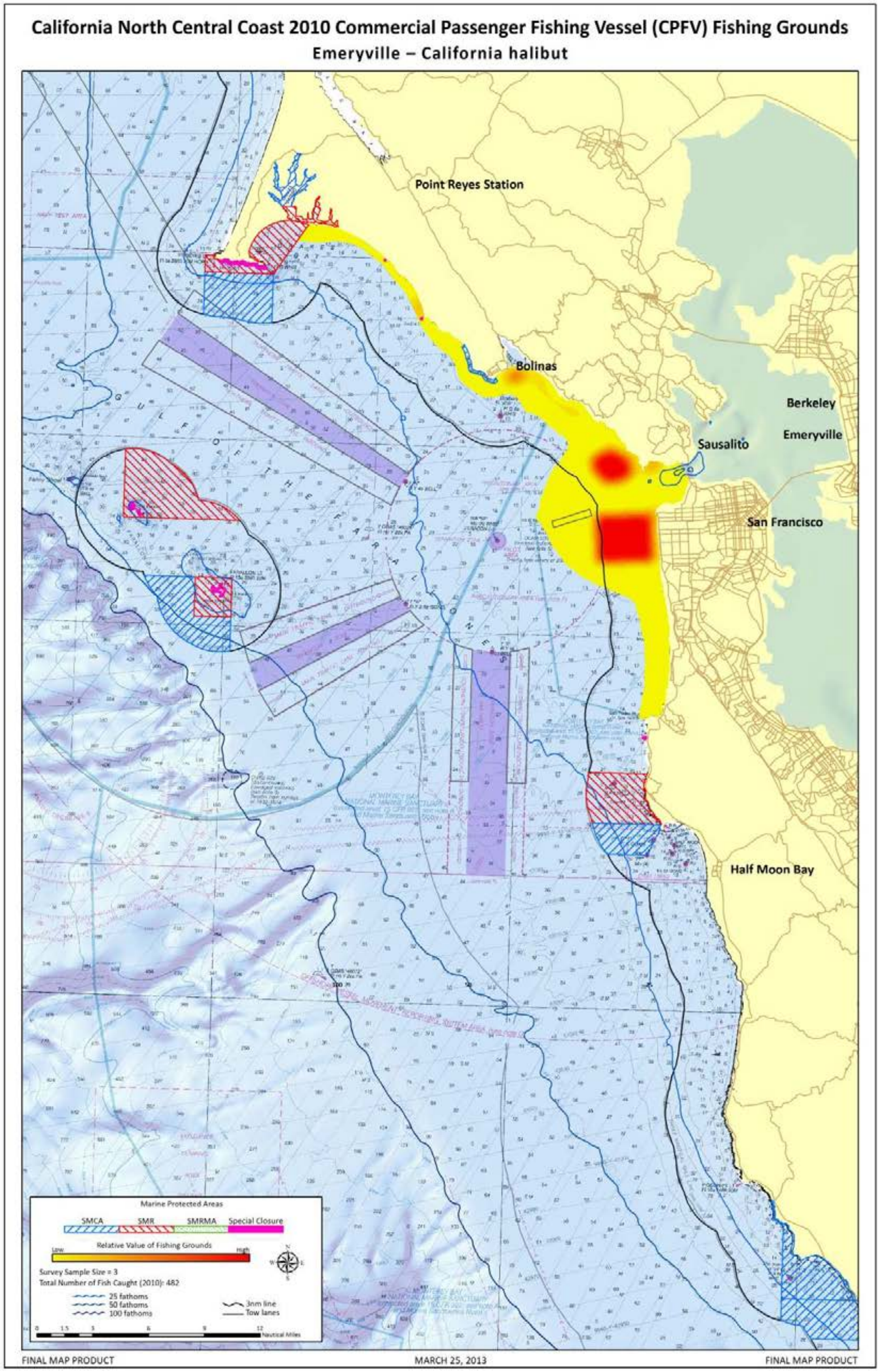
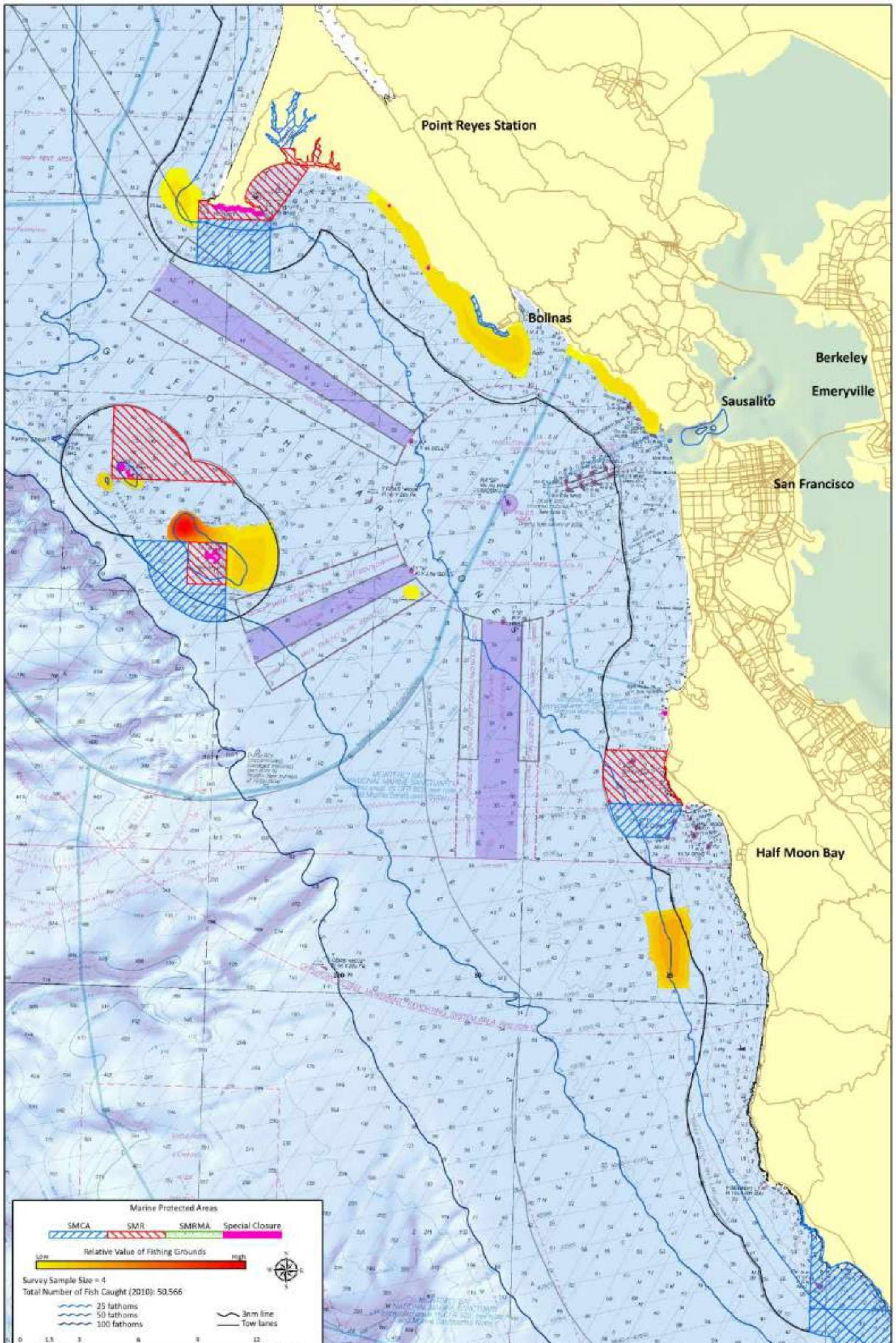
5.5. Emeryville CPFV Spatial Baseline



California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

Emeryville – Rockfish



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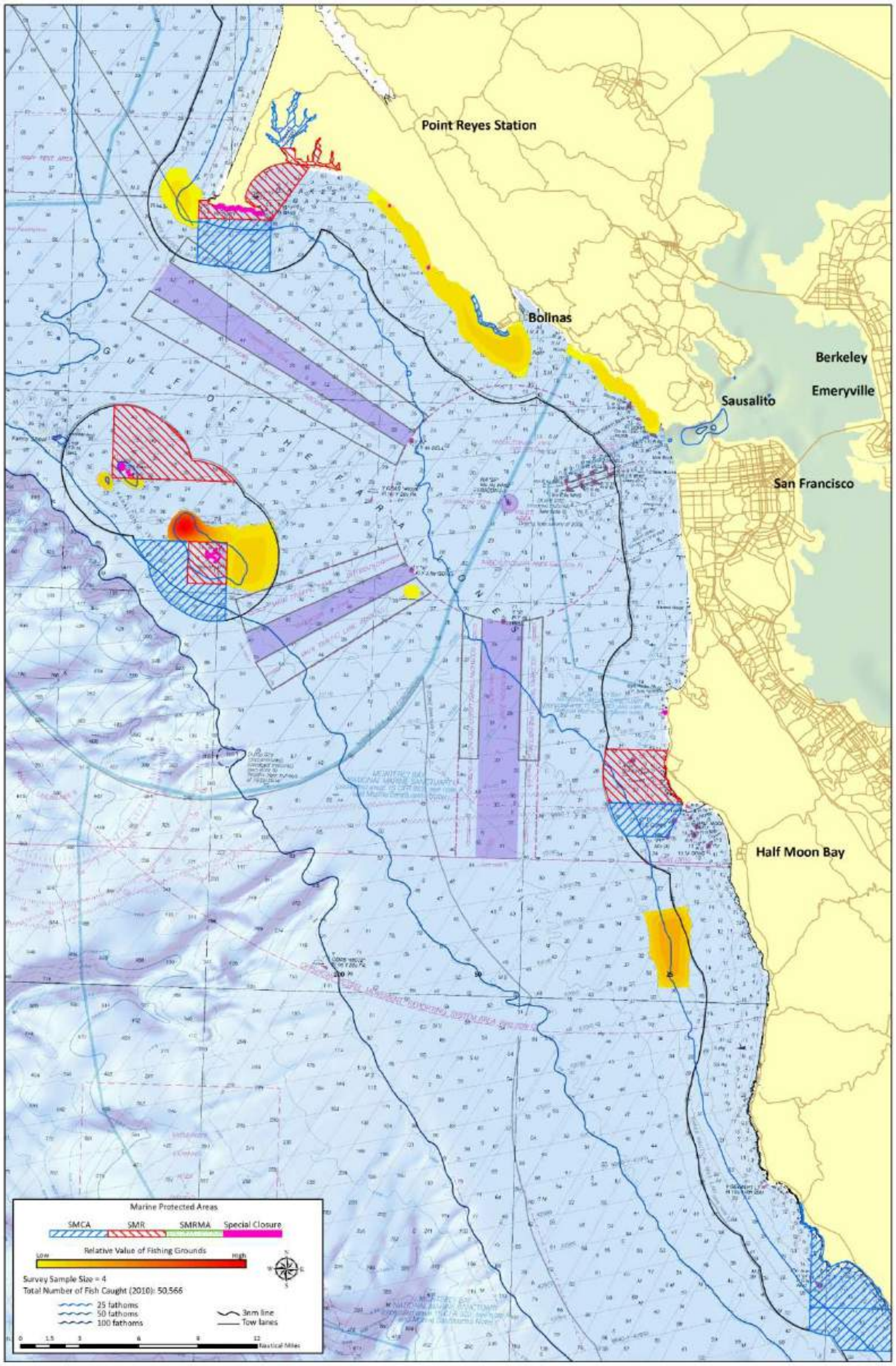
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

Emeryville – Rockfish



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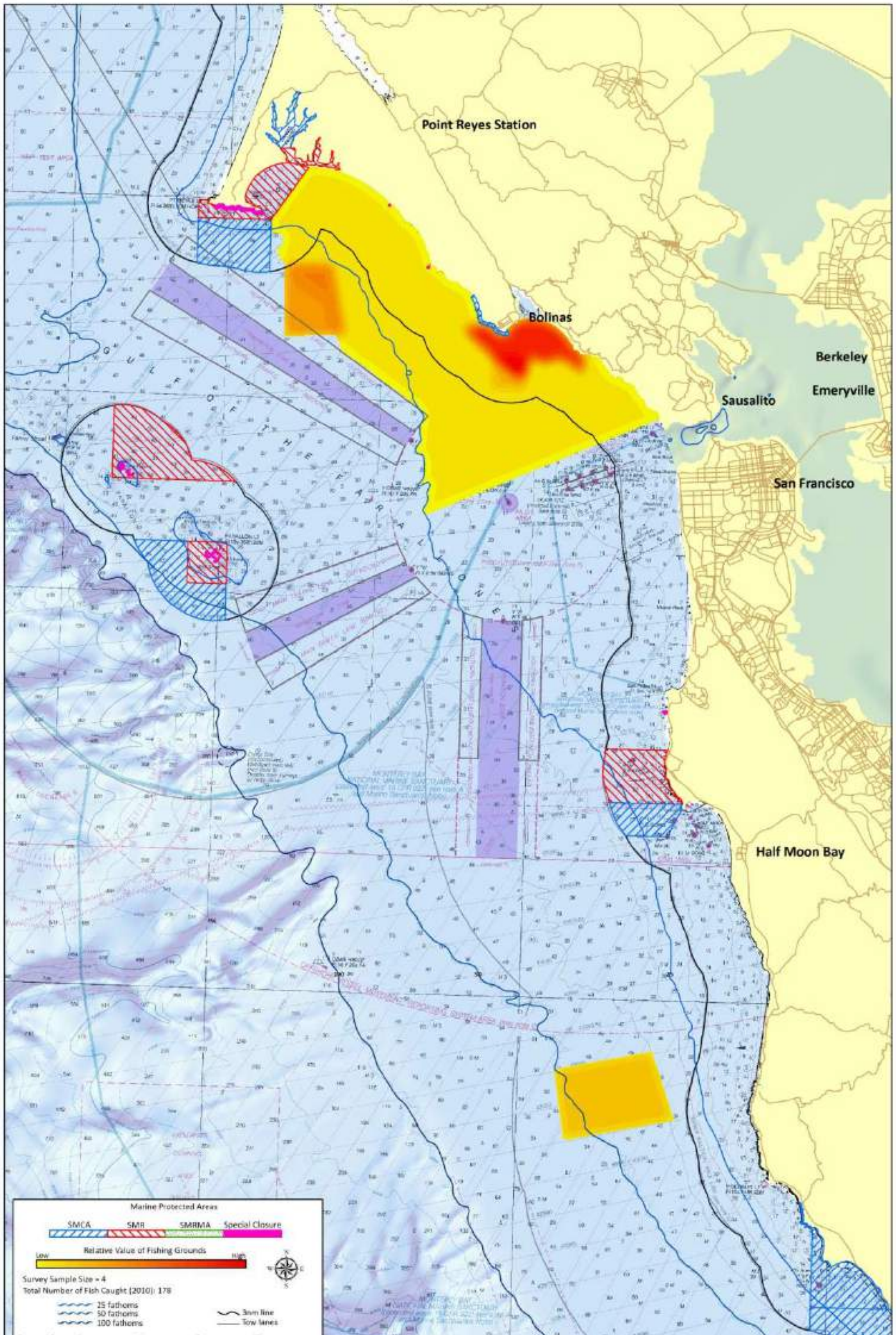
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
Emeryville – Salmon



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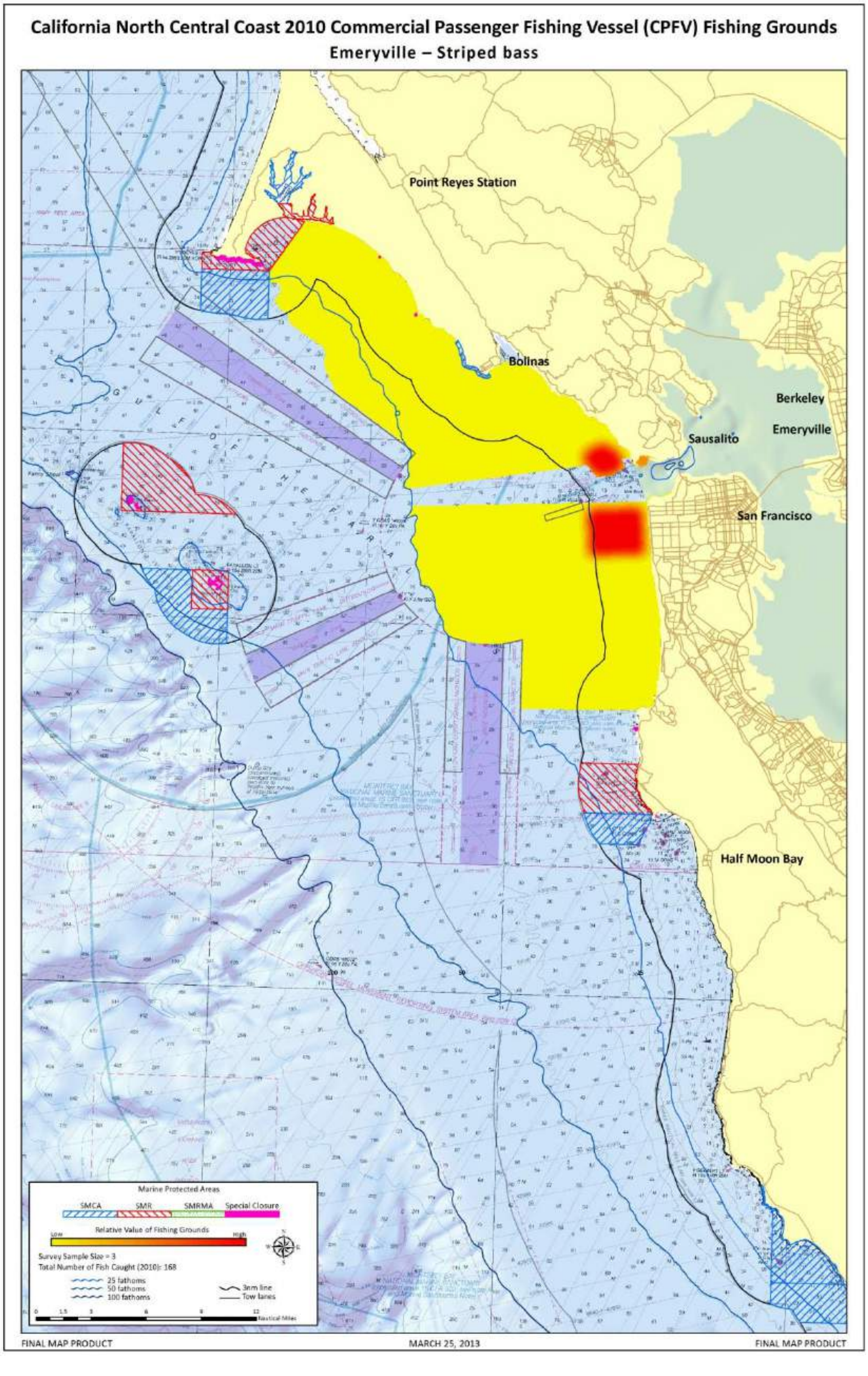
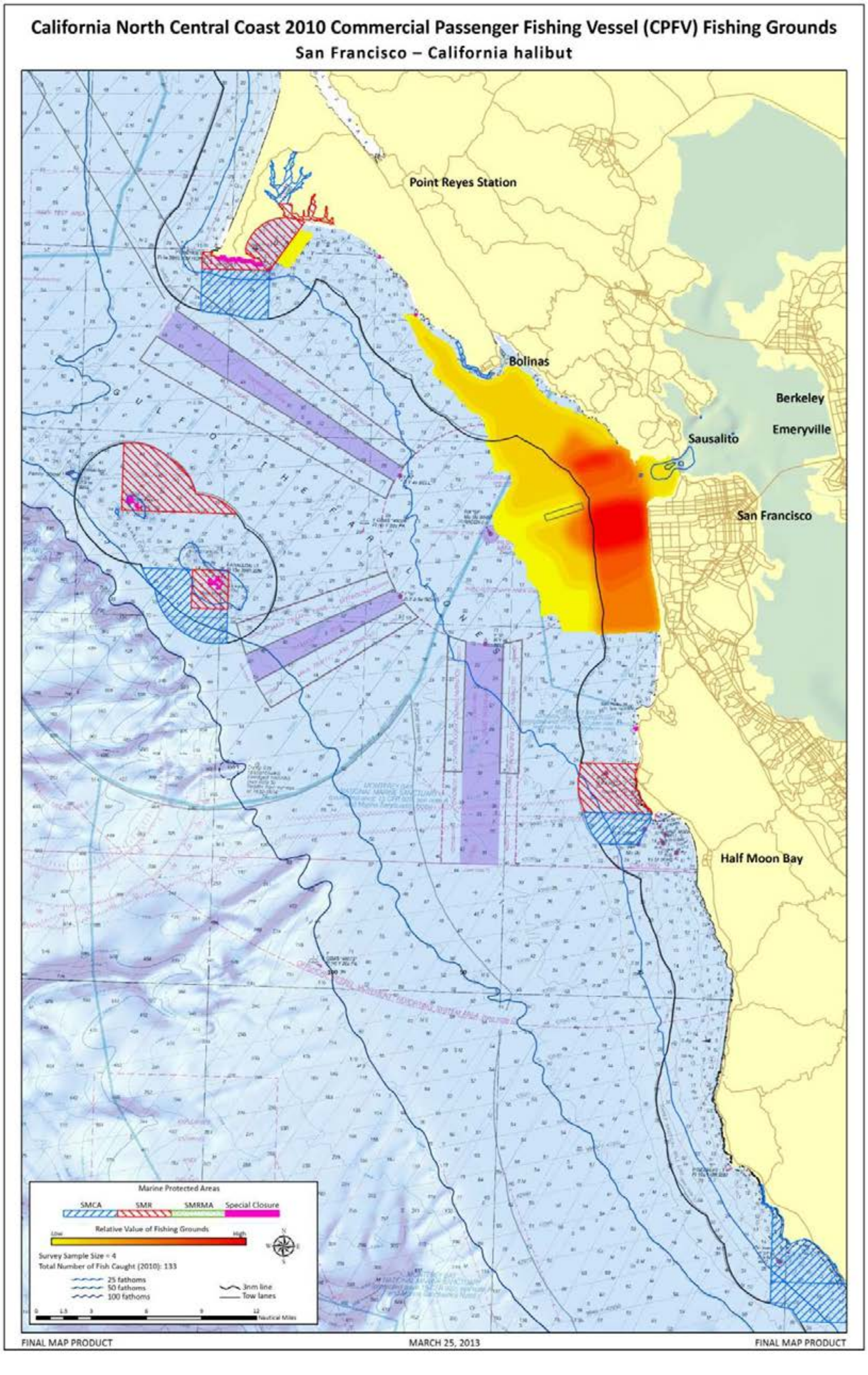
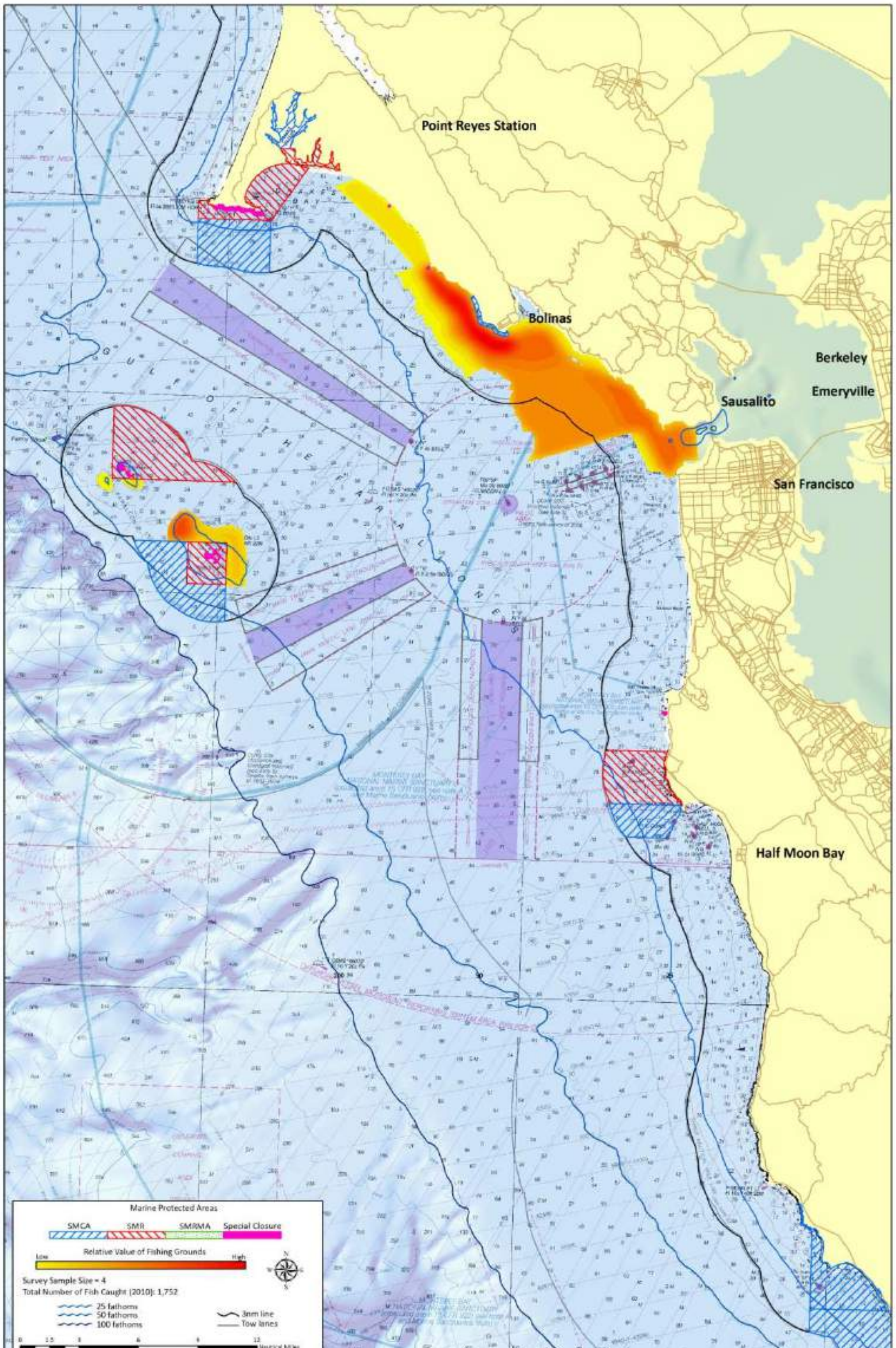

California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
Emeryville – Striped bass
Point Reyes Station
Bolinas
Berkeley
Emeryville
Sausalito
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Relative Value of Fishing Grounds
Low
High
Survey Sample Size = 3
Total Number of Fish Caught (2010): 168
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT

5.6. San Francisco CPFV Spatial Baseline



California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
San Francisco – Rockfish



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MARCH 25, 2013

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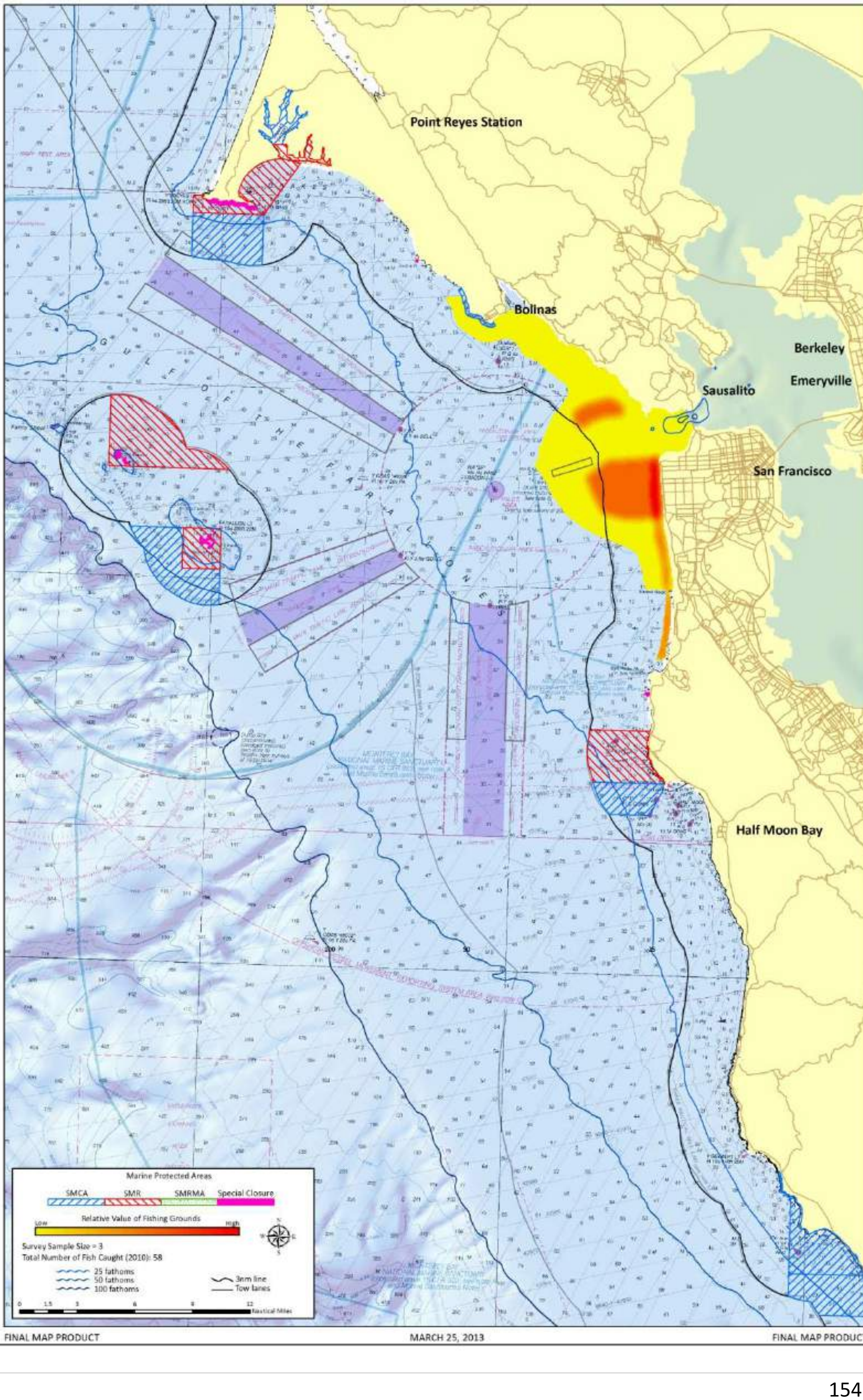
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

San Francisco – Striped bass



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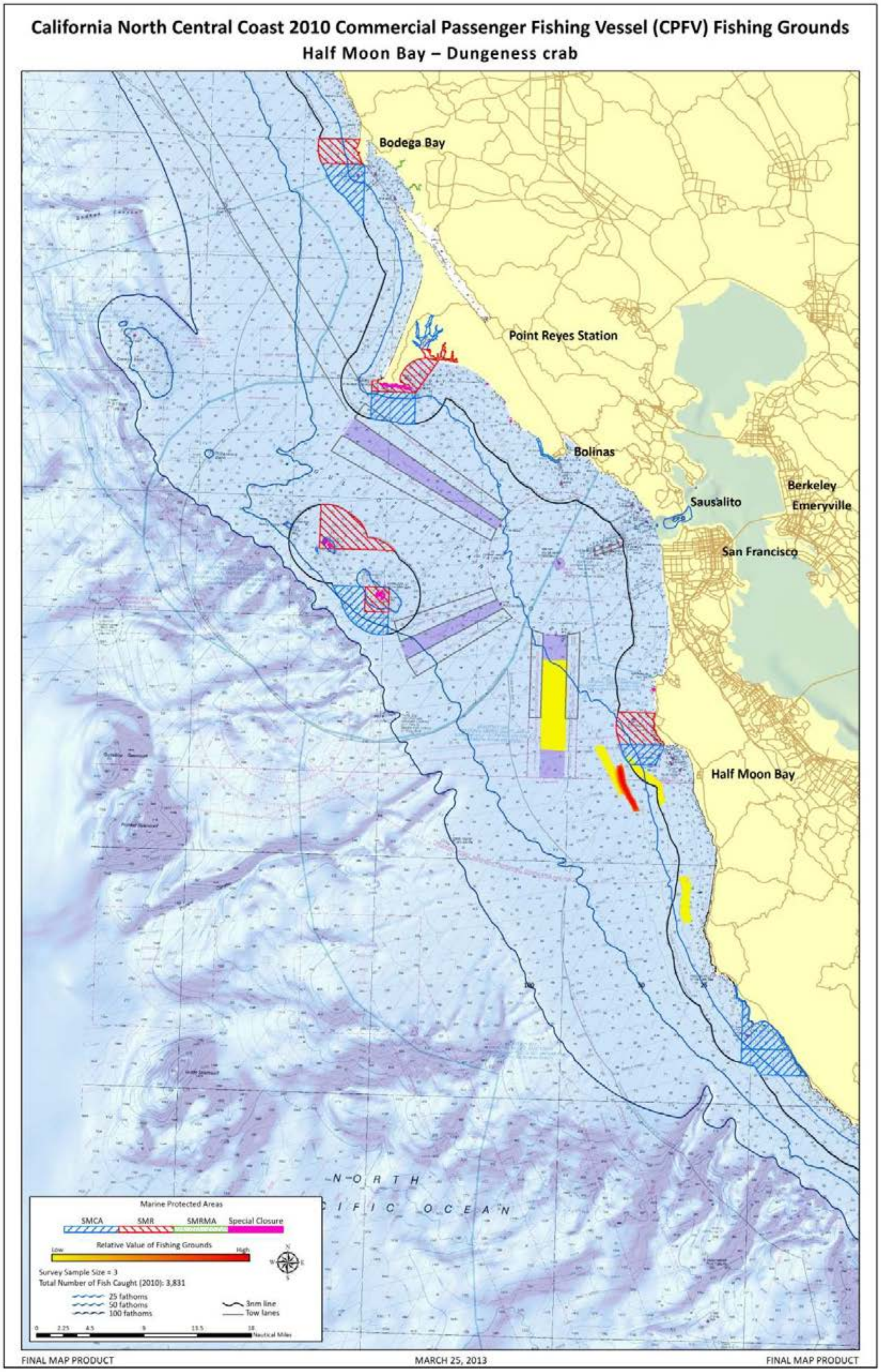
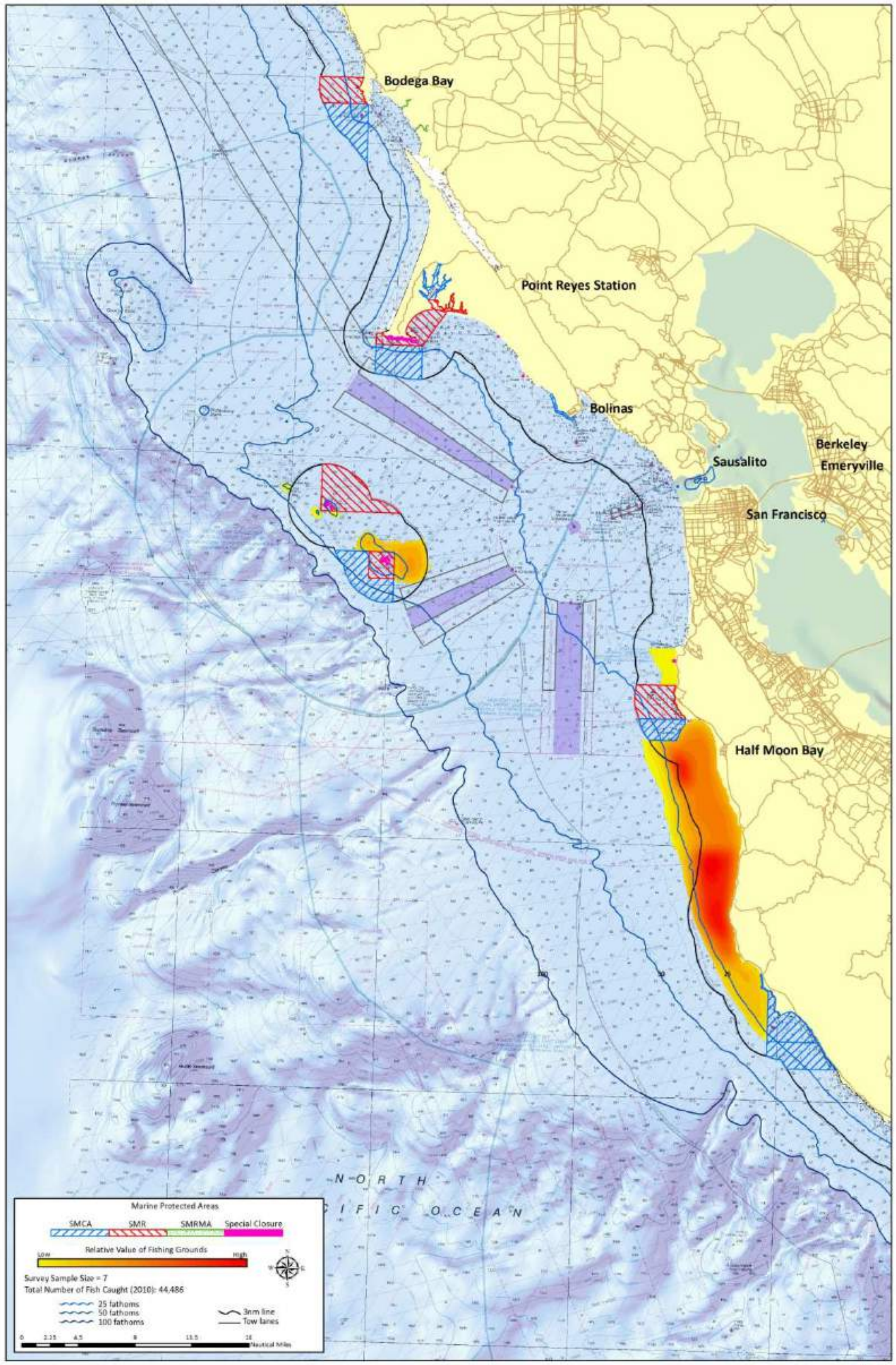
5.7. Half Moon Bay CPFV Spatial Baseline



California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
Half Moon Bay – Rockfish



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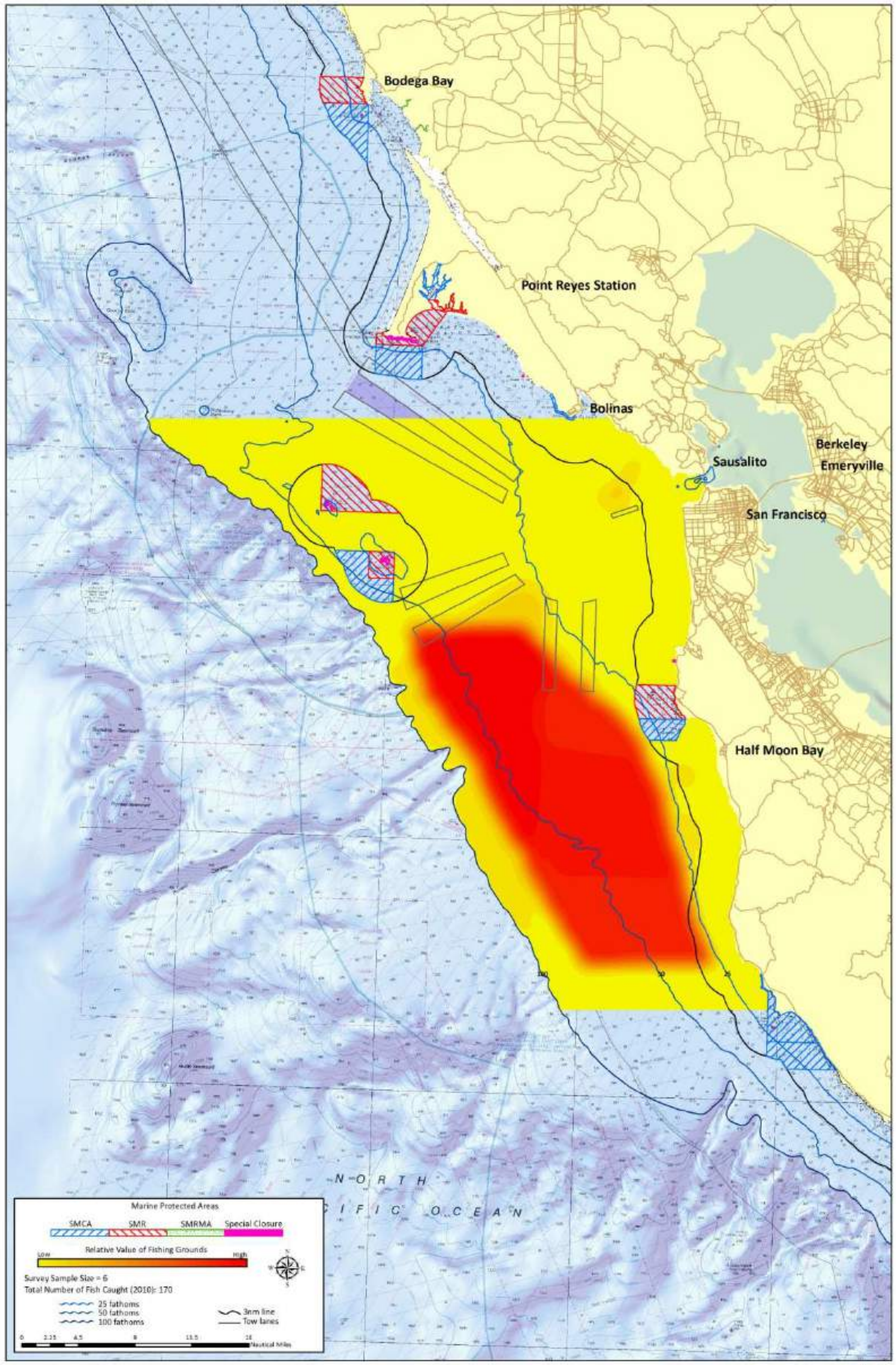
California North Central Coast 2010 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

Half Moon Bay – Salmon



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6. LESSONS LEARNED AND FUTURE RECOMMENDATIONS

This section reflects on several methodological and overall project lessons learned and recommendations to inform future long-term MPA monitoring efforts.

6.1. Lessons Learned/Future Recommendations

Community Engagement

Outreach efforts to port communities were initiated at the project's inception and continued throughout the project. Building trust and collaborating with fishing communities were important measures of success for our project; however, due to several factors such as: distrust in how information will be used; dissatisfaction with the MPA network planning process and its outcome; and unclear benefits and outcomes of participating in the project, we found that a significant number of fishermen were reticent to participate in the project.

This reticence to participate directly affects the survey sample size and thus the representativeness of the data collected. It also affects our ability to provide comprehensive interpretation of data analysis results. A wide base of community feedback and input to interpret project results is critical to add context, meaning, and identify possible drivers of change in the data we present. A good example of this is the interpretation of CPFV logbook data on historical or current trends on the number of vessels, anglers, and trips. Without the intimate knowledge of the fishing community we would only be able to provide a description of the data trends without insights of possible factors influencing observed changes which are important to understand the full landscape of factors (including MPAs) that affect change in the CPFV fleet.

During the first year of data collection, we received a fairly reasonably representative sample as fishermen were largely interested in providing their information on how MPAs have impacted them. However, in the second year of data collection we experienced considerably more resistance to participating with interviews. Many fishermen noted that they felt that they provided all the information needed in the first year's interview (e.g., mapping of fishing grounds and information on how the fisherman has been impacted by MPAs) and that the information provided has not changed since last year's interview—questioning the utility of participating in an additional interview. Furthermore, when contacted to participate in the second year of interviews we experienced an increased level of overall frustration in the lack of understanding of how spatial fishing data will be used and a belief that the data collected will somehow be used to harm fishermen or further restrict their fishing.

This presented a difficult challenge to the project, and the nature of these concerns listed above was difficult to address in a limited timeline and the limited scope of Ecotrust's role in the larger landscape of MPA management and monitoring. Despite this, Ecotrust networked within the fishing community and attended fishermen meetings to disseminate information and answer questions as to the intentions of the project, and to the extent possible explain how data will be used to inform the 5-year management review of the North Central Coast MPA network. Furthermore, Ecotrust made an intense effort to keep the fishing community informed of project progress to develop transparency in the work and maintaining relationships in the North Central Coast Region. We hope to continue and maintain these relationships into the future.

In future projects, these issues of trust, project intentions, incentives to participate, and how data will be used may be better be addressed up front with strategic joint outreach efforts with state agencies responsible for MPA management and monitoring. Implementing efforts to engage fishermen early on, acknowledging and addressing to the extent possible their concerns, and incorporating fishermen in the overall MPA monitoring process is important in key to building the fishing community relationships necessary to conduct long-term socioeconomic studies. This can be done by meaningfully incorporating fishermen into MPA monitoring efforts such as project design, data review/analysis, and data dissemination which are important to build trust and transparency and foster a sense of ownership and legitimacy over the data, information, and process which may potentially impact their livelihood.

A promising model of engaging the fishing community is currently being carried out in the North Coast region of California in which community engagement from citizens to county board of supervisors began early on and frequently with the agencies involved in both managing the MPA network as well as the MPA monitoring effort. This developed interest and support in MPA monitoring efforts as the community was engaged in shaping the MPA monitoring effort from the ground up and there was clear opportunity to develop community-based projects. This community-wide investment in MPA monitoring efforts from the beginning, even before the request for MPA monitoring proposals is developed is critical to garnering the community investment and support needed to carry out effective MPA monitoring—especially socioeconomic MPA monitoring efforts.

Collect Data on Personal and Community Well-Being

The socioeconomic well-being of fishermen and fishing communities is a multi-dimensional concept that requires both quantitative and qualitative data to fully assess and track over time. This project collected primarily economic data, however, a future recommendation would be to also collect information and quantitative data on the personal and community well-being of fishing communities. It is important to understand that economic revenue levels do not translate as a measure of personal or community well-being. A key example of this we have observed with fishermen in the North Central Coast region are scenarios in which fishermen are earning the same gross economic revenue but are spending more hours working, fishing, or travelling to fish—reducing his/her overall quality of life. This type of impact is not captured quantitatively in this project but rather only qualitatively in our survey questions where we asked generally how fishermen have been impacted by MPAs. However, well established personal well-being/quality of life measures and other measures such as sense of job satisfaction and job security can be applied to quantitatively measure these important aspects of socioeconomic health.

In addition to questions pertaining to personal well-being it is important to collect data on community well-being. This may initially include qualitatively exploring possible impacts to the fishing community as a whole, making sure to include people such as crew members, fish buyers/processors, port infrastructure staff, and port managers amongst others, to begin to explore and track any change in the complex relationships that make up the larger system of fishing beyond just fishermen. Qualitatively exploring community well-being helps to conceptualize the interconnections that make up the system that make fishing possible and thus what one must consider when quantitatively examining community impacts or impacts beyond fishermen.

Conduct More Analyses at the Individual Fisherman Level

In this report we largely utilize individual fisherman data in aggregation for port and region level analyses to establish a baseline data set. However, a future recommendation is to conduct more advanced analyses using individual fisherman data to explore typologies of fishermen or specific attributes of fishermen and how these types of fishermen are experiencing and coping with change over time. Specifically, some questions to explore with individual fisherman data include:

1. What type of fishermen are doing better or worse over time?
2. What attributes do these fishermen that are doing better or worse have in common—what do they fish for, how much do they fish, and what port are they from?
3. What type of fishermen have dropped out of commercial fishing or specific fisheries over time and why?

We know that the impacts of economic change do not unfold evenly across fishermen—some fishermen are more or less able to cope with change depending on their adaptive capacity. The questions above help explore fisherman attributes that may help us better understand what types of fishermen are successfully coping with change and why they are successful. Understanding this can lead to identifying target areas in which to focus policy efforts that help fishermen cope with economic change, such as the change that follows MPA establishment, in order to better maintain viable livelihoods.

Obtain Comprehensive Listing of CPFV Operators
An additional lesson learned is to access a comprehensive list of CPFV operators so that part-time CPFV operators that may not be as visible in a port community may be interviewed as well. Using the sampling methodology implemented in this project, full-time CPFV operations were found, however, to ensure all CPFV operators are given the opportunity to participate in monitoring efforts a list of operators and contact information could potentially be obtained through the CDFW.

6.2. Recommendations on Key CPFV Monitoring Metrics

Below are Ecotrust's recommendations of key metrics for long-term monitoring within the CPFV sector. To inform the existing monitoring plan structure we included the key monitoring metrics recommended for consumptive uses detailed in the North Central Coast and South Coast MPA monitoring plans and added additional metrics with an associated rationale.

Table 86. Recommendations for key monitoring metrics in the CPFV sector

Metric	Purpose	Source
Landings (number of fish caught)	This metric is to monitor how many fish are being caught in key CPFV fisheries. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Average annual gross revenue from CPFV operations	This metric is to monitor how gross economic revenue levels may be changing over time	Survey data
Average percent of revenue from key fisheries/activities	This metric is to monitor changes in the average proportion of CPFV operator gross economic revenue relies upon a specific fishery/activity.	Survey data
Operating costs (average yearly percentages)	This metric is to monitor how operating costs may be changing over time. This may be increases/decreases in fuel costs, equipment costs, maintenance costs, crew costs, etc. From this information changes in net revenue for individual CPFV operators may be calculated. These operating cost percentages may also be used to help estimate secondary economic impacts upon CPFV support industries.	Survey data
Total number of CPFV vessels operating	This metric is to monitor how many vessels are operating, each year. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Total number of CPFV fishing trips	This metric is to monitor changes in the number of CPFV fishing trips that are being conducted each year as this is an indicator of economic conditions. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Total number of anglers	This metric is to monitor how many anglers are taking CPFV trips each year as this is an indicator of economic conditions. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Catch per unit effort (CPUE)	This metric is to monitor the average amount of fish caught per unit of effort. This metric is useful in helping determine changes in fish abundance or the success of fishing trips which is related to customer satisfaction. This metric may be calculated by dividing the number of fish caught (landings) by the number of trips or the number of anglers.	CPFV logbook data
Number of anglers per trip	This metric is to monitor the average number of anglers participating in each CPFV fishing trip as this is an indicator of economic conditions. This metric may be calculated by dividing the total number of anglers by the total number of trips. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Spatial value of fishing area	This metric is to monitor changes in how coastal/ocean areas are being utilized and valued by CPFV operators. Data may be analyzed with previous spatial data sets to determine spatial shifts in the value of fishing areas for key fisheries	Survey data
Attitudes and perceptions	This information is to monitor and collect contextual information that may help identify key CPFV issues and factors driving the change observed in the metrics listed above.	Survey data/focus groups
Job satisfaction/ Well-being/ Quality of life	These social metrics are important to monitor as economic metrics may not reveal changes in personal well-being. For example, a fisherman may be making the same amount of revenue from one year to the next, but his/her quality of life may decline in increased work hours or travel time in order to do so.	Survey data/focus groups

7. CONCLUSION

The intention of this report was to provide a baseline characterization and description of initial changes since MPA implementation of key target fisheries and ports of the CPFV sectors in the California North Central Coast Region. It should be noted that in this report we do not account for the secondary economic effects of changes in fishing revenue and how that may affect support industries such as fish processors/buyers, port workers, crew, and the tourism economy which benefits and may rely on the business of CPFV passengers. Indeed, these industries are vital to the success and health of fishing communities and are important to account for in future monitoring efforts.

It is difficult to discern the effects of MPAs on fishing communities as they are confounded by a multitude of factors such as other regulatory constraints (e.g., area based closures, quota limits, and limited entry fisheries) and general economic downturn, environmental variability/change, market variability, and increasing competition for marine space. However, advancing our understanding of how humans utilize, value, and rely upon marine space will be critical to unraveling these interconnections as well as monitor how MPAs are benefitting or impacting fishing communities into the future. This information may then be used in adaptive management measures to improve the performance of MPAs towards meeting ecological and socioeconomic goals. Similarly, it is our hope that the data collected/compiled and lessons learned through this project will be applied to future MPA monitoring efforts to build a time series data set on how human uses and the socioeconomic health of fishing communities are changing over time. Such a robust and longitudinal dataset that provides both socioeconomic characterization and spatial fishing patterns on consumptive human uses could be used for a wide array of marine spatial planning application including the monitoring of MPAs.

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APPENDIX A

CALIFORNIA NORTH CENTRAL COAST CPFV 2011 BASELINE CHARACTERIZATION

The 2010 data set is presented in the main body of this report as the survey sample in this first year of data collection was significantly more robust and thus more representative and reliable as a baseline characterization of the North Central Coast region CPFV fleet. Reasons as to why the second year of data collection (2011 fishing year) did not yield as robust of a survey sample is explained in detail in our lessons learned section in the main body of the report.

Here we present the data collected in the second year of the project (collected in 2012 inquiring about the entire 2011 fishing year) summarized at the study regional level below. Additional port specific data can be found in the accompanying data workbooks, maps, and spatial data sets included in the deliverables package of this project which can be found on the OceanSpaces website: (http://oceanspaces.org).

In San Francisco one individual we interviewed was an owner only and provided information his captain was unable to provide (Table 1). The rest of the respondents were either owner/operators or just operators. In both Bodega Bay and Sausalito we were only able to interview one operator while in Half Moon Bay we interviewed 5 operators. The average respondent across the study region was 48.7 years old, had 17.3 years experience owning a CPFV vessel (if applicable), and 20.1 years experience operating a CPFV vessel (Table 2). Additionally, the average respondent reported that they made an average of 69.2 percent of their personal income from CPFV fishing in 2011. When asked what factors had changed between 2010 and 2011 that had impacted the percent of their revenue generated by CPFV operations, respondents provided a variety of responses (Table 3). Two individuals noted that they felt their revenue had gone up because salmon was doing better. Another respondent noted that his revenue had gone down and he felt this was due to there being fewer customers in 2011.

Table 1. Number of CPFV interviews completed, North Central Coast Region

Port	Individuals interviewed
Bodega Bay	1
Sausalito	1
Berkeley	4
Emeryville	4
San Francisco	3*
Half Moon Bay	5
Grand Total	18

Source: Current study

** One individual interviewed in San Francisco is an owner only and provided revenue information for his operator.*

Table 2. CPFV survey response statistics, 2011, North Central Coast

	Response	Standard deviation	Number responding
Individuals interviewed	18	n/a	n/a
Owner only	1	n/a	n /a
Average age	48.7	10.5	18
Average number of years owning CPFV boat/s	17.3	10.5	16
Average number of years operating CPFV boat/s	20.1	11.0	17
Average percent income from CPFV operations in 2011	69.2%	34.4%	18

Source: Current study

Table 3. Cause in change in percent of total income from CPFV from 2010 - 2011, North Central Coast

	Response	Number responding
Increase	No longer receiving salmon subsidies	1
	No longer focusing on other work	1
	2010 was a bad year	1
	Made more money fishing commercially in 2010	1
	Other work required more time in 2010	2
	Fewer salmon in 2010	2
Decrease	Fewer customers in 2011	1
	Total number responding	5

Source: Current study

Respondents were asked if they had additional sources of income other than CPFV operations. Eight respondents indicated that they did, and five indicated the source was another type of fishing related work such as commercial fishing (Table 4).

Table 4. Sources of income in 2011 in addition to CPFV operation, North Central Coast Region

Response	Number responding
Commercial fishing/other fishing related job	5
Dental practice	1
Gold mining	2
Harbor related work	2
Investments	2
Real estate	1
Total number responding	8

Source: Current study

Across the entire North Central Coast study region the average CPFV operator and/or owner reported making a gross economic revenue (GER) of $132,000 in 2011 (Table 5). Additionally, respondents reported they spent an average of 26.8 percent of their GER on fuel, 11.5 percent on crew, and 29.3 percent on other operational expenses, which left operators with an average net revenue of $42,783.

Table 5. Average CPFV gross economic revenue (GER) to operating costs, North Central Coast

	Number responding	Average response	Standard deviation
Total GER 2011	16	$132,000	$86,073
% GER to fuel	17	26.8%	9.3%
% GER to crew	17	11.5%	8.1%
% GER to other operating costs	17	29.3%	15.7%

Source: Current study

Most respondents (58.8 percent) reported that operating costs in 2011 were average compared to 2010. The remainder felt that their 2011 expenses were either somewhat higher (29.3 percent) or significantly higher (11.8 percent) than in 2010 (Table 6).

Table 6. Change in overall commercial fishing operating costs in 2011 compared to 2010, North Central Coast

	Fishery/activity	Number responding	Significantly higher	Somewhat higher	Average	Somewhat lower	Significantly lower
Fishery	California halibut	9	22.2%	33.3%	44.4%	—	—
	Dungeness crab	8	—	25.0%	75.0%	—	—
	Rockfish	16	12.5%	25.0%	62.5%	—	—
	Salmon	16	12.5%	25.0%	62.5%	—	—
	Striped bass	4	25.0%	25.0%	50.0%	—	—
	Tuna/dorado	3	—	33.3%	66.7%	—	—
Activity	Funeral services	3	—	—	100.0%	—	—
	Whale watching	3	—	—	100.0%	—	—
	Other^	6	—	16.7%	83.3%	—	—
All fisheries/activities (unique individuals)		17	11.8%	29.4%	58.8%	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, research trips, leisure cruises, and nature trips

All seven individuals who provided reasons for their increase in operating costs included rising fuel costs. Some respondents reported additional reasons which can be seen in Table 7.

Additionally, respondents were asked regarding what factors may have impacted their total gross economic revenue in 2011. Responses were varied with some individuals mentioning that 2011 had better fishing than 2010, that they had changed or added a fishery, and that they were able to fish salmon in 2011. Additional reasons are listed in Table 8.

Table 7. Cause in change in percent gross economic revenue towards CPFV operating costs, North Central Coast

Response	Number responding
Increase in fuel prices	7
Increase in bait prices	2
Overhaul/large maintenance of vessel	1
Increase in gear prices	1
Increase in crew wages	1
Total number responding	7

Source: Current study

Table 8. Cause in change in overall income from CPFV in 2011, North Central Coast

	Response	Number responding
Increase	Better fishing	3
	Changed/added fishery	2
	Put in more time/effort	1
	Better weather	1
	Was able to fish some salmon	2
	Better economy	1
	Was able to fish longer into the season	1
	More clients	1
	Charged higher prices	1
Decrease	Fished fewer months than normal	1
	Fewer squid	1
	Fewer customers	1
Total number responding		9

Source: Current study

Of the seventeen respondents (the owner only is not included here) eight reported conducting non-consumptive activities in 2011. On average, respondents reported operating fishing trips most frequently (91.2 days as opposed to 67.5 days for non consumptive activities). The average number of passengers per trip, price per trip, and crew per trip were similar for both consumptive and non consumptive trips. More information can be found below in Table 9.

Table 9. CPFV trip statistics, 2011, North Central Coast

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	n/a	17	n/a	n/a	8	n/a
Average number of trips	17	91.2	37.2	8	67.5	135.5
Average number of passengers(per trip)	17	13.5	5.3	8	13.6	11.9
Average price per passenger (per trip)	17	$110	$37	6	$106	$68
Average number of crew (per trip)	16	0.9	0.6	8	0.8	0.5

Source: Current study

Half of the respondents we spoke to who targeted Dungeness crab in 2011 indicated that they had added the fishery since 2010. Three respondents shared their reasons for doing so and they are listed below in Table 11.

Table 10. CPFV fisheries added/dropped since 2010 or not fished in 2011, North Central Coast

			Percent responding		
	Fishery/activity	Number responding	Added	Dropped	Not fished in 2011
Fishery	California halibut	9	—	—	—
	Dungeness crab	8	50%	—	—
	Rockfish	16	—	—	—
	Salmon	16	—	—	—
	Striped bass	4	—	—	—
	Tuna/dorado	3	—	—	—
Activity	Funeral services	3	—	—	—
	Whale watching	3	—	—	—
	Other^	6	—	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, research trips, leisure cruises, and nature trips

Table 11. Reason for adding/dropping a fishery since 2010 or not fishing in 2011, North Central Coast

Response	Number responding
Saw opportunity to increase profit	1
Less competition due to commercial strike	1
Had the gear from commercial fishing	1
Reinvested salmon disaster money into crab gear	1
Total number responding	3

Source: Current study

For each fishery or activity they targeted in 2011, CPFV fishermen were asked how many days they spent targeting that fishery/activity and what percent of their gross economic revenue (GER) they earned from that fishery or activity. Rockfish generated the most revenue, 43.8 percent of the average respondent's GER, followed by salmon (30.4 percent), and striped bass (22.3 percent). The only fishery that generated less revenue than any of the non consumptive activities was tuna/dorado which only generated, on average, 2.3 percent of an individual's CPFV operator's GER and was only targeted an average of 2.3 days per year. Additional information is found below in Table 12.

Table 12. Number of days and percent GER targeting fishery/activity in 2011, CPFV, North Central Coast

			Number of days targeting species (2011)			Percent of GER from fishery/activity (2011)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	California halibut	9	9	48.0	38.1	9	20.4%	14.2%
	Dungeness crab	8	8	23.4	17.1	8	11.9%	8.9%
	Rockfish/lingcod	16	16	44.7	26.9	16	43.8%	33.0%
	Salmon	16	16	35.6	36.7	16	30.4%	29.4%
	Striped bass	4	4	71.3	35.7	4	22.3%	12.7%
	Tuna/dorado	3	3	2.3	1.5	3	2.3%	2.5%
Activity	Funeral services	3	3	16.7	16.5	3	7.0%	5.2%
	Whale watching	3	3	4.0	3.5	3	4.0%	5.2%
	Other^	6	6	5.7	4.3	6	7.5%	8.7%

Source: Current study

^ includes bird watching, research trips, leisure cruises, and nature trips

All CPFV operators were asked to compare the success in each of their target fisheries and non consumptive activities in 2011 to the previous five years. As shown below in Table 13 respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. Respondents were then asked what factors they felt had contributed to the level of success in their fishery. This question was asked in an open ended manner and responses were later coded, categorized, and divided into four types of categories: regulatory, environmental, economic, and other as seen in the tables below.

An equal number of respondents (33.3 percent) indicated they felt the California halibut fishery was either the same, significantly worse, or somewhat worse than it had been in the previous five years. Respondents primarily indicated this was due to environmental factors having to do with oceanic conditions, lack of bait, and low quantity and quality of halibut. Responses in the Dungeness crab fishery were varied, with 25 percent of respondents indicating their fishery was significantly better and another 25 percent indicating it was somewhat worse. One person who thought it was doing worse mentioned that there had been an increased effort by the commercial crab fishery, creating more competition. Those who felt Dungeness crab was doing better mentioned that it was the peak year of a natural cycle. Similarly, responses for rockfish were varied. Half of the respondents who targeted rockfish in 2011 indicated their fishery was the same as it had been in the previous five years. Of the remaining respondents, 25 percent felt rockfish was somewhat worse, 6.3 percent felt it was significantly worse, 12.5 percent felt it was somewhat better, and 6.3 percent if was significantly better. Those who said rockfish was doing better mentioned good oceanic conditions and fewer private boats targeting rockfish. Those who indicated rockfish was doing worse indicated regulatory factors such as MPAs or the RCA as well as some environmental factors such as small fish, low quantity of fish, and poor oceanic conditions. Fishermen reported that the most important factor impacting success in the salmon fishery was that they were allowed more days of fishing. Few responses for non consumptive activities were given. One respondent indicated that the generally poor economy contributed to them losing whale watching customers. More responses for each fishery and activity can be found below in Table 14.

Table 13. Overall success in CPFV fishery/activity in 2011 compared to past five years, North Central Coast

			Percent response					
		Number responding	Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	9	—	—	—	33.3%	33.3%	33.3%
	Dungeness crab	8	25.0%	25.0%	12.5%	12.5%	25.0%	—
	Rockfish	16	—	6.3%	12.5%	50.0%	25.0%	6.3%
	Salmon	16	—	18.8%	31.3%	37.5%	6.3%	6.3%
	Striped bass	4	—	—	25.0%	50.0%	25.0%	—
	Tuna/dorado	3	—	—	—	33.3%	33.3%	33.3%
Activity	Funeral services	3	—	—	—	100.0%	—	—
	Whale watching	3	—	33.3%	—	33.3%	—	33.3%
	Other^	6	—	16.7%	—	83.3%	—	—

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, research trips, leisure cruises, and nature trips

Table 14. Factors influencing success in specific CPFV fishery/activity in 2011 compared to previous five years, North Central Coast

		Number responding							
		Fishery							
		California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Tuna/ dorado	Whale watching	Other^
	Regulatory factors	**2**	**—**	**4**	**6**	**1**	**—**	**—**	**—**
Worse	MPAs	1	—	4	—	—	—	—	—
	More pressure on fishery due to lack of salmon season and/or MPAs	1	—	—	—	—	—	—	—
	RCA	—	—	1	—	—	—	—	—
	Water management issues	—	—	—	2	1	—	—	—
Better	Allowed fishing days	—	—	—	4	—	—	—	—
	Fishery closed in previous seasons	—	—	—	1	—	—	—	—
	Environmental factors	**4**	**3**	**4**	**5**	**1**	**2**	**2**	**—**
Worse	Bad weather	—	—	—	—	—	1	1	—
	Poor ocean conditions	1	—	1	—	—	1	1	—
	Loss of salmon spawning grounds	—	—	—	2	—	—	—	—
	Low of natural cycle	1	—	—	—	—	—	—	—
	Lack of bait feed	2	—	—	—	—	—	—	—
	Small fish	1	—	1	—	—	—	—	—
	Low quantity of fish	1	—	1	—	—	—	—	—
Better	Good ocean conditions	—	—	2	2	1	—	1	—
	High quantity of fish	—	—	—	2	—	—	—	—
	Peak of natural cycle	—	3	—	—	—	—	—	—
	Economic factors	**—**	**—**	**—**	**—**	**—**	**—**	**1**	**—**
Worse	Bad economy	—	—	—	—	—	—	1	—
	Other factors	**1**	**1**	**1**	**1**	**—**	**1**	**—**	**1**
Worse	Put less effort into fishery	—	—	—	—	—	1	—	—
	Increase commercial effort	1	1	—	—	—	—	—	—
Better	Fewer private boats	—	—	1	—	—	—	—	—
	Did more advertising	—	—	—	—	—	—	—	1

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, research trips, leisure cruises, and nature trips

North Central Coast Region MPAs and the CPFV Sector

Determining and measuring the impact of MPAs upon CPFV operations is challenging to quantify and unravel from the multitude of environmental, regulatory, and economic factors influencing systems of fishing. Despite this, we sought to capture information from fishermen as to how they perceive they have been impacted by MPAs and the specific MPAs which are impacting their fisheries. This section provides information at the region and port levels and summarizes the response from the following three questions which were asked for each fishery during interviews:

1) Has your fishery been directly impacted by the recently established MPAs?;
2) If so, how have you been impacted?; and,
3) What MPAs have impacted your specific fishery?

Question one was posed as a simple yes or no response and questions two and three were open-ended questions in which responses were later coded and categorized into the tables below. Additionally, fishermen were given a map of the MPAs in the North Central Coast to aid in identifying and naming the MPAs impacting them. The questions above were asked for every fishery an individual participated in.

Rockfish was reported by the most respondents (93.8 percent) as being impacted by MPAs. After the loss of traditional fishing grounds, which impacted 94.1 percent of individuals in the study region, the most frequently reported type of impact was spending more time fishing and traveling for fishing, which were mentioned by 47.1 percent of all respondents. Of all the fisheries that were reported as having some sort of impact, salmon was indicated less frequently, although striped bass and tuna/dorado, were not indicated as being impacted by any respondents. More information regarding the types of impacts for each fishery and activity can be found below in Table 15. CPFV respondents indicated they had been impacted by 20 of the 31 MPAs in the North Central Coast, which are listed in Table 16. The MPAs surrounding the Farallon Islands were indicated by the largest percentage of individuals (70 – 76.5 percent), particularly for rockfish (75 to 81.3 percent) as impacting them.

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Table 15. Percent of individuals indicating direct impacts from MPAs for each fishery in 2011, CPFV fishermen, North Central Coast

	Fishery					Activity		
	California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Whale watching	Other^	Unique individuals
Number responding	9	8	16	16	4	3	6	17
Percent indicating direct impacts from MPAs	33.3%	37.5%	93.8%	18.8%	—	—	33.3%	94.1%
Response	**Percent responding**							
Loss of traditional fishing grounds	33.3%	37.5%	93.8%	18.8%	—	—	33.3%	94.1%
Spending more time fishing/traveling for fishing	—	25.0%	50.0%	18.8%	—	—	—	47.1%
Fishing more in areas with worse/less predictable weather	—	—	12.5%	6.3%	—	—	—	17.6%
Increased fishing pressure/crowding in open areas	—	—	18.8%	—	—	—	—	17.6%
Fewer passengers	—	—	12.5%	—	—	—	—	11.8%
Increase in fuel	—	—	12.5%	—	—	—	—	11.8%
Getting paid for MPA research	—	—	—	—	—	—	16.7%	5.9%
Catching fewer fish	—	—	6.3%	—	—	—	—	5.9%
Catching smaller fish	—	—	6.3%	—	—	—	—	5.9%

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, research trips, leisure cruises, and nature trips

Table 16. MPAs impacting specific CPFV fisheries/activities in 2011, North Central Coast

MPA	Fishery: California halibut	Dungeness crab	Rockfish	Salmon	Striped bass	Activity: Whale watching	Other^	Unique individuals
Number responding	9	8	16	16	4	3	6	17
Bodega Head SMCA	—	—	6.3%	—	—	—	—	5.9%
Bodega Head SMR	—	—	6.3%	6.3%	—	—	—	5.9%
Double Point/Stormy Stack SC	11.1%	—	6.3%	—	—	—	—	5.9%
Drake's Estero SMCA	—	—	6.3%	—	—	—	—	5.9%
Duxbury Reef SMCA	11.1%	—	31.3%	—	—	—	—	35.3%
Egg (Devil's Slide) Rock to Devil's Slide SC	—	—	6.3%	—	—	—	33.3%	5.9%
Montara SMR	11.1%	25.0%	43.8%	12.5%	—	—	—	41.2%
North Farallon Islands SC	—	12.5%	75.0%	—	—	—	—	70.6%
North Farallon Islands SMR	—	12.5%	81.3%	6.3%	—	—	—	76.5%
Pillar Point SMCA	—	12.5%	43.8%	6.3%	—	—	—	41.2%
Point Resistance Rock SC	11.1%	—	6.3%	—	—	—	—	5.9%
Point Reyes Headlands SC	—	—	25.0%	—	—	—	—	23.5%
Point Reyes SMCA	22.2%	—	56.3%	—	—	—	—	52.9%
Point Reyes SMR	22.2%	—	43.8%	6.3%	—	—	—	41.2%
Russian River SMCA	—	—	6.3%	6.3%	—	—	—	5.9%
Southeast Farallon Island SC	—	12.5%	75.0%	—	—	—	50.0%	70.6%
Southeast Farallon Island SMCA	—	12.5%	81.3%	—	—	—	—	76.5%
Southeast Farallon Island SMR	—	12.5%	81.3%	6.3%	—	—	33.3%	76.5%
Stewarts Point SMR	—	—	6.3%	—	—	—	—	5.9%
Number of MPAs impacting fishery	6	7	19	7	—	—	3	19

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

^ includes bird watching, research trips, leisure cruises, and nature trips

North Central Coast CPFV 2011 Spatial Baseline

In the following section we provide maps of baseline data depicting the spatial fishing patterns of specific CPFV fisheries at the port and region level. The full detailed methodology of how these data were collected, analyzed, and reviewed can be found in the methods section of the main report. The GIS data layers with associated metadata of these spatial data sets are also available and were included in the deliverables package of this project which can be found on the OceanSpaces website: (http://oceanspaces.org).

The following map products and spatial data sets for the North Central Coast region CPFV fleet for the 2011 season are provided in Table 17 below. The table below also indicated the total number of fish caught for each port-fishery or region-fishery combination. As detailed in our methods section in the main body of the report, the total number of fish caught for a given fishery in a port was used to weight port level data when aggregating data to a region level spatial data set. This was done to control for possible sample bias across ports. Only maps with 3 or more fishermen are available for use due to confidentiality protocols as indicated in the table below.

Table 17. 2011 Map products and spatial data sets developed and available

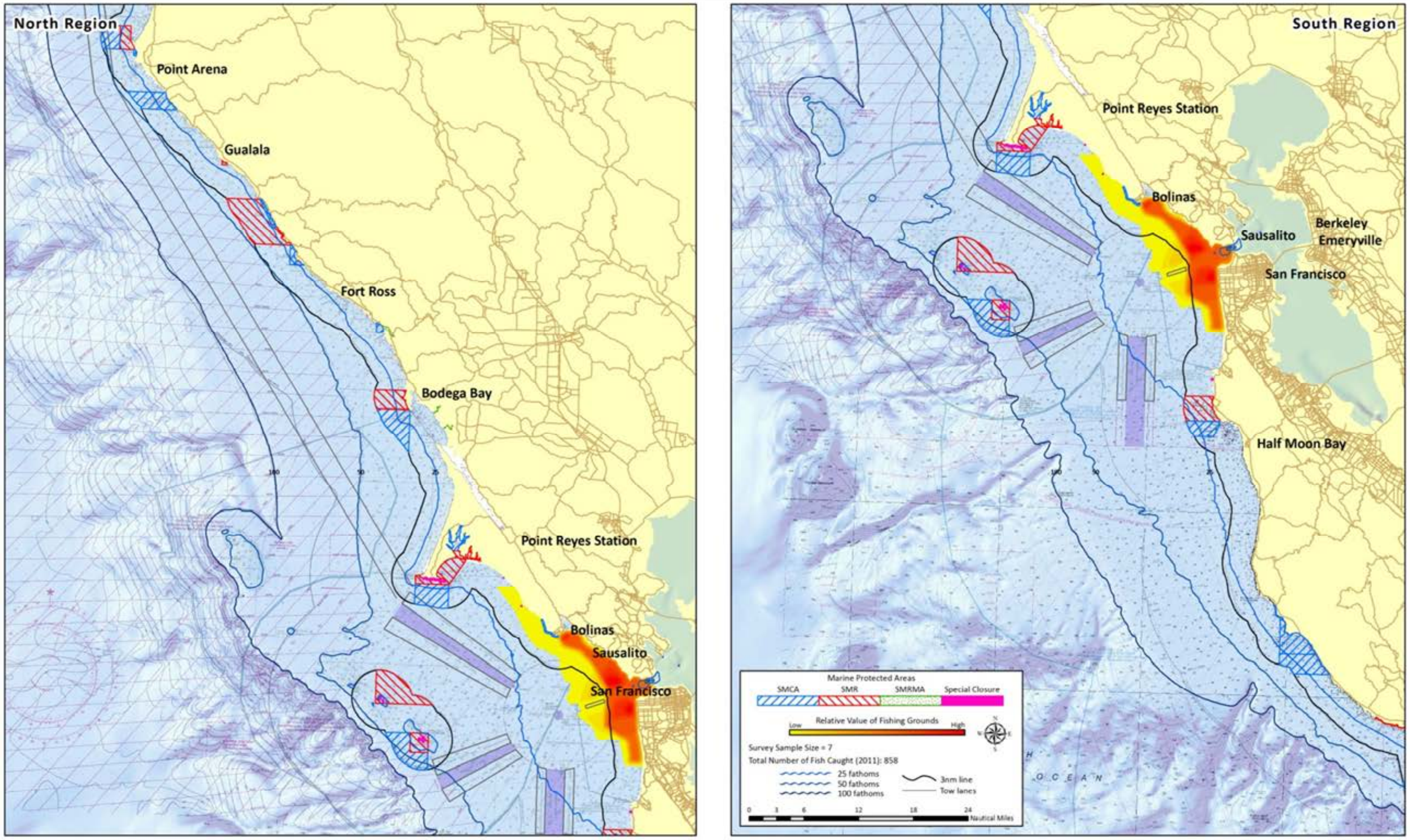
Port/Region	Fishery	Number of fish caught by CPFV operations	Number of fishermen who mapped	Map available
North Central Coast	California halibut	858	7	YES
North Central Coast	Dungeness crab	39,362	6	YES
North Central Coast	Rockfish	192,169	15	YES
North Central Coast	Salmon	8,700	15	YES
Bodega Bay	California halibut	—	—	—
Bodega Bay	Dungeness crab	12,744	1	NO
Bodega Bay	Rockfish	41,252	1	NO
Bodega Bay	Salmon	1,025	1	NO
Sausalito	California halibut	—	—	—
Sausalito	Dungeness crab	—	—	—
Sausalito	Rockfish	278	1	NO
Sausalito	Salmon	1,433	1	NO
Berkeley	California halibut	361	2	NO
Berkeley	Dungeness crab	3,914	1	NO
Berkeley	Rockfish	27,765	3	YES
Berkeley	Salmon	1,825	2	NO
Emeryville	California halibut	378	3	YES
Emeryville	Dungeness crab	14,763	2	NO
Emeryville	Rockfish	57,737	4	YES
Emeryville	Salmon	1,395	4	YES
San Francisco	California halibut	99	2	NO
San Francisco	Dungeness crab	—	—	—
San Francisco	Rockfish	819	1	NO
San Francisco	Salmon	2,200	2	NO
Half Moon Bay	California halibut	20	1	NO
Half Moon Bay	Dungeness crab	7,941	2	NO
Half Moon Bay	Rockfish	64,318	5	YES
Half Moon Bay	Salmon	822	5	YES

Source: California Department of Fish and Wildlife, Current study

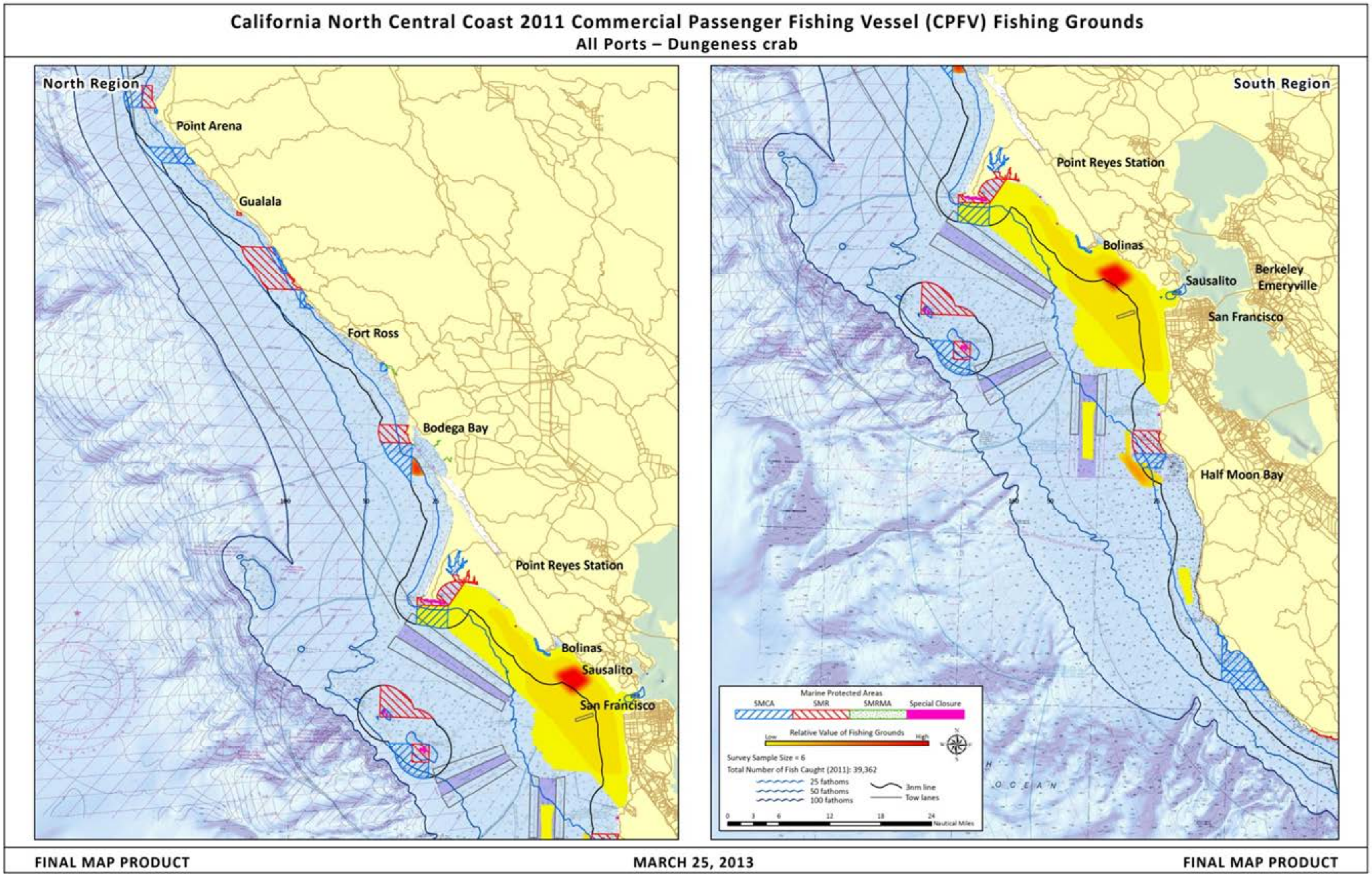
— indicates that the port/fishery was not sampled or a zero value data point

California North Central Coast 2011 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds

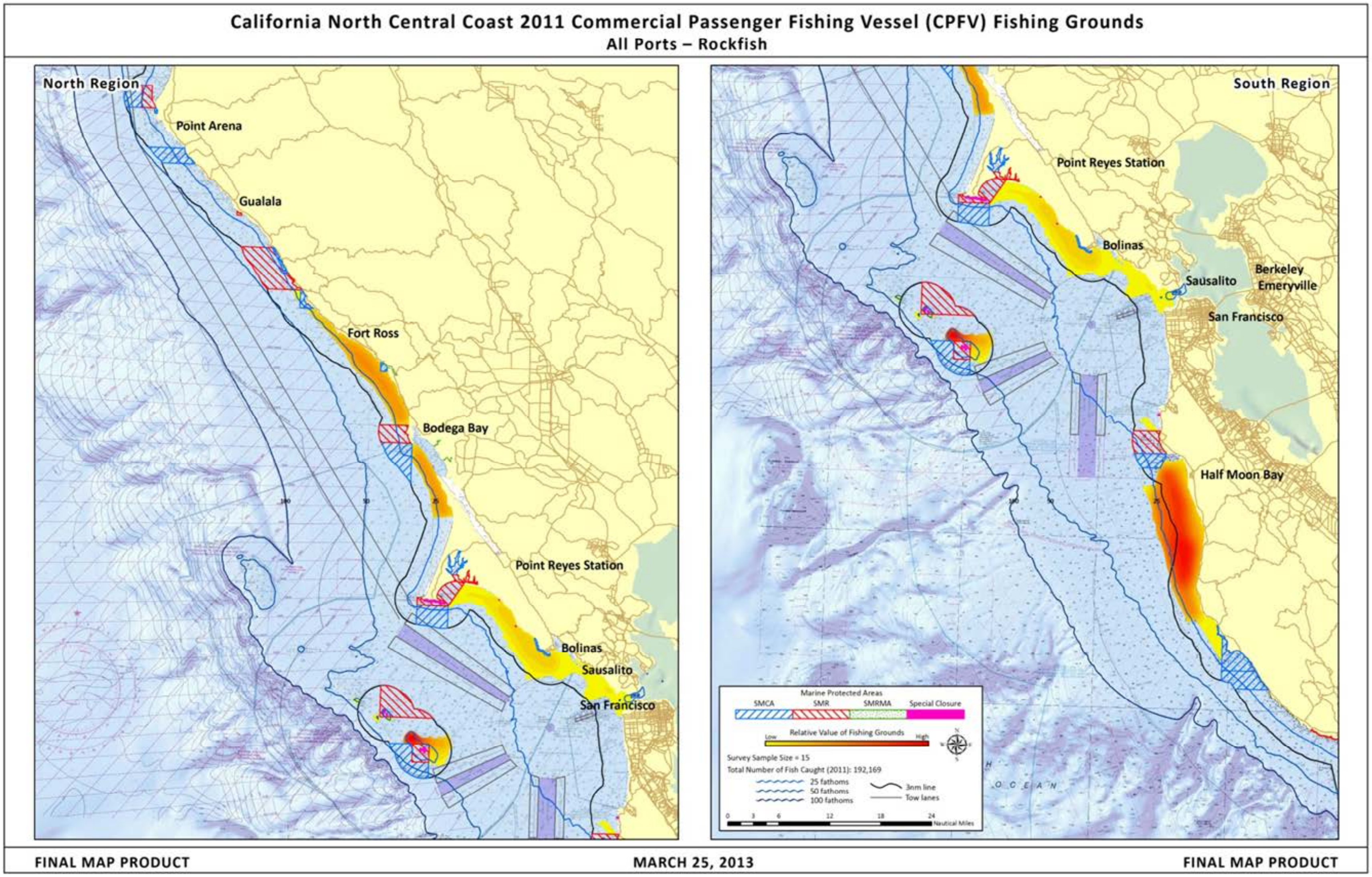
All Ports – California halibut

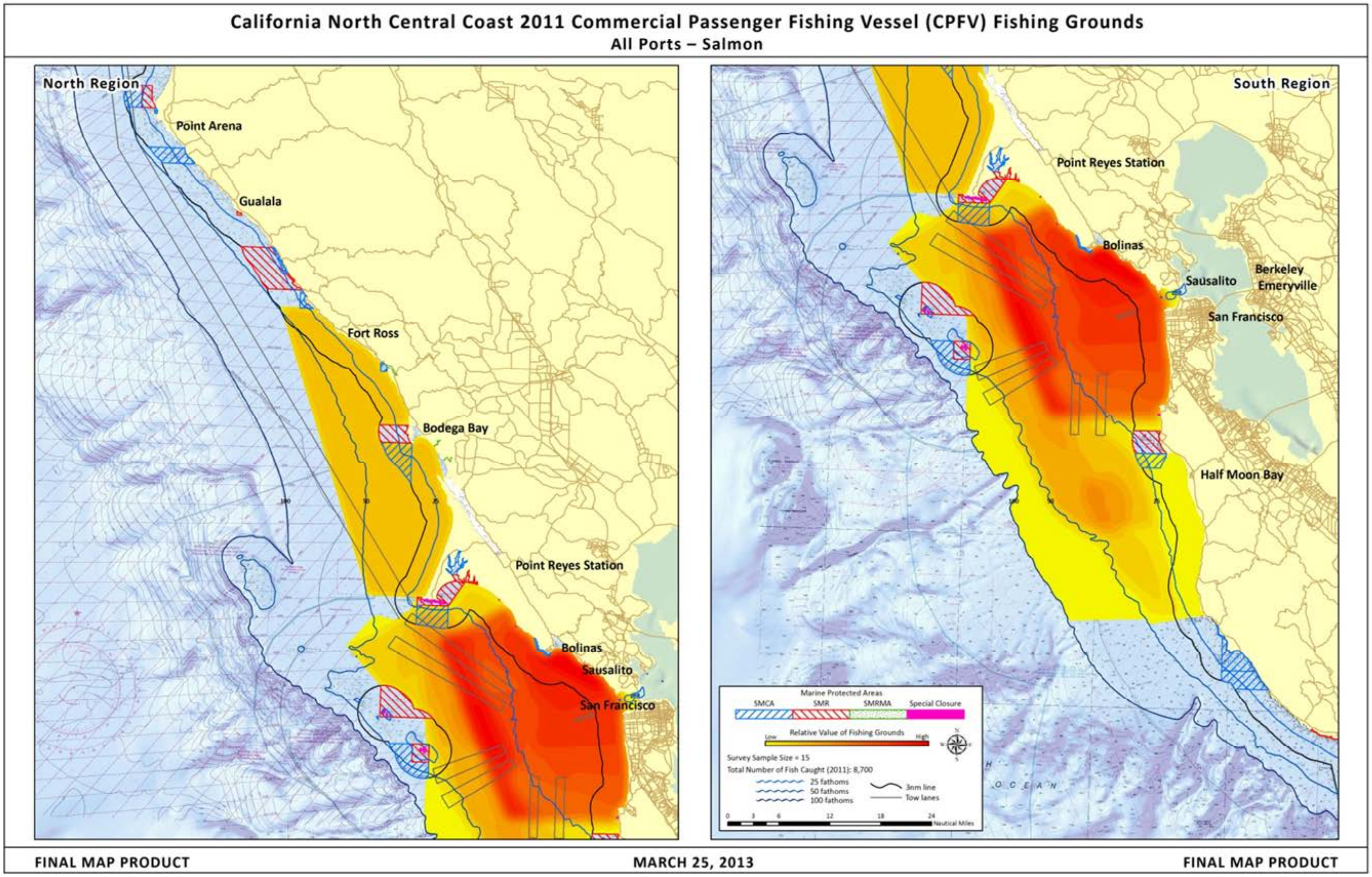


FINAL MAP PRODUCT **MARCH 25, 2013** **FINAL MAP PRODUCT**



California North Central Coast 2011 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
All Ports – Dungeness crab
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
San Francisco
South Region
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Relative Value of Fishing Grounds
Low
High
Survey Sample Size = 6
Total Number of Fish Caught (2011): 39,362
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT


California North Central Coast 2011 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
All Ports – Rockfish
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
San Francisco
South Region
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Low
Relative Value of Fishing Grounds
High
Survey Sample Size = 15
Total Number of Fish Caught (2011): 192,169
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
0 3 6 12 18 24 Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT


California North Central Coast 2011 Commercial Passenger Fishing Vessel (CPFV) Fishing Grounds
All Ports – Salmon
North Region
Point Arena
Gualala
Fort Ross
Bodega Bay
Point Reyes Station
Bolinas
Sausalito
San Francisco
South Region
Point Reyes Station
Bolinas
Sausalito
Berkeley
Emeryville
San Francisco
Half Moon Bay
Marine Protected Areas
SMCA
SMR
SMRMA
Special Closure
Relative Value of Fishing Grounds
Low
High
Survey Sample Size = 15
Total Number of Fish Caught (2011): 8,700
25 fathoms
50 fathoms
100 fathoms
3nm line
Tow lanes
0 3 6 12 18 24
Nautical Miles
FINAL MAP PRODUCT
MARCH 25, 2013
FINAL MAP PRODUCT

California North Central Coast Recreational Red Abalone Fishery:
Establishing a Spatial and Economic Baseline Data Set for Long Term MPA Monitoring

Report to the California Sea Grant College Program

In partial fulfillment of Grant No. #09-015
through the California Sea Grant College Program

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EXECUTIVE SUMMARY

Red abalone (*Haliotis rufescens*) is an important recreational fishery species in the North Central Coast of California which stretches from Pigeon Point in the south to Alder creek in the north. Historically harvested by American Indians and early settlers, this fishery remains integral to the cultural and economic history of the region. Fisheries such as the red abalone fishery exemplify the interdependencies between the natural environment and coastal communities that have characterized California since well before statehood.

In support of the Marine Protected Area (MPA) monitoring effort to characterize the ecological and socioeconomic conditions and changes within the North Central Coast region since MPA implementation on May 1, 2010, this study provides a spatially explicit baseline data set on recreational abalone harvest patterns in the study region. Three primary sets of findings are presented in this report:

1. A baseline characterization of spatial harvest patterns at the punch card site and region wide level;
2. An economic baseline characterization of abalone harvesters that includes demographic characteristics, site selection preferences, and annual expenditures associated with recreational abalone harvesting; and
3. An investigation into marine protected areas awareness among recreational abalone harvesters in the region.

Establishing a baseline characterization of the recreational abalone fishery in the North Central Coast provides a benchmark of user characteristics, economic contribution, and spatial harvest patterns against which future MPA impacts and benefits can be measured. Furthermore, establishing a long term data set will help inform how MPAs and other driving factors may interplay to influence observed changes in abalone harvest patterns and changes in the economic contribution of the fishery.

Ecotrust collaborated with key leaders in the recreational abalone community to design the survey instrument and utilized a randomly compiled database of abalone punch card purchaser telephone numbers from the California Department of Fish and Wildlife (CDFW). From March to October 2011, Ecotrust conducted phone interviews by randomly selecting individuals from the contact information provided by the CDFW. Individuals were contacted at various times of the day as well as the week, including weekends and evening hours. Approximately 656 individuals were contacted; a total of 162 individuals responded and 96 of those respondents harvested abalone in 2010 in the region and completed our full interview.

The average age of survey respondents was 48.7 years old with either 22 years of experience diving for abalone and/or 24 years of experience shore picking for abalone. The average number of days spent harvesting abalone in 2010 was 5.9 days for abalone diving and 3.7 days for abalone shore picking. Respondents were also asked if they were aware of the recently established MPAs and 89% (n=85) indicated they were aware of the MPAs and largely knew of them through CDFW (37% of respondents) or word of mouth/friends (28% of respondents). When asked which MPAs they were aware of, a large portion of respondents indicated they were aware of Stewarts Point State Marine Conservation Area (SMCA) and State Marine Reserve (SMR) (41% of respondents), Salt Point SMCA (36% of respondents), Gerstle Cove SMR (28% of respondents), and Point Arena SMR and SMCA (23% of respondents).

The most popular punch card site used by survey respondents was Fort Ross/Reef Campground (25% of respondents) followed by Timber Cove (17% of respondents). When asked why they chose a particular site to harvest abalone, the most frequent response was because of easy access/entry (20% of respondents) followed by protection from weather (17% of respondents) and abundance of abalone (17% of respondents).

Included in this report are also estimates of annual expenditures associated with abalone diving or shore picking trips in 2010, as well as a series of spatial data sets and maps depicting the intensity of use within abalone punch card site as well as across the North Central Coast region.

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For questions or comments, please contact Cheryl Chen, Marine Planning Project Manager, at Ecotrust, 721 NW 9th Avenue, Suite 200 Portland, OR 97209; cchen@ecotrust.org; 503.467.0812

The North Central Coast MPA Baseline Program

This study is a part of a larger baseline marine protected areas monitoring effort, entitled the North Central Coast (NCC) MPA Baseline Program, tasked with characterizing the ecological and socioeconomic conditions within the NCC region. Specifically, this study addresses the Baseline Program objectives by describing human use patterns across the study region and establishing initial data points for long-term tracking of conditions and trends in the North Central Coast. This study is also a part of a four-part study conducted by Ecotrust to provide baseline estimates of the quantity, spatial distribution, and economic value of human uses—specifically human use in four specific sectors: coastal recreational, commercial fishing, commercial passenger fishing vessels, and the recreational abalone fishery in the NCC region.

Ecotrust

For more than 20 years, Ecotrust has converted $80 million in grants into more than $500 million in capital for local people, businesses, and organizations from Alaska to California. Ecotrust's Marine Consulting Initiative builds tools that help people make better decisions about the ocean. Our tools help visualize and map marine ecosystems and uses, bridge differing perspectives, and implement management decisions in a more inclusive and transparent way. The marine planning tools are part of Ecotrust's 20-year history of doing innovative things with knowledge, technology, and capital to create enhanced conservation and economic development for coastal communities on a global scale. Learn more at http://www.ecotrust.org.

Acknowledgements

Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the recreational consumptive dive community who provided guidance and feedback during this study as well as the state agency staff and observers of this project. We are deeply thankful to the individuals who participated in this project and for making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us.

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1. INTRODUCTION

Red abalone (*Haliotis rufescens*) is an important recreational fishery species in the North Central Coast of California which stretches from Pigeon Point in the south to Alder creek in the north (Map 1). Historically harvested by American Indians and early settlers, this fishery remains integral to the cultural and economic history of the region. Fisheries such as the red abalone fishery exemplify the interdependencies between the natural environment and coastal communities that have characterized California since well before statehood.

In May 1, 2010, as part of the Marine Life Protection Act (MLPA) Initiative, the California Fish and Wildlife Commission (CFWC) designated 25 marine protected areas (MPAs) and six special closures within the North Central Coast state waters of California. To monitor these MPAs a baseline monitoring effort was established by the MPA Monitoring Enterprise, a program of the California Ocean Science Trust, in partnership with the California Department of Fish and Wildlife (CDFW), and supported by the California Ocean Protection Council (OPC).

Red abalone by Ian Sayers (SIMoN Photo Library)

In support of the MPA monitoring effort to characterize the ecological and socioeconomic conditions and changes within the North Central Coast region since MPA implementation, this study provides a spatially explicit baseline data set on recreational abalone harvest in the study region. Three primary sets of findings are presented in this report:

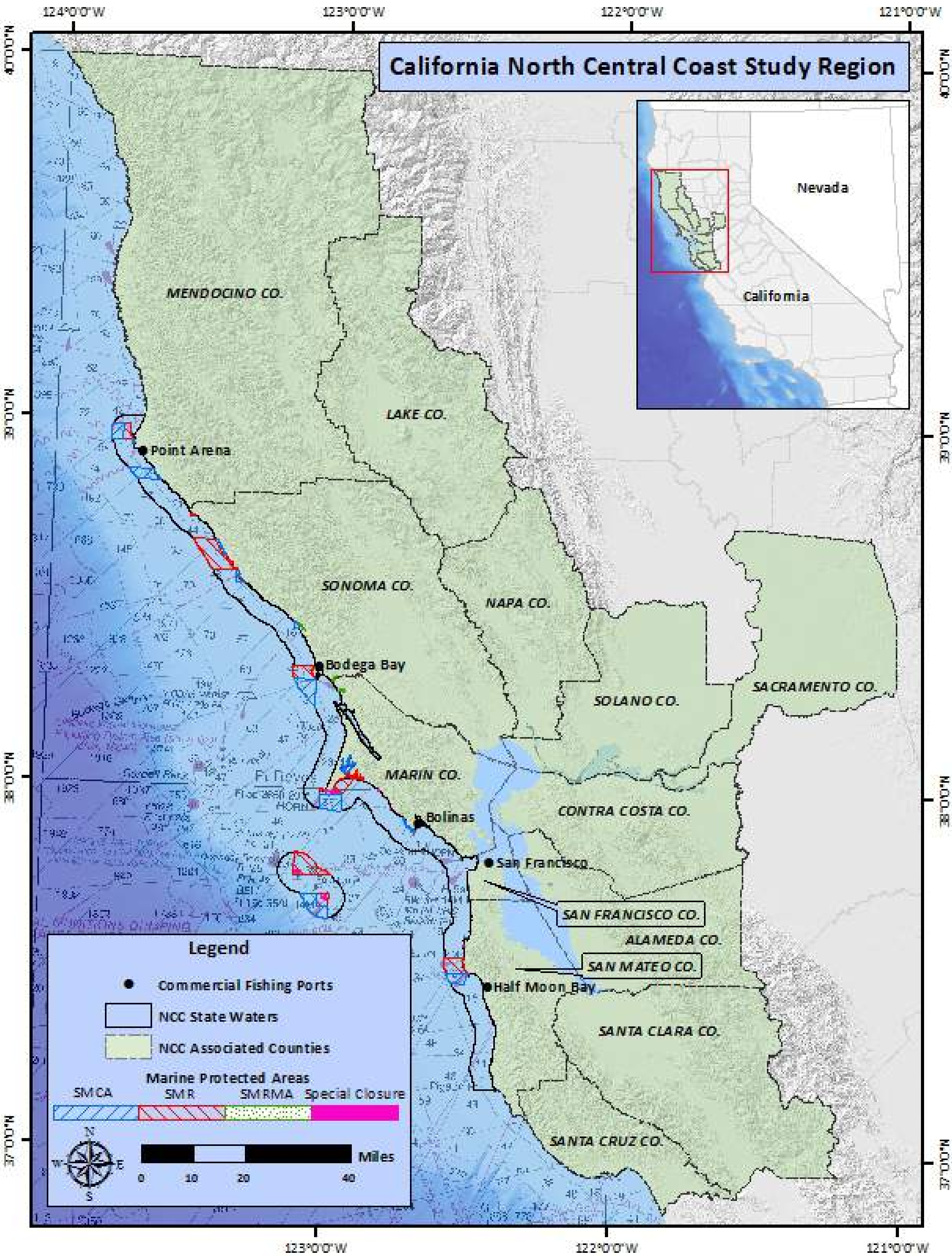
1. A baseline characterization of spatial harvest patterns at the punch card site and region wide level;
2. An economic baseline characterization of abalone harvesters that includes demographic characteristics, site selection preferences, and annual expenditures associated with recreational abalone harvesting; and
3. An investigation into marine protected areas awareness among recreational abalone harvesters in the region.

Establishing a baseline characterization of the recreational abalone fishery in the North Central Coast provides a benchmark of user characteristics, economic contribution, and spatial harvest patterns against which future MPA impacts and benefits can be measured. Furthermore, establishing a long term data set will help inform how MPAs and other driving factors may interplay to influence observed changes in abalone harvest patterns and changes in the economic contribution of the fishery.

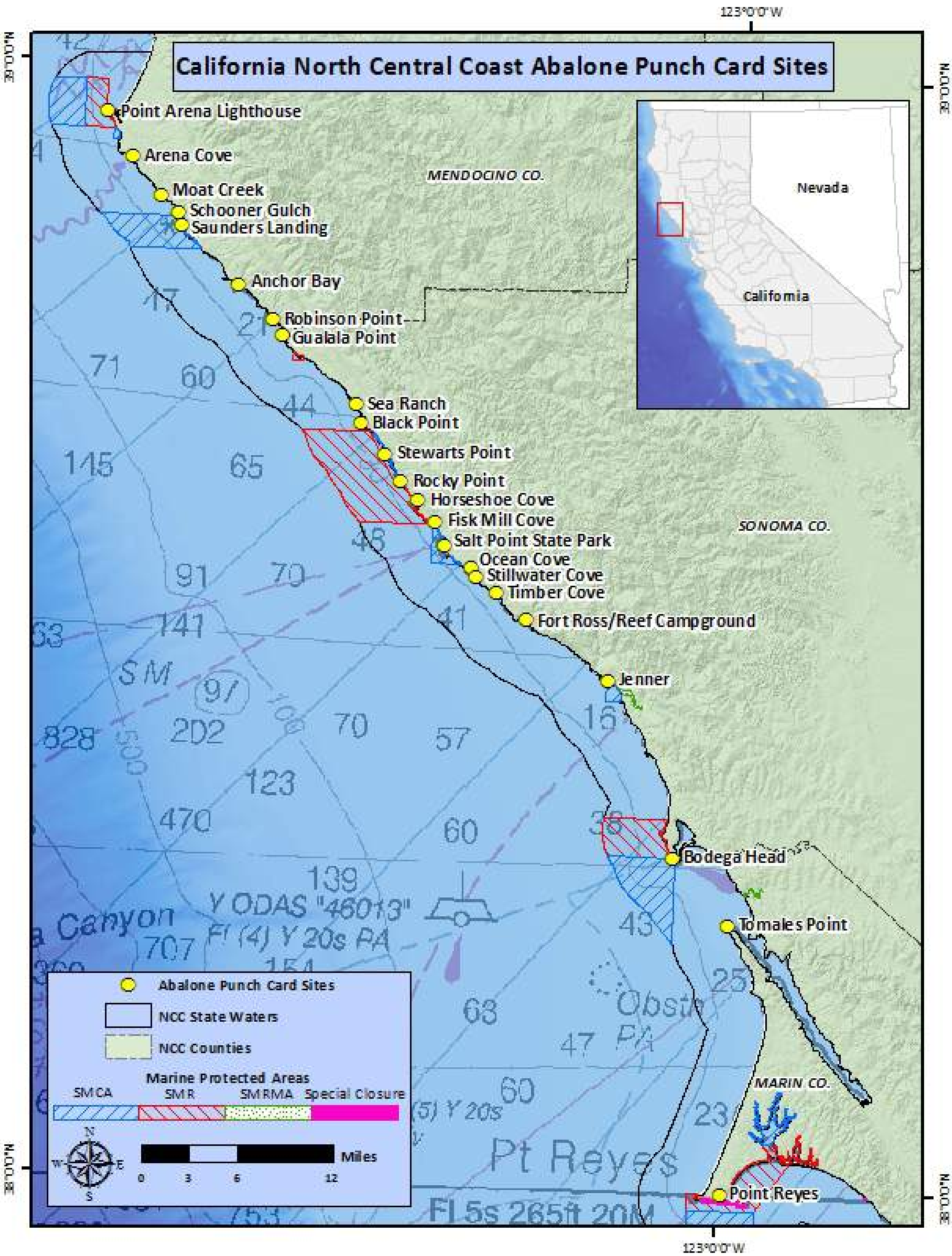
This specific survey was designed to collect data from recreational abalone harvesters as abalone is known for its ecological, recreational, and socioeconomic significance in the North Central Coast region. In coordination with the ecological monitoring work, we hope to utilize this survey data to explore and gain a better understanding of the interactions between recreational abalone harvesters and the possible ecological changes in the northern reaches of the study region in and outside of MPAs. Furthermore, we have worked closely with the California Department of Fish and Wildlife's (CDFW) abalone program to build upon their existing data sets/methods to support integration and future long-term monitoring.

The information provided in this report is a part of a larger Ecotrust project to monitor human uses in the North Central Coast region. The overarching goal of this larger project is to provide baseline estimates of the quantity, spatial distribution, and economic impacts of human uses in the North Central Coast region and assess any initial changes since MPA implementation. For more information on commercial fishing, CPFV operations, and coastal recreation uses in the region please see our additional reports.

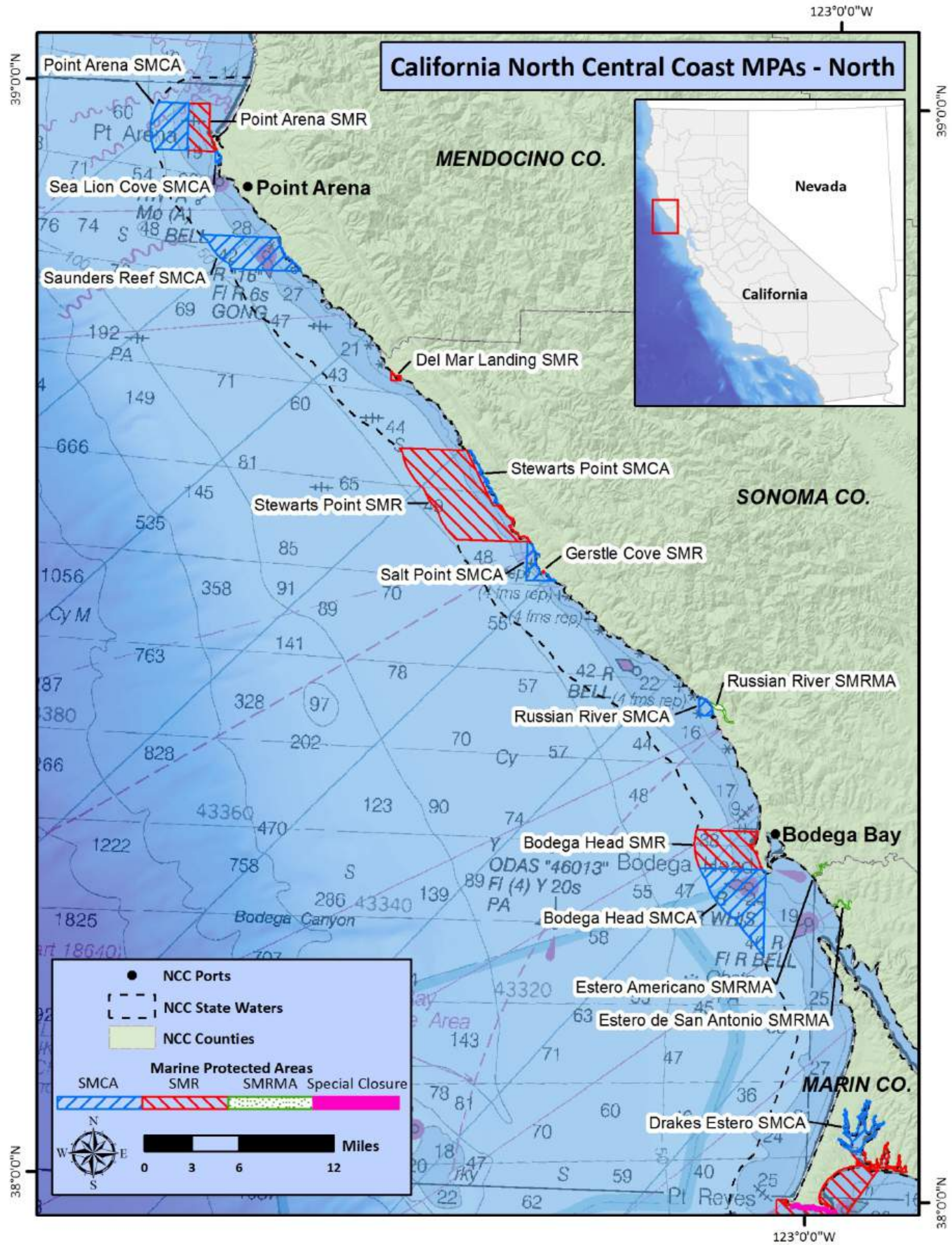
Map 1. California North Central Coast study region



Map 2. California North Central Coast study region with abalone punch card site locations



Map 3. California North Central Coast study region marine protected areas



1.1. The California Recreational Red Abalone Fishery

Documentation and regulation of the commercial and recreational harvest of abalone species in California began in the early 1900s. The fishery peaked in the 1960s but serial depletion of abalone from both fishing effort and sea otter predation resulted in the closure of the commercial and recreational fisheries south of San Francisco in 1997.

Today, a recreational red abalone fishery still exists north of the San Francisco Bay as several management measures such as prohibiting the use of underwater breather devices such as SCUBA, seasonal closures, size and bag limits, and a harvest reporting system have helped keep deep water abalone stocks protected and have helped maintain a viable recreational fishery. These regulations include a size limit requiring all abalone harvested to be seven inches or greater and that abalone may be taken only during the months of April through June and August through November from one-half hour before sunrise to one-half hour after sunset. Since 2002, the daily bag limit is three abalones and no more than 24 abalones in a year. Furthermore, no more than three abalones may be possessed at a given time.

In 1998 an abalone stamp which recreational harvesters were required to purchase was introduced to help fund monitoring, management, and enforcement efforts. In 2000, this evolved into an abalone report card system to help document catch and effort in the fishery as well as help control illegal take. This system requires recreational abalone harvesters to purchase an abalone report card which serves as a permit and to fill out the report card documenting where, when, and how many abalone were taken. These report cards are then required to be mailed back to CDFW to monitor catch and effort statistics.

To implement the abalone report card system (Figure 1) several punch card sites were identified by the CDFW in consultation with fishing community members. These punch card sites span across the North Central Coast region and are used by recreational harvesters to indicate on their abalone report cards the general location in which abalone were harvested.

However, the boundaries of punch card sites are not currently defined and thus it is difficult to determine accurate spatial use patterns for this recreational fishery. In order to better utilize the abalone report card data in marine spatial management efforts, such as MPA monitoring, the primary goal of this survey effort was to collect spatial data on the extent and intensity of recreational abalone harvest in the North Central Coast region. We collected this data at the punch card site scale and aggregated results to the regional scale to establish a baseline characterization of use patterns in this recreational fishery.

Figure 1. Example illustrating the primary components of a CDFW abalone report card

LISTING A SITE DOES NOT IMPLY PUBLIC SHORE ACCESS

COUNTY	SITE	CODE	COUNTY	SITE	CODE
Del Norte	Crescent City	05	Mendocino	Salmon Creek	46
Del Norte	Other Del Norte County	09	Mendocino	Navarro River	47
Humboldt	Patrick's Point	13	Mendocino	Elk	49
Humboldt	Trinidad	14	Mendocino	Point Arena Lighthouse	50
Humboldt	Punta Gorda	16	Mendocino	Point Arena (Arena Cove)	51
Humboldt	Shelter Cove	18	Mendocino	Moat Creek	52
Humboldt	Other Humboldt County	19	Mendocino	Schooner Gulch	53
Mendocino	Bear Harbor	20	Mendocino	Saunders Landing	54
Mendocino	Usal	21	Mendocino	Anchor Bay	56
Mendocino	Hardy Creek	22	Mendocino	Robinson Point	58
Mendocino	Abalone Point	24	Sonoma	Gualala Point	60
Mendocino	Westport	25	Sonoma	Sea Ranch	62
Mendocino	Kibesillah	27	Sonoma	Black Point	64
Mendocino	MacKerricher State Park	29	Sonoma	Stewarts Point	66
Mendocino	Glass Beach	30	Sonoma	Rocky Point	68
Mendocino	Georgia Pacific Mill	31	Sonoma	Horseshoe Cove	70
Mendocino	Todd's Point	32	Sonoma	Fisk Mill Cove	72
Mendocino	Hare Creek	33	Sonoma	Salt Point State Park	74
Mendocino	Mitchell Creek	34	Sonoma	Ocean Cove	76
Mendocino	Jughandle State Reserve	35	Sonoma	Stillwater Cove	78
Mendocino	Caspar Cove	36	Sonoma	Timber Cove	80
Mendocino	Russian Gulch State Park	38	Sonoma	Fort Ross	82
Mendocino	Jack Peters Gulch	39	Sonoma	Reef Campground (Pedotti)	84
Mendocino	Mendocino Headlands	40	Sonoma	Jenner	86
Mendocino	Gordon Lane (Spring Ranch)	41	Sonoma	Bodega Head	88
Mendocino	Van Damme State Park	42	Marin	Tomales Point	93
Mendocino	Dark Gulch	44	Marin	Point Reyes	96
Mendocino	Albion Cove	45	Marin	Other Marin County	99

Example: At 8:00 AM, on April 14, while diving from shore, you take two abalone at Salt Point State Park. Immediately upon exiting the water you write the month, day, time and location code on two abalone tags and attach them to the abalone by securing a "zip tie" through the siphon hole of the abalone and through the abalone tag. You immediately enter the month, day, time and location code on two lines of your abalone report card.

Later that day you move to Horseshoe Cove and continue diving. At 12:30 PM, you take your third abalone and you are finished diving for the day. Immediately upon exiting the water you write the month, day, time and location code on an abalone tag and attach it to the abalone by securing a "zip tie" through the siphon hole of the abalone and through the abalone tag. You immediately enter the month, day, time and location code on the third line of your abalone report card. At the end of your diving activity, your abalone report card will be completed as follows:

	MONTH	DAY	TIME	LOCATION CODE	MONTH	DAY	TIME	LOCATION CODE	
1	4	14	8:00AM	74					13
2	4	14	8:00AM	74					14
3	4	14	12:30PM	70					15

At the end of your diving activity, three abalone tags will be attached to your abalone and the tags will be completed as follows:

MONTH	DAY	TIME	LOCATION CODE	YEAR	TAG NO.
4	14	8:00AM	74	2008	000252-01
4	14	8:00AM	74	2008	000252-02
4	14	12:30PM	70	2008	000252-03

2. METHODS

As stated above, the primary goal of this study was to collect spatial data on the extent and intensity of use within an abalone punch card site and across the North Central Coast region in order to establish a baseline characterization of the use patterns in this recreational fishery.

Our project approach builds on methods developed in previous projects on the West Coast of the United States (Chen et al. 2012; Steinback et al. 2010; Scholz et al. 2004; 2005; 2006a; 2006b; 2008; 2010; 2011a; 2011b), which demonstrated novel approaches for collecting, compiling, and analyzing spatial fishing patterns and associated economic information at various geographic resolutions to aid the design and assessment of various marine spatial planning efforts (e.g., marine protected areas and wave energy siting). The successes and lessons learned in these projects were directly applied to the methods and tools deployed in this project. As Ecotrust continues to conduct MPA monitoring work in other regions in California we aim to help close existing coastal and marine use information gaps and provide a tested, consistent, and cost-effective method for long-term monitoring across California.

Specifically, Ecotrust's approach involved several steps that are designed to engage the fishing community throughout the project from project/survey design to the development of final products. These steps are generally categorized below:

1. Fishing community outreach/engagement;
2. Survey questions and survey tool design;
3. Data collection;
4. Data analysis;
5. Review of data analysis results; and
6. Final reporting.

At the onset of this project, Ecotrust conducted a series of outreach meetings with recreational abalone harvesting leaders and associations (e.g., Sonoma County Abalone Network, Recreational Fishing Alliance, etc.) in the region to gather input on an initial draft of survey questions, ideas around sample design, and review of the survey tool. As described later below, these key contacts also reviewed the data and map products developed through this effort for verification of the results.

2.1. Sample Methodology

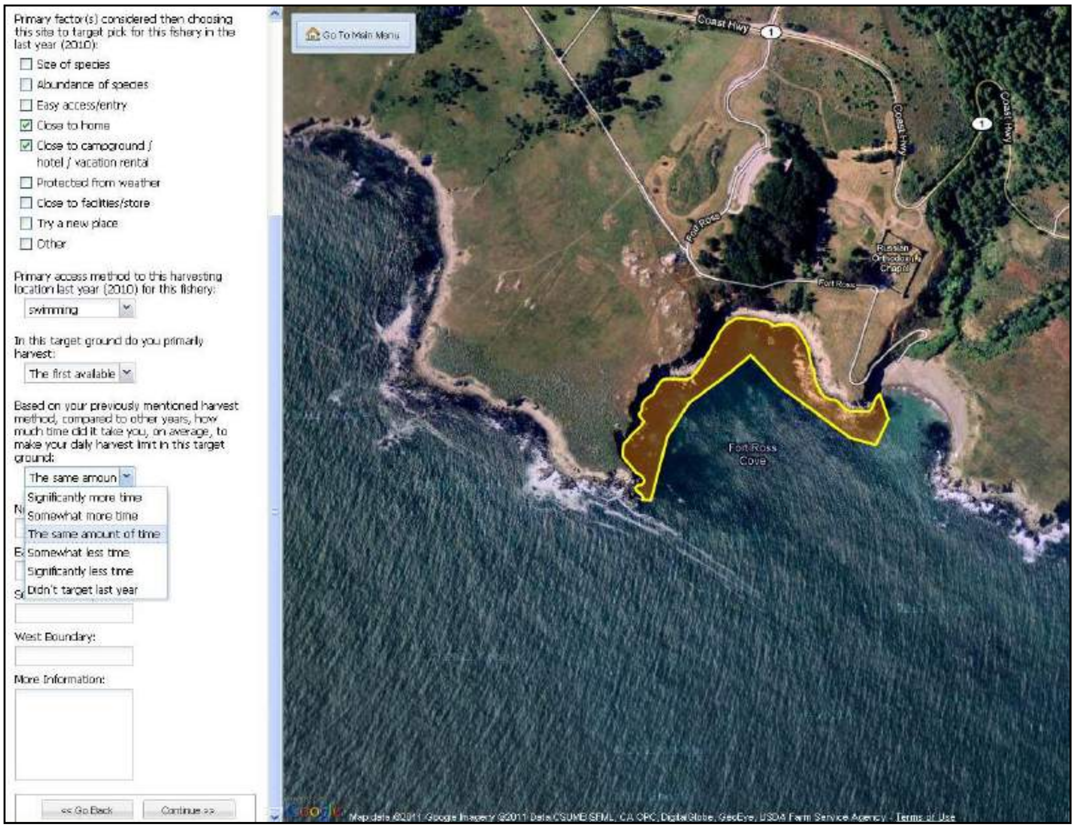
To develop a sampling methodology, Ecotrust utilized contact data provided by CDFW. This contact data was compiled using a random sample of abalone report card purchaser receipts from 2007 to 2009. Contact information for 2010 was not compiled by CDFW due to limited staff resources and thus was not available for use[1]. This contact information was compiled by CDFW to support a telephone survey effort for the abalone report card program. Each year only a portion of abalone harvesters return their report cards. Thus, in 2002, CDFW began to conduct phone surveys to determine the catch, effort, and location statistics from abalone harvesters who do not return their abalone report cards as well as the ratio of people who did not use the report card as they did not catch any abalone (CDFG, 2010; Kalvass and Geibel, 2003). We utilized this list of telephone numbers to contact randomly selected individuals.
As data did not exist to calculate the spatial variance in abalone harvest patterns and the 2010 harvest location of individual punch card purchasers we were unable to calculate an optimal sample size goal to adequately represent the spatial patterns of the abalone harvesting community or compare the characteristics of our sample to the larger study population. In lieu of a sample goal or sample stratification strategy we thus conducted a convenience sample and strived to contact abalone punch card purchasers at random and interview as many abalone harvesters as possible given our budget and staff constraints.

In January and February 2011, staff travelled to the North Central Coast region to meet with key members and leaders of the recreational abalone harvest community to gather input on survey design, best methods for sampling users, insights on impacts of MPAs and other factors impacting the recreational abalone fishery, gain support for the project, and answer questions.

[1] It is unclear if CDFW will continue to compile abalone report card purchaser contact information due to budget limitations

From March to October 2011, staff conducted phone interviews by randomly selecting individuals from the contact information provided by the CDFW. Individuals were contacted at various times of the day as well as the week including weekends and evening hours. The interview consisted of several non-spatial survey questions on the respondent's recreational abalone harvest activities in 2010 as well as a spatial component in which respondents were asked to describe and delineate the locations in which they harvested abalone in the 2010 season. The interviewer then drew these areas onto the Open OceanMap spatial mapping tool (see Figure 2) and asked about specific information about the respondent's abalone harvest site(s) such as how many days in 2010 they harvested at each site, why they chose the site, and how they accessed the site among other questions.

Figure 2. Screenshot of abalone harvest mapping survey tool



Approximately 656 individuals were contacted and of those we were able to connect with, a total of 66 individuals did not harvest abalone in 2010 in the region and 96 individuals who did harvest abalone in 2010 in the region completed interviews. Interviews were all completed by October 2011.

2.2. Spatial Analysis Methodology

Once data collection was complete all respondents were mailed maps of their specific harvest areas to verify the accuracy of the map; elective revisions were communicated to project staff and incorporated into the respondents' spatial data. Spatial data sets were then developed for each abalone punch card site by weighting each respondent's spatial data by the number of days they visited a particular area in 2010. This created a 'heat map' displaying the distribution and intensity of use within a punch card site. To create a region-wide abalone harvest 'heat map' each punch card spatial data set was weighted by CDFW's estimated number of abalone harvested in each punch card site in 2010 and combined together. These data sets were then reviewed with key members of the recreational abalone harvest community to verify their accuracy.

2.3. Data Review/Verification

The collection of spatial data has an inherent higher margin of error and thus several quality assurance and quality control (QAQC) steps were implemented in our project to ensure the spatial data collected were of the highest quality possible. Several data review and verifications steps were conducted throughout this project, standard QAQC can be summarized as follows:

1. Editing of spatial data by Ecotrust staff based on notes from interviews and when required to standardize the data (e.g. clipping a shape to the shoreline or specific depth);
2. Review by each participant of his/her individual maps and information; and
3. Review by recreational abalone fishery community, though group and individual meetings, to verify aggregated results.

Specifically, notes were taken on the boundaries of each harvest area drawn during an interview with a respondent. Once spatial data are collected, each spatial dataset is checked against spatial data notes to ensure harvest areas are drawn to the indicated depth limits and spatial extent. Furthermore, if any spatial outliers are identified, individual respondents are contacted to verify if their spatial dataset is accurate. Second, each individual respondent is mailed maps of his/her harvest grounds to review/verify its accuracy. These individual maps are printed on security paper that cannot be photocopied and are mailed with a return addressed and stamped envelope and contact information so respondents may easily communicate any changes to their spatial data. Third, once all spatial fishing data are aggregated, these maps are reviewed by key leaders in the recreational abalone fishery community with Ecotrust staff.

These review meetings with the recreational abalone fishery community are complimentary to the individual interviews and take a synergistic approach that is important in several ways. Review meetings are an opportunity to review and verify map products as well as share other data analysis results so that leaders in the abalone harvesting community can assist in interpreting data analysis results, review drafts of the project report, discuss project next steps, build trust within the recreational fishing community, and continue established relationships.

During these review meetings with key leaders in the abalone recreational fishery, map products were reviewed for errors. It should be emphasized that spatial data sets are not augmented based on where an individual who reviews the map(s) thinks areas of importance should be. Instead, the purpose of reviewing the map products are to ensure there are no large errors in the data sets made during the collecting, editing, and compiling of the data. Examples of errors include harvest areas that extend beyond possible depth limits for free diving or geographic areas in which the fishery occurs (e.g. sandy areas). Based on our experience, having the community review these map products helps build credibility of the data sets within the fishing community, produce data sets that are of higher quality, and help establish transparency and trust between researchers and the fishing community.

To the extent possible, Ecotrust validated data collected during this project with independent data sets provided by CDFW. Data validation with independent data sets is an important step in providing rigorous research methods as data collected in any survey are liable to the inconsistencies of memory, subjective judgment, and possible deliberate falsification. However, much of the data Ecotrust collected in this project are novel and thus similar data sets to our knowledge do not exist or are not readily accessible to compare survey results. One comparison of our sample population we were able to make with CDFW data collected was with information from the CDFW website (http://www.dfg.ca.gov/marine/ab_info.asp) in which CDFW estimates on average in 2002 the number of days fished by an abalone punch card holder was 5.1 days[2]. As shown in Figure 7 the average number of days our study respondents indicated they harvested abalone were 5.9 days within and outside the study region combined. It should be noted that other, more up to date abalone harvester surveys have been completed by CDFW; however, these studies estimate the number of trips instead of the number of days respondents harvested abalone which we could not compare with the survey results we collected.

[2] We were unable to find the report to use as a reference for this statistic.

3. SURVEY RESULTS

3.1. Establishing an Economic Baseline Characterization

We interviewed 96 individuals, 86 of whom were divers, defined as individuals who free dive in waters to harvest abalone, and 25 of whom were shore pickers, defined as individuals who typically harvest abalone on shore during negative tide events in which abalone are exposed and more easily harvested. Fifteen respondents indicated they participated in both diving and shore picking activities. Table 1 indicates the number of respondents in each category. For reference, the CDFW estimates that in 2010 approximately 34,169 individuals purchased abalone punch cards—however, not all purchasers end up harvesting abalone. Kalvass and Geibel (2003) estimated that for the 2002 season, approximately 12.1% of punch cards purchased have zero abalone harvested. Applying this percentage, we estimate that approximately 30,034 individuals harvested abalone in 2010.

Table 1. Abalone harvest survey: Number of individuals interviewed

	Number of individuals
Total	96
Divers	86
Shore Pickers	25
Both	15

Source: Current study

Table 2 through Table 5 provide a demographic background of the survey respondents. The average age of abalone harvesters surveyed was 48.7 years with shore pickers on average being an older age of 54.7 years and divers an average age of 47.4 years. Furthermore, the majority (53%) of respondents indicated they held a bachelor's degree or higher, 74% of respondents indicated their household income was $57,000 or more, and 90% of respondents were white or Caucasian.

Table 2. Average age of recreational abalone harvesters surveyed

	Average Age	95% CI	
		Low	High
All	48.7	45.9	51.4
Dive	47.4	44.7	50.2
Shore Pickers	54.7	51.9	57.6

Source: Current study

Table 3. Education level of recreational abalone harvesters surveyed

Education Level	All: Percent of Respondents	All: 95% CI Low	All: 95% CI High	Dive: Percent of Respondents	Dive: 95% CI Low	Dive: 95% CI High	Shore Pickers: Percent of Respondents	Shore Pickers: 95% CI Low	Shore Pickers: 95% CI High
Bachelor's degree or higher	53%	43%	63%	55%	44%	66%	53%	—	—
Associate's degree	10%	5%	18%	10%	3%	17%	5%	—	—
Some college	24%	16%	33%	23%	14%	32%	21%	—	—
High school diploma or GED	14%	8%	23%	12%	5%	19%	21%	—	—

Source: Current study

"—" indicates a zero value or that the data point could not be calculated due to a low sample size

Table 4. Household income level of recreational abalone harvesters surveyed

Household Income	All: Percent of Respondents	All: 95% CI Low	All: 95% CI High	Dive: Percent of Respondents	Dive: 95% CI Low	Dive: 95% CI High	Shore Pickers: Percent of Respondents	Shore Pickers: 95% CI Low	Shore Pickers: 95% CI High
$57,000 or more	74%	65%	82%	76%	66%	86%	67%	—	—
$22,000 - $57,000	22%	15%	32%	20%	11%	29%	33%	—	—
Less than $22,000	3%	1%	10%	4%	<1%	8%	—	—	—

Source: Current study

"—" indicates a zero value or that the data point could not be calculated due to a low sample size

Table 5. Race/Ethnicity of recreational abalone harvesters surveyed

Race/Ethnicity	All: Percent of Respondents	All: 95% CI Low	All: 95% CI High	Dive: Percent of Respondents	Dive: 95% CI Low	Dive: 95% CI High	Shore Pickers: Percent of Respondents	Shore Pickers: 95% CI Low	Shore Pickers: 95% CI High
White/Caucasian	90%	82%	95%	91%	85%	97%	95%	—	—
Spanish, Hispanic, or Latino	2%	1%	8%	1%	<1%	30%	5%	—	—
Asian/Pacific Islander	6%	3%	14%	8%	2%	14%	—	—	—
American Indian or Alaska Native	1%	<1%	6%	—	—	—	—	—	—

Source: Current study

"—" indicates a zero value or that the data point could not be calculated due to a low sample size

Table 6 and Figures 3 and 4 indicate the respondent's average number of years of experience and the distribution of years of experience by diver and shore pickers. The average years of experience did not differ much between divers (22 years) and shore pickers (24 year). However, the distribution of years of experience was more even across divers whereas across shore pickers the distribution of years of experience was roughly split between less experienced (less than 10 years of experience) and more experienced shore pickers (40+ years of experience).

Table 6. Average years of experience abalone diving or shore picking

	Average Years of experience	95% Confidence Interval	
		Low	High
Abalone - Dive	22	19	25
Abalone - Shore Picking	24	16	33

Source: Current study

Figure 3. Frequency of years of experience abalone diving

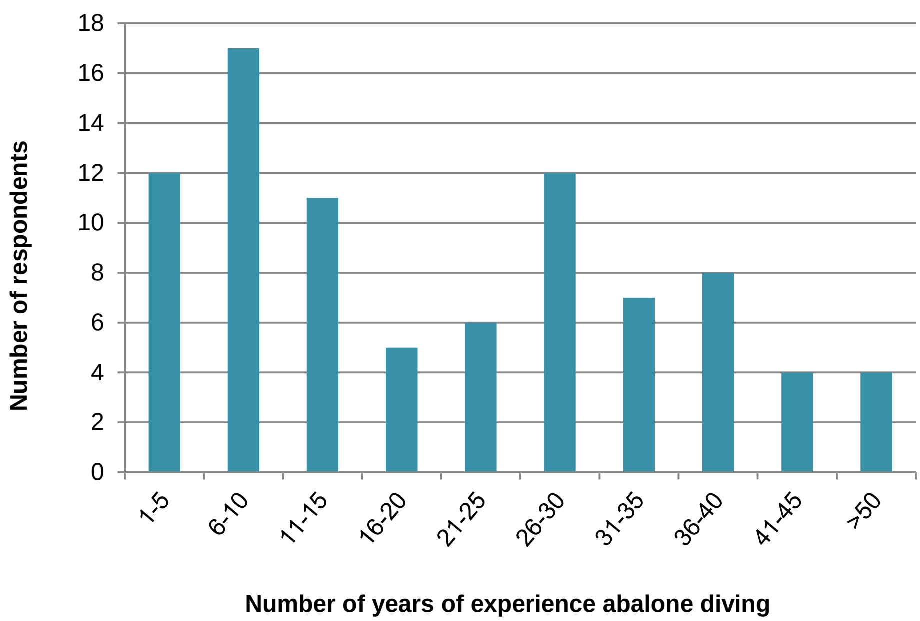
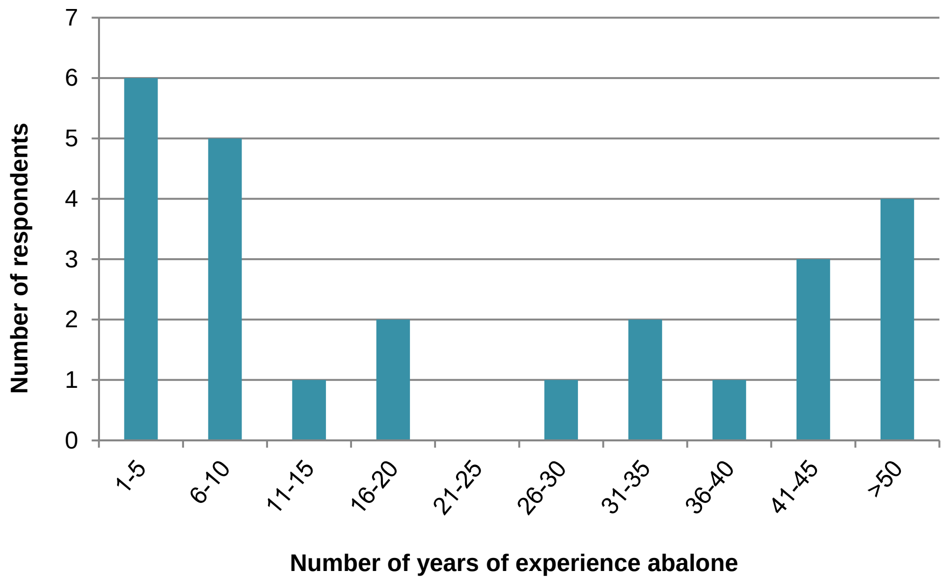


Figure 4. Frequency of years of experience abalone shore picking



Source: Current study

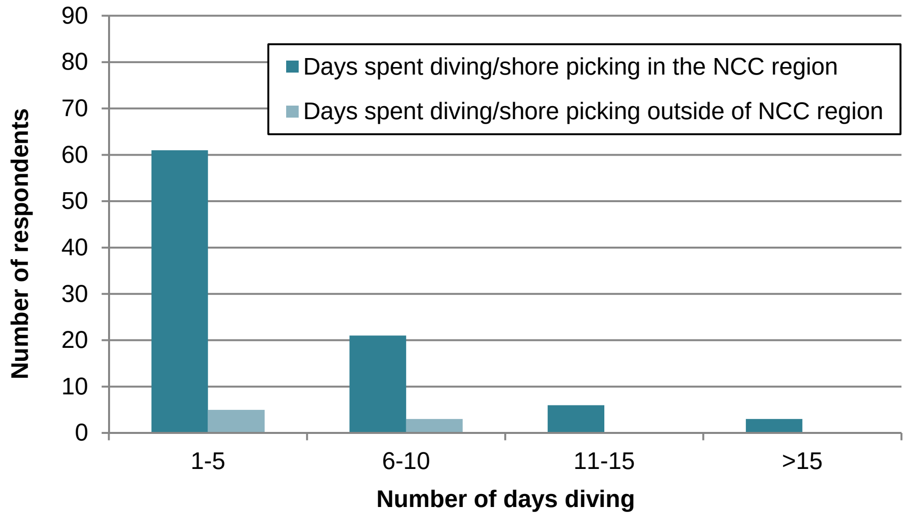
Table 7 and Figure 5 display the average number of days respondents spent diving or shore picking for abalone inside and outside the North Central Coast study region in 2010. Again, the North Central Coast study region extends from Alder Creek near Point Arena in the north to Pigeon Point near Half Moon Bay in the south. Of note is that abalone are only allowed to be harvested north of San Francisco Bay and thus any harvesting that occurs outside the study region occurs north of Alder Creek. On average, divers spent more days harvesting abalone overall (5.9 days with 5.6 days in the study region) than shore pickers (3.7 days overall with 3.6 days in the study region) interviewed. As seen in Figure 5, the majority of divers and shore pickers spend five or fewer days harvesting abalone a year.

Table 7. Average number of days diving or shore picking for abalone in and outside the NCC region in 2010

	Number of responses	Average number of days harvesting in NCC Region (2010)	95% Confidence Interval		Average number of days harvesting outside NCC Region (2010)	95% Confidence Interval	
Fishery		**Mean**	**Low**	**High**	**Average**	**Low**	**High**
Abalone - Dive	73	5.6	4.5	6.7	0.3	0.0	0.6
Abalone - Shore Picking	19	3.6	2.4	4.7	0.1	0.0	0.3
Total Responses	**92**						

Source: Current study

Figure 5. Number of days spent diving/shore picking for abalone inside and outside the NCC region in 2010



Source: Current study

In order to determine the level of awareness of the recently established marine protected areas (MPAs) among recreational abalone harvesters, we asked if respondents were aware of these MPAs and if so, how they came to know of them (Table 8). Of the 96 respondents, 88.5 percent (85 individuals) were aware of the MPAs in the region. When asked how they were informed about these MPAs the majority of respondents indicated either from the Department of Fish and Wildlife (37%) or from word of mouth/friends (28%).

Table 8. MPA awareness questions

	No. of responses		Percent of responses	
Question	**Yes**	**No**	**Yes**	**No**
Are you aware of recently established MPAs?	85	11	89%	11%
How were you informed about the MPAs?*				
Department of Fish and Wildlife	45		37%	
Word of mouth/friends	34		28%	
Online social site (e.g. fishing forum)	11		9%	
News source	11		9%	
Local store	7		6%	
Dive or fishing organization	5		4%	
Newsletter/magazine	4		3%	
Signage	2		2%	
Other	2		2%	
Television	1		1%	

Source: Current study

**Respondents were allowed to give multiple responses*

Respondents were also asked to name specific MPAs which they were aware of (Table 9). The MPAs respondents were most familiar with were Stewarts Point (SMR and SMCA) and Salt Point (SMCA). All MPAs in the North Central Coast mentioned by respondents are listed below in Table 9 along with the number of respondents who indicated they were familiar with each MPA.

Table 9. Number and percent of respondents indicating they were familier with a particular MPA

MPA	Number of respondents	Percent of respondents
Stewarts Point SMCA and SMR	25	41%
Salt Point SMCA	22	36%
Gerstle Cove SMR	17	28%
Point Arena SMR and SMCA	14	23%
Bodega Head SMCA and SMR	10	16%
Russian River SMCA and SMRMA	5	8%
Del Mar Landing SMR	2	3%
Sea Lion Cove SMCA	2	3%
Double Point/Stormy Stack SC	1	2%
Drake's Estero SMCA	1	2%
Duxbury Reef SMCA	1	2%
Egg (Devil's Slide) Rock to Devil's Slide SC	1	2%
Estero Americano SMRMA	1	2%
Estero de Limantour SMR	1	2%
Estero de San Antonio SMRMA	1	2%
Montara SMR	1	2%
North Farallon Islands SC and SMR	1	2%
Pillar Point SMCA	1	2%
Point Resistance Rock SC	1	2%
Point Reyes SMCA, SMR, and SC	1	2%
Saunders Reef SMCA	1	2%
Southeast Farallon Island SMCA, SMR, and SC	1	2%
Total number of respondents	**61**	

Source: Current study

Respondents were allowed to give multiple responses

Respondents were also asked to identify and delineate their abalone diving/picking areas in 2010 (see the following section) and were asked for each harvest area drawn to indicate the abalone punch card associated with this area. As shown in

Table 10 the most popular punch card sites were Fort Ross/Reef Campground and Timber Cove.

Table 10. NCC punch card site used for recreational abalone harvesting in 2010

CDFW Abalone Punch Card Site	Number of responses			Percent of total responses
	Dive	Shore picking	Total	
Fort Ross/Reef Campground	33	7	40	25%
Timber Cove	24	4	28	17%
Salt Point State Park	15	4	19	12%
Stillwater Cove	14	2	16	10%
Sea Ranch	14	1	15	9%
Ocean Cove	13	—	13	8%
Fisk Mill Cove	7	—	7	4%
Point Arena Cove	3	2	5	3%
Bodega Head	3	—	3	2%
Robinson Point	3	—	3	2%
Anchor Bay	2	—	2	1%
Black Point	2	—	2	1%
Gualala Point	2	—	2	1%
Jenner	2	1	3	2%
Horseshoe Cove	1	—	1	1%
Tomales Point	1	—	1	1%
Point Arena Lighthouse	—	1	1	1%
Stewarts Point	—	1	1	1%

Furthermore, for each harvest area given by a respondent we asked for the primary reasons for harvesting at this particular area. As shown in Table 11 and Figure 6 below, across all sites the most common reason divers and shore pickers chose to harvest abalone at a specific site was easy access and entry. Individuals were allowed to select more than one reason and several individuals indicated “other” reasons which are listed below in Table 12.

Table 11. Primary reasons for harvesting at a CDFW North Central Coast abalone punch card site

NCC Punch Card Site	Number of Responses	Easy access/entry	Protected from weather	Abundance of species	Size of species	Close to campground/ hotel/ vacation rental	Close to home	Trying a new place	Other
Anchor Bay	2	50%	—	50%	—	—	—	—	—
Black Point	2	—	50%	—	50%	—	—	—	—
Bodega Head	4	25%	25%	—	25%	—	25%	—	—
Fisk Mill Cove	9	11%	11%	44%	22%	—	—	11%	—
Fort Ross	59	27%	20%	17%	8%	7%	7%	5%	8%
Gualala Point	1	—	—	—	—	—	—	—	100%
Horseshoe Cove	2	—	50%	—	—	—	—	—	50%
Jenner	8	13%	—	13%	50%	—	—	—	25%
Ocean Cove	16	25%	6%	13%	13%	25%	6%	—	13%
Point Arena Cove	6	—	—	33%	—	—	33%	—	33%
Point Arena Lighthouse	1	—	—	100%	—	—	—	—	—
Robinson Point	4	50%	—	25%	—	—	—	—	25%
Salt Point State Park	29	24%	17%	17%	7%	7%	—	7%	21%
Sea Ranch	17	50%	—	50%	—	—	—	—	—
Stewarts Point	1	—	—	—	—	—	—	—	100%
Stillwater Cove	29	7%	21%	14%	21%	14%	7%	7%	10%
Timber Cove	47	19%	21%	17%	13%	6%	2%	4%	17%
Tomales Point	1	—	—	—	—	100%	—	—	—
Total	**238**	**20%**	**17%**	**17%**	**13%**	**9%**	**5%**	**4%**	**15%**

Source: Current study

— indicates a zero value

Figure 6. Primary reasons for harvesting at a CDFW North Central Coast abalone punch card site

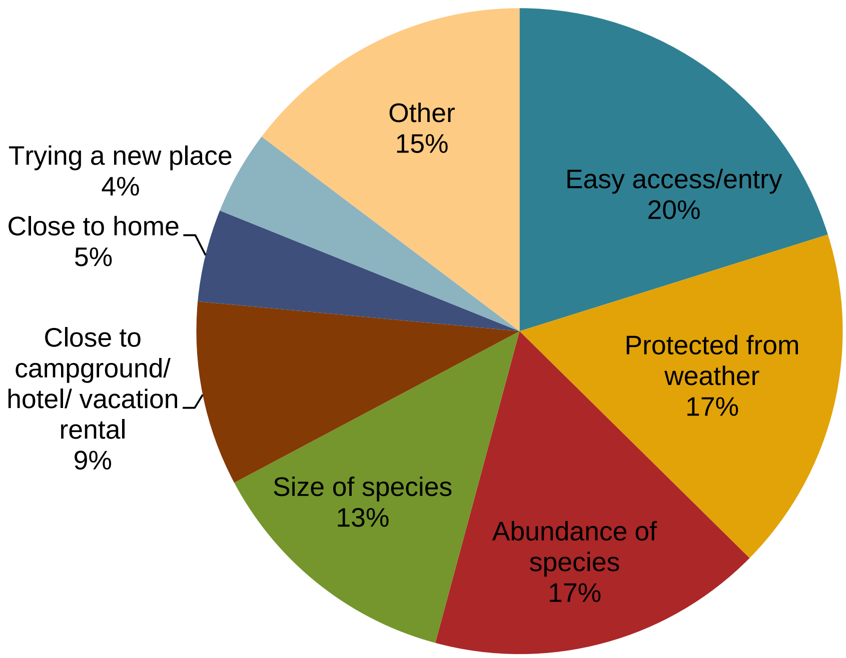


Table 12. Other reasons respondents chose to harvest at a particular abalone site

Conditions happened to be good for this site
Familiar with the site
MPA closed others areas
Nice beach
Not secluded
On friend's property
Secluded area
Successful in the past at this site
There for family/friend event
Went with others

Source: Current study

Additionally, for each harvest area, respondents were asked how they accessed the site. Most individuals (77%) swam to their abalone harvesting grounds. Several sites also allow for sport boat or kayak access as indicated by respondents. Table 13 indicates the primary access method given by respondents and is reported out by punch card site.

Table 13. Access method by NCC abalone punch card site

NCC Punch Card Sites	Number of responses	Kayak	Sport boat	Swimming
Anchor Bay	2	—	—	100%
Black Point	2	—	50%	50%
Bodega Head	3	33%	—	67%
Fisk Mill Cove	7	—	14%	86%
Fort Ross	37	5%	5%	89%
Gualala Point	2	—	—	100%
Jenner	4	—	—	100%
Ocean Cove	13	8%	31%	62%
Point Arena Cove	4	—	—	100%
Robinson Point	3	—	—	100%
Salt Point State Park	17	6%	12%	82%
Sea Ranch	17	35%	—	65%
Stillwater Cove	14	14%	7%	79%
Timber Cove	28	14%	29%	57%
Tomales Point	1	—	—	100%
Total	**154**	**11%**	**12%**	**77%**

Source: Current study

— indicates a zero value

To collect qualitative information on perceptions of change in a site over time we first asked individuals for their typical harvest strategy (Table 14) and then asked based on this strategy if it took: significantly more time; somewhat more time; the same amount of time; somewhat less time; or significantly less time to harvest their bag limit of 3 abalone (Table 15) compared to last year. The majority (75%) of respondents indicated that they harvest based on abalone size—meaning they search for the largest abalones in the area before choosing to harvest them, whereas 25% of respondents indicated they harvest just the first legal sized abalone they can find. The vast majority of respondents (75%) indicated that it took them the same amount of time to harvest abalone compared to last year. However, there is less agreement at specific sites such as Ocean Cove where 42% of respondents indicated it took them somewhat more time to harvest abalone and 50% of respondents indicated it took them the same amount of time. Over time, this type of information will be useful to collect to compare qualitative perceptions of abalone abundance and size changes with ecological data collected and changes in harvest pressure data collected by CDFW. Together these data may be used to investigate how MPAs and human pressure may be affecting abalone populations and recreational harvesting experiences.

Table 14. Harvest strategy for abalone divers and shore pickers

Harvest Strategy Type	Number of responses	Percent of responses
Abalone based on size	122	75%
First available abalone	41	25%

Source: Current study

Table 15. Perceptions of change in time it took to harvest abalone at a site from 2009 to 2010

NCC Punch Card Site	Number of responses	Significantly more time	Somewhat more time	The same amount of time	Somewhat less time	Significantly less time
Anchor Bay	1	—	—	100%	—	—
Black Point	2	—	—	100%	—	—
Bodega Head	3	33%	—	67%	—	—
Fisk Mill Cove	5	20%	—	80%	—	—
Fort Ross	42	10%	17%	67%	7%	—
Gualala Point	1	—	—	100%	—	—
Horseshoe Cove	1	—	—	100%	—	—
Jenner	5	—	20%	80%	—	—
Ocean Cove	12	—	42%	50%	8%	—
Point Arena Cove	5	—	20%	80%	—	—
Point Arena Lighthouse	1	100%	—	—	—	—
Robinson Point	3	—	—	100%	—	—
Salt Point State Park	21	—	24%	76%	—	—
Sea Ranch	12	—	—	92%	8%	—
Stewarts Point	1	—	—	100%	—	—
Stillwater Cove	14	—	7%	71%	7%	14%
Timber Cove	28	4%	7%	86%	4%	—
Tomales Point	1	—	—	100%	—	—
Total	**158**	**5%**	**14%**	**75%**	**4%**	**1%**

Source: Current study

— indicates a zero value

In order to investigate possible factors which affect abalone harvest patterns we asked respondents if there were any sites they visited in 2009 that they did not return to in 2010 (Table 16). A primary reason individuals did not return to a specific site was due to the establishment of marine protected areas in specific sites (30% of respondents). Respondents also indicated sites being too far away from home, too many people at sites, and changes in the abundance and size of abalone as reasons for not returning to a site as well. Other reasons for not returning to a site were given which are listed in Table 17 below.

Table 16. Reason for not returning in 2010 to a specific punch card site visited in 2009

Punch Card Site	Number of responses	Change in size of species	Change in abundance of species	Too many people around	Area closed as marine protected area	Too far away from home	Difficult or unsure of access	Other
Anchor Bay	1	—	100%	—	—	—	—	—
Black Point	1	—	—	—	100%	—	—	—
Fisk Mill Cove	5	20%	—	—	40%	—	20%	20%
Fort Ross	6	—	17%	—	33%	—	—	50%
Gualala Point	1	—	—	—	100%	—	—	—
Horeshoe Cove	1	—	—	—	100%	—	—	—
Jenner	2	—	—	—	—	100%	—	—
MacKerricher State Park	1	—	—	—	—	100%	—	—
Point Arena Cove	1	—	—	—	—	—	—	100%
Point Arena Lighthouse	1	—	—	—	—	100%	—	0%
Reef Campground (Pedotti)	1	—	—	100%	—	—	—	—
Salt Point State Park	9	—	11%	22%	56%	—	11%	—
Sea Ranch	3	33%	—	—	—	67%	—	—
Stewarts Point	1	—	—	—	100%	—	—	—
Stillwater Cove	5	20%	20%	—	—	20%	—	40%
Timber Cove	5	—	—	20%	—	0%	20%	60%
Total	44	7%	9%	9%	30%	16%	7%	23%

Source: Current study

— indicates a zero value

Table 17. Other reasons for not returning to a punch card site

Bad weather
Low visibility
No parking
Like other places more
Went previously with friends
Fished out
Bad experience with game warden
Wanted to try other areas

Source: Current study

Respondents were also asked to complete an economic survey regarding their expenditures associated with diving and shore picking trips in 2010. Participation in this portion of the survey was highly encouraged but not required; all but six individuals chose to participate (Table 18 and Table 20). Total yearly expenses ranged from $0 to over $8,000, but the average total annual expenses on abalone harvesting in 2010 was $1,021. Table 18 shows the average expenditure for a given item whereas Table 20 shows the average expenditure on an item averaged across all respondents (e.g. respondents who did not indicate they spent money on an item were still included in the average). The purpose of Table 18 is to show the average expenditure a person may incur if they spent money on a specific item. The purpose of Table 20 is to show the average level of expenditures on items across the total population surveyed.

Table 18 shows that after licensing fees, for which all respondents incurred expenditures, the most common expenditure category was transportation (88 respondents or 97.7% of respondents). Nearly half of the respondents reported that their spending for 2010 was average as compared to prior years (Table 19). Across all respondents, transportation expenditures were the largest ($291 per person) followed by dive equipment expenditures ($193), see Table 20 and Figure 7.

Table 18. Average annual and per item expenses in 2010 related to recreational abalone diving/shore picking

			95% Confidence Interval	
	Number of responses	Average	Low	High
Total annual expenses	90	$1,021	$763	$1,251
Private or public transportation (including gas and parking fees)	88	$292	$233	$351
Food and beverage from a store	70	$180	$124	$236
Food and beverage from a restaurant or bar	48	$112	$87	$136
Lodging and camping (if you stayed overnight)	43	$342	$139	$546
Dive equipment rental and air fills	9	$110	—	$233
Dive equipment purchase	47	$364	$211	$517
Boat Rental	1	$200	—	—
Boat purchase	1	$1,000	—	—
Boat maintenance/expenses	3	$537	—	$1,597
Boat fuel	8	$136	—	$305
Kayak purchase	5	$448	$34	$862
Ramp/launch fees	11	$114	—	$227
Charter fees	1	$250	—	—
Fishing license fees	90	$64	$60	$69
Miscellaneous (sundries, ice, etc.)	6	$129	—	$284

Source: Current study

— indicates a zero value

Table 19. Consumptive recreational diving/shore picking expenses made in 2010 compared to other years

Response	Number of responses	Percent of responses
Significantly lower	12	13%
Somewhat lower	12	13%
Average	44	49%
Somewhat higher	20	22%
Significantly higher	2	2%

Source: Current study

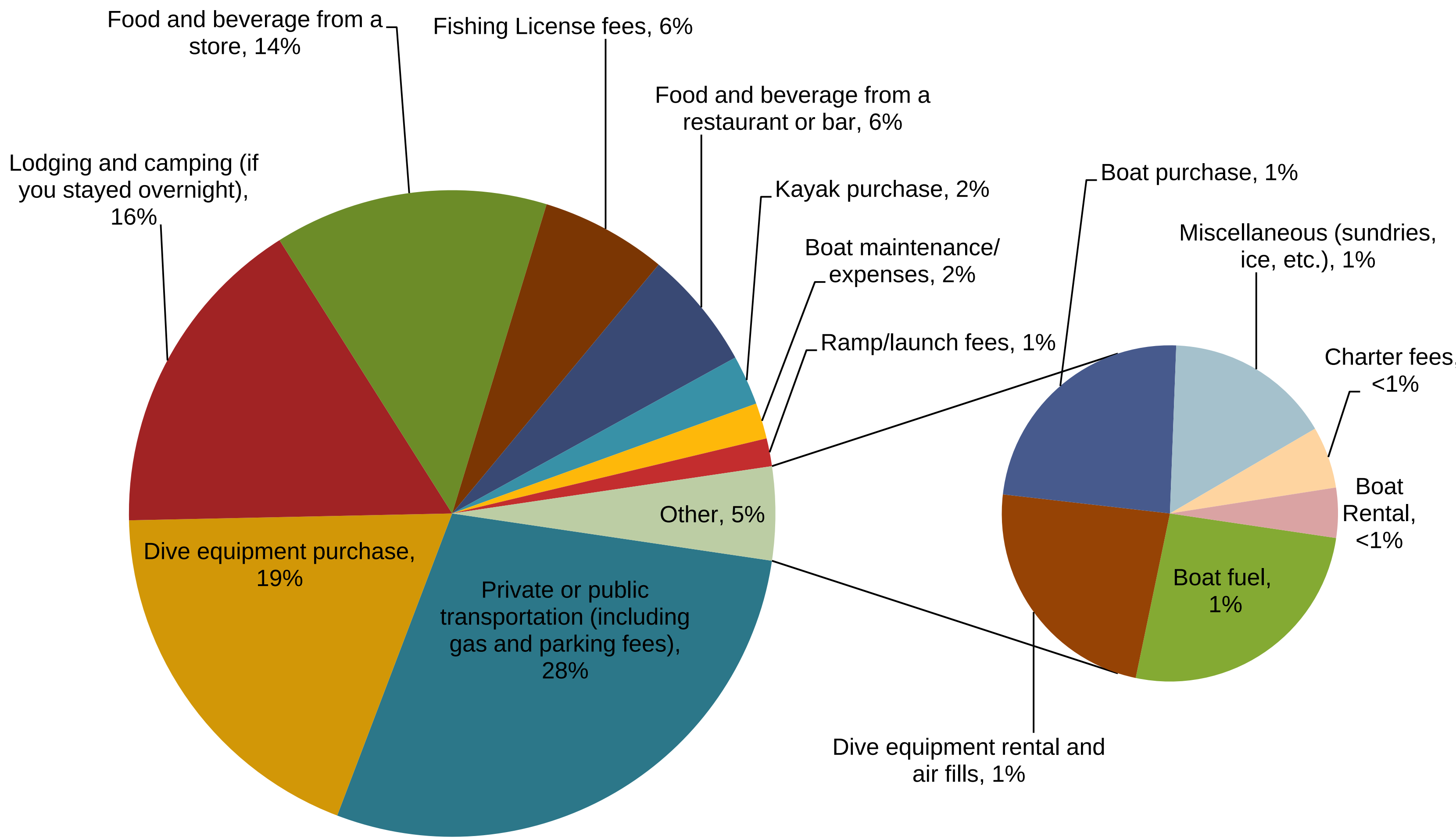
Table 20. Across all respondents: Average annual and per item expenses related to consumptive recreational abalone diving/shore picking

			95% Confidence Interval		
	Number of respondents	Average	Low	High	Percent of total expenses
Total annual expenses	90	$1,021	$763	$1,251	
Private or public transportation (including gas and parking fees)	88	$291	$227	$344	28.5%
Dive equipment purchase	47	$193	$94	$186	18.9%
Lodging and camping (if you stayed overnight)	43	$167	$42	$77	16.4%
Food and beverage from a store	70	$140	$62	$265	13.7%
Fishing License fees	90	$64	—	$23	6.3%
Food and beverage from a restaurant or bar	48	$61	$103	$277	6.0%
Kayak purchase	5	$25	—	$7	2.5%
Boat maintenance/expenses	3	$18	—	$33	1.8%
Ramp/launch fees	11	$14	—	$42	1.4%
Boat fuel	8	$12	—	$27	1.2%
Dive equipment rental and air fills	9	$11	—	$51	1.1%
Boat purchase	1	$11	—	$28	1.1%
Miscellaneous (sundries, ice, etc.)	6	$8	—	$8	0.7%
Charter fees	1	$3	$60	$69	0.3%
Boat Rental	1	$2	—	$19	0.2%

Source: Current study

— indicates a zero value

Figure 7. Across all respondents: Average annual and per item expenses related to consumptive recreational abalone diving/shore picking



Source: Current study

3.2. Establishing a Spatial Baseline

Maps depicting the extent and intensity of use within a given punch card site and across the region are presented below. Spatial data sets (in GIS raster form) are also provided as a deliverable of this project. The maps and spatial data sets were developed for each abalone punch card site by weighting each respondent's spatial data by the number of days they indicated they visited a particular area in 2010. This created a 'heat map' displaying the distribution and intensity of use within a punch card site. To create a region-wide abalone harvest 'heat map' each punch card spatial dataset was weighted by CDFW's estimated number of abalone harvested in each punch card site in 2010 (Table 22) and combined together.

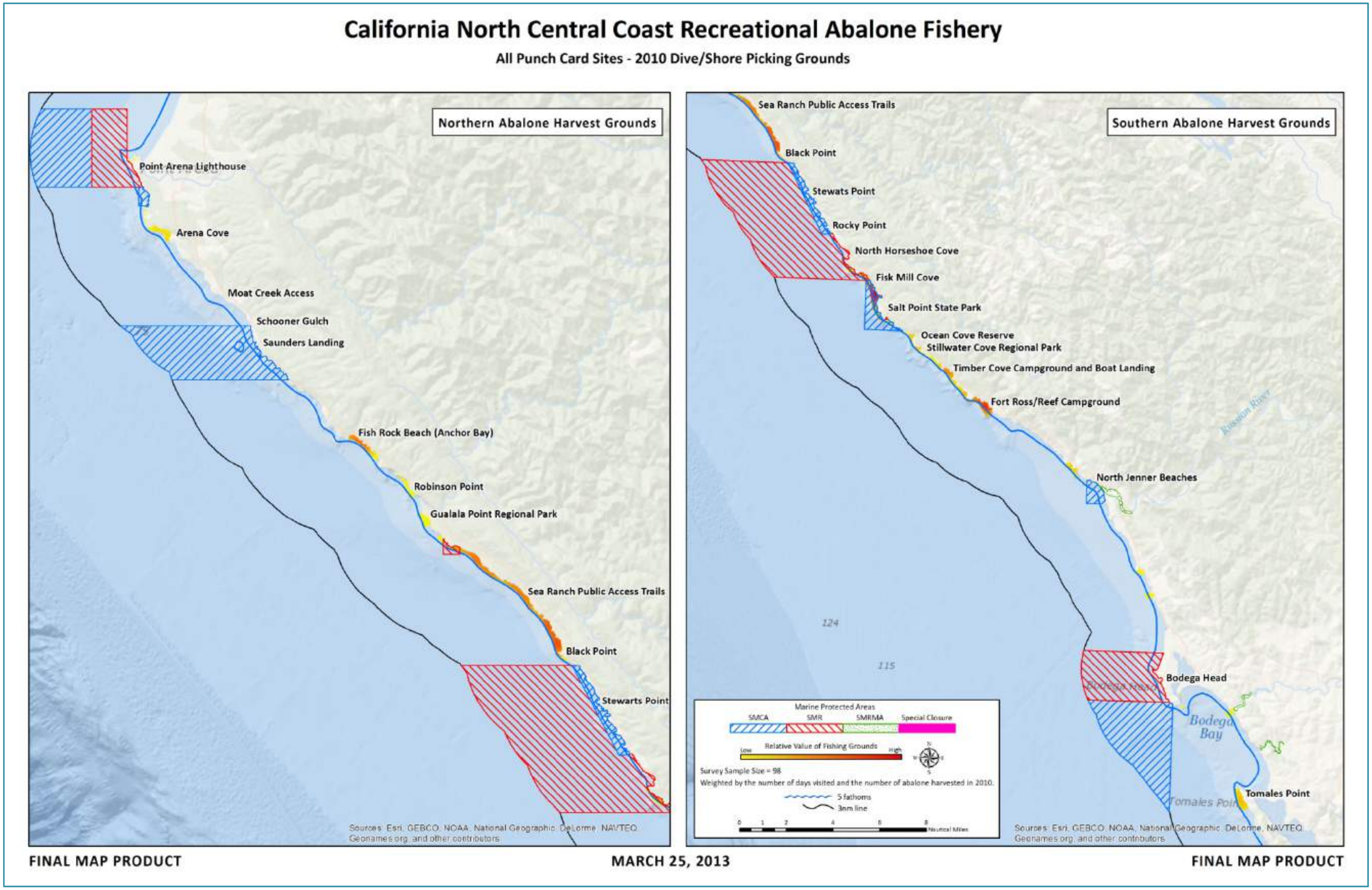
The map products and spatial data sets we have available for specific punch card sites are (from north to south) are:

1) Point Arena Cove
2) Robinson Point
3) Sea Ranch
4) Fisk Mill Cove
5) Salt Point State Park
6) Ocean Cove
7) Stillwater Cove
8) Timber Cove
9) Fort Ross/Reef Campground (these were combined due to their proximity)
10) Jenner
11) Bodega Head

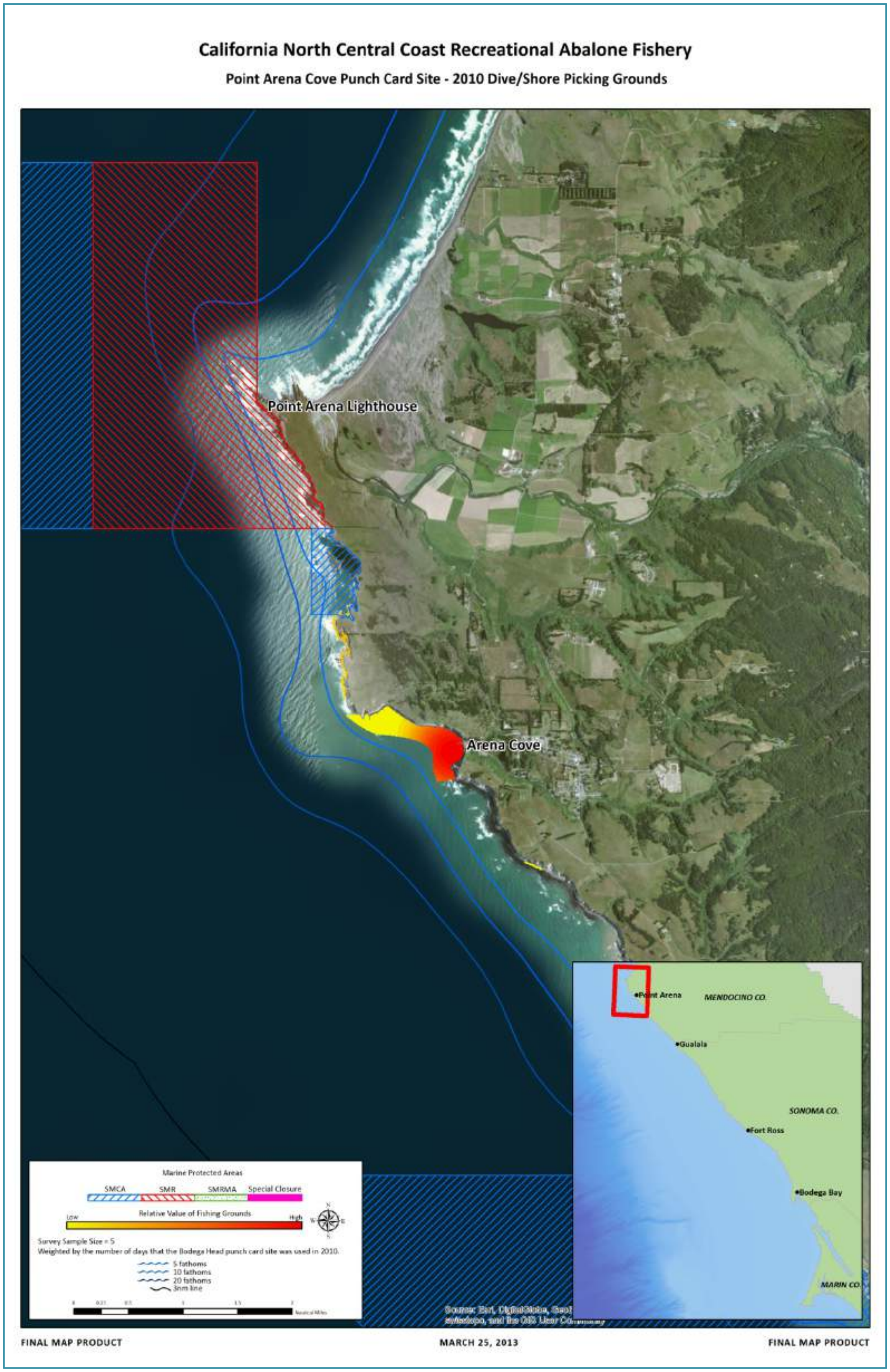
Table 21. California Department of Fish and Wildlife punch card sites and estimated number of abalone harvested in 2010 (Source: California Department of Fish and Wildlife)

Site Code	Punch Card Site	Estimated number of abalone harvested (2010)
50	Point Arena Lighthouse	787
51	Point Arena (Arena Cove)	9,144
52	Moat Creek	11,505
53	Schooner Gulch	683
54	Saunders Landing	267
56	Anchor Bay	4,246
58	Robinson Point	1,381
60	Gualala Point	980
62	Sea Ranch	12,188
64	Black Point	475
66	Stewarts Point	45
68	Rocky Point	0
70	Horseshoe Cove	193
72	Fisk Mill Cove	2,464
74	Salt Point State Park	8,951
76	Ocean Cove	4,988
78	Stillwater Cove	5,641
80	Timber Cove	12,024
82	Fort Ross	19,387
84	Reef Campground (Pedotti)	13,687
86	Jenner	4,142
88	Bodega Head	683
93	Tomales Point	2,063
96	Point Reyes Station	252
99	Other Marine County	356
	Total	**116,532**

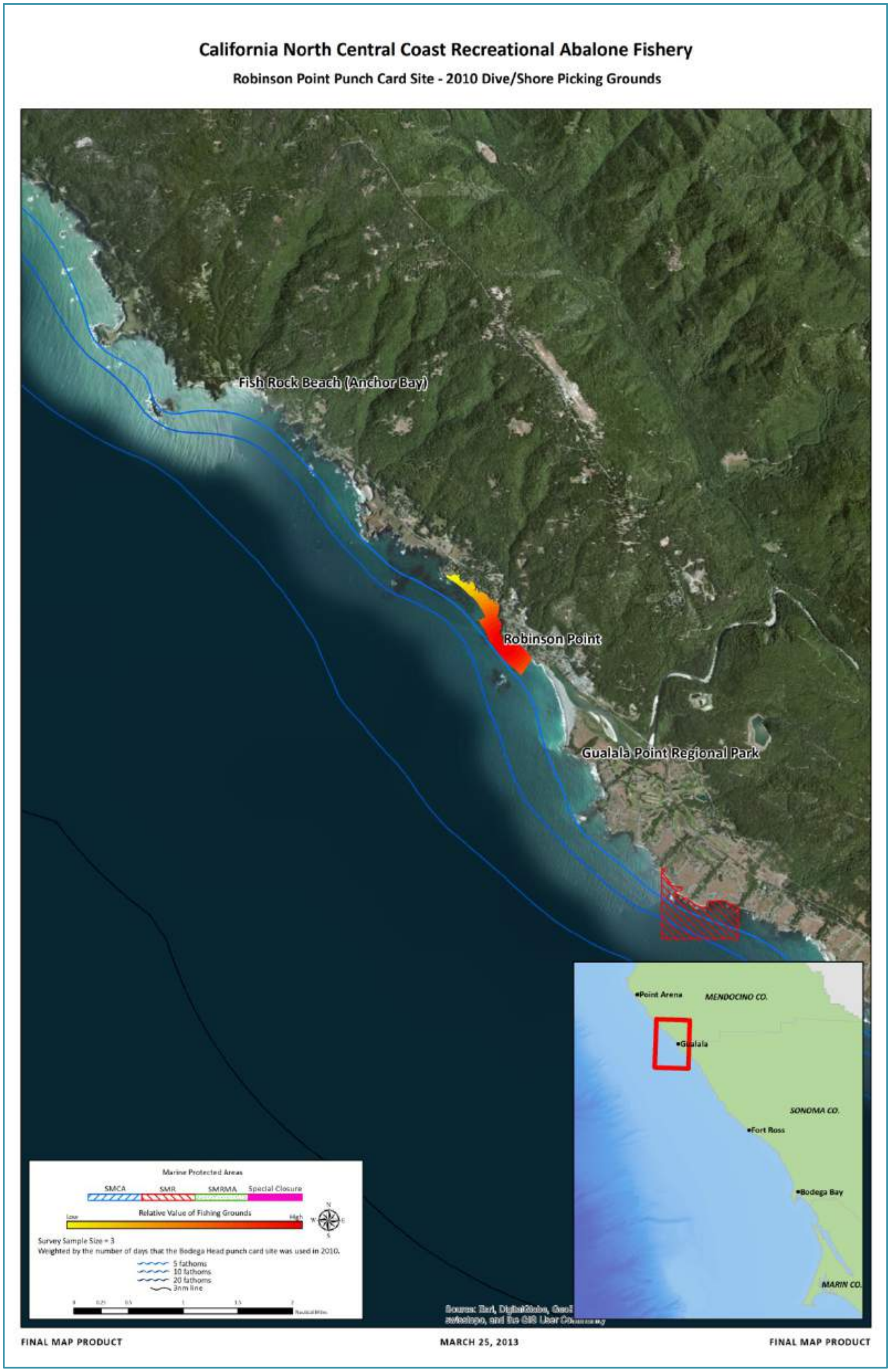
Map 2. California NCC recreational abalone fishery – All punch card sites combined– 2010 dive/shore picking grounds



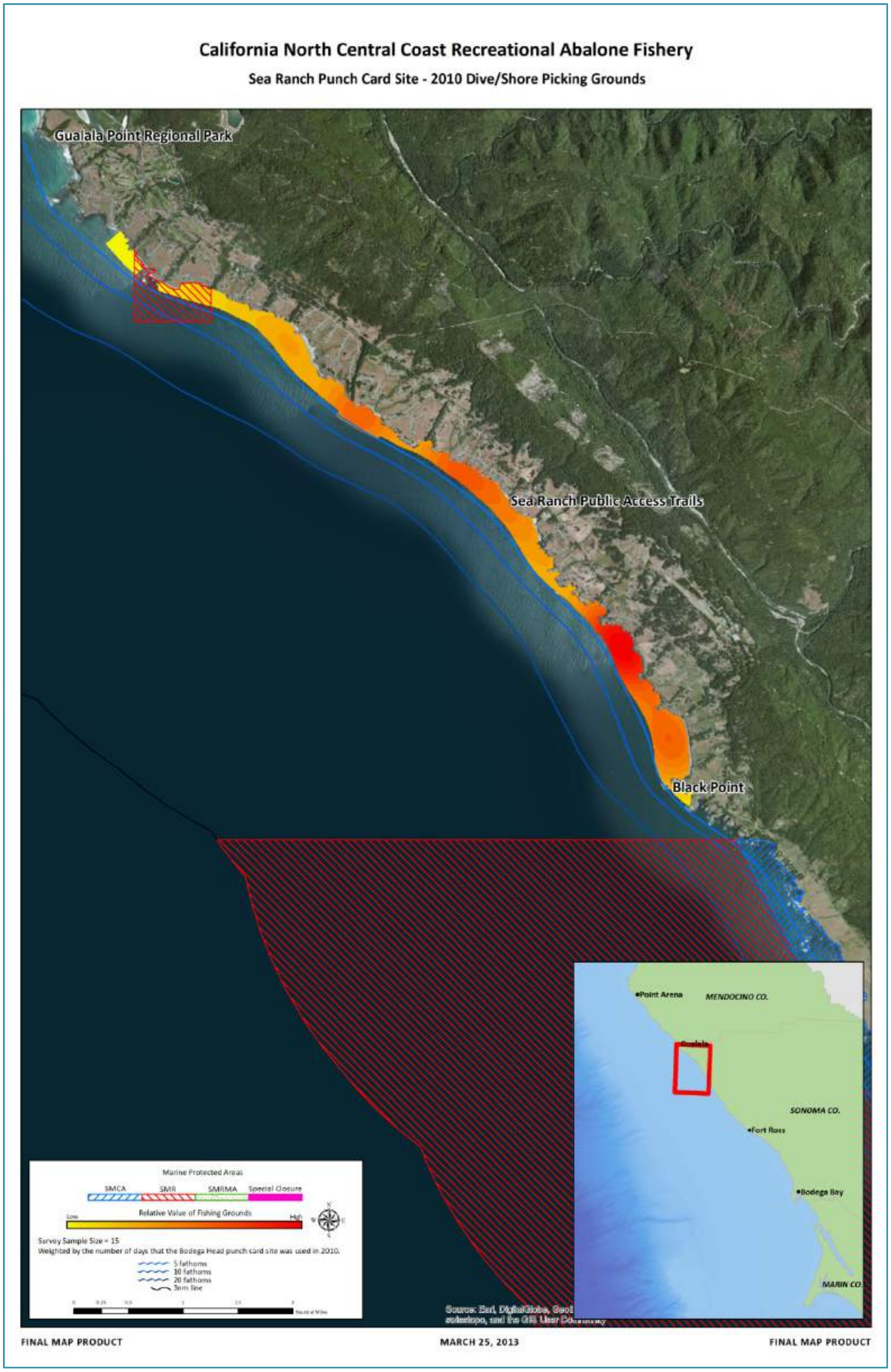
Map 3. California NCC recreational abalone fishery – Point Arena Cove – 2010 dive/shore picking grounds



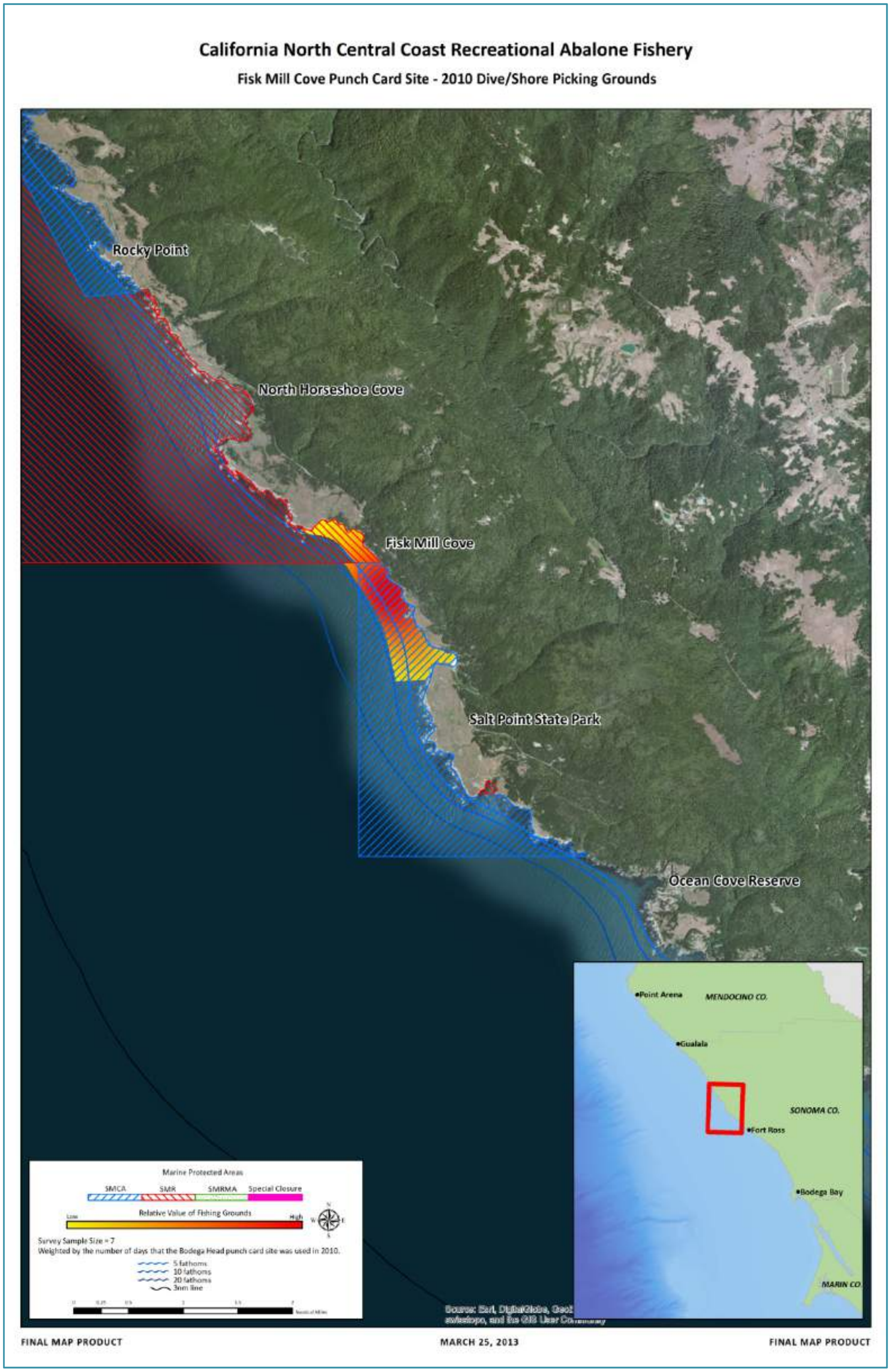
Map 4. California NCC recreational abalone fishery – Robinson Point – 2010 dive/shore picking grounds



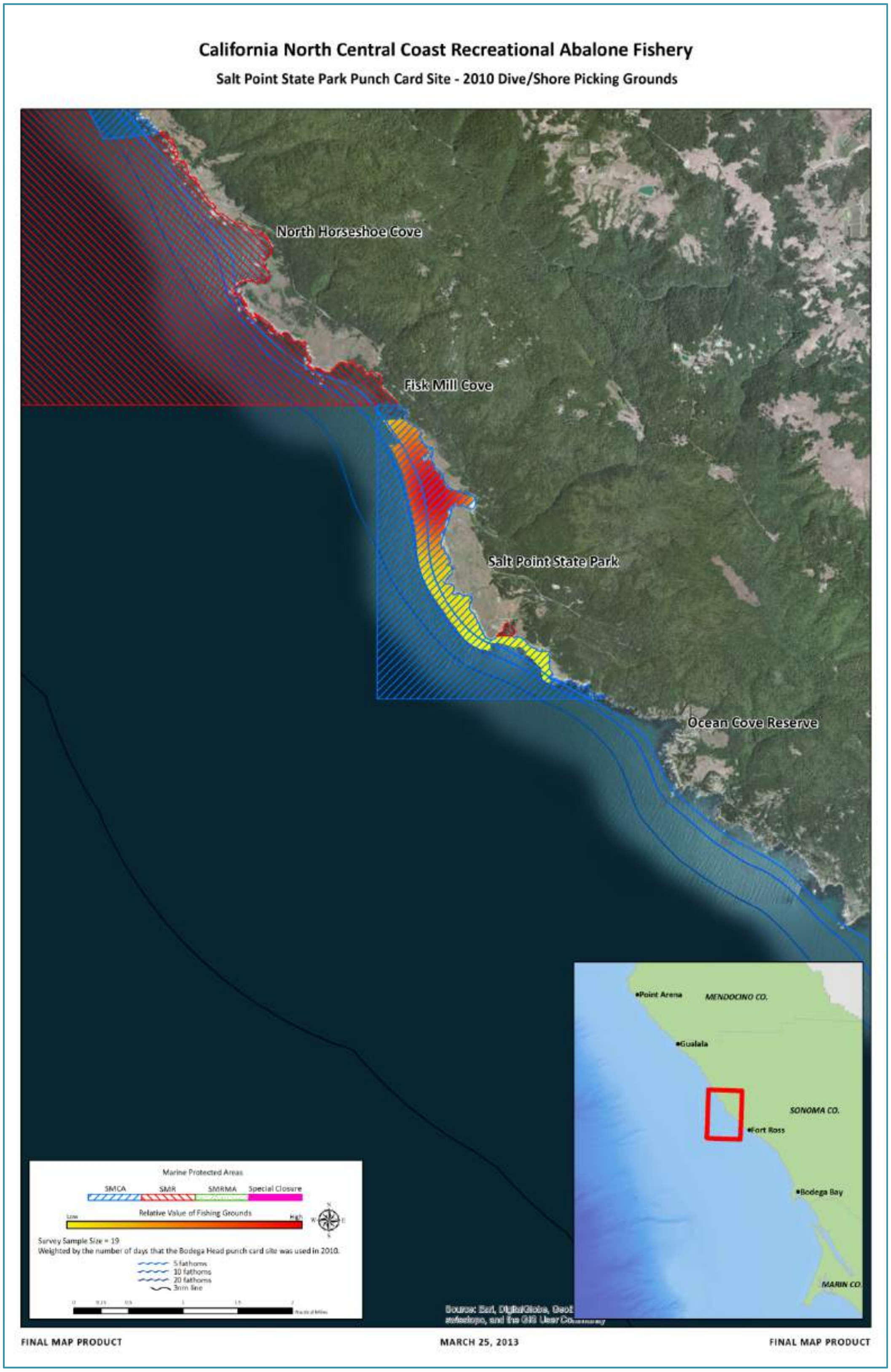
Map 5. California NCC recreational abalone fishery – Sea Ranch – 2010 dive/shore picking grounds



Map 6. California NCC recreational abalone fishery – Fisk Mill Cove – 2010 dive/shore picking grounds



Map 7. California NCC recreational abalone fishery – Salt Point State Park – 2010 dive/shore picking grounds

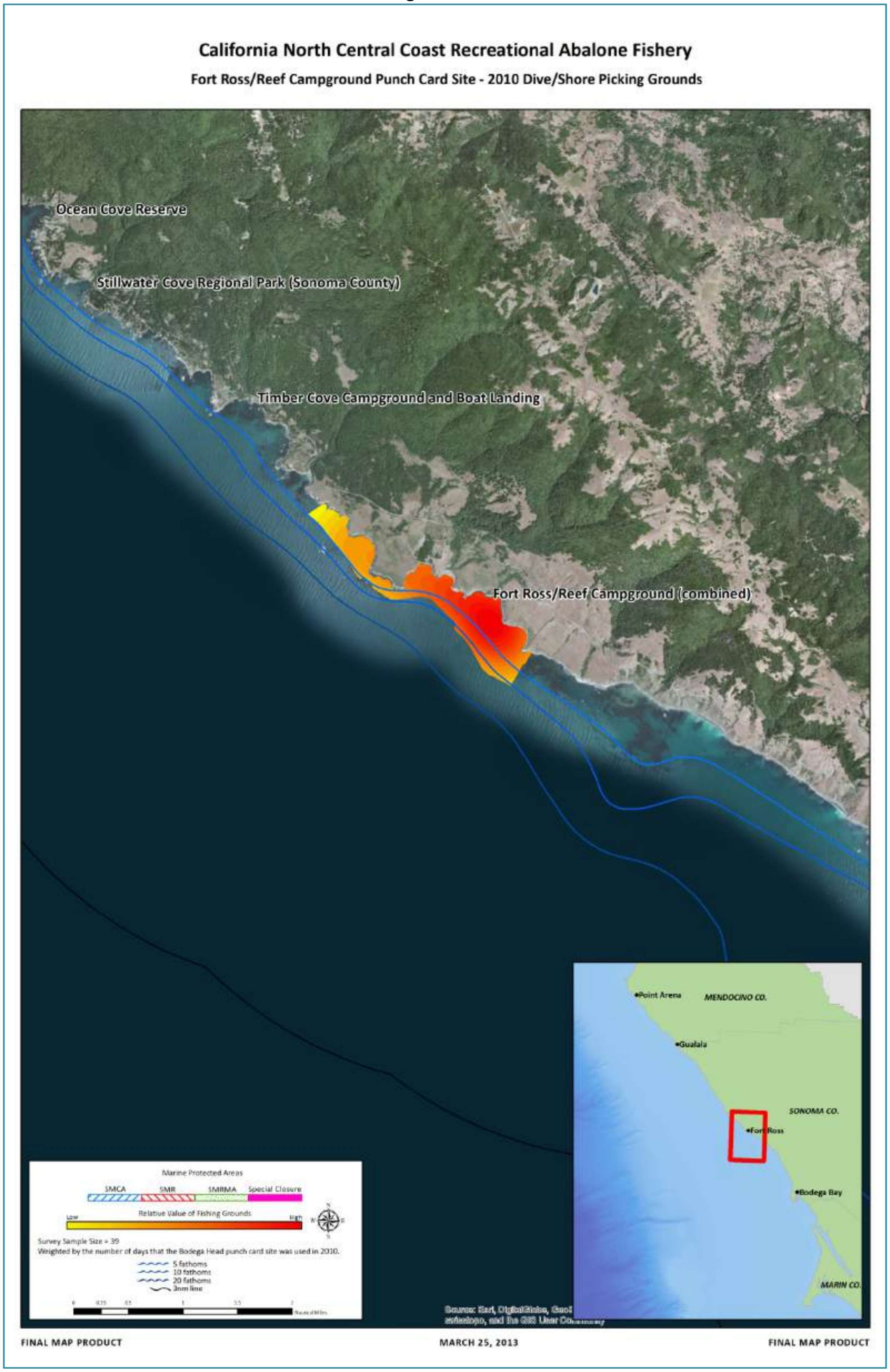


Map 8. California NCC recreational abalone fishery – Ocean Cove – 2010 dive/shore picking grounds

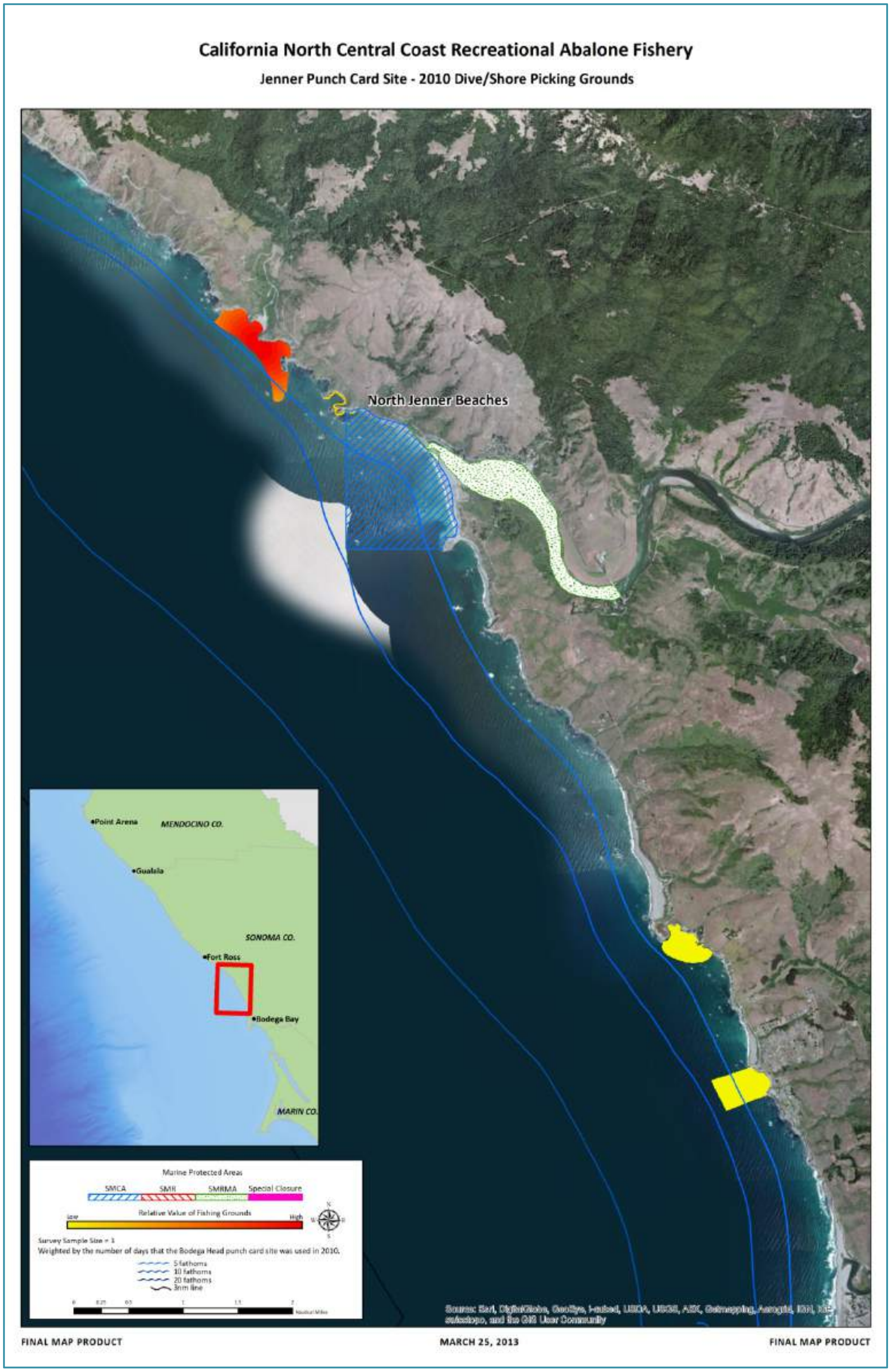
Map 9. California NCC recreational abalone fishery – Stillwater Cove – 2010 dive/shore picking grounds

Map 10. California NCC recreational abalone fishery – Timber Cove – 2010 dive/shore picking grounds

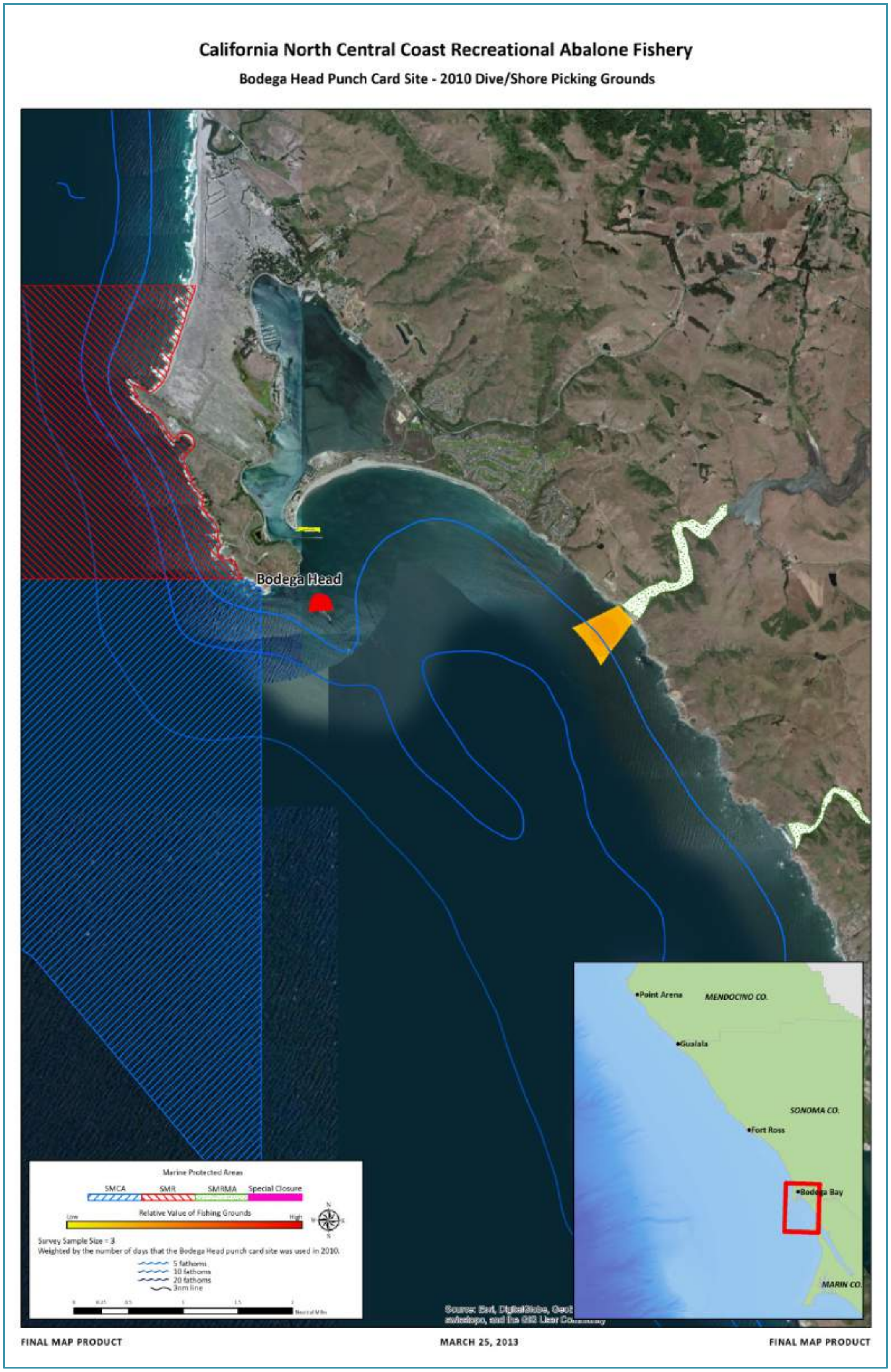
Map 11. California NCC recreational abalone fishery – Fort Ross/Reef Campground – 2010 dive/shore picking grounds



Map 12. California NCC recreational abalone fishery – Jenner – 2010 dive/shore picking grounds



Map 13. California NCC recreational abalone fishery – Bodega Head – 2010 dive/shore picking grounds



4. LESSONS LEARNED/FUTURE RECOMMENDATIONS

From the onset of this project we understood that collecting spatial data via telephone surveys would be challenging, however, a telephone survey was the best option for gathering a random sample for this fishery within the constraint of the available resources. Given our experience with this project, our future recommendation is to develop a methodology in which to conduct a random sample of abalone harvesters combined with the deployment of an online survey tool to better collect data on spatial use patterns on less frequented abalone harvest areas and collect more robust trip expenditure data that can be extrapolated to the whole abalone harvesting community.

Ecotrust has extensive experience in deploying online surveys, however, random samples of consumptive user groups have been difficult to achieve as comprehensive contact information for the study population (e.g., recreational salt-water fishing) often do not exist. However, there does exist a unique opportunity to randomly sample the recreational abalone harvesting community if contact and site use (e.g., punch card site used) information were consistently gathered and compiled through abalone report card purchases and returns. Combined with an online survey to collect spatial use patterns a robust and cost-effective study can be done of the recreational abalone harvest community that can be replicated into the long-term.

The following two components would be necessary to carry out an online survey of a random sample of abalone harvesters:

1) Continued compilation of a representative sample of contact (both phone and mailing address) and site use information of abalone punch card purchasers by California Department of Fish and Wildlife and
2) Engagement and collaboration with key recreational abalone harvesting associations and leaders.

Ongoing engagement and collaboration with the recreational abalone harvesting community is critical to obtaining adequate participation rates in an online survey effort. Recreational fishing and abalone harvesting associations can leverage their networks to inform their constituents to participate in an online survey effort if they are selected in the random sample and help build credibility of the survey effort by offering to put association logos on survey solicitation mailings. In our experiences, with the support of leaders in the recreational fishing community, an online survey can be greatly successful and collect quality and robust data to inform the adaptive management of the fishery.

Below are our recommendations and rationale for key socioeconomic monitoring metrics for the recreational abalone fishery:

1) Demographic characteristics
    a. This is important to collect to continue to characterize and determine any shifts in the age, race, or income level of the abalone harvesting population.
2) Estimates of number of abalone harvested, number of people, and days harvesting in each punch card site
    a. This is important to monitoring intensity of abalones extracted across sites as well as visitation/use/effort statistics within a site.
3) Estimate of spatial patterns of harvest within punch card site
    a. This can inform ecological monitoring efforts to integrate human pressure data into ecological monitoring results.
    b. This can help determine the spatial extent of a punch card site and the relative use within the site.
4) Perceptions of abundance and size changes over time
    a. This helps managers understand perceptions of change over time and to compare with ecological monitoring results and harvest patterns.
5) Total number of abalone harvesters
    a. To estimate the total size of the harvesting population as base data for extrapolations.
6) Trip/annual expenditures

    a. To estimate the economic contribution of recreational abalone harvesting; this information can also be spatially explicit when linked to individual respondent's harvest areas.

7) Site preferences
    a. This is important to understand drivers in site use patterns and can also be link trip expenditures to value site characteristics.
8) MPA awareness
    a. This may be used to determine outreach and education effectiveness.

5. CONCLUSION

The goal of this report was to focus on establishing a baseline of general spatial use patterns and annual expenditures among recreational abalone harvesters in the NCC study region. These data can be used to measure into the future how human use and value patterns are changing over time. It should be emphasized that annual expenditures are but a portion of the overall economic value of recreational abalone harvesting. In this study we do not account for the secondary economic effects such as the value (e.g., jobs and wages) of the recreational abalone fishery to support industries such as the local tourism economy. Indeed, additional valuation methods to investigate the full economic value of the recreational abalone fishery as well as its associated social and cultural value to the health of local economies and people are important to understand and account for in future monitoring efforts.

It is difficult to discern the effects of MPAs on coastal communities and vice versa as they are confounded by a multitude of factors such as other regulatory constraints (e.g., harvest methods and harvest limits), general economic downturn, environmental variability/change, and increasing competition for marine space. However, advancing our understanding of the interconnections that drive how humans utilize, value, and rely upon marine space will be critical to monitoring how MPAs are benefitting or impacting coastal communities into the future. This information may then be used in adaptive management measures to improve the performance of MPAs towards meeting ecological and socioeconomic goals. Similarly, it is our hope that the data collected/compiled and lessons learned through this project will be applied to future MPA monitoring efforts to build a time series data set on how human uses and the socioeconomic health of coastal communities are changing over time. A robust and longitudinal dataset that provides both socioeconomic characterization and spatial patterns on consumptive human uses could be used for a wide array of marine spatial planning application including the monitoring of MPAs.

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