

---

# **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**

**Lead Authors:  
(in alphabetical order)**

Cheryl Chen  
Kristen Sheeran  
Charles Steinback

**Contributing Authors:**

Leanne Weiss  
Nick Lyman  
Taylor Hesselgrave  
Jon Bonkoski

April 23, 2013

This publication was supported by the State Coastal Conservancy, the State of California, and the California Department of Fish and Wildlife under Grant Agreement #09-015, through the California Sea Grant College Program. The views expressed herein do not necessarily reflect the views of any of those organizations.



## 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.

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	i
1. INTRODUCTION .....	1
1.1. The California Recreational Red Abalone Fishery .....	5
2. METHODS.....	7
2.1. Sample Methodology.....	7
2.2. Spatial Analysis Methodology.....	8
2.3. Data Review/Verification .....	9
3. SURVEY RESULTS .....	10
3.1. Establishing an Economic Baseline Characterization .....	10
3.2. Establishing a Spatial Baseline .....	25
4. LESSONS LEARNED/FUTURE RECOMMENDATIONS.....	39
5. CONCLUSION.....	40
REFERENCES .....	41

For questions or comments, please contact Cheryl Chen, Marine Planning Project Manager, at Ecotrust, 721 NW 9<sup>th</sup> Avenue, Suite 200 Portland, OR 97209; [cchen@ecotrust.org](mailto: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.

## LIST OF TABLES

Table 1. Abalone harvest survey: Number of individuals interviewed .....	10
Table 2. Average age of recreational abalone harvesters surveyed .....	10
Table 3. Education level of recreational abalone harvesters surveyed .....	11
Table 4. Household income level of recreational abalone harvesters surveyed .....	11
Table 5. Race/Ethnicity of recreational abalone harvesters surveyed.....	11
Table 6. Average years of experience abalone diving or shore picking .....	12
Table 7. Average number of days diving or shore picking for abalone in and outside the NCC region in 2010 .....	13
Table 8. MPA awareness questions .....	14
Table 9. Number and percent of respondents indicating they were familiar with a particular MPA .....	15
Table 10. NCC punch card site used for recreational abalone harvesting in 2010 .....	16
Table 11. Primary reasons for harvesting at a CDFW North Central Coast abalone punch card site.....	17
Table 12. Other reasons respondents chose to harvest at a particular abalone site .....	18
Table 13. Access method by NCC abalone punch card site .....	19
Table 14. Harvest strategy for abalone divers and shore pickers.....	20
Table 15. Perceptions of change in time it took to harvest abalone at a site from 2009 to 2010 .....	20
Table 16. Reason for not returning in 2010 to a specific punch card site visited in 2009 .....	21
Table 17. Other reasons for not returning to a punch card site .....	21
Table 18. Average annual and per item expenses in 2010 related to recreational abalone diving/shore picking .....	22
Table 19. Consumptive recreational diving/shore picking expenses made in 2010 compared to other years.....	23
Table 20. Across all respondents: Average annual and per item expenses related to consumptive recreational abalone diving/shore picking.....	23
Table 21. California Department of Fish and Wildlife punch card sites and estimated number of abalone harvested in 2010.....	26

## LIST OF FIGURES

Figure 1. Example illustrating the primary components of a CDFW abalone report card.....	6
Figure 2. Screenshot of abalone harvest mapping survey tool.....	8
Figure 3. Frequency of years of experience abalone diving .....	12
Figure 4. Frequency of years of experience abalone shore picking .....	13
Figure 5. Number of days spent diving/shore picking for abalone inside and outside the NCC region in 2010 .....	14
Figure 6. Primary reasons for harvesting at a CDFW North Central Coast abalone punch card site .....	18
Figure 7. Across all respondents: Average annual and per item expenses related to consumptive recreational abalone diving/shore picking.....	24



# 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 (CFCW) 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:

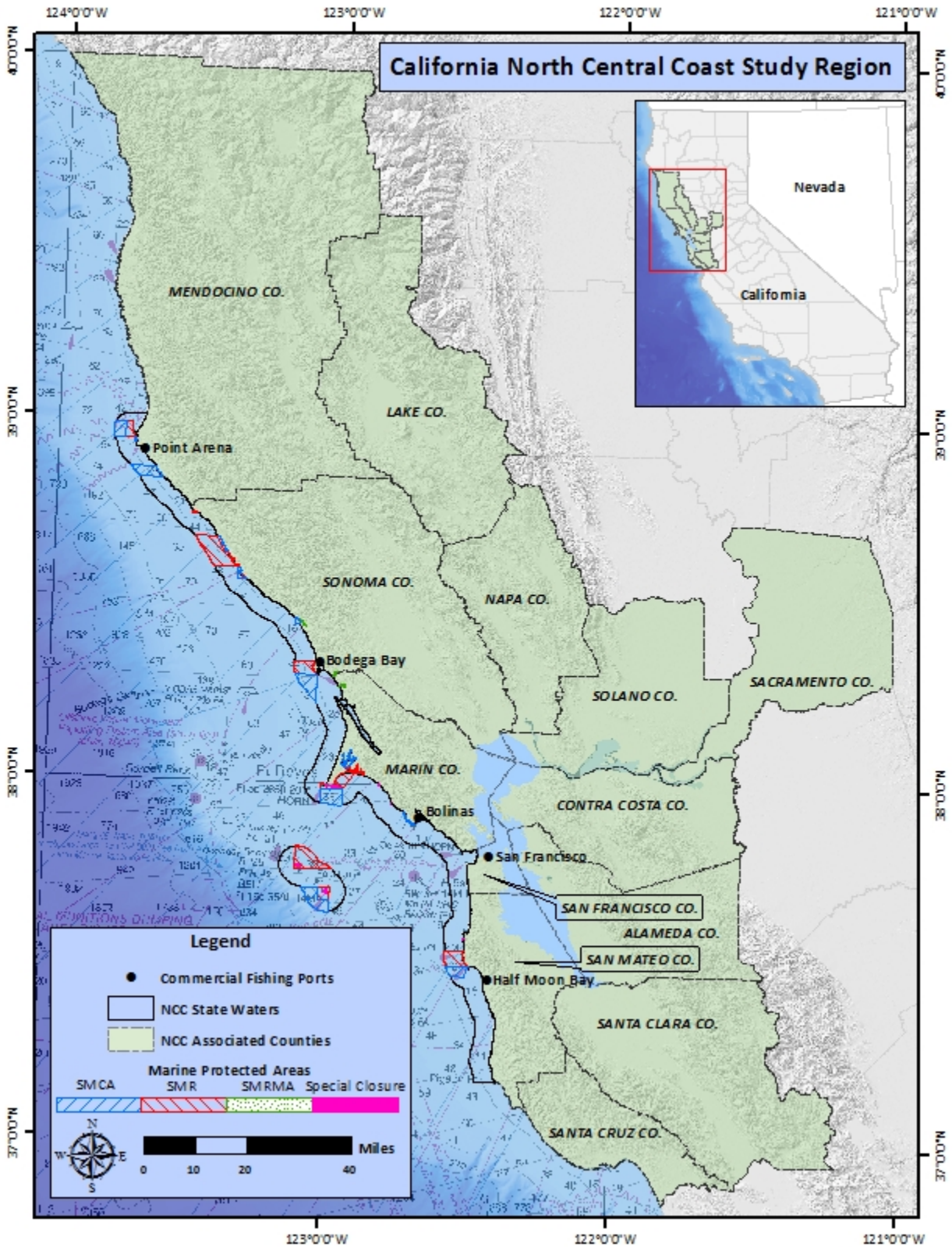
1. A baseline characterization of spatial harvest patterns at the punch card site and region wide level;
2. An economic baseline characterization of abalone harvesters that includes demographic characteristics, site selection preferences, and annual expenditures associated with recreational abalone harvesting;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

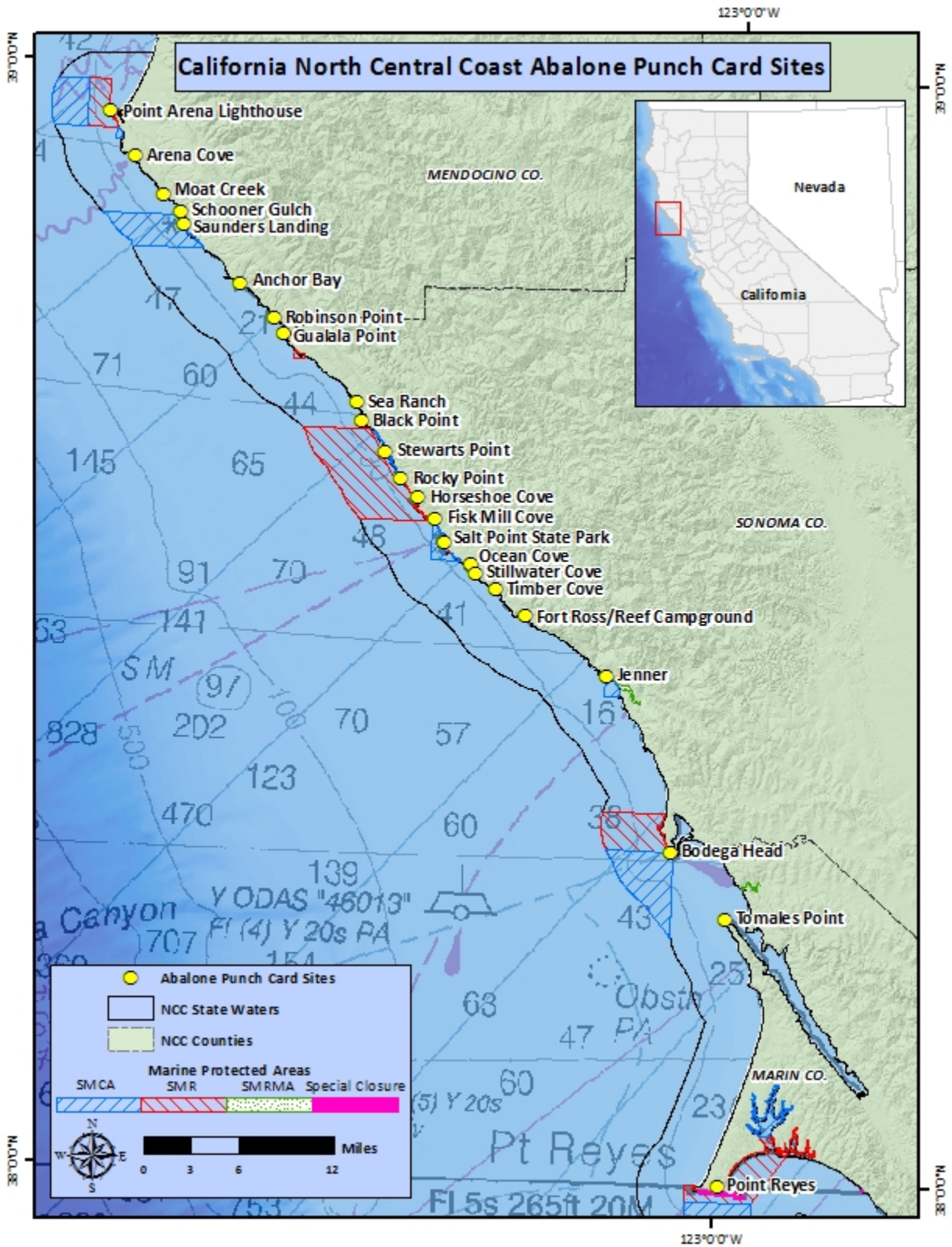
The information provided in this report is a part of a larger Ecotrust project to monitor human uses in the North Central Coast region. The overarching goal of this larger project is to provide baseline estimates of the quantity, spatial distribution, and economic impacts of human uses in the North Central 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

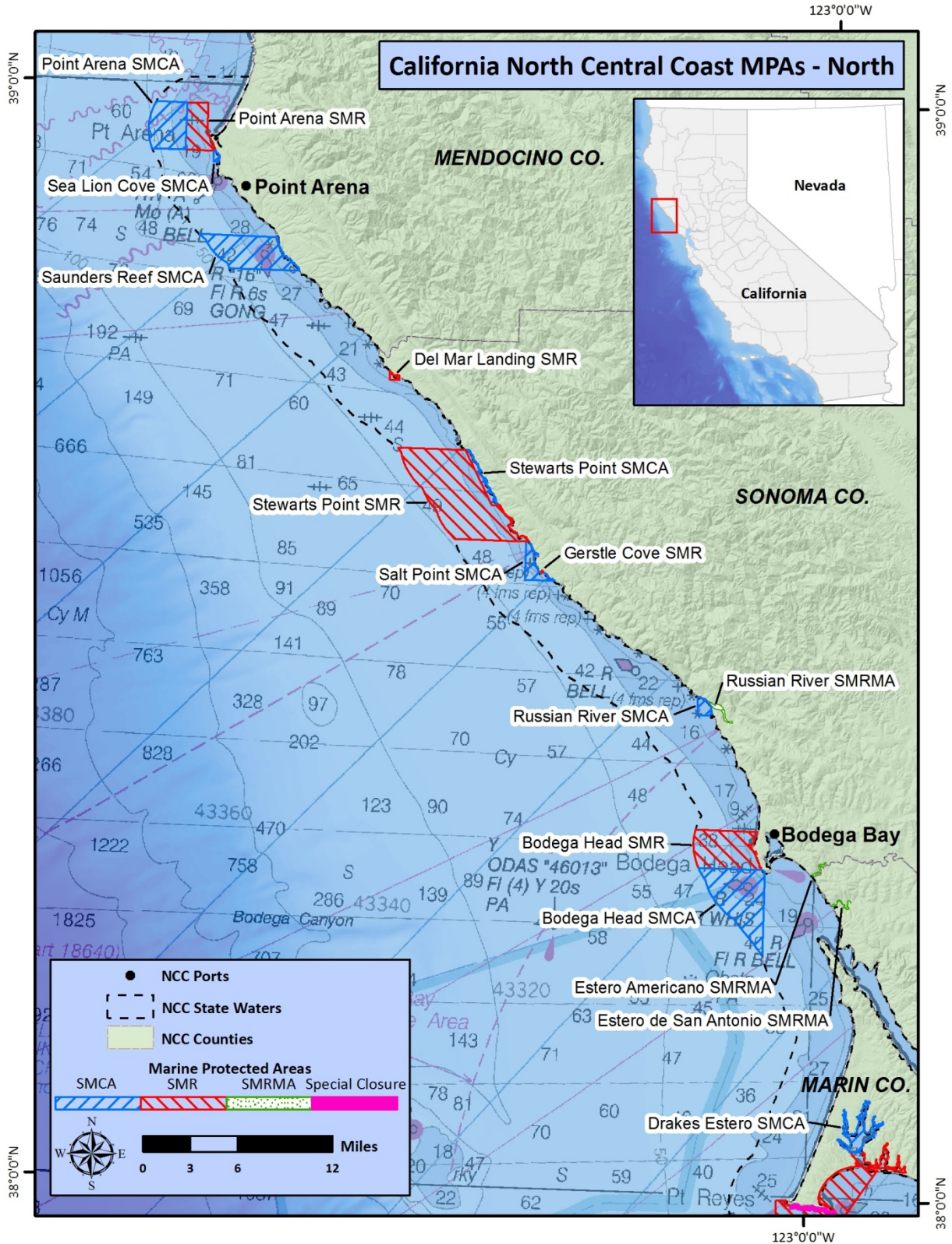




Map 2. California North Central Coast study region with abalone punch card site locations



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	Tomaes 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:

①	MO: 4TH	DA: 14	TI: 8:00AM	LOCA: 74	CODE
	2008		000252-01		
②	MO: 4TH	DA: 14	TI: 8:00AM	LOCA: 74	CODE
	2008		000252-02		
③	MO: 4TH	DA: 14	TI: 12:30PM	LOCA: 70	CODE
	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<sup>1</sup>. 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.

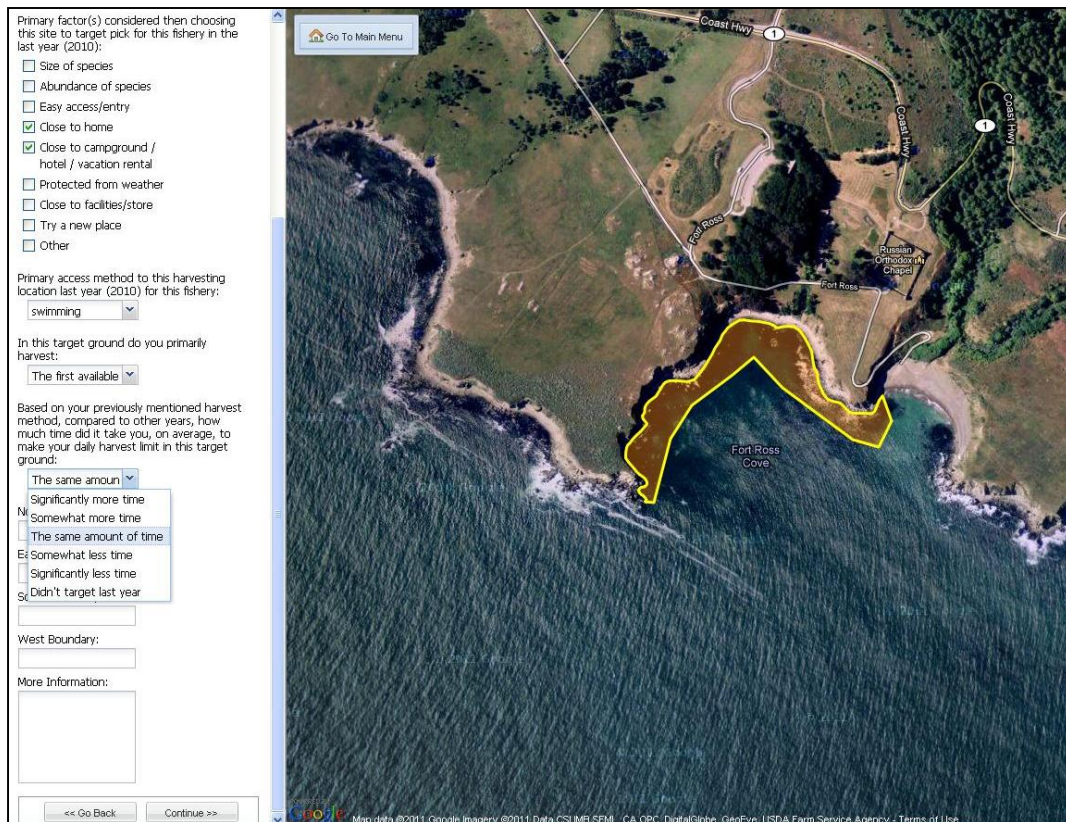
In January and February 2011, staff travelled to the North Central Coast region to meet with key members and leaders of the recreational abalone harvest community to gather input on survey design, best methods for sampling users, insights on impacts of MPAs and other factors impacting the recreational abalone fishery, gain support for the project, and answer questions.

---

<sup>1</sup> 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, through 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](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<sup>2</sup>. 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.

---

<sup>2</sup> 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			Dive			Shore Pickers		
	Percent of Respondents	95% CI		Percent of Respondents	95% CI		Percent of Respondents	95% CI	
		Low	High		Low	High		Low	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			Dive			Shore Pickers		
	Percent of Respondents	95% CI		Percent of Respondents	95% CI		Percent of Respondents	95% CI	
		Low	High		Low	High		Low	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			Dive			Shore Pickers		
	Percent of Respondents	95% CI		Percent of Respondents	95% CI		Percent of Respondents	95% CI	
		Low	High		Low	High		Low	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

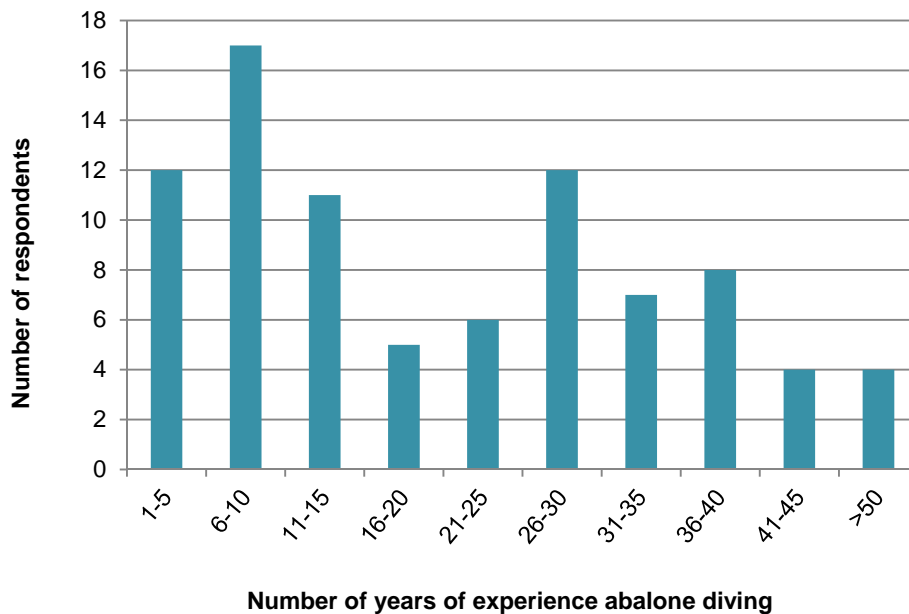
Table 6 and Figures 3 and 4 indicate the respondent's average number of years of experience and the distribution of years of experience by diver and shore pickers. The average years of experience did not differ much between divers (22 years) and shore pickers (24 year). However, the distribution of years 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**

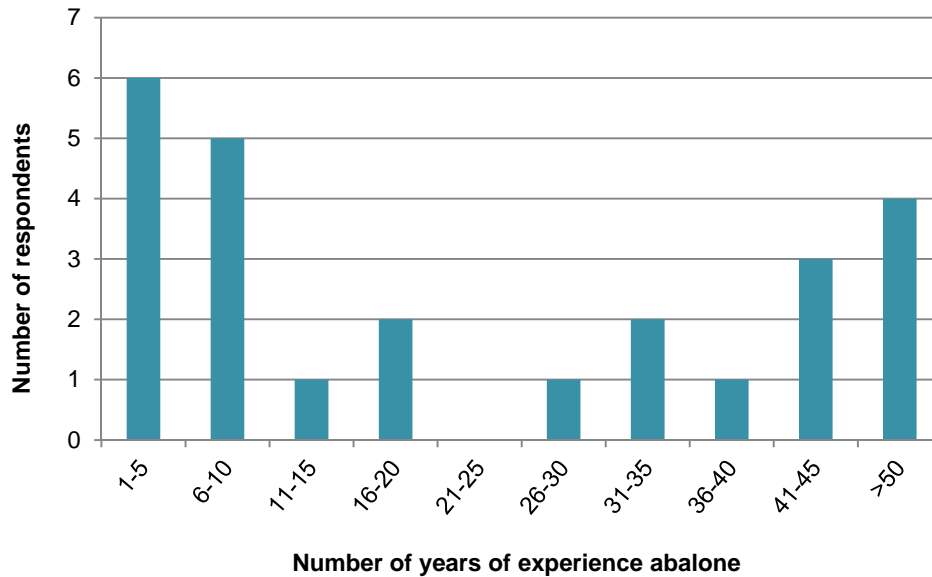
	Average Years of experience	95% Confidence Interval	
		Low	High
Abalone - Dive	22	19	25
Abalone - Shore Picking	24	16	33

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

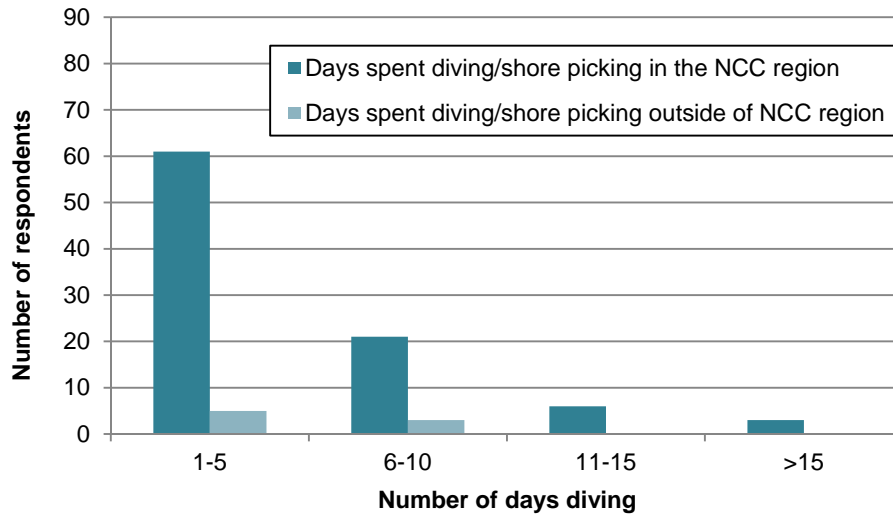
Table 7 and Figure 5 display the average number of days respondents spent diving or shore picking for abalone inside and outside the North Central Coast study region in 2010. Again, the North Central Coast study region extends from Alder Creek near Point Arena in the north to Pigeon Point near Half Moon 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**

Fishery	Number of responses	Average number of days harvesting in NCC Region (2010)			Average number of days harvesting outside NCC Region (2010)		
		Mean	95% Confidence Interval		Average	95% Confidence Interval	
			Low	High		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
<b>Total Responses</b>	<b>92</b>						

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**

Question	No. of responses		Percent of responses	
	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 familiar with a particular MPA**

<b>MPA</b>	<b>Number of respondents</b>	<b>Percent of respondents</b>
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%
<b>Total number of respondents</b>	<b>61</b>	

*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%
Tomaes Point	1	—	1	1%
Point Arena Lighthouse	—	1	1	1%
Stewarts Point	—	1	1	1%



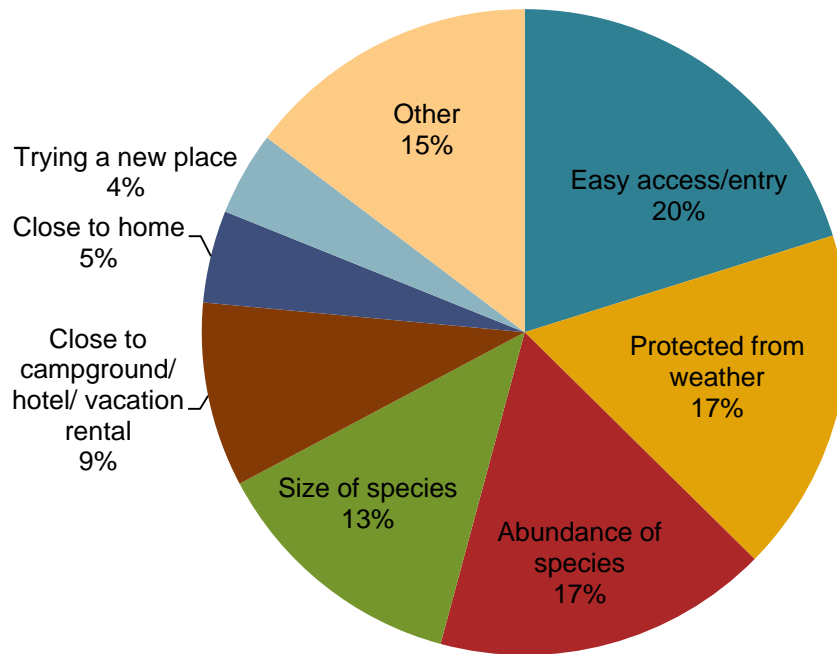
Furthermore, for each harvest area given by a respondent we asked for the primary reasons for harvesting at this particular area. As shown in Table 11 and Figure 6 below, across all sites the most common reason divers and shore pickers chose to harvest abalone at a specific site was easy access and entry. 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%	—	—	—
<b>Total</b>	<b>238</b>	<b>20%</b>	<b>17%</b>	<b>17%</b>	<b>13%</b>	<b>9%</b>	<b>5%</b>	<b>4%</b>	<b>15%</b>

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%
<b>Total</b>	<b>154</b>	<b>11%</b>	<b>12%</b>	<b>77%</b>

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%	—
Tomaes Point	1	—	—	100%	—	—
<b>Total</b>	<b>158</b>	<b>5%</b>	<b>14%</b>	<b>75%</b>	<b>4%</b>	<b>1%</b>

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%
<b>Total</b>	<b>44</b>	<b>7%</b>	<b>9%</b>	<b>9%</b>	<b>30%</b>	<b>16%</b>	<b>7%</b>	<b>23%</b>

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**

	Number of responses	Average	95% Confidence Interval	
			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**

<b>Response</b>	<b>Number of responses</b>	<b>Percent of responses</b>
Significantly lower	12	13%
Somewhat lower	12	13%
Average	44	49%
Somewhat higher	20	22%
Significantly higher	2	2%

Source: Current study

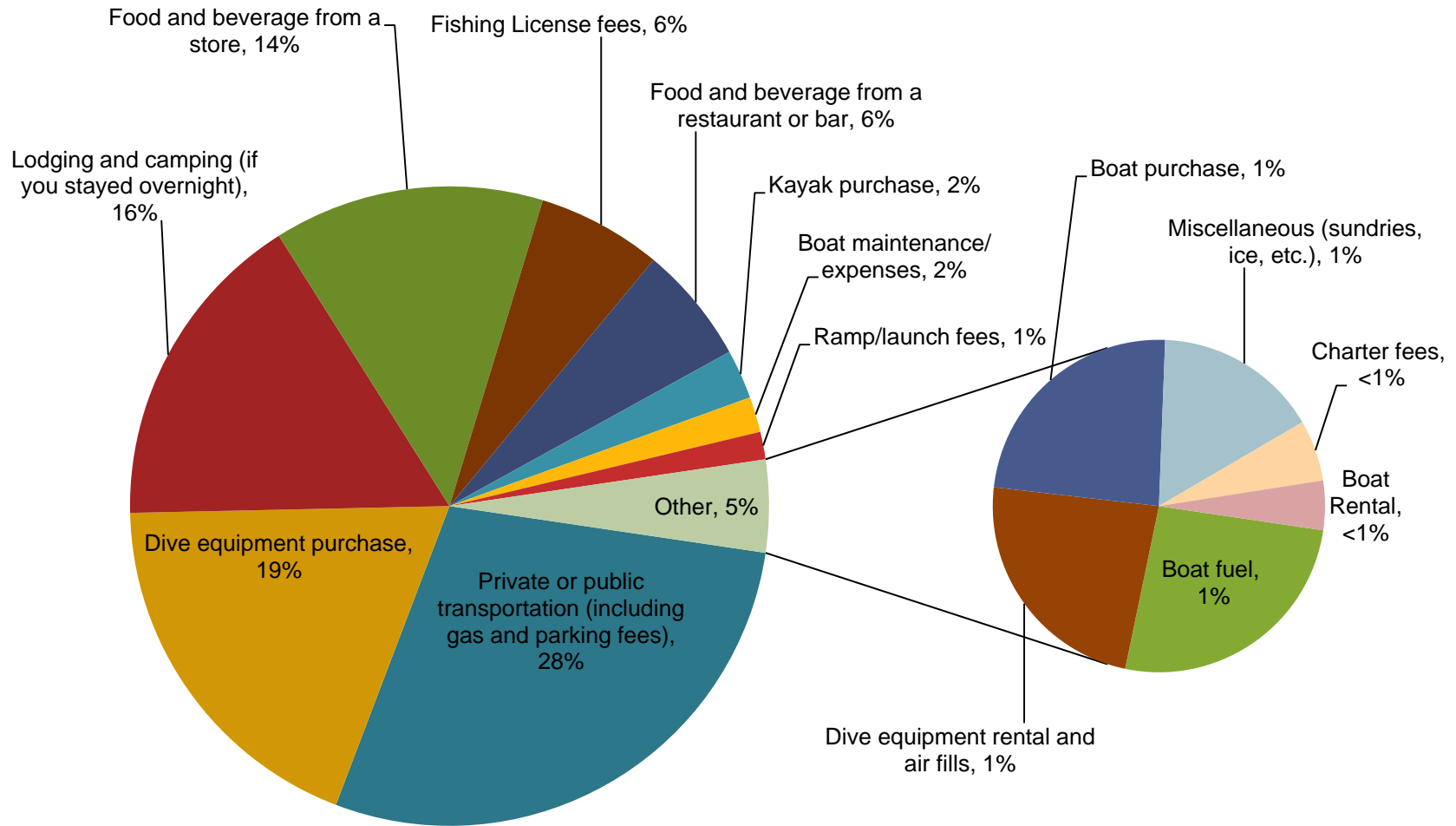
**Table 20. Across all respondents: Average annual and per item expenses related to consumptive recreational abalone diving/shore picking**

	Number of respondents	Average	95% Confidence Interval		Percent of total expenses
			Low	High	
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

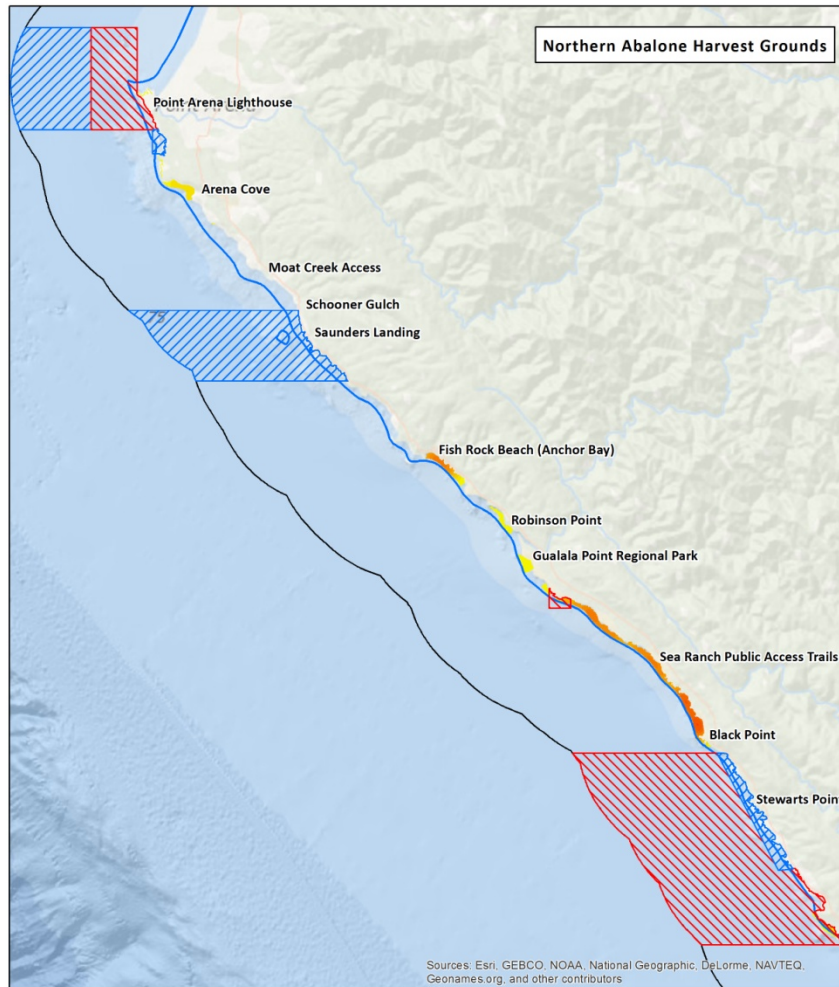
**Table 21. California Department of Fish and Wildlife punch card sites and estimated number of abalone harvested in 2010 (Source: California Department of Fish and Wildlife)**

<b>Site Code</b>	<b>Punch Card Site</b>	<b>Estimated number of abalone harvested (2010)</b>
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
<b>Total</b>		<b>116,532</b>

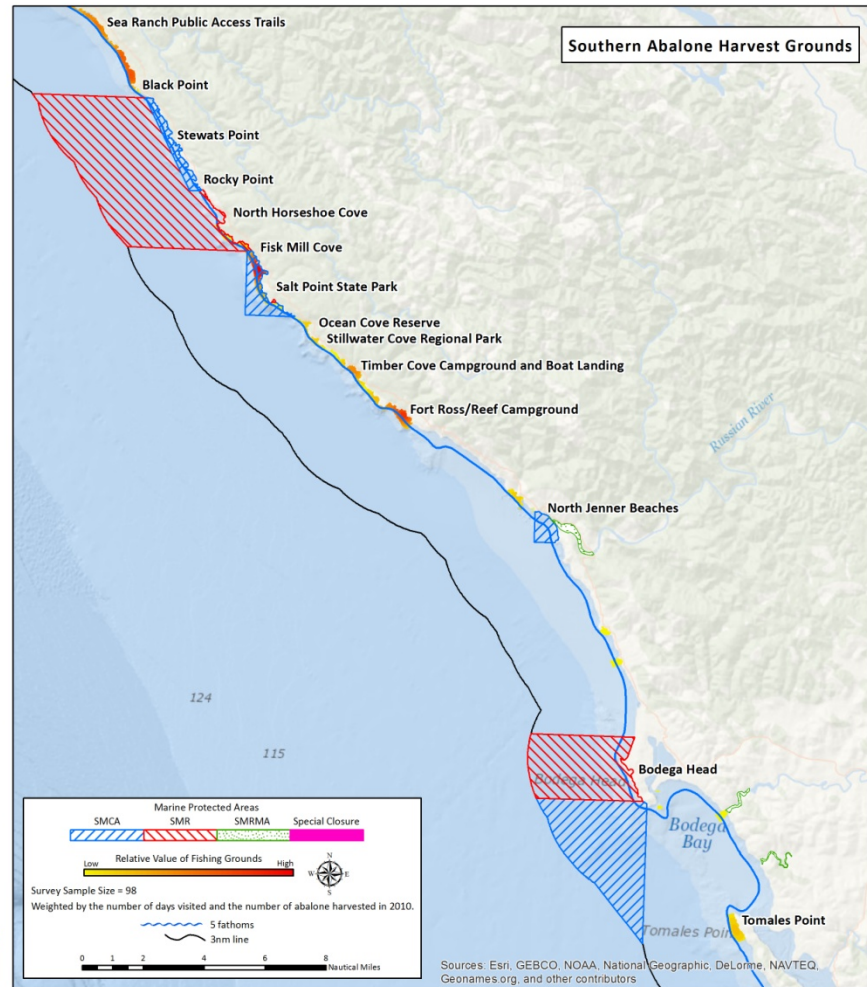
Map 2. California NCC recreational abalone fishery – All punch card sites combined– 2010 dive/shore picking grounds

### California North Central Coast Recreational Abalone Fishery

All Punch Card Sites - 2010 Dive/Shore Picking Grounds



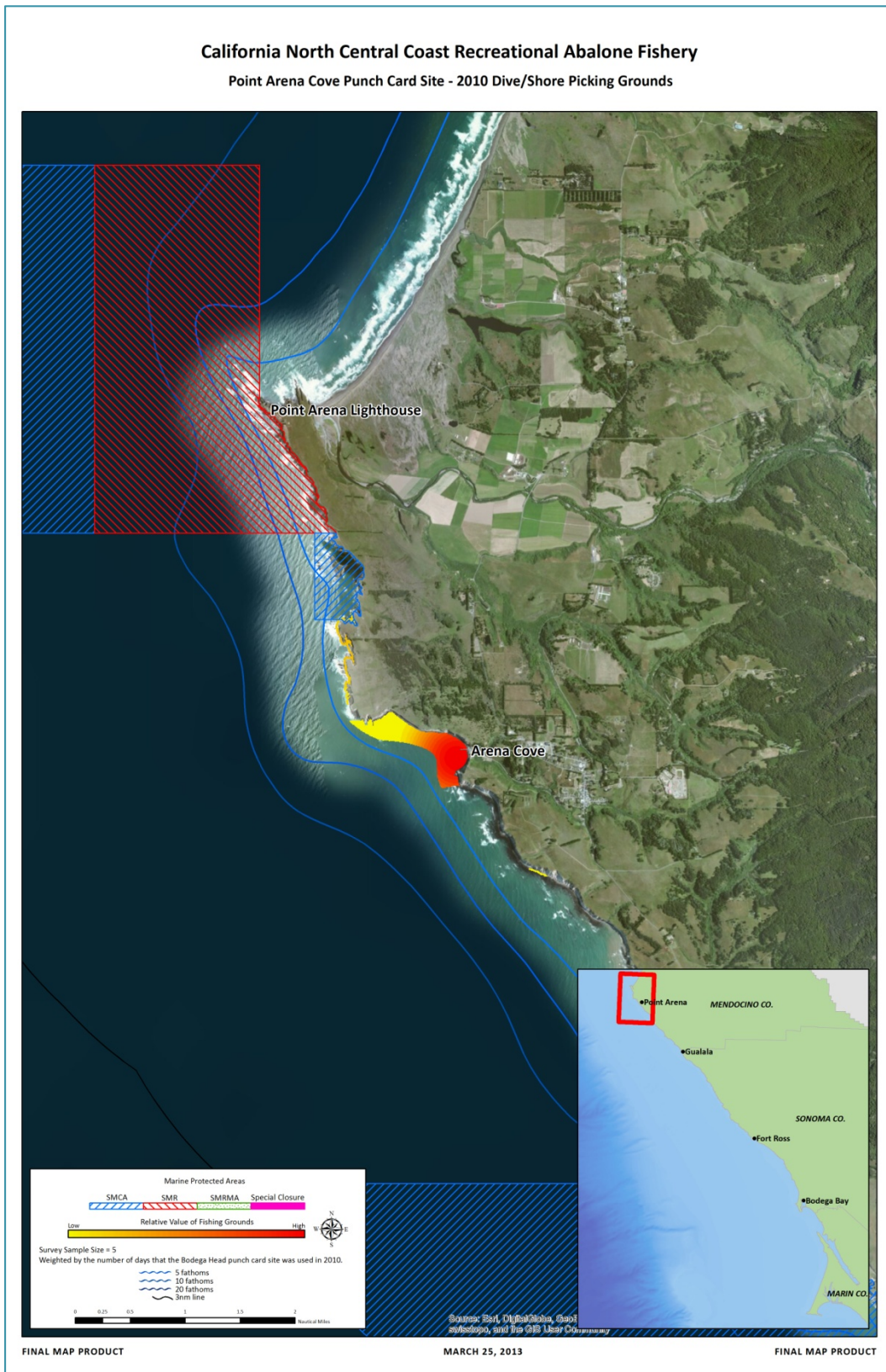
FINAL MAP PRODUCT



FINAL MAP PRODUCT

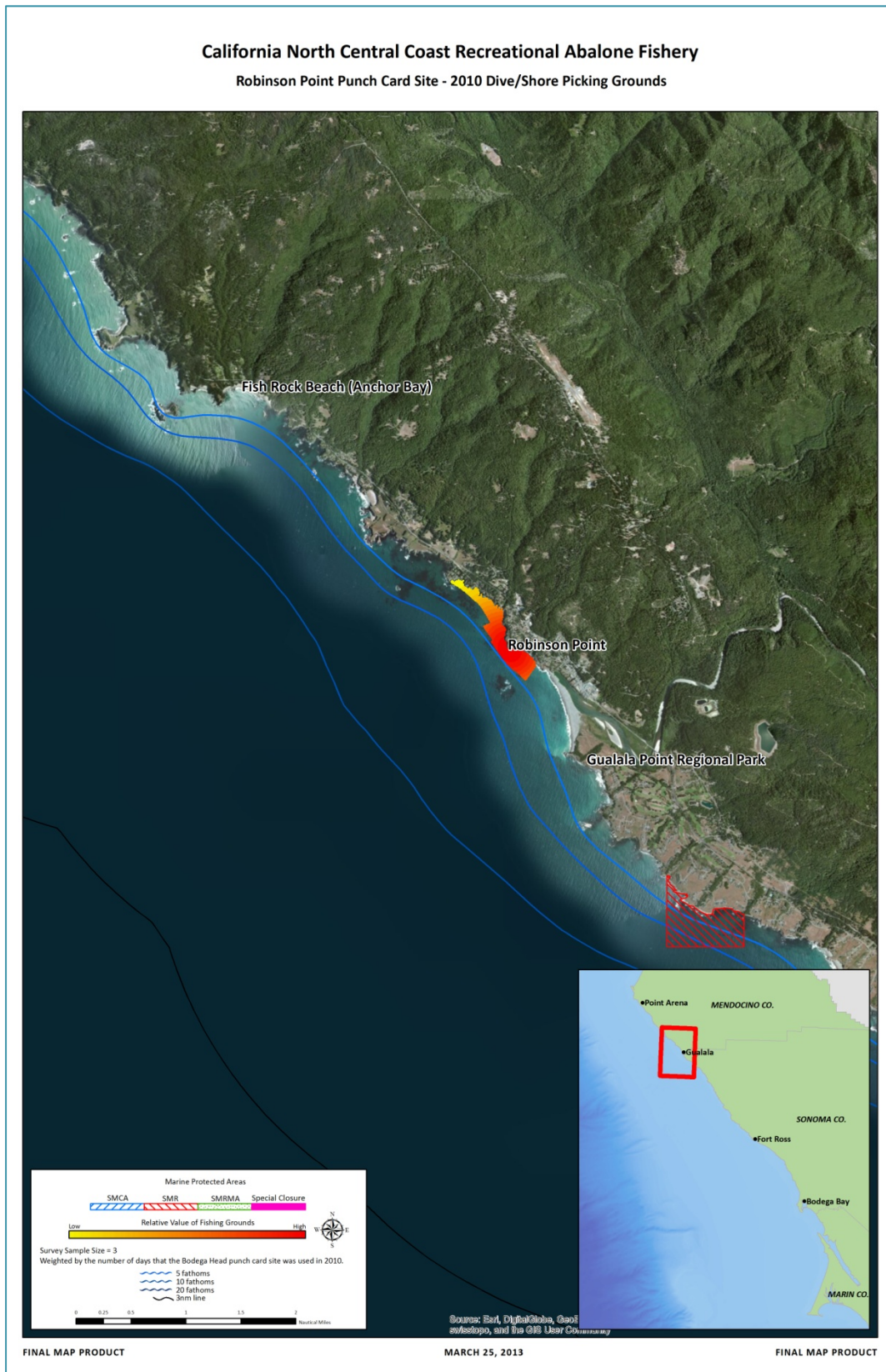
MARCH 25, 2013

Map 3. California NCC recreational abalone fishery – Point Arena Cove – 2010 dive/shore picking grounds

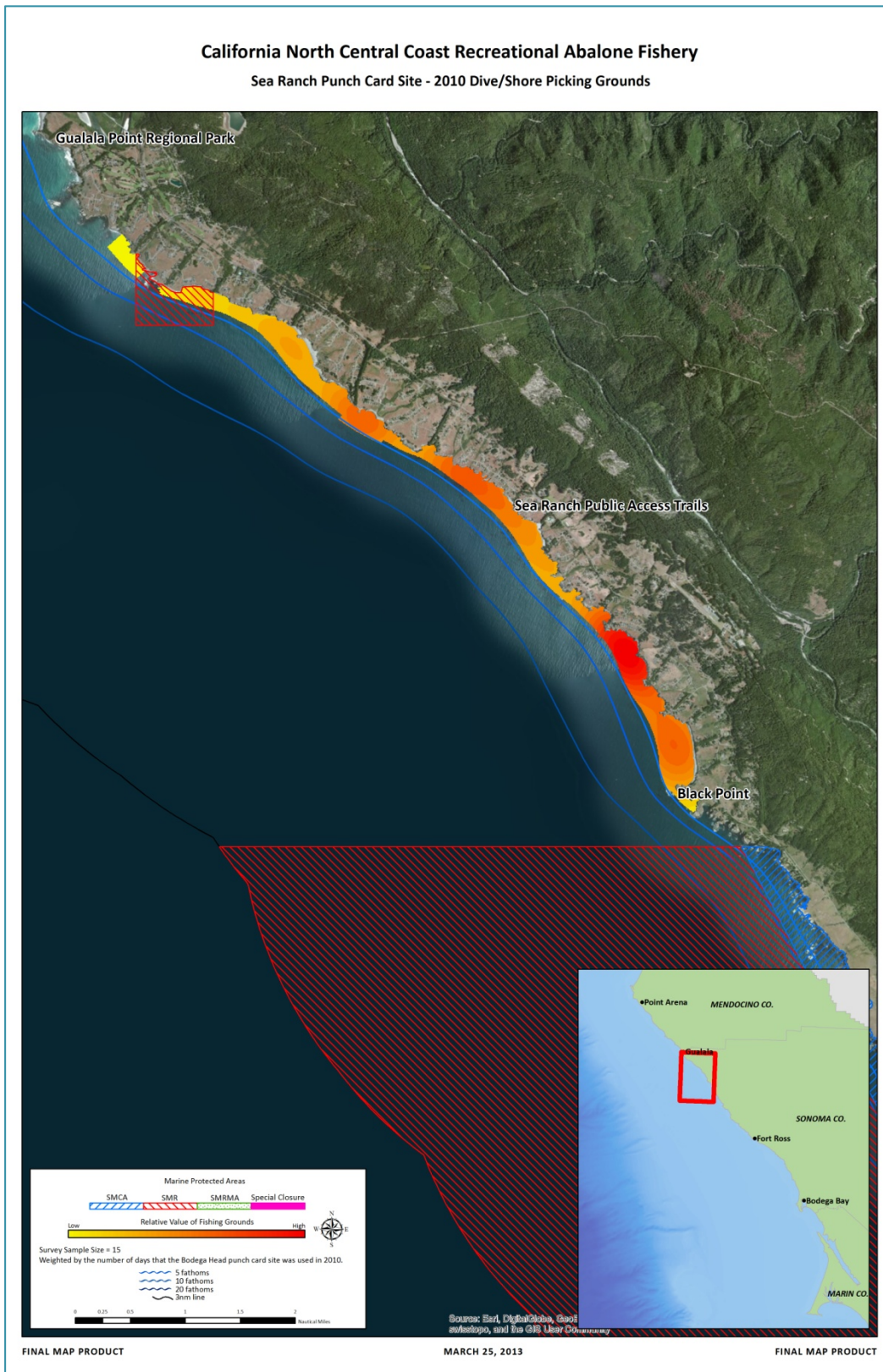




Map 4. California NCC recreational abalone fishery – Robinson Point – 2010 dive/shore picking grounds

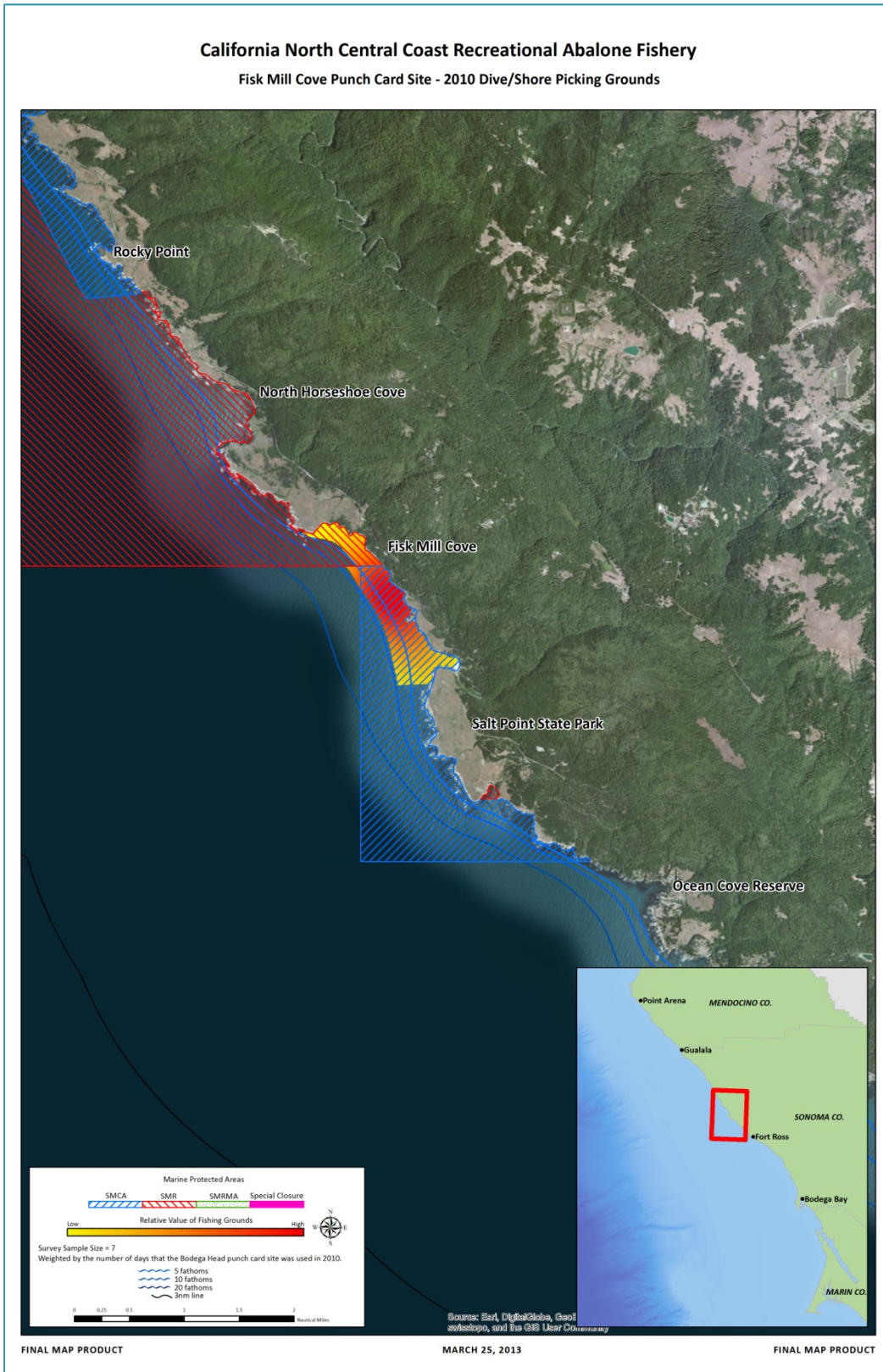


Map 5. California NCC recreational abalone fishery – Sea Ranch – 2010 dive/shore picking grounds

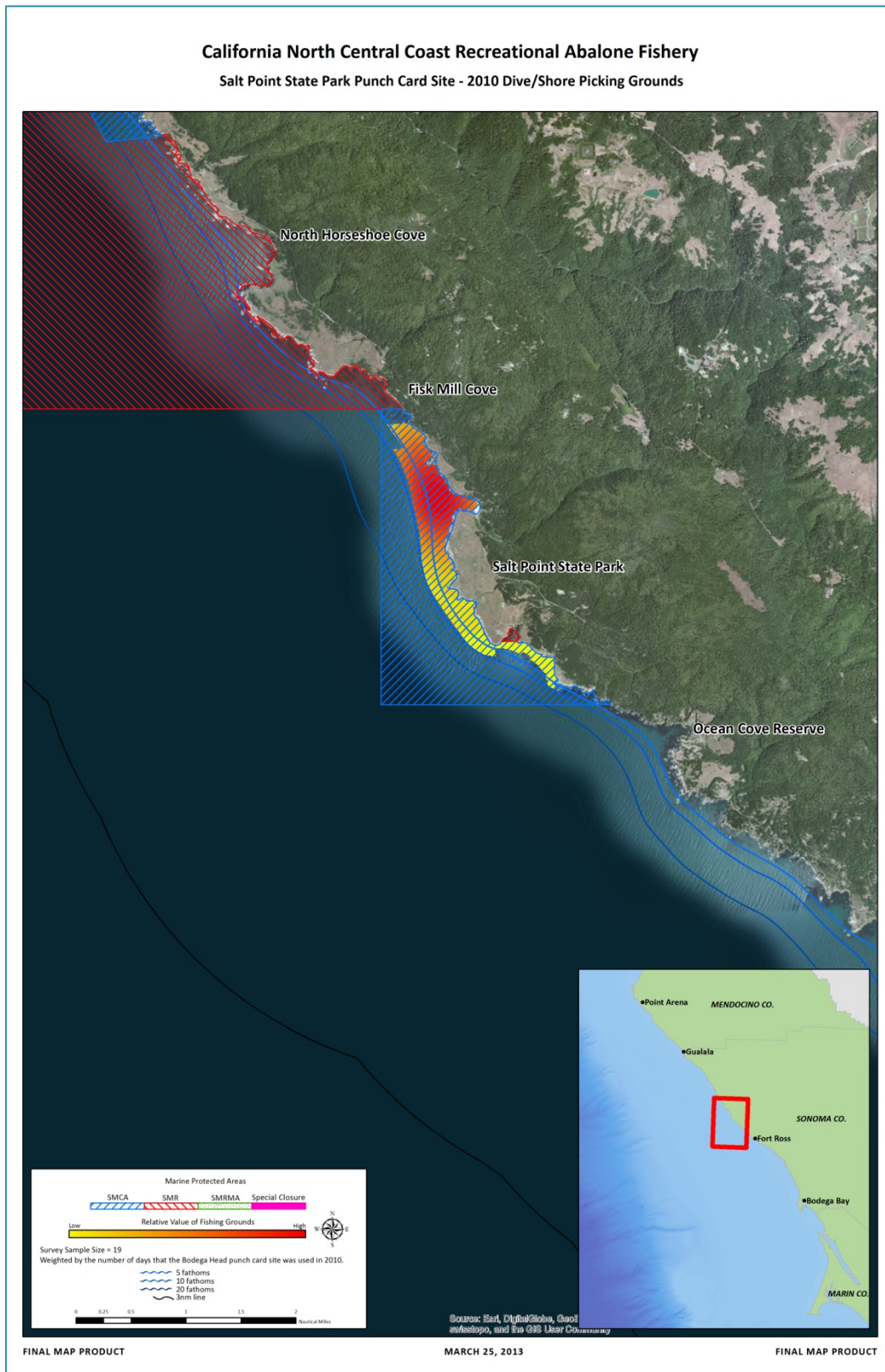




Map 6. California NCC recreational abalone fishery – Fisk Mill Cove – 2010 dive/shore picking grounds



Map 7. California NCC recreational abalone fishery – Salt Point State Park – 2010 dive/shore picking grounds

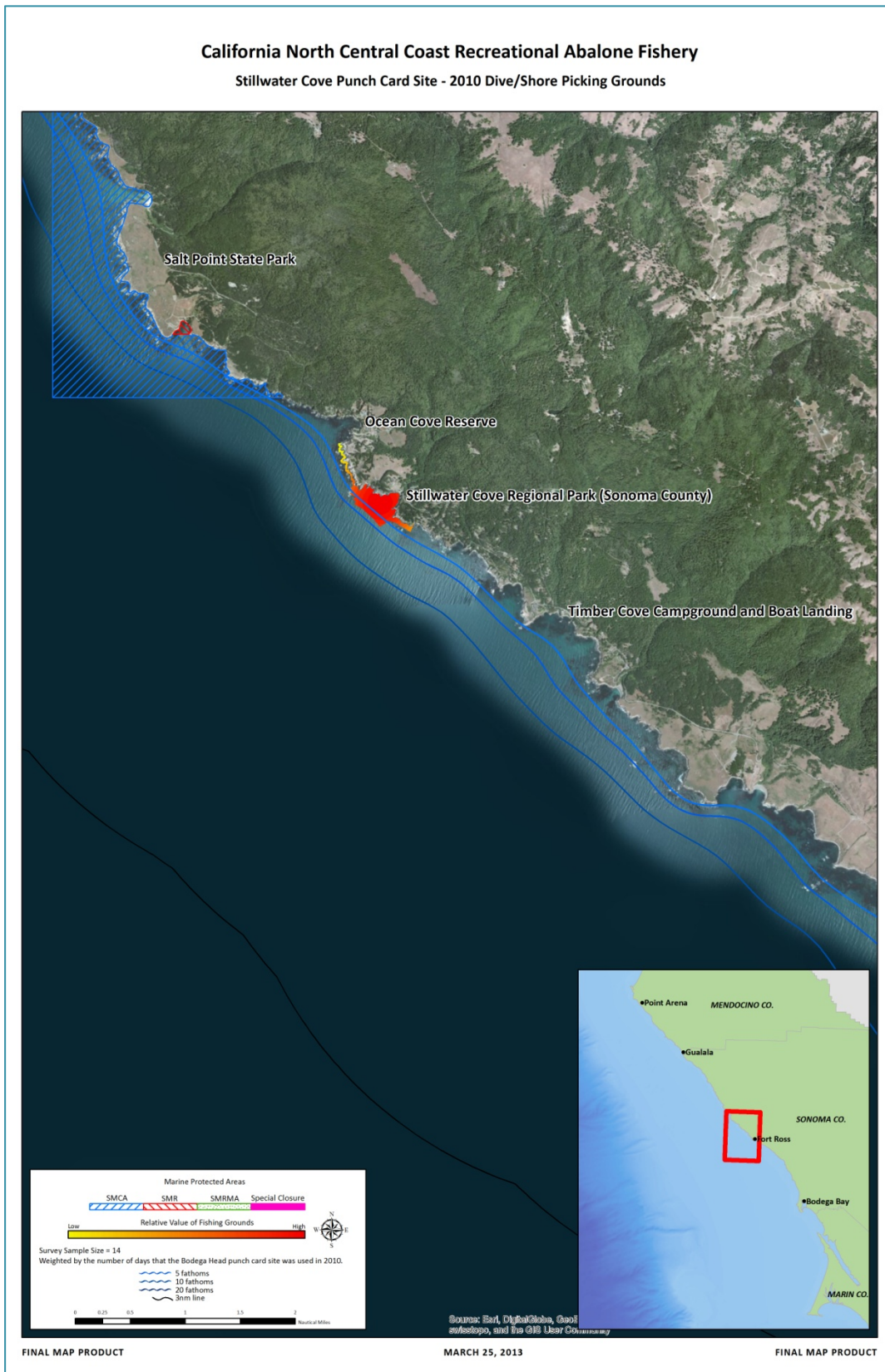




Map 8. California NCC recreational abalone fishery – Ocean Cove – 2010 dive/shore picking grounds

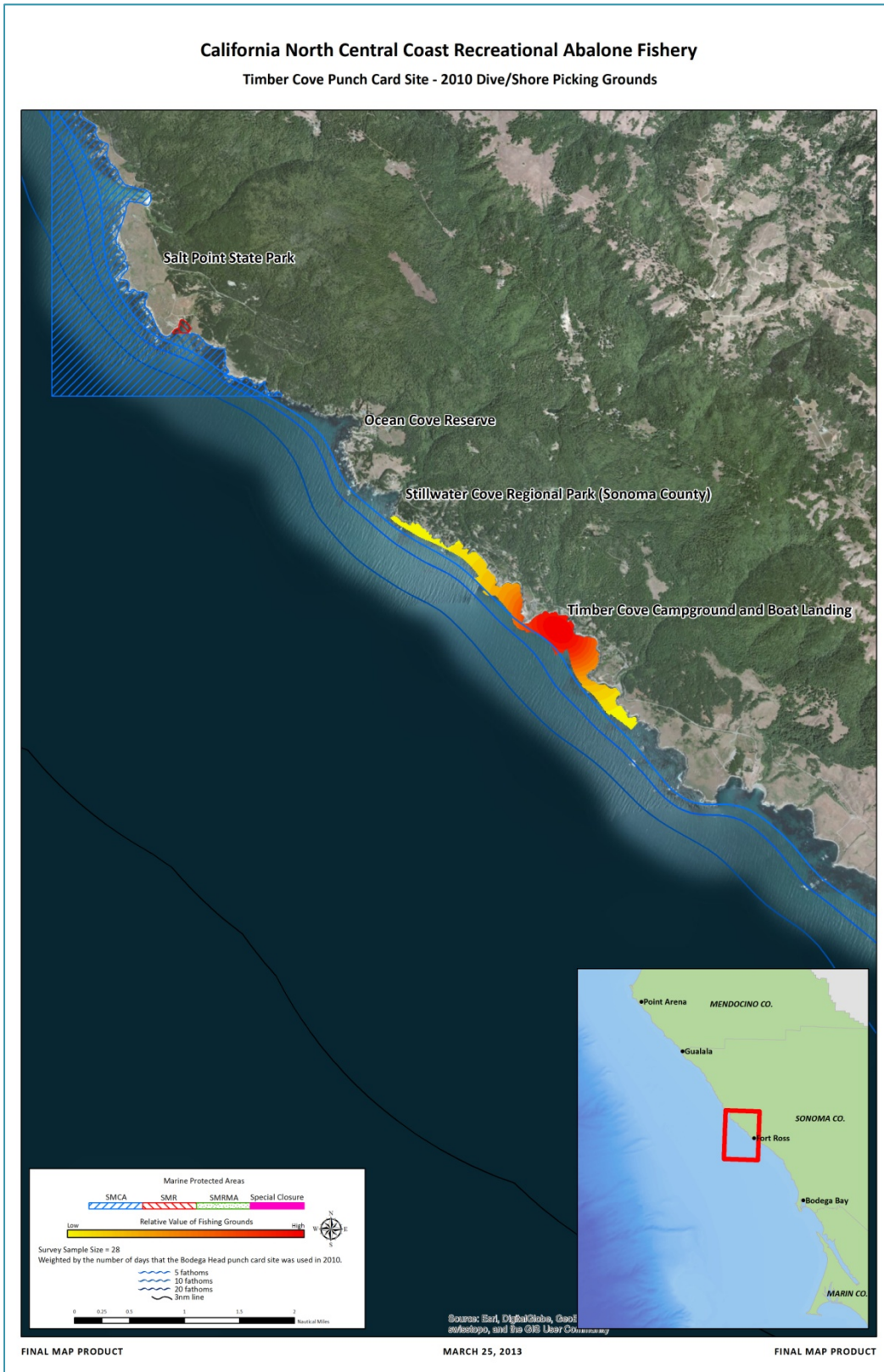


Map 9. California NCC recreational abalone fishery – Stillwater Cove – 2010 dive/shore picking grounds

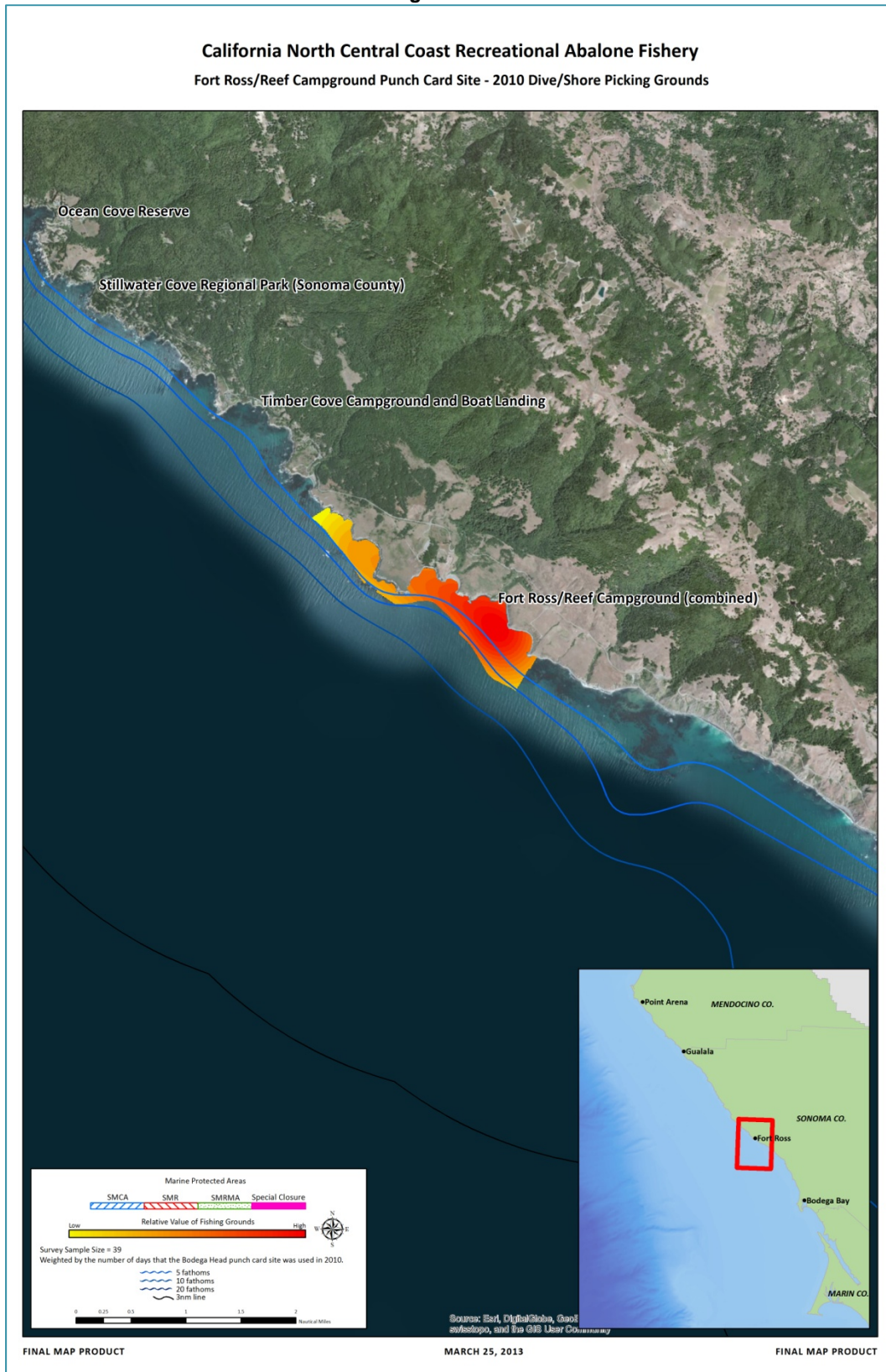




Map 10. California NCC recreational abalone fishery – Timber Cove – 2010 dive/shore picking grounds

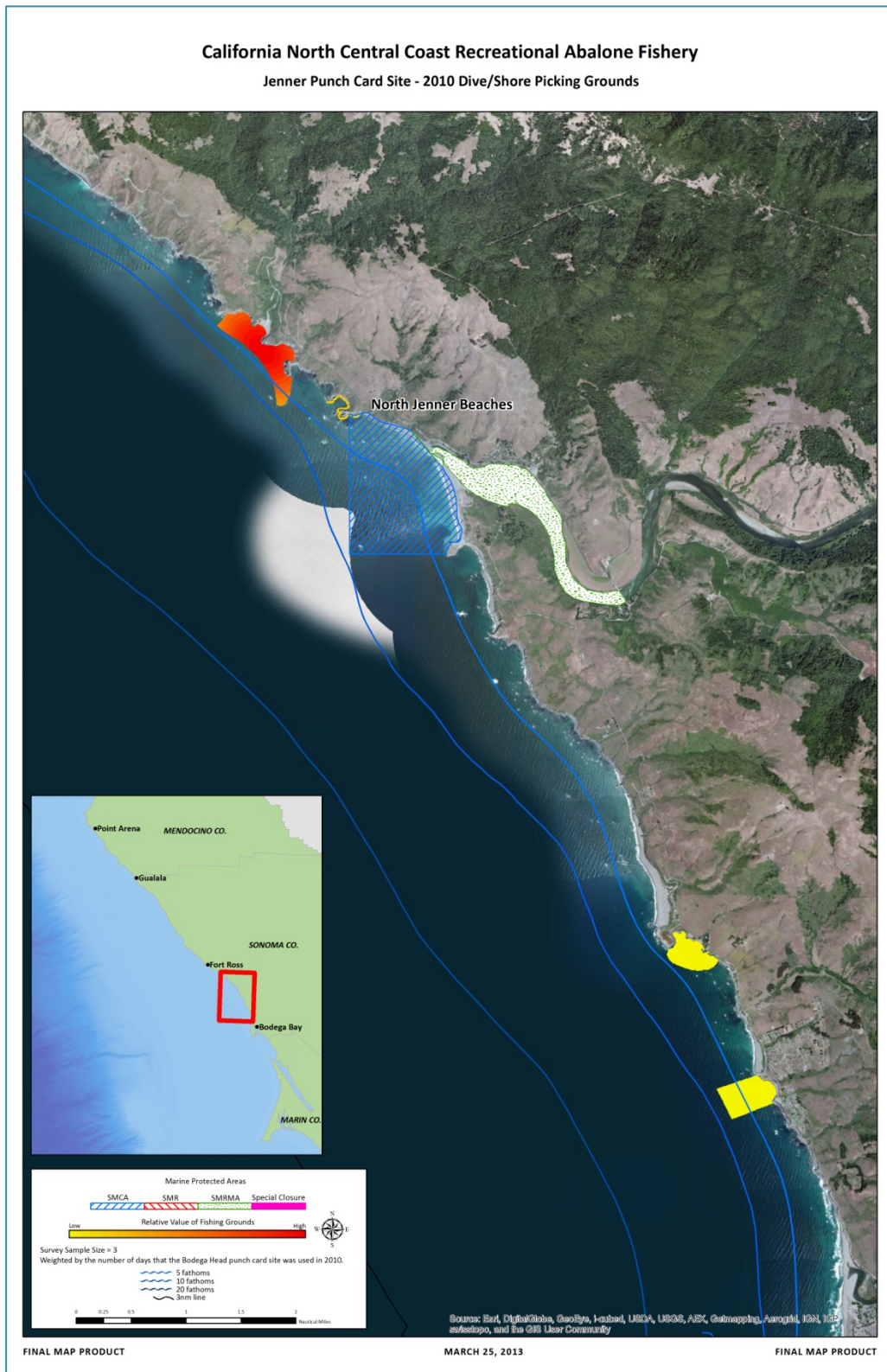


**Map 11. California NCC recreational abalone fishery – Fort Ross/Reef Campground – 2010 dive/shore picking grounds**

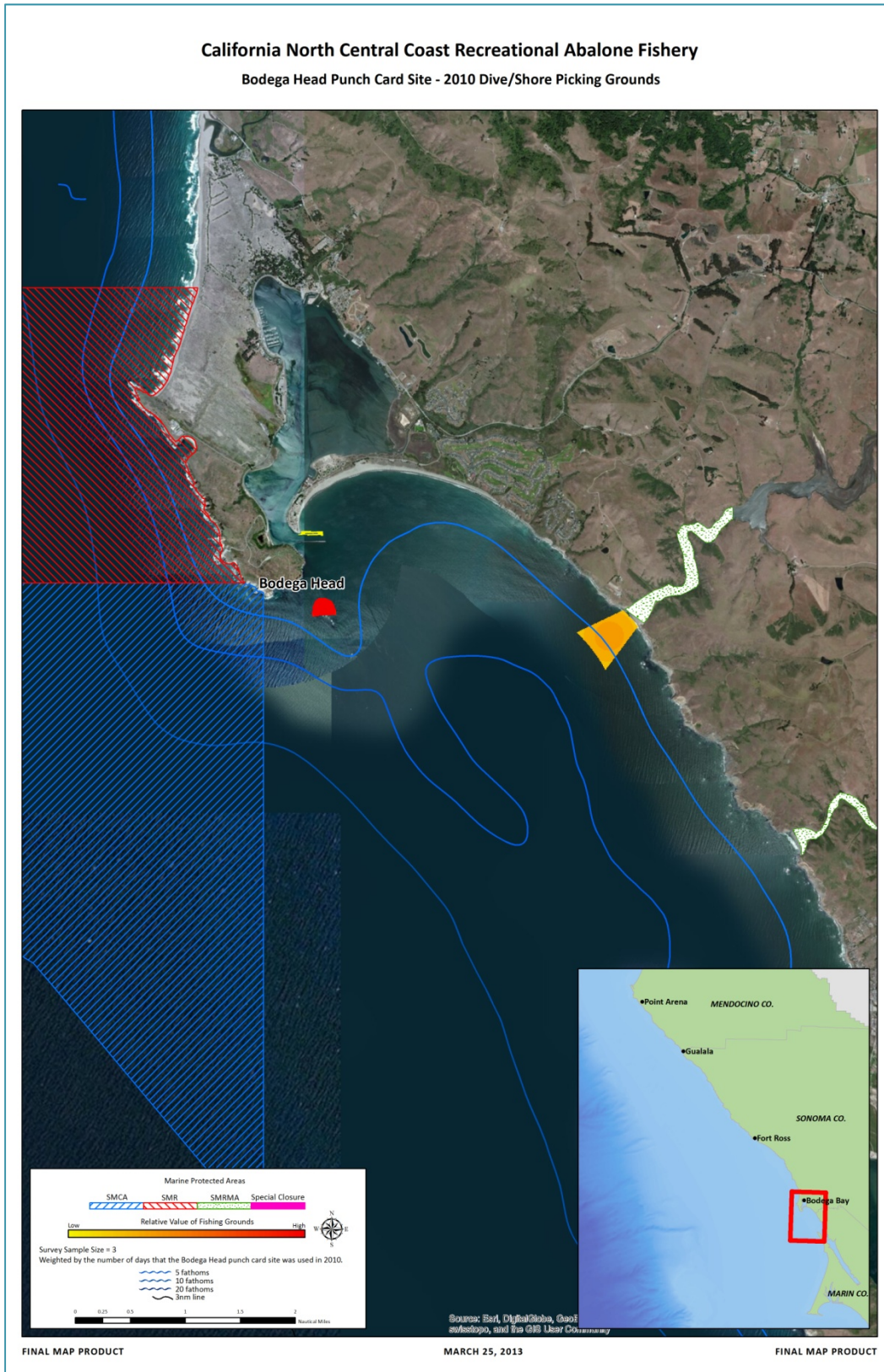




Map 12. California NCC recreational abalone fishery – Jenner – 2010 dive/shore picking grounds



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.



## REFERENCES

California Department of Fish and Game. 2010. Abalone recovery and management plan status report – Northern California red abalone fishery. Marine Region Invertebrate Management Project.

Chen, C., L. Weiss, B. Barger, T. Hesselgrave, C. Steinback, J. Bonkoski, K. Sheeran, N. Lyman, J. Bloeser, and D. Aseltine-Neilson. 2012. Establishing a baseline and assessing spatial and socioeconomic change in the California Central Coast commercial and CPFV fisheries. Report to the MPA Monitoring Enterprise, California Ocean Science Trust.

Kalvass, P.E. and Geibel, J.J. 2003. California recreational abalone fishery catch and effort estimates for 2002 from a combined report card and telephone survey. California Department of Fish and Game.

Scholz, A.J., C. Steinback, S.A. Kruse, M. Mertens and H. Silverman. 2011a. Incorporation of spatial and economic analysis of human-use data in the design of marine protected areas. *Conservation Biology* 25(3): 485-492.

Scholz, A.J., Steinback, C., S. Kruse, J. Bonkoski, C. Chen, N. Lyman, L. Weiss, and T. Hesselgrave. 2011b. Commercial and recreational fishing grounds and their relative importance off the North Coast of California. Report to the California Marine Life Protection Act Initiative. Contract No. 2009-0006M Resources Legacy Fund Foundation.

Scholz, A.J., C. Steinback, S.A. Kruse, J. Bonkoski, S. Hetrick, N. Lyman, S. Lloyd and L. Weiss, 2010. Commercial and recreational fishing grounds and their relative importance off the South Coast of California. Report to the California Marine Life Protection Act Initiative. Contract No. 2008-004M, Resources Legacy Fund Foundation.

Scholz, A.J., C. Steinback, S.A. Kruse, M. Mertens and M. Weber, 2008. Commercial and recreational fishing grounds and their relative importance off the North Central Coast of California. Report to the California Marine Life Protection Act Initiative. Contract No. 2007-0114M, Resources Legacy Fund Foundation and Contract No. 06-054, Ocean Protection Council.

Scholz, A. J., C. Steinback, S. Klain and A. Boone. 2006a. Socioeconomic profile of fishing activities and communities associated with the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries. Portland, OR: Ecotrust.

Scholz, A. J., C. Steinback and M. Mertens. 2006b. Commercial fishing grounds and their relative importance off the Central Coast of California. Report submitted to the California Marine Life Protection Act Initiative.

Scholz, A. J., M. Mertens and C. Steinback. 2005. The OCEAN framework: Modeling the linkages between marine ecology, fishing economy, and coastal communities. In D. Wright and A. J. Scholz (Eds.), *Place Matters: Geospatial Tools for Marine Science, Conservation, and Management in the Pacific Northwest*. Corvallis, OR: Oregon State University Press.

Scholz, A. J., K. Bonzon, R. Fujita, N. Benjamin, N. Woodling, P. Black and C. Steinback. 2004. Participatory socioeconomic analysis: drawing on fishermen's knowledge for marine protected area planning in California. *Marine Policy* 28(4): 335-349.

Steinback, C., S. Kruse, C. Chen, J. Bonkoski, T. Hesselgrave, N. Lyman, L. Weiss, A. Scholz, and E. Backus. 2010. Supporting the Oregon Territorial Sea Plan revision: Oregon fishing community mapping project. Report to the David and Lucile Packard Foundation, Oregon Department of Land and Conservation Development, Oregon Wave Energy Trust, and the Oregon Coastal Zone Management Association.