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**The Central Coast Marine Protected Area
Socioeconomic Baseline Data
Collection Project**



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—SUMMARY—

Introduction

The following pages summarize key elements of the Central Coast MPA Socioeconomic Baseline Data Collection Project. The project was conducted as an important component of a multi-disciplinary research and monitoring program designed to further the prospective benefits of California's Marine Life Protection Act (MLPA). The program is being administered across the coastal zone of California by the California Coastal Conservancy, the Ocean Protection Council, California Department of Fish and Game, and the California Sea Grant Program.

Collection, compilation, and analysis of primary and secondary source data, narrative description and explanation, and initial work on a practical human dimensions monitoring framework were completed for purposes of this program by Impact Assessment, Inc. (IAI). IAI specializes in socioeconomic research and analysis of marine fisheries around the coastal zone of the United States and abroad.

Data and analysis deriving from the Socioeconomic Baseline Data Collection Project and related biophysical research projects will ultimately be used to monitor and assess known and emerging human and biophysical effects associated with or following from the recent establishment of a network of Marine Protected Areas (MPAs) along the Central Coast of California. The intent of the new network is to aid in the conservation of marine life throughout the region, largely through the regulation of specific human activities, especially those involving commercial extraction of marine resources.¹ Such regulations have been implemented in 29 ocean zones between Point Conception and Pigeon Point. Additional networks of MPAs are to be established along the remainder of the California coast.

The project reviewed in this summary was focused on development of an efficient means for comprehensively assessing the human effects of the new network of MPAs. A social impact assessment (SIA) model was used to accomplish this objective. The research team has documented pertinent social, economic, and demographic trends across the study area; the resulting information will serve as a shifting baseline against which to monitor and assess changes following establishment of the new network of reserves. Research methods involved: extensive analysis of existing fisheries data; hundreds of in-depth discussions with knowledgeable fishery participants and public officials; a series of user group mapping exercises; development of a comprehensive Geographic Information System and spatial analysis of historic

¹ It should be noted that the MPA designations vary and affect human activities in different ways. Marine Conservation Areas allow some recreational extractive activities. Marine Reserve Areas tend to restrict all recreational or commercial extractive activities. Marine Recreational Management Areas allow some extractive activities. There are exceptions based on specific local management objectives.

and current use of the marine environment; and basic observation of commercial and recreational fisheries and other uses of the marine environment across the region.

While comprehensive documentation is desirable in that it will allow analysts to control for changes not associated with the MPAs, an appropriate study focus was also desirable. Particular attention was therefore applied to thorough documentation of long-term trends and current conditions in the industries that are most likely to be affected by MPA regulations – namely, commercial fishing and marine-based recreation.

The following pages summarize key elements of the baseline. First, we provide an overview of pertinent conditions in the Central Coast region, with emphasis on the economies and demographic attributes in each of the study counties.

This is followed by description of basic trends and conditions in marine-related industries along the Central Coast, with a natural emphasis on commercial fishing and associated sectors. This discussion is interspersed with reference to some of the physical-environmental, economic, and regulatory challenges encountered by the participants over the course of time. Given the nature and extent of available fisheries data, the focus of the full report is on trends between 1981 and 2008, with additional attention to the history of the region's fisheries prior to the 1980s. For sake of brevity, the current summary is focused on recent trends and conditions.

Finally, we examine some of the reported and observed initial effects of the MPAs on commercial and recreational fishing and non-consumptive recreational marine activities in the study region. The principal intent here is identification of variables, factors, and processes that at this point in time appear to warrant monitoring in the upcoming months and years.

Overview of Demographic Attributes and Principal Industries by County

The Central Coast MPA Socioeconomic Baseline Data Collection Project has enabled the study team to summarize the nature of the principal extractive and non-extractive marine industries occurring along the coastal zone of the five study counties. These first-order summary descriptions are general elements of baseline inventories deemed essential for differentiating between ongoing macro-scale social processes and pre-existing regulatory changes on one hand, and prospective or actual changes related to the recently established reserves on the other.

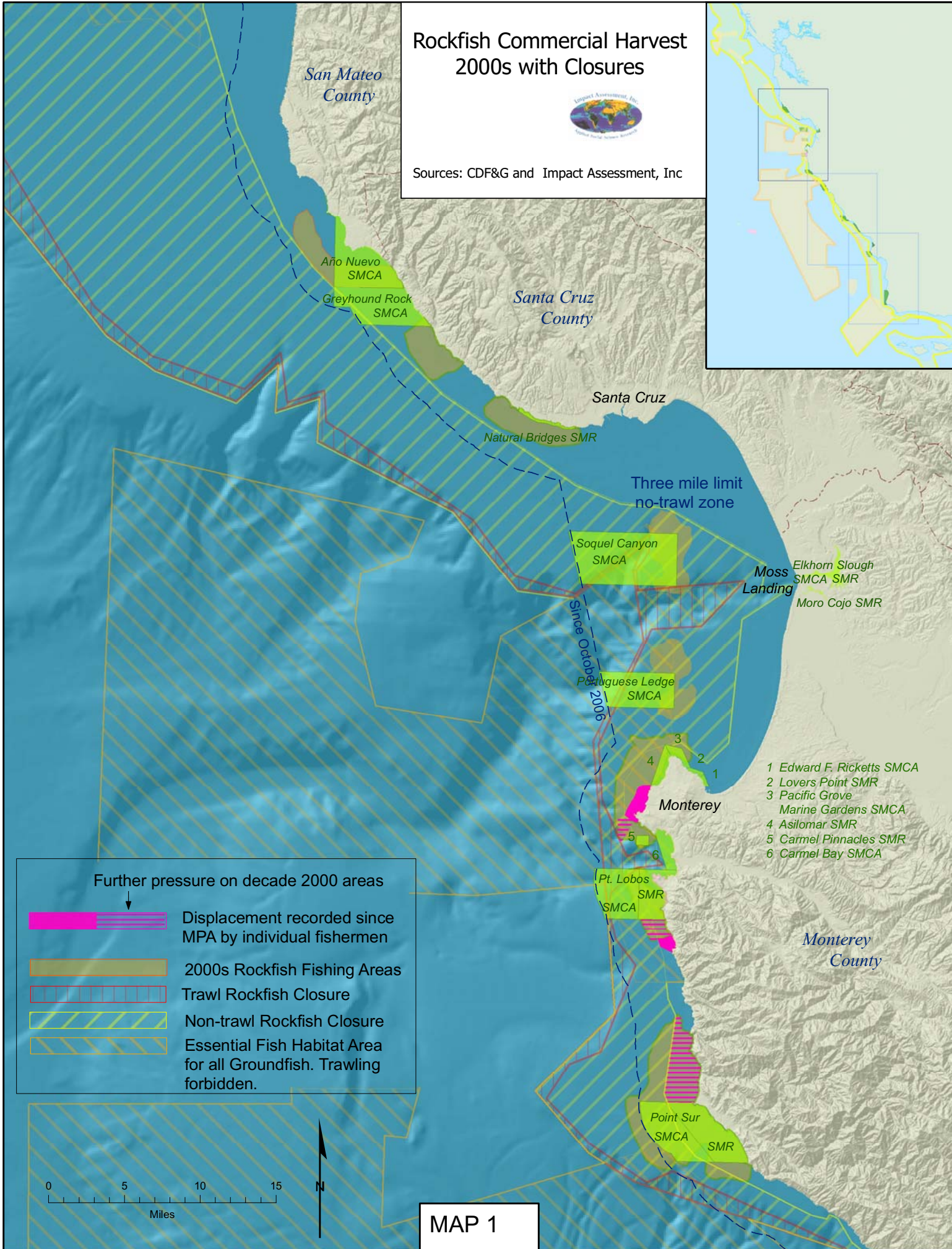
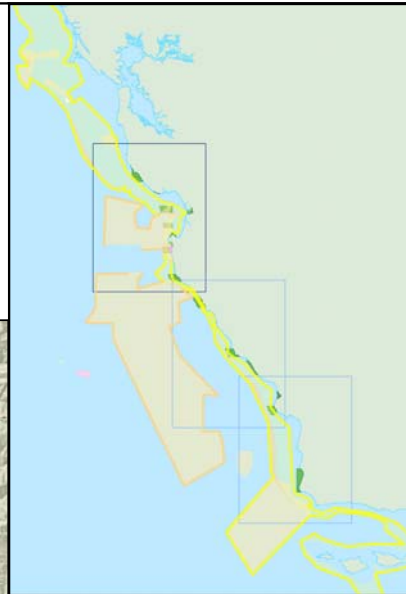
Project Bounds. The Central Coast study region includes five California counties. From north to south, these are: San Mateo, Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara. Major ports in or near the study area are Pillar Point Harbor, Santa Cruz Harbor, Monterey Harbor, Morro Bay Harbor, Avila Harbor, and Santa Barbara Harbor.

The study area can also be envisioned to include ocean areas extending seaward and northward from Point Conception in Santa Barbara County to Pigeon Point in San Mateo County. As we are interested in spatial aspects of the MPAs, including displacement of harvesters to distant fishing grounds, the project area should be considered to include even the most distant seaward locations used by the fleets prior to and/or following establishment of the reserves.

Rockfish Commercial Harvest 2000s with Closures



Sources: CDF&G and Impact Assessment, Inc



- 1 Edward F. Ricketts SMCA
- 2 Lovers Point SMR
- 3 Pacific Grove Marine Gardens SMCA
- 4 Asilomar SMR
- 5 Carmel Pinnacles SMR
- 6 Carmel Bay SMCA

MAP 1

San Mateo County. San Mateo is the northernmost of the five study counties. With an estimated population of 705,499 residents in 2006, San Mateo is by far the most populous county in the study area. It is also growing; an eight percent increase in population was noted between 1990 and 2006. Many residents in the workforce hold jobs in the Silicon Valley area.

The Año Nuevo SMCA is located in the southwestern portion of the county. The area was formerly frequented by commercial fishing fleets based in Santa Cruz and Half Moon Bay in San Mateo County. The James V. Fitzgerald Marine Reserve/State Marine Park, established in 1969, is also in San Mateo County.

As of 2006, 0.9 percent of the county's total labor force was employed in the agriculture industry (U.S. Census Bureau 2006). That figure is down 50 percent from 1990. But employment in tourism-related services was at 15 percent in 2006, a 20 percent increase above 1990 figures.

Information, bioscience, and medical technology industries are central to the economy of Santa Cruz County. Coastal tourism is important, but to a lesser degree than elsewhere in the study region. Half Moon Bay is an important destination. Some visitors come to view the large population of elephant seals that congregate at Año Nuevo. In 2005, tourist-generated sales tax receipts amounted to \$75 million or 10 percent of the county's total receipts of \$739 million. Over 35,000 persons were employed in the San Mateo County tourism industry that year (Dean Runyan Associates 2007).

Santa Cruz County. Santa Cruz County was home to 249,705 residents in 2006. Its population is growing; a growth rate of eight percent was noted between 1990 and 2006. Two of the 29 newly established MPAs are located in waters adjacent to the Santa Cruz County coastline.²

In 2006, the agriculture industry in Santa Cruz County employed five percent of the county's labor force. That figure is down 16 percent from 1990. In 2006, employment in the tourism-related service industry was 18 percent of the total workforce, a 50 percent increase over the 1990 figure of 12 percent (U.S. Census Bureau 2006).

Tourism is central to the economy of Santa Cruz County. In 2005, some five million visitors contributed nine percent or \$17 million to the county's total sales tax receipts. In that same year, the tourism industry provided employment for 8,380 persons in the county (Dean Runyan Associates 2007). Nearly three million or 60 percent of those who came to the county in 2005 visited the Santa Cruz Boardwalk. Important marine recreational activities include sailing, boating, diving, kayaking, kite surfing, and especially surfing.

Monterey County. Monterey County was home to 410,206 persons in 2006, an increase of 13.3 percent over the 1990 Census figure. Monterey and Moss Landing are the principal commercial fishing-oriented communities in the county. The majority of the newly established MPAs are

² The Greyhound Rock SMCA and Natural Bridges State Marine Reserve are located along the coastline of the City of Santa Cruz.

located in waters adjacent to the Monterey coastline³; these complement six MPAs established in the area between 1960 and 1994.⁴ The Monterey Bay National Marine Sanctuary, which encompasses 5,322 square miles of ocean and 276 miles of coastline from Cambria to Marin, was established in 1992; its administrative headquarters are in the City of Monterey.

Monterey County ranks third of all California counties in terms of agricultural production. The industry employed 15 percent of the county's labor force in 2006, which is a five percent increase over the 1990 figure (U.S. Census Bureau 2006). Commercial fishing has long been an important industry, and numerous marine fisheries research institutions are located here.

The tourism industry is also significant in economic terms. Popular coastal and marine recreational activities include sailing, boating, diving, fishing, kayaking, surfing, and kite surfing. Monterey Bay Aquarium is one of the most popular destinations along the Central Coast.

Nearly nine million visitors spent time in Monterey County in 2005. Coastal tourism contributed \$54.6 million to the county's total sales tax receipts in 2005, and employed 22,680 persons (Dean Runyan Associates 2007). Some 20 percent of the workforce was employed in tourism-related services in 2006, an increase of some 43 percent above the figure for 1990.

San Luis Obispo County. The ocean area adjacent to San Luis Obispo County is the location of eight of the 29 newly established MPAs. These complement four pre-existing MPAs established in the area between 1977 and 1985.⁵ Numerous commercial and charter fishing businesses are based in the Morro Bay area.

The population of San Luis Obispo County was estimated to be 257,005 persons in 2006. The county is growing: a 16 percent rate of growth is noted for the period 1990 to 2006. Numerous fishing-related businesses are located in Avila Beach.

The historically significant agriculture industry is in a state of relative decline in San Luis Obispo County. Only 3.4 percent of the labor force was employed in agriculture industries in 2006, down 31 percent from 1990. Employment in tourism-related service sectors is up 16 percent from 1990 (U.S. Census Bureau 2006).

³ Elkhorn Slough SMR and SMCA, Moro Cojo Slough SMR, Soquel Canyon SMCA, Portuguese Ledge SMCA, Edward F. Ricketts SMCA, Lovers Point SMR, Pacific Grove Marine Gardens SMCA, Asilomar SMR, Carmel Pinnacles SMR, Carmel Bay SMCA, Point Lobos SMR and SMCA, Point Sur SMR and SMCA, and Big Creek SMCA (CDFG 2007).

⁴ Point Lobos State reserve (1960); Point Lobos Ecological Reserve (1973); Carmel Bay Ecological Reserve (1976); Hopkins Marine Life Refuge (1984); Pacific Grove Marine Gardens Fish Refuge (1984); and Big Creek MRPA Ecological Reserve (1994).

⁵ Pismo Invertebrate Reserve (1977); Atascadero Beach Clam Preserve (1985); Morro Beach Clam Preserve (1985); and Pismo Beach-Oceano Pismo Clam Preserve (1985).

San Luis Obispo County is a popular travel destination. Some 8.6 million persons visited the area in 2005. Beach-related recreation and seal viewing are popular activities along the coast. Pismo Beach Oceano Dunes State Vehicle Recreation Area and Hearst Castle are also popular. Many visitors and residents participate in recreational boating and boat-based fishing activities.

Commercial fishing and associated sectors also constitute an important form of industry in San Luis Obispo County— especially in Morro Bay and Avila. Of note, the success of the tourism industry in these towns is based in part upon the interest of visitors in the commercial fishing industry and seafood dining opportunities.

Tourism has become increasingly important in Morro Bay. While local tax revenues generated by the fishing industry have diminished from \$10 million to \$3 million over the last few years, tourism-related industries contributed \$28.7 million in 2005 alone (Patel 2007).

Santa Barbara County. Only one of the new MPAs is located in Santa Barbara County. This is Vandenberg State Marine Reserve (SMR), located in the northwestern part of the county.⁶ Recreational and commercial harvesting is not allowed within the designated reserve boundaries. The size of the fleet using this area just prior to establishment of the reserve was relatively small, numbering no more than eight vessels. Most operators traveled to the grounds primarily to fish for rockfish species from points as far south as Ventura, though in past years a small number of captains also traveled to the grounds from points north in San Luis Obispo County. The establishment of the Vandenberg Air Force Base in the late 1950s led to a long era of federal control over activities occurring in the adjacent waters of the Pacific.⁷

The 2006 population of Santa Barbara County was estimated to be 400,335 persons, mostly distributed in Santa Barbara and in small towns along and some distance from the coast. Lompoc, home to some 41,000 persons in 2000, is the closest population center— approximately 19 miles east. The Santa Barbara County economy is based primarily in agriculture and ranching. Viticulture and wine production are important, and tourism in and around the City of Santa Barbara generates numerous jobs and extensive revenue.

While agriculture continues to be economically significant across Santa Barbara County, year 2000 employment figures suggest the industry is in a state of decline. Employment in this sector was down six percent from 1990. Meanwhile, the tourism-related service sector is growing rapidly. In 2006, employment in tourism-related service industries was at 22 percent, a significant increase from the 1990 Census when tourism-related employment constituted 13.7 percent of the total workforce (U.S. Census Bureau 2006).

Tourism, and especially coastal tourism, attracts millions of visitors to Santa Barbara County each year. More than 11 million persons visited the region in 2005. The Channel Islands

⁶ The Vandenberg MRPA Ecological Reserve, established in 1994, does not permit commercial or recreational fishing.

⁷ Lands and sea within and adjacent to the 150 square-mile Vandenberg Air Force Base are periodically closed to facilitate the mission of the 30th Space Wing which manages Department of Defense space and missile testing and placement of satellites into polar orbit from the West Coast of the United States.

National Park is one of the most popular destinations in the region; approximately 400,000 persons visited the Park in 2005 (California Tourism 2006).

The human and physical geographic attributes of the coastal zone north of Point Conception area indicate the level and manner of historic and contemporary use of what is now the Vandenberg SMR. The region is both rugged and isolated, and the nearest points of ready access for fishing vessels of any significant size are in Santa Barbara and Pismo Beach. The level of avidity of the small-boat commercial and recreational fleets using this area have thus been limited by distance, and by the challenges of fishing far from port in an area known for unpredictable winds and currents, and seasonally large swell events.

Given the relative isolation and the challenging offshore conditions in the Vandenberg SMR, relatively few recreational anglers frequented the area in years past. Fishing was prohibited in the Vandenberg MRP A Ecological Reserve in 1994.⁸ Air Force “Safety Zones” along the entire coast of Vandenberg AFB and surrounding region prohibit vessels from stopping while in transit. This effectively eliminates many fishing opportunities as well. Numerous visitors use Jalama County Beach Park for ocean and coastal recreational activities. The park, located south of the Vandenberg SMR, requires a trip east from Highway 1 through scenic ranchlands.

Summary of Trends. It is notable that the economy of the study area is increasingly characterized by coastal tourism and growth associated with the attractions of coastal living. With the exception of inland Monterey County, involvement in agriculture has declined significantly across the study area. Tourism and its supporting service sector industries continue to grow, and this is also the case in Monterey proper and in the adjacent towns of Seaside, Marina, Pacific Grove, and Pebble Beach. The region is becoming more populous, and growth and development are particularly notable in the region’s coastal towns and cities.

Summary Status of Central California’s Commercial Fishing Industry

The regional trend in levels of participation and production in the commercial fishing industry is similar to that of agriculture. Both industries were once central to the economy of the Central Coast. But analysis of various primary and secondary source data clearly indicates that commercial fishing and associated support industries are in a state of decline across the region. While the nature and scope of participation and production in the industry vary by port, a state of overall contraction is notable over the last quarter century.

Regarding the Trend of Decline in Participation and Production. In 1981, there were 6,908 commercial fishing vessels registered in California. By 2007, the size of the statewide fleet had diminished to 2,700 vessels, a decrease of 61 percent. The size of the Central Coast fleet diminished by 68 percent— from 2,623 vessels in 1983 to 815 in 2007. The size of the commercial fishing fleet in Santa Cruz County also diminished— by 48 percent between 1981 and 2007. The Monterey County fleet diminished by 46 percent during the period, the San

⁸ Within Military Danger Zone 4 off Vandenberg Air Force Base, per 33 CFR 334.1130, the stopping and loitering of any person or vessel is expressly prohibited between the mouth of the Santa Ynez River and Point Arguello unless prior permission is obtained (CDFG 2006:4-21 [http://www.dfg.ca.gov/mlpa/pdfs/ceqa_ch4.pdf]).

Mateo County fleet by 44 percent, and the Santa Barbara fleet by two percent. The San Luis Obispo fleet expanded in size by three percent during the period (PacFIN 2007).

Commercial landings and revenue have also declined. Between 1981 and 2007, commercial landings across all California ports dropped by 63 percent and the ex-vessel value of landings fell 89 percent. During that same period, commercial landings at ports along the Central Coast declined by 36 percent, with ex-vessel revenues slipping 42 percent (PacFIN 2007).

Several constraints are implicated in the contraction of the size of the active fleets and concomitant decreases in landings and revenue along the Central Coast. These constraints vary somewhat over time and by port, and they can exert influence individually, collectively, and/or cumulatively. A basic long-term objective of the baseline data collection process is to enable analytical parsing of constraining and enabling factors and effects for specific fleets and ports, and to identify key indicators useful for understanding the effects of the most recent form of regulation; that is, spatial regulation associated with the new MPAs.

Toward that end, a variety of important indicators of change in the region's commercial fishing industry have thus far been identified. These include a range of governance factors, most notably a long series of fishing regulations enacted by federal and state agencies: limited entry programs, size and bag limits, quotas, and various spatial restrictions enacted prior to establishment of the new system of MPAs, especially in Monterey Bay. While such regulations are intended to improve the status of marine resources, the net effect on many participants in the fleets that have historically pursued them has been significantly constraining.

But changes in the size of the fleets and rates of participation and production do not relate solely to management and regulatory processes; a range of environmental and fishing-specific factors are also typically involved. These include: (a) changes in the status of estuarine and benthic habitats; (b) natural cycles of abundance and scarcity; (c) El Niño events and other oceanic regime shifts; (d) current-related changes in water temperatures; (e) changes in shoreside processing capacities and other support infrastructure at the harbors; (f) changing conditions and opportunities at the marketplace; (g) escalating costs of fuel and other trip elements; (h) competition within and between fleets; (i) development and use of new fishing technologies; and (j) reduced abundance resulting from commercial and recreational fishing pressures in general.

While processing, market, and operational factors are important, larger social factors and forces are also implicated in changing rates of participation and production in commercial fisheries. This project has revealed that contraction in the commercial fishing industry along the Central Coast (and by extension elsewhere in California and the U.S.) has resulted in part from a shift away from an ethos that once championed commercial fishing and other maritime trades, to one that now prioritizes conservation of marine resources and opportunities for coastal and marine recreation.

We assert that these changes follow from significant shifts in demographic and socioeconomic conditions in formerly rural-maritime communities. That is, demographic change and economic growth is tending to displace persons and families traditionally involved in commercial fishing and other small-scale maritime trades and businesses. New persons with new ideas and skills are

arriving, and in circular fashion the process is leading to further growth, new incentives, and new opportunities that generally do not involve the dominant industries and lifeways of years past.

Challenge and Adaptation. The economic challenges of commercial fishing operations are perennial and widespread. Some are cyclical in nature. As one fisherman stated so succinctly, “things get worse and things get better.” For many operators in the Central Coast region, conditions have worsened in recent decades.

Apart from the long-term process of adapting to various state and federal regulations, commercial fishermen face a range of more immediate challenges to their operations. Fixed and trip costs, and especially high fuel costs are particularly constraining, and when considered in conjunction with various market challenges, these factors help explain why many fishing vessels in the region now remain moored for much of the year. According to the Pacific States Marine Fisheries Commission (2008), fuel prices in 2005 were four times higher than in 1999. By May 2008, diesel fuel was selling for \$3.95 per gallon at Morro Bay, and for \$4.38 per gallon in the Monterey area.

Certain commercial fishermen report that they are compensating for escalating costs by traveling at slower speeds in order to conserve fuel. Others report that they are increasingly cutting corners to make ends meet, even when such strategies may jeopardize safety at sea.

For instance, interview data indicate that some fishermen are offsetting high fuel costs and diminishing income by deferring maintenance of vessels and gear. It is typical, for instance, that fishermen in this and other regions put their vessel in dry dock for purposes of maintenance about once every year or two. But depending on the size and configuration of the vessel, even routine maintenance can tally to a significant percentage of one’s annual fishing income. Given the current economic climate, many in the harvest sector now report they will likely undertake standard maintenance procedures only once every three or four years.

Commercial fishermen increasingly report that they are working with fewer crew members than normal. In an industry known to be hazardous⁹ even under the best of conditions, such practices can be problematic. Yet, some informants report that once having invested in fuel to reach the fishing grounds, there is now a tendency to stay at sea even when weather and sea conditions reach a state of danger that formerly would have inspired a quick return to port.

The ability to afford a crew of sufficient size does not necessarily ensure quality assistance on board. Commercial fishing is often hard and dangerous, and the hours are long. Pay can be marginal, especially when fish are not abundant, and abundance can vary extensively. A seasoned captain of a fishing vessel based in Half Moon Bay confided that it had been difficult for him and other captains in the harbor to find reliable employees over the years.

This situation relates in part to overarching economic and cultural factors. Given the increasing number of challenges confronting participants in the commercial fishing industry- and

⁹ Fishing was the most dangerous occupation in the U.S. in 2005, with a fatality rate of 118.4 per 100,000 persons, or nearly 30 times higher than the rate of the average worker (Christie 2006). In 2006, there were over 140 deaths for every 100,000 fishermen (Lerner 2008)

decreasing cultural emphasis on the value of traditional work at sea in the general population-fewer experienced deck hands and mates are available to work. On the other hand, it can be difficult to retain responsible and experienced crew members, because full-time work is often not available in certain fisheries. It is often the case that crew arrangements are seasonal and part-time in nature.

In the past, fishermen relied on family members to provide much needed labor. Today, youth often do not want to fish and/or their parents do not want them to become fishermen. Many second and third generation fishermen now emphasize the value of higher education and of pursuing occupations other than fishing. Women have long played important land-based roles in support of fishing operations. Many fishermen in the Monterey and Morro Bay areas report that they have been able to persist in the industry in part because their wives provide steady income and other economic benefits for the family by working in wage jobs not associated with fishing. A few captains in the Moss Landing area report that their wives are working as crew members, thereby sidestepping costs associated with outside labor.

Another adaptive response is the undertaking of direct sale of seafood. It is increasingly common for fishermen to sell their products directly to the public at the dock, thereby eliminating middlemen who would otherwise exact some value from the seafood – various buyers, distributors, and others not directly involved in the fishing enterprise itself.

Fishermen reportedly are benefiting both economically and psychologically from participation in direct sales. First, the trend has provided a way for struggling fishermen to maximize profits in the current context of challenges. Second, it has provided them with a way to counter the constraining effects of buyers who offer low prices. Finally, some fishermen report that interacting directly with interested consumers has enhanced their sense of occupational pride.

Direct sales have reportedly increased consumer demand for quality seafood products. As the general buying public has become better educated about the virtues of “wild” and locally landed seafood, local demand for such products has increased. This is said to have benefitted fishermen and consumers alike.

Of note, direct sales are successful only when patrons can be assured that fish will be available. But fishing is fishing, and success at sea is never guaranteed. Some who have worked hard to build a loyal consumer base periodically must purchase imported seafood to meet local demand until fishing conditions improve.

For example, as a result of the 2008 salmon closure, at least one fisherman in Moss Landing has been forced to rely on imported salmon in order to supply the established clientele. The fisherman-marketer is also having difficulty acquiring and re-selling reasonably priced and locally caught spot prawn. Following establishment of the MPAs, the local spot prawn supply reportedly has diminished considerably, and prices have increased. As of March 2008, spot prawns were selling for \$15.00 per pound at the local seafood market, well above retail prices in 2007. The fisherman is currently importing prawns from Mexico, where the preferred net gear method is said to endanger marine mammals. This fisherman argues that environmental restrictions intended to promote sustainability have in this case disrupted market availability of

spot prawns, thereby increasing reliance on and demand for what he calls “unsustainable” third world shrimp. Other prawn fishermen in the region are benefiting from the price increase.

Finally, a growing number of fishermen are reporting that it has become too difficult to earn a sufficient living in today’s regulatory climate and they are leaving the industry or shifting into other fishing-related enterprises. One Morro Bay commercial fisherman with 20 years of experience recently acquired a charter captain’s license so that he could earn extra income during the summer. He is also considering selling his rockfish permit to buy a 17-foot river boat. He believes that being a guide on inland waters would involve better pay, less overhead, and less prohibitive permitting fees.

Many commercial fishery participants contacted for purposes of this study describe the future of fishing as bleak. Economic challenges are plentiful and incentives are scarce. One stated that “we’re right on the edge, and unless you have your boat paid off and you’ve raised your family, I don’t see people hanging on.” Some participants offer perspectives on the future of the fishing lifestyle itself, and these are often framed in negative terms. One fishery participant stated that “it’s a lot easier to rebuild a fish stock than to rebuild a fishing culture.” These statements are not provided here or in the larger document as advocacy statements for the commercial fishing industry, but rather as indications of the status of the industry and of the discouraged perspectives that many commercial fishermen now hold.

Harbor Infrastructure. The quality and extent of support services and infrastructure at most of the ports around the study region reportedly have been diminishing in recent years. Local harbor officials attribute the decline to several factors, but especially to cumulative effects associated with the downsizing of the commercial fishing fleets. For instance, regulatory changes which led to the departure of the trawl fleet from the region have concurrently led to significant changes in harbor infrastructure and related services. This is because participants in the trawl fleet formerly purchased large amounts of fuel, ice, and boatyard repair services. Following the departure of the trawlers, support service businesses have also departed or are struggling to remain in business. As such, there is less tax revenue available to fund repairs and projects that formerly supported the fishing industry.

Of note, many harbors in the region are tending to become tourist destinations. Many spaces formerly used by commercial fishing businesses are now occupied by tourist-friendly restaurants, shops, and charter tour operations. Visitors can now arrange for whale watching trips, glass bottom boat tours, and sport fishing trips, all of which depart conveniently from the harbors.

The Seafood Processing Industry: Challenges and Adaptations. A principal challenge reportedly faced by persons working in the seafood processing industry along the Central Coast is how to adapt to increasingly smaller volumes of locally caught seafood. Several regulatory events are frequently cited for interrupting local availability of seafood, especially availability of rockfish and other groundfish. These events include establishment of: (a) gill net regulations, (b) limited entry programs, (c) reduced quotas, (d) Rockfish Conservation Areas (RCAs), (d) reduction of the trawl fleet following the federal buyback in 2003 and, (e) The Nature Conservancy (TNC) trawl vessel and permit buyout program that occurred in the Morro Bay area in 2006.

Of particular note, implementation of RCAs¹⁰ and the Federal Groundfish Permit/Vessel Buyback Program¹¹ resulted in reduced groundfish landings in both the Monterey Bay and Morro Bay areas. The RCAs precluded access to certain areas that were considered by many fishermen to be important rockfish grounds, and the buyback reduced the size of the region's trawl fleet. Significantly, much of the seafood processing industry depended on multi-species landings from the trawl vessels. In response to reduced groundfish landings, certain buyers, in keeping with prudent business practices, reportedly increased the purchase and distribution of imported seafood products in order to meet local demand.

Some fishermen and seafood dealers assert that establishment of a limited entry program and strict quotas for the sablefish fishery also contributed to the gradual attrition of local fleets. The rate of attrition is said to have accelerated after the year 2000, when at least ten sablefish vessel captains from the Monterey Bay area left the industry; former captains contacted during this study reported that they were no longer able to make ends meet. Currently, there is only one limited entry sablefish fisherman active in the area.

In addition to importing seafood from other regions, processing firms along the Central Coast reportedly have incorporated several other strategies to cope with reduced volumes of local seafood. One involves downsizing the firm to reduce labor costs. Another involves contracting fish cutters and other laborers on a periodic basis rather than maintaining a staff of full-time employees. Because contractors are categorized by the State of California as "field workers" rather than actual employees, this strategy reportedly reduced Workman's Compensation costs for one Monterey Bay area processor by 13 percent per employee. But there are long-term disadvantages to this strategy in that high turnover rates among contractors means that the processing crews are often comprised of novices who cannot efficiently identify and sort multiple species of fish. On the other hand, some processors are having a difficult time retaining employees when all that can be offered is part-time work.

Another strategy for processors is to offer value-added products as opposed to minimally processed fish. Value-added seafood is sold already cleaned, cut, and/or breaded. Some plants have stopped processing altogether as owners have shifted their focus to the purchasing and distribution sectors.

Most notably, many processors have increased dependence on imported, farmed, and frozen products in order to meet customer demand. Owners of many mid-sized wholesale businesses in the region now import at least 80 percent of their products. One buyer in Santa Cruz purchases seafood from the East Coast, and from markets in South and Central America. A processing firm in Monterey County, which once relied almost entirely on locally caught seafood, now relies on imports and reprocessed seafood such as scallops, catfish, clams, and mussels from the East Coast. Tuna is often purchased from wholesale markets in Japan. Much of the locally distributed rockfish and salmon come from Canada. A representative of the firm estimates that

¹⁰ Rockfish Conservation Areas restrict commercial groundfish trawl and non-trawl gears by region, season, and depth.

¹¹ The Federal Groundfish Permit/Vessel Buyback Program removed 92 vessels and 240 permits, or 34 percent of the California-based groundfish fleet from the West Coast.

the company is processing one-tenth of the volume of locally caught seafood that was processed and/or sold five years ago. Unpredictable supply has led to the development of niche markets to maintain a profit margin during periodic gaps in supply of what formerly were mainstay products.

Finally, many processors have simply left the industry. Over the last ten years, three processors have gone out of business in the Moss Landing area, including a processing cannery that was formerly located on the docks. The dock was sold to Moss Landing Marine Lab (MLML), a research institute of the California State University system.

The recent conversion of the processing cannery to the MLML research pier is part of a more general change in property ownership and usage of coastal zone and waterfront areas along the Central Coast. In the case of Moss Landing, seasoned local commercial fishermen feel that the capacity of the harbor infrastructure to support the fishing industry is declining and trace this back to 1989, when the Monterey Bay Aquarium Research Institute (MBARI) was established in the area. They believe that the establishment of this first institute was pivotal in shifting the overall focus of the harbor from commercial fishing to research. Interviews with local researchers, on the other hand, make clear that researchers believe their work generates a wide range of benefits to society at-large.

Regarding the Status of the Principal Fisheries of Central California

Through the mid-1970s, environmental factors and market forces were pivotal in determining the viability of a given fishery. Beginning with passage of the Magnuson Act in 1976, however, formal regulations also began to exert significant influence on the nature of marine fisheries in the United States. Today, the nation's marine fisheries are influenced by a complexity of factors, including environmental conditions, management strategies, new technologies, market factors, and decisions made by participants in the harvest and distribution sectors.

Between 1995 and 1999, coastal pelagic species, groundfish, herring, market squid, and salmon accounted for 91 percent of all seafood landed at ports in Central California. Groundfish was most valuable, accounting for 32 percent of total value during the period. Following groundfish, the most valuable fisheries in the region were herring, salmon, and crab. Together with groundfish, these fisheries accounted for 77 percent of the total ex-vessel value of all seafood landed in the region during the period.

Landings between 2000 and 2006 were quite different. Groundfish landings in 2006 had been reduced by 98 percent of the 1996 totals (Parrish 2007), in large part due to regulatory controls established during the period. Thus, other species had become more prominent and valuable. These included: market squid (177 million lbs.), sardines (142 million lbs.), salmon (9.6 million lbs.), Dungeness crab (8.1 million lbs.), and albacore tuna (7.4 million lbs.). The five most valuable fisheries during this period were: market squid, Chinook salmon, red sea urchin, Dungeness crab, and spiny lobster.

The most obvious change between the two periods 1981 to 1999 and 2000 to 2006 was the near absence of the once important rockfish fishery during the latter period and a concomitant rise in

landings of flatfish. This shift was the result of a decrease in the stocks during the 1980s and implementation of the RCAs in 2002. The aforementioned departure of numerous trawl vessels in 2003 greatly reduced collective fishing capacity. Further, a 3.8 million-acre trawl-free Essential Fish Habitat Conservation Area was established between Point Conception and Point Sur in 2006. Finally, a series of more generalized regulatory changes undoubtedly generated dampening effects on production. These include reduced quotas, increasing constraints on gill net use, and the state's Nearshore Fishery Management Plan.

Coastal Pelagic Species. The coastal pelagic or “wetfish” fishery is one of the largest in California in terms of both landings and revenue. In the Central California region, the most economically important wetfish fisheries in recent years have been market squid, Pacific sardines, and northern anchovy. Moss Landing is the center of the wetfish fishery in Central California, and it is the primary port of production for both sardines and anchovies. From 2000 to 2006, market squid was harvested in significant quantities at all ports except Santa Cruz. All wetfish fisheries are characterized by periods of abundance and scarcity.

Although the 2007 sardine catch was extensive, reduced quotas, low market demand for canned sardines, depressed ex-vessel prices, unpredictable cycles of abundance and scarcity, and high fuel prices have driven numerous fishermen out of the fishery. A small fraction of the historically significant sardine fleet is still active in Monterey Bay. In 2007, six purse seine operators were based in Monterey, three of whom fished for sardines. Four seiners were based in Moss Landing.

California's squid fishery is currently the largest in the U.S., and market squid is the top commercial product in terms of volume and revenue. Between 1981 and 2000, market squid was one of the most economically important species landed at Pillar Point, Santa Cruz, Moss Landing, and Monterey harbors (Starr et al. 2002). In recent years, especially 2005 and 2006, however, Pacific sardine landings have surpassed squid as the top commercial product in terms of volume.

The Monterey Bay area was once the center of the California squid fishery. Since the 1990s, however, 90 percent of landings have occurred south of Point Conception (Leet et al. 2001; Starr et al. 2002).

In the Central Coast region, Moss Landing has been the primary squid producing port since 2000. Landings at that harbor averaged 14 million pounds per year between 2000 and 2006. Landings peaked in 2002 at 41 million pounds, but then declined sharply. The harvests in 2005 (3 million lbs.) and 2006 (1 million lbs.) were far below the mean for the period 2000-2006. Market squid is also an important fishery at Monterey, Santa Barbara, and Pillar Point. But landings at those ports do not approach the level of production attained by vessels based at Moss Landing.

Extensive landings for squid have been achieved by vessels based in the Morro Bay area as well. But this has varied over time; squid landings were significant in the 1990s, but diminished in the 2000s. Landings at Morro Bay and Avila were modest in both 2003 and 2004, but almost no landings were reported in 2005 and 2006. Several factors may explain the latter situation: (a)

establishment of a limited entry permit program involving a three-year moratorium on new entrants into the fishery; (b) the loss of squid grounds around the Channel Islands in association with spatial regulations in that area, and reportedly; (c) hyper-efficiency associated with use of high-voltage lights.

Dungeness Crab. Pillar Point Harbor is the center of the Central California Dungeness crab fishery. Some 60 of the approximately 113 resident vessels moored there are used to fish for crab. In recent years, landings data have been characterized by peaks and troughs of production, with landings topping out at more than 14 million pounds in 2003, 2005, and 2006. Dungeness landings also have been consistently important to fishermen and distributors based at Santa Cruz Harbor, although on a smaller scale. The Dungeness fishery in Morro Bay is comparatively minor in scope.

One of the most pressing challenges confronting crabbers is competition for crab during the first few weeks of the season. The taking of large volumes of crab early in the season reportedly tends to saturate the market, thereby making it difficult for some captains to profit during the remainder of the season. Because extensive landings can overwhelm local processing capacity, this also means that much of the crab will be frozen. Some processors report having to turn away captains or request that they remain at sea until offloading can be arranged. Delays in offloading subsequently lead to increased mortality and wasted product.

Competition is also said to be leading crabbers to persist in rough conditions (see Casey 2007). Four Central Coast crabbers were lost at sea at the start of the 2007 season. Observers in the Monterey Bay area anticipate increased participation in the fishery as a result of the 2008 salmon closure.

Spot Prawn. Shrimp is the top-selling species of seafood in the U.S. Spot prawns, the largest of the coldwater shrimps, are the target species of one of the most economically important fisheries in California.

Captains based in Monterey Harbor and Moss Landing are the primary spot prawn producers in the Monterey Bay area. Of the two harbors, Monterey receives the bulk of spot prawns offloaded in the region. In the southern zone, Morro Bay Harbor is the center of spot prawn production. Very little spot prawn is landed at Avila. In recent years (2000-2006), the primary spot prawn producing fleets were based in Morro Bay and Monterey, followed by those based in Moss Landing and Santa Barbara. Relatively little spot prawn is harvested by captains in ports north of Moss Landing.

Groundfish. Groundfish as a general category is one of the most profitable fisheries in California. Dover sole, sanddab, halibut, sablefish, and various species of rockfish are among the most commonly targeted groundfish in the region.

Some species of historic importance in the West Coast groundfish fishery have been declared to be subject to overfishing. Those are widow rockfish, canary rockfish, yelloweye rockfish, dark-blotched rockfish, bocaccio, Pacific Ocean perch, and cowcod. The fishery is now being carefully managed in an effort to rebuild those stocks.

As of 2000, 288 limited entry captains and 325 wholesalers were involved in the California groundfish fishery (Leet et al. 2001). This was the same year in which the Secretary of Commerce declared the groundfish fishery a disaster. The status of the fishery has improved in recent years and 400 limited permits were issued in 2008.

Between 1981 and 2000, the most economically important groundfish in the Monterey Bay area fisheries were Dover sole and various species of rockfishes. Groundfish landings have also been historically significant in the Morro Bay area fisheries. Between 1981 and 2000, a combined average of 7.5 million pounds of Dover sole, rockfishes, thornyheads, and sablefish were landed at Morro Bay, with an economic value of \$4.6 million (Starr et al. 2002). During the period 2000 to 2006, the principal species of groundfish landed at Monterey Bay area ports were, in descending order of value: sablefish, halibut, Dover sole, sanddab, and petrale sole. At Morro Bay area ports, the most valuable species were: cabezon, brown rockfish, halibut, Dover sole, thornyhead, and sablefish.

Nearshore Live Fish Fishery. The Central California coast is the center of the California live fish fishery; nearly half of all live fish is landed between San Luis Obispo and San Francisco. Much of the live fish fishery occurs in rocky nearshore waters. Rockfish species are primarily targeted in this fishery.

Initially developed by Asian immigrant fishermen in the early 1990s, the nearshore live fish fishery provided a niche for commercial fishermen whose groundfish and salmon landings were decreasing as a result of regulations on fishing with gill nets and implementation of limited entry programs (Starr et al. 2002). Fishing pressure on many nearshore species increased as displaced trawl captains competed for resources with recreational anglers in the same nearshore areas.

Today, effort in the lucrative live fish fishery conducted in the Monterey Bay area has to some extent shifted from nearshore species to shelf and slope species such as shortspine thornyhead, rosy rockfish, and sablefish. Much of the seafood produced in this fishery is distributed to a largely Asian clientele in San Francisco. The Monterey Bay shellfish fishery is also lucrative and linked to markets in San Francisco. Local fishermen estimate that there were between 16 and 25 commercial rockfish fishermen active around Monterey throughout the 1990s and that only three such fishermen remain in the area, with another three or four traveling up from Morro Bay to engage in the fishery on a periodic basis.

Sablefish (black cod). Sablefish (a roundfish) has been one of the most commercially important groundfish harvested in Central California in recent years. Sablefish was among the most valuable species landed in the study region between 2000 and 2006.

The volume of sablefish landings was highest at Moss Landing between 2000 and 2006, ranging from a high of 589,054 pounds in 2000 to a low of 457,249 pounds in 2002. On average, 515,000 pounds of sablefish were offloaded annually during the period, with an average ex-vessel value of \$619,640.

While significant in absolute terms, the volume of sablefish landed at Morro Bay between 2000 and 2006 was relatively less than that landed at Moss Landing. At Morro Bay, landings increased every year between 2002 and 2006, peaking at 263,484 pounds in 2006. Nearly

80,000 pounds of sablefish were landed during the period, with an average ex-vessel value of \$84,723. The volume of sablefish landed by commercial fleets at Avila, Pillar Point, and Monterey harbors was somewhat less than that achieved by fleets at Morro Bay. Sablefish landings were lowest at Santa Cruz.

The sablefish fishery has both limited entry and open access components. In the Monterey Bay area, the vast majority of sablefish fishermen participate in the open access fishery. Currently, only three long-liners participate in the limited entry fishery south of Point Arena: two are based at Moss Landing and one at Pillar Point. The chief problem reportedly facing open access fishermen is further reduction of what participants perceive to be already low quotas. Most recently, the open access limit was reduced from 3,000 pounds to 2,000 pounds per two-month period. Some fishermen see this as an effort on the part of managers to mitigate an anticipated shift of displaced salmon fishermen into the open access sablefish fishery.

Flatfish. The primary species of flatfish landed in Central California waters are Pacific Dover sole, petrale sole, sanddabs, and California halibut. Rex sole and English sole are also harvested, though in smaller quantities. Of the flatfish species, Dover sole is the focus of the most significant fishery across the region. Sanddabs are the focus of a lucrative fishery conducted from Pillar Point. Halibut is most commonly landed by captains based at Pillar Point and Santa Barbara.

Dover sole is one of the dominant continental shelf and slope species targeted by captains in the California commercial groundfish fleet. In 2004, it constituted the highest volume of landings in California (PacFIN 2005). In the mid-1980s, the largest Dover sole fleet on the Pacific coast was based at Morro Bay. At that time, more than 24 draggers moored at the port. However, following a period of increasing regulation and deteriorating market conditions, the fishery diminished in significance in the area.

In recent years, the ports of Moss Landing, Monterey, Avila, and Pillar Point received the highest volume of landings of Dover sole. During the period 2000 to 2006, Dover sole was one of the most lucrative fisheries at Avila and Monterey.

Highly Migratory Species. Albacore and swordfish are the two most economically significant highly migratory species landed at ports along the Central California coast. In the 1950s and 1960s, Monterey was one of the top albacore ports in the nation; nearly 30 tuna vessels were based at the port in the early 1950s.

The albacore fishery conducted from Monterey Bay area ports has been in a state of general decline since the mid-1980s. This is reportedly related to several factors, including: gear restrictions, an increase in foreign imports, and changes in the migratory patterns of albacore. Given that albacore fishing typically involves trolling, the high fuel costs can tend to constrain participation in the fishery.

Albacore landings at Central California ports have fluctuated widely over the last several years. In recent years (2000-2006), albacore was the second most valuable species landed at Morro Bay, the fourth most valuable at Santa Cruz and Avila, and the fifth most valuable at Moss

Landing. In terms of volume, albacore landings at the ports of Moss Landing and Morro Bay were by far the most significant in the region. Landings at both ports peaked in 2001 at just over 1.2 million pounds, and then dropped sharply the following season. During that same period, the volume of landings at Avila and Santa Cruz were moderate, while landings at Monterey, Pillar Point, and Santa Barbara were poor relative to averages of years past.

Competition with vessels hailing from Canada reportedly is a significant challenge for the Central California albacore fleet. It is said that the number of Canadian vessels fishing for tuna within the U.S. EEZ has increased as captains seek to establish a history of landings in anticipation of an international quota system for albacore.

Tuna fishermen are also challenged by the heightened demands of the changing international albacore market. In the “old days” (i.e., the cannery days), fisherman caught tuna, stored it on ice, and delivered it to canneries in the region. Today, a portion of albacore is exported for sale as *shiro maguro* in the Japanese sashimi market. This requires that the fish be kept at very cold temperatures. But many fishermen cannot afford to upgrade existing refrigeration systems to meet the cold storage requirements of discerning buyers in Tokyo and other markets.

Salmon. Chinook or “king” salmon (*Oncorhynchus tshawytscha*) is the principal salmon species harvested in California. The coho or silver salmon fishery was closed in 1994. Chinook salmon is of great importance for commercial, recreational, and subsistence harvesters, and the fishery has consistently been one of the most profitable at nearly all the major ports in Central California. Positive attributes notwithstanding, it is also a highly variable fishery and the species is currently in a state of historically unprecedented under-abundance.

In recent years, salmon landings have been highest at Pillar Point, followed by Moss Landing, Santa Cruz, Monterey, Morro Bay, and Avila. There is also a small salmon fishery in Santa Barbara. Salmon is the top local fishery in Santa Cruz and Pillar Point in terms of value, and third in terms of value at the ports of Monterey and Moss Landing. Salmon is the fourth most valuable local fishery at Morro Bay.

Several factors reportedly have affected the salmon fishery over the last decade— and particularly in the last few years. Importantly, the Sacramento River system supplies 90 percent of salmon caught in California, and nearly 60 percent of salmon is currently caught in waters north of San Francisco. It is argued (Guillen 2003) that the Klamath stock has been diminished by disease, the diversion of water to inland farms, and hydroelectric dams. The domestic wild salmon fisheries also suffered when Chilean and Norwegian farmed salmon began to be sold more cheaply in U.S. markets in the early 1990s (Knapp et al. 2007: xii-xiii). Low market prices and cyclic under-abundance have challenged many California salmon fishermen in recent years.

The recent closure of the salmon fishery is of great and immediate concern for Central Coast commercial salmon fisherman. Among such fishermen contacted during the current study, the frequency of stated concerns about the salmon closure has superseded the frequency of concerns regarding the new network of MPAs. On May 1, 2008, NOAA Fisheries approved the recommendations of the Pacific Fishery Management Council to close the 2008 salmon season to both commercial and recreational fishing. The ban affected the nearly 1,000 commercial salmon

fishermen formerly active in the fishery between Santa Barbara and Southeast Alaska (Fimrite 2008), including nearly 400 commercial salmon fishermen in California alone (Koopman 2008).

The West Coast salmon fishery was also declared to be in disaster status, thereby enabling Congressional appropriation of emergency disaster assistance for affected communities in California, Oregon, and Washington. In May 2008, the Bush administration passed a \$170 million addition to the U.S. Farm Bill to aid West Coast families and businesses affected by the closure. Some \$100 million was released in September of that year; \$63 million to fishermen in California, \$25 million to fishermen Oregon and \$12 million to fishermen in Washington State. The remaining \$70 million was released in November 2008.

Reported Preliminary Effects of the MPAs on Fishing and Recreational Activities

Overview. According to CDFG (2005), fishery participants who primarily target non-migratory nearshore and shelf species, such as rockfishes, lingcod, cabezon, kelp greenling, and Dungeness crab, are most likely to be affected by the implementation of new MPAs. Commercial fishermen report their own expectations that cabezon, kelp greenling, spot prawn, crab, and sablefish fisheries will be most heavily affected. But objective analysis makes clear that the combination of pre-existing regulations- including size and bag limits, number of allowable participants, gear restrictions, quotas, number of allowable fishing days, and conservation areas- have already led to more significant fisheries impacts than will the new MPAs.

Fishery participants typically discuss the effects of the MPAs in conjunction with other challenges, including economic and other regulatory factors. A wide range of contemporary challenges notwithstanding, some fishermen in all the study ports have reported that the new MPAs have displaced them from favored fishing grounds. Moreover, as of mid-2008, seven commercial fishermen reported that they had sold permits for fisheries that were affected by MPA closures, four reported that they had lost jobs on charter vessels that could no longer fish in preferred areas, and one reported that he could not stay in the industry because his preferred grounds had been closed and no reasonable options were available.

It is obvious that fishermen whose traditional grounds are now off-limits will ultimately have the hardest time adapting. According to a charter operator from the Santa Cruz area, the difficulties are furthered in that alternative fisheries also tend either to be heavily regulated or are relatively less profitable or tractable than those formerly occurring within what are now reserve boundaries. He asserted that it is often difficult to interest his clients in fishing for species other than rockfish or salmon.

In the case of rockfish, alternative fishing areas are limited since rockfish favor rocky shelf habitats that are limited in number and extent in the region. Thus, from a fisheries perspective, area closures may be considered not only in terms of overall percentage of protected ocean area, but also in terms of reduction in the total area of viable fishing grounds.

Northern Zone MPAs (San Mateo, Santa Cruz, and Monterey Counties)

Año Nuevo State Marine Conservation Area (SMCA) and Greyhound Rock SMCA.

Commercial take of all species is prohibited in the Año Nuevo SMCA, with the exception of giant kelp, which may be taken by hand. The Greyhound Rock SMCA allows only the commercial take of salmon, squid, and giant kelp by hand.

- ◆ **Commercial** – These new designations have reduced the total grounds available to Santa Cruz and Half Moon Bay fishermen who used these areas in recent years. Seasoned participants in the crab fleet report that there are better alternative grounds elsewhere in the general area; heightened pressure on crab resources may therefore occur in the adjacent waters. Monterey Bay crabbers who set their pots in alternative areas to the north will accrue additional fuel costs. The Año Nuevo closure also reduces available grounds for squid fishermen who formerly worked here and who might otherwise do so in the future.

Chinook salmon cyclically appear in the deeper waters around Año Nuevo and Greyhound Rock. Seasoned salmon fishermen report that if/when the current closure is lifted, they will likely pursue the species along the outer edge of the SMCA. Fishing close to reserve boundaries is feasible for this fleet given the possibility of spatially precise use of troll gear.

- ◆ **Recreational** – The area between Franklin and Waddell Creek reportedly was especially productive rockfish grounds, but Half Moon Bay and Santa Cruz charter captains who formerly fished here may no longer do so. A charter operator who departs from Santa Cruz speaks on behalf of the larger fleet, asserting that prior to establishment of the MPAs and the RCAs approximately 150 square miles were available for rockfish angling. He asserts that only about two square miles of favorable habitat now remain. This area is between Scott's Creek and Davenport, out to 25 fathoms. Seasoned charter operators in Pillar Point and Santa Cruz predict that the RCAs and new MPAs will serve to increase fishing pressure in the remaining productive rockfish grounds in the Año Nuevo area, and that pressure on halibut resources in the area will also likely increase.
- ◆ **Non-consumptive** – The primary non-consumptive recreational activities occurring in the Año Nuevo and Greyhound Rock areas include surfing, windsurfing, kiteboarding, and kayaking. These occur primarily around Waddell Creek and Scott's Creek, with relatively less activity occurring along the shoreline at Año Nuevo. Given the relatively isolated location of the MPAs and the ongoing presence of white sharks, the frequency and extent of in-the-water sports has been relatively low. Establishment of these MPAs has not yet and is not in the future expected to significantly affect non-extractive recreational uses of the marine environment.

Natural Bridges State Marine Reserve (SMR). New regulations for the Natural Bridges State Marine Reserve do not allow commercial or recreational take of any kind. The harvesting of kelp is also prohibited.

- ◆ **Commercial** – There is a recent history of commercial kelp harvesting in this general area. Harvesters formerly working close to shore will likely exploit the many adjacent kelp beds. Other extractive commercial activities in this reserve area have been minimal in years past, and thus limited effects can be expected.
- ◆ **Recreational** – Shore-based anglers and mussel gatherers are displaced by this closure. Shellfishing areas north of Waddell Creek and Año Nuevo are also no-take areas. There are many nearby alternatives for shore-based finfishing. Natural Bridges was once popular with spear and tournament divers who accessed the neashore zone from the beach. Many such divers have more recently preferred to launch from the public boat ramp at Santa Cruz Harbor.
- ◆ **Non-consumptive** – Although no previous conflicts were noted during the interviews, surfers and kayakers using areas in or near the Natural Bridges SMR may potentially benefit from a decrease in competition for space with recreational shore-based anglers. Competition for available parking spots may also diminish.

Elkhorn Slough SMCA, Elkhorn Slough State Marine Reserve (SMR) and Moro Cojo Estuary SMR. The Elkhorn Slough SMR and Moro Cojo SMR prohibit the take of all living marine resources. The Elkhorn Slough SMCA permits the recreational harvest of finfish by hook-and-line only. Clams may be taken only along the northern shoreline of the Slough in the area adjacent to the Moss Landing State Wildlife Area.

- ◆ **Commercial** – Elkhorn Slough has long been off-limits to commercial fishing. Therefore, the new regulations affect only recreational users.
- ◆ **Recreational** – Anglers have reportedly shifted activities from the main body of the slough to its entrance or to Kirby Park where there is a small pier. The small size of the pier limits the number of anglers. There are many popular angling opportunities along the adjacent coastline, although most areas reportedly do not provide the same bat ray and leopard shark fishing opportunities as exist in the Slough itself.
- ◆ **Non-consumptive** – Kayaking and wildlife viewing are the main non-consumptive activities undertaken in the area. No MPA effects on these groups have been reported to date.

Soquel Canyon SMCA and Portuguese Ledge SMCA. The Soquel Canyon and Portuguese Ledge SMCAs prohibit the harvest of living marine resources, with the exception of commercial and recreational take of pelagic finfish.

- ◆ ***Commercial*** – New restrictions on the use of historically productive fishing grounds in the Soquel Canyon and Portuguese Ledge SMCAs have significantly affected the spot prawn, Dungeness crab, sablefish, and California halibut fisheries. The sardine and squid fisheries are not expected to be affected, as these tend to occur in waters not restricted by the MPAs.

The most productive grounds for the spot prawn fishery are now off-limits. Spot prawn fishermen report losing as much as 80 percent of their historically favored grounds to the new restrictions. A few fishermen are considering leaving the industry as they realize fewer landings, though recouping vessel and permit costs is a valid concern. Shifting into the California salmon fishery is not an option for displaced fishermen this year, and the prohibitive cost of fuel is tending to preclude the long trip north to participate in the Alaskan salmon fishery.

Crabbers who formerly used the Portuguese Ledge area are also being affected by the closure. Increased competition for crab in the remaining open areas has been observed. Fishery participants contacted during this study voiced concerns about the potential for conflict between crabbers who are established in areas not affected by the new MPAs and displaced crabbers who must seek new grounds. Participants often express concern that their crab pots may drift into the MPA during storm events, thereby subjecting them to fines. Crabbers from Moss Landing are shifting their focus further north.

Sablefish fishermen also lost some productive grounds to the Portuguese Ledge MPA. Key participants report that they must now travel further west to find sablefish, thereby incurring increased fuel costs and more time at sea. Greater personal safety risks are also involved when fishing in closer proximity to busy shipping lanes. These factors reportedly are diminishing the interest of certain fishermen from persisting in the industry.

Two sablefish fishermen are relocating from Monterey Bay area to Morro Bay. The participants report being encouraged by the higher open access quotas that are available for qualifying fishermen willing to fish south of 36° N latitude.

The establishment of the Soquel Canyon and Portuguese Ledge MPAs occurred not long after the MBNMS ban on trawling. Trawling was previously conducted within the state jurisdiction waters of Monterey Bay, especially in areas where soft bottom conditions provide good habitat for flatfish. Trawling is additionally curtailed by the recent establishment of Essential Fish Habitat areas. The combined effects of these regulations are significant for participants in the trawl fishery. Some fishermen have opted to pursue California halibut west of Monterey Bay. Key participants related that the new regulations may lead to increasingly concentrated fishing activity along the western boundaries of the Portuguese Ledge SMCA.

- ◆ **Recreational** - Soquel Canyon and Portuguese Ledge were historically popular for recreational rockfish fishing. These grounds are targeted primarily by charter operators based in Monterey, Moss Landing, and Santa Cruz.

Portuguese Ledge contains numerous rock formations that are favored by rockfish. The areas are now closed to recreational take of rockfish either through regulations related to the newly designated reserves and/or RCAs that were established in 2003.

Prior to the designation of the MPAs, depth restrictions associated with the RCAs deterred recreational fishermen and charter boats from fishing shelf areas along Soquel Canyon and Portuguese Ledge. The new MPA designations merely overlay the previous RCA depth restrictions. It should be noted that while charter fishermen viewed the RCAs as temporary regulations that could be lifted should stocks sufficiently re-populate, they envision the MPAs as a permanent constraint on their operations.

- ◆ **Non-Consumptive** - Currently, two dedicated and several diversified whale-watching enterprises operate from Monterey Harbor. A few of these operations sometimes cruise in the areas around the new SMCAs. The visual absence of fishing vessels and the reduced potential for spatial conflicts between tour vessels and fishing vessels in the immediate vicinity of the new MPAs may be considered positive human effects of the new reserves. One eco-tour operator perceives the potential for increased competition from sport fishing charter operators who now also offer whale-watching tours.

Monterey Peninsula: Edward F. Ricketts SMCA, Lover's Point SMR, Pacific Grove Marine Gardens SMCA, and Asilomar SMR. No commercial take of any species is allowed in the SMRs. Edward F. Ricketts and Pacific Grove Marine Gardens SMCAs prohibit the take all living marine resources except the recreational take of finfish, and the commercial take of giant kelp and bull kelp.

- ◆ **Commercial** – Commercial fishermen consider much of the nearshore zone along the Monterey Peninsula to be prime rockfish habitat. Areas in close proximity to Monterey Harbor are particularly favored. Participants in the nearshore fisheries therefore naturally perceive the new spatial restrictions to be constraining. Seasoned local fishermen report that closures following from establishment of the four new Monterey Peninsula MPAs will likely shift commercial fishing effort south to areas between Point Joe and Pescadero Point.

Purse seiners have operated in this area in decades past. The SMCA designation could potentially impact squid fishermen if and when the squid return. Long-time local squid fishermen report their concerns that a small but productive area just south of the Asilomar MPA will now be overfished. Stipulations regarding use of seine gear reportedly are also a concern. Fishermen voice concerns about their vessels or nets drifting into MPAs during poor weather and sea conditions and thus being subject to fines.

The Edward F. Ricketts SMCA neighbors Hopkins Marine Reserve, an area already off-limits to recreational and commercial fishing. The new SMCA designation is viewed as an extension of the boundaries of the pre-existing reserve, and therefore no significant effects are anticipated.

- ◆ **Recreational** - The new MPAs are likely to affect the area's recreational rockfish fishery. One veteran fisherman predicts that recreational anglers will be particularly affected by the closures of Spanish Bay off Asilomar and Chase Reef off Lovers Point since both areas are close to the harbor and frequently productive. It is likely that the closures will encourage recreational fishermen to shift their efforts either south or northeast where recreational fishing of finfish by hook-and-line is still permitted (i.e., in the Edward F. Ricketts and Pacific Grove Marine Gardens SMCAs). Some crowding and increased focused on nearshore resources can be expected in certain areas.

One longtime recreational fisherman offered his informed perspective that in conjunction with closures at Carmel Pinnacles SMR and Point Lobos SMR, the closures at Lovers Point SMR and Asilomar SMR will impact shore-based anglers more than it will boat-based anglers. He bases his prediction on the lack of easy shoreline access to nearshore grounds from Point Lobos to Point Sur. This relates to the toll road along Pebble Beach, and to steep cliffs and long stretches of private property along much of the region's coastline.

Spear divers have been displaced from Lovers Point, which is known as a high-visibility area for halibut. Some divers are now spearing along the western boundary of the SMR south to the Pacific Grove Marine Gardens SMCA. There are numerous alternative locations for spear diving in the region. Non-extractive divers believe they may ultimately benefit from enhanced fish populations in and around the new reserves.

Rockfish were traditionally targeted west of Point Pinos, and thus kayak anglers, spear divers, and shoreline anglers are being affected by the Asilomar SMR. Enthusiasts are responding to the new no-take policies by concentrating their efforts in and south of the Pacific Grove Marine Gardens SMCA

- ◆ **Non-consumptive** – The Monterey Peninsula is frequented by many non-consumptive recreational divers. Divers access at least 15 spots within the vicinity of the new SMCAs and SMRs. Dive shop and charter operators believe that if the reserves are successful in increasing the presence of fish, seals, and otters in Monterey Bay, their businesses will benefit from the MPAs. Monterey Bay non-consumptive divers tend to support the MPAs. Surfers and kayakers also utilize a number of popular sites within the new MPAs. To date, such users report no positive or negative impacts from the new regulations.

Carmel Bay SMCA, Carmel Pinnacle SMR, Point MR, and Point Lobos SMCA. Take of any living marine resource is prohibited in both SMRs. The Carmel Bay SMCA allows only the recreational take of finfish and the commercial take of giant kelp and bull kelp by hand, under regulatory guidelines. The Point Lobos SMCA allows the recreational and commercial take of salmon and albacore, and the commercial take of spot prawn.

- ◆ **Commercial** – Commercial fishermen pursuing squid, salmon, and nearshore species such as rockfish and cabezon, will likely be impacted by the MPAs in the Carmel Bay and Point Lobos areas. The pursuit of deepwater species such as albacore is less likely to be affected. Spot prawn and California halibut fisheries are also likely to be minimally affected.

Nearshore fishermen who launch from shore with small-boats and skiffs are minimally impacted by the Carmel Bay SMCA. While this area is now closed to commercial take, fishermen have the option of departing from Stillwater Cove to other productive grounds beyond Pescadero Point. As one skiff fisherman confided “I can live with that sacrifice.”

Point Lobos is typified by high relief and highly complex substrate, and is therefore known for good rockfish fishing. The extension of the no-take reserve in this area will likely displace fishing effort to areas south of Yankee Point.

The purse seine fleet formerly fished the Carmel Pinnacles area. Seasoned participants report that in future years they will likely fish the edges of the MPA, using lights to attract the squid into unregulated waters. There are concerns that currents and wind may push vessels or gear over the boundaries of the MPAs, thereby incurring penalties.

Chinook salmon occasionally run through the deeper waters around Point Lobos, but in some years they appear closer to the shore. When the salmon reappear close to shore, fishermen report that they will likely fish the MPA boundary areas.

Historically, Carmel Canyon has been a productive spot prawn area. Spot prawn fishermen currently set their pots within the Carmel Canyon area, outside of the Carmel Bay SMCA; these participants are thus not directly affected by the MPA. Spot prawn fishermen are similarly minimally affected by the Point Lobos SMR, as this designation does not overlap with traditional grounds.

- ◆ **Recreational** – The region’s recreational rockfish fishery is being affected by the Carmel Pinnacles SMR. The headlands in this area offer some protection from the wind, enabling anglers to continue fishing rather than return to port. But the SMR now limits the amount of grounds available to this fleet.

Charter operators leaving from Monterey and Moss Landing Harbors commonly pursue rockfish around Monterey Peninsula and the Point Lobos areas. The Monterey Peninsula closures are therefore likely to lead to more concentrated activity south of Point Lobos. According to long-time charter operators, alternative fisheries also tend to be increasingly regulated or are relatively less attractive to patrons.

Boat- and kayak-based anglers also used the Point Lobos area. Kayak fishermen report that they have been fishing south of Yankee Point following the closure. Shoreline anglers may continue to fish in Carmel Bay SMCA, and therefore are negligibly affected. Local spear divers contacted during this study report that they have not historically used

the reserve areas to any great extent and therefore have not been significantly affected by the new designations.

- ◆ ***Non-consumptive*** – Non-consumptive divers typically welcome the exclusionary use of the Carmel Pinnacles area. They report enjoying and/or anticipating less competition for space, and freedom from dangers they associate with the presence of hook-and-line boat fishermen and spear fishermen. One seasoned diver asserts that protected conditions afford better subject matter for underwater photography, and will ultimately improve the status of fish populations in waters adjacent to the MPAs.

Big Sur Coastline: Pt. Sur SMR, Point Sur SMCA, Big Creek SMR, and Big Creek SMCA.

The Point Sur SMR and Big Creek SMR are no-take zones. Commercial and recreational take of salmon and albacore are permitted in the Point Sur and Big Creek SMCAs. The Big Creek SMCA also permits the commercial take of spot prawn.

- ◆ ***Commercial*** – Nearshore fishery participants who target rockfish, cabezon, and other nearshore species are being affected by the SMRs. This relates to the fact that there are optimal bathymetric features for rockfish around Point Sur and the headland offers protection from wind and seas on the southern leeside. Although rockfish are plentiful in state waters west of the Point Sur SMCA boundary, these areas are regulated under an RCA designation. Commercial fishermen must therefore concentrate their efforts elsewhere.

Due to the price of fuel and limited quotas, Monterey area fishermen contacted during the study are shifting their efforts north of Point Sur, rather than south. This includes the area between Malpaso Creek on the southern end of Point Lobos SMR and Point Sur. In short, the closure of Point Sur, Point Lobos, and other MPAs further north will likely increase pressure in the Malpaso Creek to Big Sur area. According to local fishery participants, the new MPAs are not likely to affect the crab and sardine fisheries.

Partly because of the new MPA restrictions, several small-boat fishermen who trailer their vessels are re-focusing their efforts both north and south of Point Sur. One has sold his nearshore license.

The Big Creek SMR/SMCA closures are similarly impacting nearshore fishermen from Morro Bay. Commercial skiff fishermen are most heavily impacted and are now displaced to locations further south. Fishermen who formerly accessed Big Creek through the Vincent Creek point of access shifted their efforts to reef areas south of Point Sur, such as Lopez Point, Cape San Martin, and Mill Creek. The rugged coastline here offers few places to launch; accessible areas will likely receive the greatest concentration of new effort. Fishermen traveling from the Morro Bay area to Point Sur fishing grounds are faced with greater travel time and fuel expenses.

Squid is another prominent fishery around the Point Sur area. During recent years when squid appear off Point Sur, six to 12 captains from harbors north and south fish the area from Monterey to Ventura. These participants report that they are likely to pursue squid alongside new MPA boundaries.

The impact of the SMR on the region's salmon fishery remains to be seen. Salmon fishermen differ on the possible impacts – some say that salmon are not typically targeted in the nearshore zone within the boundaries of the new SMR. Others say that when the salmon reappear, and if the fishery is reopened, they will likely fish along the boundaries of the MPA.

The establishment of the Big Creek SMR has significantly affected the Morro Bay area spot prawn fishery. Morro Bay area fishermen report that significant losses in net revenue have resulted from a loss of spot prawn grounds. Fishermen who have shifted their efforts to grounds around Point Lopez report difficulty catching enough prawns to justify associated expenses. Buyers report a relative lack of prawns subsequent to the closure.

- ◆ ***Recreational*** – The Point Sur area has historically been favored by charter operators for its abundant rockfish and other nearshore resources. The new closures are therefore affecting charter operators who formerly traveled to the area from Monterey and Morro Bay.

Squid were also formerly pursued on a recreational basis around Point Sur. Although this is a small and variable fishery, at least one Morro Bay-based charter vessel operator formerly offered squid fishing during the summer months and is therefore affected by the new MPAs. Shoreline anglers are now fishing elsewhere, often at accessible locations north of the Point Sur SMR.

Charter operations from the Monterey area did not historically undertake multi-day trips to the Big Creek area and therefore will not be affected by the SMR/SMCA. However, Morro Bay charter operators did occasionally fish in the Big Creek area and will be affected by MPA-associated closures.

- ◆ ***Non-consumptive*** – Surfing occurs around the Little Sur and Big Sur rivers. Given the relatively isolated location of these areas, however, the frequency of use is relatively low. Establishment of the MPAs does not significantly benefit or burden this user group.

Kayakers occasionally launch from Andrew Molera State Beach and Point Sur Historic State Park. The areas are far from significant population centers and thus the number of kayakers using the area is relatively small. The number of non-extractive divers using the area is also minimal. Impacts are not being reported at this time.

Southern Zone MPAs (San Luis Obispo and Santa Barbara Counties)

Piedras Blancas Marine Protected Areas: Piedras Blancas SMR and Piedras Blancas SMCA.

The take of any living marine resources is prohibited in the Piedras Blancas SMR. Commercial and recreational take of salmon and albacore is permitted in the Piedras Blancas SMCA.

- ◆ ***Commercial*** – The Piedras Blancas SMR has led to a refocusing of fishing effort to other areas. For example, nearshore kayak fishermen have shifted into the rocky substrate area between the Piedras Blancas SMR and Cambria SMR; to an area south of the Cambria SMCA; and to an area around Point Estero. Several kayak fishermen are now also fishing just offshore Morro Bay Harbor.

The live fish fishery in general has been affected by establishment of the Piedras Blancas and Cambria SMRs. The closed areas were formerly favored by the small vessel live fish fleet since these are typified by shallow, rocky substrate and could be readily accessed from Highway 101 and the public launch sites. Fishermen have responded to the closures by fishing closer to the ports of Morro Bay and Avila.

The area now comprised by the Piedras Blancas SMCA has not been heavily fished in recent years. The majority of the offshore waters are protected by a no-trawl RCA and, moreover, bottom conditions generally are not favorable for rockfish. The area has been accessed on a periodic basis for salmon and squid. Salmon fishing is permitted in this area. The squid fishery may be affected in the years to come.

- ◆ ***Recreational*** - The closure of the Piedras Blancas SMR has had a significant effect on Morro Bay-based charter operations, particularly with regard to the length of the trips that the operators are able to offer. A couple of charter operators have replaced 10-hour trips with 12-hour trips that facilitate access to distant grounds that remain open. This adds to fuel costs, however, and the longer trips reportedly are not as popular.

Since the establishment of the elephant seal colony in 1994, spearfishing has been limited in the waters that now constitute the Piedras Blancas SMR. Similarly, the Piedras Blancas area is not frequently used by shoreline anglers. No MPA-related impacts to either group have been reported.

- ◆ ***Non-consumptive*** - Surfers, windsurfers, and kiteboarders were also displaced by the elephant seal colony. Since 1994, these groups have tended to favor Arroyo Laguna. Kayakers have also tended to recreate to the south; the area most typically used for kayaking is now between Arroyo Laguna and San Simeon Bay. The SMR could potentially benefit non-consumptive kayakers by reducing traffic in this area, though no benefits have been reported to date.

Cambria Marine Protected Areas: Cambria SMCA, White Rock SMCA. Cambria SMCA regulations restrict all commercial take, while allowing recreational harvest. White Rock SMCA regulations prohibit the take of all marine resources, with the exception of limited commercial take of giant kelp and bull kelp.

- ◆ ***Commercial*** – Nearshore live fish fishermen are being affected by the Cambria and White Rock SMCAs. The closures have diminished the available fishing area from roughly 15 square miles to four square miles. This has led to more concentrated effort in the area between Cayucos and Point Estero. The closure has particularly affected commercial live fish kayak fishermen who fish in shallow waters that are inaccessible to larger vessels. Kayak fishermen report that they were formerly able to access six or seven areas around Cambria. This group typically targeted grass rockfish, which brought \$10.50 to \$12.50 per pound during 2008. Morro Bay buyers reported a significant decrease in the volume of available grass rockfish that year. No other commercial fisheries are reportedly impacted by this closure. Most other species are landed outside the boundaries of the MPAs.
- ◆ ***Recreational*** – The Cambria and White Rock areas formerly constituted important fishing grounds for boat-based anglers from Morro Bay, San Luis Obispo, Atascadero, Paso Robles, and San Joaquin Valley. Access to the two SMCAs is afforded by the Leffingwell Day Use Area, which is adjacent to the Cambria SMCA and less than four miles to the northern boundary of the White Rock SMCA.

The impact of the White Rock SMCA on charter fishing operations has been minimal. The effects vary depending on the size of the operation, but most operators have adapted by shifting effort to area outside the White Rock SMCA, such as directly to the south of the MPA and around Moonstone Beach.

There has been an increase in the number of recreational anglers fishing the Estero Point and Cayuco Point areas. One prominent rockfish angler asserted that in 2008 it was common to observe at least eight recreational fishing captains around Point Estero on a rough day, while prior to implementation of the MPA, only three such captains would be observed.

Shoreline anglers who frequent the Cambria area have not been affected by the new designation. Those who fished along what is now the shore of the White Rock SMCA have moved to spots north and south of the MPA.

Diving is a popular sport in the Cambria/White Rock area. The primary MPA-related impact observed to date for consumptive divers is confusion over where the boundaries lie between the “take” and “no-take” zones.

- ◆ ***Non-consumptive*** - Both the Cambria and White Rock SMCAs are popular recreational destinations for non-consumptive kayakers, divers, and surfers. No impacts have been reported to date.

Morro Bay MPAs: Morro Bay SMR and Morro Bay State Marine Recreational Management Area (SMRMA). The Morro Bay State Marine Reserve is a no-take zone. The Morro Bay SMRMA allows for recreational take of finfish, oyster aquaculture, and storing of finfish taken outside the SMRMA for use as bait.

- ◆ ***Commercial*** – With the exception of oyster aquaculture, no major commercial fisheries have been conducted in the Bay in recent decades. The SMRMA may potentially benefit the oyster industry; otherwise MPA effects on consumptive user groups will be negligible.
- ◆ ***Recreational*** – Morro Bay and Morro Bay Pier are popular with recreational anglers. Recreational fishing activities will not be affected by the SMRMA designation. The SMR precludes fishing and other consumptive activities in the shallow waters in the easternmost portion of the bay. Limited fishing activities occurred here in years past and thus MPA effects will be negligible.
- ◆ ***Non-consumptive*** - The Morro Bay SMR and SMRMA closures have not affected non-consumptive activities. Kayak business operators state that they have been more significantly affected by reduced access to certain areas on land than by establishment of the MPAs.

Point Buchon SMR and Point Buchon SMCA. The Point Buchon SMR is a no-take zone. Commercial and recreational take of salmon and albacore are permissible in the Point Buchon State Marine Conservation Area.

- ◆ ***Commercial*** – The SMCA lies entirely within the no-trawl RCA, and thus there has not been a rockfish fishery here for some years. The SMR has significantly affected commercial pursuit of rockfish, squid, and hagfish, and will affect the salmon fishery in future years.

Point Buchon is a favored place to fish since it is both productive and close to port. Close proximity is important since live fish are offloaded as quickly as possible. According to several fishermen, the SMR displaced 10 to 15 live fish fishermen operating from Avila, and another 20 nearshore fishermen operating from Morro Bay. Fishermen from Avila are now fishing predominantly around Point Sal, which is about eight miles more distant than Point Buchon. Although the live fish fishery has been affected by the loss of grounds in the Point Buchon area, several buyers assert that the effects cannot be confidently assessed for some time.

Live fish buyers and retail operators in Avila have noted a decline in the amount of fish that has been delivered since establishment of the MPAs. One buyer asserted that the Point Buchon SMR “puts more pressure on fishermen to get the same job done.” However, because fishing effort was constrained by unusually windy weather during much of 2008, he was unable to clearly discern the impact of the MPA on the live fish fishery.

Heightened commercial activity has been reported in three areas north of Point Buchon: (1) around Hazards reef; (2) south of the Diablo Canyon restricted zone around Pecho Rock and Santa Rita Reef; and (3) in the small allowable areas remaining between the restricted zone and Point Buchon SMR. Participants are now excluded from fishing the rocky substrate from roughly 35.15.25 N. to 35.11.00 N. However, a small triangular area between the Diablo Canyon Security Area and the Point Buchon SMR remains open.

Point Buchon has periodically been a high-yield area for squid. Two squid vessels are based in Morro Bay. However, squid have not appeared since MPA regulations went into effect, and thus the short-term effects of the SMR on the squid fishery remain uncertain.

The observed effects of the Point Buchon SMR on the hagfish fishery have thus far been negligible. With the inception of the Point Buchon MPA, one captain reportedly has moved outside the restricted area into deeper water off the Point, while others have moved their operations closer to port. Although these waters are thought to be less productive, no significant effects on landings have been reported.

The Point Buchon area has traditionally been productive for salmon fishing in years when salmon are running. Given the 2008 closure, the impacts of the Point Buchon SMR on the salmon fishery remain to be seen.

The crab and California halibut fisheries are not impacted by the Point Buchon closures. These species have traditionally been landed outside the MPA boundaries.

- ◆ **Recreational** – Charter captains operating from Morro Bay have moved operations to the northern outskirts of the SMR. Those offering short day trips to the Point Buchon area have shifted to areas north of Estero Point and offshore Cayucos Pier.

Avila charter operators who formerly frequented Point Buchon are now often traveling south to Point Sal or Purisima Point. The trip can take up to five hours during north wind events. One charter captain observes that when fishing the Hazards area north of Point Buchon, he is now often surrounded by privately owned vessels. The skipper believes this is because recreational captains are tending to follow charter vessels to avoid wandering into the MPA.

With regard to boat- and shore-based recreational anglers, the impacts have varied. Some recreational captains state that they have not fished in the Point Buchon area because of the time and fuel required and/or given ease of accessibility to other areas. Such persons logically are not experiencing MPA impacts. Others claim they now must travel to more distant grounds and are experiencing some economic impacts as a result.

Approximately 50 to 60 recreational captains launch their boats from Morro Bay during good weather weekends; between 20 and 25 launch during the week. These participants now tend to fish in various areas just outside the bay or travel to Hazards or Estero Point.

Fishermen launching from Avila now typically fish around Shell Beach or Pismo Pier. Halibut is frequently targeted. Fishermen interviewed in the Avila area assert that the MPAs have led to a re-concentration of fishing activity in favorable grounds that remain unregulated.

Spear fishing remains popular in the region, although the number of participants reportedly has declined since the 1990s. Spear fishermen affected by the Point Buchon closure have reportedly relocated northward to sites adjacent to the Cambria SMCA, and southward to areas such as Pecho Rock, Santa Rosa Reef, Sheep's Head, Souza Rock, and Shell Beach.

Observers report that an increasing number of consumptive divers and recreational anglers are active in the Shell Beach area. This area is often also used by surfers, outrigger canoe paddlers, kayakers, and kite boarders. The MPAs thus have the potential to increase the overall level of marine recreational activity here.

One dive charter operator notes that he has experienced diminished business following establishment of the Point Buchon MPA, as there are few nearby locations which permit spear fishing. However, this operator is adapting his business model to accommodate divers interested in photography and education. The owner believes he may eventually benefit from the change.

Owners of fishery-related businesses assert that fewer vessels now launch from Avila/Port San Luis. One business owner asserts that the number declined by nearly 30 percent between July 2007 from July 2008. A marina employee attributes this change almost entirely to the Point Buchon closure, and secondarily to the closure at Vandenberg AFB. He believes that fuel costs are not to blame, but rather diminished opportunities for productive fishing.

- ◆ ***Non-consumptive*** – There is some potential for space-use conflicts to result from the increased presence of recreational fishermen and divers who have moved into the Shell Beach area following establishment of the Point Buchon MPAs. No such impacts have been noted to date.

Vandenberg SMR. Take of all living marine resources is prohibited in the Vandenberg SMR, except that which is incidental to Vandenberg AFB operations and to operations associated with the commercial space launch program (where such incidental take is deemed mission critical).

- ◆ ***Commercial*** – Participants in the region's nearshore rockfish and crab fisheries may no longer fish in the formerly productive nearshore areas from just south of Purisima Point to about two miles south of Point Arguello. Fishermen affected by the closure report that they have begun to fish along the outskirts of the MPA. One seasoned Avila-based fisherman is now fishing in the Point Sur area and in nearshore areas south of the SMR boundaries at Point Arguello. Seasoned participants in the crab fishery report that the closure has not reduced the total number of pots being deployed in the region. Rather, more pots are being set in smaller areas. One such area is in the small zone between

Purisima Point and the northern boundary of the SMR. The Vandenberg MPA could potentially affect the squid fishery in years when squid are present. Impacts are as yet unknown. This is also the case for the salmon fishery.

- ◆ ***Recreational*** – Rising fuel costs and closure of grounds around Vandenberg have led Avila-based charter operators who formerly fished south of Purisima Point to frequent the Point Sal area. This has also been the case for certain boat-based recreational anglers who have been displaced from Point Buchon and Cambria. The latter report additional fuel costs associated with travel to Point Sal. Given limited access due to AFB regulations, spear fishing in the waters now encompassed by the Vandenberg SMR has historically been minimal and thus no SMR-related impacts can be expected. There have been some reports of shoreline anglers ignoring the no-take restrictions.
- ◆ ***Non-consumptive*** – Base regulations have historically limited the activities of extractive divers, kayakers, and surfers in the area now encompassed by the Vandenberg SMR. Thus, no significant effects are anticipated for these user groups.

Conclusions and Recommendations for a Human Dimensions Monitoring Framework

Use of the marine environment along the Central Coast of California has long been conditioned by a wide range of physical and human environmental factors and processes. Major fisheries have been profoundly affected by El Nino-Southern Oscillation events and other oceanic regime shifts, cycles of abundance and scarcity of certain species, and changes in relationships between components of marine and terrestrial ecosystems.

Economic and social factors have also been significant. Changing fuel costs and seafood market prices, the rising costs of permits and licenses, new seafood marketing options and channels of distribution, and the variable capacity of port-related infrastructure to serve the public have, for many years, affected the status of commercial and recreational user groups across the region. It should be noted here that gains and losses in the harvest sector can often lead to secondary economic effects in communities where numerous people are engaged in commercial fishing industries. Limited resources and the extensive geographic scope of the current project precluded in-depth research of such effects. This study was focused rather on documentation of the historic background of and contemporary conditions affecting socioeconomic aspects of the Central Coast harvest sector, and on generating a preliminary accounting of the fisheries-specific effects of the new reserves.

The regulatory environment has had profound effects on marine resource user groups along the Central Coast. We reiterate that, for participants in the commercial fishing fleets, many of the observed changes in recent decades are in large part the outcome of a long series of government-established resource management programs and policies. These have continually led to a reordering of relationships between persons in the harvest sector and the natural resources upon which they depend and upon which they exert pressure; and between persons in the harvest and distribution sectors and their home communities. In the case of many fisheries, the effects of

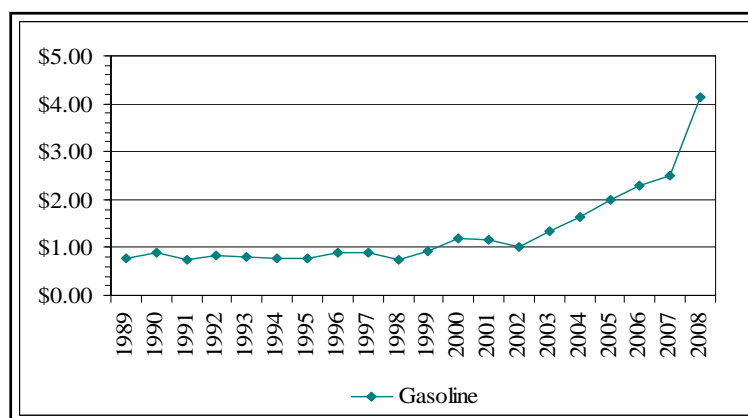
limited entry programs, conservation zones, quotas, size and bag limits, and pre-existing marine sanctuaries have preceded and supersede the initial effects of the new network of MPAs.

Changing socioeconomic and demographic conditions along the Central Coast are also important in this analysis. Growing populations and a shift toward tourism-based economies are now characteristic of the region's coastal zone, with implications for how waterfront and ocean spaces are envisioned, valued, and ultimately used. Such changes further relate to variability in popular ideas and the nature of debates about conservation and sustainable use of marine resources.

Many factors have conditioned the status of marine resources and their use over the course of time. Thus, an accurate assessment of the effects of any single source of change will require sufficient understanding and documentation of the historic and contemporary human context in which the new reserves were established. This was the goal and outcome of the project reviewed in this summary - to comprehensively document long-term changes in use of the marine environment, thereby providing the best possible point of reference against which future changes could be measured, including those associated with the new reserves.

Meaningful assessment of the new network of MPAs will also require ongoing *monitoring* of changes in the use of the marine environment, and of the larger context in which those uses occur. Indeed, the overarching human context has already undergone significant changes in the first year following formal establishment of the Central Coast MPAs. A global economic crisis has unfolded, national and regional fuel costs have risen sharply, and the perennially important California salmon fishery was closed due to poor returns of spawning fish. These and other factors will inevitably challenge future efforts to identify the specific human effects of the new MPAs, and to clearly determine the implications of MPA-induced human behavioral changes for the future status of the marine environment in and around the reserves.

But this is not to imply that human dimensions analysis should not be undertaken or that it cannot ultimately yield valid and useful results in this setting and at this juncture. Rather, it is a statement on the complexity of such analysis and recognition that such work is as important and challenging as that undertaken through any other discipline.



Trend Line for “at the Pump” California Fuel Prices

There are strong indications that as of 2008, the new MPAs were affecting marine fisheries and other uses of the marine environment throughout the study region. This is supported both by the reports of knowledgeable persons active in marine industries across the Central Coast, and by the ongoing observations of the study team.

The situation clearly calls for development of an effective strategy for monitoring and assessing the near- and long-term human and biological effects and implications of the new reserves. The table below, which draws from the findings of the current study, is presented as a resource for reviewers seeking to understand which variables and indicators may be useful for monitoring and assessing select human aspects of the new network of reserves and MPAs yet to be established elsewhere in the State of California.

Attention to an effective monitoring strategy and related indicators and variables is important for a variety of reasons. It is important because, in conjunction with rising fuel prices, a receding economy, and a limited amount of suitable fishing grounds, the new MPAs appear to be leading to the consolidation of fishing effort in certain locations. This issue is of direct and obvious relevance to those responsible for assessing the ecosystem-level biophysical and fisheries effects of the MPA-related closures in California.

Monitoring is also important for reasons that have to do with the status of persons who rely on the marine environment for their livelihoods and for purposes of recreation. Monitoring will enable resource managers to assess whether the reserves have contributed to the downward trend of participation in the region's commercial fisheries and associated changes in the harvest and distribution sectors, and/or to new opportunities in commercial, recreational, or other sectors of the coastal economy. The capacity to monitor and analyze such changes is fundamental to the success of the MLPA, and to those whose decisions would ultimately prioritize conservation of marine resources, sustainable use of the marine environment, or a well-balanced and well-planned combination of the two.

Indicators, Implications, and Variables: Toward a Human Dimensions Monitoring Framework for the Central Coast MPAs

| MPA Effect | General Indicators | Human Implications | Potential Monitoring Variables ¹ |
|--|--|---|---|
| Displacement of Individuals in the Commercial Harvest Sector | Concentrated and/or mixed use of marine environment, crowding around MPA boundaries, crowded staging areas | Social and social psychological: potential for spatial and/or political and ideological conflicts | Number and type of conflicts between individuals in various user groups; Level of ease of access to ocean; Perspectives and experiences reported in public venues/other points of interaction between government representatives and the affected polity |
| | Change in manner and/or extent of fishing along MPA boundaries | Economic: costs associated with increased possibility of fines; potential benefits where MPAs improve fishing in adjacent areas | Number/nature of MPA regulatory violations; Manner and extent of fishing near MPAs; Trip ticket/landings data where such data can be confidently attributed to specific locations |
| | Exploration and/or use of new fishing grounds | Economic: increased costs associated with travel; potential benefits from increased and/or more profitable landings; Safety: liabilities associated with more time at sea, increased possibility of exposure to dangerous conditions | Costs of fuel per trip; Cost of outfitting vessel to meet safety requirements for longer/more distant trips; Volume of landings attributable to species areas and ex-vessel revenue associated with those landings; Rates of morbidity and mortality at sea |
| | Movement of captains and/or crew to new ports in and out of region and state | Economic: costs associated with setting up operations in new location; potential benefits associated with success therein; Social: challenges associated with adaptation to configuration of fisheries in new area | Numbers and types of fishing operations based at various ports; Nature and extent of sales and leasing activity associated with the commercial fishing industry at those ports; Changes in landings and revenue attributable to specific ports and fleets |
| | Change in overall level of participation in commercial harvest sector | Social: costs associated with loss of or diminished involvement in fishing lifestyle; Economic: costs associated with diminished participation in profitable fisheries, benefits when departure leads to economic gain | Berth vacancy rates; Number of abandoned vessels; Number of vessel registrants; Number of active commercial permits; No. of harvesters engaging in land-based or alternative fishing employment (e.g., sport guides); Individual/collective ratio of full-time/part-time involvement in commercial fishing industry |
| Changes in the Commercial Fisheries Distribution and Support Sectors | Change in number and/or nature of dominant and niche seafood markets | Economic: costs and benefits associated with reduced availability of some species and increased availability of others; benefits to owners of businesses who successfully develop new markets, costs to those experiencing reduced availability of profitable mainstay products | Degree of availability and ex-vessel/market prices for mainstay and new seafood products; Number/type of wholesale and retail seafood businesses; Number of employees; Gross and ¹² net revenue |
| | Change in industries supporting harvest and distribution sectors | Economic: benefits to businesses providing gear and distribution/support services for new fisheries, potential costs to those providing gear and distribution/support services for prohibited fisheries | Degree of availability of , and ex-vessel/market prices for mainstay and new seafood products; Change in number of wholesale and retail seafood businesses and type of seafood offered; Change in fishery-specific rates and kinds of employment |

¹² A variety of methods would be required to implement long-term monitoring of the variables provided here. These include primary source interview research, direct observation, and use of various forms of information collected through existing data collection programs. A comprehensive monitoring framework would include detailed description of methods needed to gather and analyze these data while controlling for potentially intervening factors and variables.

| MPA Effect | General Indicators | Human Implications | Potential Monitoring Variables |
|---|---|---|--|
| Change in Recreational and Non-consumptive Uses of the Marine Environment | Change in manner and/or extent of use of MPA areas | Experiential: benefits to persons experiencing aesthetic aspects of area; benefits to those experiencing less crowded conditions within MPA; Economic: costs to persons traveling greater distances to reach such areas | Frequency and manner of visitation to MPAs; Level of satisfaction with various experiences; Costs of travel to and use of area |
| | Change in manner and/or level of activity in marine recreational sector | Economic: benefits to business owners providing services & materials useful for experiencing the MPAs | Nature and rate of services and goods provided; Revenue deriving from MPA-attributable sales and service |
| | Concentrated and/or mixed use of marine environment, crowding at sea or at specific staging areas | Social and social psychological: liabilities for persons experiencing conflicts and crowding at or around MPAs and staging areas; Economic: benefits to business owners such as charter operators; Generalized benefits to coastal businesses and municipalities serving tourism interests | Number, type, and rates of use of MPAs; Number and type of conflicts at sea and staging areas/points of access; Nature and rate of services and goods provided, revenue associated with goods and services to facilitate high or mixed use of MPA |
| | Competition among businesses engaged in marine recreation and/or related tourism services | Economic: benefits to successful businesses; costs to failed businesses | Number of new businesses and services; Number of failed businesses; Services offered and associated revenue; Level of satisfaction with enterprise |
| Confusion Regarding New Regulations | Violation of MPA rules | Economic: costs of citations resulting from inadvertent or intentional violation of MPA rules; Social psychological: Increased frustration resulting from inadvertent violations | Number and type of MPA regulatory violations; Nature of reaction to citations for inadvertent violations; Rate of use of MPAs over time; Extent of buffer practiced around MPA boundaries |
| | Captains following captains (e.g., inexperienced following experienced) | Social psychological: liabilities associated with inter- or intra-fleet conflicts; Economic: costs associated with inadvertent or intentional violation of MPA rules | Manner and rate of conflicts between those using MPAs; Nature, rate, and rationale of violations; Cost of violations |
| | Failure of recreational groups to engage in allowable uses | Experiential/Dietary: loss of potential benefits of using MPAs | Frequency and manner of visitation to MPAs; Rate of and rationale for avoiding MPA areas |
| Change in Status of Living Marine Resources in/around MPAs | Change in catch levels in areas adjacent to MPAs | Economic: Assuming sustained improvement, benefits to commercial and recreational participants and generalized benefits to ports and municipalities; Assuming no or negative effects on resources, status quo or diminished benefits; Social: Assuming sustained improvement, bolstering of commercial fishing as a viable way of life; enhanced social experience for visiting recreational anglers; Assuming no or negative effects, status quo or diminished lifestyle and recreational experience | Commercial landings and revenue for individuals and fleets; Revenue generated by fishing-specific support businesses; Overall measures of economic growth or change at harbors/ports/municipalities; Level of satisfaction with commercial and recreational fishing experience |
| | Change in level of receptivity to establishment of MPAs | Socio-political: assuming improvement, improved relations and trust between governance entities/ officials and affected polity; assuming no or negative effects, status quo or diminished trust & nature of relations | Perspectives and experiences reported in public venues and other points and places of interaction between government representatives and the affected polity |

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