California Marine Life Protection Act (MLPA) Initiative

Regional Profile of the Central Coast Study Region (Pigeon Point to Point Conception, CA)

DRAFT

June 30, 2005 (v.1.0)

Comments on this draft should be addressed to MLPA staff via email to ccrsgcomments@resources.ca.gov, by July 15, 2005. Comments should be as specific as possible and, when appropriate, reference the page or section that the comment applies to.

INSIDE COVER MEMO:

This Draft Regional Profile of the Central Coast Study Region (Pigeon Point to Point Conception, CA) is a ***work in progress***. In addition to this document, the Regional Profile includes spatial data layers posted on the MLPA Internet Mapping Service site (http://maps.msi.ucsb.edu/mlpa), technical appendices, and a bibliography.

This Draft will be revised and updated based on input from the Central Coast Regional Stakeholders Group and Science Advisory Team. The MLPA Initiative staff are also compiling and developing additional data layers and conducting GIS analyses. All of the spatial data layers will eventually be posted on the MLPA Internet Mapping Service site. In addition, new research contracts have been initiated to collect additional data. These include:

1. A refinement of selected commercial fishing data through interviews to apportion historic effort to microblocks (Ecotrust)
2. An assessment of non-consumptive use pattern along Central Coast (Chris LaFranchi)
3. Characterization of upwelling zones, retention areas, and freshwater plumes in the Central Coast based on satellite data (Bernardo Boitman, UCSB).

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Executive Summary

In 1999, the Governor of California signed the Marine Life Protection Act (MLPA) mandating a statewide network of marine protected areas (MPAs) by 2011. In August 2004 The California Resources Agency, California Department of Fish and Game (CDFG), and the Resource Legacy Fund Foundation launched the MLPA Initiative, a public-private partnership to begin implementation of the MLPA. The MLPA will be implemented through a series of regional processes throughout the state, beginning with the Central Coast study region. This study region extends from Pigeon Point (San Mateo County) south to Point Conception (Santa Barbara County), California.

The MLPA Central Coast Regional Profile provides background information on the biological, oceanographic, socioeconomic, and governance characteristics of the Central Coast study region. This profile consists of data and background information spanning a wide variety of disciplines and is intended to assist the Central Coast Regional Stakeholder Group (CCRSG) in developing regional goals and objectives, evaluating existing marine protected areas (MPA) within the central coast study region, and developing alternative proposals for MPAs. The Central Coast Regional Profile includes discussion on the following main topics:

- Regional Description
- Ecological Setting
- Land – Sea Interactions
- Socioeconomic Setting
- Planning & Management Issues
- Jurisdiction and Management
- Existing MPAs and Coastal Protected Areas
- Gap Analysis

The information is provided in the form of text summaries, tables, and selected maps (with links to other computer-accessible maps).

Introduction

In 1999 the Governor of California signed the Marine Life Protection Act (MLPA). The MLPA mandates establishment of a statewide network of marine protected areas (MPAs) by 2011 in accordance with the following goals:

- To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.
- To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.
- To improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.
- To protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value.
- To ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.
- To ensure that the state's MPAs are designed and managed, to the extent possible, as a network (CDFG, 2005).

In August 2004, the California Resources Agency, California Department of Fish and Game (CDFG), and the Resource Legacy Fund Foundation came together to sign a Memorandum of Understanding and to launch the MLPA Initiative. To this end, the MLPA Blue Ribbon Task Force, a Science Advisory Team (SAT), a statewide stakeholder advisory group, and MLPA Initiative staff were assembled.

Between August 2004 and December 2006 four key objectives must be achieved: (1) a draft master plan framework developed by the CDFG, (2) the development of alternative proposals for an MPA network in the Central Coast study region, (3) recommendations on funding sources for MPA implementation and management, and (4) recommendations to increase the coordination between state and federal agencies with the authority to manage marine resources (CDFG, 2005). The draft master plan framework is complete and being reviewed by the Fish and Game Commission. The process for the regional MPA planning has begun in the Central Coast study region. A Central Coast regional stakeholder group was assembled and convened their first meeting June 8 and 9, 2005 in Monterey. To facilitate the regional MPA planning process, this regional profile is being prepared.

The Marine Life Protection Act Central Coast Regional Profile provides background information on the biological, oceanographic, socioeconomic, and governance setting for the Central Coast study region. The Central Coast study region extends from Pigeon Point (San Mateo County) to Point Conception (Santa Barbara County), California. This profile consists of background information spanning a wide variety of disciplines and is intended to assist the Regional Stakeholder Group in developing regional goals and objectives, evaluating existing marine protected areas (MPA) within the central coast study region, and developing alternative proposals for MPAs. The information is provided in the form of text summaries, tables, and selected maps (with links to other computer-accessible maps).

Description of the Region

The Central Coast study region covers the state waters extending from a line due west of Pigeon Point to a line extending due west from Pt. Conception (see Map 1). The coastline covers a straight-line distance of 210 nautical miles (nmi), but is actually much longer due to the undulations of the coastal topography (over 300 nmi). In general, state waters extend from the high tide line 3 nmi seaward. However, in Monterey Bay, by definition, state waters extend 3 nmi seaward of a line from Pt. Santa

Cruz (Santa Cruz County) to Pt. Pinos (Monterey County). This line administratively defines Monterey Bay; in this area, state waters extend as far as 12.4 nmi from shore.

The study region encompasses approximately 866 square nautical miles and extends from the shoreline (mean high tide) to a maximum depth of approximately 1475 meters (806 fm) in Monterey Submarine Canyon. The study region includes a broad array of habitats from intertidal to continental shelf and slope and submarine canyons that bisect the continental margin. The edge of the continental shelf, where it transitions downward to become the continental slope is called the shelf-slope break and occurs at approximately 200m. The continental shelf varies in width in and adjacent to the study region from 0.8 nmi at its narrowest location to 24 nmi at its widest location (where it extends beyond state waters). State waters within the study region are dominated by shelf habitat (771 nm^2), with a lesser amount of slope habitat (88 nmi^2). A unique feature of the region is the presence of five large submarine canyons which extend into the near-shore, resulting in deep sea communities coming in close proximity to near-shore communities.

The Central Coast study region is a portion of the California Current large marine ecosystem. The California Current is considered globally important for biodiversity because of its high productivity and the large numbers of species it supports (WWF, 2000). The California Current has its origins in the Gulf of Alaska and flows southward along the West Coast toward the equator. It is one of four temperate upwelling zones in the world where seasonal winds blow surface water away from the coast, causing cold nutrient-rich water from deep in the ocean to upwell, or rise to the surface. The California Current is one of the most productive of these Eastern Boundary Currents and is characterized by seasonal upwelling of cold nutrient rich water, periodic El Niño - Southern Oscillation (ENSO) climatic events, and decadal climatic shifts (US GLOBEC, 1994). The waters are rich in nutrients that fuel highly productive and diverse ecosystems with large numbers of invertebrates, fish, seabirds, and marine mammals that are dependent on this seasonal abundance of prey resources.

The study region has several larger rivers (such as, Salinas, Santa Maria, Santa Ynez) and numerous small coastal streams. Monterey Bay, at 23 nmi across, is the largest embayment in the study region. Morro Bay and Elkhorn Slough are the largest estuaries in the study region.

The study region abuts five coastal California counties: San Mateo, Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara. The marine resources of the region support important commercial and recreational fisheries and many non-consumptive economic activities such as coastal tourism and recreation.

Ecological Setting

The study region includes a wide variety of ecosystems, habitats and species that are important for regional marine biodiversity, sustainable resource use, and natural heritage.

Ecosystem and Habitats

The MLPA requires that marine reserves in each bioregion encompass a representative variety of marine habitat types and communities, across a range of depths and environmental conditions (section 2857(c) of the MLPA). The MLPA specifically mentions the following habitat types in reference to their inclusion in a MPA system: rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, seamounts, kelp forests, submarine canyons, and seagrass beds. Seamounts are not found in state waters. The other seven habitats are found within the Central Coast study region. In addition, the Science Advisory Team (SAT) recommended considering specific depth zones, estuaries, upwelling areas, retention areas, and freshwater plumes from coastal rivers. Habitats are described below and have been mapped, to the extent possible, given readily available information (Map 2 and 3).

Depth Categories

Based on information about fish depth distributions in California (Allen et al, in press), the SAT has recommended considering habitats as they are represented in the following depth zones:

- Intertidal
- Intertidal to 30 m (0 to 16 fm)
- 30 to 100 m (16 to 55 fm)
- 100 to 200 m (55 to 109 fm)
- 200 m and deeper (109 fm and deeper)

Several of the seven habitats mentioned in the MLPA occur in only one depth zone, while others may occur in several depth zones. The extent and percentages of the subtidal depth ranges with the study region are as follows:

Table 1: Depth Zone as Percent of Central Coast Study Region

Depth Zone	Square nautical miles	Percentage of Study Region
Intertidal to 30 m (0 to 16 fm)	273.3	31.5%
30 to 100 m (16 to 55 fm)	435.6	50.3%
100 to 200 m (55 to 109 fm)	61.5	7.1%
200 m and deeper (109 fm and deeper)	95.9	11.1%

Bathymetric complexity is high in the northern half of the study region where the large submarine canyon complexes (Monterey Canyon, Soquel Canyon, Sur Canyon, and Partington Canyon) enter state waters. The continental shelf in the study region is relatively wide in the northern and southern ends and relatively narrow along the Big Sur coast. It is a narrow continental shelf and/or the presence of heads of large canyons in the near-shore results in the presence of deep water habitats in state waters.

Intertidal Zones

The shoreline represents a transition zone between the marine and terrestrial environments and includes many important ecosystems and communities, most of which are intertidal. Intertidal zones that have been mapped as linear features along the coastline include sandy beaches, rocky shores, tidal flats and coastal marsh along the shores of estuaries and lagoons, and man-made structures (see Maps 2a and 2b). Much of the intertidal zone extending approximately 40 miles from Cooper Pt. (just south of the Big Sur River), to Ragged Point (north of Piedras Blancas), is inaccessible from shore due to the presence of steep, rugged cliffs.

Rocky shore habitats and their associated ecological assemblages are found throughout the study area. Rocky intertidal communities, from the splash zone to the lower intertidal, vary in composition and structure with tidal height and wave exposure. Intertidal boulders, platforms, and cliffs, as well as tidepools, are home to many species of algae, barnacles, anemones, snails, mussels, crabs, starfish and fish. Mussel beds (*Mytilus* spp.), sea palm (*Postelsia palmaeformis*), and algal beds (*Endocladia* spp.) are patchily distributed along rocky shores but support high biodiversity. The following rocky shore types have been mapped in the Central Coast study region (see Table 2):

- ***Exposed rocky cliff***: Steep intertidal zone (greater than 30 degrees slope) with little width and little sediment accumulation. Strong vertical zonation of intertidal communities; barnacles, mussels, limpets, starfish, anemones, crabs, and macroalgae abundant.

- ***Exposed wave cut rocky platform***: includes flat rocky bench of variable width with irregular surface and tidepools. Shore may be backed by scarp or bluff with sediments or boulders at base. Some sediment accumulation in pools and crevices. May support rich tidepool and intertidal communities with algae, barnacles, snails, mussels, starfish, crabs, and polychaetes.

- ***Exposed wave-cut rocky platform with beach***: same as above, but with a beach either landward or seaward

- ***Sheltered rocky shore***: bedrock shores of variable slope (cliffs to ledges) that are sheltered from wave exposure. The intertidal community may include algae, mussels, barnacles, anemones, seastars, snails, and crabs. Sheltered rocky shores are very rare in central California; they are typically found inside bays or estuaries.

Significant expanses of continuous sandy shores areas occur along Monterey Bay, Estero Bay, and San Luis Obispo Bay, with shorter stretches of sandy beaches and pocket beaches along the Big Sur coast. Sandy beach communities are structured in large part by grain size, slope of the beach, and wave energy. Beaches are dynamic systems that change with wind and waves; generally sand is eroded from beaches in the winter and redeposited in the summer resulting in annual changes in beach slope and width. Barrier beaches and sand spits form at the mouths of larger rivers. Small pocket beaches occur where rocky cliffs are eroded along exposed coasts. Rivers deposit sediments and create barrier beaches and sandspits, such as those at the Salinas, Pajaro, and Santa Maria river mouths.

A variety of invertebrates live in the sand and in wracks of decaying seaweed and other detritus on the sand surface. There are numerous species of shorebirds, such as sanderlings, marbled godwits, and willets, that feed at the waters edge. Snowy plovers and California least terns nest on sandy beaches and coastal dunes. Marine mammals haulout on isolated beaches. Sand dollars, worms, clams, crabs, surfperches, flatfishes, and other fishes live in the surf zone. The following beach types have been mapped as shoreline features:

- ***Gravel beach***: Beaches composed of sediments ranging from pebbles to boulders; often steep with wave-built berms. Attached algae, mussels, and barnacles on lower stable substrates.

- ***Mixed sand and gravel beach*****:** Moderately sloping beach with a mix of sand and gravel; may be zones of pure sand, pebbles or cobbles. Sand fraction may get transported offshore in winter. More stable substrates support algae, mussels, and barnacles.

- ***Coarse-grained sand beach***: Moderate-to-steep beach of variable width, with soft sediments. Typically at river mouths. May be backed by dunes or cliffs. Fauna scarce.

- ***Fine to medium-grained sand beach*****:** Flat, wide, and hard-packed beach; significant seasonal changes in width and slope. Upper beach fauna scarce; lower beach fauna include *Emerita.*

Tidal flats and marshes occur primarily around the edges of bays and estuaries (e.g. Elkhorn Slough and Morro Bay). Tidal flats are sandy or muddy expanses that are exposed at low tides and provide important foraging ground for shorebirds due to the abundance of invertebrates such as clams, snails, crabs, and worms. High densities of sandpipers, willets, yellowlegs, and avocets can be found on tidal

flats at low tide. Herons and egrets also forage at the waters edge. At high tide, tidal flats become important foraging habitat for estuarine fish (sculpins, sanddabs, halibut, leopard sharks). Coastal marshes support high levels of productivity and provide habitat for many species. Marshes also regulate the amount of fresh water, nutrient, and sediment inputs into the estuaries and play an important role in estuarine water quality. The position of salt marshes along estuarine margins and their dense stands of persistent plants also make them essential for stabilizing shorelines and for storing floodwaters during coastal storms. Vegetation patterns and dominant species in coastal brackish marshes vary with the salinity regime which is defined by precipitation patterns and changes in freshwater inputs. The following shoreline types have been mapped as linear features of the coastline:

- ***Coastal marsh***: Coastal marshes are intertidal wetlands that have emergent vegetation; this category includes salt marsh and brackish marsh. The width of marsh varies from a narrow fringe to extensive areas and provides important habitat for a variety of species.

- ***Exposed tidal flats***: includes intertidal flats composed of sand and mud; the presence of some wave exposure generally results in the presence of sand. Occurs in bays and lower sections of rivers. Sediments generally water saturated with the presence of infaunal community that attracts foraging shorebirds. Used as roosting site for birds and haulout site for marine mammals.

- ***Sheltered tidal flats***: includes intertidal flats comprised of silt and clay (eg. mudflats). Present in calm water habitats and sheltered from wave exposure; frequently bordered by marsh. Soft sediments support large populations of worms, clams, and snails; important foraging area for migrating shorebirds.

- ***Tidal flat / Marsh*****:** includes areas with both tidal flat (sheltered or exposed) and coastal marsh present.

Table 2 is a summary of the linear length and percentage of total shoreline, (371 nmi as measured by the shoreline lengths) for each shore type (including man-made seawall and riprap) in the study region.

Table 2: Summary of the Linear Length and Percentage of Total Shoreline

Shore Type	Length in Region (nmi)	Percentage of Total Shoreline in Region
Exposed Rocky Cliffs	51.4	13.9%
Exposed Wavecut Rocky Platform	76.7	20.7
Exposed Wavecut Rocky Platform with Beach	53.7	14.5
Sheltered Rocky Shore	0.5	0.1
Gravel Beach	14.2	3.8
Mixed Sand and Gravel Beach	10.6	2.9
Coarse-grained Sand Beach	21.1	5.7
Fine to Medium Grained Sand Beach	93.2	25.1
Coastal Marsh	16.1	4.3
Exposed Tidal Flats	3.0	0.8
Sheltered Tidal Flats	2.1	0.6
Tidal Flat/Marsh	15.2	4.1

Riprap	10.6	2.9
Seawall	2.4	0.7

Estuaries

Estuaries form at the mouths of rivers and streams where freshwater and saltwater meet; the salinity in estuaries and lagoons varies seasonally and over longer timeframes when the river mouths get closed by sand spits or other barriers. Generally salinities in Central Coast estuaries are around 25 parts per thousand due to relatively low freshwater inputs in the region. Lagoons are coastal water bodies that are cut off from the sea and generally have low freshwater inputs. California's estuaries contain open water and soft-bottom habitats, as well as habitats described elsewhere, such as coastal marsh, tidal flats, and eelgrass beds. The study region includes two relatively large permanent estuaries, Elkhorn Slough and Morro Bay, and many small estuaries or lagoons at the mouths of coastal rivers: San Lorenzo, Pajaro, Salinas, Carmel, Little Sur, Big Sur, Arroyo de la Cruz, Santa Ynez, and many others. The aerial extent of estuaries in the Central Coast study area totals 6.9 nmi2 (see Maps 2a and 2b).

Estuaries and lagoons are very productive coastal ecosystems that play a key role as nursery habitat for many coastal invertebrates and fish. Coastal bays and estuaries in the region (especially Monterey Bay / Elkhorn Slough, and Morro Bay) are an important part of the Pacific Flyway and host thousands of shorebirds and waterfowl on their migrations. Anadramous species such as salmonids, sturgeons, and lampreys must pass through estuaries on their migration pathways. Steelhead in Central Coast spend a significant part of their juvenile phase in coastal estuaries. Since estuaries and lagoons are important habitat linkages between marine, aquatic and terrestrial habitats, their condition is closely tied to the condition of the surrounding watershed. Estuaries provide critical ecosystem services such as filtering sediments and nutrients from the watershed, stabilizing shorelines, and providing flood and storm protection (Airamé et. al., 2003).

Elkhorn Slough is an estuary of very high species richness and habitat diversity. The combined marshes of Elkhorn and Moro Cojo Slough are the largest between San Francisco and Morro Bays at 4,182 acres (Elkhorn Slough Foundation, 2002). Elkhorn Slough is home to over 270 species of resident and migratory birds (Elkhorn Slough Foundation, 2002). Its communities include tidal canals, mudflats, salt and brackish marshes. The marsh provides important feeding and roosting habitat for a large populations and variety of migrant and resident birds, including two heron rookeries, a small breeding population of snowy plovers, nesting pairs of golden eagles, white-tailed kites, and other species of raptors. Elkhorn Slough also serves as an important fish nursery and functions as a filter and sponge for sediment and pollution from surrounding farms and other land uses and. This function is significant, because the mouth of Elkhorn Slough opens into the Monterey Submarine Canyon.

Morro Bay Estuary is one of the most pristine estuaries in California. It encompasses approximately 2300 acres of mudflats, open water habitat, and tidal wetlands (MBNEP, 2000). This estuary supports a unique ecosystem containing numerous plants and animals and habitats including open water and channels, subtidal and intertidal eelgrass, mudflats, coastal or tidal salt marsh, brackish marsh, freshwater marsh, and riparian woodland. These habitats support a number of sensitive status species. The role of the estuary as a fish nursery is significant. The eelgrass beds in Morro Bay are known as the largest and least impacted of any in central and southern California (MBNEP, 2000). These unique beds are productive and complex environments. The beds serve as spawning and nursery grounds for many species of fish, including English sole and California halibut. The density and diversity of benthic fauna are several times greater within the eelgrass beds than in other Morro Bay habitats (MBNEP, 2000). A vital community of epiphytic flora and fauna lives upon the substrate of thick foliage of the beds. The beds function as a filter, which decontaminates the bay's water by providing a microbial environment. Furthermore, the beds moderate current and wave action, improving the water clarity and

quality of the Bay by moderating suspended sediments and organic particles to settle. The Morro Bay estuary is the only significant eelgrass habitat available to the Black Brant in central and southern California.

Seagrass Beds

Seagrass habitats are very productive and biologically diverse. The most common type of seagrass in California is *Zostera*, or eelgrass, which grows under water in estuaries and in shallow coastal bays of the ecoregion. It is a flowering plant, not an alga, and occurs in dense beds. It helps prevent erosion and maintain stability near shore by anchoring sediment with its spreading rhizomes and slowing water flow. Eelgrass beds provide foraging, breeding, or nursery areas for invertebrates, fish, and birds.
Data on eelgrass distribution in Elkhorn Slough is not yet available. Total coverage of eelgrass beds in Morro Bay is approximately 0.8 nmi^2 (see Map 2b).
Surf grass (*Phyllospadix spp*.), a flowering plant, form beds in the low intertidal and shallow subtidal areas generally along the open coast. Surf grass has not yet been mapped for the Central Coast study region and the areal extent and distribution are not known.

Kelp Forests

Kelp forests (also called kelp beds) within the study region are formed by two predominant canopy-forming brown macro-algae species: giant kelp (*Macrocystis pyrifera*) and bull kelp (*Nereocystis lutkeana*). Kelp beds are persistent over time but exhibit marked seasonal and annual changes in the extent of the canopy, primarily due to winter storm activity and changing oceanographic conditions such as El Niño events. In 2003, there was 7.2 nmi^2 of kelp bed in the Central Coast study area (see Maps 2a and 2b).

Kelp forests are one of the most productive marine habitats along the coast of California and provide habitat and nursery areas for many species of fish and invertebrates. California's giant kelp forests are globally unique and significant. Kelp forests, dominated by giant kelp, occur from Baja California (Mexico) up through central California (approximately San Hill Bluff area near Davenport) in near-shore waters with hard substrate where the kelp can attach. North of Davenport, bull kelp (*Nereocystis luetkeana*) becomes the dominant kelp. These two types of kelp beds harbor distinct ecological assemblages. In many parts of the Central Coast, especially exposed areas, mixed beds of giant kelp and bull kelp are found. Kelp beds are characterized by a high degree of spatial and temporal variability. Studies have shown that distribution and abundance of kelp beds and successional processes are affected by climatic and oceanographic changes, as well as certain types of fisheries (Tegner et al 1997; Tegner and Dayton 2000).

Kelp beds are important habitat and feeding grounds for many species. Juveniles of many nearshore rockfish species, as well as juvenile bocaccio and yellowtail rockfish occur in the midwater kelp canopy; Juveniles and adults of many nearshore rockfish species, as well as cabezon, greenlings, lingcod, and many other species associate with bottom habitats in kelp forests (Airame et al 2003). The sea otter occurs throughout the study region and is considered a keystone species for its role in structuring kelp forest communities by preying on sea urchins and other macro invertebrates, including other herbivores

Kelp beds are found along much of the Central Coast study region where hard substrate is available and wave exposure is not too high. Extensive kelp beds are found around Point Sur and Point Lopez. The kelp forests in the study area have been well mapped at fine-scale resolution over four years (1989, 1999, 2002, and 2003); data from 2003 are shown in Figures 2a and 2b.

Sandy/Soft Bottoms

The continental shelf and slope environments include soft bottom habitats in areas that range from flat expanses to slopes to deep submarine canyons. Soft bottom habitats lack the structural complexity and relief of hard-bottom substrates and are generally dominated by bottom dwelling invertebrates and fish. Squid spawning grounds occur in many of the near-shore sandy bottoms of Central Coast study region; major spawning grounds occur in Monterey Bay and in the San Luis area.

Soft bottom habitats can be highly dynamic in nature as sediments shift due to wave action, bottom currents, and geological processes. Many parts of the Big Sur coast are erosional and landslides and slumps extend offshore in the nearshore waters. Many canyon heads are also alluvial in nature and dominated by shifting soft sediments.

Soft bottom habitats predominate over hard bottom habitats in all depth zones (Table 3, Maps 3a and 3b). Soft bottom habitats are home to diverse assemblages of invertebrates and numerous species of demersal fish. Soft-sediment communities reach their peak in diversity of invertebrate epifauna and infauna around 70-230 meters, especially in areas where the shelf is wide and riverine input is present (J.Oliver, pers.comm).

Table 3 shows hard and soft bottom habitats by depth zone in the study region (amounts are approximate based on Greene et al. 1999 coarse-scale California Continental Margin mapping data).

Table 3: Hard and Soft Bottom Habitats by Depth Zone in Study Region

Depth Zone	**Hard Substrate, nm^2 (% of depth zone area)**	**Soft Substrate nm^2 (% of depth zone area)**
0-30m	36.4 (14%)	227.0 (86%)
30-100m	16.9 (4%)	419.4 (96%)
100-200m	10.8 (17%)	51.5 (83%)
>200m	14.0 (14%)	82.9 (86%)
Total	78.1 (9%)	780.8 (91%)

Rocky Reefs

All hard bottom substrates are included as “rocky reefs” but the species that associate with hard substrates differ greatly by depth zone. Rocky substrates are much less common than soft substrates in the region at all depth zones (Table 3). Rocky reefs provide hard substrate to which kelp and other alga can attach in the nearshore (<30m depth). In addition, many invertebrates such as deep sea corals, sponges, and anemones require hard substrate for attachment and are found primarily on hard substrates in deeper waters. The structural complexity of rocky reefs provides habitat and protection for mobile invertebrates and fish.

The fauna of rocky reefs differs by depth zone, with different assemblages of rockfish and other species found in deeper zones than shallow. The ecological assemblages associated with rocky habitats can also be influenced by the type of rock (example, sedimentary versus granitic reefs). A unique natural feature of the Central Coast study region is an expanse of granitic outcrops in state waters from southern Monterey Bay (Pt. Pinos) to Point Sur (G. Greene, pers. comm.). The northern half of Monterey Bay to Pigeon Point is characterized by sandstone and shale beds. South of Pt. Sur, the Franciscan Complex dominates (greenstone, serpentinite, argillite, and greywacke).

Coarse-scale maps of hard and soft substrate are available for the entire study region (Map 3a and 3b); however, these data do not provide much detail, especially in near-shore waters. Fine-scale hydroacoustic mapping of the study region is fairly extensive in the area north of Pt. Sur, and several

areas south of there, such as in and adjacent to Big Creek State Marine Reserve, are well mapped. The multi-beam sidescan sonar maps reveal the greatest detail and show relief and rugosity for hard bottom substrates; these data are being compiled into a GIS layer that covers some portion of the northern half of the region. Rocky reefs within the study region are also well known to commercial and recreational fishermen, as well as other mariners and researchers. In areas not well mapped at a fine-scale resolution, nearshore rocky reefs can potentially be inferred by the presence of kelp beds and rocky shores.

Underwater Pinnacles

Pinnacles are vertical rocky features that are tens of meters in diameter and height, with a cone-shaped geometry. Pinnacles can be distinguished from large boulders by their geologic origin. Pinnacles are generally a product of in-place erosional processes acting on rocky outcrops, while boulders are the result of erosional processes in other locations and resulting movement of large rocks (G.Greene, pers.comm). Pinnacles are scattered in State waters along the entire Big Sur coast and can be important bathymetric features that attract fish and other species. Pinnacles have not been mapped, but will be provisionally identified using bathymetric data.

Submarine Canyons

Submarine canyon habitat is represented in several areas within the study region. The Monterey Submarine Canyon is the most prominent topographical feature in central California waters and a significant portion is contained within the study region, included a well-known extension to the north called Soquel Canyon. Carmel Canyon, extends seaward from the mouth of the Carmel River, and is a southern extension of the Monterey canyon complex. The upper reaches of Partington Canyon, approximately 12 miles south of Pt. Sur, bring deep water habitats close to shore along the Big Sur coast. Other canyons in the region include Sur Canyon, Lucia Canyon, and Arguello canyon. Canyons provide areas of high bathymetric complexity, bring deep water communities close to shore, and affect local and regional circulation patterns. The south side of Monterey Canyon is very productive because prey organisms migrate up from the canyon depths to feed and are transported by currents southward to be trapped in shallow shelf waters, where they are then preyed upon by fish, birds, and marine mammals (Airame et al 2003). In addition to the canyons themselves, the canyon heads that occur in near-shore water are considered areas of high biodiversity importance because of the presence of a steep elevation gradient, variation in benthic topography, and other factors that support biological richness. Canyon heads vary in their structure from steep rocky relief to flat alluvial forms. Steep and rocky canyon walls provide shelter for many species of benthic fishes, including rockfishes and thornyheads; sedimentary canyon heads provide habitat for species such as flatfishes (Airame et al 2003).

Oceanographic Habitats

The SAT recommended that habitat definitions in the MLPA be expanded to include oceanographic features that significantly affect productivity, ecological assemblages, and recruitment patterns. While highly complex and dynamic, some oceanographic features are relatively predictable or persistent and can be considered important habitat components for spatial planning of MPAs.

In Central California, the main currents are the southward flowing coldwater California Current which is located far offshore (90-130 miles off the shelf-slope break) and the subsurface northward flowing warmwater Davidson Current (just offshore of the shelf-slope break). The flow of the California Current is reduced in the winter and the Davidson Current becomes the dominant large current. These currents converge at Point Conception creating a major biogeographic boundary that many species cannot cross. North of Pt. Conception, the countercurrent may surface as a nearshore northward flowing current, especially in fall and winter. Ocean circulation patterns are affected by winds, ocean

temperatures and salinities, tides, coastal topography, and ocean bottom features (Airamé et. al., 2003).

The study region is characterized by three seasons driven largely by oceanographic conditions (Airamé et. al., 2003). The seasons are the upwelling season, wind relaxation period, and winter storm period (Table 4). Upwelling of cold nutrient rich waters occurs in early spring and summer and generally peaks in May and June; however, there is significant variability in upwelling between years and with latitude. Upwelling is also associated with coastal features, such as headlands, and bathymetric features such as the shelf-slope break and offshore banks.

Table 4: Oceanic Seasons in Central California

Oceanic Season	Typical Months	Characteristics
Upwelling season	March – August	Upwelling is variable in duration and intensity; generally upwelling episodes are sustained for 7-10 days
Wind relaxation	August – November	Winds are light and seas generally calm during the relaxation period.
Winter storms	November – March	Low pressure systems from Alaska generate southerly winds, large waves, and storms. The northward flow of the Davidson Current is enhanced during this season.

The California Current is also characterized by highly variable oceanographic conditions. The El Nino-Southern Oscillation (ENSO) is a large-scale change in atmospheric pressure, trade winds, and sea surface temperatures (SST) of the tropical Pacific that occurs every few years and has significant effects on the California Current System. During ENSO events, there is a reduction in upwelling of cold nutrient rich waters, increased onshore and northward flow, increased SST, and increased northward advection of warm subtropical waters. ENSO events generally result in a decline in zooplankton and reductions in productivity that can affect fish, seabird, and marine mammal populations. Longer term decadal and multi-decade climatic cycles also affect a wide variety of marine organisms. Changes in atmospheric circulation in the central and northern Pacific and other factors yet unknown result in shifts in mean SST every 20-30 years that have large-scale impacts on zooplankton and fish productivity throughout the region; the effects of these climatic regime shifts (called Pacific Decadal Oscillations) are just now being studied (Airamé et. al., 2003).

Oceanographic processes such as currents, water masses, and temperature influence marine biodiversity. Variation in factors such as water temperature, upwelling and currents determine areas of productivity where krill, squid, anchovy, seabirds, and marine mammals congregate in the pelagic ecosystem (Forney, 2000; Yen et. al., 2004). The importance of these processes and their predictability over time is leading to a greater emphasis on identifying persistent oceanographic features, such as upwelling areas, retention areas, and freshwater plumes as important influences on regional productivity, recruitment patterns, and the movement and distribution of many species. These features are very dynamic and therefore difficult to capture in a static map; probability maps of the likelihood of occurrence of three oceanographic features are being generated for the MLPA Central Coast region (maps not yet available):

- ***Upwelling zones***: The upwelling centers in the region (off of Davenport, Point Sur, and Point Conception) fuel the pelagic food web that is composed primarily of plankton, krill, squid, fish, seabirds and marine mammals. Upwelling is typically defined based on variation in sea surface temperature during the upwelling season (March – August). Upwelling often peaks around and

south of major headlands, resulting in sections of the coast being either upwelling dominated or in upwelling shadows. Large upwelling zones often result in the generation of offshore jets and squirts, where surface waters are carried tens to hundreds of kilometers offshore.

- ***Retention areas:*** Longshore coastal currents interact with headlands or other coastal features causing the formation of headland eddies or upwelling shadows on the lee side of headlands, especially where embayments occur. These eddies and upwelling shadows increase the retention (or reduce the dispersion) of planktonic organisms and areas where they occur are considered retention areas. Even small embayments in the lee of small headlands can be localized retention zones (Roughan et. al., in press; Wing et. al. 1998).

- ***River plumes:*** Estuarine water flowing out of larger coastal rivers is lighter and warmer than the continental shelf waters and is visible as a distinct plume. In the region, the coastal rivers and streams (especially larger rivers such as the Salinas, Santa Maria, etc.) introduce freshwater, sediment, nutrients, and pollutants into localized nearshore areas. These plumes reach their greatest extent during winter storm events. Satellite data on ocean color and turbidity is being used to map plume areas in the region (data not available yet).

Important Regional Species

A brief discussion of regional species likely to benefit from establishment of MPAs, species currently described as depleted or overfished, and species that receive special protections due to their legal status (protected, threatened, or endangered) is provided below.

Species likely to benefit from MPAs

The MLPA requires that all species likely to benefit from MPAs be identified. The identification of these species will contribute to the identification of habitat areas that will support achieving the goals of the MLPA. CDFG drafted a list of species and is working with the SAT to refine the list for the study region. Appendix I include the draft list of Central Coast species likely to benefit from MPAs.

Species occur on this list based on three criteria (a) if they occur in the Central Coast study region, (b) they are taken directly, or indirectly in commercial and/or recreational fisheries, and (c) based on the species life history, an MPA would be expected to increase the species abundance or spawning biomass, if the species is at a presently low abundance or abnormally low size frequency. While this list is a good start, it should be noted that there are other species that may benefit or even diminish from the establishment of an MPA.

Depleted and Overfished Species

In its second goal in Section 2853(b), the MLPA refers to the term “depleted” in reference to marine life populations. While there is no formal definition for this term as related to fisheries management, the CDFG applies this term to five species of abalone (red, pink, green, black, and white), all of which were previously harvested commercially, and links the cause of depletion to multiple factors, including commercial harvest, increased market demand, sport fishery expansion, an expanding population of sea otters, pollution of mainland habitat, disease, loss of kelp populations associated with El Niño events, and inadequate wild stock management (CDFG 2001). Specifically for red abalone, the term “depleted” only applies to that portion of the population south of San Francisco. Only red and black abalone occurs within the Central Coast study region, and their populations within the region remain at relatively low levels.

In addition to abalone, several other macro-invertebrate species (Dungeness crab, brown rock crab, red sea urchin, and Pismo clam) within the study region are also preferred prey of the sea otter. These species are not considered to be depleted. The otter's presence is a major factor in limiting recreational and/or commercial fisheries for them in this region. Along with abalone, it is unlikely that regional objectives, related to the enhancement or recovery of these invertebrate populations by the establishment of additional MPAs, would be achieved; however, MPAs would allow the comparison of the status of these stocks within and outside of fished areas and assist in the evaluation of traditional management measures.

Copper rockfish is considered a potential candidate for local depletion (CDFG 2001). This species occurs within the study region and is a good candidate for receiving additional protection through the establishment of MPAs.

Central coast coho and steelhead populations occurring within the Central Coast study region are listed under the federal Endangered Species Act: California Central Coast Coho, and steelhead. These species and runs all are of a highly migratory nature and are not logical candidates for species which would directly benefit from the establishment of marine MPAs; however, due to their dependence on healthy estuarine environments during juvenile stages, estuarine MPAs where runs persist may benefit these species.

The National Marine Fisheries Service has a formal definition for the term "overfished":
"any stock or stock complex whose size is sufficiently small that a change in management practices is required to achieve an appropriate level and rate of rebuilding"
(http://www.pcoucil.org/facts/acronyms.pdf). The term generally describes any stock or stock complex determined to be below its overfished/rebuilding threshold. The default proxy is generally 25% of its estimated unfished biomass; however, other scientifically valid values are also authorized."

There are eight groundfish species (lingcod and seven rockfishes) which the National Marine Fisheries Service has formally declared to be overfished. Seven of the eight species occur within the Central Coast study region:

- lingcod
- bocaccio
- canary rockfish
- cowcod
- darkblotched rockfish
- widow rockfish
- yelloweye rockfish

The eighth, Pacific Ocean perch, is uncommon within the study region. Based on their life history traits and habitat requirements, the first seven species would benefit from the establishment of MPAs, including MPAs in which the primary goal is not related to fishery management within the Central Coast study region, if appropriate habitats are protected.

The starry flounder population is "at extremely low levels" (CDFG 2001). This flatfish ranges widely in depth although it is usually found in shallow estuarine and coastal waters; it occurs within the Central Coast study region.

In summary, a short list of species within the Central Coast study region are considered to be overfished, depleted or a candidate for becoming depleted, or at extremely low population levels, and which may benefit from the establishment of MPAs, include lingcod, seven species of rockfishes

(bocaccio, canary, copper, cowcod, darkblotched, widow, and yelloweye), starry flounder, and red and black abalone.

Special Status Species

Many marine mammals and seabirds of the Central Coast region whose populations have declined receive special protections under the Endangered Species Act, Marine Mammal Protection Act, Migratory Bird Treaty Act, and other legal implements. Many of these species are also highly mobile. While it is not expected that state MPAs will directly affect the populations of wide-ranging species, the presence of an integrated network of MPAs along the coast can help to provide healthy ecosystems and habitats that support the full range of biodiversity, including declining populations of special status plants and animals. A list of special status species expected to occur in the region is provided in Appendix I. A brief description of selected species follows:

Sea otters: Historically, the sea otter, *Enhydra lutris*, ranged from Japan to Baja and numbered in the tens of thousands on the California coast; they were hunted almost to extinction until receiving protection in the early 1900s. There are currently around 2100 otters on the central California coast. Sea otters use many near-shore habitats, from estuaries to kelp forests and rocky habitats, along the coast. Mapped data on the density of otters in linear segments of the Central Coast have been compiled (NOAA, 2004).

Pinnipeds: Four species of pinnipeds have colonial rookeries or haulout sites in central California:

- ***California sea lion***: The California sea lion, *Zalophus californianus,* breeds in the Channel Islands but migrates as far north as British Columbia during the non-breeding season. They tend to feed in cool upwelling waters of the continental shelf.
- ***Steller sea lion***: Central California is the southern extent of the range of the Stellar sea lion, *Eumatopias jubatus*, also known as the Northern Sea Lion.
- ***Northern elephant seal***: The northern elephant seal, *Mirounga angustirostris*, was hunted almost to extinction by the late 1800s. Today there are breeding colonies at Ano Nuevo island, Point Ano Nuevo, Piedras Blancas, and Cape San Martin,
- ***Harbor seal***: Harbor seals, *Phoca vitulina*, are widely distributed in the coastal areas of the northern Pacific and northern Atlantic. While not colonial, they are gregarious while molting and resting and haul out in groups on sandbars and rock ledges along the Central Coast.

Cetaceans: The entire California coast is part of the annual gray whale migration route and gray whales and they can be observed from shore. Harbor porpoises and bottlenose dolphin are relatively common in nearshore waters. Several species of whales (blue, gray, humpback, and fin whales) can be seen in the Monterey Bay area and throughout the Central Coast study region.

Seabird colonies. The region supports a diverse assemblage of seabirds many of whom aggregate into colonies, especially during the breeding season. Prey resources are often abundant because of the high productivity of the California Current and there are numerous cliffs, offshore rocks and islands for roosting and nesting habitat. Millions of seabirds migrate through or breed in the region annually. Many populations of seabirds in the region are sensitive to changes in oceanographic conditions, with reproductive success and population size fluctuating with changes in food availability associated with warm and cold water events (Mills and Sydeman 2003; Ainley and Boekelheide 1990). Upwelling areas, persistent fronts, the shelf-slope break, and Monterey Bay are all important foraging areas for seabirds in the region. Some important breeding sites include Año Nuevo Island and Devils Slide Rock. Some seabird species with colonies in the Central Coast study region include common murres, pigeon guillemot, least tern, black oystercatcher, pelagic cormorant, and Brandts cormorant.

Land-Sea Interactions

The Central Coast study region has both terrestrial and marine biodiversity of global significance. Important land-sea interactions happen across variable time scales and wide geographic ranges and vary along the coastal region because they depend upon a unique combination of factors that include biotic factors, climate, human use, and ocean currents.

Watersheds bring freshwater and sediments to bays, estuaries, and the ocean. These riverine environments once supported large numbers of salmon, steelhead trout, and sturgeon. However, today due to degradation of watersheds and freshwater ecosystems and the presence of barriers to fish passage, many native anadromous fish stocks throughout California are in danger of extinction (Airamé et. al., 2003).

Estuaries and bays are particularly vulnerable to coastal development, pollution, introduction of invasive species, and commercial and recreational fishing for species that live in nearshore waters. Increases in sedimentation, diversion of freshwater, and channelization have impacted the conditions in salt marshes, brackish water and eelgrass meadows. Urban runoff transports bacteria, viruses, and toxins that can cause harmful algal blooms and reduced oxygen concentrations. Humans have modified and transformed about 90% of the wetlands in California by such activities as diking, mining, dredging, filling and reclamation (Airamé et. al., 2003). Wetlands along the Central Coast study region are small; however, they support millions of birds during migration and numerous marine species use embayments, lagoons, and estuaries as spawning and nursery grounds. Bat rays, leopard and smoothhound sharks, midshipman, Pacific herring, starry flounder, staghorn sculpin, several surf perches, jacksmelt, and topsmelt mate and bear their young in estuarine habitats. Healthy coastal wetlands are critical to the existence of organisms that depend on these habitats for survival. Two major estuaries in the Central Coast study region are Elkhorn Slough (National Estuarine Reserve) and Morro Bay (a National Estuary Program site).

Along the Central Coast strong land-sea interactions are minimal due to the Mediterranean climate and active tectonic coastline (Coastal Reserves Working Group, 2005). Furthermore, since the California current is such a nutrient rich upwelling zone, the contributions of nutrients from land use are almost insignificant relative to ocean-derived nutrients. There are four main classes of land-sea interaction to consider when examining the effects of land use on the marine ecosystems of Central California. They are:

- Watershed processes and the export of sediment and earthy materials to estuaries and the ocean (particularly persistent toxic chemicals and pathogens).
- Sediment input from coastal erosion, landslides, and disposal;
- Use of land and streams by marine-dependent species (e.g. sea lion haulouts, sea bird rookeries, anadromous fish); and,
- Socioeconomic interactions between land and sea at the coastal margin (e.g. beach closures or seasonal bans that may affect ecotourism and management of environments) (Coastal Reserves Working Group, 2005).

These four classes of land-sea interactions specifically affect nearshore and estuarine dependent species and habitats and marine species that spend some portion of their life cycle on land or freshwater (Coastal Reserves Working Group, 2005).

Ecological Linkages

Many of the ecosystems along the Central Coast study region are the most productive in the world. The structure and function of these communities depend upon complex biological and physical processes and interactions. Many of these species have ecological linkages within and between communities.

Competition amongst species and natural and human disturbances add further complexity to these interactions and linkages. Some examples of critical ecological linkages along the Central Coast study region are described below (from Airamé et. al., 2003);

- Anadromous fish, such as coho salmon (*Oncorhynchus kisutch*), chinook salmon (*O.tshawytscha*), steelhead trout (*O. mykis*), and sturgeon (*Acipenser* spp.) produce eggs and juveniles in fresh water. Then the juveniles pass through estuarine environments to mature at sea and return through the estuaries as adults to migrate upstream in coastal rivers for reproduction.
- Shorebirds and waterfowl, such as clapper rail, black rail, saltmarsh common yellowthroat, and saltmarsh song sparrow inhabit coastal lagoons, estuaries, and salt marshes. Large numbers of shorebirds are attracted to eelgrass beds where they feed on the eelgrass, fish and invertebrate eggs and young. Many bird species use salt marshes, shallow intertidal flats, and lagoons during their annual migrations. The estuaries and bays of coastal California are part of the Pacific Flyway, one of the four principal bird migration routes in North America.
- Marine Mammals, such as California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and harbor seals (*Phoca vitulina*), have many haulout sites and a few rookeries on secluded sand beaches or tidal flats in the region.
- Estuarine vegetation, such as macroalgal mats, composed primarily of *Ulva* and *Enteromorpha* spp., may be carried on tides or currents to the open ocean where they provide shelter and food for numerous organisms, notably juvenile fishes. Eventually, these mats may wash up on shore where they provide nutrients to sandy beach and rocky intertidal communities.
- Fish, such as sole, sablefish, hake, and rockfish, live as adults on the continental shelf and slope or in submarine canyons. They produce pelagic larvae that recruit to estuaries, bays, intertidal habitats, kelp forests, rock outcrops, and cobble fields. Many fishes, including Pacific herring, spawn in eelgrass beds, among other habitats. The structure of eelgrass beds provides protection from predation for juvenile invertebrates and fishes.

Coastal Watersheds & Landuse

The Central Coast study region extends for over 200 miles along the Californian coast. This region has large land and water area (see Table 5). The largest coastal watersheds of the region include: The Elkhorn Slough, and the Pajaro, Salinas, Carmel, Big Sur, Arroyo De La Cruz, Santa Maria, and Santa Ynes Rivers.

Table 5: Land and Water Areas of Central Coast Counties, 2000

County	Water area Square miles	Land area Square miles	Total area Square miles
Monterey	449.1	3,322.0	3,771.1
San Luis Obispo	311.2	3,304.3	3,615.5
San Mateo	291.9	449.1	741.0
Santa Barbara	1,052.1	2,737.0	3,789.1
Santa Cruz	161.9	445.2	607.1

USA Counties 2000 [on-line data file] / prepared by the California Digital Library, --Oakland, California: [producer and distributor], 2001. Generated by *Tegan Hoffmann*; using Counting California; <http://countingcalifornia.cdlib.org>

Agriculture is one of the largest industries in Monterey County and is vitality important the Santa Cruz, Santa Barbara, and San Luis Obispo. Three of the counties in the region have almost more than 50% of the land in farm land (see Table 6).

Table 6: Land in Farms as a Percent of Total Land

County	1992
Monterey	65
San Luis Obispo	63
San Mateo	20
Santa Barbara	48
Santa Cruz	19

USA Counties 1998 [on-line data file] / prepared by the California Digital Library, --Oakland, California: [producer and distributor], 2001. Generated by *Tegan Hoffmann* using Counting California; <http://countingcalifornia.cdlib.org>

Agricultural operations heavily impact both terrestrial and estuarine environments. Intensive cultivation in areas such as Salinas and Pajaro River Valley in Monterey and Santa Cruz Counties and the Morro Bay area in San Luis Obispo County has modified the landscape and hydrological systems, changed saltwater intrusion into freshwater aquifers, introduced intensive sedimentation into coastal streams and estuaries as well as toxic pollutants, ultimately altering and reducing biodiversity in the region (Weinstein).

Morro Bay Watershed and Elkhorn Slough are two watersheds that are integrating conservation planning and coastal ecosystem management. In Morro Bay, the Morro Bay Watershed National Monitoring Program and Morro Bay Comprehensive Conservation and Management Plan, and in Elkhorn Slough, Elkhorn Slough Watershed Conservation Plan, are working on improving land us practices and watershed protection and riparian restoration to improve the riverine and estuarine health.

Socioeconomic Setting

California's marine and coastal environments form part of the State's identity and support important economies that depend on healthy ocean resources. Socioeconomic conditions, affect marine resource use patterns, coastal livelihoods, and human activities. Socioeconomic issues need to be balanced with marine protection strategies. A brief overview of the demographics and economy in the region is provided as regional context.

Coastal Communities

Most of the population of California lives near the coast. Population growth trends in coastal counties will result in increasing pressure on and impacts to coastal and marine resources and habitats. San Luis Obispo County has the highest percent change in population growth (+29.3) among counties along the Central Coast study region. Population centers include the largely urbanized cities of Salinas, Santa Cruz, the Monterey Peninsula, and Santa Maria (see Table 7 and Table 8).

Table 7: Total Population, Population Change, and Projected Growth in Coastal Counties in the Central Coast

Coastal County	Total Population (2003)*	% Population change 1990-2000	% Projected population change 2000-2010
San Mateo	697,456	+ 10.5	+ 10.7
Santa Cruz	251,584	+ 12.9	+ 20.3
Monterey	414,449	+ 14.9	+ 20.7
San Luis Obispo	253,118	+ 15.1	+ 29.3

Santa Barbara	403,134	+ 9.9	+ 15.2

(Source: *US Census Bureau Quickfacts, quickfacts.census.gov; California Institute for County Government, www.cicg.org)

Table 8: 2003 Population of Major Cities in The Region

City	County	Population 2003
Santa Cruz	Santa Cruz	54,700
Scotts Valley	Santa Cruz	11,650
Watsonville	Santa Cruz	47,700
Monterey	Monterey	30,350
Salinas	Monterey	150,300
Seaside	Monterey	33,450
Atascadero	San Luis Obispo	27,400
El Paso de Robles	San Luis Obispo	26,850
San Luis Obispo	San Luis Obispo	44,350
Lompoc	Santa Barbara	41,850
Santa Maria	Santa Barbara	82,100

(Source: LMID, 2003)

Populations of all coastal counties are expected to grow, though at markedly different rates. Based on census data, populations in all coastal counties grew during the period between 1990 and 2000. All of the counties in the regional except Santa Cruz had rates of growth greater than 15% in that period (see table 9). Based on a demographic model that incorporates fertility, migration, and survival rates, population projections for the year 2050 indicates that Monterey county will have population changes of greater than 50% and San Luis Obispo county close to 40% (see Table 9). Rapid growth is occurring in the countries where the population density is the lowest (see Table 9).

Table 9: Population Density, Total Population, & Projected Population Growth For the Year 2050 (Department of Finance)

Counties	People Per Square Mile (2002)*	Total Population (2003)*	Projected Population 2050	% Projected Population Change 2000-2050
San Mateo	1574.7	697,456	826,342	16.3
Santa Cruz	445	251,584	293,350	14.2
Monterey	120	414,449	654,847	62.2
San Luis Obispo	74.7	253,118	343,548	38.3
Santa Barbara	574.1	403,134	481,840	20.2

(Source: *US Census Bureau Quickfacts, quickfacts.census.gov; State of California, Department of Finance, 2004. Population Projections by Race/Ethnicity, Gender and Age for California and Its Counties 2000-2050, Sacramento, California, May)

Monterey, San Luis Obispo, and Santa Barbara all have large land areas and much of this area is rural and still used for agricultural purposes (see Table 5 and Table 6). These three counties are also home to the major commercial harbors and ports (see Table 11).

The region is heavily dependent for revenue upon the service sector, primarily leisure and hospitality. Santa Barbara County has a growing manufacturing sector as does Santa Cruz County (see Table 10). Retail trade is a large sector for all of the counties. Monterey County is a national leader in agriculture.

Table 10: Earnings in Different Business Sectors by County (in thousands of dollars), 1994

County	Agriculture	Finance, Insurance, Real Estate	Manufacturing	Retail Trade	Service
Monterey	430,751	236,158	366,020	562,653	1,270,835
San Luis Obispo	49,833	108,363	192,926	376,614	680,119
San Mateo	69,504	1,181,605	1,820,373	1,485,821	4,822,109
Santa Barbara	143,067	304,104	829,350	689,980	2,177,625
Santa Cruz	32,348	124,635	534,087	421,180	1,001,166

USA Counties 1998 [on-line data file] / prepared by the California Digital Library, --Oakland, California: [producer and distributor], 2001. Generated by *Tegan Hoffmann* ; using Counting California; <http://countingcalifornia.cdlib.org>

San Mateo County

San Mateo County is the 13th most populated county in the state (see Table 9). Population density is high, particularly in the eastern half of the county. The coastal Santa Cruz Mountains divide the county, with the western, coastal side having more rural uses such as farming, game preserves, watersheds, parks, and undeveloped lands. Industry projections from 1999-2006, show that the three largest growth industries are service, retail trade, and manufacturing (LMID, 2003).

Santa Cruz County

Santa Cruz is the second smallest county in California with just 440 square miles of land (see table xx). The county expects population growth in the next few years at a growth rate of approximately 1.3 - 1.6% annually (LMID, 2003). Unemployment is higher in this county than other counties due to the seasonal variations of employment in the main industries agriculture, recreation, and tourism (LMID, 2003). Government, including federal, state, and local, is the largest area of growth at 17.6%. The service sector is expected to grow at 17.5%, between 1999-2006 and, retail trade is the third largest industry of growth. The southern part of the county incorporates more fertile lands of Pajaro Valley which is a productive agricultural community producing strawberries, raspberries, landscape plants, lettuce, and flowers among other crops. Between 1999-2001 there were three years of decline in agricultural industry, however 2002 increased by 8%. Watsonville is the major agricultural community in the region where many food processing firms are based.

Monterey County

Monterey County includes 100 miles of California's coast. The third-highest agricultural producing county in the state, Monterey is a national leader in and a rich agricultural center. Twenty-one percent of all people in the county are employed in agriculture. This is the largest industry in the county. The fishing industry remains significant in Seaside, Sand City, Monterey, and Moss Landing.

Population projections are high with demographers estimating that by 2020 the population will be close to 600,000 (LMID, 2003). Job growth will be mainly in services, government, and retail trade sectors (LMID, 2003). Unemployment in 2002 was 10.4 % where the average in California was 6.7%. Seasonal jobs in agriculture and tourism, the mainstay of the economy, create seasonal unemployment.

San Luis Obispo County

San Luis Obispo County has a small population compared with other counties in the region, but cities such as El Paso De Robles are growing rapidly at a rate of 4.3%. Unemployment was only 3.4% in 2002, compared with the state average of 6.7%. Tourism and education are the basis of the economy. The government is the largest employer in the county providing more than 23,000 jobs. Trade, transportation and utilities are and leisure and hospitality are the second and third largest industries. Natural resources, mining and construction, information, and other service are the fastest growing industries in the county. The county continues record job growth with the service sector expected to be grow almost 20% between 1999-2006.

Santa Barbara County

Government, trade, transportation and utilities, and leisure and hospitality are significant industries in the county. The largest employer is the government providing close to 20% of all employment due to the University of California Santa Barbara, federal prison, and Vandenburg Air Force Base. Services, retail trade, and government are the largest projected growth industries.

Commercial Fisheries

The Monterey port area includes the ports of Monterey, Moss Landing, and Santa Cruz. The Morro Bay port area includes the ports of Morro Bay, Port San Luis/Avila, and San Simeon (see Table 11).

Table 11: Northern California Commercial Harbor Area and Port (2002)

Area	Ports	Total Pounds of Fish	Total Value ($)
Monterey Bay	Moss Landing	80,794,721	$9,613,056
	Monterey	14,825,262	$3,084,849
	Santa Cruz	438,369	$615,336
	Mill Creek	9,629	$17,620
	All Other Ports	1,956	$3,759
	Monterey Bay Area Total	**96,069,937**	**$13,334,620**
Morro Bay	Morro Bay	1,651,562	$2,488,919
	Avila/Port San Luis	3,140,501	$1,856,848
	San Simeon	39,491	$66,240
	Morro Bay Area Total	**4,831,554**	**$4,412,007**

(Source: California CDFG, California Commercial Landings, 2002)

(CDFG's Preliminary California Commercial Landings for 2005, Table 15). There are 121 categories of fishes and 16 categories of invertebrates with landings in 2004 in the Monterey and/or Morro Bay port areas (the area encompassed by the Central Coast study region). This does not correspond exactly to the number of species landed because some of the categories are market categories containing multiple species. In addition the landings totals include some poundage from north or south of the study region's latitudinal boundaries. In summary, however, these statistics attest to the high value and diversity of fishery resources in waters off the Central Coast.

Brief profiles of the most important commercial fisheries within the Central Coast study region are included as Appendix II. Important commercial fisheries are defined as those fisheries with average

annual landings during the 1999-2004 period of at least 10,000 pounds or average annual ex-vessel value (base price paid to the fishermen) of at least $10,000 in one or both port areas. Some of the fisheries contain multiple species due to the nature of the fishing gear and the association of particular species; others target single species and, while other species may be taken incidentally, either their retention is prohibited or they are of little or no economic value.

Each fishery profile in Appendix II is organized into sections for the Monterey and Morro Bay port areas, and has the following information**:**

- Port area
- Fishery
- Species targeted
- 2004 preliminary landings and ex-vessel value
- 2003 landings and ex-vessel value
- 1999-2004 average landings and ex-vessel value
- Rank of average annual landings and annual value in port area 1999-2004
- General trend in annual landings 1999-2004
- Comments on the trend in landings
- Number of fishermen making landings in 2003 and/or 2004 in port area
- Primary gear type(s) used in the fishery
- Primary depth range in which the fishery occurs
- Primary habitat type(s) in which the fishery occurs
- Primary area of fishery (state waters and/or federal waters)
- Synopsis of regulations applicable to central coast study region

Within each port area, the fishery profiles are organized by descending order of 1999-2004 average annual landings. Some fishery profiles are not included in both port areas due to relatively few landings in one area. Profiles for the butterfish, jacksmelt and sardine/mackerel/anchovy fisheries are provided for the Monterey port area only. Profiles for the surfperch, ocean shrimp, and urchin fisheries are provided for the Morro Bay area only.

Four tables are also provided in the Appendix II which contain annual landings and ex-vessel values from 1999 through 2004 for all of the species or species groups described in the fishery profiles for the particular port area (See Appendix II). One pair of tables precedes each port area profile section. Figure 1-4 below summarize ex-vessel value of finfish and invertebrates. Monterey Bay total ex-vessel values are significantly higher than Morro Bay. Monterey Bay ex-vessel invertebrates values are highly variable due to squid catch.

Perhaps the most important aspect of commercial fisheries as related to the MLPA Initiative is the area in which each fishery occurs, more specifically the relative effort occurring in, and the relative value derived from, specific areas. Many of these spatially explicit data sets are being obtained by EcoTrust through direct interviews with fishermen and will be available in August 2005. The Department will provide spatially explicit data for the squid and trawl fisheries which occur within the study region, based on logbooks submitted by fishermen since the mid- to late-1990's. This information will be available as GIS data layers. The Department will also provide spatial information from 1997-98 by DFG catch block from logbook data for the spot prawn trawl fishery. Although this fishery operated primarily outside state waters and the use of spot prawn trawl gear is no longer permitted, this data set will provide some perspective on the extent of spot prawn habitat adjacent to state waters within the study region.

Some of the fisheries included in these profiles operate largely or entirely outside of state waters; these include the albacore and other tuna, swordfish, and shark fisheries. Spatially explicit data are not

available for these fisheries nor are these data specifically germane to the MLPA Initiative process. However, these fisheries are still important to the local economy within the study region.

Figure 1: Monterey Ex-vessel Value: Finfish

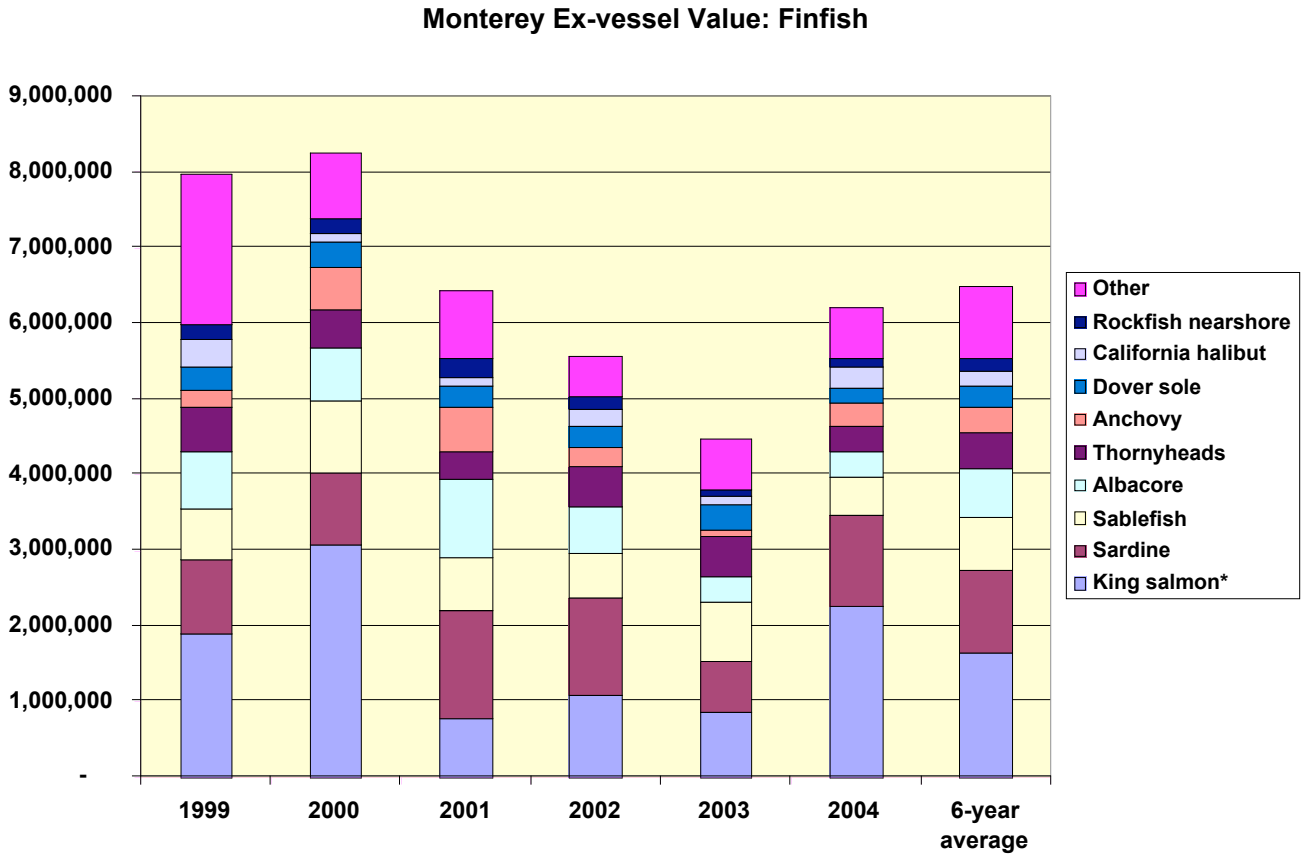


Figure2: Monterey Ex-Vessel Value: Invertebrates

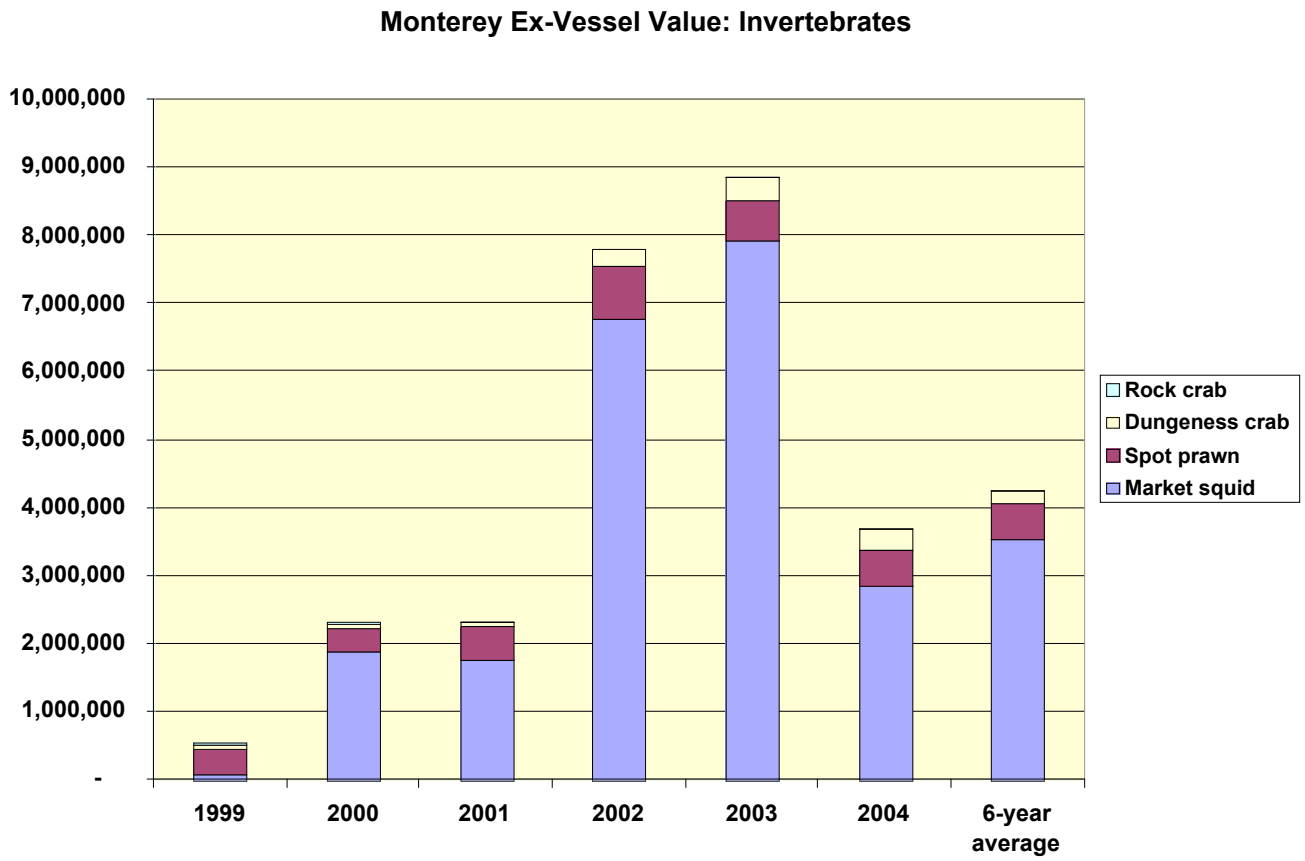


Figure 3: Morro Bay Ex-Vessel Value: Finfish

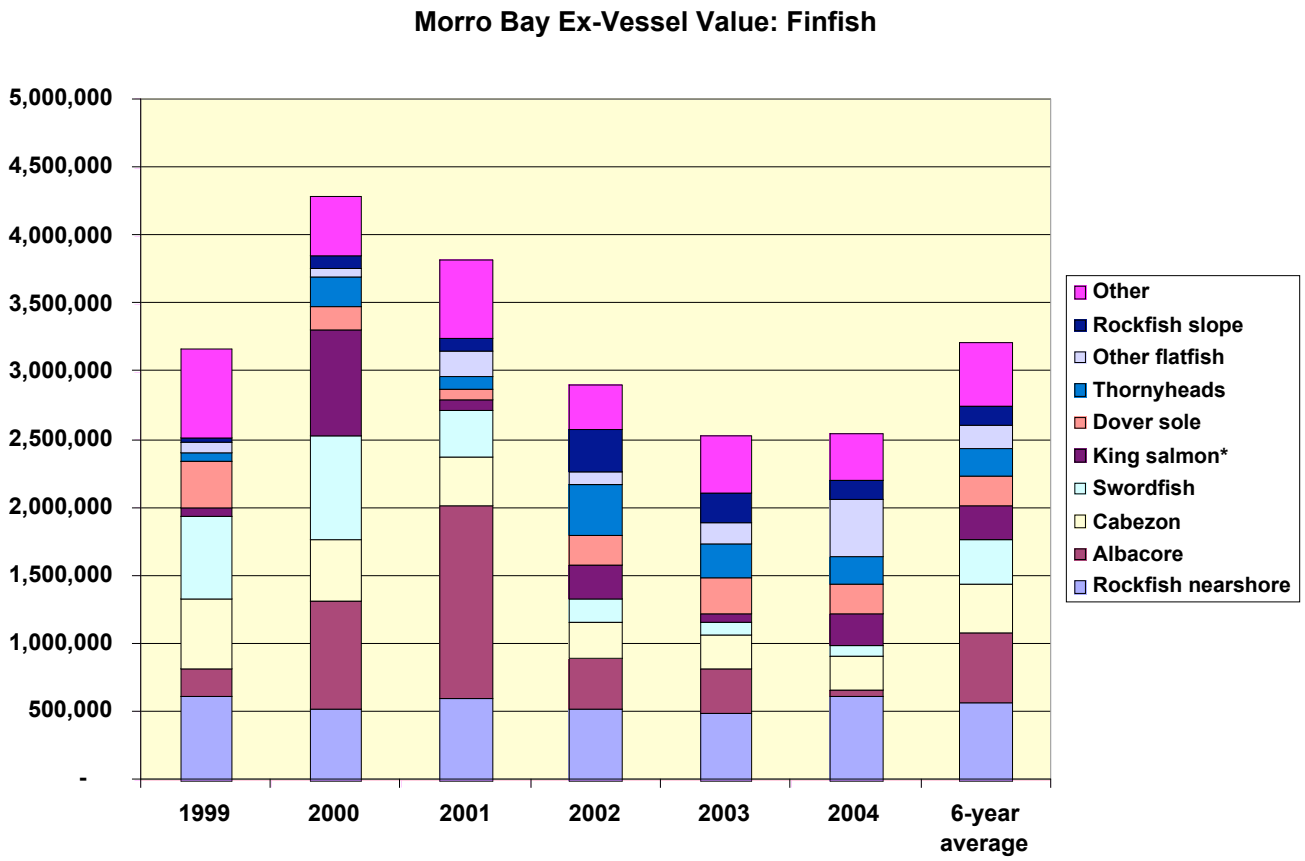
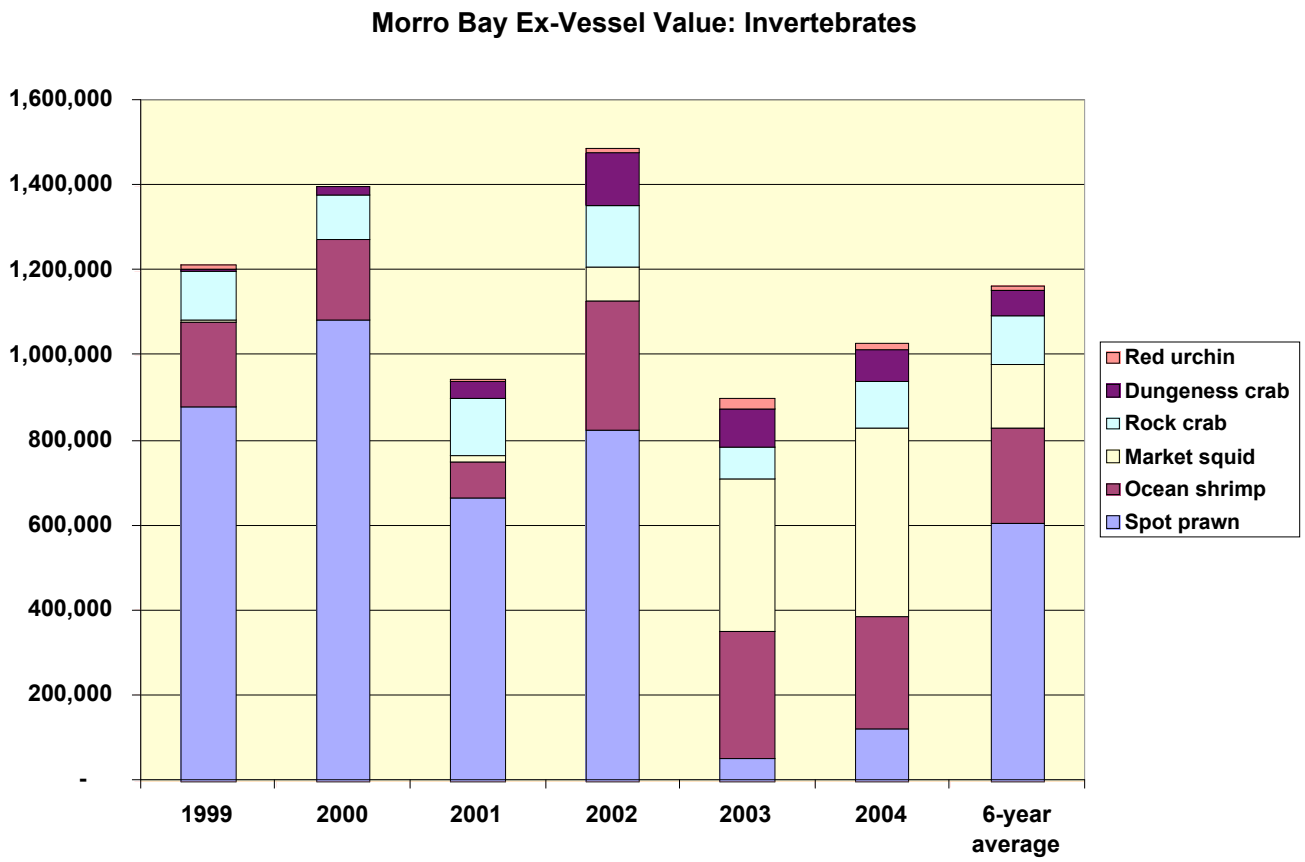


Figure 4: Morro Bay Ex-Vessel Value: Invertebrates



Recreational Fisheries

Recreational fishing occurs throughout the Central Coast study region. According to data provided by the Pacific States Marine Fisheries Commission (PSMFC), more than 150 species of finfishes were caught by recreational anglers in 2004 within the study region, although many of these were seen infrequently in sampled catches.

Annual estimates of total recreational fishing catch and effort are important statistics to state and federal fishery managers, as well as to the anglers themselves. In January 2004, California began an integrated recreational fishery sampling and assessment program called the California Recreational Fisheries Survey (CRFS). CRFS was implemented through the Recreational Fisheries Information Network program at PSMFC using federal funds from the National Marine Fisheries Service and state funds from the CDFG. This program represents an expansion and improvement within California of the previous national sampling program, the Marine Recreational Fisheries Statistics Survey. CRFS has combined the efforts of the department's Ocean Salmon Project with other modes of recreational finfish sampling, expanded the number of anglers contacted by samplers, and has provided a more accurate

telephone-based survey for estimating private boat angler effort from marinas or from night fishing (not sampled in the field by CRFS).

The distribution of recreational fishing effort varies by mode of fishing and availability of access. The CRFS program categorizes recreational fishing effort into four basic modes:

- Commercial passenger fishing vessels (CPFV)
- Private and rental skiffs
- Beach and bank
- Manmade structures

CPFVs, also called party boats, carry recreational anglers to ocean fishing locations for a fee and in general range farther from port. CPFVs operate out of the ports of Santa Cruz, Moss Landing, Monterey, Morro Bay, and Port San Luis. One CPFV operator in the Morro Bay area has the capacity to conduct multi-day trips; this increases accessibility to fishing areas more distant from port. CPFVs may carry up to 40-50 anglers, although a passenger load of 10-30 is more common; some small CPFVs are known as “six-packs” due to their reduced passenger-carrying ability.

Private and rental skiffs, with some exceptions, generally fish closer to port or launch ramp areas than CPFVs, although albacore anglers may travel considerable distances. The port areas for private and rental boats within the study region are the same as those for CPFVs, with the addition of the Capitola pier, Santa Cruz County, where rental boats are available, and a primitive small boat launch site at Leffingwell’s in Cambria, San Luis Obispo County. A rental boat facility is also available on the Santa Cruz Wharf.

Boat-based anglers and divers generally have a target species or species group in mind when they head out to fish, although some anglers or divers fish for whatever happens to be available in their region. Primary target species/species groups in this region are king salmon, rockfishes/lingcod/cabezon/kelp greenling, California halibut, sanddabs, and albacore.

The beach and bank mode consists of shore-based anglers but also includes divers or anglers entering the water in kayaks, royals, or on other floatation devices directly from the shore. Shore-based angling comprises the overwhelming majority of fishing effort in this mode. Primary target species/species groups in this region are surfperches, jacksmelt, and several nearshore rockfishes. Additional information will be needed from consumptive diver representatives to adequately characterize this subset of fishing effort within the central coast study region.

Manmade structures consist of piers, jetties and breakwaters; if these structures are public a fishing license is not required. Primary target species/species groups in this region are Pacific sardine, northern anchovy, jacksmelt, surfperches, white croaker, and several nearshore rockfishes.

One form of recreational fishing not sampled by the CRFS program is the charter consumptive dive industry. Within this study region only a few such boats operate; vessel owners are required to submit CDFG logbooks summarizing their activities.

Another subset of recreational fishing which occurs within the study region but which is not sampled by the CFRS program is competitive free-diving meets sponsored by the Central California Council of Divers (CenCal). Several sites within the study region are used on an approximately annual basis for these meets and several other sites have been used less frequently. Fortunately, the Department has monitored a high proportion of these dive meets since the late 1950’s, recording diver effort in hours, species composition, and length frequency of retained fishes. The species composition and length

frequency are influenced by meet regulations which have changed over time, thus the data may not be comparable to that of more random spearfishing by divers or by hook-and-line fishing. However, the data do provide a long-term index of relative abundance of the primary target species in specific locations.

Each of the four basic regional profiles of recreational fishing (Appendix III) is organized as follows:

- Port area
- Fishing mode
- Species targeted
- Estimated number of fishing trips in 2004 in study region by target species
- 2004 estimated catch (number of fish)
- 2004 estimated catch (weight of fish)
- Comments
- Primary depth range in which fishing occurs
- Primary habitat type(s) in which the fishery occurs
- Primary area of fishery (state waters and/or federal waters)
- Synopsis of regulations applicable to central coast study region

Spatially explicit data on fishing recreational effort will be provided from three primary sources:

1. For CPFV fishing targeting rockfish and lingcod, the Department has compiled effort data (number of sampled trips by microblock), over an 11-year period from an onboard observer program. This will provide an estimate of the relative amount of fishing effort in discrete locations, which is in turn an estimate of the relative value of particular locations to the CPFV industry. The data will be available as a series of maps panning the central coast study region, with relative effort indicated by different colors. This data base will contain estimates of overall average catch per hour of the most frequently observed species in each microblock. While more recent spatially explicit data is available from the 2004 CRFS program, these data are depth-limited due to more restrictive fishing regulations; thus the historic data set provides a more compete picture of species distribution in a large percentage of hard bottom habitat within the study region.

2. For private and rental boat recreational fishing, the Department has compiled spatially-explicit data from 2004, the first year of the CRFS program. While these data are depth-limited in scope for bottom-oriented fishes due to regulations, they are the only data available with this degree of resolution for private and rental boat fishing. These data will also be presented on microblock maps with colors representing the total number of sampled trips to each microblock. A composite is presented with all targeted trips combined, and separate map sets will be available for the following target groups: king salmon, rockfish/lingcod, California halibut, sanddabs, and albacore (see Map 4). It is important to note that these data include fishing trips in which no catch occurred. The microblocks compiled in this data set are those reported by the fishermen to the samplers.

3. Beach and bank fishing locations will be depicted on maps as predetermined sampling areas by the CRFS program, with the shoreline color-coded by relative angler effort (average number of anglers encountered per sampling day).

4. On the same maps, manmade structures used for fishing will be identified.

5. Fishing effort data from divers will be provided from three primary sources:

a. the 2004 CRFS program, which included interviews of divers in private and rental boats;
b. Department- monitored Central California Council of Divers free-diving meets;
c. consumptive diver representatives on the Regional Stakeholder Group.

Non-consumptive Uses

An important non-consumptive use of marine resources is marine recreation. Recreational activities along the Central Coast study region include recreational boating, diving, sightseeing, hiking, surfing kayaking, whale watching, beachgoing, and tidepooling.

Recreational boating with motor-powered, sail-powered, and hand-powered vessels occurs throughout the region, but with higher density around major harbors (Weinstein). In the Central Coast study region, the number of registered boats has increased and will continue to increase (see Table 12 and 13).

Table 12: Historical Boat Population and Trends, California by Region, 1985 to 2000

	1985	1990	1995	2000
Central Coast	20,225	24,438	27,268	30,617

(Source: Department of Boating and Waterways, 2002)

Table 13: Forecasts of Total Boats by Region of Owner's Residence, 2000 to 2020

	2000	2005	2010	2015	2020
Central Coast	30,617	35,196	40,089	45,150	51,009

(Source: Department of Boating and Waterways, 2002)

Recreational diving is growing in the Central Coast. The Monterey Bay area is a world-class diving destination and an estimated 70% of all dives that occur in the region occur in Monterey Bay (Guerrero and Kvitek, 1996). Aside from Monterye Bay, other important dive spots include Point Lobos State Marine Reserve, Carmel Bay State Marine Conservation Area, and Julia Pfeiffer Burns State Marine Conservation Area. (Weinstein). Growth of the sector in the region was estimated at 10-20% in the 1980s and 5-7% in the 1990s (Weinstein). Revenue from diving and snorkeling in 1988 was $13.2 million in San Mateo, Santa Cruz, and Monterey counties (Meyers Resources, 1990).

The Central Coast study region is one of the most popular surf spots in the world. Approximately 1.6 million surfers live in the region surfing at popular spots along the coast (Weinstein).

Ecotourism such as kayaking, whalewatching and nature observation have all increased in popularity (Weinstein).

Coastal Tourism

California is the most visited state in America. Travel and tourism is the fourth largest industry and employer in California. In 2003 total travel and tourism expenditures were $78.2 billion, and provided jobs for 894,000 Californians (CTTC, 2004). Californians love to travel around California and are the mainstay of the state's travel and leisure industry accounting for 86% of all visitors (CTTC, 2004).

The Central Coast is a popular destination with some of the top 10 most visited sites in the state, such as Monterey Bay Aquarium with close to 1.7 million visitors, Santa Cruz beach Boardwalk with 3 million visitors, and Morro Bay State Park with 1.5 million visitors in 2003 (CTTC, 2004). Tourism and recreation are important economic drivers in Central Coast counties. San Mateo and Monterey counties generated roughly $2 billion in travel expenditures and 20,000-30,000 jobs.

Table 14: 2003 Tourism Economies in Central Californian Counties

	Travel Expenditures ($ millions)	Earnings ($ millions)	Employment (# jobs)	Local Tax ($ millions)	State Tax ($ millions)
San Mateo	2,025	1694	34,320	53	117
Santa Cruz	531	163	7,860	12	22
Monterey	1,844	787	22,210	52	75
San Luis Obispo	931	319	16,460	22	39
Santa Barbara	1,219	404	15,310	36	52

(Source: *Dean Runyan and Associates. 2004. California Travel Impacts by County, 1992-2003, 2004 Preliminary State Estimates California)

Recreational boat use and sport diving have increased in the Central Coast over the last 2 decades. The number of registered boats increased by more than 50% in the state between 1978 and 1991; jet skis (also known as motorized personal watercraft) comprise 11% of all registered recreational vessels in 1994 (Guerrero and Kvitek 1996). The popularity of non-motorized craft such as kayaks has also increased in most coastal waters.

The Central Coast attracts naturalists and lovers of nature from all over the world to birdwatch, whalewatch, tidepool walk, and hike the magnificent coastal environments. The region hosts many coastal state and federal parks that each draws thousands of visitors a year including Pffeifer-Big Sur State Park, Elkhorn Slough National Estuarine Reserve, Ano Nuevo State Reserve, and Big Basin Redwoods State Park (see Table 15). In addition, there are other state parks, state beaches, state marine reserves, and state marine conservation areas.

Table 15: Park Attendance in Selected Coastal Parks & Marine Attractions

Park	**County**	**# visitors (2003)**
Salinas River State Beach	Monterey	505,221
Monterey Bay Aquarium	Monterey	1,678,929
Point Lobos State Reserve	Monterey	285,032
Pfeiffer Big Sur State Park	Monterey	379,562
Morro Bay State Park	San Luis Obispo	1,515,506
Hearst Castle	San Luis Obispo	767,816

(Source: California Travel and Tourism Commission – Fast Facts 2004; http://visitcalifornia.com)

Research & Education

Major Institutions in the Study Region

The physical setting and regional marine biodiversity make the Central Coast study region, and particularly Monterey Bay and Monterey Canyon, as a world center for marine research and education. There are 18 marine laboratories and education centers just around Monterey Bay and they are large employers for the region (Weinstein). Major institutions include: California State University at Monterey Bay, Hopkins Marine Station of Stanford University, Monterey Bay Area Research Institute, and University of California at Santa Cruz Center for Ocean Health, Monterey Bay Aquarium, and Center for Coastal Marine Science of Cal Poly San Luis Obispo.

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Scientific Research and Collecting

Major marine monitoring programs in the region include Cooperative Research and Assessment of Nearshore Ecosystems,(CRANE), Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), Central California Ocean Observing System (CEENOS), and Center for Integrative Coastal Observation, Research and Education (CI-CORE).

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Public Education and Outreach

Local, state, and federal agencies throughout the region sponsor public outreach activities and campaigns, such as Volunteer Monitoring Programs with a strong focus on water quality. These include the State Water Resources Control Board, the Elkhorn Slough National Estuarine Research Reserve, the Monterey Bay National Marine Sanctuary, and the Morro Bay National Estuary Program. The Monterey Bay Aquarium provides public education on a variety of marine issues relevant to the central coast.

Aquaculture and Kelp Harvesting

Within the Central Coast study region there are four marine aquaculture operations, one in Cayucos, (San Luis Obispo County), two in Monterey, and one in Davenport, (Santa Cruz County), that culture red abalone (*Haliotis rufescens*). The primary source of food for these abalone is giant kelp (*Macrocystis pyrifera*). All of the kelp is harvested from beds within the study region. In addition, one abalone aquaculturist in Goleta, Santa Barbara County, and one at Pillar Point harbor, San Mateo County, harvest kelp from beds within the study region. Oysters are cultured in Morro Bay.

Administrative kelp bed areas in California waters are numbered from north to south (see Title 14 California Code of Regulations Section 165.5 (j)(1)), are defined by compass bearings from known landmarks, and applicable commercial regulations pertain to the harvest of giant kelp or bull kelp (*Nereocystis lutkeana*) only. The entire coastline, including southern offshore islands, is numbered although not all areas contain kelp beds. The administrative kelp beds are classified as closed, leasable, leased (to the state), or open. Closed beds may not be harvested. Leased beds provide the exclusive privilege of harvesting to the lessee. Open beds may be harvested by anyone with a kelp harvesting license.

There are 25 administratively numbered kelp beds within the study region; one of these (Pt. Sal to Pismo Beach Pier) has no kelp. Three of these beds are closed, six are leasable, six are leased, and 10 are open. Kelp harvesting by aquaculturists presently occurs in three leased beds between Pismo Beach and Cambria and three open beds from Cypress Pt, Monterey County, to Pt. Año Nuevo. Harvesting in beds 204, 207, and 208 is accomplished using a mechanical harvester; harvesting in other beds is done by hand. Approximately 3,600 tons of kelp are harvested annually as follows:

Table 16: Kelp Bed Location and Annual Harvest

Admin. bed number	Location	Annual harvest (tons)
204 and 207	204: Pismo Beach Pier to Pt. San Luis 207: Morro Rock to Pt. Estero	1,950 (combined)
208	Pt. Estero to Von Helm Rock	850
220 and 221	220: Cypress Point to Monterey Pier 221: Monterey Pier to Santa Cruz Pier	550

222	Santa Cruz Pier to Sand Hill Bluff	250

In June 2005, the country's largest kelp harvesting facility, ISP Alginates, announced it was closing its plant in San Diego County after 76 years in operation. ISP Alginates conducted the majority of their harvesting in southern California. However, the company did harvest on a regular basis in some of the beds in the southern half of the study region and, infrequently, their kelp cutter traveled as far north as Carmel Bay to harvest kelp.

Synopsis of Kelp Harvest Regulations

No kelp or other aquatic plant may be harvested in a state marine reserve or state marine park. A kelp harvester may harvest kelp by cutting and removing portions of attached kelp or by collecting unattached kelp. A kelp harvester may not cut attached kelp at a depth greater than four feet below the surface at the time of cutting.

Between April 1 and July 31, a kelp harvester may not harvest bull kelp from a nonleased bed that lies partially or totally within the boundary of the Monterey Bay National Marine Sanctuary extending from Santa Rosa Creek, San Luis Obispo, northward to rocky Point, Marin County. However, bull kelp may be removed from beaches within the sanctuary during the seasonal closure.

A kelp harvester may not harvest kelp in that portion of kelp bed 220 in Monterey County that lies between the tip of the Monterey breakwater and a line created by a seaward extension running 40° magnetic north from the northern-most portion of the unnamed point that lies seaward of the Chart House restaurant, approximately 3000 feet northwest of the tip of the Monterey breakwater.

Recreational Kelp Harvest

There is a small but unknown amount of kelp harvest occurring within the study region by licensed recreational fishermen. There is no closed season, closed hours, or minimum size limit, and the daily bag limit on all marine aquatic plants is 10 pounds wet weight. No eel grass (*Zostera* sp.), surf grass (*Phyllospadix* sp.), or sea palm (*Postelsia* sp.) may be cut or disturbed.

Other Aquaculture

One other aquaculture enterprise exists in the Port San Luis area. Central Coast Salmon Enhancement is a local non-profit entity that raises fingerling salmon in a grow-out holding pen in San Luis Obispo Bay for a few months each year and then releases them in the fall.

MPA Planning and Management Issues

There are a variety of management issues relevant to MPA planning and siting along the Central Coast study region. Some of these issues have already been raised by CCRSG or SAT members and are briefly described below.

Understanding regional impacts to marine habitats that can be addressed by MPAs. A regional profile is not complete without an identification of impacts to marine biodiversity, habitats, and resources of the region. However, it is also important to acknowledge that not all kinds of impacts or threats can be abated by the establishment of MPAs, though the presence of MPAs can help to bring resources to bear on a variety of management problems (Agardy et al 2003). In addition, the MLPA recognizes that MPAs provide benefits beyond addressing impacts, such as serving as reference sites to better understand impacts and as areas for enjoyment of less disturbed marine systems. Some potential threats or impacts to marine habitat and biodiversity in the region are listed below; it will be important to discuss which types of impacts are relevant to MPA planning and where specific impacts occur within the study region.

- Overfishing and Destructive Fishing: Populations of many large predatory fish, and native invertebrates, have experienced declines in California correlated with overfishing (Pew, 2003, Airame et al 2003). Commercial fisheries and recreational fishing can have a significant adverse effect on marine biodiversity (Thrush and Dayton 2002; Engel and Kvitek 1998; NRC 2002; Schroeder and Love 2002; Coleman et al 2004). Declines in targeted species and increased awareness of fishing impacts have resulted in significant changes in fishery management in California waters; the CDFG has management and recovery plans for many nearshore species in state waters. However, it should also be noted that many targeted species have not yet been assessed.
- Habitat Loss and Alteration: Habitat loss, conversion, and alteration have directly affected many coastal ecosystems in central California (eg less than 10% of coastal wetland habitat remains in California). Coastal development has drastically altered or converted coastal habitats in heavily populated areas around Monterey Bay, Morro Bay, and San Luis Obispo.
- Pollution and Degraded Water Quality: Pollution from land and sea-based sources releases inorganic and organic chemicals and nutrients into the ocean where they may accumulate to the extent that they may cause adverse impacts to species, communities, and the functioning of ecosystems (Sheehan and Tasto, 2001). Urban areas, agricultural runoff and oil and gas development can significantly affect water quality in nearshore environments and put marine resources within MPAs at risk.
- Altered Hydrologic Regimes: Alterations in fresh-water inputs change the basic characteristics of estuaries by altering the dynamic exchange between fresh and salt water. Alteration of hydrologic regimes by water diversions and flow reductions has affected many native estuarine-dependent fish and anadramous fish in California, including steelhead in Central California.
- Invasive Species: The rate of exotic species that are invasive has increased exponentially over the past 200 year and they can crowd out native species, alter habitats, and introduce foreign pathogens (Carlton, 2001). Most of the introduced marine species have arrived in ship ballast water, but other important means of introduction include improperly disposed home aquarium water, hull fouling, and intentional introductions (CDFG 2002c). Many of the more invasive species pose a potential threat to smaller California estuaries as they move up and down the coast from the larger estuaries where they first appeared; most bays and estuaries along the coast already have a significant number of introduced species (CDFG 2002c).
- Recreation/Disturbance of Wildlife: Disturbance of seabirds, shorebirds, and marine mammals can occur from recreational activities (eg. boating, diving, kayaking, surfing, and whale-watching), shore and island-based development and industries (eg. tourism) and military activities (eg. bombing, overflights, underwater sonar) especially when they occur near nursery or rookery areas. In Monterey Bay, the increasing popularity of kayaking has resulted in increasing interactions between humans and wildlife such as sea otters, pinnipeds, and seabirds. In rocky intertidal areas, tidepooling can result in trampling impacts on fragile species and population impacts on harvested species.
- Climate Change: Climate change will likely modify the flow of energy and cycling of materials within marine ecosystems—in some cases, altering their ability to provide the ecosystem services many species depend upon (Pew, 2003). The California marine environment may experience changes in oceanographic patterns, productivity and distribution of species due to climate change. Sea level rise may affect coastal marsh systems if vertical accretion of sediments cannot keep pace with sea levels.

Compiling the best readily available data to support planning and monitoring. The MLPA planning process will involve compiling data and using the best readily available science to support the design of MPAs. This process will also include drawing upon knowledge, values, and expertise of local communities and stakeholders. Understanding and assessing the distribution, magnitude and spatial

extent of economic activities and values, as well as other human activities that may affect habitats and focal species, is critical

Balancing habitat protection goals of the Act with use of marine resources. The MLPA requires an assessment of socioeconomic impacts of MPA alternatives. The regional stakeholders can provide important input about resource use patterns and socioeconomic impacts in the region.

Integration of MPA design and implementation with fisheries management; While the MLPA is not focused on fishery management, implementation of additional MPAs in state waters may help to achieve some fishery management objectives and should be integrated with other types of fishery management measures already in place. These include the Department of Fish and Game's Nearshore Fisheries Plan and draft Abalone Recovery Plan.

Jurisdiction & Management

Federal, State & Local Agencies

No single federal, state, or local agency has complete jurisdiction over the marine environment. The main agencies are highlighted below with a brief description of their role and responsibility.

Federal Agencies

Bureau of Land Management (BLM), has management responsibility for the recently-established California Coastal National Monument that includes most of California's rock and islets. Management authority pertains to lands at and above the mean high tide line.

National Marine Fisheries Service, a division of NOAA, with a mission is to manage living marine resources and Essential Fish Habitat.

National Oceanographic and Atmospheric Administration (NOAA), guides the use and protection of ocean and coastal resources and through the National Marine Sanctuary Program manages the Monterey Bay National Marine Sanctuary.

U.S. Army Corp of Engineers, plans, designs, constructs, operates, and maintains a wide variety of water resources infrastructure to support U.S. national economic interests (navigation structures, channels, shore protection, and restoration projects).

U.S. Fish and Wildlife Service (USFWS), monitors and implements programs that manage migratory birds and fish, national wildlife refuges, national fish hatcheries, and endangered species. Has management authority over marine birds and mammals.

U.S. Geological Survey (USGS), is the earth science research and information agency.

U.S. Coast Guard, is the primary maritime law enforcement agency.

U.S. Environmental Protection Agency (EPA), the EPA Office of Waters, is responsible for implementing the Clean Water Act and Safe Drinking Water Act, and other portions of lawsfocused upon pollution prevention and watershed management.

State Agencies

Ocean resource management in California is under the authority of the Resources Agency and the California Environmental Protection Agency (CalEPA). The Resources Agency coordinates with 17 departments, commissions, conservancies, and boards with the mission to preserve, manage, and enhance California's cultural and natural resources.

California Coastal Commission (CCC), together with coastal cities and counties, plans and regulates the use of land and water in the coastal zone.

California Department of Fish and Game (CDFG) The mission of the CDFG is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. Has management authority for all marine fishes, invertebrates, and plants within state waters.

California Department of Parks and Recreation, manages state park units, including underwater areas off some coastal state parks, but does not have authority over restrictions on the take of living marine resources.

California Department of Water Resources, protects, conserves, develops, and manages California's water supplies in coordination with other agencies. These activities directly impact water quality and quantity in estuaries and nearshore ocean environments.

State Coastal Conservancy, protects, restores, and improves coastal resources, and provide access to the shore.

State Water Resources Control Board and the Regional Water Quality Control Board, issue permits and set conditions for the discharge of materials into coastal waters from point and nonpoint sources.

Governmental Programs

Federal, state, and local agencies support a variety of marine resource management programs that may have a significant link to the effectiveness of existing or future MPAs along the Central Coast. There follow brief descriptions are a sample of programs.

Federal Programs

The Monterey Bay National Marine Sanctuary Integrated Monitoring Network is a consortium of more than 40 institutions conducting monitoring in Monterey Bay.

National Estuary Program, (EPA) identifies, restores, and protects nationally significant estuaries such as Morro Bay.

National Estuarine Research Reserve Program, (NOAA) focuses upon the protection and management of estuarine resources, environmental education and interpretation, and monitoring and research within designated sites (Elkhorn Slough is a NERR site).

The National Marine Protected Areas Center, includes a Science Institute based in Santa Cruz and a Technical and Training Institute in North Carolina. Both of these institutes sponsor research and training in a range of MPA matters relevant to the central coast MPA process.

The National Marine Sanctuary Program, (NOAA) manages four national marine sanctuaries off the California coast including the Monterey Bay National Marine Sanctuary.

The Pacific Fishery Management Council (PFMC) plays a lead role in managing fisheries in federal waters, including some groundfish species also managed by the CDFG.

Water Quality Protection Program, Coordinated by the Monterey Bay National Marine Sanctuary, a partnership of federal, state, and local agencies and private groups that have developed and implemented plans for monitoring and addressing polluted runoff from urban, agricultural, rural, and marina/boating sources.

State Programs

Critical Coastal Areas Program, California Coastal Conservancy, fosters collaboration among local stakeholders and government agencies to focus resources and efforts to reduce polluted runoff in coastal zone watersheds.

California Ocean Resources Management Program, (CORMP), is a program of the California Resources Agency. The mission of the program is to ensure comprehensive and coordinated management, conservation, and enhancement of California's ocean resources.

The state Nonpoint Source Pollution Interagency Coordinating Committee involves 28 agencies in implementing California's federally-approved nonpoint source pollution control program by promoting a watershed approach and by providing a forum for resolving policy and programmatic conflicts.

Local Government Programs

The City of Monterey has sought to establish an underwater park to 10 fathoms off part of its shoreline, based on treaty doctrine.

The City of Pacific Grove passed an ordinance preventing all extraction of marine invertebrates within the intertidal area of its city limits.

Non-governmental Programs

Dozens of local, community-based voluntary organizations participate in efforts to address issues in coastal watersheds in the five counties along the central coast. Many such organizations also support volunteer water-quality monitoring programs in harbors and along beaches.

Existing MPAs & Coastal Protected Areas

A marine protected area, according to California State law, is a discrete geographic area that has been designated by the law, administrative action, or voter initiative to protect or conserve marine habitat and life. Estuarine protected areas are considered MPAs. The MLPA requires an analysis of the regions's existing MPAs to assess the need for changing existing MPAs or adding new ones in order to fulfill the MLPA requirement. The preliminary site characterizations and evaluations of existing MPAs in the region have been completed by CDFG (Appendix IV).). Within the characterization there is a preliminary assessment on the overall effectiveness of each MPA based upon the following criteria:

- baseline monitoring studies;
- comparing species diversity and density;
- individual animal sizes;
- ability to conduct research, educational, and non-extraction recreation activities; and,

ability to enforce regulation. These evaluations will be further refined after the development of regional goals and objectives to better characterize the role existing MPAs play in meeting regional objectives.

There are 12 MPAs and a Special Closure area that are in the Central Coast Study Region (Map 5) that together encompass 3.8% of the total study region area (Table 17) An evaluation of the effectiveness of three of the state marine reserves in the region has also been conducted (Starr et al 2002a and 2002b).

Table 17: MPAs in Central Coast Study Region

MPA NAME	Type	Area_nmi2	% of Total Region
Special Closure: Ano Nuevo Invertebrate Area	Special Closure	1.66	0.19
Elkhorn Slough	State Marine Reserve	1.02	0.12
Hopkins	State Marine Reserve	0.12	0.01
Pacific Grove	State Marine Conservation Area	1.16	0.13
Carmel Bay	State Marine Conservation Area	2.11	0.24
Point Lobos	State Marine Reserve	0.90	0.10
Julia Pfeiffer Burns	State Marine Conservation Area	2.00	0.23
Big Creek	State Marine Reserve	1.71	0.20
Atascadero Beach	State Marine Conservation Area	4.78	0.55
Morro Beach	State Marine Conservation Area	5.15	0.59
Pismo	State Marine Conservation Area	0.06	0.01
Pismo-Oceano Beach	State Marine Conservation Area	10.04	1.16
Vandenberg	State Marine Reserve	1.87	0.22
Total Area of State MPAs		**32.58**	**3.76**
Total Area Central Coast Study Region (including Elkhorn Slough)		**867.54**	

Terrestrial Protected Areas in Coastal Watersheds

In addition to state MPAs, there are also a variety of terrestrial protected areas within coastal watersheds of the region (Map 5). Many of the state and federal parks, state beaches, and military lands along the coast provide some protection for shoreline and estuarine habitats.

Gap Analysis

A gap analysis is an evaluation of the amount of each habitat in a protected area; gap analysis helps to identify habitats that are underrepresented in protected areas (National Gap Program).

A gap analysis will be conducted by mid-August 2005 to evaluate the approximate amount of each habitat type present in existing state MPAs in the region. This analysis has not yet been completed and will be quantitative for those habitats with good spatial data (eg. Kelp) and much more qualitative for those habitats with insufficient spatial data (eg. Rocky reefs in the southern part of the region).

Conclusions

The Central Coast study region is the first region to begin implementation of the MLPA planning process. The regional profile summarizes and provides background information on the biological, oceanographic, socioeconomic and governance aspects and draws upon suggestions and information provided by regional stakeholders and the SAT. The profile serves as a foundation for setting goals and objectives, evaluating existing MPAs and describing alternatives of potential new MPAs, and identifying needs for additional data and information.

The MLPA Initiative has a number of goals that includes conservation of biodiversity and health of marine ecosystems, recovery of depleted marine populations, protection of representative and unique habitats for their intrinsic value, and improvement of recreational, educational, and study opportunities. The Central Coast study region is one of the most biologically productive regions in the world. Furthermore, California's marine and coastal environments form part of the State's identity and support important economies that depend on healthy ocean resources, such as fisheries and coastal tourism.

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