In 1913, concerns about many sea life population declines led to the designation of the waters surrounding Santa Catalina Island as a marine protected area. All fishing, except hook-and-line angling, was prohibited in the state waters (from the coastline to 3nmi seaward) surrounding the entire island. The protected area status was later revoked. The map was hand drawn by Harry Wilson in 1913 to provide a guide to the island's recreational activities including the locations of the fishing grounds surrounding the island.
INTRODUCTION

There is a present interest in the establishment of new marine protected areas (MPAs), no-take marine life reserves and networks of MPAs in California, and throughout the world, to conserve and manage marine resources. Concern about the status of California’s marine ecosystems, and dissatisfaction with existing MPAs, led the Legislature to pass the Marine Life Protection Act (MLPA) in 1999. The MLPA requires that the California Department of Fish & Game (CDFG) develop a plan to improve the array of MPAs and design an alternative network that includes fully protected marine life reserves (http://www.dfg.ca.gov/mlpa). Goals of the MLPA include protection of marine life populations and ecosystems for their recreational, commercial and intrinsic value, protection of marine natural heritage, and provision of recreational, educational, and research opportunities. Therefore, the purposes for creating MPAs are much broader than providing a management tool solely to help sustain fisheries (CDFG 2002). To meet these multiple objectives the Legislature determined that new and existing MPAs must be redesigned and managed, to the extent possible, as a network.

MPAs and marine life reserves are being considered in California for multiple reasons. The Legislature stated some of these reasons when it declared a set of “findings” supporting the MPA. (Fish & Game Code § 2511). They include:

1) “New technologies and demands have encouraged the expansion of fishing and other activities to formerly inaccessible marine areas that once recharged nearby fisheries (i.e. natural reserves). As a result, ecosystems throughout the state’s ocean are being altered, often at a rapid rate.”

2) “Only 1/4 of the 220,000 square miles of combined state and federal waters off California, or 6 thousandths of one percent, are set aside as genuine no-take areas.”

3) “The existing collection of MPAs is ineffective because it was . . . established on a piecemeal basis rather than according to a coherent plan and sound scientific guidelines. As a result, the array of MPAs creates the illusion of protection while falling far short of its potential to protect and conserve living marine life and habitat. Moreover, many of them lack clearly defined purposes, effective management measures and enforcement.”

4) “Since there is increasing evidence of a wide range of benefits associated with fully protected marine life reserves, they are “an essential element of an MPA system.” “[They protect habitat and ecosystems, conserve biological diversity, provide a sanctuary for fish and other sea life, enhance recreational and educational opportunities, and may help to rebuild fisheries.”

5) “Understanding of the impacts of human activities and the processes required to sustain the abundance and diversity of marine life is limited. The designation of certain areas as state life reserves can help expand our [e.g., managers, researchers and the general public] knowledge by providing baseline information and improving our understanding of ecosystems where minimal disturbance occurs.”

The purpose of California’s Marine Protected Areas: Past and Present is to present examples of the historical, anthropological, ecological, scientific, and socioeconomic data underlying each of these findings. This additional background will provide managers, decision makers, stakeholders and the general public involved or interested in the MPA process with a broader understanding of the fundamental concepts and rationales underpinning the MPA.

The objective of this publication is to increase the availability of science-based information for public policy debate, not to advocate for or against the formation of marine life reserves. This publication does not interpret the MLPA or provide an exhaustive analysis of the information available to the Legislature at the time the Bill was enacted. Additionally, the publication focuses primarily on ecological parameters. Decisions about the implementation of marine reserves may also need to incorporate social and economic factors.

This analysis is limited to California state waters and state designated MPAs and excludes areas comprised of only federal waters or designated by federal agencies. National Marine Sanctuaries, National Parks and State Areas of Special Biological Significance are excluded because they currently do not restrict fishing activities in California. As a result of these exclusions, there are only 51 MPAs mentioned in this publication as opposed to the 103 in Mcardle (1997).

—Deborah A. McArdle
A LOOK AT THE PAST: Natural Reserves

CA Legislative Finding
“New technologies and demands have encouraged the expansion of fishing and other activities to formerly inaccessible marine areas that once recharged nearby fisheries (i.e., natural reserves). As a result, ecosystems throughout the states ocean are being altered often at a rapid rate.” Fish and Game Code, §2851 (c).

The “formerly inaccessible marine areas” identified by the Legislature above are described by researchers as “natural reserves” or places too deep, too remote, too dangerous or too rough to fish. It is difficult to determine where these “natural reserves” may have been located because most of them probably have not existed for hundreds, or perhaps thousands of years. One possible way to define their boundaries is to use anthropological and archeological evidence of the probable limitations on fishing during these times.

For example, anthropologists and archeologists have gathered data from which one can approximate the boundaries of fishing grounds around Santa Cruz Island, California between 1300 and 1782 AD. This evidence consists of population size and mobility, fishing gear and vessels used, habitat of fish caught, diet, site location, and social customs (Pletka 2001; Glassow 2002). Anthropologists and archeologists believe that during this prehistoric time period there was intensive fishing of the island’s nearshore waters and concentrated fishing of a few species in mid and deep waters. The map of Santa Cruz Island below shows a simplified representation of the approximate limits of the prehistoric fishing grounds. The map was created using Pletka’s (2001) data analysis and definitions. Areas outside the highlighted fishing grounds may have been prehistoric “natural reserves” because the evidence suggests that the island inhabitants did not take resources from these locations. Note one exception, swordfish were caught in deep waters during human transit to the mainland, but this area was not represented as a fishing ground. All waters surrounding the island (from the coastline to 11 km) are fished today (Leeworthy et al. 2002).

PREHISTORIC (1300-1782 AD) & PRESENT DAY FISHING GROUNDS AT SANTA CRUZ ISLAND

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PARKE Young and black abalone at Santa Cruz Island, 1948. By John Fitch, California Department of Fish and Game.

A Big Hammerhead, caught with a rod and reel by Mr. Paine, Mexican Joe, boatman. In (Holder 1910).

Prehistoric Fishing Grounds

Potential Prehistoric Natural Reserves

Present Day Fishing Grounds

PREHISTORIC (1300-1782 AD) & PRESENT DAY FISHING GROUNDS AT SANTA CRUZ ISLAND


Party boat (CPFV) “Sunshine II” with a catch of bluefin tuna. San Pedro, September 20, 1937. Photo by R. S. Croker, California Dept. Fish and Game

Polarizing black abalone at Santa Cruz Island, 1948. By John Fitch, California Department of Fish and Game.
During the 1880s, the growth of coastal populations subjected California marine resources to increased pressure. Moreover, improvements in fishing vessels and gear enabled fishermen to venture farther from port into areas that were previously inaccessible natural reserves. These factors contributed to the decline of many marine species. By the turn of the century, reports on the status of marine resources requested by the Fish and Game Commission often documented these declines. Excerpts from a few of those reports are shown below.

FISH REPORTS FROM THE EARLY 1900s

**OVERVIEW**

1913 The comparatively recent and consequent development of our fisheries, the prospect of a far more extensive utilization of their products, and the perfection of the machinery of exploitation, has brought sharply to our focus the question of the capacity of the species of fish to withstand the strain. The introduction of power vessels, the enormous improvements in transportation facilities, the use of ice and refrigerating plants, the introduction of the otter trawl, and the great increase in population have taken place within the last thirty-five years. Instances of over-exploitation are already well known, both on our own coast and in the Atlantic, and the stability of the supply is a real question everywhere. Those intimately concerned with the fisheries are having as a rule decided opinions regarding the species in which they are particularly interested, frequently ask why the world should not accept at once and act upon their belief that the fish are becoming less in number, or their contradiction of such an assertion; however, proof that seeks to modify the ways of thinking through depletion is not only to aid in procuring the greatest return, but the same thing is true of many other places where the abalone was formerly abundant. The large individuals of legal size are taken and it is probably true that in this manner the most prolific breeders are sacrificed. (Edwards 1913)

1913 Big wooden tubs hold the abalone meat which is part-boiled. It’s then placed in the sun, smoked for three hours and again boiled and dried several times. Fish Bulletin, v.1 1913

1913 “Four years ago the spiny lobster supply of our waters had so seriously depleted that the legislation passed a measure prohibiting the capture of spiny lobster for a period of two years. Interesting accounts are given of their former abundance. The supply has become greatly depleted, this being especially evident in some places. Santa Catalina Island furnishes a good example of how a coast splendidly adapted as a habitat for these crustaceans, and formerly abounding in them, has become so depleted by intensive fishing that the fishery is no longer profitable there. We have consistent conservation of the supply will, in the long run, benefit the consumer. Exact principles apply to the conservation of our fish as to the conservation of our forests.” (Weymouth 1913)

1913 “Two Californian who pur-
chasen this crab (Samlson/ Orvedahl) at twenty-five cents is a item of the possible fate in store for his delicacy, that through depletion of the supply, the price is already about three times what it was in 1880. Unless protected, the future history of the crab may be but a repetition of that of the lobster of New England.” (Weymouth 1913)

**LOBSTER**

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1913 “It was said that 300 tons were shipped from Mendocino collected as many as 2300

1913 “In 1913, Professor Charles Frederick Holder was asked to make a report to the Fish & Game Commission on the status of island fisheries (Holder 1913). Based on observations from 30

**CRAB**

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1913 “In 1913, Professor Charles Frederick Holder was asked to make a report to the Fish & Game Commission on the status of island fisheries (Holder 1913). Based on observations from 30

1913 December 3, 1913

Dear Sir,

I trust that you may be successful in having Santa Catalina and San Clemente islands set apart as game preserves. . . .

Very truly yours,

David Share-Ahran

1914 Very truly yours,

David Share-Ahran
**MPA Designation Timeline**

Many management strategies were implemented since 1950 to protect and rebuild marine animal populations. One strategy that retrieved interest was marine protected areas. After 1950, state administrative agencies, the Legislature, and the public through the initiative process created 53 state MPAs in the state waters off California's coast. There are 18 refuges, 13 state parks, 10 ecological reserves, 7 reserves, 4 marine resource protection act (MRPA) ecological reserves and 1 U.C. natural reserve. The 53 state MPAs cover 2.2% of state waters; 10 are fully protected or no-take marine life reserves and cover 0.2% of state waters.

Unfortunately, many of the MPAs established after 1950 were poorly designed, placed and managed. Recognition of these inadequacies caused the Legislature to pass the Marine Life Protection Act in 1999 to improve the array of MPAs in California. This Act has generated public policy debates similar to those that occurred nearly a century ago when the Legislature created the first MPAs.

### MPA Designation Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>MPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900–1950</td>
<td><strong>State MPAs (53)</strong></td>
</tr>
<tr>
<td>1909</td>
<td>Humboldt and Trinidad Bays Crab Preserve</td>
</tr>
<tr>
<td>1913</td>
<td>Santa Cruz Bay Fish Preserve</td>
</tr>
<tr>
<td>1913</td>
<td>False Bay Fish Preserve</td>
</tr>
<tr>
<td>1913</td>
<td>Monterey Shellfish and Invertebrate Reserve</td>
</tr>
<tr>
<td>1913</td>
<td>Santa Catalina Island Fish Reserve</td>
</tr>
<tr>
<td>1913</td>
<td>All reserves were repealed.</td>
</tr>
<tr>
<td>1950–1970</td>
<td><strong>State MPAs (40)</strong></td>
</tr>
<tr>
<td>1957</td>
<td>San Diego Marine Life Refuge</td>
</tr>
<tr>
<td>1963</td>
<td>Point Lobos Reserve State Park</td>
</tr>
<tr>
<td>1965</td>
<td>U.C. Scripps Natural Reserve</td>
</tr>
<tr>
<td>1968</td>
<td>Laguna Beach Marine Life Refuge</td>
</tr>
<tr>
<td>1969</td>
<td>South Laguna Beach Marine Life Refuge</td>
</tr>
<tr>
<td>1969</td>
<td>James V. Fitzgerald Reserve (Marine Life Refuge)</td>
</tr>
<tr>
<td>1972</td>
<td>Dana Point Marine Life Refuge</td>
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<tr>
<td>1972</td>
<td>Doheny Beach Marine Life Refuge</td>
</tr>
<tr>
<td>1973</td>
<td>CA Fish and Game Commission given authority to create no-take ecological reserves</td>
</tr>
<tr>
<td>1970–1980</td>
<td><strong>State MPAs (28)</strong></td>
</tr>
<tr>
<td>1970</td>
<td>Nine Underwater Parks</td>
</tr>
<tr>
<td>1971</td>
<td>Gerstle Cove Reserve</td>
</tr>
<tr>
<td>1971</td>
<td>Duxbury Reef Reserve</td>
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<tr>
<td>1972</td>
<td>Iow Point Marine Life Refuge</td>
</tr>
<tr>
<td>1972</td>
<td>Miguel Marine Life Refuge</td>
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<tr>
<td>1972</td>
<td>San Diego La Jolla Ecological Reserve</td>
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<tr>
<td>1972</td>
<td>Del Mar Landing Ecological Reserve</td>
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<tr>
<td>1972</td>
<td>Point Reyes Headlands Reserve</td>
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<tr>
<td>1973</td>
<td>Farnsworth Bank Ecological Reserve</td>
</tr>
<tr>
<td>1973</td>
<td>Point Loma Ecological Reserve</td>
</tr>
<tr>
<td>1974</td>
<td>Healer Park Ecological Reserve*</td>
</tr>
<tr>
<td>1974</td>
<td>Lovers Cove Reserve, Santa Catalina Island</td>
</tr>
<tr>
<td>1975</td>
<td>Point Cabrillo Reserve</td>
</tr>
<tr>
<td>1976</td>
<td>Carmel Bay Ecological Reserve</td>
</tr>
<tr>
<td>1977</td>
<td>Pismo Invertebrate Reserve</td>
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<tr>
<td>1977</td>
<td>San Miguel Island Ecological Reserve</td>
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<tr>
<td>1978</td>
<td>Abalone Cove Ecological Reserve</td>
</tr>
<tr>
<td>1978</td>
<td>Anacapa Island Ecological Reserve (Natural Area)</td>
</tr>
<tr>
<td>1978</td>
<td>Santa Barbara Island Ecological Reserve</td>
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<tr>
<td>1980–1990</td>
<td><strong>State MPAs (5)</strong></td>
</tr>
<tr>
<td>1981</td>
<td>Newport Beach Marine Life Refuge</td>
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<tr>
<td>1982</td>
<td>Crystal Cove State Park</td>
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<tr>
<td>1984</td>
<td>Pacific Grove Marine Gardens Fish Refuge</td>
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<tr>
<td>1985</td>
<td>Atascadero Beach Pismo Clam Preserve</td>
</tr>
<tr>
<td>1985</td>
<td>Morro Beach Pismo Clam Preserve</td>
</tr>
<tr>
<td>1987</td>
<td>Pismo Oceanic Pismo Clam Preserve</td>
</tr>
<tr>
<td>1988</td>
<td>Santa Barbara State Park</td>
</tr>
<tr>
<td>1988</td>
<td>City of Encinitas Marine Life Refuge</td>
</tr>
<tr>
<td>1990–2000</td>
<td><strong>State MPAs (28)</strong></td>
</tr>
<tr>
<td>1994</td>
<td>Big Creek MRPA Ecological Reserve*</td>
</tr>
<tr>
<td>1994</td>
<td>Sycamore Canyon MRPA Ecological Reserve*</td>
</tr>
<tr>
<td>1999</td>
<td>Marine Life Protection Act Passed</td>
</tr>
<tr>
<td>2000–present</td>
<td><strong>State MPAs (4)</strong></td>
</tr>
<tr>
<td>2002</td>
<td>Marine Life Protection Act master plan being developed</td>
</tr>
<tr>
<td></td>
<td>*No take reserves</td>
</tr>
</tbody>
</table>

### State and Federal Marine Protected Areas

**Legend**
- **Total protection or no-take reserves**
- **Limited take MPAs (in all > 20 species may be fished)**
- **One species protected**
- **No fishing restrictions due to MPA status**

**Existing Marine Reserves**

- **California Marine Protected Areas**
- **Level of Protection**

**Percentage of California State Waters Covered**

- **Waters MPAs that Allow**
- **Waters MPAs that Allow**

**State MPAs (53)**

- **FEDERAL MPAs (8)**

**Limited Take**

- **Reserves**

**No-Take**

- **Reserves**

**STATE MPAS (53)**

- **FEDERAL MPAS (8)**

**No-Take**

- **Reserves**

**Legend**

- **Degree of protection from extractive resource use**
  - **Total protection or no-take reserves**
  - **Limited take MPAs (in all > 20 species may be fished)**
  - **One species protected**
  - **No fishing restrictions due to MPA status**
Fishing can have significant impacts on marine ecosystems (Jackson 2001, Pauly 1998). Since most existing MPAs allow both commercial and recreational fishing, it is important to consider the effect that fishing may have on the potential success of MPAs. Moreover, those involved in the present MLP discussions will need to decide what the appropriate levels of restrictions are for new MPAs. One recent study summarized below examined whether recreational fishing could prevent an MPA from achieving its goals (Schroeter and Love, in press).

The combined effect of millions of anglers on fish abundance, size, and species composition can be substantial. As a result, areas that exclude commercial but not recreational fishing may not generate the outcomes associated with fully protected marine reserves.

In California, for example, 1.7 million recreational fishers take some 6 million ocean fishing trips per year. For some shallow-water species, they accounted for 75 percent or more of the total landings, far exceeding landings by commercial fishers. Currently, most recreational saltwater fishing is catch-and-release due to regulations on size and number of fishes taken. Even so, the stress from capture leads to the death of many fishes after release. Estimates of mortality after release average 20 percent but could be higher. By elevating the death rate, catch-and-release fishing increases the influence of recreational fishing on populations.

Effects of recreational angling on fish abundance can be tremendous for certain species of fish. Along the California coast, cod and botacchio, two federally listed overfished species, were 32 times and 408 times more abundant, respectively, in an area where no fishing occurs than in a recreational fishing area. Fish in the unprotected area were also smaller because anglers primarily remove large fishes. This change in average size can lead to a decline in reproduction.

The data on recreational fishing indicate that it warrants consideration in management planning for marine protected areas.

The four MFPA Ecological Reserves were designated by the state Legislature to provide “habitat” means for scientific research. Appropriately, they all prohibit extractive uses including commercial and recreational fishing.

The State Parks (established by the State Parks and Recreation Commission) include thirteen small underwater sites with varying objectives. All allow extensive commercial and recreational fishing even though some classifications’ objective is to maintain areas of outstanding natural or scenic aspects in undisturbed integrity.

Where Are We Now?

The quoted legislative declaration is understandable because MPA regulations often appear to be inconsistent with the objectives stated in the initial legislation authorizing their creation. For example, since the vast majority of California MPAs have few commercial or recreational fishing restrictions, it is questionable whether these areas are meeting their intended objective of resource protection. This inconsistency is potentially dangerous because it produces an ‘illusion of protection.’ This false sense of security could endanger the resources the MPA was designed to protect.

Fishing is limited by regulations within marine protected areas (Jackson 2001; 1998). However, the potential for protection is limited. The array of MPAs creates the illusion of protection while falling far short of its potential to protect and conserve living marine life and habitat. (Fish & Game Code, § 2851(a).)

Do the Restrictions Enable the MPAs to Meet Their Goals?

In some cases, it is cleat why certain types of fishing are allowed within an MPA’s borders. In many cases, however, it is not clear how the permitted fishing activities enable the MPA to achieve its goals. Primarily because many MPAs lack clear objectives and MPA regulations are often inconsistent within a classification. The Legislature enacted the Marine Managed Areas Improvement Act (AB 2800) in 2000. One goal of the Act is to simplify the existing classification system of the state’s marine managed areas (which include MPAs) and provide categories with clear objectives and consistent degrees of regulation. Existing MPAs will be re-classified and their regulations will not change as a result of this legislation. However, the MLPA process will likely result in changes to some of the existing MPA regulations as well as create new MPAs. The new MPA classifications will be:

- State Marine Reserve (no-take reserve): Prohibits all commercial and recreational fishing
- State Marine Park: Prohibits commercial fishing and allows recreational fishing although some restrictions may apply
- State Marine Conservation Area: Prohibits specific commercial and/or recreational activities on a case-by-case basis

Comparisons of fishing restrictions to the objectives of the six state MPA classifications that existing MPAs currently fall into are illustrated. It is important to note that the restrictions described are only those imposed by the MPA designation. Other types of regulations (e.g. temporary closures, gear restrictions, etc.) may prohibit the take of certain species within the MPA as well. However, these restrictions are often only temporary and/or subject to change.

Where Do Restrictions Seem Appropriate for the Objectives?

Where Is It Unclear If Restrictions Are Appropriate for the Objectives?
Reserve Effects in the Worlds Oceans
A comprehensive review of over 80 separate studies of reserves worldwide provides insight into the effects no take reserves can have on sea life (Halpern, in press). The review shows that protection from fishing leads to rapid increases in biomass, abundance, and average size of exploited organisms and to increased diversity within reserves. The results include findings across a range of partially to fully protected reserves. Studies of the best-protected reserves show that they can have more than triple biomass of exploited species, and some species can increase by orders of magnitude. Nearly half of the study sites were in temperate oceans like Californias.

Reserve Effects in the Worlds Temperate Oceans
Studies of marine reserves in temperate ecosystems suggest that it is reasonable to anticipate increases in densities (numbers) of lobster, fish, and other species in California marine reserves. The effects of reserves on sea life in temperate ecosystems were summarized by M. Carr in (Starr 2002). Examples from the review are listed below:

- **Puget Sound**: Surveys at seven sites show that reserve effects can vary among species, largely corresponding to fishing intensity. The more heavily a species was fished before the reserve was created, the greater the effect of the reserve. For example, heavily and moderately fished species like copper and black rockfish were more abundant and larger within than outside reserves. In contrast, the number of lightly fished species (e.g., Brown and Puget Sound rockfish) did not differ significantly between reserve and fished sites (Palson 1998). Lingcod abundance was three times greater in a reserve than in fished areas outside of the reserve (Palsson & Paukso 1995).

- **Chile**: Commercially taken snails increased in abundance five to 14 times and doubled in body size in reserves compared to fished areas (Castilla & Duran 1985).

- **Tasmania**: Rock lobster and reef fish abundance increased by one and two orders of magnitude on temperate rocky reefs within reserves (Edgar & Barret 1999).

- **Straits of Georgia**: The abundance of spawning lingcod was significantly greater in two reserves than in adjacent fished areas (Marr et al. 2000).

- **New Zealand**: The abundance of the fish red moki, was six times higher in fished areas (Martell et al. 2000). The abundance of spawning lingcod was significantly greater in reserves. Reserve effects on sea life are summarized in more for a comprehensive review of the scientific literature on the effects of reserves on marine life see (PISCO 2002).

**CA Legislative Finding**

*Marine life reserves are an essential element of an MPAs system because they protect habitat and ecosystems, conserve biological diversity, provide a sanctuary for fish and other sea life, enhance recreational and educational opportunities, provide a reference point against which scientists can measure changes elsewhere in the marine environment, and may help rebuild depleted fisheries.* Fish & Game Code § 2850(e)

Reserve Effects in California’s Temperate Oceans
A review of the effectiveness of three fully protected marine reserves in central California, and one in southern California was conducted in 2001 (Starr et al. 2002). The review concludes that reserve effects are apparent and are briefly summarized below.

- **Pt. Lobos Ecological Reserve and Hopkiss Marine Life Refuge**: Fish abundance, size, and species compositions were modestly greater inside the reserves relative to adjacent areas with similar habitat.

- **Big Creek MRPA Ecological Reserve**: The number, size, and diversity of fishes were similar inside and outside the reserve. This is not surprising given that this reserve was only recently established. Moreover, most fish species there are rockfishes, which grow slowly and have low reproductive success so it may take many years for them to grow bigger and produce large numbers of young. Some rockfish species take over 30 years to reach maturity. The reserve does serve as a rearing ground for rockfish or at least an area to which rockfish young (recruits) can arrive and settle (Yoklavich et al. 2002).

Anacapa Island Natural Reserve
Harvested species were in greater abundance inside the reserve than in areas fished outside the reserve. The abundance of species that were not commonly harvested, however, were similar or greater outside the reserve.

**GATHERING BASELINE DATA ON CALIFORNIA’S FULLY PROTECTED RESERVES**

To determine the effectiveness of a reserve, baseline data is first needed to determine the abundance and sizes of fish populations and the types of habitats within reserves. To that end, in 1996, the California Sea Grant College Program was selected by the Fish and Game Commission to design and administer a competitive peer-reviewed research program focusing on the four new fully protected ecological reserves, the Marine Reserves Research Program (MRRP). The goal of the program was to learn how marine reserves might be used as a management tool and to enable managers to make better decisions about their placement and design.

For example, one study characterized the benthic habitats and fish species that occur in deep water areas in and around Big Creek MRPA’s ecological reserve. This characterization provides a valuable baseline data set that can be used for future monitoring. To learn more about the MRRP studies visit [www.csgc.ucsd.edu](http://www.csgc.ucsd.edu).

**CAN RESERVES PROVIDE MANAGERS WITH BASELINE DATA?**

Summarized by J. Casseau in (Starr 2002)

Many studies have shown that fully protected reserves are able to protect populations of sea life within their borders. However, fully protected reserves may also provide baseline data that can be used to more accurately assess what changes are occurring in fish stocks. A recent study at the Channel Islands off Santa Barbara, California, compared the long-term population fluctuations of the wrasse sea cucumber (Parastichopus parvimensis) within the Anacapa Island Natural Reserve with several fished areas outside of the reserve (Schmutz et al. 2001).

Sea cucumber abundance was measured both inside the reserve and outside at fished sites both before and after the onset of fishing. These data were then compared to stock assessments obtained from traditional catch per unit effort (fishery dependent data) (i.e., the amount of a time it takes to catch a specific number of animals in a specific amount of time) often used by managers.

Following the onset of the fishery, the abundance of wrasse sea cucumber decreased, (35% to 83%), at seven fished sites throughout the islands. In contrast, sea cucumber abundance at the two unfished sites in the reserve showed no significant change. Moreover, their populations tended to increase in the reserves.

Interestingly, it did not take longer to catch sea cucumbers at any of the fished sites after the onset of fishing despite the general decline in abundance at the sites. This implies that the traditional method of using the amount of time it takes to catch fish (catch per unit effort) as an indicator of population health may not be a true estimate. Areas that are not fished, fully protected reserves, may be able to assist managers in determining what the true standing of fish-stocks are.

**Reserves and Baseline Data**

*Understanding of the impacts of human activities and the processes required to sustain the abundance and diversity of marine life is limited. The designation of certain areas as sea life reserves can help expand our knowledge by providing baseline information and improving our understanding of ecosystems where minimal disturbance occurs.* Fish & Game Code § 2850(e)
**California No-take Reserves**

- **King Range (Punta Gorda) Marine Reserve**
  - Year established: 1954
  - Area: 1.97 nm
  - Shoreline length: 1.74 nm
  - Depth range: 18 to 180

- **Bodega Marine Life Refuge**
  - Year established: 1965
  - Area: 0.20 nm
  - Shoreline length: 1.0 nm
  - Depth range: 0 to 56

**Habitat types:**
- Dominate by sand with some hard bottom, in a vigorous upwelling zone.
- Large wash rock (Gorda Rock) and a few subtidal pinnacles offshore.

**Surrounding habitat types:**
- Rocky outcrops in sandy bottom.
- Exposed coastline, wash rocks, rocky bottom interspersed with sand.

**Baseline and ongoing monitoring and research studies:**

**Unpublished references related to use of this MPA as a research tool:**
- None found.

**Unpublished references related to effectiveness of this MPA:**
- None found.

**Published references related to effectiveness of this MPA:**
- Karpov, et al. (In Prep.)

**Habitat types:**
- Rocky outcrops in sandy bottom.
- Exposed coastline, wash rocks, rocky bottom interspersed with sand.

**Baseline and ongoing monitoring and research studies:**
- Botsford Marine Laboratory utilizes this refuge on a regular basis for research projects and observations.

**Basic Evaluation:**
- This refuge is relatively small and is the only existing MPA in the North Central region which is entirely marine and which has complete protection for all marine organisms. Complete protection has only been afforded to this reserve since 1999, a relatively short time period in which to access its function as a no-take reserve. However, several studies utilize the reserve as a comparative baseline for species protected from the effects of fishing (i.e., urchins, crab, and abalone). The current boundaries of the refuge are honored and generally accepted by users groups. Any proposed enlargement of the boundaries is likely to be met with opposition.

**Unpublished references related to effectiveness of this MPA:**
- None found.

**Published references related to effectiveness of this MPA:**

**Unpublished references related to use of this MPA as a research tool:**
- None found.

**Published references related to use of this MPA as a research tool:**
- None found.

**Unpublished references related to effectiveness of this MPA:**
- None found.

**Published references related to use of this MPA as a research tool:**
- Karpov, et al. (In Prep.)

**Unpublished references related to effectiveness of this MPA:**
- None found.
Habitat types: Mostly granite reef, smaller portions of sand, especially on outside edge

Surrounding Habitat types: Similar

Baseline and ongoing monitoring and research studies: Numerous studies of algae, invertebrates, and fish have taken place in the HMLR. Long-term monitoring of the intertidal zone dates back to the 1930s. The Department carried out relatively intensive fish counts, and some re-monitoring of those counts has taken place. A recent study was completed comparing counts and sizes of benthic fishes in and adjacent to the refuge. In addition, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) has had permanent intertidal and subtidal monitoring sites here for several years.

Basic Evaluation: The area contains one of the oldest fully-protected marine research sites in the state and contains a variety of shallow habitats within a relatively small area. It is a classic example of how a small but fully protected MPA can function well by providing a multitude of research opportunities with populations of marine organisms occurring at natural densities and size frequencies. While it is relatively small, studies have documented significantly greater biomass and size frequencies of nearshore fishes compared with adjacent fished areas.

There is a great deal of public support for establishing some form of MPA to the east and adjacent to HMLR, using 60 feet as the offshore depth boundary. Establishing an MPA from the eastern boundary of HMLR to the base of the Coast Guard Breakwater (in the Cannery Row area) would provide increased protection for marine fishes and invertebrates in an area that is frequently utilized by dive classes, recreational divers, and recreational anglers but would leave the area west of HMLR to the north in the area west of the Carmel Bay Ecological Reserve would include part of the Carmel submarine canyon is nearby. Expansion to the south (to Yankee Point or beyond) would add additional area extensive rock reef habitat but would impact commercial and recreational finfish fisheries. Offshore extension of the reserve would add deeper reef habitat but would impact existing commercial fisheries such as spot prawn and hook-and-line finfish, as well as recreational CPFV fisheries. Expansion to the south to Yankee Point or beyond would add additional area extensive rock reef habitat but would impact commercial and recreational finfish fisheries. Offshore extension of the reserve would add deeper reef habitat but would impact existing commercial fisheries such as spot prawn and hook-and-line finfish, as well as recreational CPFV fisheries. As an alternative to expanding this site, a more suitable location in terms of less socioeconomic impact might be possible to the south between Point Lobos and Point Sur. In addition to the above rationale, this site is also overlapped by an Area of Special Biological Significance designation (which will be re-named State Water Quality Protection Area).


Unpublished references related to effectiveness of this MPA: Castleton, M.R. 2000

Habitat types: Mostly granite reef surrounded by sand bottom. Reef habitat with many crevices and pinnacles. Extensive kelp beds

Surrounding habitat types: Carmel submarine canyon is nearby. Extensive hard bottom offshore, as determined from submersible studies

Baseline and ongoing monitoring and research studies: UC Santa Cruz student found slightly greater abundances of benthic fish in the reserve than in adjacent areas. Department has conducted habitat-based surveys of fish abundances within the reserve. Submersible surveys have been carried out offshore of the reserve. In addition, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) has had permanent intertidal and subtidal monitoring sites here for several years.

Basic Evaluation: This site contains a complex variety of habitats, primarily hard bottom, and contains high densities of large, adult bottom fish such as rockfishes and lingcod. Although relatively small, the reserve functions well as a fully protected area because of its high species diversity and variety of habitat, and it is effectively enforced. Studies by the Department and others have documented high population densities and large sizes of economically important nearshore fish species, in particular rockfishes, lingcod, cabezon, and greenlings, with population densities and size frequencies significantly greater than in adjacent and more distant fished areas. In addition, the site is a prime destination for non-extractive scuba divers, and use is limited by local policy.

This site would be an excellent candidate for expansion from the point of view of habitat protection, but it could cause significant impacts to users groups. The region is approximately 10 miles from a major central coast port (Monterey). Expansion to the north in the area west of the Carmel Bay Ecological Reserve would include part of the Carmel Submarine Canyon but would impact existing commercial fisheries such as spot prawn and hook-and-line finfish, as well as recreational CPFV fisheries. Expansion to the south (to Yankee Point or beyond) would add additional area extensive rock reef habitat but would impact commercial and recreational finfish fisheries. Offshore extension of the reserve would add deeper reef habitat but would impact existing commercial fisheries such as spot prawn and hook-and-line finfish, as well as recreational CPFV fisheries. As an alternative to expanding this site, a more suitable location in terms of less socioeconomic impact might be possible to the south between Point Lobos and Point Sur. In addition to the above rationale, this site is also overlapped by an Area of Special Biological Significance designation (which will be re-named State Water Quality Protection Area).


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Baseline and ongoing monitoring and research studies: UC Santa Cruz student found slightly greater abundances of benthic fish in the reserve than in adjacent areas. Department has conducted habitat-based surveys of fish abundances within the reserve. Submersible surveys have been carried out offshore of the reserve. In addition, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) has had permanent intertidal and subtidal monitoring sites here for several years.
This site could benefit from extending boundaries offshore for the purpose of maintaining a larger portion of an intact ecosystem. There are presently no State Marine Reserves in California which extend to 3 miles offshore, and the existing array of MPAs does not include adequate representation of deep-water habitat, particularly in depths exceeding 50 ft. This area would be a likely candidate because it already has full protection. If fishing pressure increases outside the reserve boundaries, and would include a wider variety of habitat within an MPA. An expanded SRM at this site would allow the natural ecological functions to occur in this area and would enhance economically important species, including lingcod and rockfishes such as bacaccio, yelloweye, canary, vermillion, and yellowtail.

**Site Name:** Big Creek Marine Resources Protection Act Ecological Reserve

**MLPA Region:** South Central (Monterey County)

- **Year established:** 1994
- **Area:** 1.9 nm²
- **Shoreline length:** 2.7 nm
- **Depth range:** 0 to 100

**Habitat Types:** Soft Intertidal: est. 10%; Hard Intertidal: est. 90%; Soft Subtidal: est. 25%; Hard Subtidal: est. 75%; Kelp beds: many rocks and pinacles.

**Surrounding habitat types:** To the north and south a mixture of hard and soft bottom with scattered kelp beds. Several heads of submarine canyons adjacent on seaward side.

**Baseline and ongoing monitoring and research studies:** Benthic habitat mapping and characterization: baseline information for entire reserve (Yoklanski, VenTresca). Mapping ocean currents and related hydrographic studies: ongoing research (C. Collins, J. Schwing). Benthic fish surveys: baseline research; deep (Yoklanski), subtidal (VenTresca, Paddock). Benthic Invertebrates; some baseline; intertidal (Pearse), subtidal (Mira Parks). Local Fishery (social aspects; Pomeroy, Smiley). PSSD long-term subtidal monitoring site (Garr).

**Basic Evaluation:** This site contains a variety of habitats with hard and soft substrates, including kelp beds, and is one of the few existing MPAs which extend to 5 fathoms depth. This site functions well as a completely protected area while allowing research, particularly the documentation of population densities of nearshore and offshore fishes. Studies by the CDFG, National Marine Fisheries Service, and others have quantified density and size frequency of populations of rockfishes, lingcod, cabezon, and other economically important finfishes within and outside the reserve boundaries, and have found significant numbers of large, reproductively mature fishes within as well as adjacent to the site. Populations of fishes in adjacent areas are of higher density than within fished areas closer to ports, primarily due to the remoteness of the areas and their difficult access from shore. If fishing pressure increases in the future in adjacent areas, the reserve will continue to serve as a baseline for indices of natural populations. The reserve benefits from the presence of an on-site manager and has excellent enforcement.

**Habitat types:** The area contains a mixture of hard and soft bottom. This is a high energy area that is likely heavily scourred.

**Surrounding habitat types:** Fairly similar to north, south, and offshore, although a higher percentage of soft bottom to the north.


**Basic Evaluation:** This site contains primarily shallow soft-bottom substrate but includes some low-relief subtidal reef. Based on Department of Energy and Environmental Protection survey data, the site is the most diverse and highest density of species. Fish populations in adjacent areas are at functional full protection level. This site could benefit from extending boundaries offshore to increase populations of species in the area. No other sites along the south coast of California are as diverse in terms of marine species and habitats.

**Unpublished references related to effectiveness of this MPA:**


**Unpublished references related to effectiveness of this MPA:**


**Unpublished references related to use of this MPA as a research tool:**

- Watson, W., et al., 1999

**Unpublished references related to use of this MPA as a research tool:**

- None found.
Habitat types: Nearly 100% rocky shoreline and intertidal zone with rocky reef to 20 m in depth and rock reef scattered below that. Approximately 80% hard substrate overall. There are kelp beds and sand/mud areas through the area.

Surrounding habitat types: Nearshore kelp forest and reef habitat with interspersed sandy areas.

Baseline and ongoing monitoring and research studies: Channel Islands National Park has two fixed sites for the Kelp Forest Monitoring program, (est. 1982) within the natural area. Comparisons of fish inside and out of the reserve were made by Larson (2000). Tetreault (2000) made independent assessments of fish inside and out of the reserve. Schroeter et al. (2001) used a BACI analysis of Channel Islands National Park data to look at fish effects on sea cucumbers. There is a pink abalone enhancement study site (density enhanced through transplanting to increase reproduction), a joint ODA and Channel Islands National Park project. In addition, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) has had a permanent subtidal monitoring site here for several years.

Basic Evaluation: Provides complete protection of marine life in a limited area in the warmer water region of the Northern Channel Islands. Provides an opportunity to evaluate effects of complete protection on resident species. This site has a diversity of habitat and species, but encompasses a relatively small portion of the habitat in the area extending only to a depth of 20 m and may be affected by intense edge fishing for finish and lobster. Nevertheless, kelp bass and sheephead were found in higher densities and larger sizes in this MPA than in nearby areas open to harvesting indicating that this MPA is protecting these desirable species to a greater extent than general fishery regulations elsewhere. Sea cucumber abundances were stable or increased here compared to other sites at the Channel Islands open to harvests of that species. Lobster populations were higher and lobster and sea urchin populations more stable in this MPA as well. It is within an ecological reserve, National Park, National Marine Sanctuary, International Biosphere Reserve, and Area of Special Biological Significance. Current proposals to establish two new MPAs at Anacapa Island include a no-take reserve encompassing and greatly expanding the area this MPA. A wide range of habitats and resources present in this warmer water region will be represented by this proposed MPA. It is also designed to provide connectivity with other MPAs and open areas at the Channel Islands through movements of adult and juvenile organisms and transport of larval. Published references related to effectiveness of this MPA:


Unpublished references related to effectiveness of this MPA:


Unpublished references related to use of this MPA as a research tool:

Unpublished references related to use of this MPA as a research tool:

Published references related to effectiveness of this MPA:

Laferty, K.D. and D.J. Kushner. 2000

Unpublished references related to effectiveness of this MPA:


Unpublished references related to effectiveness of this MPA:


Habitat types: Overall this site has about 50% hard and 50% soft substrates. Southwest of the pier is a soft-bottom cove with approximately 20 moorings for large boats. Southeast is a small soft-bottom cove. Within the small cove there are approximately 8 moorings for small research craft. Further southeast are rocky walls and hard bottom (to 50 m) and deeper soft bottom (to 100 m). The hard bottom habitat supports kelp forests.

Surrounding habitat types: Rocky shoreline, kelp forest and reefs adjacent to site. Some soft bottom areas offshore and in nearby coves. Extensive reef systems in nearby general area.

Baseline and ongoing monitoring and research studies: There have been numerous studies by scientific, volunteer and student researchers. The Catalina Conservancy Divers have long-term studies, especially for giant kelp. Published and grey literature in the Southern California Academy of Sciences Bulletin. Dr. Jack Engle of UCSB has conducted roving diver fish surveys during the last 3 or 4 years and is working with others to monitor rocky intertidal populations at Bird Rock. Mark Littler and Steve Murray established a site near Fisherman Cove as part of the BLM-sponsored studies in the mid-1970s. Steve Murray of GSU Fullerton has recently re-assessed the distributions and abundances of rocky intertidal populations to examine decadal scale changes in intertidal systems. Irene Tetreault has on-going fish and habitat surveys.

Basic Evaluation: Provides complete protection to all marine life in a semi-sheltered island habitat in the warm water region of the southern Channel Islands. It was established as a research site under control of the adjacent Wrigley Institute for Environmental Studies (WIES). WIES has become a popular educational and outreach center. It now subsidizes graduate student work and continues to support university researchers. The no-take MPA is vital to those operations. In addition, this site has strong research and monitoring potential to assess the effectiveness of no-take MPAs on resources since surrounding areas receive heavy recreational fishing pressure. Kelp bass and sheephead were found in higher densities and larger sizes in this MPA compared with nearby areas open to harvest indicating that this MPA is protecting these desirable species to a greater extent than general fishery regulations elsewhere. Expansion of this site, either along the shoreline or to include nearby offshore reef systems, could increase its usefulness as a research tool.

Published references related to effectiveness of this MPA:

None found

Unpublished references related to effectiveness of this MPA:

Tetreault, I. and R.F. Ambrose. (in prep.)

Published references related to use of this MPA as a research tool:

Unpublished references related to use of this MPA as a research tool:
Tetreault, I. and R.F. Ambrose. (in prep.)
Habitat mapping
Tetreault, I. and Dawson, E. Y.

- Shoreline length: 1.84 nm
- Area: 1.67 nm
- Year established: 1994

a State Marine Reserve.
Marine Managed Areas Improvement Act from an “Ecological Reserve” to

- Area: 0.04 nm
- MLPA Region: South (Orange County)

- Twin Pts.

- Seal Rock

- Bird Rock

- Twin Pts.

Maps created by McArdle & Gerson 2002.

- Big Sycamore Canyon

- Sandstone Bank 100%

Surrounding habitat types: Mostly sandy areas. Kelp forest and reef habitat at Deer Canyon to the east. Mugu Submarine Canyon to the west.

Baseline and ongoing monitoring and research studies: Habitat mapping surveys (sonar) conducted as part of MERIP research projects.

Basic Evaluation: This site was chosen as an MPA location because it was least objectionable to users during the MPAs process. Habitat here is almost entirely sand with no reef structure. As such, this site does not contain the large diversity of species and habitats that are present in many other MPAs. Despite these limitations, it is the only MPA which provides protection to an extensive area of this type of wide spread habitat in southern California. Habitat, a highly sought after species, are protected here, as well as a potential spawning area for market squid. Expansion of this site to the east would include kelp reef habitats providing a more diverse habitat representation in the reserve.

Published references related to effectiveness of this MPA: None found


Published references related to use of this MPA as a research tool: None found


Habitat types: Rocky platforms and sandy beaches. Extending out into the subtidal zone. As for most of this section of the coast, rocky benches are hereditarily sand inhibited with rocky platforms and headlands separated by intermittent pocket sandy beaches. Main Beach in Laguna is very heavily used by tourists.

Surrounding habitat types: Similar to the site. Rocky points and benches, sandy coves with scattered eelgrass beds

Baseline and ongoing monitoring and research studies: Historic algae surveys were performed in 1957–59 by E. Yale Dunton at a site inside Heisler Park. Two surveys were repeated in the late 1960s by T. Widdowson and in the 1970s and early 1980s by Ronald Thom. Steve Murray resurveyed Dunton’s transects at Laguna Beach during Fall 1998. Bruce Tettavall surveyed the nearshore fish populations at Heisler Park as part of a study of the effects of Ecological Reserve designations on extracted populations.

Basic Evaluation: Provides complete protection to all marine life in a southern California coastal nearshore reef habitat. The site’s small size and heavy public use within the site and nearby areas appears to limit the effectiveness of protection. Despite these factors, burned sand and low bush had higher densities and larger sizes in this MPA than in areas nearby subject to harvesting pressures indicating that this site is protecting these desirable species to a greater extent than general fishery regulations alone in areas elsewhere. Combining the adjacent Laguna Beach Marine Life Refuge with this site and providing for the same higher level of resource protection would eliminate public confusion over allowable activities and simplify enforcement while providing a larger area of habitat for undisturbed ecosystem functions and biodiversity maintenance.

Published references related to effectiveness of MPAs: None found

Unpublished references related to effectiveness of MPAs: Tettavall, I. and R. J. Anderson. (in prep)

Published references related to use of this MPA as a research tool: Dunton, E. Y. 1959; Dunton, E. Y. 1965; Thom, R. M., and T. B. Widdowson. 1978; Widdowson, T. B. 1971

Unpublished references related to use of this MPA as a research tool: Tettavall, I. and R.J. Anderson. (in prep.)
Selected References


Thompson, W.F. 1919. The scientific investigations of marine fisheries, as related to the work of the Fish & Game Commission in Southern California. California Fish & Game Commission. Fish Bull. No.2. Sacramento.


Williamson, M.B. 1894. Abalone or *Haliotis* Shells of the Californian Coast, Amer. Nat., Vol. XXVII.

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Meeresalgen (kelp) in “Das Meer” (The Sea) in MJ Scheiden, p. 168. 1888. NOAA Digital Library