Chapter 6. ENVIRONMENTAL IMPACTS OF ALTERNATIVES

In developing the proposed project, the Department and a broad based constituent panel, the Marine Reserves Working Group (MRWG), evaluated several approaches and alternatives. In addition to the proposed project, the Department has provide the Commission with five alternatives that were developed during the MRWG process or suggested by the public (Appendix 3). The alternatives, including the no-action (status-quo) alternative required under CEQA guidelines, were selected to provide the Commission with a range of alternatives. The no-action alternative would involve continuation of the existing commercial and sport regulations and Marine Protected Areas within State waters. An alternative was also provided that would defer decision on the matter to the ongoing Marine Life Protection Act process.

The following analyses use the same criteria listed in Chapter 5 for impacts to the natural and human environment. Descriptions of each alternative are found in Chapter 3 and Appendix 5. A summary comparison of all alternatives is provided in section 6.8.

6.1 Alternative 1

6.1.1 Natural Environment

The State water area in Alternative 1 is approximately ~~69~~ **79** square nautical miles, 6 percent of Sanctuary waters or 12 percent of State waters within the Sanctuary (Table 6-1). Protecting the reserve areas proposed as Alternative 1 would contribute to increasing biomass, individual size, and reproductive potential of organisms within the reserve areas, particularly for species with low dispersal and high reproduction. However, the network of MPAs in Alternative 1 is not likely to achieve the goal for conservation of ecosystem biodiversity or sustaining fisheries established by the Marine Reserves Working Group because the reserve areas do not include all habitat types in all bioregions, and the individual reserves are relatively small. In particular, the areas proposed as Alternative 1 do not include sufficient representation of nearshore habitats, rocky sediments in the euphotic zone (0-30 m) and kelp forests.

The Federal waters phase would add one offshore MPA to the network as well as additional offshore area to most of the MPAs in Alternative 1. This additional area would have additional beneficial impacts to the biological environment through the addition of habitat representation. The total area in Alternative 1 and the subsequent Federal waters phase is approximately 12 percent, or ~~141~~ **162** square nautical miles, of the Sanctuary (Table 6-1).

NOTE: For the purposes of comparative size analysis in the Draft Environmental Document, the project area was considered to be a "planning unit" area encompassing 1500 square miles (1133 square nautical miles) which could be easily described in a Geographic Information System database. In order to more specifically and accurately represent reserve size, total square nautical miles is used in this Final Environmental Document. This does not change the percentage areas or comparative analyses nor does it alter the environmental impact analysis or Department's conclusions as to the potential impacts of the proposed prosed project.

Habitat Representation

Alternative 1 protects a relatively small portion of all bioregions in the project area. Although each bioregion is represented with one or several small MPAs, none of the bioregions is represented sufficiently to contribute to production outside of the MPAs. In other words, export of harvested or targeted species from MPAs would be diluted because the reserve area is small relative to the fished area.

Protection from fishing provided by Alternative 1 is not equally distributed across bioregions. Five MPAs are located in the cool water region (the Oregonian Bioregion) around the northwestern Channel Islands. Three MPAs are located in the warmer water (the Californian Bioregion) around Anacapa and Santa Cruz Islands. No nearshore or shallow water habitats are protected around Anacapa and Santa Barbara Islands. A single reserve is located in the transitional zone between warm and cool waters. The existing Cowcod Conservation Area below 120 feet around Santa Barbara Island supplements the relatively low representation in the Transition Zone. Table 6-1 compares the area and percentage coverage of various habitats protected in State Marine Reserves.

Rocky shores (exposed and protected combined) and sandy beaches are inadequately represented in State Marine Reserves proposed in Alternative 1, with percentage representation ranging from 12-18% (Table 6-1). The cumulative impacts of the Federal waters phase would not increase this representation (Table 6-1)

All sediments (mud, sand, gravel, boulder, and bedrock) in the euphotic zone (0-30 m) are inadequately represented in Alternative 1 (Table 6-1). Rocky sediments are inadequately represented and sandy sediments poorly represented on the shallow continental shelf (30-100 m). However, the Cowcod Conservation Area below 120 feet around Santa Barbara Island is closed to bottom fishing, thus protecting additional habitat in the Transition Zone (Table 6-1). The Cowcod Conservation Area protects additional sandy and rocky habitats in the Transition Zone. Soft sediments on the deep continental shelf (100-200 m) are poorly represented (Table 6-1). Little is known about the distribution of hard sediments on the deep continental shelf and slope in the Oregonian and California Bioregions. The cumulative impacts of a Federal waters phase would increase protection for most sediments in deeper water. Cumulative representation of soft sediments would be inadequate and hard sediments adequate on the shallow continental shelf (30-100 m) (Table 6-1). Cumulative representation of soft habitats would be inadequate on the continental shelf (100-200 m) and poor on the continental slope (greater than 200 m) (Table 6-1).

Giant kelp and surfgrass are both inadequately represented in this alternative (Table 6-1). Eelgrass, however, is well represented with 35% of the available habitat in Marine Protected Areas (Table 6-1). Cumulative impacts of a Federal waters phase would not change these levels of representation.

Table 6-1. Total and percent representation of ecological criteria protected by State Marine Reserves proposed as Alternative 1.

Ecological Criteria	Alternative 1 State Waters	Federal Waters Phase	Cumulative Total
Reserve Size (nm^2)	79	83.1	162.1
(Percent of Habitat in Sanctuary Waters)	(6%)	(6%)	**(12%)**
1. Sandy Coast (mi)	7.7 (18%)	-	**7.7 (18%)**
2. Rocky Coast (protected) (mi)	7.6 (12%)	-	**7.6 (12%)**
3. Rocky Coast (exposed) (mi)	7.6 (18%)	-	**7.6 (18%)**
4. Soft Sediment (0-30 m) (nm^2)	9.1 (11%)	-	**9.1 (11%)**
5. Hard Sediment (0-30 m) (nm^2)	5.9 (12%)	-	**5.9 (12%)**
6. Soft Sediment (30-100 m) (nm^2)	28.8 (9%)	31.7 (10%)	**60.5 (18%)**
7. Hard Sediment (30-100 m) (nm^2)	7.1 (19%)	1.3 (4%)	**8.4 (22%)**
8. Soft Sediment (100-200 m) (nm^2)	11.3 (5%)	15.8 (6%)	**27.1 (11%)**
9. Hard Sediment (100-200 m) (nm^2)	-	-	**-**
10. Soft Sediment (>200 m) (nm^2)	2.5 (0.4%)	41.9 (8%)	**41.9 (7%)**
11. Hard Sediment (>200 m) (nm^2)	-	-	**-**
12. Emergent Rocks (nearshore) (no.)	62 (12%)	-	**62 (12%)**
13. Emergent Rocks (offshore) (nm^2)	0	3 (8%)	**3 (8%)**
14. Submarine Canyons (nm^2)	6 (17%)	9 (25%)	**15 (41%)**
15. Kelp Forest (nm^2)	2.6 (11%)	-	**2.6 (11%)**
16. Eelgrass (nm^2)	0.2 (35%)	-	**0.2 (35%)**
17. Surfgrass (nm^2)	3.3 (14%)	-	**3.3 (14%)**

Monitoring Sites

The potential benefits and costs of MPAs can only be determined if sufficient monitoring efforts follow their establishment. No-take marine reserves are necessary to distinguish the effects of fishing on marine organisms and habitats from environmental fluctuations. Existing monitoring sites are particularly important in MPA design because baseline data collected at monitoring sites would help scientists determine how populations within MPAs

have changed over time. It would not be possible to evaluate the impacts of State Marine Reserves proposed in Alternative 1 using data from existing monitoring sites because too few are included in the reserves. The MPAs proposed as Alternative 1 contain only ~~2~~ **3** of 16 National Park Service kelp forest monitoring sites. ~~None~~ **One** of the five monitoring sites is protected in the Oregonian Bioregion, one of six in the Transition Zone, and ~~two~~ **one** of five in the Californian Bioregion.

Human Threats and Natural Catastrophes

It is unlikely that all MPAs proposed in Alternative 1 would be impacted simultaneously by catastrophic events, such as oil spills or large storms, because they are widely distributed across the Sanctuary. However, catastrophic events could remove entire populations in one or several of the reserve areas because individual MPAs are small. The impacts of catastrophic events could be reduced by adding area to MPAs in the existing design or by adding additional reserve areas. The design of Alternative 1 does not incorporate the "insurance factor", a multiplier required to account for the effects of catastrophic events, recommended by Allison et al. (in press). Other mechanisms are available to prevent and respond to threats from spills or human catastrophes. These other mechanisms include spill response plans and traffic separation schemes to limit the chance of large tanker collisions. The distribution of MPAs in multiple areas around the islands may limit the impacts of a single event on all reserves at once.

Connectivity

Marine organisms often exhibit dispersal during at least one life history stage. Protecting multiple habitats, either in one large reserve or in several small but interconnected MPAs, may be important for growth and reproduction of marine organisms. In the Channel Islands, the strongest currents transport organisms across the northern Channel Islands from west to east, often forming strong counterclockwise recirculation in the Santa Barbara Channel. The patterns of circulation suggest that source populations may be located in productive areas on the north sides of San Miguel, Santa Rosa, and Santa Cruz Islands. A region of low current flow and potentially high larval retention occurs off northeastern Santa Cruz Island. There is limited potential connectivity among MPAs proposed as Alternative 1. The probability that larvae and adults would disperse to adjacent MPAs is relatively low because the total area covered by MPAs is small and each individual MPA on the north sides of Santa Rosa, Santa Cruz, and Anacapa Islands is small.

Potential for Congestion

Alternative 1 is the smallest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. There would be a high probability of relocating effort and a low probability of crowding and congestion effects in this alternative (Leeworthy and Wiley 2002). Potential impacts of crowding and congestion are discussed in Chapter 5.3.1.

6.1.2 Human Environment

Step 1 Analysis - Commercial Fishing and Kelp Harvesting

The Socioeconomic Panel estimated that this alternative would potentially impact more than $2 million or 7.2 percent of all ex-vessel revenue in the Sanctuary (Leeworthy and Wiley 2002). As a percent of total commercial catch in the Sanctuary, the largest potential impacts are on urchins (14 percent), prawn (13.4 percent), rockfish (13.3 percent) and sea cucumbers (12.8 percent). The smallest potential impacts are on tuna (1.6 percent), wetfish (3.3 percent), kelp (4.4 percent), squid (5.1 percent) and flatfishes (5.2 percent) (Table 6-2). The cumulative impacts of the Federal waters phase would potentially impact more than $2.1 million or 7.7 percent of all ex-vessel revenue in the Sanctuary. Most of the potential impact is from catch in State waters (93 percent). All of the potential impact on harvest of kelp and catch of urchins, spiny lobsters, rockfish, crab, California sheephead, and sea cucumbers is in the State waters portion of the Sanctuary. Most of the potential impact on prawn and tuna catch is in Federal waters. The cumulative effect of the Federal waters phase would potentially raise prawn impacts to 24.8 percent and tuna to 4.7 percent (Table 6-2).

Table 6-2. Commercial Fishing & Kelp: Impact of Alternative 1 on Ex-Vessel Value by Species Group - Step 1 Analysis

	State Waters		Federal Waters		Total	
Species Group	Value	% [1]	Value	%	Value	%
Squid	$ 661,722	5.07	$ 51,227	0.39	$ 712,950	5.46
Kelp [2]	$ 265,568	4.43	$ -	0.00	$ 265,568	4.43
Urchins	$ 735,214	13.96	$ -	0.00	$ 735,214	13.96
Spiny Lobster	$ 81,627	8.85	$ -	0.00	$ 81,627	8.85
Prawn	$ 94,170	13.39	$ 80,095	11.39	$ 174,265	24.78
Rockfish	$ 72,964	13.28	$ -	0.00	$ 72,964	13.28
Crab	$ 26,331	7.66	$ -	0.00	$ 26,331	7.66
Tuna	$ 5,007	1.64	$ 9,382	3.07	$ 14,389	4.71
Wetfish	$ 9,994	3.31	$ 4,800	1.59	$ 14,794	4.91
CA Sheephead	$ 24,024	10.18	$ -	0.00	$ 24,024	10.18
Flatfishes	$ 9,562	5.20	$ 600	0.33	$ 10,162	5.53
Sea Cucumbers	$ 21,406	12.76	$ -	0.00	$ 21,406	12.76
Sculpin & Bass	$ 4,435	7.35	$ 624	1.03	$ 5,059	8.39
Shark	$ 3,058	8.80	$ 144	0.41	$ 3,202	9.21
Total	$ 2,015,082	7.17	$ 146,873	0.52	$ 2,161,955	7.69

1. Percents are the amount of each species/species groups ex-vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

The greatest potential impact of Alternative 1, in terms of percent of annual total ex-vessel revenue by port, is on Santa Barbara ($852 thousand or 10 percent) (Table 6-3). Port Hueneme could potentially lose the next greatest amount (almost $554 thousand or 4.1

percent). Channel Islands Harbor could potentially lose $170 thousand or 3.5 percent. Ventura Harbor could potentially lose $70 thousand or 1.3 percent of the annual ex-vessel of all landings (Table 6-3). Although these potential losses represent between 1.3 and 10 percent of ex-vessel revenue, the percentage loss in total port revenue would be less because revenue from activities other than fishing would continue in the port areas. All other ports' ex-vessel revenue would potentially be decreased by small amounts. The cumulative potential losses with the addition of the Federal waters phase would result in the same distribution of impacts, with increases in dollar values (Table 6-3).

Table 6-3. Commercial Fishing & Kelp: Impacts of Alternative 1 on Ex-Vessel Value by Port - Step 1 Analysis

	State Waters		Federal Waters		Total	
Port	Value	% [1]	Value	%	Value	%
1. Moss Landing	3	N/A	1	N/A	4	N/A
2. Morro Bay	39	0.76	0	0.00	39	0.76
3. Avila/Port San Luis	17	0.00	1	0.00	19	0.00
4. Santa Barbara	852,406	9.92	5,116	0.06	857,523	9.98
5. Ventura Harbor	70,409	1.31	10,287	0.19	80,696	1.50
6. Channel Islands	170,227	3.48	65,863	1.35	236,090	4.83
7. Port Hueneme	553,819	4.06	49,954	0.37	603,773	4.43
8. San Pedro	66,681	0.48	5,938	0.04	72,618	0.52
9. Terminal Island	20,534	0.11	9,481	0.05	30,015	0.17
10. Avalon & Other LA	107	0.01	7	0.00	113	0.01
11. Newport Beach	5	0.00	7	0.00	12	0.00
12. San Diego	4,001	0.12	52	0.00	4,053	0.12

1. Percents are the amount of ex vessel value as a percent of the total ex-vessel value of landings at the Port (1996-1999 Average Annual Value).

The maximum potential impact on total annual income (Table 6-4) is over $5.3 million across all seven counties in the impact area. Most of the potential impacts are concentrated in Ventura and Santa Barbara counties. The potential impact in San Diego County is primarily from kelp. Potential employment impacts are distributed among counties similarly to the annual income impacts with 156 full and part-time jobs potentially impacted (Table 6-5). The cumulative effect of the Federal waters phase would potential create additional impact to both jobs and income (Tables 6-4 and 6-5).

Table 6-4. Commercial Fishing & Kelp: Impact of Alternative 1 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$481,271	$37,261	$518,532
2. San Luis Obispo	$14,383	$32	$14,416
3. Santa Barbara	$1,679,016	$12,112	$1,691,129
4. Ventura	$2,279,347	$312,044	$2,591,391
5. Los Angeles	$481,003	$33,225	$514,227
6. Orange	$12	$16	$28
7. San Diego	$427,929	$168	$428,097
All Counties	$5,362,962	$394,857	$5,757,819

Table 6-5. Commercial Fishing & Kelp: Impacts of Alternative 1 on Total Employment by County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	14	1	15
2. San Luis Obispo	1	0	1
3. Santa Barbara	55	0	55
4. Ventura	69	9	79
5. Los Angeles	13	1	14
6. Orange	0	0	0
7. San Diego	4	0	4
All Counties	156	12	168

Step 2 Analysis- Commercial Fishing and Kelp Harvesting

Alternative 1 is the smallest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. There would be a high probability of relocating effort and a low probability of crowding and congestion effects, both of which should decrease costs relative to the Step 1 analysis. The ability to catch tuna and wetfish in

surrounding areas lowers Step 1 estimates by about 1.4 percent. The relatively low potential impact to squid (5 percent, Table 6-2) means weekend closures are not likely to result in additional costs beyond Step 1. There is some possibility that this low level of catch reduction in squid could be made up from catch in other areas, to the extent that squid move around and they can be caught in the remaining open areas. The potential kelp impacts are also relatively low for this alternative (4.4 percent, Table 6-2); however, it is not clear that this can be made up by additional harvest in other areas. This alternative has a relatively high estimated potential impact on prawn fishermen (13.4 percent, Table 6-2). It is not clear whether these costs could in anyway be reduced. In the short-term, the overall potential impacts estimated in Step 1 are most likely over estimates. If the squid catch losses could be replaced from other areas, the reduction in potential impacts could be as much as 33 percent, since squid accounts for about 33 percent of the potential impact ($662 thousand of $2 million, Table 6-2).

In the long-term, the replenishment effects from Alternative 1 are likely to be minimal since the State Marine Reserves only cover about 6 percent of the Sanctuary, with only one of the 17 habitat types receiving protection levels of 20 percent or higher (Table 6-1). The benefits to areas outside the State Marine Reserves are probably minimal for this alternative and the long-term mitigation of costs lower. Whether replenishment effects are greater than crowding or congestion effects would determine if this alternative's long-term cost can be transformed into long-term benefits.

Step 1 Analysis – Recreational Consumptive Activities

In terms of potential impact on recreational consumptive activities, Alternative 1 is the smallest marine reserve alternative. It is significantly smaller that the proposed project in terms of both market and non-market potential impacts. The aggregate maximum potential loss to annual income for all consumptive recreation activities is about $1.9 million (Table 6-6) or 7.7 percent of the $24.7 million in annual income generated by recreational consumptive activities in the project area. The cumulative impact of the Federal waters phase is $2.4 million (Table 6-6) or 9.7 percent of the $24.7 million in annual income.

Table 6-6. Summary: Recreation Consumptive Activities for State and Federal Phases - Alternative 1 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	40,679	32,585	80.1%	8,093	19.9%
Market Impact					
Direct Sales	$ 3,352,951	$ 2,682,838	80.0%	$ 670,114	20.0%
Direct Wages and Salaries	$ 1,372,910	$ 1,097,074	79.9%	$ 275,836	20.1%
Direct Employment	43	34	80.4%	8	19.6%
Total Income					
Upper Bound	$ 2,402,592	$ 1,919,879	79.9%	$ 482,713	20.1%
Lower Bound	$ 2,059,364	$ 1,645,610	79.9%	$ 413,754	20.1%
Total Employment					
Upper Bound	64	51	80.4%	13	19.6%
Lower Bound	53	43	80.4%	10	19.6%
Non-Market Impact					
Consumer's Surplus	$ 471,006	$ 377,296	80.1%	$ 93,711	19.9%
Profit[1]	$ 42,086	$ 33,439	79.5%	$ 8,647	20.5%

1. Profit is used as a proxy for producer's surplus.

The magnitude of potential impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g., income). In terms of person-days, the activity with the highest potential impacts is private boat fishing with a maximum potential loss of 16,267 person-days, followed by charter/party boat fishing with 12,752 person-days (Table 6-7). In terms of total annual income, the activity with the highest potential impacts is charter/party boat fishing with a maximum potential loss of $1.3 million. Cumulative impacts with the addition of the Federal phase would increase both potential losses in person-days of activity and income. **In** terms of person-days, the activity with highest cumulative potential impacts is private boat fishing with a maximum potential loss of 20,469 person-days. In terms of total annual income, the activity with highest cumulative potential impacts is charter/party boat fishing with a maximum potential loss of $1.7 million (Table 6-8).

Table 6-7. Recreational Consumptive Activities - Alternative 1 - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	12,752	8.03%	1,337	7.46%	16,267	7.60%	2,229	4.72%
Market Impact								
Direct Sales	$ 1,666,068	8.07%	$ 218,625	7.27%	$ 675,571	7.60%	$ 122,574	4.72%
Direct Wages and Salaries	$ 768,553	8.11%	$ 106,221	7.33%	$ 189,973	7.60%	$ 32,327	4.73%
Direct Employment	23	8.29%	4	7.60%	6	7.54%	1	4.81%
Total Income								
Upper Bound	$ 1,344,968	8.11%	$ 185,887	7.33%	$ 332,452	7.60%	$ 56,572	4.73%
Lower Bound	$ 1,152,829	8.11%	$ 159,332	7.33%	$ 284,959	7.60%	$ 48,490	4.73%
Total Employment								
Upper Bound	35	8.27%	5	7.60%	10	7.60%	2	4.81%
Lower Bound	29	8.27%	5	7.60%	8	7.57%	1	4.73%
Non-Market Impact								
Consumer's Surplus	$ 147,657	8.03%	$ 15,482	7.46%	$ 188,352	7.60%	$ 25,805	4.72%
Profit [1]	$ 30,310	8.05%	$ 3,130	7.11%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 6-8. Recreational Consumptive Activities - Alternative 1 – Cumulative Total Including Federal Waters Phase - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	16,345	10.29%	1,456	8.12%	20,469	9.56%	2,409	5.10%
Market Impact								
Direct Sales	$ 2,131,987	10.33%	$ 238,408	7.92%	$ 850,074	9.56%	$ 132,482	5.10%
Direct Wages and Salaries	$ 983,138	10.38%	$ 115,823	7.99%	$ 239,051	9.56%	$ 34,897	5.11%
Direct Employment	29	10.54%	4	8.27%	8	9.48%	1	5.20%
Total Income								
Upper Bound	$ 1,720,492	10.11%	$ 202,691	7.49%	$ 418,340	9.36%	$ 61,069	4.73%
Lower Bound	$ 1,474,708	10.17%	$ 173,735	7.59%	$ 358,577	9.40%	$ 52,345	4.81%
Total Employment								
Upper Bound	44	10.25%	6	7.83%	12	9.41%	2	4.80%
Lower Bound	37	10.35%	5	7.87%	10	9.44%	2	4.95%
Non-Market Impact								
Consumer's Surplus	$ 189,256	10.29%	$ 16,856	8.12%	$ 237,004	9.56%	$ 27,890	5.10%
Profit [1]	$ 38,674	10.28%	$ 3,412	7.75%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Due to the absence of a reserve in the Santa Barbara Island region of the project area, the potential impact of this alternative on Los Angeles county would be lower (7 percent in terms of person-days of activity). Because of the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles county. Therefore, the maximum potential loss to this group of users would be less.

Step 2 Analysis – Recreational Consumptive Activities

Alternative 1 is the smallest of those being considered, both in terms of area and potential impact to recreational consumptive users. The probability of success of relocating effort and substituting to alternative sites is higher for this alternative than for the proposed project because of the relatively small size of the alternative and because Alternative 1 does not contain a high proportion of heavily used areas for any of the consumptive

activities. Furthermore, the highest use areas surrounding Anacapa Island and the east side of Santa Cruz Island are not as heavily impacted as other areas that are less used by consumptive users. The potential for crowding/congestion effects could also be low, again because of the relatively small sizes and the locations of MPAs proposed in this alternative. In the short-term, potential impacts should be less than estimated in Step 1 analyses.

In the long-term, depending upon consumptive users' success in finding substitute sites combined with an expected increase in size and quantity of sport fish in areas adjacent to State Marine Reserves, there may actually be a net benefit to consumptive users. The number of interacting variables in marine ecosystems precludes accurate predictions of the magnitude of potential changes in abundance of target species. However, preliminary attempts to model ecosystems with reserve management have suggested that large MPAs provide significantly greater benefits to target species than small MPAs and limited-take zones (Salomon et al. 2002). Protecting the reserve areas proposed as Alternative 1 is not likely to contribute to recreational fisheries through larval export and spillover. In other words, export from MPAs would be diluted because the reserve area is small relative to the fished area. Individual MPAs, particularly those on the north sides of Santa Rosa, Santa Cruz and Anacapa, are not likely to provide sufficient protection to reduce mortality and sustain local populations of some targeted species.

Step 2 Analysis – Recreational Non-Consumptive Users

In terms of potential impact (in this case positive) of non-consumptive activities this is the smallest marine reserve alternative. The total baseline annual income associated with all non-consumptive activities in Alternative 1 is about $362 thousand. In terms of annual income, the activity with the highest baseline is whale watching with a baseline of $181 thousand, followed by non-consumptive diving with $129 thousand, sailing with $28 thousand and kayaking/sightseeing with $23 thousand (Table 6-9). The cumulative effect of a Federal phase would potentially total $383 thousand or 6.4 percent of the annual income generated in the project area (Table 6-10). In terms of annual income, the activity with the highest cumulative baseline is whale watching with a baseline of $182 thousand (Table 6-10).

Table 6-9. Economic Impact Associated with Non-consumptive Activities - Alternative 1 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,288	4.96%	937	8.69%	197	4.91%	126	10.19%
Market Impact								
Direct Sales	$ 213,891	5.0%	$ 151,064	8.1%	$ 33,296	4.8%	$ 26,492	10.3%
Direct Wages and Salaries	$ 103,687	5.0%	$ 73,702	8.2%	$ 16,112	4.9%	$ 13,315	10.3%
Direct Employment	3	4.8%	3	8.7%	1	4.9%	1	10.4%
Total Income								
Upper Bound	$ 181,453	5.0%	$ 128,978	8.2%	$ 28,196	4.9%	$ 23,301	10.3%
Lower Bound	$ 155,531	5.0%	$ 110,553	8.2%	$ 24,168	4.9%	$ 19,973	10.3%
Total Employment								
Upper Bound	5	4.8%	4	8.6%	1	4.8%	1	10.2%
Lower Bound	4	4.8%	3	8.7%	1	5.0%	1	9.7%
Non-Market Impact								
Consumer's Surplus	$ 14,910	5.0%	$ 10,848	8.7%	$ 2,281	4.9%	$ 1,455	10.2%
Profit[1]	$ 6,428	4.1%	$ 3,054	6.6%	$ 439	2.4%	$ 275	10.0%

1. Profit is used as a proxy for producer's surplus.

Table 6-10. Economic Impact Associated with Non-consumptive Activities - Alternative 1 – Cumulative Total Including Federal Phase (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,290	4.96%	1,042	9.67%	229	5.70%	126	10.19%
Market Impact								
Direct Sales	$ 214,264	5.0%	$ 169,595	9.1%	$ 38,651	5.6%	$ 26,492	10.3%
Direct Wages and Salaries	$ 103,868	5.0%	$ 82,767	9.2%	$ 18,703	5.7%	$ 13,315	10.3%
Direct Employment	3	4.8%	3	9.7%	1	5.7%	1	10.4%
Total Income								
Upper Bound	$ 181,769	5.0%	$ 144,842	9.2%	$ 32,731	5.7%	$ 23,301	10.3%
Lower Bound	$ 155,802	5.0%	$ 124,150	9.2%	$ 28,055	5.7%	$ 19,973	10.3%
Total Employment								
Upper Bound	5	4.8%	5	9.6%	1	5.6%	1	10.2%
Lower Bound	4	4.8%	4	9.6%	1	5.8%	1	9.7%
Non-Market Impact								
Consumer's Surplus	$ 14,936	5.0%	$ 12,067	9.7%	$ 2,648	5.7%	$ 1,455	10.2%
Profit[1]	$ 6,437	4.1%	$ 3,511	7.6%	$ 510	2.8%	$ 275	10.0%

1. Profit is used as a proxy for producer's surplus.

Table 6-10 shows the cumulative baseline economic impact to potential beneficiaries of Alternative 1. The Socioeconomic Panel extended that logic to a range of benefit scenarios (Leeworthy and Wiley 2002). Table 6-11 shows the range of potential cumulative benefits based on certain assumptions about the increase in quality and the value elasticity of quality. By quality, the Socioeconomic Panel referred to a composite attribute that takes into consideration the range of benefits that could have an impact on the non-consumptive recreation experience (Leeworthy and Wiley 2002). This included such attributes as the diversity of wildlife, abundance of fish and invertebrates, the decrease in the density of users, the increase in water quality, etc. They used a range of a 10 percent increase to a 100 percent increase in quality (Leeworthy and Wiley 2002). Value elasticity of quality is defined as the percentage increase in value associated with a one-percent increase in quality. The Socioeconomic Panel used a range of elasticities of 0.04 to 4.5 in the analyses (Leeworthy and Wiley 2002). The valuation measure used for this illustration is consumer surplus associated with the boundary alternative, summed

across all non-consumptive uses. Table 6-9 presents a range of benefits with low end of $124 with the assumption of a 10 percent increase in quality and a 0.04 value elasticity of quality and a high end of $139,977 with a 100 percent increase in value and a value elasticity of quality of 4.5 (Table 6-11).

Table 6-11. Potential Benefits to Non-consumptive Users from Alternative 1 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 124	$ 3,111	$ 13,998
	Income	$ 1,531	$ 38,264	$ 172,189
	Employment	0.05	1.14	5.14
	Person-days	11	269	1,209
50%				
	Consumer's Surplus	$ 622	$ 15,553	$ 69,989
	Income	$ 7,653	$ 191,322	$ 860,947
	Employment	0.23	5.72	25.72
	Person-days	54	1,344	6,046
100%				
	Consumer's Surplus	$ 1,244	$ 31,106	$ 139,977
	Income	$ 15,306	$ 382,643	$ 1,721,895
	Employment	0.46	11.43	51.44
	Person-days	107	2,687	12,092

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 1

Vessel Traffic

Like the proposed project (Section 5.4.6), Alternative 1 does not change the commercial vessel Traffic Separation Scheme, does not alter existing mainland ports and harbors, and allows for transit through and anchoring in MPAs. Alternative 1 would not significantly impact vessel traffic.

6.2 Alternative 2

6.2.1 Natural Environment

The State water area in Alternative 2 is approximately ~~72~~ **83** square nautical miles, 6 percent of Sanctuary waters or 12 percent of State waters within the Sanctuary. Protecting the reserve areas proposed as Alternative 2 would contribute to increasing biomass, individual size, and reproductive potential of organisms within the reserve areas, particularly for species with low dispersal and high reproduction. However, the network of MPAs that is Alternative 2 is not likely to achieve the goal for conservation of ecosystem biodiversity established by the Marine Reserves Working Group because the reserve areas do not include all habitat types in all bioregions nor enough of each habitat. In

particular, the reserve areas proposed as Alternative 2 do not include sufficient representation of nearshore rocky and sandy habitats, and giant kelp forests in the Californian Bioregion and the Transition Zone. State Marine Reserves proposed as Alternative 2 do not adequately protect rocky and sandy habitats on the continental shelf and slope in all bioregions. It is difficult to determine the biological effects of the State Marine Conservation Areas proposed in Alternative 2 because allowing certain activities does not meet the criteria of ecosystem protection.

The Federal waters phase would add one offshore MPA to the network as well as additional offshore area to most of the MPAs in Alternative 2. This additional area would have additional beneficial impacts to the biological environment through the addition of habitat representation. The total area in Alternative 2 and the subsequent Federal waters phase is approximately 14 percent, or ~~161~~ **185** square nautical miles, of the Sanctuary (Table 6-12).

Habitat Representation

Alternative 2 protects a portion of all bioregions in the project area. Although each bioregion is represented with one or several small MPAs, none of the regions is represented sufficiently to contribute to production outside of the MPAs. In other words, export from MPAs would be diluted because the reserve area is small relative to the fished area.

Protection from fishing provided by Alternative 2 is not equally distributed across bioregions. Five MPAs are located in the cool water region (the Oregonian Bioregion) around the northwestern Channel Islands. Three MPAs are located in the warmer water (the Californian Bioregion) around Anacapa and Santa Cruz Islands. A single reserve (32 square nautical miles) is located in the transitional zone between warm and cool waters. No MPAs are proposed for the waters around Santa Barbara Island. The existing Cowcod Conservation Area below 120 feet around Santa Barbara Island supplements the relatively low representation in the Transition Zone. Table 6-12 compares the area and percentage coverage of various habitats protected in State Marine Reserves within each bioregion. As some fishing could occur in other types of MPAs, the habitats they represent are not included in this table.

Exposed rocky coast is adequately represented in Alternative 2. Protected rocky coast, however, is poorly represented and sandy coast is inadequately represented (Table 6-12). The cumulative impacts of a Federal waters phase would not increase this representation (Table 6-12).

All sediments (mud, sand, gravel, boulder, and bedrock) in the euphotic zone (0-30 m) are inadequately represented in Alternative 2. Representation of habitats on the shallow continental shelf (30-100 m) is also inadequate (Table 6-10). The Cowcod Conservation Area, however, protects additional sandy and rocky habitats in the Transition Zone (Table

6-12). Soft sediments on the continental shelf (100-200 m) are poorly represented in this alternative (Table 6-12). Little is known about the distribution of hard sediments on the deep continental shelf. Though the cumulative impacts of a Federal waters phase would add representation fo sediments on the shallow continental shelf, continental shelf, and continental slope, the relative representation remains the same. With the exception of the existing Cowcod Conservation Area around Santa Barbara Island all sediments along the continental slope (greater than 200 m) are poorly represented in Alternative 2 (Table 6-12).

Giant kelp and surfgrass are both inadequately represented in Alternative 2 (Table 6-12). Eelgrass, however, is adequately represented. (Table 6-12). The addition of a Federal waters phase would have no cumulative impact or change the representation of these nearshore habitats.

Table 6-12. Total and percent representation of ecological criteria protected by State Marine Reserves proposed as Alternative 2.

Ecological Criteria	**Alternative 2 State Waters**	**Federal Waters Phase**	**Cumulative Total**
Reserve Size (nm^2)	**83**	**102**	**185**
(Percent of Habitat in Sanctuary Waters)	(6%)	(8%)	**(14%)**
1. Sandy Coast Habitat	7.2 (17%)	-	**7.2 (17%)**
2. Rocky Coast (protected)	5.3 (9%)	-	**5.3 (9%)**
3. Rocky Coast (exposed)	8.9 (21%)	-	**8.9 (21%)**
4. Soft Sediment (0-30 m)	8.6 (10%)	-	**8.6 (10%)**
5. Hard Sediment (0-30 m)	6.7 (14%)	-	**6.7 (14%)**
6. Soft Sediment (30-100 m)	31.7 (10%)	20.5 (6%)	**52.2 (16%)**
7. Hard Sediment (30-100 m)	5.0 (13%)	0	**5 (13%)**
8. Soft Sediment (100-200 m)	9.6 (4%)	19 (8%)	**28.6 (12%)**
9 Hard Sediment (100-200 m)	-	-	**-**
10. Soft Sediment (>200 m)	3.1 (0.6%)	44.9 (8%)	**44.9 (8%)**
11. Hard Sediment (>200 m)	-	-	**-**
12. Emergent Nearshore Rocks	89 (17%)	-	**89 (17%)**
13. Emergent Offshore Rocks	7 (18%)	2 (5%)	**10 (25%)**
14. Submarine Canyons	7 (19%)	5 (14%)	**12 (33%)**
15. Kelp Forest	3.2 (13%)	-	**3.2 (13.5%)**
16. Eelgrass	0.14 (23%)	-	**0.1 (23.3%)**
17. Surfgrass	3.7 (16%)	-	**3.7 (16%)**

Monitoring Sites

The potential benefits and costs of State Marine Reserves can only be determined if sufficient monitoring efforts follow their establishment. No-take marine reserves are necessary to distinguish the effects of fishing on marine organisms and habitats from environmental fluctuations. Existing monitoring sites are particularly important in the design of State Marine Reserves because baseline data collected at monitoring sites will help scientists determine how populations within MPAs have changed over time. It would not be possible to evaluate the potential impacts of State Marine Reserves proposed in Alternative 2 using data from existing monitoring sites because too few existing sites are contained within the MPAs. The MPAs proposed as Alternative 2 contain only ~~4~~ **5** of 16 National Park Service kelp forest monitoring sites. ~~None~~ **One** of the five monitoring sites is protected in the Oregonian Bioregion, one of six in the Transition Zone, and three of five in the Californian Bioregion.

Human Threats and Natural Catastrophes

It is unlikely that all MPAs proposed as Alternative 2 would be impacted simultaneously by catastrophic events, such as oil spills or large storms, because they are widely distributed across the Sanctuary. However, catastrophic events could decimate entire populations in one or several of the reserve areas because individual MPAs are small. The potential impacts of catastrophic events could be reduced by adding area to MPAs in the existing design or by adding additional reserve areas. The design of Alternative 2 does not incorporate the "insurance factor", a multiplier required to account for the effects of catastrophic events, recommended by Allison et al. (in press). Other mechanisms are available to prevent and respond to threats from spills or human catastrophes. These other mechanisms include spill response plans and traffic separation schemes to limit the chance of large tanker collisions. The distribution of MPAs in multiple areas around the islands may limit the impacts of a single event on all reserves at once.

Connectivity

Marine organisms often exhibit dispersal during at least one life history stage. Protecting multiple habitats, either in one large reserve or in several small but interconnected MPAs, may be important for growth and reproduction of marine organisms. In the Channel Islands, the strongest currents transport organisms across the northern Channel Islands from west to east, often forming strong counterclockwise recirculation in the Santa Barbara Channel. The patterns of circulation suggest that source populations may be located in productive areas on the north sides of San Miguel, Santa Rosa, and Santa Cruz Islands. A region of low current flow, and potentially high larval retention occurs off northeastern Santa Cruz Island. There is limited potential connectivity among MPAs proposed by Alternative 2. The probability that larvae and adults would disperse between MPAs located around the western and eastern islands is relatively low because the total area covered by MPAs is small, and each individual reserve on the north sides of Santa Rosa, Santa Cruz, and

Anacapa Islands is small. In particular, the reserve on the north side of Santa Rosa Island is much smaller than recommended by the MRWG Science Advisory Panel. Alternative 2 does not provide protection for habitats and species on the north side of Santa Cruz Island, west of Chinese Harbor.

Potential for Congestion

Alternative 2 is the second smallest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. There would be a high probability of relocating effort and a low probability of crowding and congestion effects in this alternative (Leeworthy and Wiley 2002). Potential impacts of crowding and congestion are discussed in Chapter 5.3.1

6.2.2 Human Environment

Step 1 Analysis – Commercial Fishing and Kelp Harvesting

The Socioeconomic Panel estimated that this alternative would potentially impact more than $2.1 million or 7.5 percent of all ex-vessel revenue in the Sanctuary (Leeworthy and Wiley 2002). As a percent of total commercial catch in the Sanctuary, the largest potential impacts are on California sheephead (19 percent), sea cucumbers (17 percent), sea urchins (13.4 percent), and rockfish (11.1 percent). The smallest potential impacts are on tuna (1.8 percent), wetfish (4.2 percent), shark (5.1 percent), squid (5.5 percent), and kelp (5.6 percent) (Table 6-13). The cumulative impacts of the Federal waters phase would potentially impact more than $2.2 million or 7.9 percent of all ex-vessel revenue in the Sanctuary (Table 6-13). Most of the potential impact is from catch in State waters (94.7 percent). All of the potential impact on harvest of kelp and catch of urchins, spiny lobsters, ~~rockfish~~, crab, California sheephead, and sea cucumbers is in the State waters portion of the Sanctuary. Most of the potential impact on prawn catch is in Federal waters. The cumulative effect of the Federal waters phase would potentially raise prawn impacts to 19.4 percent (Table 6-13). This alternative attempts to further limit impact by creating four State Marine Conservation Areas (e.g., Carrington Point, Scorpion East, Scorpion West and Anacapa West). These SMCAs allow commercial take of squid, spiny lobster, crab, urchin, and for selected pelagic finfish (tuna and wetfish). The potential impact on annual ex-vessel revenue without these exemptions would have been over $3.3 million or 11.8 percent of all annual ex-vessel revenue from the Sanctuary. The exemptions resulted in a reduction of potential impact of this alternative by one-third.

Table 6-13. Commercial Fishing & Kelp: Impact of Alternative 2 on Ex-Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 712,953	5.46	$ 12,807	0.10	$ 725,760	5.56
Kelp [2]	$ 332,794	5.55	$ -	0.00	$ 332,794	5.55
Urchins	$ 704,761	13.39	$ -	0.00	$ 704,761	13.39
Spiny Lobster	$ 83,425	9.05	$ -	0.00	$ 83,425	9.05
Prawn	$ 63,271	9.00	$ 73,248	10.42	$ 136,519	19.41
Rockfish	$ 60,731	11.06	$ 8,458	1.54	$ 69,189	12.60
Crab	$ 26,943	7.84	$ -	0.00	$ 26,943	7.84
Tuna	$ 5,467	1.79	$ 10,910	3.57	$ 16,377	5.36
Wetfish	$ 12,573	4.17	$ 6,186	2.05	$ 18,759	6.22
CA Sheephead	$ 44,262	18.76	$ -	0.00	$ 44,262	18.76
Flatfishes	$ 20,152	10.96	$ 2,775	1.51	$ 22,927	12.47
Sea Cucumbers	$ 28,667	17.09	$ -	0.00	$ 28,667	17.09
Sculpin & Bass	$ 6,004	9.95	$ 2,886	4.78	$ 8,890	14.74
Shark	$ 1,773	5.10	$ 450	1.29	$ 2,223	6.40
Total	$ 2,103,776	7.48	$ 117,720	0.42	$ 2,221,495	7.90

1. Percents are the amount of each species/species groups ex-vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

The greatest potential impact of Alternative 2, in terms of percent of annual total ex-vessel revenue by port, is on Santa Barbara ($822 thousand or 9.6 percent) (Table 6-14). In absolute amount, Port Hueneme could potentially lose the next greatest amount (almost $600 thousand or 4.4 percent of all annual ex-vessel revenue of landings) (Table 6-14). Channel Islands Harbor could potentially lose about $156 thousand or 3.2 percent. Ventura Harbor could potentially lose $83 thousands 1.5 percent of the annual ex-vessel of all landings (Table 6-14). Although these potential losses represent between 1.5 and 9.6 percent of ex-vessel revenue, the percentage loss in total port revenue would be less because revenue from activities other than fishing would continue in the port areas. All other ports' ex-vessel revenue would potentially be decreased by small amounts. The cumulative potential losses with the addition of the Federal waters phase would result in the same distribution of impacts, with increases in dollar values (Table 6-14).

Table 6-14. Commercial Fishing & Kelp: Impact of Alternative 2 on Ex-Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
1. Moss Landing	$4	N/A	$2	N/A	$6	N/A
2. Morro Bay	$72	1.41	$0	0%	$72	1.41
3. Avila/Port San Luis	$33	0.00	$5	0%	$38	0.00
4. Santa Barbara	$822,512	9.57	$11,574	13%	$834,085	9.71
5. Ventura Harbor	$83,274	1.54	$8,609	16%	$91,883	1.70
6. Channel Islands	$155,890	3.19	$62,714	128%	$218,604	4.47
7. Port Hueneme	$596,426	4.37	$19,445	14%	$615,871	4.52
8. San Pedro	$74,519	0.53	$3,469	2%	$77,987	0.56
9. Terminal Island	$21,819	0.12	$10,126	6%	$31,945	0.18
10. Avalon & Other LA	$114	0.01	$2	0%	$116	0.01
11. Newport Beach	$5	0.00	$8	0%	$13	0.00
12. San Diego	$3,836	0.11	$62	0%	$3,898	0.12

1. Percents are the amount of ex-vessel value as a percent of the total ex-vessel value of landings at the Port (1996-1999 Average Annual Value).

The maximum potential impact on total annual income is $5.6 million across all seven counties in the impact area (Table 6-15). Most of the potential impacts are concentrated in Ventura and Santa Barbara counties. The potential impact in San Diego County is primarily from kelp. Potential employment impacts are distributed among counties similarly to the annual income impacts with 161 full and part-time jobs potentially impacted (Table 6-16). The cumulative effect of the Federal waters phase would potential create additional impact to both jobs and income (Tables 6-15 and 6-16).

Table 6-15. Commercial Fishing & Kelp: Impact of Alternative 2 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$518,533	$9,319	$527,852
2. San Luis Obispo	$12,168	$1,628	$13,796
3. Santa Barbara	$1,625,984	$18,768	$1,644,751
4. Ventura	$2,418,613	$205,779	$2,624,392
5. Los Angeles	$522,535	$13,884	$536,419
6. Orange	$13	$19	$31
7. San Diego	$533,544	$196	$533,740
All Counties	$5,631,389	$249,592	$5,880,981

Table 6-16. Commercial Fishing & Kelp: Impact of Alternative 2 on Total Employment by County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	15	0	16
2. San Luis Obispo	0	0	1
3. Santa Barbara	53	1	53
4. Ventura	74	6	80
5. Los Angeles	14	0	14
6. Orange	0	0	0
7. San Diego	5	0	5
All Counties	161	8	169

Step 2 Analysis – Commercial Fishing and Kelp Harvesting

Alternative 2 is the second smallest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. There would be a high probability of relocating effort and a low probability of crowding and congestion effects both of which should decrease costs relative to the Step 1 analysis. The ability to catch tuna and wetfish

in surrounding areas lowers Step 1 analysis costs by 1.6 percent. Like Alternative 1, this alternative has a relatively low potential impact on the squid fishery (5.5 percent, Table 6-13). Potential kelp impacts are also relatively low for this alternative (5.6 percent, Table 6-13), but just as with Alternative 1, the Socioeconomic Panel was certain kelp harvest can be increased from other areas (Leeworthy and Wiley 2002). This alternative has a moderate initial impact to prawn fishermen (9 percent, Table 6-13), which could become relatively high with the cumulative impacts of a Federal waters phase (19.4 percent, Table 6-13). It is not clear how or if this potential impact could be reduced because other fishing sites may not be available. As in Alternative 1, it might be possible that squid catch could be replaced from other areas. Since squid represents about one-third of the lost annual ex-vessel value of catch from Alternative 2, it is possible that the Step 1 analysis estimates could be reduced by over 34 percent, even in the short-term.

In the long-term, the replenishment effects are likely to be minimal since the MPAs only cover about 12 percent of State waters within the Sanctuary, with only two of the 17 habitat types receiving protection levels of 20 percent or higher (Table 6-12). The benefits to areas outside the MPAs are probably minimal for this alternative and the long-term mitigation of costs lower. Whether replenishment effects are greater than crowding or congestion effects would determine if this alternative's long-term costs can be transformed into long-term benefits.

Step 1 Analysis – Recreational Consumptive Activities

In terms of potential impact on consumptive activities, Alternative 2 is slightly smaller than the proposed project. The aggregate maximum potential loss to annual income for all consumptive recreation activities is about $3.1 million (Table 6-17) or 12.6 percent of the $24.7 million in annual income generated by recreational consumptive activities in the project area. The cumulative impact of the Federal waters phase is $3.9 million (Table 6-17) or 15.8 percent of the $24.7 million in annual income.

Table 6-17. Summary: Recreational Consumptive Activities - Alternative 2 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	71,875	59,451	82.7%	12,424	17.3%
Market Impact					
Direct Sales	$ 5,632,831	$ 4,527,946	80.4%	$ 1,104,886	19.6%
Direct Wages and Salaries	$ 2,234,694	$ 1,769,845	79.2%	$ 464,849	20.8%
Direct Employment	70	56	80.0%	14	20.0%
Total Income					
Upper Bound	$ 3,910,714	$ 3,097,229	79.2%	$ 813,485	20.8%
Lower Bound	$ 3,352,040	$ 2,654,767	79.2%	$ 697,273	20.8%
Total Employment					
Upper Bound	105	84	80.0%	21	20.0%
Lower Bound	87	70	80.0%	17	20.0%
Non-Market Impact					
Consumer's Surplus	$ 832,222	$ 688,366	82.7%	$ 143,856	17.3%
Profit[1]	$ 62,683	$ 47,436	75.7%	$ 15,247	24.3%

1. Profit is used as a proxy for producer's surplus.

The magnitude of potential impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g., income). In terms of person-days, the activity with the highest potential impacts is private boat fishing with a maximum potential loss of 28,385 person-days, followed by charter/party boat fishing with 16,615 person-days (Table 6-18). In terms of total annual income, the activity with the highest potential impacts is charter/party boat fishing with a maximum potential loss of $1.7 million. Cumulative impacts with the addition of the Federal phase would increase both potential losses in person-days of activity and income. **In** terms of person-days, the activity with highest cumulative potential impacts is private boat fishing with a maximum potential loss of ~~33,996~~ **33,956** person-days. In terms of total annual income, the activity with highest cumulative potential impacts is charter/party boat fishing with a maximum potential loss of $2.4 million (Table 6-19).

Table 6-18. Recreational Consumptive Activities - Alternative 2 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	16,615	10.46%	3,447	19.22%	28,385	13.26%	11,004	23.32%
Market Impact								
Direct Sales	$ 2,164,101	10.49%	$ 579,796	19.27%	$ 1,178,848	13.26%	$ 605,200	23.32%
Direct Wages and Salaries	$ 997,646	10.53%	$ 281,282	19.41%	$ 331,484	13.26%	$ 159,432	23.33%
Direct Employment	30	10.64%	9	19.28%	11	13.15%	6	23.59%
Total Income								
Upper Bound	$ 1,745,881	10.53%	$ 492,244	19.41%	$ 580,097	13.26%	$ 279,006	23.33%
Lower Bound	$ 1,496,469	10.53%	$ 421,924	19.41%	$ 497,226	13.26%	$ 239,148	23.33%
Total Employment								
Upper Bound	44	10.62%	14	19.28%	17	13.25%	9	23.59%
Lower Bound	37	10.63%	12	19.28%	14	13.21%	7	23.20%
Non-Market Impact								
Consumer's Surplus	$ 192,375	10.46%	$ 39,914	19.22%	$ 328,668	13.26%	$ 127,408	23.32%
Profit [1]	$ 39,158	10.41%	$ 8,279	18.81%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 6-19. Recreational Consumptive Activities - Alternative 2 – Cumulative Total Including Federal Waters Phase - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	22,981	14.47%	3,639	20.29%	33,956	15.87%	11,299	23.94%
Market Impact								
Direct Sales	$ 2,988,969	14.48%	$ 612,212	20.35%	$ 1,410,210	15.87%	$ 621,440	23.94%
Direct Wages and Salaries	$ 1,377,478	14.54%	$ 297,005	20.50%	$ 396,555	15.87%	$ 163,656	23.95%
Direct Employment	41	14.62%	10	20.35%	13	15.65%	6	24.43%
Total Income								
Upper Bound	$ 2,410,587	14.16%	$ 519,759	19.20%	$ 693,971	15.52%	$ 286,397	22.18%
Lower Bound	$ 2,066,217	14.24%	$ 445,508	19.47%	$ 594,832	15.60%	$ 245,483	22.55%
Total Employment								
Upper Bound	61	14.21%	15	19.28%	20	15.65%	9	22.55%
Lower Bound	51	14.35%	12	19.38%	17	15.72%	7	22.90%
Non-Market Impact								
Consumer's Surplus	$ 266,086	14.47%	$ 42,136	20.29%	$ 393,173	15.87%	$ 130,827	23.94%
Profit [1]	$ 53,942	14.34%	$ 8,741	19.86%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

As in Alternative 1 this alternative does not have a reserve in the Santa Barbara Island region and one would expect the impact of this alternative on Los Angeles county users to be lower. However, because Alternative 2 encompasses the entire region in which users from Los Angeles operate, the relative impacts to Los Angeles county and the project area in general are similar (about 16 percent in terms of person-days).

Alternative 2 includes 11 individual sites, with two types of MPAs. Eight of these MPAs are State Marine Reserves. Three of the MPAs, Carrington Point, Scorpion (East and West), and Anacapa Island, are Marine Conservation Areas. This type of MPA allows take of spiny lobster and pelagic finfish. Although recreational fishing or consumptive diving data by species were not collected, the Recreational Fisheries Information Network (RecFIN), which adds fishing location to the Marine Recreational Fisheries Statistics Survey (MRFSS) data, was used to estimate the proportion of recreational pelagic finfish by California Department of Fish and Game fish block. Using this proportion to eliminate

pelagic finfish from the analysis, the model only takes into account prohibited species of finfish for these MPAs. Unfortunately, the sample did not include data for recreational taking of spiny lobsters. As a result, this analysis may be an overestimate of actual maximum potential impact.

Step 2 Analysis – Recreational Consumptive Activities

In the short term, complete mitigation by substituting to alternative sites is less likely for Alternative 2 in comparison to Alternative 1 because Alternative 2 encompasses areas of more intense use. Consumptive fishermen (both charter/party and private household boat) are more likely than divers to find a substitute site because Alternative 2 encompass relatively less of their current usage distribution. The portions of Alternative 2 to the north of Anacapa Island and on the northeast side of Santa Cruz Island encompass a particularly high usage area for charter/party and private boat diving. However, these areas also contain the West Anacapa Marine Conservation Area, the East- and West-Scorpion Marine Conservation areas, and the Carrington Point Marine Conservation Areas, which would lessen the potential impact to recreational consumptive users in this area. In the short-term, impacts should be less than estimated in Step 1 analysis.

Because Alternative 2 is larger than Alternative 1, the assumption is made that the increases in abundance and size of fish would be higher in magnitude in the long-term. As mentioned above, no-take areas result in benefits that extend beyond their boundaries (Roberts et. al. 2001). The number of interacting variables in marine ecosystems precludes accurate predictions of the magnitude of potential changes in abundance of target species. However, preliminary attempts to model ecosystems with reserve management have suggested that large MPAs provide significantly greater benefits to target species than small MPAs and limited-take zones (Salomon et al. 2002). Protecting the reserve areas proposed as Alternative 2 is not likely to contribute to fisheries through larval export and spillover. In other words, export from MPAs would be diluted because the reserve area is small relative to the fished area. Individual MPAs, particularly those on the north sides of Santa Rosa, Santa Cruz and Anacapa, are not likely to provide sufficient protection to reduce mortality and sustain local populations of some targeted species.

Step 2 Analysis – Recreational Non-consumptive Users

In terms of potential impact (in this case positive) associated with non-consumptive activities Alternative 2 is slightly ~~larger~~ **smaller** than the proposed project. The total baseline annual income associated with all non-consumptive activities in Alternative 2 is about $937 thousand. In terms of annual income, the activity with the highest baseline is whale watching with a baseline of $575 thousand, followed by non-consumptive diving with $270 thousand, sailing with $69 thousand and kayaking/sightseeing with $23 thousand (Table 6-20). The cumulative effect of a Federal phase would potentially total $1 million (Table 6-21). In terms of annual income, the activity with the highest cumulative baseline is whale watching with a baseline of $635 thousand (Table 6-21).

Table 6-20. Economic Impact Associated with Non-consumptive Activities - Alternative 2 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,079	15.70%	1,821	16.90%	482	12.00%	130	10.54%
Market Impact								
Direct Sales	$ 677,801	15.8%	$ 317,349	17.1%	$ 81,425	11.7%	$ 26,627	10.3%
Direct Wages and Salaries	$ 328,537	15.8%	$ 154,119	17.1%	$ 39,402	12.1%	$ 13,333	10.3%
Direct Employment	11	15.2%	5	16.9%	1	12.0%	1	10.2%
Total Income								
Upper Bound	$ 574,941	15.8%	$ 269,708	17.1%	$ 68,953	12.1%	$ 23,332	10.3%
Lower Bound	$ 492,806	15.8%	$ 231,178	17.1%	$ 59,103	12.1%	$ 19,999	10.3%
Total Employment								
Upper Bound	16	15.2%	8	16.8%	2	11.8%	1	10.0%
Lower Bound	14	15.2%	7	16.9%	2	12.1%	1	9.5%
Non-Market Impact								
Consumer's Surplus	$ 47,235	15.7%	$ 21,090	16.9%	$ 5,579	12.0%	$ 1,504	10.5%
Profit[1]	$ 20,188	12.8%	$ 7,946	17.2%	$ 1,074	6.0%	$ 305	11.0%

1. Profit is used as a proxy for producer's surplus.

Table 6-21. Economic Impact Associated with Non-consumptive Activities - Alternative 2 – Cumulative Total Including Federal Waters Phase (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,503	17.33%	1,984	18.41%	540	13.44%	130	10.54%
Market Impact								
Direct Sales	$ 748,574	17.5%	$ 346,919	18.7%	$ 91,179	13.1%	$ 26,627	10.3%
Direct Wages and Salaries	$ 362,749	17.4%	$ 168,585	18.7%	$ 44,122	13.5%	$ 13,333	10.3%
Direct Employment	12	16.7%	6	18.4%	1	13.5%	1	10.2%
Total Income								
Upper Bound	$ 634,811	17.4%	$ 295,024	18.7%	$ 77,213	13.5%	$ 23,332	10.3%
Lower Bound	$ 544,123	17.4%	$ 252,878	18.7%	$ 66,183	13.5%	$ 19,999	10.3%
Total Employment								
Upper Bound	18	16.7%	9	18.3%	2	13.3%	1	10.0%
Lower Bound	15	16.7%	7	18.4%	2	13.6%	1	9.5%
Non-Market Impact								
Consumer's Surplus	$ 52,138	17.3%	$ 22,971	18.4%	$ 6,247	13.4%	$ 1,504	10.5%
Profit[1]	$ 21,867	13.9%	$ 8,725	18.8%	$ 1,203	6.7%	$ 305	11.0%

1. Profit is used as a proxy for producer's surplus.

Table 6-21 shows the cumulative baseline economic impact of potential beneficiaries of Alternative 2. The Socioeconomic Panel extended that logic to a range of benefit scenarios (Leeworthy and Wiley 2002). Table 6-22 shows the range of cumulative benefits based on certain assumptions about the increase in quality and the value elasticity of quality. It presents a range of benefits with low end of $331 with the assumption of a 10 percent increase in quality and a 0.04 value elasticity of quality and a high end of $372,875 with a 100 percent increase in value and a value elasticity of quality of 4.5 (Table 6-22).

Table 6-22. Potential Benefits to Non-consumptive Users from Alternative 2 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 331	$ 8,286	$ 37,287
	Income	$ 4,122	$ 103,038	$ 463,671
	Employment	0.12	2.96	13.32
	Person-days	29	716	3,220
50%				
	Consumer's Surplus	$ 1,657	$ 41,431	$ 186,437
	Income	$ 20,608	$ 515,190	$ 2,318,355
	Employment	0.59	14.80	66.60
	Person-days	143	3,578	16,101
100%				
	Consumer's Surplus	$ 3,314	$ 82,861	$ 372,875
	Income	$ 41,215	$ 1,030,380	$ 4,636,710
	Employment	1.18	29.60	133.21
	Person-days	286	7,156	32,202

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 2

Vessel Traffic

Like the proposed project (Section 5.4.6), Alternative 2 does not change the commercial vessel Traffic Separation Scheme, does not alter existing mainland ports and harbors, and allows for transit through and anchoring in MPAs. Alternative 2 would not significantly impact vessel traffic.

6.3 Alternative 3

6.3.1 Natural Environment

The State water area in Alternative 3 is approximately ~~89~~ **102** square nautical miles, 8 percent of Sanctuary waters or 15 percent of State waters within the Sanctuary. Protecting the reserve areas proposed as Alternative 3 would contribute to increasing biomass, individual size, and reproductive potential of organisms within the reserve areas, particularly for species with low dispersal and high reproduction. Alternative 3 includes some consideration of the goal for conservation of ecosystem biodiversity established by the Marine Reserves Working Group because the reserve areas include a portion of different habitat types in the Oregonian Bioregion and the Transition Zone. However, some aspects of the biodiversity goal would not be realized unless additional area is protected on the shorelines of Anacapa and Santa Barbara Islands.

The Federal waters phase would add additional offshore area to four of the MPAs in Alternative 3. This additional area would have additional beneficial impacts to the biological environment through the addition of some deep water habitat representation. The total area in Alternative 3 and the subsequent Federal waters phase is approximately 21 percent, or ~~231~~ **267** square nautical miles, of the Sanctuary (Table 6-23).

Habitat Representation

Alternative 3 protects a portion of all bioregions in the project area. Alternative 3 includes at least one reserve on the north and south sides of San Miguel, Santa Rosa, and Santa Cruz Islands. Alternative 3 does not designate MPAs at Anacapa and Santa Barbara Islands. Five MPAs are located in the cool water region (the Oregonian Bioregion) around the northwestern Channel Islands. Two MPAs are located in the warmer water (the Californian Bioregion) around Santa Cruz Island. A single reserve is located in the transitional zone between warm and cool waters. The existing Cowcod Conservation Area below 120 feet around Santa Barbara Island supplements the relatively low representation in the Transition Zone. Table 6-23 compares the area and percentage coverage of various habitats protected in State Marine Reserves within each bioregion.

Exposed rocky coast is represented adequately in Alternative 3, while protected rocky coast is inadequately represented (Table 6-23). Sandy coast is also inadequately represented (Table 6-23). The cumulative impact of a Federal waters phase would not add additional representation to these nearshore habitats (Table 6-23).

Alternative 3 inadequately represents all sediment types (mud, sand, gravel, boulder, and bedrock) in the euphotic zone (0-30 m) (Table 6-23). Soft sediments are inadequately represented on the shallow continental shelf (30-100 m), while hard sediments are adequately represented (Table 6-23). However, the Cowcod Conservation Area protects additional habitat in the Transition Zone. Soft sediments (sand, silt, mud) on the deep continental shelf (100-200 m) are poorly represented in Alternative 3. Little is known about the distribution of hard sediments (boulder, and bedrock) on the deep continental shelf and slope in the Sanctuary. The Cowcod Conservation Area protects some of the deep continental shelf and slope in the vicinity of Santa Barbara Island (Table 6-23). The cumulative impacts of a Federal waters phase would add representation to some deeper habitats. This is particularly true of soft sediments on the continental slope (>200 m) which would become adequately represented. Submarine canyons would be well represented with the addition of a Federal waters phase.

Giant kelp and surfgrass are inadequately represented in Alternative 3 (Table 6-23). Eelgrass, however, is well represented (Table 6-23). There would be no cumulative additional representation of these nearshore habitats with a Federal waters phase (Table 6-23).

Table 6-23. Total and percent representation of ecological criteria protected by State Marine Reserves proposed as Alternative 3

Ecological Criteria	Alternative 3 State Waters	Federal Waters Phase	Cumulative Total
Reserve Size (nm^2)	102	164.5	266.5
(Percent of Habitat in Sanctuary Waters)	(8%)	(13%)	**(21%)**
1. Sandy Coast Habitat	6.6 (15%)	-	**6.6 (15%)**
2. Rocky Coast (protected)	8.1 (13%)	-	**8.1 (13%)**
3. Rocky Coast (exposed)	8.7 (20%)	-	**8.7 (20%)**
4. Soft Sediment (0-30 m)	11.0 (13%)	-	**11.1 (13%)**
5. Hard Sediment (0-30 m)	6 (12%)	-	**6 (12%)**
6. Soft Sediment (30-100 m)	35.6 (11%)	26.5 (8%)	**62.1 (19%)**
7. Hard Sediment (30-100 m)	7.7 (21%)	0	**7.7 (21%)**
8. Soft Sediment (100-200 m)	11.3 (5%)	54.8 (22%)	**66.1 (27%)**
9 Hard Sediment (100-200 m)	-	-	**-**
10. Soft Sediment (>200 m)	2.5 (0.4%)	49.9 (9%)	**49.9 (9%)**
11. Hard Sediment (>200 m)	-	-	**-**
12. Emergent Nearshore Rocks	66 (13%)	-	**66 (13%)**
13. Emergent Offshore Rocks	8 (20%)	2 (5%)	**10 (25%)**
14. Submarine Canyons	6 (17%)	9 (25%)	**15 (41%)**
15. Kelp Forest	3.8 (16%)	-	**3.8 (16%)**
16. Eelgrass	0.2 (35%)	-	**0.2 (35%)**
17. Surfgrass	3.9 (17%)	-	**3.9 (17%)**

Monitoring Sites

The potential benefits and costs of State Marine Reserves can only be determined if sufficient monitoring efforts follow their establishment. No-take marine reserves are necessary to distinguish the effects of fishing on marine organisms and habitats from environmental fluctuations. Existing monitoring sites are particularly important in MPA design because baseline data collected at monitoring sites would help scientists determine how populations within MPAs have changed over time. It would not be possible

to evaluate the potential impacts of State Marine Reserves proposed in Alternative 3 using data from existing monitoring sites. ~~Two~~ **Three** of 16 National Park Service kelp forest monitoring sites are located within MPAs proposed as Alternative 3. ~~None~~ **One** of the five monitoring sites is protected in the Oregonian Bioregion, one of six in the Transition Zone, and one of five in the Californian Bioregion.

Human Threats and Natural Catastrophes

It is unlikely that all MPAs proposed as Alternative 3 would be impacted simultaneously by catastrophic events, such as oil spills or large storms, because they are widely distributed across the Sanctuary. However, catastrophic events could impact populations in one or several of the reserve areas. The impacts of catastrophic events could be reduced by adding area to MPAs in the existing design or by adding additional reserve areas. The design of Alternative 3 does not incorporate the "insurance factor", a multiplier required to account for the effects of catastrophic events, recommended by Allison et al. (in press). Other mechanisms are available to prevent and respond to other threats from spills or other human catastrophes. The distribution of MPAs in multiple areas around the islands may limit the impacts of a single event on all reserves at once.

Connectivity

Marine organisms often exhibit dispersal during at least one life history stage. Protecting multiple habitats, either in one large reserve or in several small but interconnected MPAs, may be important for growth and reproduction of marine organisms. In the Channel Islands, the strongest currents transport organisms across the northern Channel Islands from west to east, often forming strong counterclockwise recirculation in the Santa Barbara Channel. The patterns of circulation suggest that source populations may be located in productive areas on the north sides of San Miguel, Santa Rosa, and Santa Cruz Islands. A region of low current flow, and potentially high larval retention occurs off northeastern Santa Cruz Island. There is some potential connectivity among MPAs off San Miguel, Santa Rosa, and Santa Cruz Islands. Although distances between MPAs are relatively small, larvae and adults may have difficulty dispersing between MPAs because individual MPAs are relatively small.

Potential for Congestion

Alternative 3 is the third smallest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting; however, this alternative covers 15 percent of State waters within the Sanctuary. There would be a high probability of relocating effort and a low probability of crowding and congestion effects in this alternative. The potential for crowding/congestion effects would be low because of the relatively small sizes of the MPAs proposed in this alternative and, in particular, their locations in areas of relatively lower use (Leeworthy and Wiley 2002). Potential impacts of crowding and congestion are discussed in Chapter 5.3.1.

6.3.2 Human Environment

The Socioeconomic Panel estimated that this alternative would potentially impact more than $2.1 million or 7.6 percent of all ex-vessel revenue in the Sanctuary (Leeworthy and Wiley 2002). As a percent of total commercial catch in the Sanctuary, the largest potential impacts are on Rockfish (16.1 percent), sea urchins (14.3 percent), sea cucumbers (13.9 percent), and prawn (13.4 percent). The smallest potential impacts are on tuna (1.9 percent), wetfish (3.3 percent), kelp (5 percent), flatfishes (5.2 percent), and squid (5.3 percent) (Table 6-24). The cumulative impacts of the Federal waters phase would potentially impact more than $2.3 million or 8.4 percent of all ex-vessel revenue in the Sanctuary (Table 6-24). Most of the potential impact is from catch in State waters (90 percent). All of the potential impact on harvest of kelp and catch of urchins, spiny lobsters, crab, California sheephead, and sea cucumbers is in the State waters portion of the Sanctuary. Most of the potential impact on prawn and tuna catch is in Federal waters. The cumulative effect of the Federal waters phase would potentially raise prawn impacts to 29.5 percent and rockfish to 24.2 percent (Table 6-24).

Table 6-24. Commercial Fishing & Kelp: Impact of Alternative 3 on Ex-Vessel Value by Species Group - Step 1 Analysis

	State Waters		Federal Waters		Total	
Species Group	Value	% [1]	Value	%	Value	%
Squid	$ 695,876	5.33	$ 42,689	0.33	$ 738,566	5.66
Kelp [2]	$ 298,241	4.98	$ -	0.00	$ 298,241	4.98
Urchins	$ 753,956	14.32	$ -	0.00	$ 753,956	14.32
Spiny Lobster	$ 97,403	10.56	$ -	0.00	$ 97,403	10.56
Prawn	$ 94,170	13.39	$ 112,927	16.06	$ 207,097	29.45
Rockfish	$ 88,222	16.06	$ 44,542	8.11	$ 132,764	24.17
Crab	$ 26,278	7.65	$ -	0.00	$ 26,278	7.65
Tuna	$ 5,812	1.90	$ 19,206	6.28	$ 25,019	8.19
Wetfish	$ 10,078	3.34	$ 4,800	1.59	$ 14,878	4.93
CA Sheephead	$ 26,174	11.09	$ -	0.00	$ 26,174	11.09
Flatfishes	$ 9,562	5.20	$ 3,675	2.00	$ 13,237	7.20
Sea Cucumbers	$ 23,361	13.93	$ -	0.00	$ 23,361	13.93
Sculpin & Bass	$ 4,571	7.58	$ 3,822	6.34	$ 8,393	13.91
Shark	$ 2,906	8.36	$ 882	2.54	$ 3,788	10.90
Total	$ 2,136,610	7.60	$ 232,544	0.83	$ 2,369,154	8.43

1. Percents are the amount of each species/species groups ex-vessel value impacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

The greatest potential impact of Alternative 3, in terms of percent of annual total ex-vessel revenue by port, is on Santa Barbara ($898 thousand or 10.5 percent) (Table 6-25). In absolute amount, Port Hueneme could potentially lose the next greatest amount (almost $581 thousand or 4.3 percent of all annual ex-vessel revenue of landings) (Table 6-25).

Channel Islands Harbor could potentially lose about $174 thousand or 3.6 percent. Ventura Harbor could potentially lose $74 thousands 1.4 percent of the annual ex-vessel of all landings (Table 6-25). Although these potential losses represent between 1.4 and 10.5 percent of ex-vessel revenue, the percentage loss in total port revenue would be less because revenue from activities other than fishing would continue in the port areas. All other ports' ex-vessel revenue would potentially be decreased by small amounts. The cumulative potential losses with the addition of the Federal waters phase would result in the same distribution of impacts, with increases in dollar values (Table 6-25).

Table 6-25. Commercial Fishing & Kelp: Impact of Alternative 3 on Ex-Vessel Value by Port - Step 1 Analysis

	State Waters		Federal Waters		Total	
Port	Value	% [1]	Value	%	Value	%
1. Moss Landing	$3	N/A	$1	N/A	$5	N/A
2. Morro Bay	$43	0.83	$0	0.00	$43	0.83
3. Avila/Port San Luis	$17	0.00	$7	0.00	$24	0.00
4. Santa Barbara	$898,422	10.46	$44,472	0.52	$942,894	10.97
5. Ventura Harbor	$74,260	1.38	$14,607	0.27	$88,867	1.65
6. Channel Islands	$174,353	3.56	$97,396	1.99	$271,749	5.55
7. Port Hueneme	$581,830	4.27	$44,824	0.33	$626,654	4.59
8. San Pedro	$70,180	0.50	$6,937	0.05	$77,117	0.55
9. Terminal Island	$21,943	0.12	$17,937	0.10	$39,880	0.22
10. Avalon & Other LA	$115	0.01	$6	0.00	$121	0.01
11. Newport Beach	$5	0.00	$14	0.00	$20	0.00
12. San Diego	$4,106	0.12	$109	0.00	$4,214	0.12

1. Percents are the amount of ex-vessel value as a percent of the total ex-vessel value of landings at the Port (1996-1999 Average Annual Value).

The maximum potential impact on total annual income is $5.7 million across all seven counties in the impact area (Table 6-26). Most of the potential impacts are concentrated in Ventura and Santa Barbara counties. The potential impact in San Diego County is primarily from kelp. Potential employment impacts are distributed among counties similarly to the annual income impacts with 164 full and part-time jobs potentially impacted (Table 6-27). The cumulative effect of the Federal waters phase would potential create additional impact to both jobs and income (Tables 6-26 and 6-27).

Table 6-26. Commercial Fishing & Kelp: Impact of Alternative 3 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$506,111	$31,051	$537,163
2. San Luis Obispo	$17,315	$8,521	$25,836
3. Santa Barbara	$1,759,886	$61,295	$1,821,181
4. Ventura	$2,386,413	$363,219	$2,749,632
5. Los Angeles	$507,237	$32,523	$539,760
6. Orange	$13	$33	$46
7. San Diego	$479,688	$346	$480,034
All Counties	$5,656,664	$496,988	$6,153,652

Table 6-27. Commercial Fishing & Kelp: Impact of Alternative 3 on Total Employment by County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	15	1	16
2. San Luis Obispo	1	0	1
3. Santa Barbara	57	2	59
4. Ventura	73	11	84
5. Los Angeles	13	1	14
6. Orange	0	0	0
7. San Diego	5	0	5
All Counties	164	15	179

Step 2 Analysis – Commercial Fishing and Kelp Harvesting

Alternative 3 is the third smallest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. There would be a high probability of relocating effort and a low probability of crowding and congestion effects, both of which should decrease costs relative to the Step 1 analysis, but less so than Alternatives 1 and 2. The

ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 1.6 percent. Like Alternatives 1 and 2, this alternative has a relatively low potential impact on the squid fishery (5.3 percent, Table 6-24). Potential kelp impacts are also relatively low for this alternative (5 percent, Table 6-24), but just as with Alternatives 1 and 2, the Socioeconomic Panel was not certain kelp harvest can be increased from other areas (Leeworthy and Wiley 2002). This alternative has a relatively high potential impact on prawn fishermen (13.4 percent, Table 6-24), which could potentially increase with the cumulative impacts of a Federal waters phase (24.2 percent, Table 6-24). It is not clear how or if this potential impact could be reduced because other fishing sites may not be available. As in Alternative 1 and 2, it might be possible that squid catch could be replaced from other areas. Since squid represents about 31 percent of the lost annual ex-vessel value of catch from Alternative 3, it is possible that the Step 1 analysis estimates could be reduced by about 32.6 percent, even in the short-term.

In the long-term, the replenishment effects are of medium likelihood since the MPAs cover about 15 percent of State waters within the Sanctuary, with 4 of the 17 habitat types receiving protection levels of 20 percent or higher (Table 6-19). The benefits to areas outside the State Marine Reserves are higher than Alternatives 1 and 2, and the long-term mitigation of costs greater than for Alternatives 1 and 2. Whether replenishment effects are greater than crowding or congestion effects would determine if this alternative's long-term costs can be transformed into long-term benefits.

Step 1 Analysis – Recreational Consumptive Activities

In terms of potential impact on consumptive activities, Alternative 3 is smaller than the proposed project. The aggregate maximum potential loss to annual income for all consumptive recreation activities is about $2 million (Table 6-28) or 8.1 percent of the $24.7 million in annual income generated by recreational consumptive activities in the project area. The cumulative impact of the Federal waters phase is $2.9 million (Table 6-28) or 11.7 percent of the $24.7 million in annual income.

Table 6-28. Summary: Recreation Consumptive Activities - Alternative 3 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	46,273	34,113	73.7%	12,160	26.3%
Market Impact					
Direct Sales	$ 3,943,786	$ 2,800,674	71.0%	$ 1,143,113	29.0%
Direct Wages and Salaries	$ 1,632,707	$ 1,143,952	70.1%	$ 488,756	29.9%
Direct Employment	50	36	71.0%	15	29.0%
Total Income					
Upper Bound	$ 2,857,238	$ 2,001,916	70.1%	$ 855,322	29.9%
Lower Bound	$ 2,449,061	$ 1,715,928	70.1%	$ 733,133	29.9%
Total Employment					
Upper Bound	76	54	71.0%	22	29.0%
Lower Bound	63	45	71.0%	18	29.0%
Non-Market Impact					
Consumer's Surplus	$ 535,789	$ 394,989	73.7%	$ 140,800	26.3%
Profit[1]	$ 51,263	$ 34,738	67.8%	$ 16,525	32.2%

1. Profit is used as a proxy for producer's surplus.

The magnitude of potential impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g., income). In terms of person-days, the activity with the highest potential impacts is private boat fishing with a maximum potential loss of 17,098 person-days, followed by charter/party boat fishing with 13,180 person-days (Table 6-29). In terms of total annual income, the activity with the highest potential impacts is charter/party boat fishing with a maximum potential loss of $1.4 million. Cumulative impacts with the addition of the Federal phase would increase both potential losses in person-days of activity and income. terms of person-days, the activity with highest cumulative potential impacts is private boat fishing with a maximum potential loss of 21,890 person-days. In terms of total annual income, the activity with highest cumulative potential impacts is charter/party boat fishing with a maximum potential loss of $2.1 million (Table 6-30).

Table 6-29. Recreation Consumptive Activities - Alternative 3 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	13,180	8.30%	1,446	8.06%	17,098	7.99%	2,390	5.06%
Market Impact								
Direct Sales	$ 1,722,352	8.35%	$ 236,790	7.87%	$ 710,081	7.99%	$ 131,451	5.06%
Direct Wages and Salaries	$ 794,563	8.39%	$ 115,036	7.94%	$ 199,680	7.99%	$ 34,672	5.07%
Direct Employment	24	8.57%	4	8.21%	7	7.92%	1	5.16%
Total Income								
Upper Bound	$ 1,390,486	8.39%	$ 201,313	7.94%	$ 349,440	7.99%	$ 60,677	5.07%
Lower Bound	$ 1,191,845	8.39%	$ 172,554	7.94%	$ 299,520	7.99%	$ 52,009	5.07%
Total Employment								
Upper Bound	36	8.55%	6	8.21%	10	7.98%	2	5.16%
Lower Bound	30	8.56%	5	8.21%	8	7.96%	2	5.08%
Non-Market Impact								
Consumer's Surplus	$ 152,604	8.30%	$ 16,738	8.06%	$ 197,974	7.99%	$ 27,673	5.06%
Profit [1]	$ 31,349	8.33%	$ 3,389	7.70%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 6-30. Recreation Consumptive Activities - Alternative 3 – Cumulative Total Including Federal Waters Phase - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	20,028	12.61%	1,689	9.42%	21,890	10.23%	2,667	5.65%
Market Impact								
Direct Sales	$ 2,610,434	12.65%	$ 277,598	9.23%	$ 909,087	10.23%	$ 146,667	5.65%
Direct Wages and Salaries	$ 1,203,580	12.70%	$ 134,838	9.31%	$ 255,649	10.23%	$ 38,641	5.65%
Direct Employment	36	12.87%	5	9.57%	9	10.09%	1	5.80%
Total Income								
Upper Bound	$ 2,106,265	12.38%	$ 235,967	8.72%	$ 447,385	10.01%	$ 67,621	5.24%
Lower Bound	$ 1,805,370	12.45%	$ 202,257	8.84%	$ 383,473	10.06%	$ 57,961	5.32%
Total Employment								
Upper Bound	54	12.51%	7	9.07%	13	10.09%	2	5.36%
Lower Bound	45	12.64%	6	9.12%	11	10.14%	2	5.44%
Non-Market Impact								
Consumer's Surplus	$ 231,895	12.61%	$ 19,560	9.42%	$ 253,457	10.23%	$ 30,877	5.65%
Profit [1]	$ 47,291	12.57%	$ 3,972	9.03%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Due to the absence of a reserve in the Santa Barbara Island region, the potential impact of this alternative on Los Angeles county would be lower than the proposed project (8 percent in terms of person-days of activity). Because of the distance to San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands, the relative proximity of Santa Barbara Island makes it the primary destination of consumptive recreational users from Los Angeles county. The maximum potential loss to this group of users would therefore be less.

Step 2 Analysis – Recreational Consumptive Activities

Mitigation of losses from Alternative 3 is more likely than for the proposed project in the short term. The most important reason for this is the siting of the MPAs. The area of intense use for consumptive activities to the north of Anacapa Island and the east side of Santa Cruz Island are not included in this Alternative. For the relatively small number of users operating in MPAs proposed in Alternative 3, successful substitution is likely. In

addition to not encompassing high use areas, Alternative 3 is smaller than the proposed project, which gives users more options in their choice of substitutes. The potential for crowding/congestion effects would also be low, again because of the relatively small sizes and the locations of the MPAs proposed in this alternative.

Resource protection in the reserve areas proposed in Alternative 3 may contribute a small amount to the goal for sustainable fisheries established by the Marine Reserves Working Group. Over time, export from MPAs may help to offset the short-term costs to commercial and recreational fisheries. Increases in density and reproductive potential of organisms in MPAs may contribute to export of larvae and spillover of adult fish that would help to offset the loss of recreational fishing grounds. However, because many of the proposed MPAs are small (e.g., Carrington Point, Painted Cave, and Scorpion), fisheries benefits may not be detected because exported larvae would be diluted in a relatively large fished zone. Because reserve areas proposed in Alternative 3 are relatively small, there is a high likelihood of substitution of fishing grounds that would reduce the impact to consumptive users.

Step 2 Analysis – Recreational Non-consumptive Users

In terms of potential impact (in this case positive) associated with non-consumptive activities, Alternative 3 is significantly smaller than the proposed project because it does not include high use areas such as Santa Barbara and Anacapa Islands. The total baseline annual income associated with all non-consumptive activities in Alternative 3 is about $348 thousand. In terms of annual income, the activity with the highest baseline is whale watching with a baseline of $156 thousand, followed by non-consumptive diving with $134 thousand, sailing with $33 thousand and kayaking/sightseeing with $25 thousand (Table 6-31). The cumulative effect of a Federal phase would potentially total $383 thousand (Table 6-32). In terms of annual income, the activity with the highest cumulative baseline is non-consumptive diving with a baseline of $164 thousand (Table 6-32).

Table 6-31. Economic Impact Associated with Non-consumptive Activities - Alternative 3 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,108	4.26%	975	9.05%	232	5.78%	136	11.00%
Market Impact								
Direct Sales	$ 182,925	4.3%	$ 157,141	8.5%	$ 39,234	5.7%	$ 28,472	11.1%
Direct Wages and Salaries	$ 88,920	4.3%	$ 76,673	8.5%	$ 18,985	5.8%	$ 14,304	11.1%
Direct Employment	3	4.3%	3	9.0%	1	5.8%	1	11.1%
Total Income								
Upper Bound	$ 155,610	4.3%	$ 134,178	8.5%	$ 33,224	5.8%	$ 25,032	11.1%
Lower Bound	$ 133,380	4.3%	$ 115,010	8.5%	$ 28,478	5.8%	$ 21,456	11.1%
Total Employment								
Upper Bound	5	4.3%	4	9.0%	1	5.7%	1	10.9%
Lower Bound	4	4.3%	4	9.0%	1	5.8%	1	10.4%
Non-Market Impact								
Consumer's Surplus	$ 12,828	4.3%	$ 11,287	9.0%	$ 2,688	5.8%	$ 1,570	11.0%
Profit[1]	$ 6,627	4.2%	$ 3,173	6.9%	$ 518	2.9%	$ 300	10.8%

1. Profit is used as a proxy for producer's surplus.

Table 6-32. Economic Impact Associated with Non-consumptive Activities - Alternative 3 – Cumulative Total Including Federal Waters Phase (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	1,112	4.28%	1,175	10.90%	264	6.57%	136	11.00%
Market Impact								
Direct Sales	$ 183,670	4.3%	$ 192,526	10.4%	$ 44,589	6.4%	$ 28,472	11.1%
Direct Wages and Salaries	$ 89,284	4.3%	$ 93,983	10.4%	$ 21,577	6.6%	$ 14,304	11.1%
Direct Employment	3	4.3%	3	10.9%	1	6.6%	1	11.1%
Total Income								
Upper Bound	$ 156,246	4.3%	$ 164,471	10.4%	$ 37,759	6.6%	$ 25,032	11.1%
Lower Bound	$ 133,926	4.3%	$ 140,975	10.4%	$ 32,365	6.6%	$ 21,456	11.1%
Total Employment								
Upper Bound	5	4.3%	5	10.8%	1	6.5%	1	10.9%
Lower Bound	4	4.3%	4	10.9%	1	6.6%	1	10.4%
Non-Market Impact								
Consumer's Surplus	$ 12,881	4.3%	$ 13,605	10.9%	$ 3,055	6.6%	$ 1,570	11.0%
Profit[1]	$ 6,660	4.2%	$ 4,054	8.8%	$ 588	3.3%	$ 300	10.8%

1. Profit is used as a proxy for producer's surplus.

Table 6-32 shows the cumulative baseline economic impact of potential beneficiaries of Alternative 2. The Socioeconomic Panel extended that logic to a range of benefit scenarios (Leeworthy and Wiley 2002). Table 6-33 shows the range of cumulative benefits based on certain assumptions about the increase in quality and the value elasticity of quality. It presents a range of benefits with low end of $124 with the assumption of a 10 percent increase in quality and a 0.04 value elasticity of quality and a high end of $139,995 with a 100 percent increase in value and a value elasticity of quality of 4.5 (Table 6-33).

Table 6-33. Potential Benefits to Non-consumptive Users from Alternative 3 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 124	$ 3,111	$ 14,000
	Income	$ 1,534	$ 38,351	$ 172,578
	Employment	0.05	1.16	5.23
	Person-days	11	269	1,209
50%				
	Consumer's Surplus	$ 622	$ 15,555	$ 69,998
	Income	$ 7,670	$ 191,754	$ 862,892
	Employment	0.23	5.82	26.17
	Person-days	54	1,344	6,046
100%				
	Consumer's Surplus	$ 1,244	$ 31,110	$ 139,995
	Income	$ 15,340	$ 383,508	$ 1,725,785
	Employment	0.47	11.63	52.34
	Person-days	107	2,687	12,092

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 3

Vessel Traffic

Like the proposed project (Section 5.4.6), Alternative 3 does not change the commercial vessel Traffic Separation Scheme, does not alter existing mainland ports and harbors, and allows for transit through and anchoring in MPAs. Alternative 3 would not significantly impact vessel traffic.

6.4 Alternative 4

6.4.1 Natural Environment

The State water area in Alternative 4 is approximately ~~120~~ **138** square nautical miles, 10 percent of Sanctuary waters or 20 percent of State waters within the Sanctuary. Protecting the reserve areas proposed as Alternative 4 would contribute to increasing biomass, individual size, and reproductive potential of organisms within the reserve areas, particularly for species with low dispersal and high reproduction. Alternative 4 is likely to achieve the goal for conservation of ecosystem biodiversity established by the Marine Reserves Working Group because the reserve areas include all habitat types in all bioregions, encompassing at least some portion of the ranges of most species of interest.

The Federal waters phase would add additional offshore area to most of the MPAs in Alternative 4. This additional area would have additional beneficial impacts to the

biological environment through the addition of some deep water habitat representation. The total area in Alternative 4 and the subsequent Federal waters phase is approximately 29 percent or ~~340~~ **367** square nautical miles of the Sanctuary (Table 6-34).

Habitat Representation

Alternative 4 protects a portion of all bioregions in the project area. Each bioregion is represented with one or several MPAs, and the reserve network across the northern Channel Islands is likely to contribute to fishery production outside of the MPAs. Over time, export from MPAs may be sufficient to offset the short-term loss to commercial and recreational fisheries.

Protection from fishing provided by Alternative 4 is distributed sufficiently across bioregions. Five MPAs are located in the cool water region (the Oregonian Bioregion) around the northwestern Channel Islands. Three MPAs are located in the warmer water (the Californian Bioregion) around Anacapa and Santa Cruz Islands. Two MPAs are located in the Transition Zone between warm and cool waters. The existing Cowcod Conservation Area below 120 feet around Santa Barbara Island supplements the protection to species and habitats in the Transition Zone. Table 6-34 compares the area and percentage coverage of various habitats protected in State Marine Reserves within each bioregion.

Exposed rocky coast is well represented in Alternative 4 and protected rocky coast is adequately represented (Table 6-34). Similarly, Sandy coast is well represented (Table 6-34). The cumulative impact of a Federal waters phase would not add additional representation to these nearshore habitats (Table 6-34).

All sediments (mud, sand, gravel, boulder, and bedrock) in the euphotic zone (0-30 m) are adequately represented in Alternative 4 (Table 6-34). Soft sediments on the shallow continental shelf (30-100 m) are inadequately represented in this alternative, though hard sediments are adequately represented (Table 6-34). In contrast, soft sediments, on the shallow continental shelf (100-200 m) are poorly represented (Table 6-34). The Cowcod Conservation Area protects additional sandy and rocky habitats in the Transition Zone (Table 6-34). Little is known about the distribution of hard sediments (boulder, and bedrock) on the deep continental shelf and slope in the Sanctuary. The cumulative impacts of a Federal waters phase would increase representation of many deeper habitats. Soft sediments on the shallow continental shelf would become adequately represented (Table 6-34). The cumulative impact to soft sediments (sand, silt, mud) on the deep continental shelf (100-200 m) would make them well represented (Table 6-34). Soft sediment representation along the continental slope (greater than 200 m) would increase, but still remain inadequate (Table 6-34).

Giant kelp and surfgrass are adequately represented in Alternative 4 (Table 6-34). Eelgrass is very well represented with greater than 50 percent of available eelgrass

habitat within MPAs (Table 6-34). This representation, however, is above the maximum recommended by the Scientific Advisory Panel to the Marine Reserves Working Group. Cumulative impacts of a Federal waters phase would not add representation to these nearshore habitats.

Table 6-34. Total and percent representation of ecological criteria protected by State Marine Reserves proposed as Alternative 4.

Ecological Criteria	Alternative 4 State Waters	Federal Waters Phase	Cumulative Total
Reserve Size (nm^2)	137.9	228.8	366.7
(Percent of Habitat in Sanctuary Waters)	(10%)	(19%)	**(29%)**
1. Sandy Coast (mi)	13.9 (32%)	-	**13.9 (32%)**
2. Rocky Coast (protected) (mi)	16.8 (28%)	-	**16.8 (28%)**
3. Rocky Coast (exposed) (mi)	12.8 (30%)	-	**12.8 (30%)**
4. Soft Sediment (0-30 m) (nm^2)	19.9 (23%)	-	**19.9 (23%)**
5. Hard Sediment (0-30 m) (nm^2)	11.8 (24%)	-	**11.8 (24%)**
6. Soft Sediment (30-100 m) (nm^2)	50.6 (15%)	44.7 (14%)	**95.3 (29%)**
7. Hard Sediment (30-100 m) (nm^2)	7.9 (21%)	1.3 (4%)	**9.2 (25%)**
8. Soft Sediment (100-200 m) (nm^2)	13.8 (6%)	73.3 (30%)	**87.1 (36%)**
9. Hard Sediment (100-200 m) (nm^2)	-	-	**-**
10. Soft Sediment (>200 m) (nm^2)	2.5 (0.4%)	93.9 (17%)	**93.9 (17%)**
11. Hard Sediment (>200 m) (nm^2)	-	-	**-**
12. Emergent Rocks (nearshore) (no.)	172 (33%)	-	**172 (33%)**
13. Emergent Rocks (offshore) (nm^2)	8 (20%)	4 (10%)	**12 (30%)**
14. Submarine Canyons (nm^2)	6 (17%)	9 (25%)	**15 (42%)**
15. Kelp Forest (nm^2)	5.8 (24%)	-	**5.8 (24%)**
16. Eelgrass (nm^2)	0.3 (53%)	-	**0.3 (53%)**
17. Surfgrass (nm^2)	6.2 (26%)	-	**6.2 (26%)**

Monitoring Sites

The potential benefits and costs of State Marine Reserves can only be determined if sufficient monitoring efforts follow establishment of MPAs. No-take marine reserves are necessary to distinguish the effects of fishing on marine organisms and habitats from environmental fluctuations. Existing monitoring sites are particularly important in MPA design because baseline data collected at monitoring sites would help scientists determine how populations within MPAs have changed over time. It would be possible to evaluate the potential impacts of State Marine Reserves proposed as Alternative 4 using data from existing monitoring sites. Nine of 16 National Park Service kelp forest monitoring sites are located within MPAs proposed as Alternative 4. One of five monitoring sites is protected in the Oregonian Bioregion, five of six in the Transition Zone, and three of five in the Californian Bioregion.

Human Threats and Natural Catastrophes

It is unlikely that all MPAs proposed as Alternative 4 would be impacted simultaneously by catastrophic events, such as oil spills or large storms, because they are widely distributed across the Sanctuary. Alternative 4 includes multiple MPAs on the north and south sides of each island in the Sanctuary. However, catastrophic events could impact populations in one or several of the reserve areas. The impacts of catastrophic events could be reduced by adding area to MPAs in the existing design or by adding additional reserve areas. The design of Alternative 4 does not incorporate the “insurance factor”, a multiplier required to account for the effects of catastrophic events, recommended by Allison et al. (in press). Other mechanisms are available to prevent and respond to threats from spills or human catastrophes. These other mechanisms include spill response plans and traffic separation schemes to limit the chance of large tanker collisions. The distribution of MPAs in multiple areas around the islands may limit the impacts of a single event on all reserves at once.

Connectivity

Marine organisms often exhibit dispersal during at least one life history stage. Protecting multiple habitats, either in one large reserve or in several small but interconnected MPAs, may be important for growth and reproduction of marine organisms. In the Channel Islands, the strongest currents transport organisms across the northern Channel Islands from west to east, often forming strong counterclockwise recirculation in the Santa Barbara Channel. The patterns of circulation suggest that source populations may be located in productive areas on the north sides of San Miguel, Santa Rosa, and Santa Cruz Islands. A region of low current flow, and potentially high larval retention occurs off northeastern Santa Cruz Island. There is excellent potential connectivity among MPAs proposed as Alternative 4. The probability that larvae and adults would disperse to adjacent MPAs is relatively high because the total area covered by MPAs is large, and they are located in the predominant current across the north sides of Santa Rosa, Santa Cruz, and Anacapa

Islands. Larvae and adults may disperse between MPAs because distances between them are relatively small and individual MPAs are relatively large.

Potential for Congestion

Alternative 4 is the second largest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. This alternative covers 20 percent of State waters within the Sanctuary. There would be a medium probability of relocating effort and a low to moderate probability of crowding and congestion effects in this alternative. The potential for crowding/congestion effects would be higher because of the relatively large size of MPAs proposed in this alternative and their locations in high use areas (Leeworthy and Wiley 2002). Potential impacts of crowding and congestion are discussed in Chapter 5.3.1.

6.4.2 Human Environment

Step 1 Analysis – Commercial Fishing and Kelp Harvesting

The Socioeconomic Panel estimated that this alternative would potentially impact more than $3.8 million or 13.6 percent of all ex-vessel revenue in the Sanctuary (Leeworthy and Wiley 2002). As a percent of total commercial catch in the Sanctuary, the largest potential impacts are on Rockfish (21.1 percent), California sheephead (20.6 percent), sea urchins (20.3 percent), and sea cucumbers (19.6 percent). The smallest potential impacts are on tuna (2.58 percent), wetfish (6.9 percent), and kelp (7.8 percent) (Table 6-35). The cumulative impacts of the Federal waters phase would potentially impact more than $4.1 million or 14.7 percent of all ex-vessel revenue in the Sanctuary (Table 6-35). Most of the potential impact is from catch in State waters (92 percent). All of the potential impact on harvest of kelp and catch of urchins, spiny lobsters, crab, California sheephead, and sea cucumbers is in the State waters portion of the Sanctuary. Most of the potential impact on prawn and tuna catch is in Federal waters. The cumulative effect of the Federal waters phase would potentially raise prawn impacts to 41.1 percent and rockfish to 30 percent (Table 6-35).

Table 6-35. Commercial Fishing & Kelp: Impact of Alternative 4 on Ex-Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 1,716,217	13.15	$ 55,496	0.43	$ 1,771,713	13.58
Kelp [2]	$ 467,886	7.81	$ -	0.00	$ 467,886	7.81
Urchins	$ 1,068,453	20.29	$ -	0.00	$ 1,068,453	20.29
Spiny Lobster	$ 150,333	16.30	$ -	0.00	$ 150,333	16.30
Prawn	$ 104,858	14.91	$ 184,214	26.20	$ 289,072	41.11
Rockfish	$ 116,040	21.12	$ 48,796	8.88	$ 164,836	30.01
Crab	$ 48,483	14.11	$ -	0.00	$ 48,483	14.11
Tuna	$ 7,886	2.58	$ 19,270	6.30	$ 27,156	8.88
Wetfish	$ 20,675	6.86	$ 6,853	2.27	$ 27,528	9.13
CA Sheephead	$ 48,562	20.58	$ -	0.00	$ 48,562	20.58
Flatfishes	$ 20,546	11.17	$ 6,225	3.39	$ 26,771	14.56
Sea Cucumbers	$ 32,909	19.62	$ -	0.00	$ 32,909	19.62
Sculpin & Bass	$ 7,248	12.01	$ 6,543	10.85	$ 13,791	22.86
Shark	$ 5,321	15.31	$ 1,494	4.30	$ 6,815	19.61
Total	$ 3,815,416	13.57	$ 328,891	1.17	$ 4,144,308	14.74

1. Percents are the amount of each species/species groups ex-vessel value mpacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

The greatest potential impact of Alternative 4, in terms of percent of annual total ex-vessel revenue by port (Table 6-36), is on Port Hueneme. Port Hueneme potentially could lose almost $1.4 million or about 10.5 percent of all annual ex-vessel revenue of landings at the port. Santa Barbara could potentially lose about $1.3 million, but this represents about 15.1 percent of all their annual ex-vessel revenue from landings. Channel Islands Harbor could potentially lose $230 thousand or 4.7 percent. Ventura Harbor could potentially lose $158 thousand or 2.9 percent of the annual ex-vessel of all landings. Although these potential losses represent between 2.9 and 15.1 percent of ex-vessel revenue, the percentage loss in total port revenue would be less because revenue from activities other than fishing would continue in the port areas. All other ports' ex-vessel revenue would potentially be decreased by small amounts. The cumulative potential losses with the addition of the Federal waters phase would result in the same distribution of impacts, with increases in dollar values (Table 6-36).

Table 6-36. Commercial Fishing & Kelp: Impact of Alternative 4 on Ex-Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
1. Moss Landing	$6	N/A	$2	N/A	$8	N/A
2. Morro Bay	$79	1.55	$0	0.00	$79	1.55
3. Avila/Port San Luis	$37	0.00	$11	0.00	$48	0.00
4. Santa Barbara	$1,296,171	15.09	$52,361	0.61	$1,348,532	15.70
5. Ventura Harbor	$158,103	2.93	$22,943	0.43	$181,045	3.36
6. Channel Islands	$229,807	4.70	$158,169	3.23	$387,976	7.93
7. Port Hueneme	$1,425,261	10.45	$60,360	0.44	$1,485,621	10.89
8. San Pedro	$165,356	1.18	$8,986	0.06	$174,342	1.25
9. Terminal Island	$47,183	0.26	$18,543	0.10	$65,726	0.36
10. Avalon & Other LA	$259	0.01	$7	0.00	$267	0.01
11. Newport Beach	$9	0.00	$14	0.00	$23	0.00
12. San Diego	$5,819	0.17	$110	0.00	$5,929	0.18

1. Percents are the amount of ex-vessel value as a percent of the total ex-vessel value of landings at the Port (1996-1999 Average Annual Value).

The maximum potential impact on total annual income is $11.2 million across all seven counties in the impact area (Table 6-37). Most of the potential impacts are concentrated in Ventura and Santa Barbara counties. The potential impact in San Diego County is primarily from kelp. Potential employment impacts are distributed among counties similarly to the annual income impacts with 324 full and part-time jobs potentially impacted (Table 6-27). The cumulative effect of the Federal waters phase would potential create additional impact to both jobs and income (Tables 6-37 and 6-38).

Table 6-37. Commercial Fishing & Kelp: Impact of Alternative 4 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$1,248,202	$40,367	$1,288,570
2. San Luis Obispo	$23,310	$9,348	$32,658
3. Santa Barbara	$2,557,664	$75,480	$2,633,144
4. Ventura	$5,377,737	$548,320	$5,926,057
5. Los Angeles	$1,210,094	$41,776	$1,251,870
6. Orange	$22	$33	$55
7. San Diego	$751,107	$350	$751,457
All Counties	$11,168,136	$715,674	$11,883,810

Table 6-38. Commercial Fishing & Kelp: Impact of Alternative 4 on Total Employment By County - Step 1 Analysis

County	State Waters Employment	Federal Waters Employment	Total Employment
1. Monterey	37	1	38
2. San Luis Obispo	1	0	1
3. Santa Barbara	83	2	85
4. Ventura	164	17	180
5. Los Angeles	32	1	33
6. Orange	0	0	0
7. San Diego	8	0	8
All Counties	324	22	346

Step 2 Analysis – Commercial Fishing and Kelp Harvesting

Alternative 4 is the second largest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. There would be a medium probability of relocating effort and a low to moderate probability of crowding and congestion effects, both of which should decrease costs relative to the Step 1 analysis, but less so than

Alternatives 1, 2,3 and the proposed project (Leeworthy and Wiley 2002). The ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 1.3 percent. This alternative has a more significant potential impact on the squid fishery (13.2 percent, Table 6-35). Potential kelp impacts are still relatively low for this alternative (7.8 percent, Table 6-35). The Socioeconomic Panel was not certain if squid harvest could be increased enough to fully offset the losses from this alternative (Leeworthy and Wiley 2002). If half of the estimated losses could be replaced, then 21.4 percent of the total potential impact on annual ex-vessel value of this alternative would be eliminated. As with other alternatives, the Socioeconomic panel was not certain if kelp harvest can be increased from other areas (Leeworthy and Wiley 2002). This alternative has the highest potential impact on prawn fishermen (14.9 percent, Table 6-35), which could potentially increase with the addition of a Federal waters phase (41.1 percent, Table 6-35). It is not clear how or if this potential impact could be reduced because other fishing sites may not be available. If half the squid losses could be replaced from other areas, it is possible that the Step 1 analysis estimates could be reduced by about 23 percent, even in the short-term.

In the long-term, the replenishment effects are of high likelihood since the MPAs cover about 20 percent of State waters within the Sanctuary, with 11 of the 17 habitat types receiving protection levels of 20 percent or higher (Table 6-34). Four habitat types receive 30 percent or more protection. The benefits to areas outside the State Marine Reserves are higher than Alternatives 1,2,3 and the proposed project, and the long-term mitigation of costs greater than for Alternatives 1, 2, 3 and the proposed project. Whether replenishment effects are greater than crowding or congestion effects would determine if this alternative's long-term costs can be transformed into long-term benefits.

Step 1 Analysis – Recreational Consumptive Activities

In terms of potential impact on consumptive activities, Alternative 4 is larger than the proposed project. The aggregate maximum potential loss to annual income for all consumptive recreation activities is about $3.6 million (Table 6-39) or 14.6 percent of the $24.7 million in annual income generated by recreational consumptive activities in the project area. The cumulative impact of the Federal waters phase is $5 million (Table 6-39) or 20.2 percent of the $24.7 million in annual income.

Table 6-39. Summary: Recreational Consumptive Activities - Alternative 4 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	88,462	69,182	78.2%	19,279	21.8%
Market Impact					
Direct Sales	$ 7,142,126	$ 5,298,977	74.2%	$ 1,843,149	25.8%
Direct Wages and Salaries	$ 2,862,600	$ 2,070,691	72.3%	$ 791,910	27.7%
Direct Employment	89	65	73.4%	24	26.6%
Total Income					
Upper Bound	$ 5,009,550	$ 3,623,708	72.3%	$ 1,385,842	27.7%
Lower Bound	$ 4,293,900	$ 3,106,036	72.3%	$ 1,187,865	27.7%
Total Employment					
Upper Bound	133	98	73.4%	35	26.6%
Lower Bound	111	82	73.4%	29	26.6%
Non-Market Impact					
Consumer's Surplus	$ 1,024,276	$ 801,044	78.2%	$ 223,232	21.8%
Profit[1]	$ 85,268	$ 58,280	68.3%	$ 26,988	31.7%

1. Profit is used as a proxy for producer's surplus.

The magnitude of potential impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g., income). In terms of person-days, the activity with the highest potential impacts is private boat fishing with a maximum potential loss of 33,373 person-days, followed by charter/party boat fishing with 20,726 person-days (Table 6-40). In terms of total annual income, the activity with the highest potential impacts is charter/party boat fishing with a maximum potential loss of $2.2 million. Cumulative impacts with the addition of the Federal phase would increase both potential losses in person-days of activity and income. terms of person-days, the activity with highest cumulative potential impacts is private boat fishing with a maximum potential loss of 40,660 person-days. In terms of total annual income, the activity with highest cumulative potential impacts is charter/party boat fishing with a maximum potential loss of $3.3 million (Table 6-41).

Table 6-40. Recreational Consumptive Activities - Alternative 4 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	20,726	13.05%	3,368	18.78%	33,373	15.59%	11,716	24.83%
Market Impact								
Direct Sales	$ 2,704,517	13.10%	$ 564,107	18.75%	$ 1,385,993	15.59%	$ 644,360	24.83%
Direct Wages and Salaries	$ 1,239,357	13.08%	$ 271,899	18.76%	$ 389,711	15.59%	$ 169,724	24.83%
Direct Employment	37	13.26%	9	18.87%	13	15.46%	6	25.13%
Total Income								
Upper Bound	$ 2,168,875	13.08%	$ 475,823	18.76%	$ 681,994	15.59%	$ 297,016	24.83%
Lower Bound	$ 1,859,036	13.08%	$ 407,848	18.76%	$ 584,566	15.59%	$ 254,585	24.83%
Total Employment								
Upper Bound	55	13.23%	14	18.87%	20	15.58%	9	25.13%
Lower Bound	46	13.24%	11	18.87%	17	15.53%	8	24.72%
Non-Market Impact								
Consumer's Surplus	$ 239,979	13.05%	$ 38,992	18.78%	$ 386,421	15.59%	$ 135,653	24.83%
Profit [1]	$ 50,046	13.30%	$ 8,233	18.71%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 6-41. Recreational Consumptive Activities - Alternative 4 – Cumulative Total Including Federal Waters Phase - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	31,962	20.13%	3,751	20.92%	40,660	19.00%	12,088	25.62%
Market Impact								
Direct Sales	$ 4,159,819	20.16%	$ 628,832	20.90%	$ 1,688,613	19.00%	$ 664,862	25.62%
Direct Wages and Salaries	$ 1,909,430	20.15%	$ 303,296	20.93%	$ 474,802	19.00%	$ 175,073	25.62%
Direct Employment	56	20.27%	10	21.01%	16	18.74%	6	26.15%
Total Income								
Upper Bound	$ 3,341,502	19.63%	$ 530,767	19.61%	$ 830,904	18.58%	$ 306,377	23.73%
Lower Bound	$ 2,864,145	19.75%	$ 454,944	19.89%	$ 712,203	18.67%	$ 262,609	24.12%
Total Employment								
Upper Bound	85	19.70%	15	19.90%	24	18.74%	9	24.14%
Lower Bound	70	19.90%	13	20.01%	20	18.83%	8	24.52%
Non-Market Impact								
Consumer's Surplus	$ 370,078	20.13%	$ 43,437	20.92%	$ 470,793	19.00%	$ 139,968	25.62%
Profit [1]	$ 76,111	20.23%	$ 9,157	20.81%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Step 2 Analysis - Recreational Consumptive Activities

In the short term, complete mitigation by substituting to alternative sites is less likely for Alternative 4 in comparison to the proposed project because it is larger and encompasses areas of more intense use. Both those participating in consumptive fishing and consumptive diving would be less likely to find a substitute site based upon the current distribution of use. Crowding/congestion effects are expected to be higher for this alternative. The portions of Alternative 4 to the north of Anacapa Island and on the northeast side of Santa Cruz Island encompass a particularly high usage area. Additionally, Alternative 4 encompasses the high use areas surrounding Santa Barbara Island. The potential for crowding/congestion effects would also be higher, again because of the relatively large size and the locations of MPAs proposed in this alternative. Overall,

some substitution would likely take place, so even in the short-term estimated impacts would be expected to be less than estimated in Step 1 analysis.

As was mentioned above, the size of a reserve is fundamental to its effectiveness (Roberts et. al. 2001). Because Alternative 4 is of a larger overall size, the assumption is made that the increases in abundance and size of fish would be higher in magnitude, resulting in a positive influence on the long-term net benefit. Reserves established in areas of high recreational use are most likely to provide benefits to target species and long-term benefits to recreational fisherman. When intense fishing pressure is reduced in areas of high productivity, target species in MPAs are likely to increase rapidly in abundance and individual size, leading to significantly higher reproductive potential. Increases in density and reproductive potential are likely to contribute to export of larvae and spillover of adult fish that would help to offset the loss of recreational fishing grounds. In the long-term, it is highly likely that this alternative would result in net benefits to consumptive recreation users.

Step 2 Analysis – Recreational Non-consumptive Users

In terms of potential impact (in this case positive) associated with non-consumptive activities Alternative 4 is larger than the proposed project. The total baseline annual income associated with all non-consumptive activities in Alternative 4 is about $1 million. In terms of annual income, the activity with the highest baseline is whale watching with a baseline of $602 thousand, followed by non-consumptive diving with $322 thousand, sailing with $74 thousand and kayaking/sightseeing with $32 thousand (Table 6-42). The cumulative effect of a Federal phase would potentially total $1.2 million (Table 6-43). In terms of annual income, the activity with the highest cumulative baseline is whale watching with a baseline of $767 thousand (Table 6-43).

Table 6-42. Economic Impact Associated with Non-consumptive Activities - Alternative 4 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,272	16.44%	2,194	20.36%	518	12.89%	174	14.13%
Market Impact								
Direct Sales	$ 709,897	16.6%	$ 378,420	20.4%	$ 89,135	12.8%	$ 36,097	14.0%
Direct Wages and Salaries	$ 344,085	16.5%	$ 184,058	20.5%	$ 42,118	12.9%	$ 18,101	14.0%
Direct Employment	11	15.9%	6	20.4%	1	12.9%	1	13.9%
Total Income								
Upper Bound	$ 602,149	16.5%	$ 322,101	20.5%	$ 73,706	12.9%	$ 31,676	14.0%
Lower Bound	$ 516,127	16.5%	$ 276,087	20.5%	$ 63,177	12.9%	$ 27,151	14.0%
Total Employment								
Upper Bound	17	15.9%	10	20.2%	2	12.7%	1	13.7%
Lower Bound	14	15.9%	8	20.3%	2	13.0%	1	13.0%
Non-Market Impact								
Consumer's Surplus	$ 49,469	16.4%	$ 25,407	20.4%	$ 5,993	12.9%	$ 2,018	14.1%
Profit[1]	$ 21,098	13.4%	$ 9,198	19.9%	$ 2,112	11.7%	$ 399	14.4%

1. Profit is used as a proxy for producer's surplus.

Table 6-43. Economic Impact Associated with Non-consumptive Activities - Alternative 4 – Cumulative Total Including Federal Waters Phase (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	5,450	20.97%	2,505	23.25%	569	14.17%	174	14.13%
Market Impact								
Direct Sales	$ 903,539	21.1%	$ 434,389	23.4%	$ 97,837	14.1%	$ 36,097	14.0%
Direct Wages and Salaries	$ 438,372	21.0%	$ 211,439	23.5%	$ 46,329	14.2%	$ 18,101	14.0%
Direct Employment	15	20.5%	7	23.2%	1	14.2%	1	13.9%
Total Income								
Upper Bound	$ 767,151	21.0%	$ 370,018	23.5%	$ 81,076	14.2%	$ 31,676	14.0%
Lower Bound	$ 657,558	21.0%	$ 317,159	23.5%	$ 69,493	14.2%	$ 27,151	14.0%
Total Employment								
Upper Bound	22	20.6%	11	23.1%	2	13.9%	1	13.7%
Lower Bound	19	20.6%	9	23.2%	2	14.3%	1	13.0%
Non-Market Impact								
Consumer's Surplus	$ 63,099	21.0%	$ 29,005	23.2%	$ 6,589	14.2%	$ 2,018	14.1%
Profit[1]	$ 28,847	18.3%	$ 10,645	23.0%	$ 2,227	12.4%	$ 399	14.4%

1. Profit is used as a proxy for producer's surplus.

Table 6-43 shows the cumulative baseline economic impact of potential beneficiaries to Alternative 4. The Socioeconomic Panel extended that logic to a range of benefit scenarios (Leeworthy and Wiley 2002). Table 6-44 shows the range of benefits based on certain assumptions about the increase in quality and the value elasticity of quality. This table presents a range of benefits with low end of $403 with the assumption of a 10 percent increase in quality and a 0.04 value elasticity of quality and a high end of $453,195 with a 100 percent increase in value and a value elasticity of quality of 4.5 (Table 6-44).

Table 6-44. Potential Benefits to Non-consumptive Users from Alternative 4 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 403	$ 10,071	$ 45,320
	Income	$ 5,000	$ 124,992	$ 562,465
	Employment	0.15	3.64	16.37
	Person-days	35	870	3,914
50%				
	Consumer's Surplus	$ 2,014	$ 50,355	$ 226,598
	Income	$ 24,998	$ 624,961	$ 2,812,323
	Employment	0.73	18.19	81.85
	Person-days	174	4,349	19,571
100%				
	Consumer's Surplus	$ 4,028	$ 100,710	$ 453,195
	Income	$ 49,997	$ 1,249,921	$ 5,624,646
	Employment	1.46	36.38	163.70
	Person-days	348	8,698	39,141

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 4

Vessel Traffic

Like the proposed project (Section 5.4.6), Alternative 4 does not change the commercial vessel Traffic Separation Scheme, does not alter existing mainland ports and harbors, and allows for transit through and anchoring in MPAs. Alternative 4 does include some area within Johnsons Lee, Santa Rosa Island, a popular anchorage and fishing site. While this would reduce the allowable take in the area, anchoring and transit would still be allowed. Alternative 4 would not significantly impact vessel traffic.

6.5 Alternative 5

6.5.1 Natural Environment

The State water area in Alternative 5 is approximately ~~137~~ **155** square nautical miles, 12 percent of the Sanctuary or 23 percent of State waters within the Sanctuary. Protecting the reserve areas proposed as Alternative 5 would contribute to increasing biomass, individual size, and reproductive potential of organisms within the reserve areas, particularly for species with low dispersal and high reproduction. Alternative 5 is likely to achieve the goal for conservation of ecosystem biodiversity established by the Marine Reserves Working Group because the reserve areas include all habitat types in all bioregions, encompassing at least some portion of the ranges of most species of interest.

The Federal waters phase would add on offshore MPA and additional offshore area to most of the MPAs in Alternative 5. This additional area would have additional beneficial impacts to the biological environment through the addition of some deep water habitat representation. The total area in Alternative 5 and the subsequent Federal waters phase is approximately 34 percent, or ~~390~~ **425** square nautical miles of the Sanctuary. (Table 6-45).

Habitat Representation

Alternative 5 protects a portion of all bioregions in the project area. Each bioregion is represented with one or several MPAs, and the reserve network across the northern Channel Islands is likely to contribute to fishery production outside of the MPAs. Over time, export from MPAs may be sufficient to offset the short-term loss to commercial and recreational fisheries. Five MPAs are located in the cool water region (the Oregonian Bioregion) around the northwestern Channel Islands. Three MPAs are located in the warmer water (the Californian Bioregion) around Anacapa and Santa Cruz Islands. Three MPAs are located in the Transition Zone between warm and cool waters. The existing Cowcod Conservation Area below 120 feet around Santa Barbara Island supplements the protection for species and habitats in the Transition Zone. Table 6-45 compares the area and percentage coverage of various habitats protected in State Marine Reserves within each bioregion.

Rocky coast (exposed and protected combined) is well represented in Alternative 5 (Table 6-45). Sandy beaches are also well represented (Table 6-45). Emergent nearshore rocks are well represented in this alternative. The cumulative impact of a Federal waters phase would not add additional representation to these nearshore habitats (Table 6-45).

All sediments (mud, sand, gravel, boulder, and bedrock) in the euphotic zone (0-30 m) are adequately represented in Alternative 5 (Table 6-45). Hard sediments on the continental shelf (30-200 m) are adequately represented, while soft sediments are inadequately represented (Table 6-45). Both sediment types on the continental shelf (100-200 m) are poorly represented (Table 6-45). Little is known about the distribution of hard sediments (boulder, and bedrock) on the deep continental shelf and slope in the Sanctuary. The Cowcod Conservation Area, however, provides additional habitat protection in the Transition Zone (Table 6-45). Emergent offshore rocks are adequately represented and submarine canyons are almost adequately represented (19 percent) in Alternative 5 (Table 6-45). The cumulative impacts of a Federal waters phase would increase the representation of most deeper habitats. Soft sediments on the shallow continental shelf, continental shelf, and continental slope (greater than 200 m) would all become well represented (Table 6-45). Submarine canyons and emergent offshore rocks would also become well represented (Table 6-45)

Giant kelp and surfgrass are adequately represented in Alternative 5 (Table 6-45). Eelgrass is very well represented, with 53 percent of available eelgrass habitat within MPAs (Table 6-45). This representation, however, is above the maximum recommended by the Scientific Advisory Panel to the Marine Reserves Working Group. Cumulative impacts of a Federal waters phase would not add representation to these nearshore habitats.

Table 6-45. Total and percent representation of ecological criteria protected by State Marine Reserves proposed as Alternative 5.

Ecological Criteria	Alternative 5 State Waters	Federal Waters Phase	Cumulative Total
Reserve Size (nm^2)	**155.2**	**270.2**	**425.4**
(Percent of Habitat in Sanctuary Waters)	(12%)	(22%)	**(34%)**
1. Sandy Coast (mi)	13.8 (32%)	-	**13.8 (32%)**
2. Rocky Coast (protected) (mi)	22.4 (37%)	-	**22.4 (37%)**
3. Rocky Coast (exposed) (mi)	13.3 (31%)	-	**13.3 (31%)**
4. Soft Sediment (0-30 m) (nm^2)	22.6 (27%)	-	**22.6 (27%)**
5. Hard Sediment (0-30 m) (nm^2)	13.9 (29%)	-	**13.9 (29%)**
6. Soft Sediment (30-100 m) (nm^2)	47.2 (14%)	51.3 (16%)	**98.5 (30%)**
7. Hard Sediment (30-100 m) (nm^2)	8.2 (22%)	1.7 (5%)	**9.9 (27%)**
8. Soft Sediment (100-200 m) (nm^2)	20.6 (8%)	64 (26%)	**84.6 (34%)**
9. Hard Sediment (100-200 m) (nm^2)	-	-	**-**
10. Soft Sediment (>200 m) (nm^2)	16.9 (3%)	118.1 (21%)	**135 (24%)**
11. Hard Sediment (>200 m) (nm^2)	-	-	**-**
12. Emergent Rocks (nearshore) (no.)	175 (34%)	-	**175 (34%)**
13. Emergent Rocks (offshore) (nm^2)	8 (20%)	4 (10%)	**12 (30%)**
14. Submarine Canyons (nm^2)	7 (19%)	5 (14%)	**12 (33%)**
15. Kelp Forest (nm^2)	5.8 (24%)	-	**5.8 (24%)**
16. Eelgrass (nm^2)	0.3 (53%)	-	**0.3 (53%)**
17. Surfgrass (nm^2)	6.6 (29%)	-	**6.6 (29%)**

Monitoring Sites

The potential benefits and costs of MPAs can only be determined if sufficient monitoring efforts follow establishment of MPAs. No-take marine reserves are necessary to

distinguish the effects of fishing on marine organisms and habitats from environmental fluctuations. Existing monitoring sites are particularly important in MPA design because baseline data collected at monitoring sites would help scientists determine how populations within MPAs have changed over time. It would be possible to evaluate the potential impacts of State Marine Reserves proposed in Alternative 5 using data from existing monitoring sites. Eight of 16 National Park Service kelp forest monitoring sites are located within MPAs proposed by Alternative 5. ~~One~~ **Two** of five monitoring sites is protected in the Oregonian Bioregion, ~~four~~ **three** of six in the Transition Zone, and three of five in the Californian Bioregion.

Human Threats and Natural Catastrophes

It is unlikely that all MPAs proposed as Alternative 5 would be impacted simultaneously by catastrophic events, such as oil spills or large storms, because they are widely distributed across the Sanctuary. Alternative 5 includes multiple MPAs on the north and south sides of each island in the Sanctuary. However, catastrophic events could impact populations in one or several of the reserve areas. The design of Alternative 5 incorporates the "insurance factor", a multiplier required to account for the effects of catastrophic events, recommended by Allison et al. (in press). The potential impacts of catastrophic events may be reduced by setting aside the amount of area necessary to restore, protect, and sustain the marine ecosystem under stable conditions (30-50 percent) plus additional area to account for the frequency of catastrophes and the recovery time of local habitats and species. Alternative 5 includes more than 30 percent of several important habitats in the project area.

Connectivity

Marine organisms often exhibit dispersal during at least one life history stage. Protecting multiple habitats, either in one large reserve or in several small but interconnected MPAs, may be important for growth and reproduction of marine organisms. In the Channel Islands, the strongest currents transport organisms across the northern Channel Islands from west to east, often forming strong counterclockwise recirculation in the Santa Barbara Channel. The patterns of circulation suggest that source populations may be located in productive areas on the north sides of San Miguel, Santa Rosa, and Santa Cruz Islands. A region of low current flow, and potentially high larval retention occurs off northeastern Santa Cruz Island. There is excellent potential connectivity among MPAs proposed as Alternative 5. The probability that larvae and adults would disperse to adjacent MPAs is relatively high because the total area covered by them is large, and they are located in the predominant current across the north sides of Santa Rosa, Santa Cruz, and Anacapa Islands. Larvae and adults may disperse between MPAs because distances between them are relatively small and individual MPAs are relatively large.

Potential for Congestion

Alternative 5 is the largest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. This alternative covers 23 percent of State waters

within the Sanctuary. There would be a lower probability of relocating effort and a higher probability of crowding and congestion effects in this alternative compared to the others. The potential for crowding/congestion effects would be higher because of the relatively large size of MPAs proposed in this alternative and their locations in high use areas (Leeworthy and Wiley 2002). Potential impacts of crowding and congestion are discussed in Chapter 5.3.1.

6.5.2 Human Environment

Step 1 Analysis – Commercial Fishing and Kelp Harvesting

The Socioeconomic Panel estimated that this alternative would potentially impact more than $4.8 million or 17.1 percent of all ex-vessel revenue in the Sanctuary (Leeworthy and Wiley 2002). As a percent of total commercial catch in the Sanctuary, the largest potential impacts are on California sheephead (26.7 percent), Rockfish (26.4 percent), sea cucumbers (25.9 percent), and sea urchins (25.4 percent). The smallest potential impacts are on tuna (3.1 percent), and prawn (9 percent) (Table 6-46). The cumulative impacts of the Federal waters phase would potentially impact more than $5.1 million or 18.3 percent of all ex-vessel revenue in the Sanctuary (Table 6-46). Most of the potential impact is from catch in State waters (92 percent). All of the potential impact on harvest of kelp and catch of spiny lobsters, crab, California sheephead, and sea cucumbers is in the State waters portion of the Sanctuary. Most of the potential impact on prawn and tuna catch, as is almost half of the wetfish potential impact, is in Federal waters. The cumulative effect of the Federal waters phase would potentially raise rockfish impacts to 32.6 percent and prawn impacts to 29.3 percent (Table 6-46).

Table 6-46. Commercial Fishing & Kelp: Impact of Alternative 5 on Ex-Vessel Value by Species Group - Step 1 Analysis

Species Group	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
Squid	$ 2,079,098	15.94	$ 76,843	0.59	$ 2,155,941	16.52
Kelp [2]	$ 730,650	12.20	$ -	0.00	$ 730,650	12.20
Urchins	$ 1,338,737	25.43	$ 2,687	0.05	$ 1,341,424	25.48
Spiny Lobster	$ 202,201	21.93	$ -	0.00	$ 202,201	21.93
Prawn	$ 63,271	9.00	$ 142,504	20.27	$ 205,775	29.26
Rockfish	$ 144,957	26.39	$ 33,857	6.16	$ 178,814	32.55
Crab	$ 54,416	15.84	$ -	0.00	$ 54,416	15.84
Tuna	$ 9,495	3.11	$ 31,300	10.24	$ 40,794	13.35
Wetfish	$ 32,924	10.92	$ 31,249	10.36	$ 64,173	21.29
CA Sheephead	$ 63,098	26.74	$ -	0.00	$ 63,098	26.74
Flatfishes	$ 28,421	15.46	$ 6,750	3.67	$ 35,171	19.13
Sea Cucumbers	$ 43,477	25.93	$ -	0.00	$ 43,477	25.93
Sculpin & Bass	$ 8,611	14.27	$ 7,020	11.64	$ 15,631	25.91
Shark	$ 6,351	18.28	$ 1,620	4.66	$ 7,971	22.94
Total	$ 4,805,706	17.10	$ 333,830	1.19	$ 5,139,536	18.28

1. Percents are the amount of each species/species groups ex-vessel value mpacted by an alternative divided by the Study Area Total for the species/species group.
2. Kelp is processed value from ISP Alginates in San Diego.

The greatest potential impact of Alternative 5, in terms of percent of annual total ex-vessel revenue by port (Table 6-47), is on Santa Barbara ($1.6 million or 18.9 percent). In absolute amount, Port Hueneme could potentially lose the greatest amount ($1.7 million or 12.7 percent of the total port annual ex-vessel revenue). Channel Islands Harbor could potentially lose 4.8 percent. Ventura Harbor could potentially lose 3.5 percent and San Pedro could potentially lose over $200 thousand or 1.4 percent of the annual ex-vessel of all landings. Although these potential losses represent between 1.4 and 18.9 percent of ex-vessel revenue, the percentage loss in total port revenue would be less because revenue from activities other than fishing would continue in the port areas. All other ports' ex-vessel revenue would potentially be decreased by small amounts. The cumulative potential losses with the addition of the Federal waters phase would result in the same distribution of impacts, with increases in dollar values (Table 6-47).

Table 6-47. Commercial Fishing & Kelp: Impact of Alternative 5 on Ex-Vessel Value by Port - Step 1 Analysis

Port	State Waters Value	% [1]	Federal Waters Value	%	Total Value	%
1. Moss Landing	$10	N/A	$9	N/A	$19	N/A
2. Morro Bay	$103	2.01	$0	0.00	$103	2.01
3. Avila/Port San Luis	$50	0.00	$12	0.00	$62	0.00
4. Santa Barbara	$1,627,439	18.94	$40,122	0.47	$1,667,562	19.41
5. Ventura Harbor	$190,136	3.53	$21,143	0.39	$211,279	3.92
6. Channel Islands	$235,051	4.80	$124,611	2.55	$359,662	7.35
7. Port Hueneme	$1,730,254	12.69	$96,743	0.71	$1,826,997	13.40
8. San Pedro	$201,867	1.44	$14,451	0.10	$216,318	1.55
9. Terminal Island	$57,570	0.32	$30,770	0.17	$88,340	0.49
10. Avalon & Other LA	$320	0.02	$11	0.00	$331	0.02
11. Newport Beach	$10	0.00	$23	0.00	$33	0.01
12. San Diego	$7,288	0.22	$192	0.01	$7,480	0.22

1. Percents are the amount of ex-vessel value as a percent of the total ex-vessel value of landings at the Port (1996-1999 Average Annual Value).

The maximum potential impact on total annual income (Table 6-48) is more than $13.8 million across all seven counties in the impact area. Most of the potential impacts are concentrated in Ventura and Santa Barbara counties, with potential impacts of around $1.5 million in Monterey and Los Angeles counties. Like Alternative 4, the potential impacts of Alternative 5 have broader potential impact because of the greater impact on squid. The potential impact in San Diego County is primarily from kelp. Potential employment impacts are distributed among counties similarly to the annual income impacts with 397 full and part-time jobs potentially impacted (Table 6-49). The cumulative effect of the Federal waters phase would potential create additional impact to both jobs and income (Tables 6-48 and 6-49).

Table 6-48. Commercial Fishing & Kelp: Impact of Alternative 5 on Total Income by County - Step 1 Analysis

County	State Waters Income	Federal Waters Income	Total Income
1. Monterey	$1,512,132	$55,911	$1,568,043
2. San Luis Obispo	$29,095	$6,517	$35,613
3. Santa Barbara	$3,203,964	$60,523	$3,264,487
4. Ventura	$6,452,097	$622,547	$7,074,645
5. Los Angeles	$1,472,076	$67,284	$1,539,360
6. Orange	$27	$53	$80
7. San Diego	$1,168,775	$598	$1,169,374
All Counties	$13,838,166	$813,434	$14,651,600

Table 6-49. Commercial Fishing & Kelp: Impact of Alternative 5 on Total Employment By County - Step 1 Analysis

County	State Waters Total Employment	Federal Waters Total Employment	Total Total Employment
1. Monterey	45	2	46
2. San Luis Obispo	1	0	1
3. Santa Barbara	104	2	106
4. Ventura	196	19	215
5. Los Angeles	39	2	41
6. Orange	0	0	0
7. San Diego	12	0	12
All Counties	397	25	421

Step 2 Analysis – Commercial Fishing and Kelp Harvesting

Alternative 5 is the largest among the alternatives in both size and potential impact on commercial fishing and kelp harvesting. There would be a low probability of relocating effort and a high probability of crowding and congestion effects, the net effect is more likely to be an increase in costs relative to the Step 1 analysis. The ability to catch tuna and wetfish in surrounding areas lowers Step 1 analysis costs by 2.04 percent. Alternative 5 has the highest potential impact on the squid fishery (15.9 percent, Table 6-46) and on

kelp harvesting (12.2 percent, Table 6-46). As with other alternatives, the Socioeconomic Panel was uncertain if kelp harvests could be increased from other areas (Leeworthy and Wiley 2002). As with Alternative 4, the Socioeconomic Panel was not certain if squid harvest could be increased in outside areas enough to fully offset the losses from this alternative (Leeworthy and Wiley 2002). If half of the estimated losses could be replaced, then 21 percent of the total potential impact on annual ex-vessel value of this alternative would be eliminated. This alternative has moderate potential impact on prawn fishermen (9 percent, Table 6-46), however this impact could be dramatically increased through the cumulative impacts of a Federal waters phase (29.3 percent, Table 6-46). It is not clear how or if this potential impact could be reduced because other fishing sites may not be available. If half the squid losses could be replaced from other areas, it is possible that the Step 1 analysis estimates could be reduced by about 24 percent, even in the short-term.

In the long-term, the replenishment effects are of high likelihood since the MPAs cover about 23 percent of the Sanctuary, with 11 of the 17 habitat types receiving protection levels of 20 percent or higher (Table 6-45). Five habitat types receive 30 percent or more of protection. The benefits to areas outside the State Marine Reserves are higher than all other alternatives, and the long-term mitigation of costs greater than for all other alternatives. Whether replenishment effects are greater than crowding or congestion effects would determine if this alternative's long-term costs can be transformed into long-term benefits.

Step 1 Analysis - Recreational Consumptive Activities

In terms of potential impact on consumptive activities, Alternative 5 is significantly larger than the proposed project. The aggregate maximum potential loss to annual income for all consumptive recreation activities is about $4.3 million (Table 6-50) or 17.4 percent of the $24.7 million in annual income generated by recreational consumptive activities in the project area. The cumulative impact of the Federal waters phase is $5.9 million (Table 6-39) or 23.9 percent of the $24.7 million in annual income.

Table 6-50. Summary: Recreational Consumptive Activities - Alternative 5 - Step 1 Analysis

	Total	State Waters		Federal Waters	
Person-days	104,497	81,716	78.2%	22,781	21.8%
Market Impact					
Direct Sales	$ 8,437,525	$ 6,289,616	74.5%	$ 2,147,909	25.5%
Direct Wages and Salaries	$ 3,378,264	$ 2,460,811	72.8%	$ 917,454	27.2%
Direct Employment	105	78	73.9%	27	26.1%
Total Income					
Upper Bound	$ 5,911,963	$ 4,306,419	72.8%	$ 1,605,544	27.2%
Lower Bound	$ 5,067,397	$ 3,691,216	72.8%	$ 1,376,181	27.2%
Total Employment					
Upper Bound	157	116	73.9%	41	26.1%
Lower Bound	131	97	73.9%	34	26.1%
Non-Market Impact					
Consumer's Surplus	$ 1,209,945	$ 946,171	78.2%	$ 263,774	21.8%
Profit[1]	$ 99,431	$ 68,324	68.7%	$ 31,107	31.3%

1. Profit is used as a proxy for producer's surplus.

The magnitude of potential impact varies by activity depending upon whether it is expressed in terms of direct usage (person-days) or economic impact (e.g., income). In terms of person-days, the activity with the highest potential impacts is private boat fishing with a maximum potential loss of 38,603 person-days, followed by charter/party boat fishing with 23,744 person-days (Table 6-51). In terms of total annual income, the activity with the highest potential impacts is charter/party boat fishing with a maximum potential loss of $2.5 million. Cumulative impacts with the addition of the Federal phase would increase both potential losses in person-days of activity and income. **In** terms of person-days, the activity with highest cumulative potential impacts is private boat fishing with a maximum potential loss of 47,460 person-days. In terms of total annual income, the activity with highest cumulative potential impacts is charter/party boat fishing with a maximum potential loss of $3.8 million (Table 6-52).

Table 6-51. Recreational Consumptive Activities - Alternative 5 - State Waters - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	23,744	14.96%	4,626	25.79%	38,603	18.04%	14,744	31.24%
Market Impact								
Direct Sales	$ 3,096,409	15.00%	$ 779,126	25.90%	$ 1,603,166	18.04%	$ 810,914	31.24%
Direct Wages and Salaries	$ 1,421,247	15.00%	$ 375,186	25.89%	$ 450,785	18.04%	$ 213,593	31.25%
Direct Employment	42	15.19%	12	25.83%	15	17.88%	8	31.62%
Total Income								
Upper Bound	$ 2,487,182	15.00%	$ 656,576	25.89%	$ 788,874	18.04%	$ 373,787	31.25%
Lower Bound	$ 2,131,870	15.00%	$ 562,779	25.89%	$ 676,178	18.04%	$ 320,389	31.25%
Total Employment								
Upper Bound	63	15.15%	19	25.83%	23	18.02%	11	31.62%
Lower Bound	53	15.17%	15	25.83%	19	17.97%	10	31.11%
Non-Market Impact								
Consumer's Surplus	$ 274,926	14.96%	$ 53,560	25.79%	$ 446,970	18.04%	$ 170,716	31.24%
Profit [1]	$ 56,935	15.13%	$ 11,389	25.88%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Table 6-52. Recreational Consumptive Activities - Alternative 5 – Cumulative Total Including Federal Waters Phase - Step 1 Analysis

	Charter Boat Fishing		Charter Boat Diving		Private Boat Fishing		Private Boat Diving	
	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area	Boundary Alternative	% of Study Area
Person-days	36,568	23.03%	5,128	28.60%	47,460	22.18%	15,341	32.51%
Market Impact								
Direct Sales	$ 4,757,769	23.05%	$ 865,003	28.75%	$ 1,971,015	22.18%	$ 843,737	32.51%
Direct Wages and Salaries	$ 2,186,026	23.07%	$ 415,873	28.70%	$ 554,220	22.18%	$ 222,145	32.50%
Direct Employment	64	23.19%	14	28.61%	19	21.87%	8	33.18%
Total Income								
Upper Bound	$ 3,825,545	22.48%	$ 727,778	26.88%	$ 969,886	21.69%	$ 388,754	30.10%
Lower Bound	$ 3,279,039	22.61%	$ 623,810	27.27%	$ 831,331	21.80%	$ 333,218	30.61%
Total Employment								
Upper Bound	97	22.55%	21	27.10%	28	21.87%	12	30.63%
Lower Bound	81	22.77%	17	27.25%	24	21.98%	10	31.11%
Non-Market Impact								
Consumer's Surplus	$ 423,411	23.03%	$ 59,380	28.60%	$ 549,528	22.18%	$ 177,626	32.51%
Profit [1]	$ 86,727	23.05%	$ 12,704	28.87%	n/a	n/a	n/a	n/a

1. Profit is used as a proxy for producer's surplus.

Step 2 Analysis - Recreational Consumptive Activities

Because Alternative 5 is larger and because it covers more of the area that is important to consumptive users generally, mitigation by substituting to alternative sites is less likely for Alternative 5 than for the proposed project. Both those participating in consumptive fishing and consumptive diving would be less likely to find a substitute sight based upon the current distribution of use. Specifically, Alternative 5 covers more of the area around Anacapa Island, the east side of Santa Cruz Island and a much larger area around Santa Barbara Island. The potential for crowding/congestion effects would also be higher, again because of the relatively large size and the locations of MPAs proposed in this alternative. Although substitution is not likely to lead to full mitigation of costs, some substitution would be expected to occur resulting in lower impacts than estimated in Step 1 analysis.

Because Alternative 5 is of a larger size, the assumption is made that the increases in abundance and size of fish would be higher in magnitude in the long-term. The number of

interacting variables in marine ecosystems precludes accurate predictions of the magnitude of potential changes in abundance of target species. However, preliminary attempts to model ecosystems with reserve management have suggested that large MPAs provide significantly greater benefits to target species than small MPAs and limited-take zones (Salomon et al. 2002).

Reserves established in areas of high recreational use are most likely to provide benefits to target species and long-term benefits to recreational fisherman. When intense fishing pressure is reduced in areas of high productivity, target species in MPAs are likely to increase rapidly in abundance and individual size, leading to significantly higher reproductive potential. Increases in density and reproductive potential are likely to contribute to export of larvae and spillover of adult fish that would help to offset the loss of recreational fishing grounds.

Step 2 Analysis – Recreational Non-consumptive Users

In terms of potential impact (in this case positive) associated with non-consumptive activities Alternative 5 is significantly larger than the proposed project. The total baseline annual income associated with all non-consumptive activities in Alternative 5 is about $1.2 million. In terms of annual income, the activity with the highest baseline is whale watching with a baseline of $691 thousand, followed by non-consumptive diving with $375 thousand, sailing with $87 thousand and kayaking/sightseeing with $71 thousand (Table 6-53). The cumulative effect of a Federal phase would potentially total $1.5 million (Table 6-54). In terms of annual income, the activity with the highest cumulative baseline is whale watching with a baseline of $939 thousand (Table 6-54).

Table 6-53. Economic Impact Associated with Non-consumptive Activities - Alternative 5 - State Waters (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	4,901	18.86%	2,542	23.59%	609	15.17%	386	31.31%
Market Impact								
Direct Sales	$ 814,227	19.0%	$ 439,779	23.7%	$ 105,427	15.2%	$ 80,471	31.3%
Direct Wages and Salaries	$ 394,686	18.9%	$ 214,245	23.8%	$ 49,494	15.2%	$ 40,387	31.2%
Direct Employment	13	18.2%	7	23.6%	2	15.2%	2	31.2%
Total Income								
Upper Bound	$ 690,701	18.9%	$ 374,930	23.8%	$ 86,615	15.2%	$ 70,676	31.2%
Lower Bound	$ 592,030	18.9%	$ 321,368	23.8%	$ 74,242	15.2%	$ 60,580	31.2%
Total Employment								
Upper Bound	20	18.3%	11	23.4%	2	14.9%	2	30.7%
Lower Bound	16	18.3%	9	23.5%	2	15.3%	2	29.2%
Non-Market Impact								
Consumer's Surplus	$ 56,749	18.9%	$ 29,428	23.6%	$ 7,052	15.2%	$ 4,470	31.3%
Profit[1]	$ 24,353	15.5%	$ 10,680	23.1%	$ 2,795	15.5%	$ 870	31.5%

1. Profit is used as a proxy for producer's surplus.

Table 6-54. Economic Impact Associated with Non-consumptive Activities - Alternative 5 – Cumulative Total Including Federal Waters Phase (Baseline 1999)

	Whale Watching		NC Diving		Sailing		Kayaking/Sightseeing	
	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]	Boundary Alternative	% of Study Area[2]
Person-days	6,670	25.67%	2,901	26.93%	672	16.75%	386	31.31%
Market Impact								
Direct Sales	$ 1,104,869	25.8%	$ 504,751	27.2%	$ 116,137	16.7%	$ 80,471	31.3%
Direct Wages and Salaries	$ 536,287	25.7%	$ 246,032	27.3%	$ 54,677	16.8%	$ 40,387	31.2%
Direct Employment	18	25.2%	8	26.9%	2	16.8%	2	31.2%
Total Income								
Upper Bound	$ 938,502	25.7%	$ 430,556	27.3%	$ 95,685	16.8%	$ 70,676	31.2%
Lower Bound	$ 804,430	25.7%	$ 369,048	27.3%	$ 82,016	16.8%	$ 60,580	31.2%
Total Employment								
Upper Bound	27	25.3%	13	26.7%	3	16.5%	2	30.7%
Lower Bound	23	25.3%	10	26.8%	2	16.9%	2	29.2%
Non-Market Impact								
Consumer's Surplus	$ 77,233	25.7%	$ 33,594	26.9%	$ 7,786	16.7%	$ 4,470	31.3%
Profit[1]	$ 36,362	23.1%	$ 12,367	26.7%	$ 2,936	16.3%	$ 870	31.5%

1. Profit is used as a proxy for producer's surplus.

Table 6-54 shows the cumulative baseline economic impact of potential beneficiaries to Alternative 5. The Socioeconomic Panel extended that logic to a range of benefit scenarios (Leeworthy and Wiley 2002). Table 6-55 shows the range of cumulative benefits based on certain assumptions about the increase in quality and the value elasticity of quality. This table presents a range of benefits with low end of $492 with the assumption of a 10 percent increase in quality and a 0.04 value elasticity of quality and a high end of $553,874 with a 100 percent increase in value and a value elasticity of quality of 4.5.

Table 6-55. Potential Benefits to Non-consumptive Users from Alternative 5 - Step 2 Analysis

Increase in Quality	Economic Measure	Elasticity of 0.04	Elasticity of 1.0	Elasticity of 4.5
10%				
	Consumer's Surplus	$ 492	$ 12,308	$ 55,387
	Income	$ 6,142	$ 153,542	$ 690,939
	Employment	0.18	4.50	20.23
	Person-days	43	1,063	4,784
50%				
	Consumer's Surplus	$ 2,462	$ 61,542	$ 276,937
	Income	$ 30,708	$ 767,710	$ 3,454,693
	Employment	0.90	22.48	101.17
	Person-days	213	5,315	23,918
100%				
	Consumer's Surplus	$ 4,923	$ 123,083	$ 553,874
	Income	$ 61,417	$ 1,535,419	$ 6,909,387
	Employment	1.80	44.96	202.34
	Person-days	425	10,630	47,835

1. Benefits are the aggregate amounts across all non-consumptive activities for Alterantive 5

Vessel Traffic

Like the proposed project (Section 5.4.6), Alternative 5 does not change the commercial vessel Traffic Separation Scheme, does not alter existing mainland ports and harbors, and allows for transit through and anchoring in MPAs. Alternative 5 would not significantly impact vessel traffic.

6.6 Defer Decision

The alternative to defer decision would use the Marine Life Protection Act (MLPA) public process and master plan to evaluate and recommend MPAs at the Channel Islands. This alternative does not adequately recognize the comprehensive community process and detailed and extensive scientific and socioeconomic data collection that has already occurred in consideration of the proposed project (Appendix 3). It is unlikely that new information would become available in the MLPA process that would change the proposed project. Local economic and environmental impacts may be underestimated by combining them with those of the entire State. **In an area this size, local benefits to populations within the Channel Islands would not be expected to lead to stock wide benefits across a species entire range. In addition, the economic impacts on an individual level are not as readilly apparent when viewed in the context of the total California economy. Adjustments were made to the proposed project based on local input that could be overlooked in a Statewide forum.** The Channel Islands process was initiated prior to the enactment of the MLPA and is considerably ahead of the MLPA implementation process. As a result deferral to the MLPA would unnecessarily delay decision on the Channel Islands proposal.

Impacts and benefits of this project could be addressed and analyzed in the broader MLPA process. It is not possible to ~~examine~~ **quantify** the potential environmental impacts of deferring decision, as the decisions for the Marine Life Protection Act are still forthcoming. **If the MLPA process led to an increase in overall protection, there would be no expected negative impacts to the environment. Conversely, if the MLPA process resulted in maintenance of the status quo, there would be a potential for continued declines in various populations as described in section 6.7 below**. ~~Rather~~ **A** timely decision will provide needed insight and experience in the implementation of reserves before the MLPA suggests MPAs for the entire State. Furthermore, biological and economic monitoring will contribute more information to the biological and fishery effects of reserves thus helping to refine future MPA decisions like the MLPA.

6.7 No Action

The no action alternative means no change would occur to existing regulations. This would maintain one small no-take reserve at Anacapa Island, and three invertebrate closure areas at Anacapa and Santa Barbara Islands. These areas have no negative biological impacts on the project area. **The No Action alternative would, however, be expected to result in the continuation of current habitat and population trends (as described in Chapter 4). As noted by the Pacific Fishery Management Council in their Phase I Technical Analysis of marine reserves (Parish et al., 2001), the estimated biomass of the majority of West Coast groundfish species have long term downward trends. Since 1985 abundances of harvestable red urchins have declined by 1% per year at fished sites on Santa Rosa and San Miguel Islands relative to non-fished reserve sites on Anacapa Island (S. Schroeter & D. Reed, analysis of NPS data). The commercial fishery for rock crab (*Cancer spp.*) has localized effects on crab abundance and size. Crab fishing areas intensively exploited over an extended period show a lower catch-per-trip and reduced size frequency distribution compared to lightly exploited areas (Leet et al., 2001). Very little is known about the long term status of many other stocks, including certain invertebrates and nearshore rockfish. Effective management of marine fisheries is being attempted in an environment where there are many unknowns and uncertainties about the status of stocks and the entire ecosystem supporting them. Given the variability in regulations and unknown nature of future regulatory actions, it is difficult to assess whether no action will necessarily continue downward trends.**

Because no action represents no change to existing regulations, there are no immediate economic impacts. In the long-term, however, negative economic impacts could occur from decreased fisheries sustainability and more variable catch rates. **Management failure could prevent rebuilding of overfished stocks and could lead to ESA listings that would have dramatic negative consequences for the fisheries.** There is no way to estimate or quantify these potential negative impacts.

6.8 Comparison of Alternatives

This chapter presents, in summary form, a comparison among the alternatives. Summary comparisons of the ecological criteria and socioeconomic impacts are described.

6.8.1 Environmental Impacts

Table **6-55A and 6-56** show~~s~~ the ~~environmental impacts that are associated~~ **relative representation** with respect to the criteria of "habitat representation" for the proposed project and each alternative. Habitat representation may be used as a surrogate for species representation. If all habitats are represented, then the species that rely on those habitats would also have some protection. The level of protection is correlated to the amount of habitat protected. **In general, the percentage of populations protected in MPAs increases with reserve area until most species are included in the reserve network. For the purposes of comparison, habitats represented at a level of 20% or greater were considered adequately represented. This level was based on the bulk of published science regarding habitat representation for a variety of MPA goals. Table 6-55A shows the relative representation of all habitats within each bioregion. Percentages listed are the percent of the total area of that bioregion. Table 6-56 shows the relative representation of each habitat type for the entire project area.**

Table 6-55A. Area (square nautical miles) and percentage habitat representation for each bioregion within the State waters of the Project Area.

	Californian	Oregonian	Transition	Total
Proposed Project	22.1 (16%)	79.6 (21%)	30.6 (18%)	132.3 (19%)
Alternative 1	8 (6%)	60 (16%)	11 (7%)	79 (12%)
Alternative 2	10.4 (7%)	57.3 (15%)	15.6 (9%)	83 (12%)
Alternative 3	4.7 (3.4%)	83.1 (22%)	14.2 (8%)	102 (15%)
Alternative 4	31.7 (23%)	84.9 (23%)	21.3 (13%)	137.9 (20%)
Alternative 5	35.8 (26%)	90.1 (24%)	29.3 (17%)	155.2 (23%)

Table 6-56. Representative Habitat for the Proposed Project and Alternatives 1-5.

Representative Habitat	Proposed Project	Alternative 1 State Waters	Alternative 2 State Waters	Alternative 3 State Waters	Alternative 4 State Waters	Alternative 5 State Waters
Reserve Size (nm^2)	132.3	79	83	102	137.9	155.2
(Percent of Habitat in Sanctuary Waters)	(10%)	(6%)	(6%)	(8%)	(10%)	(12%)
1. Sandy Coast (mi)	13.8 (32%)	7.7 (18%)	7.2 (17%)	6.6 (15%)	13.9 (32%)	13.8 (32%)
2. Rocky Coast (protected) (mi)	19.8 (34%)	7.6 (12%)	5.3 (9%)	8.1 (13%)	16.8 (28%)	22.4 (37%)
3. Rocky Coast (exposed) (mi)	13.3 (31%)	7.6 (18%)	8.9 (21%)	8.7 (20%)	12.8 (30%)	13.3 (31%)
4. Soft Sediment (0-30 m) (nm^2)	28.6 (34%)	9.1 (11%)	8.6 (10%)	11.0 (13%)	19.9 (23%)	22.6 (27%)
5. Hard Sediment (0-30 m) (nm^2)	13.5 (28%)	5.9 (12%)	6.7 (14%)	6 (12%)	11.8 (24%)	13.9 (29%)
6. Soft Sediment (30-100 m) (nm^2)	76.6 (23%)	28.8 (9%)	31.7 (10%)	35.6 (11%)	50.6 (15%)	47.2 (14%)
7. Hard Sediment (30-100 m) (nm^2)	7.6 (20%)	7.1 (19%)	5.0 (13%)	7.7 (21%)	7.9 (21%)	8.2 (22%)
8. Soft Sediment (100-200 m) (nm^2)	38.9 (16%)	11.3 (5%)	9.6 (4%)	11.3 (5%)	13.8 (6%)	20.6 (8%)
9. Hard Sediment (100-200 m) (nm^2)	-	-	-	-	-	-
10. Soft Sediment (>200 m) (nm^2)	8.1 (1.4%)	2.5 (0.4%)	3.1 (0.6%)	2.5 (0.4%)	2.5 (0.4%)	16.9 (3%)
11. Hard Sediment (>200 m) (nm^2)	-	-	-	-	-	-
12. Emergent Rocks (nearshore) (no.)	136 (27%)	62 (12%)	89 (17%)	66 (13%)	172 (33%)	175 (34%)
13. Emergent Rocks (offshore) (nm^2)	8 (20%)	0	7 (18%)	8 (20%)	8 (20%)	8 (20%)
14. Submarine Canyons (nm^2)	7 (19%)	6 (17%)	7 (19%)	6 (17%)	6 (17%)	7 (19%)
15. Kelp Forest (nm^2)	5.1 (21%)	2.6 (11%)	3.2 (13%)	3.8 (16%)	5.8 (24%)	5.8 (24%)
16. Eelgrass (nm^2)	0.2 (35%)	0.2 (35%)	0.14 (23%)	0.2 (35%)	0.3 (53%)	0.3 (53%)
17. Surfgrass (nm^2)	6.4 (28%)	3.3 (14%)	3.7 (16%)	3.9 (17%)	6.2 (26%)	6.6 (29%)

(Note: A section of text and Figure 6-1 were removed because they were unclear and did not further the comparative analysis of the various alternatives.)

Relative Habitat Representation
(Note: this section was moved from pages 6-74 through 6-75 in the Draft ED)

Proposed project

This alternative is the third largest in size at approximately ~~114~~ **132** square nautical miles, **yet protects the most habitats at a level of 20% or more.** It covers 10 percent of the Sanctuary or 19 percent of State waters within the Sanctuary. Twelve of the 17 habitats receive 20 percent or more of protection and ~~5 habitats~~ **5 of these 12** receive more than 30 percent protection **(Table 6-56)**. This alternative would be expected to have the highest non-use or passive use economic values among all alternatives. In addition this alternative has one of the highest potentials for direct benefits to user groups.

Alternative 1

This alternative is the smallest in size at approximately ~~69~~ **79** square nautical miles. It covers only 6 percent of Sanctuary waters or 12 percent of State waters within the Sanctuary (Table 6-56). Only one of the 17 habitat types receives protection at a level of 20 percent or higher. This alternative should have the lowest non-use or passive economic use value.

Alternative 2

This alternative is the second smallest in size at approximately ~~72~~ **83** square nautical miles. It covers 6 percent of Sanctuary waters or 12 percent of State waters within the Sanctuary. Only two of the 17 habitat types receiving protection levels of 20 percent or higher (Table 6-56). This alternative is not readily distinguishable from Alternative 1 without more detail on the impacts of State Marine Conservation Areas.

Alternative 3

This alternative is the third smallest in size at approximately ~~89~~ **102** square nautical miles. It covers 8 percent of Sanctuary waters or 15 percent of State waters within the Sanctuary. Four of the 17 habitat types receiving protection levels of 20 percent or higher (Table 6-56). This alternative would be expected to have higher non-use or passive use economic value than alternatives 1 and 2.

Alternative 4

This alternative is the second largest in size at approximately ~~120~~ **138** square nautical miles. It covers 10 percent of Sanctuary waters or 20 percent of State waters within the Sanctuary. Eleven of the 17 habitat types receiv**e** protection levels of 20 percent or higher and 4 ~~habitats~~ **of these 11** receive 30 percent or higher (Table 6-56). This alternative would be expected to have higher non-use or passive economic use value than alternatives 1,2, 3 and the proposed project.

Alternative 5

This alternative is the largest in size at approximately ~~137~~ **155** square nautical miles. It covers 12 percent of the Sanctuary or 23 percent of State waters within the Sanctuary. Eleven of 17 habitats receive 20 percent or more of protection and 5 ~~habitats~~ **of these 11** receive more than 30 percent protection (Table 6-**56**). This alternative would be expected to have the second highest non-use or passive use economic value among all alternatives.

Besides habitat representation, a number of other criteria were used to relatively gauge the potential benefits of each alternative. These criteria include the presence of monitoring sites to establish a baseline and determine impacts, the potential to withstand human and natural catastrophes, relative connectivity of individual MPAs, and the potential for congestion of effort due to displacement. Table 6-56A Compares each alternative based on these other criteria. Monitoring sites shows the number of the 16 existing Channel Islands National Park Kelp Forest Monitoring sites contained in each alternative. The relative potential ability to withstand catastrophes and relative connectivity, high to low, are shown in the next columns. The relative potential displacement of existing fishing effort, low to high, is shown in the final column.

6-56A. Relative comparison of alternatives based on other biological criteria.

	Monitoring Sites (# out of 16)	Withstand Catastrophes	Connectivity	Displacement
Proposed Project	7	moderate	high	low
Alternative 1	3	moderate	low	low
Alternative 2	5	moderate	low	low
Alternative 3	3	moderate	moderate	low
Alternative 4	9	moderate	high	moderate
Alternative 5	8	high	high	high

6.8.2 Economic Impacts

Table 6-57 shows the aggregate potential impacts to consumptive activities for the propose project and each alternative. This table is based on Step 1 analyses and does not reflect potential benefits to non-consumptive users. It does, however, represent the comparative, short-term, potential impacts of each alternative.

Table 6-57. Aggregate Consumptive Activities: Summary of Impacts by Alternative - Step 1 Analysis

	State Waters		Federal Waters		Total	
Alternative	Amount	% [1]	Amount	%	Amount	%
			Income [2]			
1	$7,282,841	6.8%	$877,570	0.8%	$8,160,411	7.6%
2	$8,728,618	8.1%	$1,063,077	1.0%	$9,791,695	9.1%
3	$7,658,580	7.1%	$1,352,310	1.3%	$9,010,890	8.4%
4	$14,791,844	13.7%	$2,101,516	2.0%	$16,893,360	15.7%
5	$18,144,585	16.9%	$2,418,978	2.2%	$20,563,563	19.1%
Proposed Project	$13,407,739	12.5%	$1,498,958	1.4%	$14,906,697	13.9%
			Employment [3]			
1	207	7.0%	25	0.8%	232	7.8%
2	245	8.3%	29	1.0%	274	9.3%
3	218	7.4%	37	1.2%	255	8.6%
4	422	14.3%	57	1.9%	479	16.2%
5	513	17.3%	66	2.2%	579	19.6%
Proposed Project	385	13.0%	41	1.4%	426	14.4%

1. Percents are the percent of total baseline amounts from the aggregate data.
2. Total income, including multiplier impacts, is equal to $107,600,471 (Baseline Study Area Total).
3. Total employment, including multiplier impacts, is equal to 2,961 jobs (Baseline Study Area Total).

The potential impacts of the proposed project are compared to the other alternatives below. The maximum potential loss to commercial fish landings would vary between 2.8% and 16.5% of annual ex-vessel value generated in Sanctuary waters in the proposed project (Table 6-57A). This reflects a combined maximum potential annual ex-vessel loss of $3,307,652 (1996 - 1999 average ex-vessel value) to commercial fisheries (Table 6-57A).

The maximum potential loss to income derived from recreational fishing varies between 11.6% and 24.6% annually in the proposed project (Table 6-57B). This represents a maximum potential loss in income of $3,284,059 generated by recreational fishing annually (Table 6-57B).

Maximum potential impact to income derived from non-consumptive activities (diving, whale watching, kayaking, sightseeing, and sailing) ranges between 10.9% and 29% annually in the Department preferred alternative (Table 6-57C). This represents a maximum potential annual income of $954,601 generated by non-consumptive activities annually (Table 6-57C). Non-consumptive income is that supported by existing activities. This income is expected to increase over

time by some unknown amount based on expected improvements in site quality, thus impact in this case is positive.

Losses can be expanded to include losses in total income including processors, fish buyers and other related business. This maximum potential loss in income from commercial activities to all counties is estimated at $10,123,680 per year (Table6-57D).

Table 6-57A: Maximum potential loss in annual ex-vessel value to commercial fisheries by species group[1] (1996-1999 average values) for the initial state waters phase.

Species Group	Preferred Alternative		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
Squid	$1,660,718	12.73	$661,722	5.07	$712,953	5.46	$695,876	5.33	$1,716,217	13.15	$2,079,098	15.94
Kelp	$332,794	5.55	$265,568	4.43	$332,794	5.55	$298,241	4.98	$467,886	7.81	$730,650	12.20
Urchins	$830,464	15.77	$735,214	13.96	$704,761	13.39	$753,956	14.32	$1,068,453	20.29	$1,338,737	25.43
Spiny Lobster	$149,133	16.17	$81,627	8.85	$83,425	9.05	$97,403	10.56	$150,333	16.30	$202,201	21.93
Prawn	$58,615	8.34	$94,170	13.39	$63,271	9.00	$94,170	13.39	$104,858	14.91	$63,271	9.00
Rockfish	$87,985	16.02	$72,964	13.28	$60,731	11.06	$88,222	16.06	$116,040	21.12	$144,957	26.39
Crab	$50,139	14.59	$26,331	7.66	$26,943	7.84	$26,278	7.65	$48,483	14.11	$54,416	15.84
Tuna	$8,544	2.80	$5,007	1.64	$5,467	1.79	$5,812	1.90	$7,886	2.58	$9,495	3.11
Wetfish	$28,511	9.46	$9,994	3.31	$12,573	4.17	$10,078	3.34	$20,675	6.86	$32,924	10.92
CA Sheephead	$38,622	16.37	$24,024	10.18	$44,262	18.76	$26,174	11.09	$48,562	20.58	$63,098	26.74
Flatfishes	$22,652	12.32	$9,562	5.20	$20,152	10.96	$9,562	5.20	$20,546	11.17	$28,421	15.46
Sea Cucumber	$27,731	16.54	$21,406	12.76	$28,667	17.09	$23,361	13.93	$32,909	19.62	$43,477	25.93
Sculpin & Bass	$6,865	11.38	$4,435	7.35	$6,004	9.95	$4,571	7.58	$7,248	12.01	$8,611	14.27
Shark	$4,879	14.04	$3,058	8.80	$1,773	5.10	$2,906	8.36	$5,321	15.31	$6,351	18.28
Total	$3,307,652	11.77	$2,015,082	7.17	$2,103,776	7.48	$2,136,610	7.60	$3,815,416	13.57	$4,805,706	17.10

[1] Species groups used are as defined in Leeworthy and Wiley, 2002.

Table 6-57B: Maximum potential loss in annual income generated by consumptive recreational activities for the initial state waters phase.

Activity Type	Preferred Alternative		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
	Income	%	Income	%	Income	%	Income	%	Income	%	Income	%
Charter/Party Boat Fishing	$1,915,274	11.55	$1,344,968	8.11	$1,745,881	10.53	$1,390,486	8.39	$2,168,875	13.08	$2,487,182	15.00
Charter/Party Boat Diving	$458,094	18.06	$185,887	7.33	$492,244	19.41	$201,313	7.94	$475,823	18.76	$656,576	25.89
Private Boat Fishing	$616,055	14.09	$332,452	7.60	$580,097	13.26	$349,440	7.99	$681,994	15.59	$788,874	18.04
Private Boat Diving	$294,636	24.63	$56,572	4.73	$279,006	23.33	$60,677	5.07	$297,016	24.83	$373,787	31.25
Total	$3,284,059	13.30	$1,919,879	7.70	$3,097,229	12.60	$2,001,916	8.10	$3,623,708	14.60	$4,306,419	17.40

Table 6-57C: Maximum potential impact[1] in annual income generated by non-consumptive activities for the initial state waters phase.

	Preferred Alternative		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Activity Type	Income	%	Income	%	Income	%	Income	%	Income	%	Income	%
Whale Watching	$533,824	14.6	$181,453	5.0	$574,941	15.8	$155,610	4.3	$602,149	16.5	$690,701	18.9
Non-Consumptive Diving	$292,754	18.6	$128,978	8.2	$269,708	17.1	$134,178	8.5	$322,101	20.5	$374,930	23.8
Sailing	$62,438	10.9	$28,196	4.9	$68,953	12.1	$33,224	5.8	$73,706	12.9	$86,615	15.2
Kayaking / Island Sightseeing	$65,585	29.0	$23,301	10.3	$23,332	10.3	$25,032	11.1	$31,676	14.0	$70,676	31.2
Total	$954,601	15.8	$361,928	6.0	$936,934	15.6	$348,044	5.8	$1,029,632	17.1	$1,222,922	20.3

[1]Non-consumptive users are considered beneficiaries of MPAs. Therefore impact, in this case, is positive.

Table 6-57D: Maximum potential loss in annual income generated by commercial fisheries by county[1] for the initial state waters phase.

County	Preferred Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Income	Income	Income	Income	Income	Income
Monterey	$1,207,845	$481,271	$518,533	$506,111	$1,248,202	$1,512,132
San Luis Obispo	$17,914	$14,383	$12,168	$17,315	$23,310	$29,095
Santa Barbara	$2,085,917	$1,679,016	$1,625,984	$1,759,866	$2,557,664	$3,203,964
Ventura	$5,102,153	$2,279,347	$2,418,613	$2,386,413	$5,377,737	$6,452,097
Los Angeles	$1,174,655	$481,003	$522,535	$507,237	$1,210,094	$1,472,076
Orange	$23	$12	$13	$13	$22	$27
San Diego	$535,173	$427,929	$533,544	$479,688	$751,107	$1,168,775
All Affected Counties	$10,123,680	$5,362,962	$5,631,389	$5,656,664	$11,168,136	$13,838,166

[1]Counties listed are those where fish are landed and/or processed.

The above analyses were based on the economic dimensions of the potential impacts of alternatives at a broad level (across all fisheries). The proposed project is in the mid-range of potential impacts among all alternatives. Another way to view the relative impacts, even in the limited Step 1 context, is to compare the ratio of the percent of habitat represented to the percent of annual income lost within the Sanctuary. If the habitat represented is too low, or the cost too high, the alternative is less desirable. The higher the ratio the more protection per dollar of annual income lost (Table 6-58). Alternative 3 had the highest ratio (1.13) followed by the Alternative 1 (0.88) and the proposed project (0.80). Alternative 5 had the lowest ratio and, thus, the least representation per unit of lost annual income (0.71) followed by Alternative 4 (0.73) and Alternative 2 (0.74) (Table 6-58). The proposed project is mid-range both in percent protection and protection per dollar impact. While Alternatives 1 and 3 rate higher in habitat representation per dollar impact, neither has representation in the nearshore areas of Anacapa or Santa Barbara Islands. This artificially raises their ratings by not representing critical habitats in economically important areas.

Table 6-58. Habitat Representation per Dollar of Impact on Income.

Alternative	Percent of Sanctuary waters	Percent Impact on Income	Habitat Representation per Dollar Impact
Alternative 5	12 %	16.9 %	0.71
Alternative 4	10 %	13.7 %	0.73
Alternative 2	6 %	8.1 %	0.74
Proposed Project	10 %	12.5 %	0.80
Alternative 1	6 %	6.8 %	0.88
Alternative 3	8 %	7.1 %	1.13

Step 2 Analysis of Recreational Consumptive Activities

The assumption that was made in Step 1 analyses is that potential losses are real and there is no way to recover from being displaced from the respective marine reserve alternatives. **In the long term, the potential negative impacts are expected to be balanced by the positive impacts of sustainable fisheries, non-consumptive benefits, and ecosystem function in the reserve areas. In addition potential benefits may be realized through adult fish spillover to areas adjacent marine reserves and larval transport to distant fished sites.**

In the Step 2 analyses, the benefits to non-consumptive users and non-users is included in the assessment. Although these issues are addressed quantitatively where possible, the discussion is largely qualitative because it is generally not possible for the analysts to quantify mitigating factors and benefits.

Substitution

If displaced users are simply able to relocate their activities, they may be able to fully or partially mitigate their losses. Potential substitution depends on the availability of substitute sites and their resource/habitat qualities. Several scenarios are possible. Even when total activity remains constant (i.e., person-days remain the same as they simply go to other sites), if the quality of the site is lower there could be some loss in consumer's surplus (no change in activity, so no change in annual income and employment). If it costs more to get to the substitute sites, there could still be increases in costs and thus lower consumer's surplus to users and profits to charter/party businesses. If there is not an adequate supply of substitute sites, then there could be losses in total activity and in all the non-market and market economic measures referenced in the above analysis of displaced use. The possibilities for substitution vary by alternative.

The presence of other closed areas would also affect the ability of displaced users to substitute. There are currently other marine areas subject to fishery closure, such as the Cowcod Conservation Area, in the project area in addition to the reserve areas proposed

in this process. However to mitigate the negative potential impacts of the proposed areas, these are either being completely or partially re-opened. The effect this would have on the ability of users to find adequate substitutes site would vary by alternative.

Long-term Benefits from Replenishment Effects

Marine reserve systems may have beneficial effects beyond the direct ecological protection for the sites themselves. That is, both the size and number of fish and invertebrates inside and outside the MPAs may increase. State Marine Reserves can be a benefit to recreational anglers. The long-term benefits from the reserves could offset any losses from displacement and may also result in long-term benefits and no costs to recreational users that are displaced by a proposed reserve alternative. The Socioeconomic Panel maintained that this conclusion may still vary by alternative (Leeworthy and Wiley 2002).

Step 2 Analysis of Recreational Non-consumptive Activities

In addition to benefits derived from replenishment effects, the establishment of MPAs is expected to result in benefits to non-consumptive recreational users. These increased benefits take the form of increases in wildlife viewing opportunities from increased abundance of fish and invertebrates, and improved habitat quality. Benefits may also be derived from the decrease in the density of users or in the reduction in conflicts with consumptive users.

There are no data available to directly estimate the magnitude of these non-consumptive benefits. Hence, the Socioeconomic Panel analysis should not be considered a true comparison of potential costs and benefits associated with alternatives and the proposed project.

In light of this fact, the Socioeconomic Panel conducted a simulation for each alternative using a range of increases in quality and of elasticities (Leeworthy and Wiley 2002). Estimates of aggregate benefits presented in this chapter tend to under-estimate true benefits. **It is important to note that while the elasticity values are estimated, the same values were used for each alternative, allowing a comparative analysis of relative potential benefits.**

For each of the alternatives and the proposed project along with the Federal waters phase, Table 6-59 presents the estimated Step 2 potential cumulative economic impacts on recreational non-consumptive activities within the project area. Again it should be understood that these impacts are positive.

Table 6-59. Summary: Potential Cumulative Economic Impacts on Non-consumptive Activities - Step 2 Analysis

	Range of Impacts											
	Person-days						Consumer's Surplus					
Alternative	Amount			%			Amount			%		
Proposed Project	29	-	32,211	0.07%	-	77%	$ 332	-	$ 372,969	0.07%	-	77%
Alternative 1	11	-	12,092	0.03%	-	29%	$ 124	-	$ 139,977	0.03%	-	29%
Alternative 2	29	-	32,202	0.07%	-	77%	$ 331	-	$ 372,875	0.07%	-	77%
Alternative 3	11	-	12,092	0.03%	-	29%	$ 124	-	$ 139,995	0.03%	-	29%
Alternative 4	35	-	39,141	0.08%	-	93%	$ 403	-	$ 453,195	0.08%	-	93%
Alternative 5	43	-	47,835	0.10%	-	114%	$ 492	-	$ 553,874	0.10%	-	114%
	Income						Employment					
	Amount			%			Amount			%		
Proposed Project	$ 4,169	-	$ 4,689,833	0.07%	-	78%	0.12	-	135	0.07%	-	75%
Alternative 1	$ 1,531	-	$ 1,721,895	0.03%	-	29%	0.05	-	51	0.03%	-	28%
Alternative 2	$ 4,122	-	$ 4,636,710	0.07%	-	77%	0.12	-	133	0.07%	-	74%
Alternative 3	$ 1,534	-	$ 1,725,785	0.03%	-	29%	0.05	-	52	0.03%	-	29%
Alternative 4	$ 5,000	-	$ 5,624,646	0.08%	-	93%	0.15	-	164	0.08%	-	92%
Alternative 5	$ 6,142	-	$ 6,909,387	0.10%	-	115%	0.18	-	202	0.10%	-	113%

1. Percents are percent of baseline 1999 for the entire study area.

Other Potential Benefits

In previous sections the potential costs to all consumptive users (both the recreational industry and for the commercial fishery and kelp) were discussed, as well as, the potential benefits to recreational consumptive users and commercial fisheries from the replenishment effect of the marine reserves. Also mentioned were the potential benefits to non-consumptive recreational users and simulations of the potential benefits using a range of assumptions about future quality increases in the marine protected areas and the behavioral responses (quality elasticities).

(Note: Sections on numeric estimates of potential benefits to non-consumptive users and a net assessment were removed from the Draft Environmental Document. As noted here, these benefits are difficult to quantify and are best discussed qualitatively.)

Benefits would also accrue through the additional research and monitoring capabilities that the MPAs would provide. Information developed through the study of populations within, adjacent to, and distant from MPAs would assist fisheries managers in determining both the potential benefits of MPAs and the potential impacts on populations caused by human activities and natural events. This scientific benefit would be accompanied by a cost in the form of economic expenditures made to perform the research and monitoring. While it is difficult to quantify the benefits, some of the potential costs have been estimated for other processes. The estimated costs for research and management connected to the implementation of the Nearshore Fishery Management Plan (of which MPAs would be a subset) was nearly $4 million. Two million dollars of this would need to come from new funding sources. The Department expects to use traditional and

existing funds to support this research, as well as new funding through a variety of sources. In addition, costs to the Department can be offset by partnering with university scientists and other agency to help perform the monitoring and research.

Non-use economic values would be expected to be greater the larger the area protected. A review of four studies based on National surveys of U.S. households evaluated adult's perceptions and concerns about the environment. In addition, one of the studies focused specifically on ocean related issues (SeaWeb 1996) and found strong support for marine protected areas. One more recent study (SeaWeb 2001) directly addressed the issue of marine protected areas and fully protected marine protected areas. Each of the surveys demonstrated that U.S. citizens have a high level of concern about the environment and believe the environment is threatened and requires action and overwhelming support the creation of marine protected areas. One recent study based on a survey of Californians (SeaWeb 2002) found support for the California MLPA and for marine protected areas in the Sanctuary. **In particular, the study found that 71% of those surveyed support fully-protected areas in the Ocean and 76% support these areas within National Marine Sanctuaries. Even more striking was the fact that 83% of the people surveyed agreed with the statement "I am willing to give up personal access to certain places in the ocean just so there can be some places that are fully protected" (SeaWeb 2002).**

The U.S. population is certainly a high income and highly educated population and, as the results above predictably show, the U.S. and California population has high environmental concern and overwhelmingly supports the creation of marine protected areas. Characteristics of the people valuing the reserve would be constant (U.S. households) across different proposed marine reserve boundary alternatives. **It is fair to say that some level of benefit would accrue from non-use and passive-use values from each alternative, except the no action alternative.**

To differentiate among alternatives would require comparing some measurements that would serve as indicators of the relative quality, condition and uniqueness of the proposed reserves across alternatives. In addition potential direct benefits to user groups are correlated to the amount of each habitat type protected. The following summary compares each alternative based on the information compiled for 15 habitat types.