

# CALIFORNIA MARINE RECREATION



Catamaran at anchor, Coches Prietos anchorage

## Private Boating and Boater Activities in the Channel Islands: A spatial analysis and assessment

### FINAL REPORT

**Prepared for:**

The Resources Legacy Fund Foundation (RLFF)  
The National Marine Sanctuary Program (NMSP)

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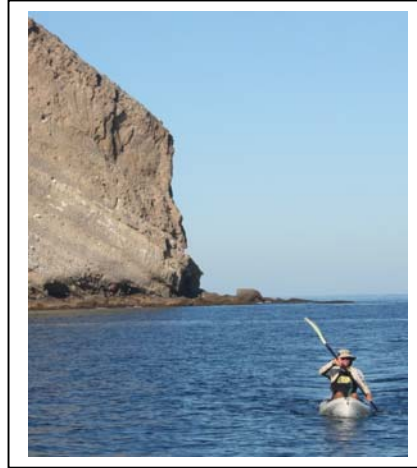
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## SUMMARY



Boater gazing at San Miguel Island

"Oh, the rare old Whale,  
mid storm and gale  
In his ocean home will be  
A giant in might, where might is right,  
And King of the boundless sea."  
-WHALE SONG



Kayaker at Santa Cruz Island

### S1. Boating in the Channel Islands

That the sea and islands stir the imagination and draw us to them is not a new idea. Whale songs and books by Herman Melville are but a few indications of how the sea and islands figure prominently not only in imagination, but in our economy, culture, and heritage. In recent times, such objects of our imagination have become the subjects of careful and impartial studies that inform our management and stewardship of them.

Channel Islands boaters are not a common breed: there are fewer than 5,500 slips available in Santa Barbara and Ventura Counties, compared to a population of about 1.2 million people in these counties. Moreover, not all slip-stored boat owners take their vessels to the Channel Islands. Yet, something motivates a relatively small proportion of the resident population (and a few visitors from outside these counties) to venture forth across 10-30 miles of open ocean and cross a major shipping lane to visit the Channel Islands, not to mention the cost of buying and maintaining a boat that is capable of safely crossing the Santa Barbara Channel. For slip-stored vessels, annual storage fees alone are in the range of \$3,400- \$7,500.

## S2. Introduction

This study contributes to our understanding of private boating and boaters in the Channel Islands. It informs managers and policy makers who must decide, over time, how to manage these islands- *these public resources*<sup>3</sup>, which lie less than 150 miles from the homes of more than 10 million people. A focus of this work is establishing baseline data on boaters, against which future impacts of no-take marine reserves can be measured (no-take reserves prohibit fishing and other *consumptive* activities). Moreover, data can be used to spatially define “hotspots” of human activity, including areas that are heavily used and valued.

Access to the waters of the Channel Islands is almost exclusively by private or charter boat. Since human actions are a key determinant of ecological change in the Channel Islands, decision makers need to understand the ins and outs of how boaters interact with these islands if they are to be effective stewards of *public* resources there. When private boaters visit the Channel Islands, they make decisions that affect managed resources- whether and where to fish, toss their anchor, or step ashore. Managers, consequently, benefit from knowing boater patterns of use and motivations. Managers also need to know how their management actions, e.g., establishing no-take marine reserves, affect boaters. Finally, boaters are potential partners in efforts to sustainably manage Channel Islands resources.

This study also enhances our understanding of what motivates people to recreate in the Channel Islands, how they value use of the marine environment there, and how people are affected by marine reserves. Are private boaters benefiting from marine reserves? Which people are affected by marine reserves, in what ways, and over what time periods and spatial areas? Specifically, what are the *net* benefits and what is the social significance over a network of marine reserves, in the short and long term? If marine protection contributes to rejuvenated populations of previously depleted marine organisms, will more divers, kayakers, boaters, and wildlife watchers be attracted to these areas? How will boaters who enjoy both consumptive and non-consumptive activities respond to no-take reserves? The baseline is the first important step in answering these questions now and in the future.

Eventually, we want to know if marine protection results in greater *net* economic value and social satisfaction. This baseline is needed so that comparisons can be made with data collected in the future, as a measure of marine protection performance. Furthermore, information on human use of the marine environment is needed to elucidate, anticipate, and in some cases mitigate the impact that humans have on marine environments (even through non-consumptive activities).

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<sup>3</sup> While all marine resources surrounding the Channel Islands are publicly owned, a portion of Santa Cruz Island is owned and managed by The Nature Conservancy. The remaining portion of Santa Cruz Island and all of San Miguel, Santa Rosa, Anacapa, and Santa Barbara Islands are publicly owned.

### **S3. Methods and Approach**

A baseline of scientifically rigorous information was developed on non-consumptive and consumptive forms of recreation. Using four integrated, peer-reviewed surveys, information was collected on where boaters go in the waters of the Channel Islands, what they do, how much time and money they spend, how much information they have on marine protected areas, and their attitudes and perceptions toward marine protection and management (for example, do they think marine reserves will work; do they support existing reserves). Information on trip-related expenditures in local economies and demographics was also collected.

Four surveys were conducted during 2006-2007 to collect information from boaters who take trips to the Channel Islands to go diving, kayaking, and view wildlife (or simply relax in natural settings): 1) A postcard survey of private boaters, 2) a Web-based anchorage choice survey, 3) An on-site intercept survey of boater activities at anchor, and 4) A knowledge, attitudes, and perceptions survey. While the focus is on non-consumptive uses, some information on consumptive activities, such as fishing and spearfishing, was also collected (we recognize that consumptive and non-consumptive activities are sometimes intertwined during a single trip to the coast or islands).

### **S4. Summary of Baseline Data**

We summarize baseline data by presenting key findings for each of four surveys conducted in 2006-2007.

#### **S4.1 Postcard Survey: gathering information on the boater population**

The postcard survey is a brief survey provided online and in mailback format. We used it to collect basic data on visitation to the Channel Islands, participation in consumptive and non-consumptive activities, and boater demographic characteristics. It was distributed to virtually all slip-stored boat owners in Santa Barbara and Ventura Counties. To survey owners of trailerable boats, we distributed postcard surveys at launch ramps during busy weekends and advertised the survey<sup>4</sup> in several boating publications: The Log and Sea Magazine. Below, we present key findings in two areas:

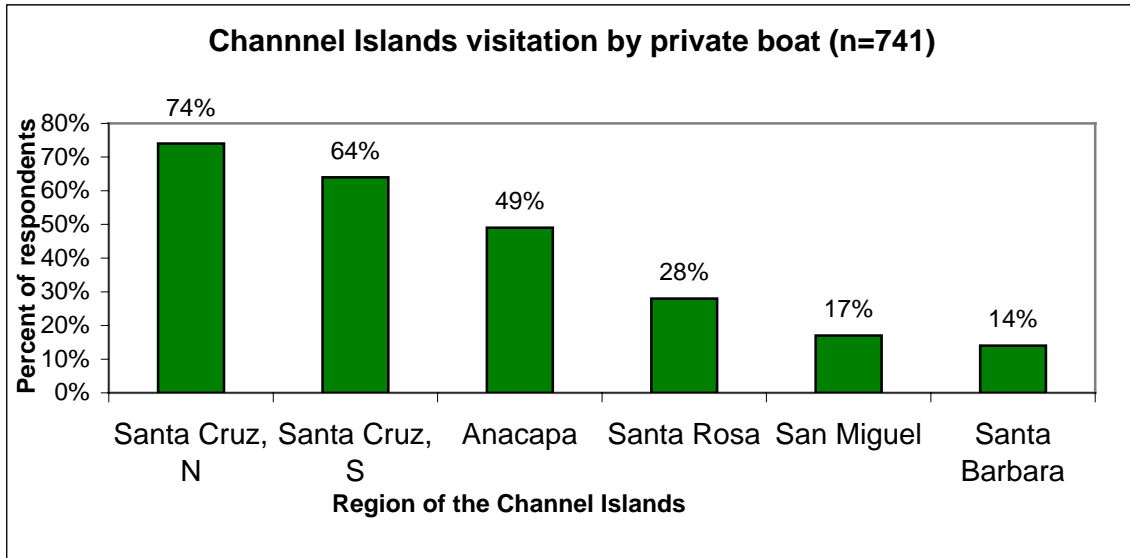
1. Visitation to regions of the Channel Islands (Figure 1)
2. Participation in consumptive and non-consumptive activities (Figure 2)

**Visitation to the Channel Islands:** About 85% of the 741 postcard survey respondents indicated that they used their boat to go to the Channel Islands at least once in the previous 12 months. Visitation is differentiated according to six regions where boaters can anchor. On average, respondents report visiting between two and three (2.46) regions in the past twelve months, with some boaters reporting that they visited all six regions.

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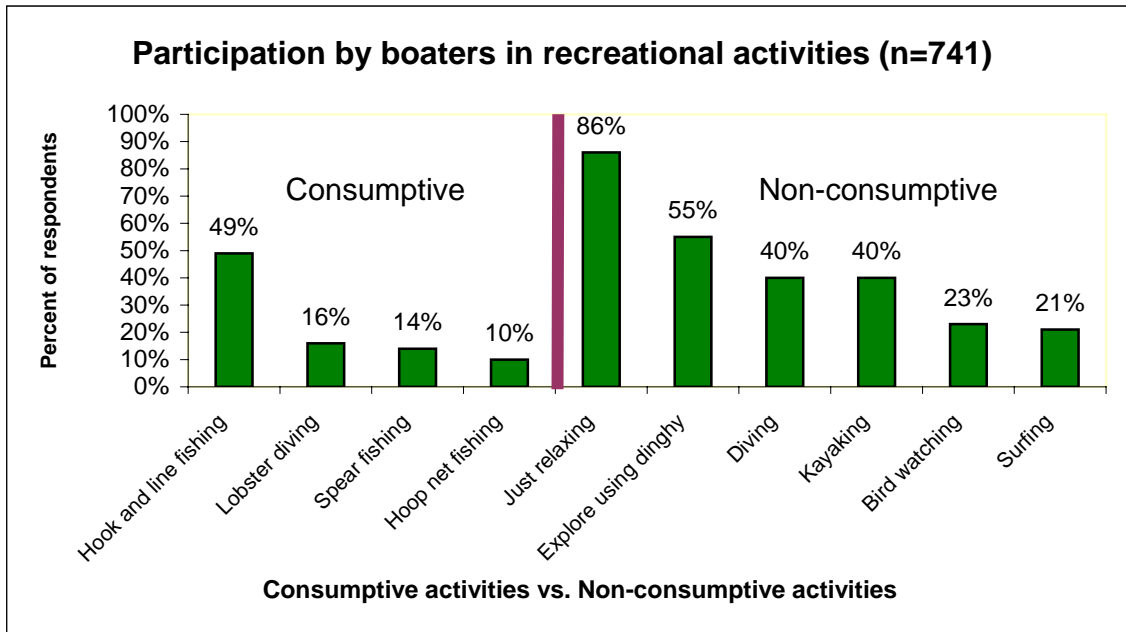
<sup>4</sup> The ad encouraged boaters to visit our survey website and take the online version of the postcard survey.

**Figure 1** Visitation data (below) were derived from responses to postcard survey question “Where do you like to go boating? Please check any place you have anchored in the past 12 months



**Participation in recreational activities:** the average number of activities reported per postcard survey respondent is 2.6 (out of ten possible). The max is nine activities; zero is the minimum reported. See Figure below for data on participation rates.

**Figure 2** Activity participation rates derived from postcard survey data, broken down by consumptive and non-consumptive categories. From survey question “Which of these activities do you do on your boat” (mark all that apply- 10 possible)?



**S4.2 Web Survey: boaters who use their vessels to visit the Channel Islands**

Boaters who indicated in the postcard survey that they used their boat to visit the Channel Islands in the past 12 months were recruited to the web survey. This survey collected detailed information on anchorage visitation and trip-related expenditures. Below, we present key findings in two areas:

1. Visitation to overnight anchorages (Table 1, Figure 3)
2. Trip-related expenditures (Figure 4)

Data were collected for a set of 52 anchorages. Table 1 below presents the top ten anchorages, in terms of percent of respondents who visited an anchorage at least once. This measure indicates that the five most-often-visited anchorages are distributed throughout the east region, each of which was visited by 30% or more of web survey boaters. This finding is consistent with what we know is a pronounced east-west pattern (private boat visits are concentrated in the east portion of the Channel Islands); moreover, there is further spatial concentration of private boater visitation within the east portion, e.g., Smuggler’s. In contrast, the top five anchorages in the west portion were each visited by less than 15% of web survey respondents.

**Table 1: Visitation to Selected Anchorages**

**Nights and Days Spent at Anchorage between Memorial Day (May 26) and Labor Day (September 4) 2007 (n=215)**

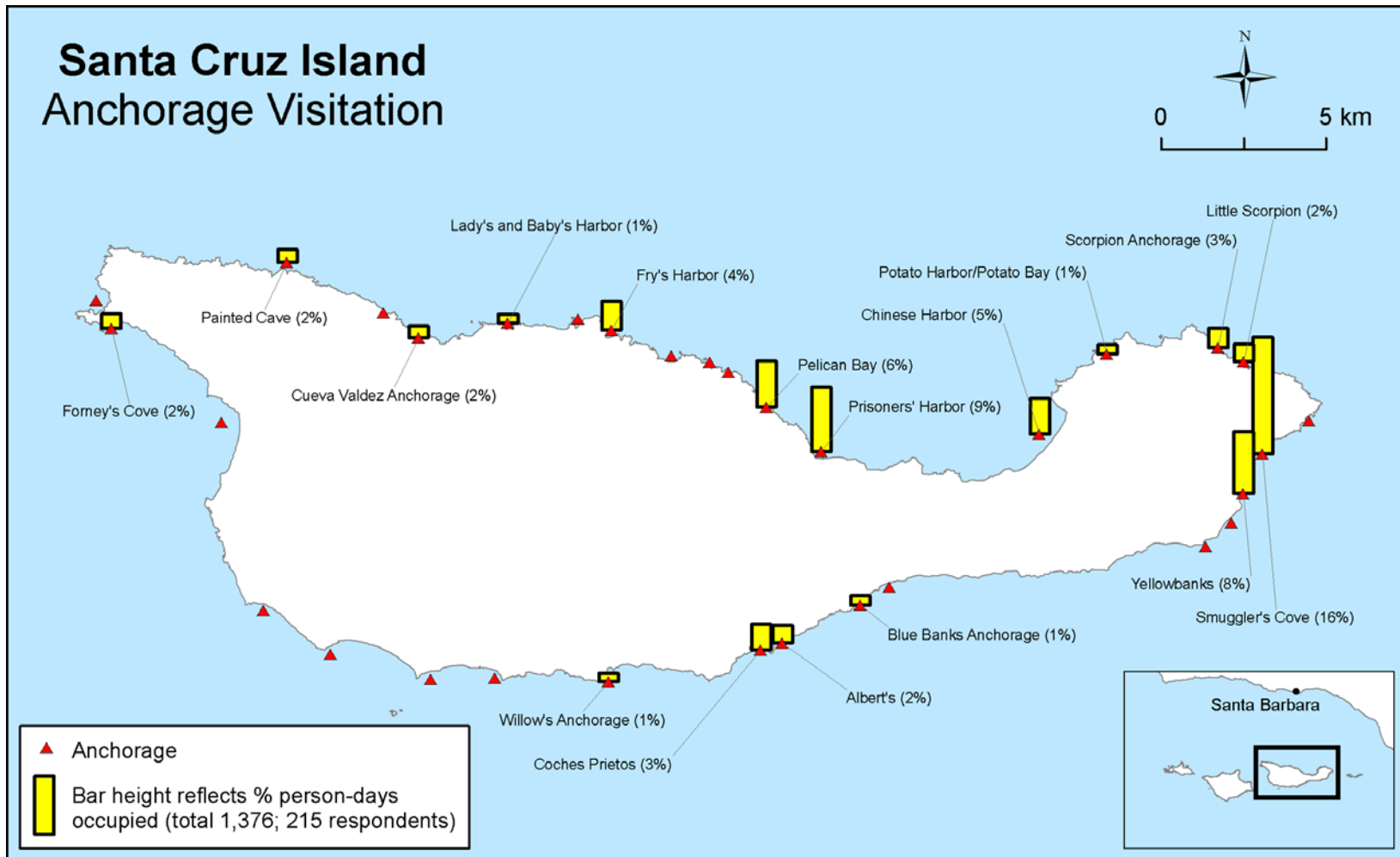
<b>Top Ten Anchorages (all areas of Channel Islands)<sup>5</sup></b>	<b>Percent of respondents (spent one+ night or day)</b>
1. Smuggler's, (Santa Cruz Is., S.)	53.2%
2. Prisoner’s, (Santa Cruz Is., N.)	41.2%
3. Yellowbanks (Santa Cruz Is., S.)	37.5%
4. Pelican's, (Santa Cruz Is., N.)	36.1%
5. Frenchy’s, (Anacapa Is.)	30.6%
6. Coches Prietos, (Santa Cruz Is., S.)	24.5%
7. Little Scorpion, (Santa Cruz Is., N.)	23.6%
8. Fry’s, (Santa Cruz Is., N.)	22.7%
9. Scorpion, (Santa Cruz Is., N.)	21.8%
10. Albert’s, (Santa Cruz Is., S.)	21.3%
<b>Top Five Anchorages (West Portion only)<sup>6</sup></b>	
1. Becher's Bay (NW), (Santa Rosa Is.)	13.4%
2. Main Anchorage, (Santa Barbara Is.)	12.1%
3. Cuyler Harbor, (San Miguel Is.)	11.6%
4. Becher's Bay (SE), (Santa Rosa Is.)	10.6%
5. Johnson’s Lee, (Santa Rosa Is.)	9.3%

<sup>5</sup> Including San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands only.

<sup>6</sup> Including San Miguel, Santa Rosa, and Santa Barbara Islands only.

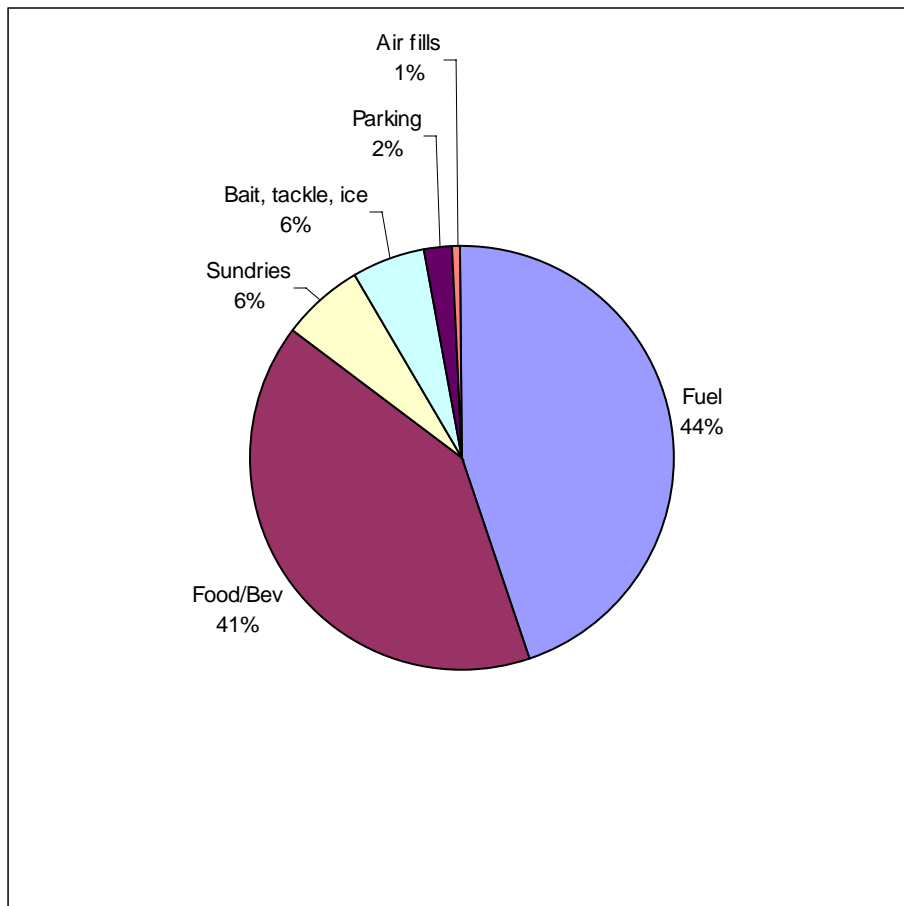


**Figure 3** Relative visitation rates, Santa Cruz Island, derived from web survey data. This figure summarizes data from survey questions that ask boaters how many days and nights they spent at CINMS anchorages between Memorial Day and Labor Day, 2007.



**Trip-related expenditures:** these data are required to estimate the direct financial impact<sup>7</sup> from private boat trips to the Channel Islands, the multiplier effects from these financial expenditures, and, ultimately, the economic value<sup>8</sup> of trips by boaters. Below is a cost breakdown for all boaters; in the main body of the report, we also compare the expenditure patterns of boaters who participate in consumptive activities to purely non-consumptive boaters. While consumptive boaters spend more in total on trips, non-consumptive boaters spend more on food/beverage and sundry categories, which are known to have greater multiplier effects. The difference between these two groups, furthermore, is mainly due to the higher fuel expenditures of consumptive boaters, which has implications for the carbon footprint of boaters. See Section 4.2 for details.

**Figure 4** Breakdown of mean trip-related expenditures for all web survey boaters (n=217). Mean total expenditure per private boat trip: \$254. See main body of report for breakdown of trip-related expenditures by consumptive and non-consumptive boaters.



<sup>7</sup> Financial impacts include increased gross sales revenues spurred by boater purchases

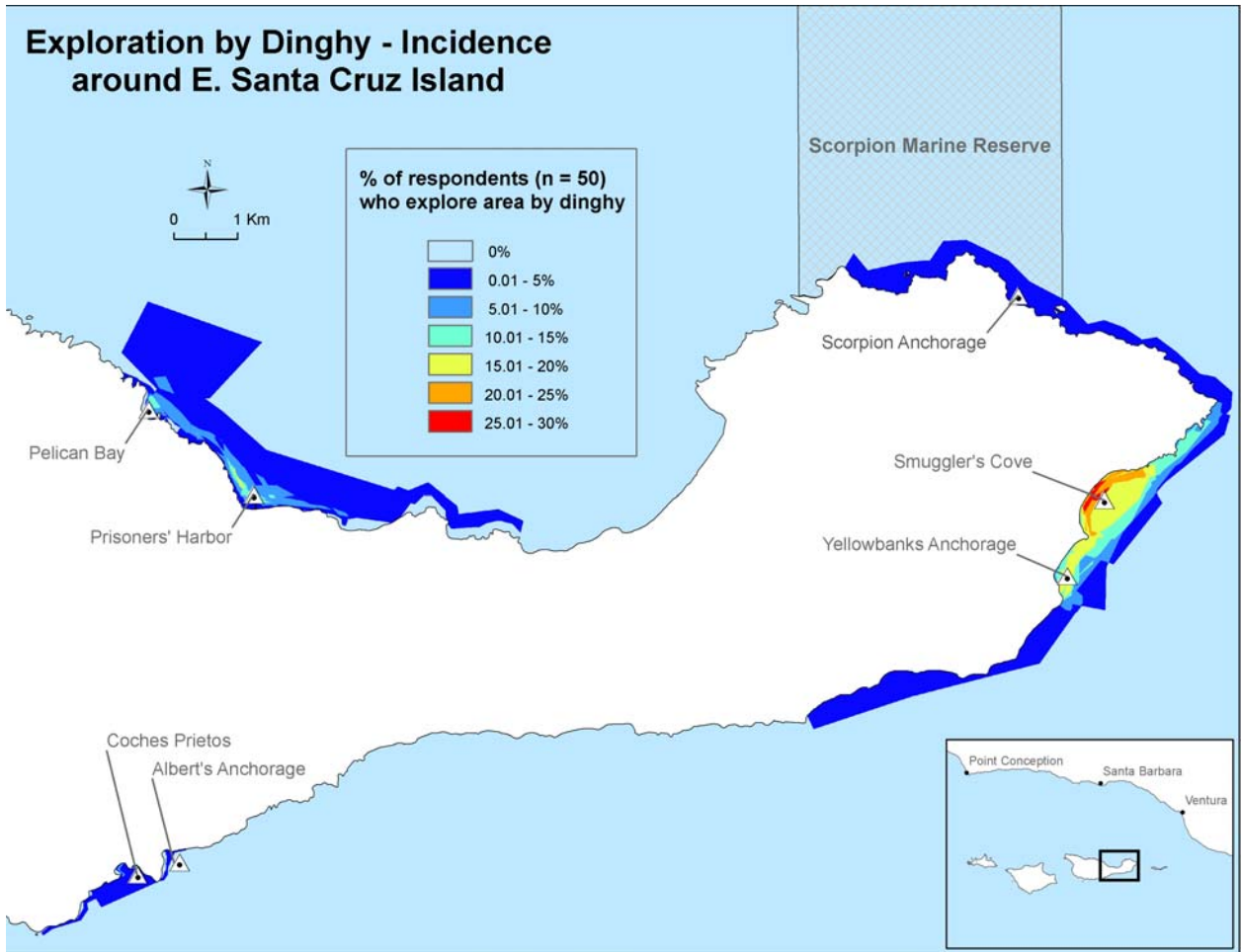
<sup>8</sup> Economic value corresponds to the total willingness to pay for a trip minus the cost of taking that trip. To estimate these values, we plan to estimate a type of discrete choice model called a random utility model (RUM). Part of the RUM requires estimating a trip demand curve.

### S4.3 Intercept Survey: collecting fine-scale activity data

To better understand the spatial distribution of recreational activities at specific anchorages, we conducted in-person interviews on site, using an interactive GIS-based survey tool. This survey was conducted from a research vessel anchored at a pre-determined set of private boat anchorages in the Channel Islands. During 2006 and again in 2007, we focused our survey effort over the period May-October, to correspond with the highest historical rate of visitation to the Channel Islands by recreational vessels.

To illustrate our findings, we present below a map of the incidence of the most popular non-consumptive activity- exploration by dinghy- in a heavily used portion of the Channel Islands- east Santa Cruz Island. Data are available for all consumptive and non-consumptive activities we studied, and can be used to create similar maps.

**Figure 5** Incidence of the non-consumptive activity “exploration by dinghy” at east Santa Cruz Island.



#### S4.4 Knowledge, Attitudes, and Perceptions Survey

Working with Christy Loper of NOAA’s National Ocean Service and the University of Delaware, we conducted a survey designed to help policymakers and managers understand more about (i) the level of knowledge boaters have about MPA and related rules, regulations, and locations, (ii) attitudes and perceptions of marine protection, the need for protection, and the efficacy of MPAs in relation to their goals. The survey is self-administered as a paper survey in connection with the on-site intercept survey described above.

**Knowledge, attitudes, and perceptions (KAP):** We acquired 192 survey responses from private boat captains and their passengers, whom we intercepted at popular overnight anchorages at Santa Cruz Island. This survey was conducted in tandem with the intercept survey of boater activities from the CINMS research vessel *Shearwater*. All data were collected during weekends beginning in May 2006 and terminating on Labor Day, 2007. In accordance with study protocol, the KAP survey was offered to all boat captains and accompanying passengers that boarded the research vessel with the intention of taking the intercept survey.

While a variety of information about knowledge, attitudes, and perceptions were collected, we present KAP data relevant to two key topics: (i) attitudes toward no-take marine reserves- support and opposition to reserves (Table 2), and (ii) the most highly ranked factors that were important to boaters in their choice of the Channels Islands as a destination (Figure 6).

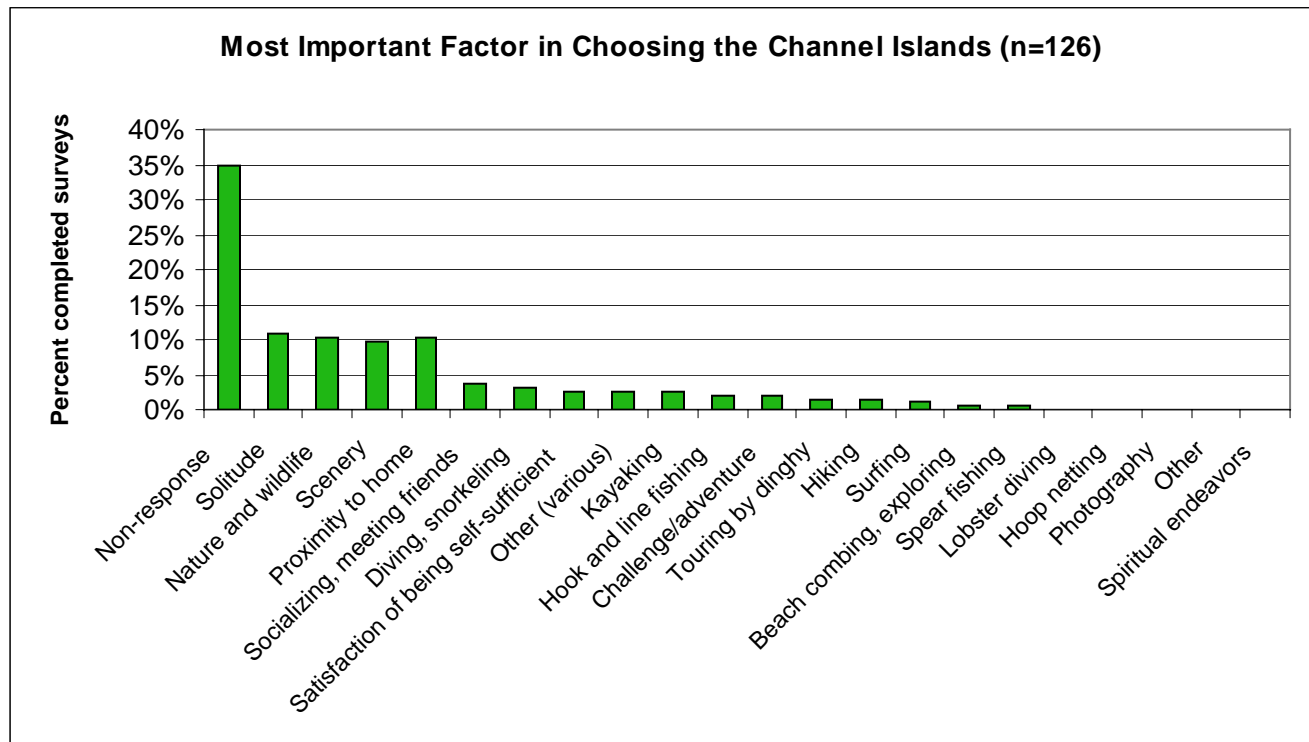
**Table 2**

**Support and Opposition to No-take Marine Reserves:  
Percent of responses from intercepted private boaters (n=192)**

	Support/opposition scale						
	Strongly support	Support	Neutral	Oppose	Strongly oppose	Don't know	Non-response
Support reserves generally	39%	32%	15%	6%	3%	3%	3%
Support reserves in present locations: Anacapa, SC Is.	37%	31%	26%	7%	3%	7%	3%
Support reserves in present locations: Santa Rosa, San Miguel, Santa Barbara	35%	28%	19%	6%	3%	7%	4%
Support additional reserves: Anacapa, SC Is.	30%	22%	26%	16%	10%	8%	4%
Support additional reserves: Santa Rosa, San Miguel, Santa Barbara	30%	21%	19%	11%	8%	7%	4%

**Factors in choosing the Channel Islands as a destination:** First, boaters were asked to (i) identify factors that were important in choosing the Channel Islands as a destination, and (ii) rank the top three factors in two separate categories: (a) environmental factors, e.g., nature and wildlife, solitude, and proximity to home, and (b) activity factors, e.g., diving and fishing. Finally, boaters were asked to identify the single factor that was most important (Figure below). Thirty-five percent of respondents chose not to answer this question (even though they answered the previously described portion of the question). Findings in the figure below are derived from survey question “Finally, out of all the factors that you checked above, which would you say is most important when choosing the Channel Islands as a destination?” Of those that responded, a strong majority chose an environmental factor, as compared to activity factors. That more than one-third did not respond illustrates the apparent reluctance of respondents to select a single factor among multiple factors identified as important by respondents in the first part of the question.

**Figure 6** Results of identifying and then ranking factors that are important to boaters in the choice of the Channel Islands as a destination.



## **S5. Implications for Policy and Management**

Following is a brief summary of much more detailed discussion of these subjects that appears in Section 5. of this report.

Survey data can be used to inform policy and management in a number of ways. First, we are able to create the first baseline ever of boating and boaters in the Channel Islands:

1. Who visits the CINMS and where they go
2. Suite and spatial distribution of activities undertaken
3. How boaters contribute to local economies through trip-related expenditures
4. How their spatial use depends on the activities they undertake and their personal characteristics
5. The relative importance to boaters of various factors in their choice of the Channel Islands as a destination

Data in these categories can be measured against the future impacts of marine reserves as a measure of the performance of no-take marine reserves in the CINMS.

Second, the baseline gives us a starting point against which we can measure how changes in the environment and the CINMS management affect boaters. By combining ecological, management, weather, and boater data with activity data we can learn more about the determinants of activity choice, how the choice of activities affects the economic value of boating, and how management (especially the creation of marine reserves) affects these values.

### **S5.1 Using Survey Data to Inform CINMS Management and Policy**

Survey data can be used to inform management in a number of ways. First, we are able to create the first baseline ever of the suite and spatial distribution of activities undertaken by boaters in the CINMS, against which we can measure the future impacts of marine reserves. Second, we draw policy implications using the baseline data set (see below). In particular, use of baseline data allow for greater understanding of the relative importance of and motivations for consumptive and non-consumptive activities, which are combined by the majority of boaters during trips to the Channel Islands. Baseline data, furthermore, enhance our ability to study and monitor spatial and/or activity substitution. Finally, by combining ecological, management, weather, and boater data with activity data within a model of boater site choice, we can (in future analyses) learn more about the determinants of activity choice, how the choice of activities affects the economic value of boating, and how management (especially the creation of marine reserves) affects these values.

#### **Implications for CINMS management and policy:**

1. Activities and anchorage choices of about half (47%) of the boaters who participated in our study are unfettered by reserves. Almost half of the boaters who participated in our surveys do not engage in consumptive activities and, therefore, are not negatively affected (directly) by no-take marine reserves that prohibit take of biotic and abiotic resources.

2. A slight majority of boaters (51%) enjoy at least one consumptive activity, in combination with non-consumptive activities, that varies in degree of importance across a broad spectrum (low to high importance in determining anchorage choice). The resulting heterogeneity indicates that these boaters will be unevenly affected by no-take marine reserves. Most affected are about one-third of this group (16% of all boaters) for whom consumptive activities are their most important activities. Remaining boaters in this category, however, may also be affected, even if their observed anchorage choice does not change. They lose the opportunity to participate in a consumptive activity that they enjoy, but that is not in itself enough of a loss to induce them to modify their selection of anchorages (non-market value decline).
3. Boaters overwhelming cite environmental factors and non-consumptive activities as key in their choice to go to the Channel Islands. Even though the majority of boaters participate in one or more consumptive activities (predominantly hook and line fishing), study findings indicate that these activities are not often among primary factors in boater's decision to visit the Channel Islands (again, consumptive activities are highly important to about 16% of web survey boaters). Data indicate that factors related to environment, e.g., nature and wildlife, solitude, and proximity to home, are most important. Even when boaters rank activities alone, non-consumptive forms of recreation consistently rank the highest. For CINMS management and policy, this means that the well-being of CINMS private boaters is directly dependent on maintaining ecological structure and function of habitats in places where boaters visit with the greatest frequency.
4. Baseline data on spatial use patterns indicate that private boating and boater activities are concentrated in several areas in the eastern portion of the CINMS. For management, this means that the direct affects by boaters to the marine environment occur in spatially concentrated areas we define as "hotspots" of activity, e.g., Smugglers, Prisoner's, and proximity to such anchorages (within a distance of ~2 nautical miles). Likewise, the stationary marine and island resources that boaters interact with and derive benefits from are also a small minority of total CINMS resources. Focusing monitoring and management resources and attention on these places (i.e., "hotspots") will help ensure that a) the benefits that flow from them to boaters are maintained, and b) boaters will continue to select the CINMS and these places in the CINMS for their trips and activities. This has the benefit of maintaining current patterns of use, values, and associated contribution to local economies. Furthermore, it may reduce the likelihood that boaters choose other, relatively undisturbed areas, at an increasing rate. The undesirable alternative is that environmental degradation of current "hotspots", perhaps in combination with increases in boater visitation, results in serial degradation by migrating human pressures.
5. The majority of boaters intercepted and surveyed from anchorages on Santa Cruz Island support no-take marine reserves. That fewer than 10% of these boaters

oppose reserves, suggests that most boaters will be receptive to information about reserves, including the potential benefits of reserves for them, e.g., resilient ecological structure and function, increased abundance and diversity of marine species, and spill-over of adults targeted by hook and line fisherman from reserves to areas where they can be legally caught.

6. Correcting common misperceptions about commercial and recreational fishing regulations may change the way the CINMS is perceived and thus boater decisions about how often to visit the Channel Islands and where to anchor. About 65% of participating boaters do not understand with certainty that commercial fishing is allowed in the CINMS. Perceptions may change if these boaters were to correctly understand that commercial fishing is allowed. About 25% of participating boaters are unsure or have an incorrect understanding about recreational fishing inside reserves. Conceivably, some boaters are deterred from enjoying consumptive activities in areas where fishing is permitted. Other boaters are likely to fish and collect sea life illegally inside reserves. A better-informed boater population holds out the prospect for three benefits: (i) reduced burden on enforcement resources, resulting in lower enforcement costs (ii) reduced incidence of consumptive activities in no-take marine reserves, enhancing the likelihood that reserve benefits will be realized and sustained, and (iii) increased fishing and consumptive activities where permitted and thus improve the economic value of recreational fishing within the CINMS (something that would benefit private anglers and also anglers that visit the CINMS on party and charter boats and the captains and owners of these boats).
7. Channel Islands trip-related expenditures by private boaters contribute to the local economy. Moreover, a significant portion of these expenditures goes to food, beverages, and sundries, which result in multiplier effects. These data can be used to quantify the local economic benefits and show how maintaining environmental quality in the CINMS contributes to the maintenance of these flows. Thus, it can be shown that effective CINMS management contributes directly to local economic health.



## S6. The Interaction Between Science and Society

In addition to informing management, study findings can be used by private boaters to represent their interests. Not only are private boaters *de facto* stewards of the Channel Islands, by way of the decisions they make, e.g. where to anchor and which activities to engage. They are given a voice as stakeholders, e.g., the Sanctuary Advisory Council and management planning processes. As a group that presumably stands to benefit from sustainable management of the Channel Islands, they can use these data as a basis for further informing management actions.

This research has offered opportunities to enhance the connection private boaters have with marine environments in the Channel Islands- in a non-partisan setting. For example, one of our surveys in the Channel Islands is conducted from a research vessel *Shearwater*. A corps of Marine Sanctuary volunteers<sup>9</sup> was trained to administer this survey to boaters. After administering the survey, volunteers offer information about the Sanctuary and National Park. Since most of the volunteers are boaters themselves, conversations are between members of the same boating community, about things boaters might care about, such as how to avoid anchoring in sensitive eel grass beds or finding an uncongested anchorage during a holiday weekend. These types of interactions lend themselves to programs that could be explicitly designed to foster the type of social learning that can contribute to the preservation of ecological function and similar objectives of Channel Islands managers.



Power boat with recreational fisher and kayak, Willows anchorage, Santa Cruz Island

*"Call me Ishmael. Some year ago- never mind how long precisely- having little or no money in my purse, and nothing particular to interest me on shore, I though I would sail about a little and see the watery part of the world. It is a way I have of driving off the spleen and regulating the circulation. Whenever I find myself growing grim about the mouth; whenever it is a damp, drizzly November in my soul; whenever I find myself involuntarily pausing before coffin warehouses, and bringing up the rear of every funeral I meet; and especially whenever my hypos get such an upper hand of me, that it requires a strong moral principal to prevent me from deliberately stepping into the street, and methodically knocking people's hats off- then, I account it high time to get to sea as soon as I can".*

First paragraph from Chapter 1 "Loomings"  
*MOBY DICK*, by HERMAN MELVILLE

<sup>9</sup> The Naturalist Corps, a volunteer program supported by the Channel Islands National Marine Sanctuary Program.

## 2. Introduction

### 2.1 The Study

A baseline of scientifically rigorous information was developed on non-consumptive and consumptive forms of recreation enjoyed by private boaters in the Channel Islands<sup>10</sup> of southern California. Boating is the principal way in which people may independently access the waters of the Channel Islands Marine Sanctuary (CINMS). Using four integrated, per-reviewed surveys, information was collected on where boaters go, what they do, how much time and money they spend, what they know about marine protected areas, and their attitudes and perceptions toward marine protection and management (for example, do they think marine reserves will work; do they support existing reserves). Information on expenditures in local economies and boater demographics also was collected.

These baseline data enhance our understanding of what motivates people to recreate in the Channel Islands, how they value use of the marine environment there, and how they respond to marine reserves. The survey data enhance our understanding of how marine protection, especially the creation of marine reserves, affect private boating, boaters, and the activities boaters enjoy, including diving, kayaking, whale watching, hook and line fishing, and spearfishing. Do private boaters benefit from marine reserves? Which boaters are affected by marine reserves, in what ways, and over what time periods and spatial areas? Specifically, what are the *net* economic benefits and what is the social significance of a network of marine reserves, in the short and long term? If marine protection contributes to rejuvenated populations of previously depleted marine organisms, will more divers, kayakers, boaters, and wildlife watchers be attracted to these areas? How will boaters who enjoy both consumptive and non-consumptive activities respond to no-take marine reserves? This baseline of data on boater activity is the first important step in answering these questions now and in the future.

Ultimately, we want to know how marine protection affects *net* economic value and social satisfaction and whether management strategies can be developed to further improve value and satisfaction. This baseline is needed so that we have a starting point against which future data can be compared to help understand the effect of marine protection on private users - one measure of marine protection performance. The data we collect also will help us better understand the attributes of the sanctuary that are most important to boaters and the areas and resources that are used most heavily by boaters. As a result, these data will help elucidate, anticipate, and in some cases mitigate the impact that humans have on marine environments (even through non-consumptive activities).

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<sup>10</sup> The study areas encompass the Channel Islands National Marine Sanctuary (CINMS). Non-consumptive recreation includes activities that do not involve the take of a biotic or abiotic resources. Examples include kayaking, diving, and exploring the islands using a dinghy. Consumptive recreation involves the take of resources such as fish and invertebrates. Examples include hook and line fishing, spearfishing, and hoop netting.

## 2.2 Background

Since 1981, several public agencies<sup>11</sup> have monitored the condition of marine resources in the Channel Islands. Depletion of a number of species, such as abalone, spiny lobsters, California sheephead, rockfish, and red sea urchins, has been documented- largely in relation to human activities (Davis, 2005). In 1998, the Channel Islands National Park and a group of recreational anglers (Channel Islands Marine Resources Restoration Committee) asked the California Department of Fish and Game (DFG) to create a network of “no-take” marine reserves. At that time, marine reserves were perceived as a relatively new tool and approach to marine management and stewardship, at least in the Channel Islands. In April 2003, a network of no-take marine reserves was established in the Channel Islands under a state and federal partnership. These reserves prevent the take of marine life in about 19% of state waters surrounding the Channel Islands (fishing is still allowed, yet regulated, outside reserves).

Similar scenarios of marine protection are occurring elsewhere in California. More recently, the Monterey Bay National Marine Sanctuary (MBNMS) started a marine reserve process in federal waters. The DFG has stated its intention to establish a statewide network of marine reserves in state waters, under the Marine Life Protection Act (MLPA). In April 2007, the California Fish and Game Commission gave final approval to the largest network of marine protected areas in the continental United States, located in the Central Coast of California, including the Monterey Bay area.

While the specific objectives of these processes differ, all of them have or will almost certainly make commitments to evaluating the performance of marine protection and spatial regulation as tools for sustainable management and effective stewardship of marine resources. In addition to biological objectives, managers, policymakers, and the public want to know how marine protected areas affect human well-being. Will they help to rehabilitate depleted marine fauna and habitat and maintain healthy environments that contribute to human wants and needs?

## 2.3 The Human Dimension of Marine Management

Natural and anthropogenic forces drive ecological and biological processes. These processes, in combination with direct human consumption, determine fluctuations in populations of fish and other marine life. Only the human element, however, is under the control or influence of policy makers and managers. Thus, achieving the biological and ecological goals of marine protected areas (MPAs) requires management of human activities. Marine resource policymakers and managers, consequently, seek to better manage the way humans interact with marine environments. People also benefit from better management of marine resources. An important motivation for curtailing certain destructive human activities is the idea that doing so will benefit society. There is an

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<sup>11</sup> These agencies include the National Park Service (NPS), California Department of Fish and Game (DFG), and the Channel Islands National Marine Sanctuary (CINMS).

implicit hope in marine management that the social benefits of protection, assumed to be provided by MPAs, will ultimately outweigh the costs<sup>12</sup>.

Human interactions with the marine environment contribute directly and indirectly to livelihoods, recreation, our natural heritage, economy, sense of community, and way of life. MPAs represent a tool that policymakers and managers use to protect marine habitat and biodiversity, fisheries, endangered species, recreational and research opportunities, and cultural resources. This tool is only partially tested and often controversial, in part, because it can restrict, constrain, and/or influence the way humans interact with marine environments.

Often the economic costs of marine protection are clear – monitoring and management can be expensive, commercial fisherman may be displaced from traditional fishing grounds; recreational anglers may lose access to coastal fishing areas. Unlike the costs, the benefits of marine protection have proven easier to articulate than to measure. As a result, the socioeconomic analysis and often the public debate over the economic impacts of marine protection often are biased towards minimizing affects on consumptive users instead of looking for ways of improving the overall net benefit of marine protection to all users.

#### **2.4 The Need for Baseline Data**

Policymakers and managers need good information on human use to fully assess the social and economic impacts of new policies, such as area closures (e.g. marine reserves) that often are associated with MPAs. For example, the network of MPAs established about five years ago in the Channel Islands affects recreational fishing and spear fishing by closing areas to these consumptive recreational activities. Non-consumptive uses, such as kayakers, whale watchers, and SCUBA divers, may enjoy greater benefits from area closures. Furthermore, some consumptive commercial and recreational users could benefit over the long-run if the so-called spill over effects of MPAs contribute (Halpern *et al.*, 2004) to enhanced and sustainable catch of targeted species of fish and invertebrates.

The survey data and analysis described below provide the first information capable of supporting the socioeconomic assessment of the impact of management activities in the Channel Islands National Marine Sanctuary. The data were collected at a spatial scale fine enough to permit the examination of spatial management activities relevant to sanctuary management decisions.

Perhaps of equal value is what was learned from the process of developing effective methods for collecting spatial data from recreational users. In many cases, the resources that boaters hope to visit during their trips to the Channel Islands are spatially distinct. A cave, a kelp bed, a surfbreak, or an underwater rock all could be specific destinations. Knowing the detailed spatial use of boaters is important to managers. Even moving a reserve boundary a short distance in any direction could significantly affect the welfare of

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<sup>12</sup> We assume that addressing social costs and benefits of MPAs is a necessary condition for effective, long-term management of human-marine environment interactions.

boaters. Similarly, it is important to know how and where boater activity is likely to put pressure on marine resources. For instance, the location of some ecologically sensitive eelgrass beds coincides with several popular overnight anchorages in the Channel Islands.

## **2.5 Policy and Management Context**

Our research addresses a critical gap in information needed to inform the adaptive management of MPAs: the spatial use, economic importance, and knowledge, attitudes and perceptions of private boaters<sup>13</sup> and the ways in which they are affected by marine protection. Private boaters in the Channel Islands engage in both consumptive (e.g., fishing, spear fishing) and non-consumptive activities (e.g., kayaking, diving) from their boats. While data are collected by DFG on commercial and recreational fishing within the Sanctuary, there has been no systematic attempt to collect data on private non-consumptive uses within the Sanctuary. The focus of our current work is specifically on non-consumptive recreation, which we define as any recreational activity that does not involve removing or killing marine resources (e.g. scuba diving, snorkeling, whale watching, bird watching, viewing other wildlife, viewing/ photographing scenery, kayaking, and boating).

Filling the gap in data on private non-consumptive uses in the CINMS was formally recommended by a NOAA-sponsored public stakeholder process (NOAA 2003, p. 46). Developing a credible baseline of recreational use data also has been identified as a ‘high priority’ by the Baseline Science-Management Panel, an ad hoc group of scientists expert in marine protected areas assessment, convened by the MLPA initiative in June 2006 (MLPA initiative, 2006). The importance of developing and applying socioeconomics to support a functional policymaking structure capable of effectively designing MPAs across geographic and political boundaries also was identified at the national level by the Marine Protected Areas Center (Wahle *et al.*, 2003).

Policymakers and legislators increasingly view marine protected areas as a fundamental cornerstone of California’s and the Nation’s strategies for improved ocean stewardship. MPAs are being developed in California under the auspices of the National Marine Sanctuary Act and the Marine Life Protection Act (MLPA):

1. In 2003, a network of marine reserves was established in State waters (0-3 nm offshore) within the Channel Islands National Marine Sanctuary (CINMS), under a state/federal partnership. In 2006, the CINMS proposed extending these marine reserves into Federal waters (3nm – 6nm offshore). A five-year assessment is planned for CINMS marine reserves, to be presented and discussed at a symposium planned for spring 2008.
2. A network of marine reserves and protected areas is under consideration in the Monterey Bay National Marine Sanctuary (MBNMS). A multi-stakeholder processes is underway to evaluate marine protected areas via a working group of the MBNMS.

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<sup>13</sup> We also collect limited data on private consumptive uses that are often undertaken in combination with the non-consumptive activities, e.g., hook-and-line fishing and spear fishing.

3. More recently, The California Department of Fish and Game (DFG) created a new, wide-ranging network of marine protected areas in the Central Coast Region of the state; similar designations will follow, statewide. Currently, the second in a sequence of four regional, multi-stakeholder processes are underway to evaluate marine protected areas under the MLPA.

A key policy and management feature of marine protected areas is the corresponding commitments by implementing agencies to ‘adaptively’ manage MPAs over the long term (more than 5 years). For example, the state and federal partnership that established marine reserves in the Channel Islands National Marine Sanctuary is committed to monitoring biological and socioeconomic changes occurring inside and outside the reserves and cooperatively and adaptively managing them<sup>14</sup>. After no-take marine reserves were approved within the Channel Islands National Marine Sanctuary waters in 2003, the CINMS and DFG laid the groundwork for monitoring socioeconomic conditions that may be affected by Sanctuary policies. With the help of partners, the Sanctuary is developing a social science program that will ultimately construct a more complete picture of human-sanctuary interactions and support an MPA adaptive management process.

The MLPA, moreover, requires adaptive management to ensure that a system of marine protected areas meets stated goals [Section 2853 (c) (3)]<sup>15</sup>. Adaptive management requires learning from current experience to improve the process of achieving the goals of the MLPA over time. As required by law (MLPA), the DFG must develop a baseline of data on socioeconomic activities within the marine protected areas against which it must assess the impacts of MPAs. In particular, information on non-consumptive use is needed to address the explicit MLPA goal of protecting and enhancing recreational uses of marine resources.

Finally, the Marine Life Management Act (MLMA) explicitly recognizes that non-consumptive values such as aesthetic, educational and recreation values are equally important in comparison to consumptive activities [7050(b)2]. It also calls for adaptive management based on best available science to ensure that managers can respond to changing environmental and socioeconomic conditions [7056(1)].

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<sup>14</sup> Section 309 of the National Marine Sanctuary Act stipulates that Sanctuaries “... conduct, support, or coordinate research, monitoring, evaluation, and education programs ...”

<sup>15</sup> The MLPA defines adaptive management as “a management policy that seeks to improve management of biological resources, particularly in area of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that, even if they fail, they will provide useful information for future actions, and monitoring and evaluation shall be emphasized so that the interaction of different elements with marine systems may be better understood” [Section 2852 (a)].

## 2.6 The Market and Non-Market Economics of Recreational Use<sup>16</sup>

The direct contribution that recreational users make to local economies is intuitive: boaters buy fuel and marine supplies, divers buy equipment and pay to have their tanks filled, whale watchers purchase tickets on charter vessels. Marine sanctuary and coastal visitors often purchase hotel rooms and meals, for example. Data on these expenditures can be used to estimate the **direct market impact to coastal economies** of recreational use of the marine environment. Baseline data on visitor expenditures collected for this study can be used to estimate the market impacts (including economic output, local jobs and wages supported by visitors), by area and mode of recreational use.

It is important to note here, though, that from an economic perspective, the real value of any good or resource is how much it contributes to society beyond what it costs society to provide this good. This economic value consists of two parts: the value enjoyed by producers beyond their costs (a notion very similar to profits) and the value to users beyond what they pay (something economists call consumer surplus).

The benefit to local firms of marine recreational use is typically estimated as some fraction of expenditures or revenues. Much more difficult to estimate, however, is the value of recreational uses from the perspective of people who undertake these activities—the **private economic value** of enjoying access to these resources. For marine and coastal environments, this value is embedded in the value that coastal users place on access to and enjoyment of marine areas beyond what they pay to use these areas. Recreational users spend their time and money to undertake these activities. With knowledge of spatial use and frequency of trips, information about the attributes of sites, and demographic data, we can use economic environmental valuation methods to estimate, in monetary terms, the value of recreational use beyond what people spend. This value is known in the literature as consumer surplus, non-market value or simply the net economic benefit of recreation.

The non-market aspects of trips to undertake recreational activities are potentially large and may be affected significantly by marine management. For example, consider a group of avid boaters and divers who have already sunk considerable time and money into buying and caring for a vessel (boaters) and buying all necessary SCUBA diving equipment after completing a lengthy dive certification course (divers). The next time these recreational users go out to enjoy boating/diving, only minimal expenses will be incurred, especially relative to abovementioned expenditures of time and money. Yet, the value of the marine environment enjoyed by each may, from their perspective, be quite large: the diver that never forgets a first underwater encounter with seals or a giant sea bass. The boater that considers a sunset viewed amid the natural beauty of a quiet anchorage as ‘priceless’. The cost of these trips may be quite low in financial terms, even though the economic benefit of such trips may be large. Further, changes in the marine environment could significantly affect the magnitude of value enjoyed.

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<sup>16</sup> While some prominent aspects of recreational use are covered, this section does not represent a comprehensive treatment of the economics of recreation use in the marine environment.

An even more compelling example might be a bird watcher or coastal visitor who may enjoy their coastal experience at little or no cost. Each of these recreational uses entails relatively small direct expenditures (gas, time) compared to the benefits, which are arguably hidden because they are not traded in a formal market (hence the name non-market benefits). Intuitively, non-market value of many marine activities can be large when an activity is much enjoyed but not costly - at least not in a direct sense<sup>[1]</sup>.



### 3. Research Tasks and Methods

#### 3.1 Overall Approach

The primary objective of our research is to inform MPA<sup>17</sup> policy and management by providing scientifically rigorous baseline data and analysis on non-consumptive and consumptive recreational uses undertaken by boaters in the CINMS, including diving, kayaking, wildlife viewing, fishing, and other types of recreation. The baseline data will serve as a first estimate of the magnitude and nature of boating activity and its related economic impact. Future monitoring data can be compared against this baseline. Our focus is on private recreational use, for which there are two modes of visitation: by charter vessel, e.g., dive boat or party fishing boat, or private boat, such as a sailboat, motor yacht, or sport fishing vessel. Charter vessel operations in the CINMS have been studied previously by Leeworthy and Wiley, 2001. We focus entirely on private boaters (and their activities) in the Channel Islands

A secondary objective is to show how attributes of the marine environment and management activities affect the use decisions of boaters, especially attributes that (i) may explain user values and behavior, and (ii) are targets or outcomes of MPA policy and management, e.g., biomass and diversity of marine organisms across multiple habitats.

The survey data presented here provide the first robust “picture” or inventory of boaters, their activities, trip-related expenditures, and the extent to which they combine consumptive activities with non-consumptive activities. Furthermore, the data include responses to questions addressing knowledge of marine protection measures, and attitudes and perceptions toward marine protection and its efficacy. In short, these data and analyses provide the first scientifically rigorous insights into the underlying motivations of boaters, especially as they relate to marine management and stewardship.

In the future, these data can be used to provide (i) analysis of the market and non-market economic impact of non-consumptive use, and (ii) analysis of how non-market use and value varies with respect to biological and physical attributes of marine and coastal environments used by boaters.<sup>18</sup>

Baseline data include:

1. The spatial distribution of overnight anchorage use by private boaters,

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<sup>17</sup> The National Marine Sanctuary Program now refers to MPAs as marine zones. We use marine protected areas here to be consistent with the common vernacular and terminology used throughout the state of California.

<sup>18</sup> For this purpose, we have compiled an initial database of biogeophysical attributes, drawing from multiple sources: The California Department of fish and game, Channel Islands National Park Service, and the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO). Ultimately, we would like to identify attributes, e.g., biomass and species diversity, that determine user behavior and values. Our efforts are constrained, however, by the fact that biological monitoring sites and socioeconomic monitoring sites do not correspond well enough to support full statistical analyses. Moreover, the complete set of biological data needed to support estimates of biomass and species diversity exists only for some fraction of monitored sites.

2. Estimates of the rates of participation by boaters in recreational activities,
3. Socioeconomic and expenditure profiles of boaters, and
4. Knowledge, attitudes, and perceptions of boaters toward Sanctuary management strategies and no-take marine reserves established in April 2003.

All of the baseline data can be parsed by boater characteristics and activity preferences and the four primary components of the baseline can be cross-referenced to understand how the relationship between boater characteristics, spending, value, activity choice, and knowledge, attitudes, and perceptions.

### **3.2 Use of Four Integrated Survey Instruments**

We used four distinct survey instruments, deployed between May 2006 and December 2007.

**Postcard Survey of Private Boaters:** A post card survey was used to collect basic information from the boating population in Santa Barbara and Ventura Counties (see appendix A for copy of the survey). Because the proportion of boaters in the general population is low, it is difficult to use telephone surveys to canvas boaters. Further, since many boaters that visit the Channel Islands do not register their vessels with the state (these vessels have U.S. Coast Guard Documentation) we are unable to use Department of Motor Vehicle registries to get a complete list of boater addresses and phone numbers. As a result, we attempted to blanket the entire boater population by distributing the postcards in marina slip bills and at boat ramps, fuel docks, and marine chandleries. This survey was also available online. Data collected using the post card survey enable us to characterize the boater population over all and in terms of visitation to six defined regions of the Channel Islands (listed below), vessel type and storage location, participation in various private consumptive and non-consumptive activities (e.g., diving, fishing) – See list below for activities, and demographic information, such as age, place of residence, and education level.

#### **Regions Defined for the Channel Islands Postcard Boater Survey**

1. Anacapa Island
2. Santa Cruz Island (front side- facing North)
3. Santa Cruz Island (back side- facing South)
4. Santa Rosa Island
5. San Miguel Island
6. Santa Barbara Island

#### **Off site regions and anchorages:**

1. Coho Anchorage
2. Catalina Island
3. Guest Slip at other harbor

### **Categorization of Recreational Activities, Channel Islands Postcard Boater Survey:**

The following set of 11 consumptive and non-consumptive recreational activities are defined for this study.

#### Consumptive activities

1. Hook and line fishing
2. Lobster diving
3. Spear fishing
4. Hoop netting (fishing for crab and lobster with a hoop net)

#### Non-consumptive activities:

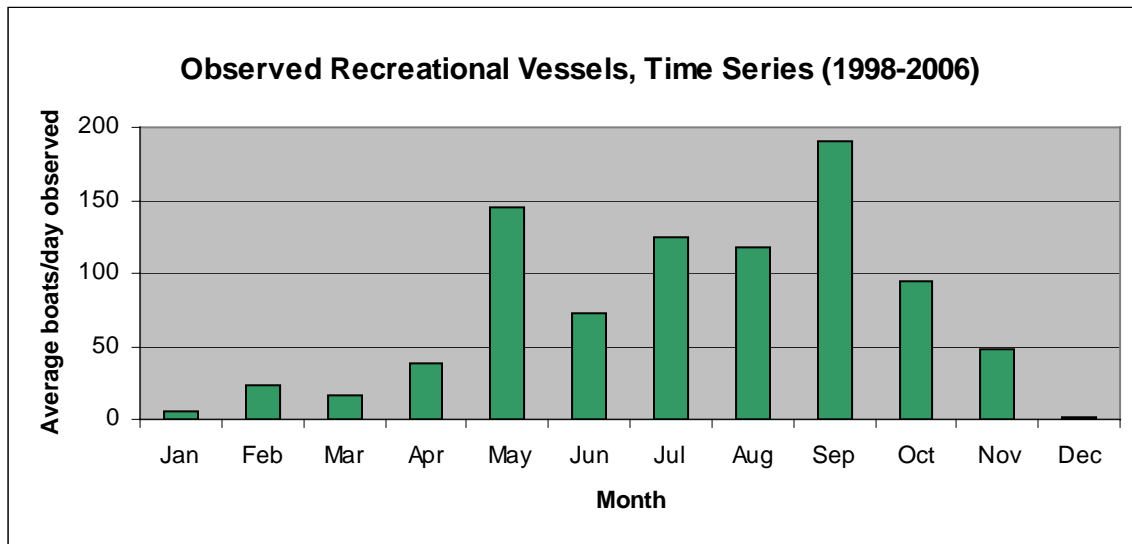
5. Kayaking
6. Hiking/beach going and exploring
7. Exploring using a dinghy
8. Diving/snorkeling
9. Surfing
10. Bird watching
11. Just relaxing

**Internet Anchorage Choice Survey:** Boaters who use their vessel to visit the Channel Islands were recruited through the postcard survey, and through adds in local boating newspapers, to participate in a more extensive online survey. The web survey enabled us to collect spatially explicit data on boater trips, anchorage and activity choices, and direct expenditures by private boaters who have used their vessel in the previous 12 months to go to the Channel Islands.

The first of two survey “waves” was deployed in early 2007. About 1/3 of boats moored in slips in the Channel Islands Harbor, Ventura Harbor, and Santa Barbara Harbor were sent the postcard survey and accompanying letter during March 2007. The remaining 2/3 of these boaters received a postcard survey and letter during the second “wave” in September and October 2007. Boaters were also approached at launch ramps and marine chandleries during August and September 2007. As mentioned, the anchorage choice survey is associated with the postcard survey in that the postcard “recruits” boaters to take the anchorage choice survey by going to [www.oceanstudy.net](http://www.oceanstudy.net) website. Various incentives were offered to induce boaters to complete the anchorage choice survey online, including coupons and savings at marine stores of up to \$20 and four cash prizes (1x\$1,000 and 3x\$400).

**On-site Intercept Survey:** To better understand the distribution of recreational uses by boaters at specific anchorages, at a fine spatial scale, we conducted in-person interviews at anchorages in the Channel Islands using an interactive GIS-based survey tool (Oceanmap). This survey was conducted from a research vessel anchored at a pre-determined set of private boat anchorages in the Channel Islands. We focused our survey effort over the period May 2007-October 2008, to correspond with the highest historical rate of visitation to the Channel Islands by recreational vessels; the monthly distribution of vessels is known from aerial flyover data (see Figure 1 below).

**Figure 7** Time series of recreational vessels observed during aerial flyovers in Channel Islands. Source: Channel Islands National Marine Sanctuary, Sanctuary Aerial Monitoring Spatial Analysis Program (SAMSAP)



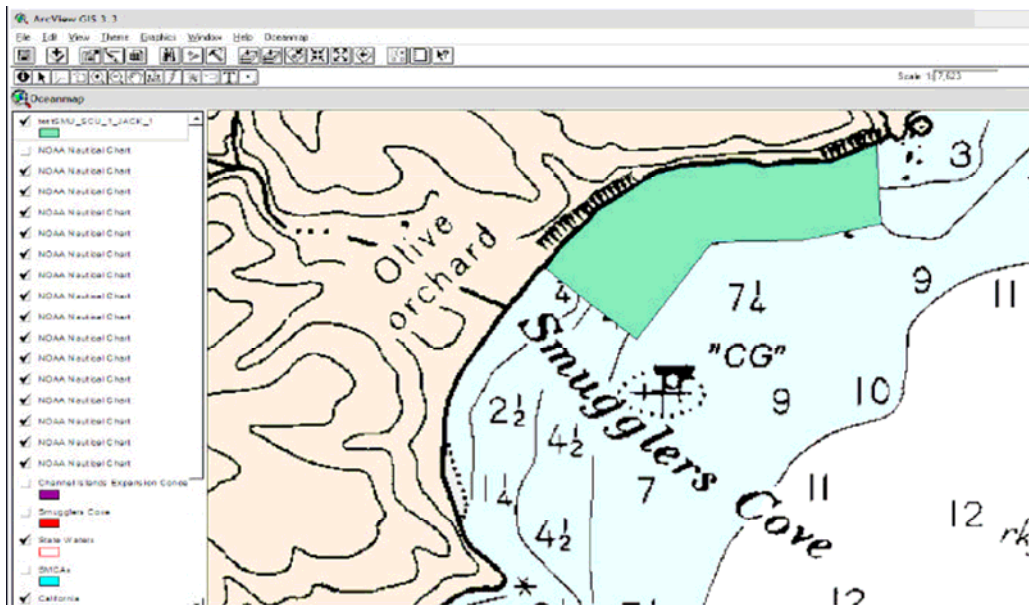
Private boaters were intercepted and surveyed while at anchor in the sanctuary. Researchers and sanctuary staff recruited boaters from a skiff, launched from the R/V Shearwater, a 62-foot aluminum catamaran. We offered the survey to the captain of every boat we encountered at an anchorage. Boaters were given the option to either come aboard the research vessel or take the survey on their vessel. A computerized, GIS-based map approach (Oceanmap tool) was used, allowing boaters to define the spatial areas they use.



Private boater returning to her vessel after survey, Yellowbanks anchorage, Santa Cruz Island

The Oceanmap tool (Figure 2) allows boaters (with assistance of an interviewer) to zoom in and out on digitized nautical charts- drawing “freeform” spatial areas (in the form of polygons) that correspond to places they use for diving, kayaking, wildlife viewing, dinghy exploration, and other activities. The interactive Oceanmap program runs on a laptop computer and, thus, can be employed on a private vessel. All freeform shapes are automatically logged as shape files, along with responses to questions on characteristics of the respondent’s vessel, characteristics of their trip to the islands, their activities in the Sanctuary, and demographic information.

**Figure 8** Screen capture of the interactive GIS program Oceanmap, showing Smuggler’s cove anchorage (green shaded polygon denotes area used by a boater for an activity).



**Knowledge, Attitudes And Perceptions (KAP) Survey:** Working with Christy Loper of NOAA’s National Ocean Service and the University of Delaware, we conducted a survey designed to help policymakers and managers understand more about (i) the level of knowledge boaters have about MPA and related rules, regulations, and locations, (ii) attitudes and perceptions of marine protection, the need for protection, and the efficacy of MPAs in relation to their goals. The survey is administered as a paper survey in connection with the on-site intercept survey described above.

The Intercept and “KAP” surveys were pre-tested with six randomly selected volunteer boaters and then deployed in tandem during 12 weekends of work between May 2006 and September 2007 aboard the research vessel Shearwater of the Channel Islands National Marine Sanctuary.

### **3.3 Biophysical Attributes of the Marine Environment**

For the Channel Islands, a database of biophysical attributes at the anchorage level was compiled. This database will be used in future research to model, statistically, the influence that biological, physical, and management attributes have on boater choices (e.g. of anchorage or activity). Examples of attributes include the presence of kelp, average anchorage depth, fish density, fish species richness, and the presence of a surf break. Using econometric models and the data collected in our surveys, we can identify whether and to what degree and level of significance such anchorage attributes affect boater decisions (such as whether to go and, if yes, where to go). This modeling will help us understand more about the motivations of boaters and, more specifically, which marine and management attributes explain the choices boaters make and resulting net values they capture. That will, in turn, help us understand and anticipate how marine protection will affect recreationists.

Attributes in the database are defined according to seven categories, presented in Table 1 below.

<b>Table 1</b>	
<b>Biophysical Attributes Database Categories and Variables</b>	
<b>CATEGORY</b>	<b>VARIABLES</b>
<b>Bottom Characteristics</b>	Substrate
	Kelp_Present
<b>Static Descriptors</b>	NW Exposure
	WS Exposure
	SE Exposure
	EN Exposure
	Enclosed
	Depth_Class
	Average_Depth
	Anchorage_Area
	CI_Dist_NM_Rounded
	SB_Dist_NM_Rounded
	V_Dist_NM_Rounded
	Island_Packers
	MPA
	Lobster_Take
	Shoreline
	TNC_NPS
	Shoreline
	Caves
	Sandy_Shore
	Pier
Buildings	
Camping	
Surf_Spot	
<b>PISCO</b>	fish richness
	fish density
	invertebrate density
<b>Dynamic Descriptors</b>	Wind_Direction
	Wind_Speed
	Swell_Direction
	Swell_Size
	Swell_Period
	Pressure

## 4. Baseline Data Set

Below we present data summaries for private boaters, broken down by survey type (e.g. postcard, internet, intercept, and KAP). The summaries presented do not represent the full spectrum of collected data, which is too large to present in this report. The complete set of processed baseline data, summarized to protect the identity of individual respondents, will be made publicly available following publication of this report.

### 4.1 Summary of Responses: Postcard Survey Of Private Boaters

We distributed 5,400 mailback postcards by inserting them in marina slip bills (Channel Islands harbor and Ventura Harbor), mailing them directly to slip owners (Santa Barbara Harbor) or handing them out at boat launch ramps and marine chandleries during busy weekends. We received 741 usable responses (“sample”). In all cases, a flier describing the study and asking boaters to help by completing the survey and going to [www.oceanstudy.net](http://www.oceanstudy.net) accompanied the survey. Chris LaFranchi and Linwood Pendleton signed the flier.

The 14% response rate we experienced is typical for mailback responses.

It is important to note that we were able to achieve much greater coverage and representation of slip-stored boats compared to trailerable boats. This is primarily because we were able to get permission to insert the postcard survey into marina slip bills, a distribution mode not possible with trailerable boat owners. We did acquire and attempt to utilize boat ownership records compiled by the California Department of Motor Vehicles; however, these records proved unusable for our purposes because we could not distinguish Channel Islands boaters from the tens of thousands of records. Using this database would have necessitated mailing over 35,000 postcards, the majority of which would have been delivered to boaters who do not use their vessel to visit the Channel Islands. Ultimately, we opted to distribute postcards at launch ramps during busy weekends. We targeted the period 12pm –sunset in an attempt to reach boaters upon their return from a day or overnight trip.

**Visitation to the Channel Islands:** About 85% of respondents indicated that they used their boat to go to the Channel Islands at least once in the previous 12 months. Visitation is differentiated according to six regions (see Figure 3). On average, respondents report visiting between two and three (2.45) regions in the past twelve months. The maximum number reported is all six, the minimum zero.

A clear east-west pattern was observed that is consistent with aerial flyover data that has been collected by the CINMS over the past nine years: Santa Cruz and Anacapa Islands (in the east) are visited by private boats with much greater frequency than Santa Rosa, San Miguel, and Santa Barbara Islands (western portion). Much of this pattern is intuitively explained by prevailing weather patterns, which produce the most favorable conditions for boating in the eastern portion of the Channel Islands. Furthermore, the eastern portion is much closer to all homeports in the study area and so visiting the region requires less fuel and time. We present finer scale visitation data- to overnight anchorages- in the next section.



**Summary of sample statistics:**

Estimated number of private slip-stored vessels in Santa Barbara, Ventura, and Channel Islands harbors: ~5172

Number of trailerable boats using these harbors: unknown

Postcards distributed: 5,400

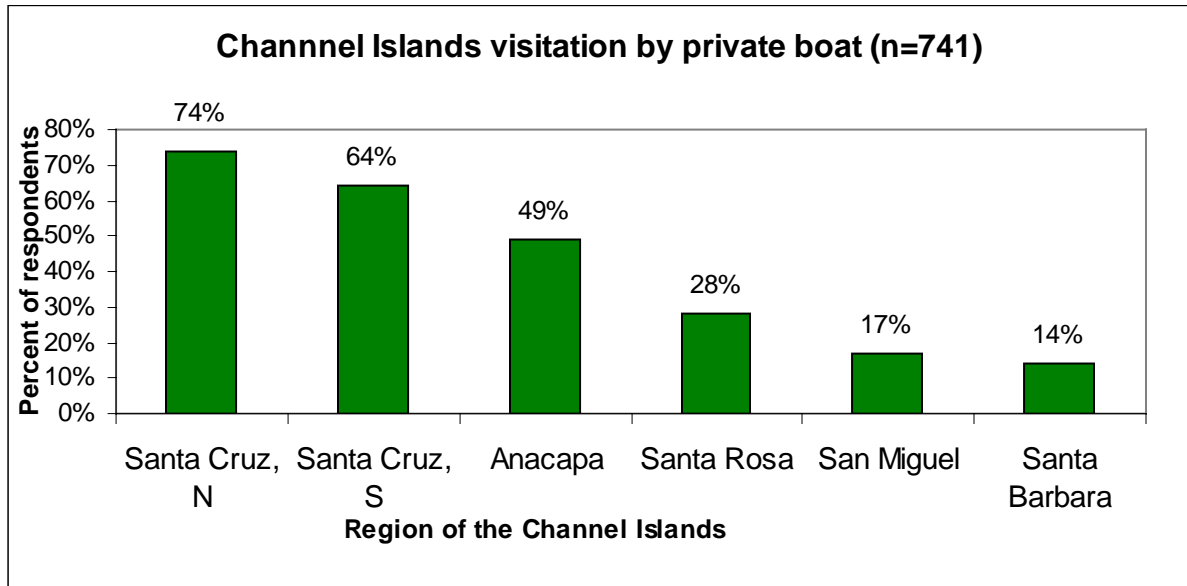
Total number of useable responses: 741 (n=741)

Mailback postcard response rate: ~14%

Percent trailerable boats in sample: ~11%

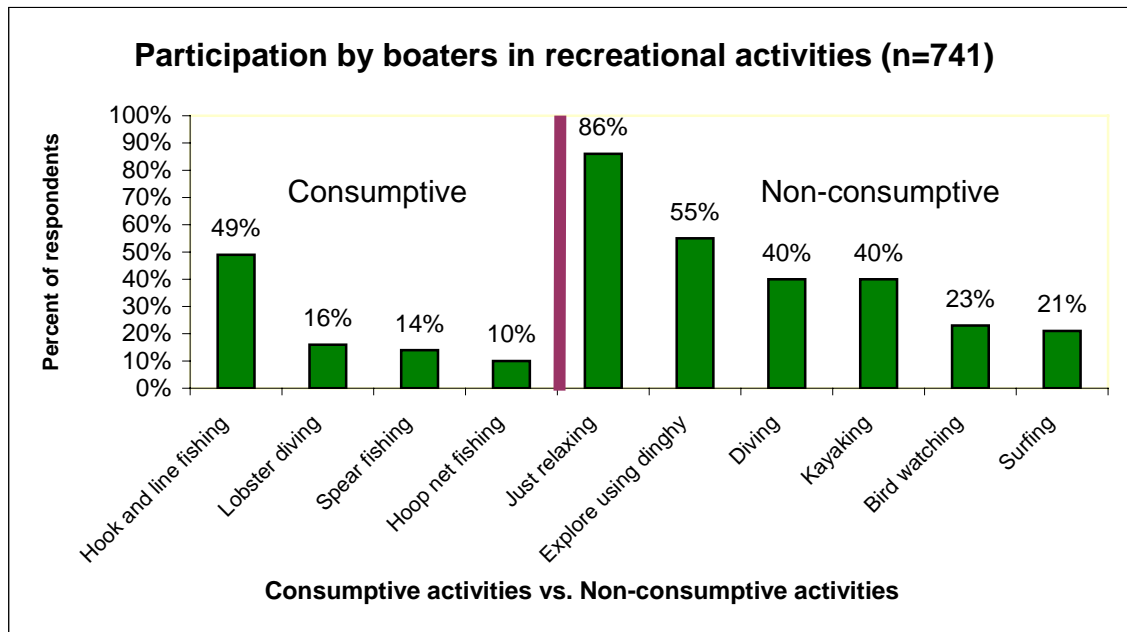
Percent slip-stored boats in sample: ~89%

**Figure 9** Visitation to regions of the Channel Islands. Below figure derived from responses to survey question “Where do you like to go boating? Please check any place (all six regions presented) you have anchored in the past 12 months”



**Participation in recreational activities:** A key finding is that private boaters commonly mix consumptive and non-consumptive activities. Hook and line fishing, relaxing, exploring by dinghy, diving, and kayaking are all popular activities (see figure below). The average number of reported activities per respondent is 3.4 (out of ten possible). The max is nine activities; zero is the minimum reported. Study of boater behavior<sup>19</sup>, consequently, does not lend itself to separate analyses of “consumptive” and “non-consumptive” categories. This aspect of private boating has relevance to monitoring of no-take marine reserves that prohibit all consumptive activities<sup>20</sup>. It is hoped that the loss in access to areas where consumptive activities are allowed will be outweighed in the long run by (i) benefits to non-consumptive activity participants through enhanced species diversity and abundance, and (ii) benefits to consumptive activity participants through spillover of targeted animals, e.g. halibut, kelp bass, and lobster, from reserves to non-reserve areas. Thus, gaining an understanding of how boaters might trade or substitute non-consumptive and consumptive activities- in response to the establishment of reserves- is critical to our overall understanding of whether reserves contribute to marine ecosystems that provide what people need and want.

**Figure 10** Boater activity participation rates, broken down by consumptive and non-consumptive categories. From survey question, “Which of these activities do you do on your boat” (mark all that apply- 10 possible)?



<sup>19</sup> Behaviors such as choice of recreational site, e.g., anchorage visitation, recreational activity, trip-related expenditures, and attitudes toward marine resource management and regulations.

<sup>20</sup> A network of no-take marine reserves and conservation areas was established in April 2003. The total area of these zones is equal to 19% of CINMS waters.

**Vessel and demographic information (n=741):** Postcard data are also used to create profiles of boaters according to vessel type, gender, Internet access, etc. (see Table below). Postcard data indicate that the average boater is a male who is about 56 years old, has access to the Internet, and is about equally likely to own either a sailboat or powerboat/motor sailor that is about 33 feet in length<sup>21</sup>. These data help us understand which boaters are represented by our data: what, for example, are the demographic characteristics of boaters who enjoy non-consumptive diving and occasional spearfishing at sites located near Anacapa or San Miguel Islands? Do demographic characteristics differ between boaters who primarily enjoy non-consumptive compared to consumptive activities? We have learned that boaters are a heterogeneous group. Understanding the varying demographic characteristics is important to management of areas where vessel type and associated activities matter (e.g., for conflict avoidance), and outreach efforts that need to identify which boaters to target for specific messages. Furthermore, applying demographic data enhances our ability to understand how boaters are responding to no-take marine reserves and natural changes that occur in the marine environment.

**Table 2: Characteristics of Boats and Boaters<sup>22</sup> (n=741)**

<b>Vessel characteristics</b>	
Average length	33 feet
Max length in sample	77 feet
Min length in sample	18 feet
Sailboats	52%
Motor sailors	2%
Power boats	45%
<b>Demographic information</b>	
Males	90%
Females	10%
Average age	56 years old
No response	3%
Internet access	97%
Non response	0-4% (for the above variables)

<sup>21</sup> Intercept survey data suggest, furthermore, that Channel Islands boaters have income and education levels that are higher than the national average.

<sup>22</sup> These data are from the postcard survey; 85% of postcard respondents used their boat to go to the Channel Islands at least once in the previous year.

## 4.2 Summary of Responses: Web Survey

Postcard survey respondents who reported using their vessel at least once in the previous 12 months were asked to complete the web survey (i.e., boaters who use their boats to visit the Channel Islands were recruited to the web survey). The web survey collected spatial use information at the anchorage level, additional information on vessels and boaters, and expenditure data from recent trips. In total, data were collected from 215 web survey responses out of a possible 741 postcard responses (about 29% of total possible). We present a sample of the web data here, including a) anchorage visitation, b) trip frequency, c) boater experience level, and d) trip-related expenditure data.

**Anchorage visitation:** For the web survey, we define a set of 52 anchorages (49 of them “within the waters of the three principal islands of the CINMS”), for which we collected information on exactly how many nights and days boaters spent at each anchorage during a period between and inclusive of Memorial Day and Labor Day weekends<sup>23</sup>. We present these data in two ways: 1) Percent of web survey respondents who visited an anchorage for at least one night or day (Table below), and 2) Percent of person-days that boaters occupied an anchorage in our set during the period from Memorial Day to Labor Day (Figure below). In both cases, the abovementioned pattern of declining visitation from east to west is present; furthermore, the data indicate that visitation is concentrated in 10-15 anchorages.

Table 3 below presents the top ten anchorages, in terms of percent of respondents who visited an anchorage at least once. This measure indicates that the five most-often-visited anchorages are distributed throughout the east region, each of which was visited by 30% or more of web survey boaters. This finding is consistent with what we know is a pronounced east-west pattern (private boat visits are concentrated in the east portion of the Channel Islands); moreover, there is further spatial concentration of private boater visitation within the east portion, e.g., Smuggler’s. In contrast, the top five anchorages in the west portion were each visited by less than 15% of web survey respondents.

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<sup>23</sup> This is the period we define as the boating season, recognizing that, based on aerial survey data, the majority of private boating activity in the Channel Islands occurs during this period.

**Table 3: Visitation to Selected Anchorages**

**Nights and Days Spent at Anchorage between Memorial Day (May 26) and Labor Day (September 4) 2007 (n=215)**

	<b>Percent of respondents (spent one+ night or day)</b>
<b>Top Ten Anchorages</b>	
1. Smuggler's, (Santa Cruz Is., S.)	53.2%
2. Prisoner's, (Santa Cruz Is., N.)	41.2%
3. Yellowbanks (Santa Cruz Is., S.)	37.5%
4. Pelican's, (Santa Cruz Is., N.)	36.1%
5. Frenchy's, (Anacapa Is.)	30.6%
6. Coches Prietos, (Santa Cruz Is., S.)	24.5%
7. Little Scorpion, (Santa Cruz Is., N.)	23.6%
8. Fry's, (Santa Cruz Is., N.)	22.7%
9. Scorpion, (Santa Cruz Is., N.)	21.8%
10. Albert's, (Santa Cruz Is., S.)	21.3%
<b>Top Five Anchorages (West Portion only)</b>	
1. Becher's Bay (NW), (Santa Rosa Is.)	13.4%
2. Main Anchorage, (Santa Barbara Is.)	12.1%
3. Cuyler Harbor, (San Miguel Is.)	11.6%
4. Becher's Bay (SE), (Santa Rosa Is.)	10.6%
5. Johnson's Lee, (Santa Rosa Is.)	9.3%

Figure 3, below, presents the percent of person-days spent at anchorages, using three maps. The figure presents:

1. All “on-site” anchorages (49 red triangles) in our choice set
2. The percent of total nights/days expressed by respondents in the sample (yellow bars)
3. A close up of Santa Cruz and Anacapa Islands only, which includes anchorage names

Total person-days is a measure of the cumulative amount of time spent by boaters at anchorages, and is thus a more accurate indicator of the level of human presence across anchorages in our defined set. Not only is the east-west pattern present, but the data indicate a concentration of visitation: the sum of person days for the area from Fry's (traveling east) to Yellowbanks and the area around Anacapa Island account for 73% of all person days. Thus, data suggest that almost three-quarters human presence (as represented by web survey responses) is concentrated over about half of the Santa Cruz Island coastline and the coastline of Anacapa Island.

To further illustrate the concentration of anchorage visitation, we define a set of three “hotspots” that together account for 58% of total person days:

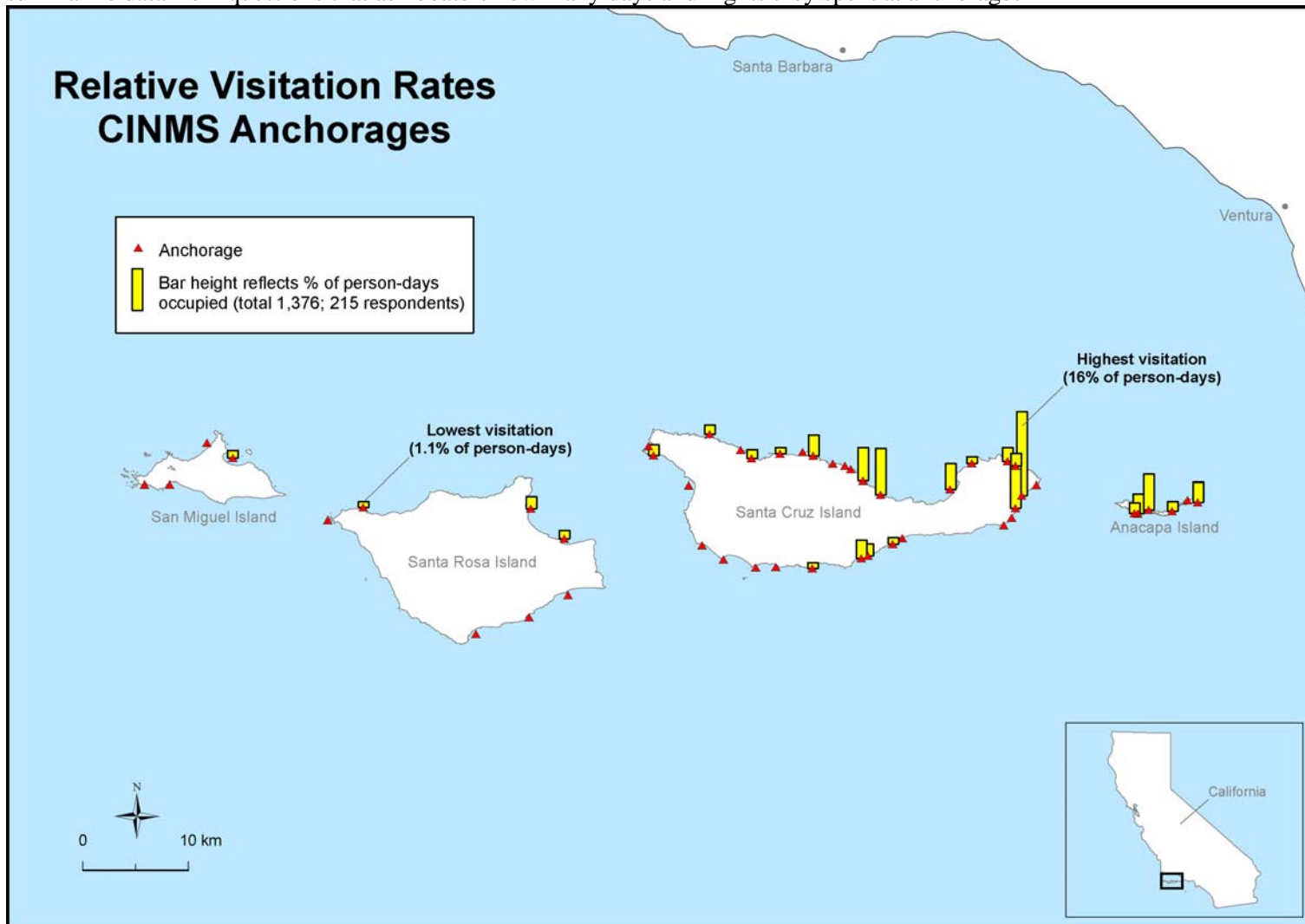
1. The area encompassing Smuggler's and Yellowbanks (24% of total person days),
2. The area around Anacapa Island (19% of total person days),
3. Prisoner's and Pelican's (15% of total person days).

**Using data to address management and policy:** Data indicate that the majority of private boater visits to anchorages are concentrated in relatively small portions of the Channel

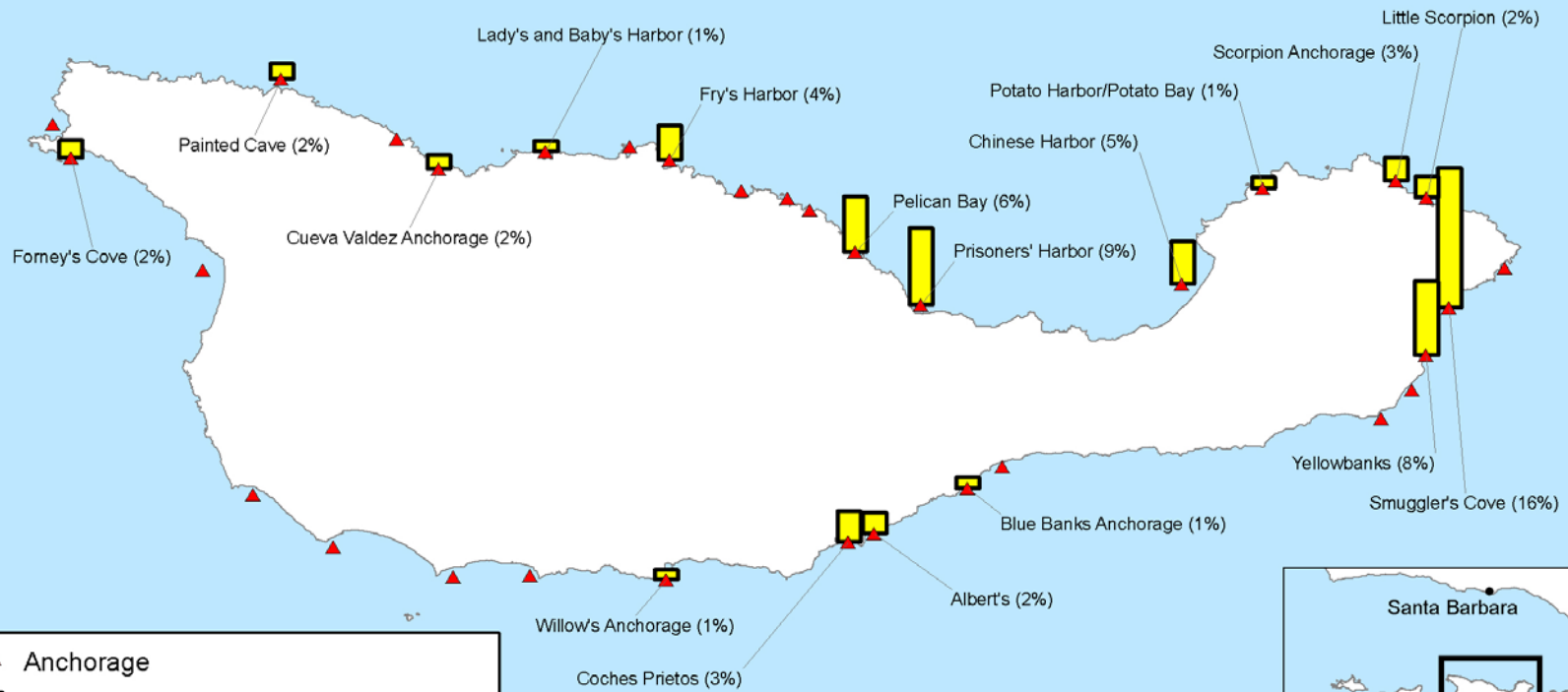
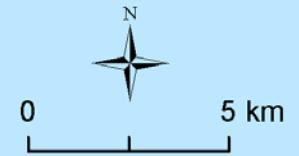
Island's eastern half. This is significant for Channel Islands managers who benefit from understanding the distribution and intensity of human pressure across space in the CINMS. Understanding the distribution of pressure is key to understanding possible connections between findings from biological monitoring and human activities. It also can be used to allocate scarce management resources and to assist ecological restoration or protection of places that may be important but spatially very small, e.g., concentrated in a few sensitive habitats, such as eel grass, which occur at or near popular anchorages. It allows managers to target areas of high human use and value.

Furthermore, it enhances our understanding of how boaters may be affected by no-take reserves and can be used in the future to measure changes in patterns of anchorage visitation. Of course, to know boating and boaters, managers also need the same type of spatial information for the recreational activities enjoyed by boaters. In the section below on the intercept survey, we explore the incidence of consumptive and non-consumptive activities that corresponds to popular anchorages.

**Figure 11** (i) Relative visitation rates, CINMS anchorages, (ii) Santa Cruz Island visitation, and (iii) Anacapa Island visitation. These figures are summarize data from questions that ask boaters how many days and nights they spent at anchorages



# Santa Cruz Island Anchorage Visitation

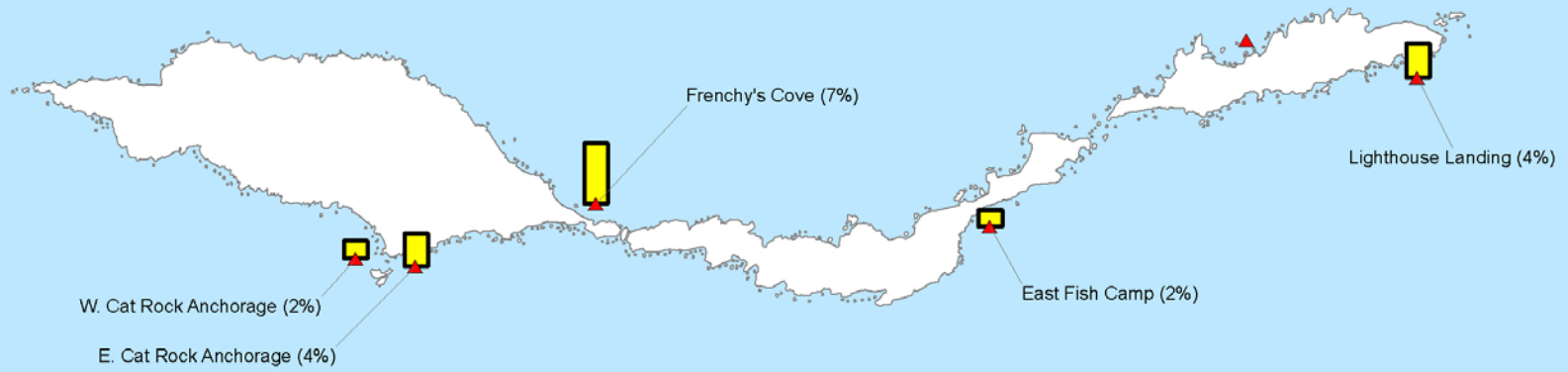
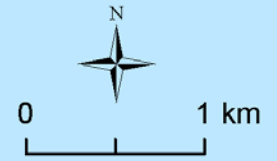


▲ Anchorage  
 Bar height reflects % person-days occupied (total 1,376; 215 respondents)





# Anacapa Island Anchorage Visitation



▲ Anchorage

■ Bar height reflects % person-days occupied (total 1,376; 215 respondents)





**Trip frequency and experience level:** The average web survey respondent took 8.6 trips to the Channel Islands in his or her boat in the past year and has 17.2 years of boating experience. This is an understandable level of avidity and experience, given that travel by boat to the Channel Islands requires crossing 13-25 miles of open ocean and a shipping lane, not to mention encountering winds that are sometimes in excess of 20 knots. Channel Islands private boaters invest time and take relatively frequent trips in order to gain a level of experience that, conceivably, makes for safe and enjoyable boating in this region.

**Table 4: Trip Frequency and Boating Experience**

<b>Number of Trips in the Last Twelve Months by Private Boaters (n=191)</b>	
Average	8.6
Max	50
Min	1
No response to this question	24
<b>Years of Boating Experience In Channel Islands (n=191)</b>	
Average	17.2
Max	50
Min	2
No response to this question	24 of 215

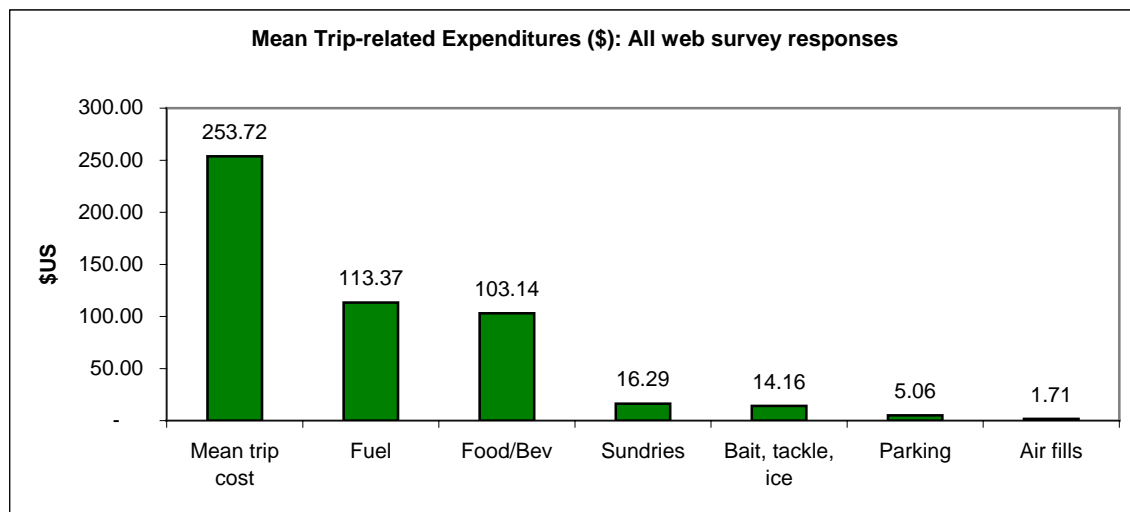
**Trip-related expenditures:** These data are required to estimate the direct financial impact<sup>24</sup> from private boat trips to the Channel Islands, the multiplier effects from these financial expenditures, and, ultimately, the economic value<sup>25</sup> of trips by boaters.

For the web survey, boaters were asked to provide detailed information on expenditures that coincided with their last trip to the Channel Islands in their boat. Trip-related costs are defined as the additional (variable) costs directly associated with the most recent trip, by private boat, to the Channel Islands. They include boat fuel, food and beverages, bait, tackle, ice, parking fees, and sundry items such as sunscreen, hats, or sunglasses. In contrast, fixed costs are not trip-related and include, for example, boat purchase, slip fees, and other annual costs. Additionally, some annual costs are related to the frequency of use, but cannot be easily broken down by trip (e.g. annual maintenance costs).

Mean trip related expenditures, broken down by cost category and user type (i.e., consumptive and non-consumptive<sup>26</sup>) are presented in the figure below. Food/beverages and fuel account for 85% of mean trip-related costs.

The six cost categories presented below are aggregated mean values from the 33 trip related cost categories we asked about in the web survey. The disaggregated mean trip expenditures and summary statistics, including number of observations, standard deviation, minimum, and maximum are presented in Appendix A of this report.

**Figure 12** Mean trip-related costs (\$253.72), broken down by cost category



<sup>24</sup> Financial impacts include increased gross sales revenues spurred by boater purchases

<sup>25</sup> Economic value corresponds to the total willingness to pay for a trip minus the cost of taking that trip. To estimate these values, we plan to estimate a type of discrete choice model called a random utility model (RUM). Nested in the RUM is a trip demand curve that cannot be estimated without trip cost data.

<sup>26</sup>“Non-consumptive” = boaters who participate only in non-consumptive activities, such as exploration by dinghy, kayaking, and beach combing. “Consumptive” = boaters who participate in at least one consumptive activity, and who likely participate in other consumptive or non-consumptive activities.

Table 4 breaks out trip related costs by consumptive and non-consumptive boaters. When we compare these groups, we count two key differences: a) consumptive boaters use almost twice as much fuel as non-consumptive boaters, and b) non-consumptive boaters spend more on food/beverages and sundries. In fact, non-consumptive boaters have higher mean trip-related costs when fuel costs are not considered. This is potentially significant to economic impact of trips, as fuel expenditures have lower average multiplier benefits compared to other categories (Leeworthy and Wiley, 2001). Depending on their sensitivity to fuel prices, consumptive boaters may be disproportionately impacted by increasing fuel costs, which could affect their site and activity choices. Due to lower fuel consumption, moreover, non-consumptive boaters almost certainly have a smaller average trip-related carbon foot print, at least as it relates to level of trip fuel burned.

**Table 4: Mean trip-related costs (\$US) – boaters last trip**

	<b>Non-consumptive</b>	<b>Consumptive</b>	<b>All boaters</b>
<b>Air fills</b>	0.68	3.05	1.71
<b>Parking</b>	3.59	7.60	5.06
<b>Bait, tackle, ice</b>	5.27	25.65	14.16
<b>Sundries</b>	21.26	15.67	16.29
<b>Food and Beverages</b>	137.79	96.36	103.14
<b>Fuel</b>	80.49	170.49	113.37
<b>MEAN TOTAL</b>	<b>249.1</b>	<b>318.8</b>	<b>253.72</b>
<b>MEAN TOTAL WITHOUT FUEL</b>	<b>168.60</b>	<b>148.33</b>	<b>140.35</b>

### 4.3 Summary of Responses: On-site Intercept Survey

Between Memorial Day 2006 and Labor Day 2007, we intercepted and surveyed 97 recreational boat captains and 96 of their passengers at popular anchorages on Santa Cruz Island. Researchers hailed boaters from a skiff launched from the CINMS research vessel *Shearwater*, a 62-foot aluminum catamaran. They then invited boaters to come



Taking a survey aboard research vessel *Shearwater*

aboard the research vessel to take a tour and participate in the study. Boat captains were offered the intercept and KAP surveys; accompanying passengers were offered the KAP survey only<sup>27</sup>. After respondents completed their survey, *Shearwater* staff and a volunteer naturalist were available to answer questions about the CINMS and its programs. The intercept survey response rate was greater than 80%.

The focus of this survey was acquiring fine-scale spatial data on boater activities. Using electronic charts, a

surveyor helped respondents identify areas in the CINMS where they undertake different types of activities (e.g. kayaking, fishing, exploring in dinghies). Respondents were asked to help the surveyor draw polygons on the chart that indicated the areas for which they participated in these activities. The resulting data were automatically compiled in a custom GIS (a version of Oceanmap<sup>28</sup>) that allows us to create maps of use intensity (see Figures below for examples of these maps).

**Recreational activity data at fine-scale:** Survey effort was focused on a pre-defined set<sup>29</sup> of the most often visited anchorages located at Santa Cruz and Anacapa Islands<sup>30</sup>

<sup>27</sup> Only the captain of the vessel took the intercept survey, which asks about recreational activities at or in the vicinity of the anchorage where the survey was administered. The captain reported on his or her activities and the activities enjoyed by passengers. Both captain and passengers were offered the KAP survey.

<sup>28</sup> Mr. Peter Black of Environmental Defense, a non-profit organization, developed the Oceanmap program using ArchView 3.3 (Geographic Information System software).

<sup>29</sup> On several occasions, we experimented by attempting to intercept boaters at Santa Rosa and San Miguel Islands, which are visited with much less frequency than Santa Cruz Island. Before departing to these locations, we conferred with a Coast Guard helicopter pilot or the Sanctuary's aerial flyover aircraft to confirm the presence or absence of private boats in anchorages at those islands. Because the return to these efforts (completed surveys) was very low, we concluded that the best use of our research vessel resources was to focus entirely on a set of nine popular anchorages.

<sup>30</sup> We did not intercept boaters at Anacapa anchorages; however, we did collect data on participation in activities at Anacapa by asking intercept survey respondents to tell us about any Anacapa activities that occurred during their present trip. Thus, Anacapa activity data were collected from Santa Cruz Island anchorages.

(see below). Fine-scale spatial data are available for the following activities and at sites (overnight anchorages) listed below. Maps have not been developed for all activities at all sites. Rather, we present below a sample of several maps<sup>31</sup> we have developed that correspond to popular activities at the most often visited sites, to maximize the value to managers and policy makers. Again, additional maps can be developed for any combination of sites and activities listed below.

Intercept Survey Sites: overnight anchorages

1. Painted Cave
2. Fry's Harbor
1. Pelican Bay
2. Prisoner's Harbor
3. Scorpion Anchorage
4. Smuggler's Cove
5. Yellowbanks Anchorage
6. Albert's Anchorage
7. Coches Prietos Anchorage
8. East Fish Camp
9. Frenchy's Cove

Recreational activities:

1. SCUBA diving
2. Snorkeling/free diving
3. Wave riding or surfing
4. Kayaking
5. Exploring using a dinghy
6. Beach going and exploring/hiking
7. Hook and line fishing
8. Spear fishing
9. Lobster diving
10. Hoop netting

To illustrate the fine scale data on boater activities, maps below show: a) data for the activity “exploring by dinghy”, the most popular activity overall (and a non-consumptive activity). Data presented in the maps correspond to the most often visited regions of the Channel Islands (east Santa Cruz Island and Anacapa Island), and b) “recreational fishing”, the most popular consumptive activity, at the same locations in the CINMS.

First, the activity data clearly indicate that boaters commonly participate in activities in close proximity to where they anchor their boats: activity use patterns, for both activities profiled, spatially correspond to the level of anchorage visitation, e.g., high use concentrated around Smuggler's and Prisoner's. Also, note that activity data are at a scale that is fine enough to be compared to fine-scale maps of patchy marine habitats.

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<sup>31</sup> Dr. David Greenberg at the Marine Science Institute (MSI), University of California at Santa Barbara (UCSB), developed these maps.

These data can then be used, for example, to identify areas that contain sensitive habitats and are used for multiple recreational activities.

Second, data for these activities suggests that in addition to being focused in proximity to popular anchorages, participation in activities is patchy over space. Thus, human pressures resulting from activity participation are likely to be patchy and spatially intermittent, even in the most heavily used portions of the CINMS. The general and intuitive conclusion drawn is that most activity use is focused in and around the most popular anchorages, and generally declines as one moves away from them. In interpreting our maps, however, caution should be applied: activity data on these maps only represents the anchorages where we were able to intercept and survey private boaters. We did not have enough research vessel time and resources to comprehensively survey even the most often visited portions of Santa Cruz Island. These data, consequently, give us a good picture of activity use only for the sites we list above. Nonetheless, they provide valuable insights to managers, as we focused our effort on the anchorages most often used by private boaters.

**Special note on recreational fishing:** Recreational fishing differs from other activities in ways that almost certainly cause it to be under-represented by our data. First, unlike activities such as exploring by dinghy and kayaking, recreation fishing is often conducted from the boat and while the boat is moving or drifting, often when fishing gear is deployed. Since our survey protocol calls for approaching boats only while safely at anchor with no gear deployed, we were prevented from approaching and surveying such private boats that were engaged in recreational fishing. Second, we are aware that trailerable boats can be launched and used to fish for a single day without use of one of our anchorage sites. We also noted that when these boats did use our anchorage sites, they sometimes anchored at or near sunset and departed before sunrise. Consequently, boats that exhibit abovementioned behaviors were almost certainly not as well represented as boats that spent full days and nights at our sites.

**Using data to address management and policy: activity data:** Marine area-based management is focused on management of human activities over time and space. Understanding and managing the anchoring and recreational activities of boaters is critical to such management in the Channel Islands. Intercept survey data contributes to these tasks in several ways. In combination with biological monitoring and habitat data, managers can use intercept survey data to identify specific environmental attributes in heavily used areas, and construct maps with layers of recreational activities. Thus, a valuable tool is created that can be used to better understand how changes in the marine environment affect boaters and their activities, and how boaters and their activities result in changes to the attributes of the environment that attract them to these places.

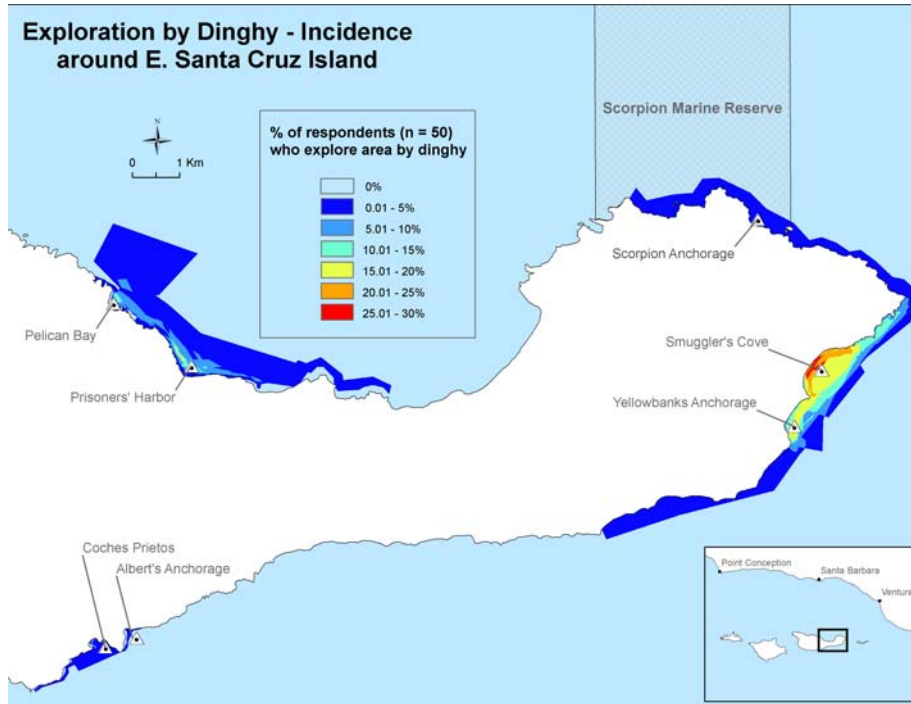
Attributes of the marine environment, such as small kelp patches over a rocky sea floor, furthermore, are important to specific activities such as diving, kayaking, and fishing. Some activities that use the same such areas may be in conflict with one another, e.g., a healthy kelp patch that is used by non-consumptive divers and recreational anglers, or popular areas for anchoring that support eel grass beds.



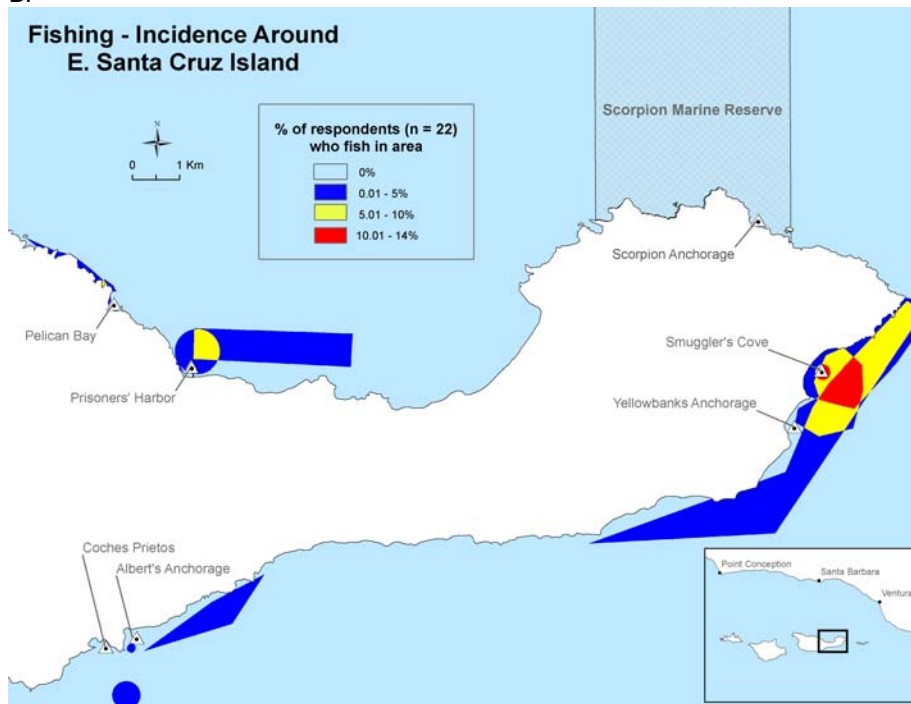
Because many of these environmental attributes encompass small spatial areas (sometimes less than 1,000 square meters, for example), managers need to know not only the their location, but the incidence and mix of human activities at a fine scale. It is especially valuable for managers to be able to focus on fine-scale management of such attributes in places that are heavily used and valued by people, since these are often the places where people find the easiest and most favorable access to ocean activities- the places where people and ocean interact. Successful management of these areas ensures that people are served, and increases the likelihood that infrequently used areas remain free of significant human pressure that might steadily increase if heavily used areas are degraded over time.

**Figure 8.** (A.) Incidence of dinghy exploration, the most popular non-consumptive boater activity, summarized using intercept survey data (n=50), for east Santa Cruz Island, (B.) Incidence of recreational fishing, the most common consumptive boater activity, summarized using intercept survey data (n=50), for east Santa Cruz Island.

A.

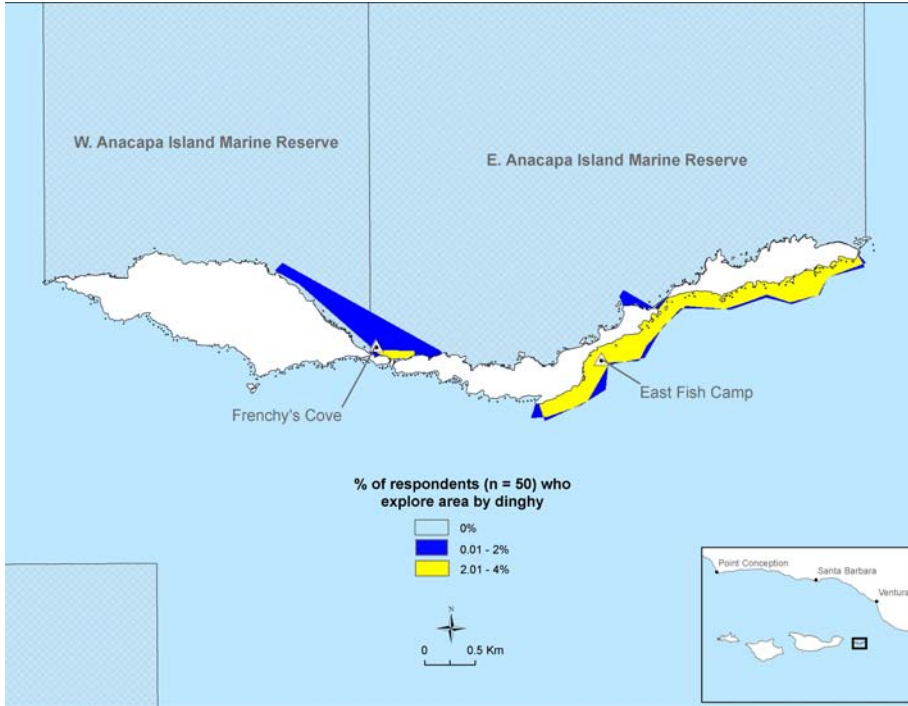


B.

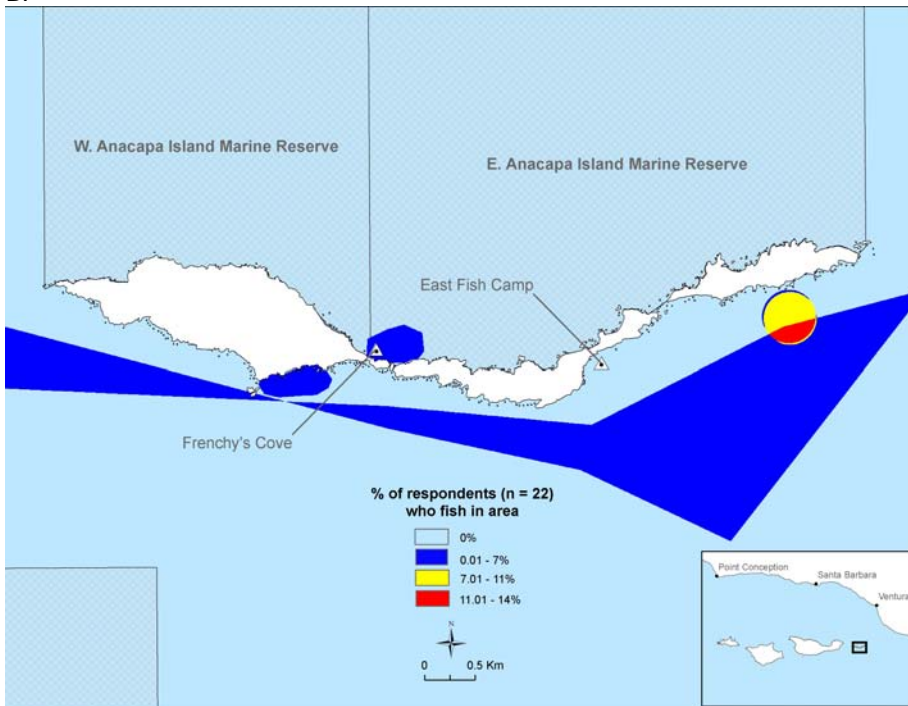


**Figure 9.** (A.) Incidence of dinghy exploration, the most popular non-consumptive boater activity, summarized using intercept survey data (n=50), for Anacapa Island, (B.) Incidence of recreational fishing, the most common consumptive boater activity, summarized using intercept survey data (n=50), for Anacapa Island.

A.



B.



#### 4.4 Summary of Responses<sup>32</sup>: Knowledge, Attitudes, and Perceptions Survey (“KAP”)

“Not everything that counts can be counted, and not everything that can be counted counts”. –Albert Einstein



To investigate the knowledge, attitudes, and perceptions of boaters, we conducted 193 surveys of private boat captains and their passengers, whom we intercepted at popular overnight anchorages at Santa Cruz Island; the response rate exceeded 80 percent. The surveys were conducted at anchor, from the research vessel *Shearwater*, in tandem with the intercept survey of spatial patterns of boater activities. All data were collected during weekends between May and September in both 2006 and 2007. In accordance with study protocol, the KAP survey was offered to all boat captains and accompanying passengers.

The KAP is a self-administered paper survey designed primarily to collect qualitative data that pertain to three primary themes:

1. Level of private boater knowledge
  - a. Pertaining to regulations, island access, and information sources used
  - b. Spatial location of private vessels in relation to marine reserves (do boaters know when they are in a reserve?)
  - c. Sanctuary and marine reserve regulatory restrictions
2. Attitudes
  - a. Level of support or opposition to marine reserves, either generally, in their present locations, or in relation to the establishment of additional reserves
  - b. Identification and ranking of factors that are important in the choice of the Channel Islands as a boating destination
3. Perceptions
  - a. Level of agreement or disagreement with statements pertaining to the perceived effect of marine reserves on the local economy, provision of

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<sup>32</sup> Not all KAP survey responses are summarized here. In particular, responses on information sources used by boaters, spatial locating by private boats, and responses to perceptions questions referenced above are not summarized, but available upon request.

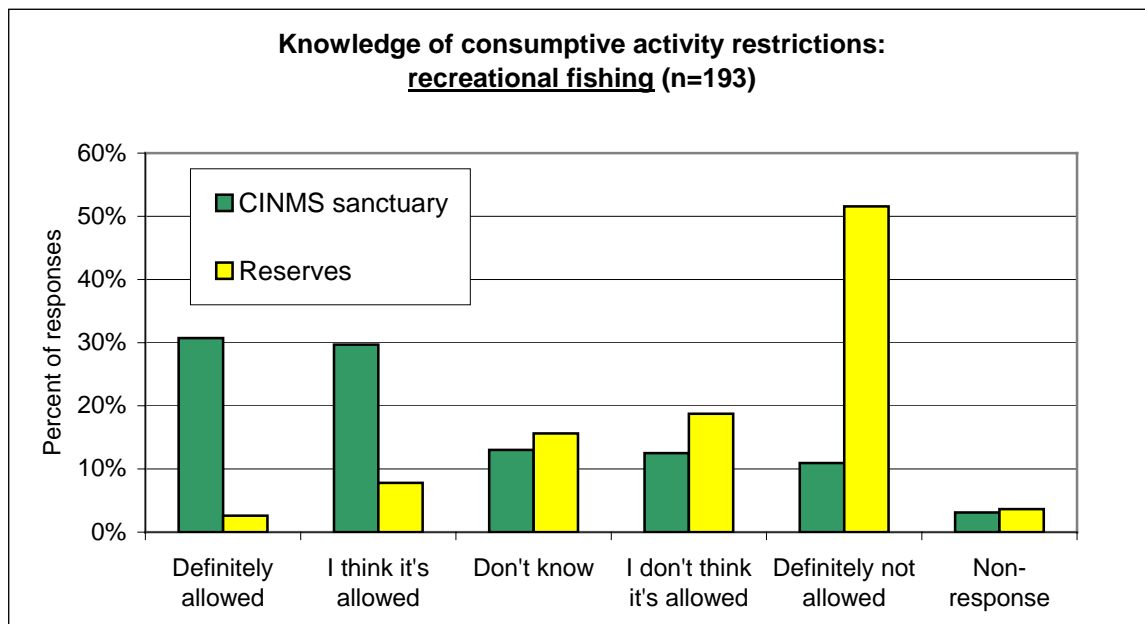
recreational opportunities, and various aspects of reserve efficacy, e.g., will they protect habitats, increase the number of fish outside reserves, and protect marine mammals.

- b. Perceived effects of marine reserve, in the short and long term<sup>33</sup>, to various user groups, including recreational and commercial fisherman, recreational users such as divers and kayakers, educators, and scientists.

**Knowledge of regulations:** We analyzed the data to estimate how well intercepted private boaters understand Sanctuary and marine reserve restrictions on commercial and recreational fishing. Commercial and recreational fishing is allowed, subject to state and federal regulations, in Sanctuary waters outside marine reserves. They are prohibited entirely inside no-take marine reserves and partially prohibited inside marine conservation areas.

**Knowledge of recreational fishing restrictions:** Sixty percent (60%) of respondents indicated, correctly, that recreational fishing is allowed in the Sanctuary; about 37% either said they did not know or erroneously believe that it is not allowed. About 70% of respondents correctly indicated that recreational fishing is prohibited in marine reserves, 11% did not know, and 11% erroneously thought it is allowed.

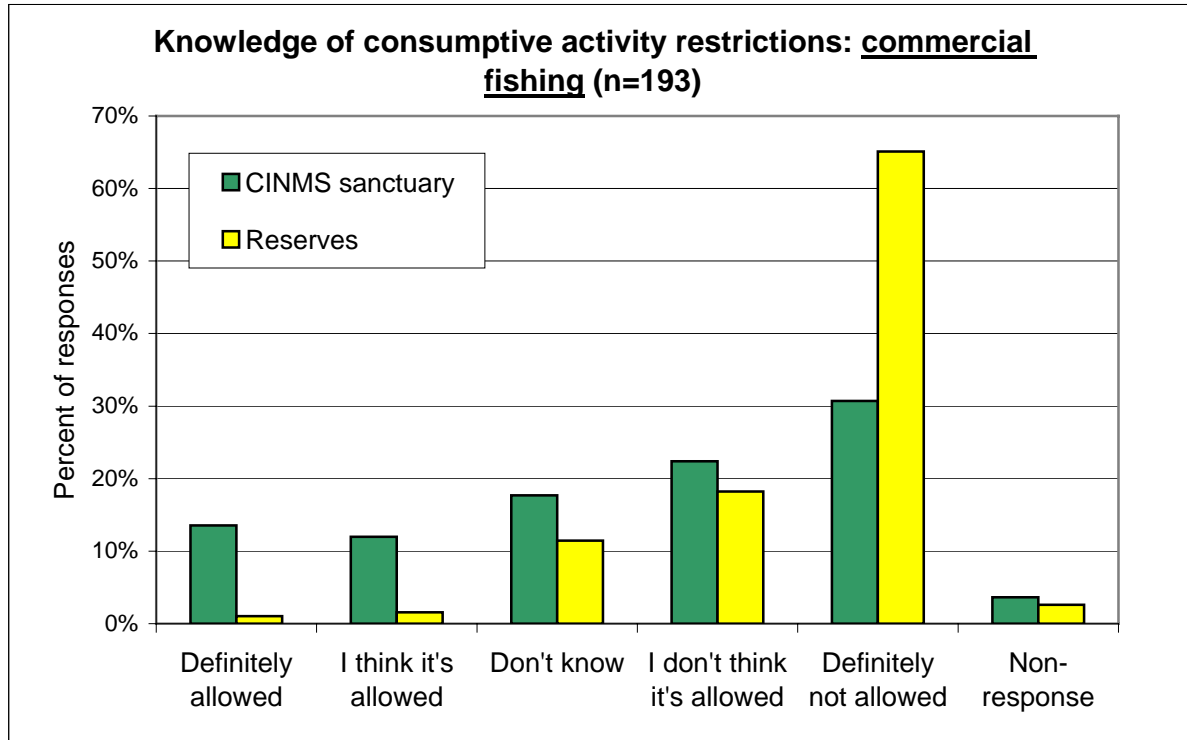
**Figure 13** Knowledge of Recreational Fishing Restrictions



**Knowledge of commercial fishing restrictions:** Twenty-six percent (26%) of respondents indicated, correctly, that commercial fishing is allowed in the CINMS; about 71% either said they did not know or erroneously believed that it is not allowed. Eighty three percent (83%) of respondents correctly indicated that it is prohibited in marine reserves, 11% did not know, and 3% erroneously think it is allowed.

<sup>33</sup> In the survey, short and long term are defined as 0-5 years and 5-10 years, respectively

**Figure 14** Knowledge of commercial fishing restrictions



**Using data to address management: knowledge of regulations:** The enforcement and compliance of CINMS regulations and policy depends on having an educated base of CINMS users. We have chosen to profile two findings for their relevance to CINMS management and policy.

1. Sixty five percent (65%) of boaters are either unsure or have incorrect beliefs about commercial fishing regulations in the CINMS (many believe incorrectly that commercial fishing is banned with in CINMS waters).
2. Twenty seven percent (27%) of boaters are either unsure about recreational fishing inside no-take marine reserves or incorrectly think it is allowed in these zones.

These findings indicate that there is significant scope for educating boaters in both of these areas. Better informed boaters would have a more accurate understanding of the CINMS and its role in sustainably managing marine resources. In terms of commercial fishing regulations, education could show that while the Federal mandate of the agency is protection, that key consumptive uses and economic contributors are indeed not restricted by the CINMS outside no-take marine reserves (of course other agencies regulate commercial fishing inside CINMS waters). That boaters are confused on this issue is not counter-intuitive, given the common definition of word Sanctuary<sup>34</sup> (note definition 4. in

<sup>34</sup> Definition of “sanctuary” from Webster’s New Universal Unabridged Dictionary: [Fr. *Sanctuaire*; LL. *Sanctuarum*, a sacred place, shrine, from L. *sanctus*, sacred.] 1. a holy place; a building or place set aside for worship or a god or gods, 2. a place of refuge or protection: originally fugitives from justice were immune from arrest in churches or other sacred places., 3.refuge or protection; immunity from punishment

the footnote). Perceptions of the CINMS and its capacity to regulate may change if these boaters were to correctly understand that commercial fishing is allowed.

In terms of recreational fishing and no-take marine reserves, some boaters are may be deterred from enjoying consumptive activities in areas where fishing is permitted. Other misinformed boaters may fish and collect sea life illegally inside reserves. A better-informed boater population holds out the prospect for three benefits: (i) reduced burden on enforcement resources, resulting in lower enforcement costs (ii) reduced incidence of consumptive activities in no-take marine reserves, enhancing the likelihood that reserve benefits will be realized and sustained, and (iii) increased fishing and consumptive activities where permitted and thus improve the economic value of recreational fishing within the CINMS (something that would benefit private anglers and also anglers that visit the CINMS on party and charter boats and the captains and owners of these boats).

**General support and opposition to reserves in the CINMS sanctuary:** We analyzed the data to estimate levels of support and opposition to reserves generally, reserves established in 2003 (“in their present locations”), and the possibility of new reserves. The KAP survey spatially divided the Sanctuary into two regions: the area surrounding Anacapa and Santa Cruz Islands, and the area surrounding Santa Rosa, San Miguel, and Santa Barbara Islands. Seventy-one percent (71%) of respondents support reserves in the Channel Islands, 15% are neutral, 3% strongly oppose them, and 3% do not know.

Table 5 below presents attitudes among private boaters intercepted at overnight anchorages. Figures in the table are derived from responses to the following survey questions:

1. Now we would like to find out whether you support or oppose no-take marine reserves in the Channel Islands. Fishing is prohibited within these areas.
2. Generally, how do you feel about the establishment of no-take marine reserves within the Channel Islands National Marine Sanctuary?
3. Do you support or oppose the establishment of marine reserves in the specific locations that they have been established (“present” above)?
4. Would you support or oppose the establishment of **additional** marine reserves in the Channel Islands: a. around Anacapa and Santa Cruz Islands, and b. around Santa Barbara, Santa Rosa, and San Miguel Islands?

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or the law, as by taking refuge in a church, etc., 4. a reservation where animals or birds are sheltered for breeding purposes and may not be hunted or otherwise molested.

**Table 5**

**Support and Opposition to No-take Marine Reserves:  
Percent of responses from intercepted private boaters  
(n=192)**

	<b>Support/opposition scale</b>						
	Strongly support	Support	Neutral	Oppose	Strongly oppose	Don't know	Non-response
Support reserves generally	39%	32%	15%	6%	3%	3%	3%
Support reserves in present locations: Anacapa, SC Is.	37%	31%	26%	7%	3%	7%	3%
Support reserves in present locations: Santa Rosa, San Miguel, Santa Barbara	35%	28%	19%	6%	3%	7%	4%
Support additional reserves: Anacapa, SC Is.	30%	22%	26%	16%	10%	8%	4%
Support additional reserves: Santa Rosa, San Miguel, Santa Barbara	30%	21%	19%	11%	8%	7%	4%

**Using data to address management: attitudes toward reserves:** Opposition to no-take marine reserves is sometimes voiced during stakeholder processes, often by individuals or representatives of groups that perceive that they will be negatively affected. To respond meaningfully, CINMS managers need a comprehensive understanding of reserve attitudes held by the full spectrum of CINMS users. These data contribute to that end by showing the attitudes of private boaters who were intercepted at overnight anchorages on Santa Cruz Island during 2006 and 2007. There is little doubt that the notion of reserves excites emotions in CINMS users, and so it is valuable to understand the nuances of reserve attitudes. Again, these data contribute to our understanding of how boaters feel about reserves, generally, in the places where they have been established, and the prospect of new ones. Overall, data indicate support for reserves in all of these categories, although slightly less when boaters are asked about new reserves, notably in Anacapa and Santa Cruz Island, areas most frequently visited by private boaters.

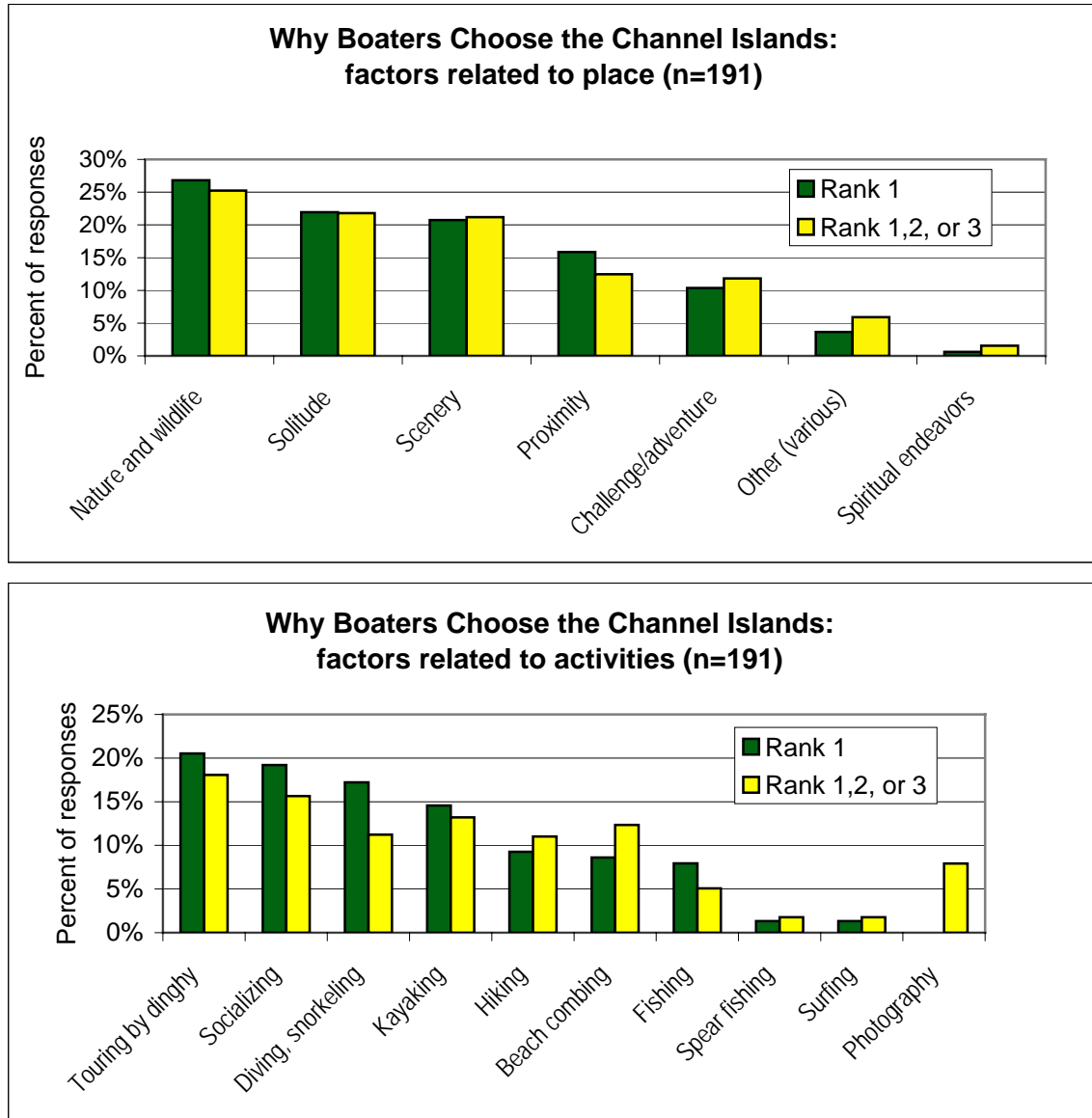
Boaters who responded to attitudes questions also provided data on their anchorage and activity choices, and basic demographic information. Thus, with further analysis we can gain a better understanding of the behaviors and demographic characteristics of boaters who support or oppose reserves. For example, is opposition to reserves most heavily concentrated in boaters who enjoy consumptive activities (as we might intuitively hypothesize)? To what degree and under what circumstances do boaters who enjoy both consumptive and non-consumptive activities support or oppose reserves?



Finally, this survey instrument can be administered to other groups of boaters- to compare attitudes among different groups of CINMS users- and can be replicated to measure attitudinal changes. If attitudinal changes are observed, they can be analyzed against education and outreach efforts, additional management actions, and measures of social learning among CINMS users.

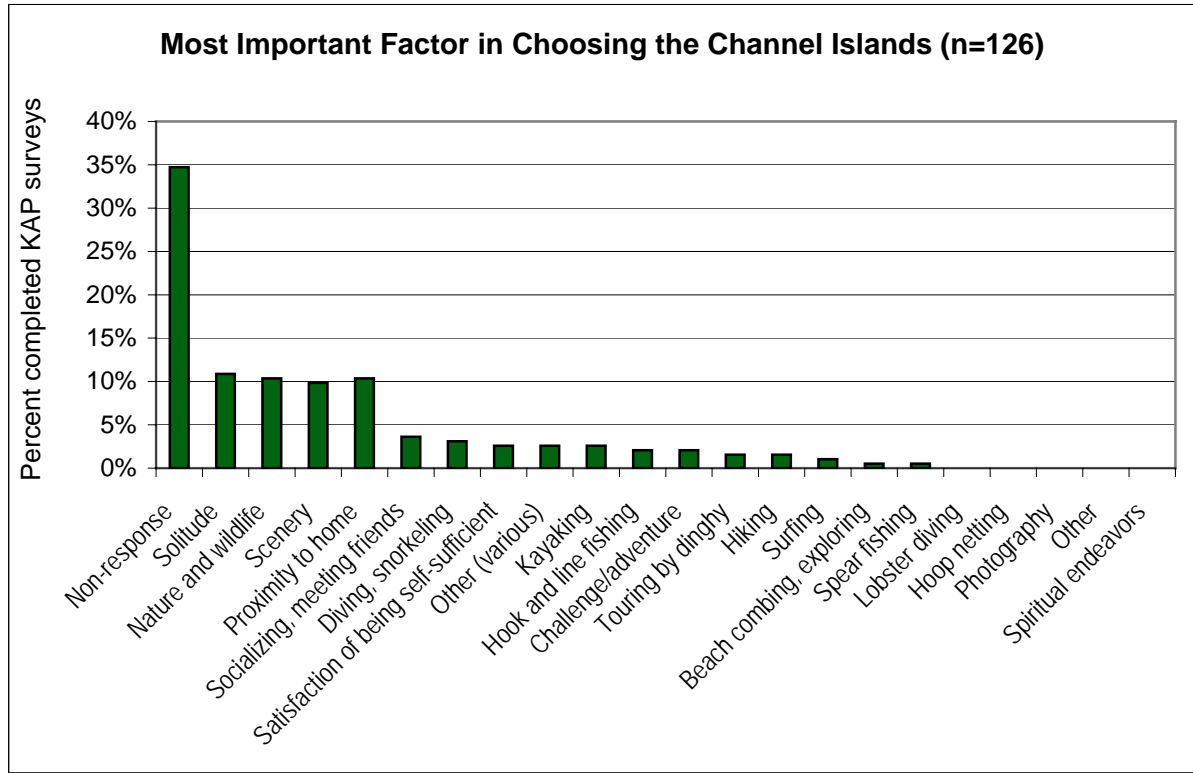
**Factors important in boater decision to visit the Channel Islands:** We analyzed KAP responses to identify and rank factors that are important in the decision to visit the Channel Islands. First, boaters were asked to (i) identify factors that were important in choosing the Channel Islands as a destination, and (ii) separately rank the top three factors in two distinct categories: (a) environmental factors, e.g., nature and wildlife, solitude, and proximity to home, and (b) activity factors, e.g., diving and fishing (Figures below).

**Figure 15** Factors important in choice of Channel Islands as destination



Finally, boaters were asked to identify the single factor that was most important (Figure below). Thirty-five percent of respondents chose not to answer this question (even though they answered the previously described portion of the question). Findings in the figure below are derived from survey question “Finally, out of all the factors that you checked above, which would you say is most important when choosing the Channel Islands as a destination?” Of those that responded, a strong majority chose an environmental factor, as compared to activity factors. That more than one-third did not respond illustrates the apparent reluctance of respondents to select a single factor among multiple factors identified as important by respondents in the first part of the question. Finally, boaters were asked to identify the single most important factor in their choice of the Channel Islands as a boating destination.

**Figure 16** Most important factor in decision to visit the Channel Islands



**Using data to address management- important factors in choosing the Channel Islands:** Despite its remoteness and the difficulty of getting to the Channel Islands, boaters still make the long trek to the CINMS and its anchorages. Understanding the reasons boaters choose to visit the CINMS is important in understanding how management decisions may affect whether boaters continue to choose the Channel Islands as a destination. We asked boaters to choose from a list of possible factors relating to the environment and recreational activities. We also asked boaters to rank these factors. Below, we present summaries of boaters’ choices for primary reasons for choosing to visit the Channel Islands and their top three choices. Factors relating to environment, e.g., nature and wildlife, and non-consumptive activities like dinghy exploration ranked most highly. Moreover, factors relating to environment consistently ranked higher than the group of activity factors.

The results indicate that boaters are drawn to the Channel Islands for their natural qualities – qualities that are the primary management focus of both the CINMS and the National Park. Efforts to safeguard or improve the wildlife, nature, and scenic quality of the Channel Islands will undoubtedly influence how often boaters visit the CINMS in the future. Common lore among the boating community has it that boaters are drawn to the islands because of the physical challenges and seamanship required to get there. Such thinking often is invoked when boaters protest the idea that the CINMS and National Park might install moorings or other infrastructure that would make boating and anchoring “easier.” In fact, we find that “challenge and adventure” was not highly ranked. In contrast, solitude is important in the boaters’ decision, even though the pattern

of anchoring shows that solitude can be found at only certain, less visited, anchorages. While further research is needed to fully understand the effect on boaters of moorings, piers, or other infrastructure, these sorts of management options should not be ruled out *a priori*.

## 5 Implications for Policy and Management

During 2006 and 2007, we studied private boaters in the Channel Islands National Marine Sanctuary (CINMS) and their activities, such as diving, kayaking, fishing, wildlife viewing, and exploring by dinghy. We collected data using four types of surveys: (i) a mailback postcard survey, (ii) a web survey, (iii) an intercept survey, for which we interviewed boaters at the islands, and (iv) a knowledge, attitudes, and perceptions (KAP) survey.

The result is the first baseline database of recreational boaters and their activities in the Channel Islands that is spatially explicit, peer reviewed, and scientifically rigorous. The survey data provide information about boating use patterns and related recreational activities, characteristics of boats and boaters, attitudes and perceptions toward no-take marine reserves, and how much boaters know about the sanctuary and where they acquire their information about it. In addition, expenditure data collected in the web survey provide insights about how much money boaters spend in the local economy and how those expenditures relate to specific areas and features of the CINMS.

The data are important in their own right. Using the data, we can develop a better understanding of who visits the CINMS, what activities they undertake, and what contribution these boaters make to the local economy.

Most importantly, the data form the foundation of future analyses that can be used to estimate the greater net economic value to boaters of the CINMS and its resources. The values, and the boater decisions that give rise to these values, in turn depend on the natural and physical attributes of the CINMS and the Channel Islands National Park. By modeling how these factors affect boater decisions, we can gain insight into the way in which management affects boaters, their spending, and the economic value of boating. Such analysis would enhance the opportunities for CINMS managers and policymakers to include humans in their approach to adaptive management of marine areas, an objective that is clearly aligned with the objective of integrating ecosystem-based management (EBM) principals into state and federal agency operations.

In particular, by using site choice models, we can combine information on boater characteristics and the CINMS's biophysical attributes to model how management decisions influence what types of boaters (sail boaters, power boaters, primarily non-consumptive users or primarily consumptive users) visit the islands, where they choose to anchor, how much they contribute to the local economy, and ultimately how much economic value is generated by boating opportunities in the CINMS. With these data we can begin the process of statistically identifying which attributes are determinants of boater behavior and motivations. These data can also be used to anticipate and address management issues related to crowding, user conflicts, and human impacts to habitats inside and outside of MPAs. These data contribute to an understanding of whether potential improvements in the value of recreational uses in marine areas will be realized as hoped for or anticipated. Ultimately, they contribute to our understanding of

cumulative impacts and tradeoffs among ecosystem services, as described in Halpern *et al.*, 2007.

### **5.1 Current Findings and Future Analyses**

Marine reserves and sanctuary management may affect boaters in a number of ways: boaters may change their anchorage choices, the frequency with which they visit the islands, and the activities they undertake. All of these aspects of boater behavior influence the economic value of boating. Baseline data provide insight into boater decisions, knowledge, perceptions, and attitudes (summarized below). Future analysis will let us expand this analysis further to understand how marine reserves and sanctuary management affect boater choices and thus the economic impacts of these management decisions.

**Where Boaters Go- spatial use and intensity:** Our initial analysis of the data find boater anchoring intensity that is consistent with aerial flyover data obtained over the past nine years. Boater visitation and activities are concentrated in the eastern portion of Santa Cruz Island and Anacapa Island and generally decline from east to west. On the south facing side of Santa Cruz Island, visitation is focused between Bowen Point in the west and San Pedro Point in the east and generally decreases from east to west. On the north side, visitation and activity is generally focused between Fry's Harbor in the west and San Pedro Point. Hotspots of activity occur: (i) in the area between Sandstone point and San Pedro Points, notably at Smuggler's and Yellowbanks anchorages, (ii) the area that encompasses Pelican Bay and Prisoner's Harbor, and (iii) the area surrounding Anacapa Island. Moreover, an assessment of aerial flyover data<sup>35</sup> suggests a spatial concentration of private boating activity, in the period after no-take marine reserve establishment, in the southeastern portion of Santa Cruz Island and the southern portion of Anacapa Island. Our data indicate that Smuggler's, Prisoner's, Yellow Banks, Pelican's, and Frenchy's Cove are the most often visited anchorages; see the previous section for full details, including maps.

Traveling by private boat to the Channel Islands requires, at minimum, crossing 13-25 miles of open ocean and a major shipping lane. Wind speeds are sometimes greater than 20 knots; swells of 4-6 feet are common. Distance from the port of embarkation, seasonal weather patterns, and anchoring ease are likely to play an important role in determining where boaters go. Thus, the general east-west use pattern and concentration of use among a few anchorages is intuitive. Boaters tend to favor anchorages that are closer to their homeport; anchorages that are protected from prevailing winds and ground swells (e.g., are tucked more inside the California Bight) see more boater use.

**Future analysis:** Anchorage choices are likely to also be influenced by the activities undertaken by the boater, ecological characteristics of the marine environment and adjacent island habitat, and characteristics of the boat and boater (including experience). Boaters may also make choices about anchorages based on the proximity of the anchorage to a marine reserve. Our spatial use data can be combined with ecological data, marine data from the PISCO project, weather data, information about boater

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<sup>35</sup> CINMS reference, Special Monitoring Symposium Proceedings, June 2008 (forthcoming)

facilities (e.g. docks and park areas) and boat and boater data to estimate a model that explicitly examines the factors that affect anchorage choices by boaters. In doing so, we can identify the affect of marine reserves on boater anchorage choice, while controlling for other important factors.

**What Boaters Do - participation in consumptive and non-consumptive activities:**

Managers often speak of consumptive and non-consumptive users of marine areas. Our data show that a majority of boaters engage in both consumptive and non-consumptive behaviors. Responses to our postcard survey, which best represent the larger population of sailboats and power boats that frequent overnight anchorages, find that a slight majority of boaters enjoy a combination of both consumptive and non-consumptive activities. The majority of these boaters enjoy “just relaxing” and exploration using a dinghy; about half say they engage in hook and line fishing. The most commonly enjoyed activities, from most to least, include Just relaxing, exploring using a dinghy, hook and line fishing, kayaking, and diving.

There is considerable heterogeneity among boaters and their activities. While the boating community, as a whole, participates in a wide variety of activities, boaters piloting trailerable powerboats overwhelmingly participate in consumptive activities. Approximately 85% of trailerable powerboats in our survey participated in hook and line fishing and/or another consumptive activity, such as spearfishing<sup>36</sup>.

**Future analysis:** The activities that boaters plan to enjoy are likely to be important in the boaters’ decision about where to anchor and how often to visit the Channel Islands. Furthermore, the economic impact (both market impacts like expenditures and non-market economic value) is likely to differ between boaters that participate in different activities. The data collected will allow us to investigate how ecological conditions and management actions affect the activities that boaters undertake and the economic consequences of these changes in behavior.

**How Much Boaters Spend- trip-related expenditures:** Boaters provided detailed information on expenditures that coincide with trips to the Channel Islands taken in private boats. These include the cost of boat fuel, beverages and food, sundries, parking, and fishing bait, fishing tackle, and ice. Other costs of boating, such as the cost of the boat, slip fees, and insurance are fixed in that they are incurred whether or not boat is take to the Channel Islands. We count only costs that are directly incurred because of a trip.

In all cases, fuel, and food/beverages account for the majority of mean trip costs, which total \$253.72. Consumptive boaters spend 28% more (\$318.80 mean trip cost) than non-consumptive boaters (\$249.10 mean trip cost). Fuel costs are disproportionately much higher among consumptive boaters; in fact, if you exclude fuel costs, non-consumptive boaters spend, on average, about \$20 more per trip.

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<sup>36</sup> This finding is based on a relatively small sample size: about 15% of the 741 responses to our mailback postcard survey identified themselves as trailerable powerboat owners.

**Future analysis:** trip-related expenditures provide additional gross revenues for local businesses, which in turn may contribute to business profits and employment. Purchases of sundry items, food, and beverages have pronounced multiplier effects (fuel purchases are known to have small multiplier effects). Expenditure data can be used to estimate the financial impact to local economies, including coastal and harbor communities. In addition to the gross level of expenditures, the types of items and services purchased have important implications that relate to no-take marine reserves. That non-fuel costs are more pronounced with non-consumptive boaters has potentially implications for multiplier effects in coastal communities and reducing the carbon footprints of boaters. By analyzing these data further, we can learn more about the relationship between increases in non-consumptive activity incidence and the two abovementioned benefits: 1) increased average multiplier effect per unit cost (and possible reduction in financial leakage from local economies), and 2) reduced carbon footprint.

**What boaters think - boater knowledge, attitudes, and perceptions (“KAP”):**

Marine reserves can affect boater behavior in a variety of ways depending on the effect that marine reserves have on marine life, terrestrial wildlife, and the potential for conflict between consumptive and non-consumptive activities. Of course, the effect that marine reserves have on boater behavior depends not just on the real impact of marine reserves on fauna and habitat, but on how boaters perceive marine reserves.

Preliminary analysis of KAP data finds that the majority of boaters support no-take marine reserves and choose the Channel Islands as a boating destination primarily because of factors relating to environment and nature, e.g., scenery, wildlife, solitude, natural features. Despite the importance of environmental quality in the boaters’ decisions, many boaters still have an incomplete or incorrect understanding of key Sanctuary and no-take marine reserve regulations.

**Support for Marine Reserves:** Survey data indicate that about 10% of respondents “oppose” or “strongly oppose”<sup>37</sup> reserves either generally or in particular the reserves that were created in 2003. Opposition to the possibility of new reserves was somewhat higher: (i) about 26% “oppose” or “strongly oppose” new reserves in the Santa Cruz Island and Anacapa Island (West Region) and, (ii) about 19% “oppose” or “strongly oppose” new reserves in San Miguel, Santa Rosa, and Santa Barbara Islands (East Region).

**Factors important in selection of Channel Islands:** When asked about factors that are important in their selection of the Channel Islands as a boating destination, boaters selected both activities and factors related to the environment. In terms of activities, boaters most frequently selected non-consumptive activities, including exploring by dinghy, socializing, diving, kayaking, hiking, and beach combing (in that relative order). While about half of boaters said they engage in hook and line fishing, this activity was ranked seventh in the top ten activities. It was factors related to place and proximity,

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<sup>37</sup> Three percent (3%) of respondents chose “strongly oppose” in both cases: 1) considering reserves generally and, 2) in the places where they have been established. The remaining 6-7% chose “oppose”.



however, that took the overall ranking: nature and wildlife, scenery, solitude, and proximity to home were consistently ranked more highly than any activity.

**Boater knowledge of regulations:** The enforcement and compliance of Sanctuary regulations and policy depends on having an educated base of Sanctuary users. Sixty five percent (65%) of boaters are either unsure or have incorrect beliefs about commercial fishing regulations in the Sanctuary (many believe incorrectly that commercial fishing is banned within Sanctuary waters). Twenty five percent (?) of boaters are either unsure about recreational fishing inside no-take marine reserves or incorrectly think it is allowed in these zones.

See final section for discussion of management and policy implications.

## 5.2 Consumptive Uses, Non-Consumptive Uses, and Multiple Uses

At the inception of this study, the focus was exclusively on non-consumptive uses by private boaters. It was realized early on, however, that boaters often mix and combine an array of consumptive and non-consumptive activities when they visit the Channel Islands. Since a goal of the study is to better understand boater motivations, site choices, and values, questions about consumptive activities were added to our surveys, in a limited capacity<sup>38</sup>.

Because about 51% of boaters participate in some form of consumptive use activity in the CINMS, marine reserves are likely to impact boaters in ways that are more subtle than originally envisioned by our proposed scope of work. In the short run, the act of creating marine reserves may not only displace users who come to the CINMS primarily to undertake consumptive activities; other boaters may also be affected negatively. Even boaters that come to the islands primarily to engage in non-consumptive activities may choose to avoid anchorages that lie within marine reserves if they often participate in casual hook and line fishing or other consumptive activities. It may also be the case that marine reserves do not lead boaters to change their decisions about where to anchor, but could change the activities they undertake while at anchorage. Even if boaters do not change anchorage or even the frequency with which they visit the islands, a change in behavior may signal a loss of net (non-market) economic value for these boaters. The converse may also be true. If marine reserves significantly improve the value of non-consumptive activities to boaters, then marine reserves may benefit boaters that enjoy both non-consumptive and consumptive activities.

Given that there is a continuum of uses from purely consumptive to purely non-consumptive, with almost every combination in between, we provide a preliminary look deeper into boater activities by focusing on three aspects of the data from the internet survey. Specifically we:

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<sup>38</sup> This involved several elements: (i) adding consumptive activity questions to surveys and, (ii) allocating survey effort to modes and locations that coincide more closely with boaters that focus on consumptive activities, e.g., trailerable powerboats that launch from ramps in harbors. Nonetheless, collected data provide more complete representation of the owners of slip-stored boats that visit the Channel Islands compared to trailerable power boat owners.

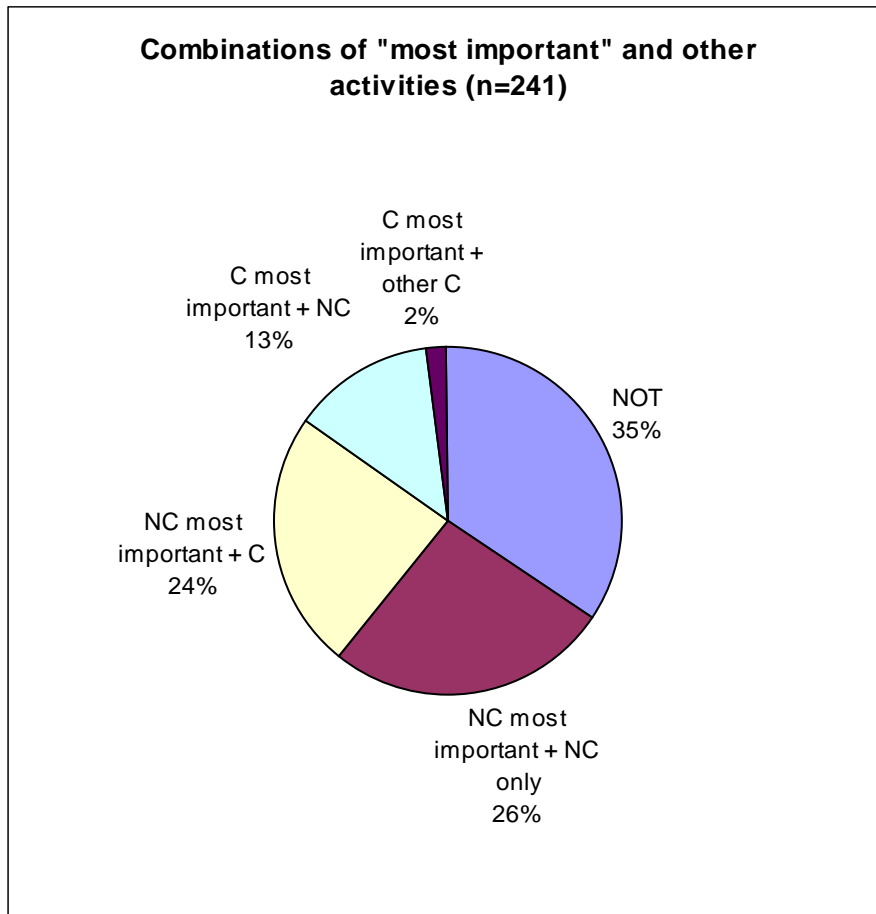
1. Show a breakdown in the sets of activities: non-consumptive only, both consumptive and non-consumptive, and consumptive only
2. Summarize data on the activities that boaters selected as "...most important in determining anchorage selection ...” (most important activity)
3. Summarize the various combinations of most important activity and other activities

**Basic Breakdown- consumptive and non-consumptive activities:** fifty-one percent (51%) of boaters from the web survey sample (n=241) report participating in at least one consumptive activity from their boat, in combination with one or more non-consumptive activities (note: hook and line fishing is significantly more popular than all other consumptive activities). Forty-seven percent (47%) participate in non-consumptive activities only. Two percent (2%) participate in consumptive activities only.

**Activity Importance- determining anchorage choice:** while 51% of boaters participate in one or more consumptive activities, only 16% selected a consumptive activity as being most important to anchorage choice; 49% of boaters selected a non-consumptive activity, 35% did not select a “most important” activity (these boaters selected “non of these” from set of activities offered).

**Combining of “Most Important” with Other Activities:** about half of boaters from the web survey chose a non-consumptive activity as most important, roughly half of whom also participate in at least one consumptive activity. For about 15% of these respondents, a consumptive activity is most important, although most of these boaters also participate in non-consumptive activities. That “none of these” was selected about one-third of the time suggests the relative importance of non-activity factors in anchorage selection, which is consistent with the findings of the KAP survey (recall that factors related to place were consistently ranked highest in the selection of the Channel Islands as a boating destination). See figure below for a summary of the breakdown.

**Figure 17** Combinations of "most important and other activities



Key:

C = consumptive activities

NC = non-consumptive activities

NOT = non of these (from set of activities offered)

Most important = answer to question "of the activities you do from your boat, which one is most important in determining where you anchored on your last trip?"

### 5.3 Using Survey Data to Inform CINMS Management and Policy

Survey data can be used to inform management in a number of ways. First, we are able to create the first baseline ever of the suite and spatial distribution of activities undertaken by boaters in the CINMS, against which we can measure the future impacts of marine reserves. Second, we draw policy implications using the baseline data set (see below). In particular, use of baseline data allow for greater understanding of the relative importance of and motivations for consumptive and non-consumptive activities, which are combined by the majority of boaters during trips to the Channel Islands. Baseline data, furthermore, enhance our ability to study and monitor spatial and/or activity substitution. Finally, by combining ecological, management, weather, and boater data with activity data within a model of boater site choice, we can (in future analyses) learn more about the determinants of activity choice, how the choice of activities affects the economic value of boating, and how management (especially the creation of marine reserves) affects these values.

#### Implications for CINMS management and policy:

1. Activities and anchorage choices of about half (47%) of the boaters who participated in our study are unfettered by reserves. Almost half of the boaters who participated in our surveys do not engage in consumptive activities and, therefore, are not negatively affected (directly) by no-take marine reserves that prohibit take of biotic and abiotic resources.
2. A slight majority of boaters (51%) enjoy at least one consumptive activity, in combination with non-consumptive activities, that varies in degree of importance across a broad spectrum (low to high importance in determining anchorage choice). The resulting heterogeneity indicates that these boaters will be unevenly affected by no-take marine reserves. Most affected are about one-third of this group (16% of all boaters) for whom consumptive activities are their most important activities. Remaining boaters in this category, however, may also be affected, even if their observed anchorage choice does not change. They lose the opportunity to participate in a consumptive activity that they enjoy, but that is not in itself enough of a loss to induce them to modify their selection of anchorages (non-market value decline).
3. Boaters overwhelmingly cite environmental factors and non-consumptive activities as key in their choice to go to the Channel Islands. Even though the majority of boaters participate in one or more consumptive activities (predominantly hook and line fishing), study findings indicate that these activities are not often among primary factors in boater's decision to visit the Channel Islands (again, consumptive activities are highly important to about 16% of web survey boaters). Data indicate that factors related to environment, e.g., nature and wildlife, solitude, and proximity to home, are most important. Even when boaters rank activities alone, non-consumptive forms of recreation consistently rank the highest. For CINMS management and policy, this means that the well-being of CINMS private boaters is directly dependent on maintaining ecological structure and function of habitats in places where boaters visit with the greatest frequency.

4. Baseline data on spatial use patterns indicate that private boating and boater activities are concentrated in several areas in the eastern portion of the CINMS. For management, this means that the direct affects by boaters to the marine environment occur in spatially concentrated areas we define as “hotspots” of activity, e.g., Smugglers, Prisoner’s, and proximity to such anchorages (within a distance of ~2 nautical miles). Likewise, the stationary marine and island resources that boaters interact with and derive benefits from are also a small minority of total CINMS resources. Focusing monitoring and management resources and attention on these places (i.e., “hotspots”) will help ensure that a) the benefits that flow from them to boaters are maintained, and b) boaters will continue to select the CINMS and these places in the CINMS for their trips and activities. This has the benefit of maintaining current patterns of use, values, and associated contribution to local economies. Furthermore, it may reduce the likelihood that boaters choose other, relatively undisturbed areas, at an increasing rate. The undesirable alternative is that environmental degradation of current “hotspots”, perhaps in combination with increases in boater visitation, results in serial degradation by migrating human pressures.
5. The majority of boaters intercepted and surveyed from anchorages on Santa Cruz Island support no-take marine reserves. That fewer than 10% of these boaters oppose reserves, suggests that most boaters will be receptive to information about reserves, including the potential benefits of reserves for them, e.g., resilient ecological structure and function, increased abundance and diversity of marine species, and spill-over of adults targeted by hook and line fisherman from reserves to areas where they can be legally caught.
6. Correcting common misperceptions about commercial and recreational fishing regulations may change the way the CINMS is perceived and thus boater decisions about how often to visit the Channel Islands and where to anchor. About 65% of participating boaters do not understand with certainty that commercial fishing is allowed in the CINMS. Perceptions may change if these boaters were to correctly understand that commercial fishing is allowed. About 25% of participating boaters are unsure or have an incorrect understanding about recreational fishing inside reserves. Conceivably, some boaters are deterred from enjoying consumptive activities in areas where fishing is permitted. Other boaters are likely to fish and collect sea life illegally inside reserves. A better-informed boater population holds out the prospect for three benefits: (i) reduced burden on enforcement resources, resulting in lower enforcement costs (ii) reduced incidence of consumptive activities in no-take marine reserves, enhancing the likelihood that reserve benefits will be realized and sustained, and (iii) increased fishing and consumptive activities where permitted and thus improve the economic value of recreational fishing within the CINMS (something that would benefit private anglers and also anglers that visit the CINMS on party and charter boats and the captains and owners of these boats).

7. Channel Islands trip-related expenditures by private boaters contribute to the local economy. Moreover, a significant portion of these expenditures goes to food, beverages, and sundries, which result in multiplier effects. These data can be used to quantify the local economic benefits and show how maintaining environmental quality in the CINMS contributes to the maintenance of these flows. Thus, it can be shown that effective CINMS management contributes directly to local economic health.

## **6. Data Sharing and Outreach**

### **6.1 Sharing Study Data and Findings**

After publication of this report, all data will be made publicly available, in easy to understand and technical formats, for use by policymakers, managers, academics, and public/private user groups.

Venues for sharing data and findings:

1. National Marine Sanctuary programs, e.g., Advisory Council presentations, Sanctuary publications, Sanctuary-sponsored symposia
2. Study website ([www.oceanstudy.net](http://www.oceanstudy.net) or similar): technical/non-technical reports, data summaries, summary statistics, study updates
3. Talks at various venues
4. Meetings with various user groups, e.g., diver groups

### **6.2 Coordination with Partners**

Data, analytical results, reports, and support of outreach efforts contribute to four distinct efforts:

1. Socioeconomic monitoring and adaptive management of no-take marine reserves established in the Channel Islands in 2003, under a state and federal partnership.
2. Development of a baseline database for the Central Coast Region of the MLPA initiative, used by the DFG
3. The marine reserves process of the MBNMS
4. Acquisition of baseline socioeconomic data and development of associated methods and protocols for the emerging California MPA Monitoring Enterprise

The study coordinator is in regular contact with staff of the CINMS, MBNMS, DFG, and the California MPA Monitoring Enterprise.

### **6.3 Connecting People with Marine Environments**

This study provides the first scientifically robust collection of data on a poorly understood but growing group of California marine sanctuary users: private boaters who mix and combine consumptive and non-consumptive forms of recreation. Information on their activities, economic values, and financial impacts at the county level, which has often been omitted from discourse on the marine environment, can now be used by policymakers and managers and brought into the public debate. The result is that we can account for a fuller range of human-marine environment interactions and begin to foster a sense of shared community and coordination across the array of recreational users who benefit in the long term from effective management and stewardship of marine environments. Furthermore, the study will help connect people to marine environments by raising awareness about the many forms of non-consumptive use and the previously unaccounted and scarcely acknowledged non-market benefits. Adaptive management of MPAs will benefit not only by being informed by the data and analysis, but by support from organized users who have access to scientifically rigorous and topically relevant information.

This study is also fostering a fusion of socioeconomic research and public outreach efforts. Naturalist Corps Volunteers of the CINMS are being trained to serve as socioeconomic survey enumerators and naturalist speakers. During six weekends in 2007, two five-person teams will work aboard the CINMS research vessel *Shearwater*, enumerating surveys using the custom GIS program *Oceanmap* and delivering short talks on various aspects of the Sanctuary for the benefit of boaters who come aboard the *Shearwater* to take the survey. They will also assist the study by administering the boater postcard survey during holiday weekends at fuel docks and launch ramps in Ventura and Santa Barbara Counties. The study is thus providing a venue for development of the CINMS Naturalist Corps and similar programs to develop capacity of citizens to participate in and benefit from socioeconomic research and monitoring.



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## APPENDIX A Trip-related expenditures

Table 1 Codebook	
variable name	variable label
respnum	RespNum
exp_parksb	q29_1_1; parking expenditures in Santa Barbara
exp_parkvta	q29_1_2; parking expenditures in VTA
exp_parkout	q29_1_3; parking expenditures outside SB and VTA
exp_parknum	q29_1_4; number of people in car while parking
exp_fbsb	q29_2_1; food and beverage expenditure in SB
exp_fbvta	q29_2_2; food and beverage expenditure in VTA
exp_fbout	q29_2_3; food and beverage expenditure outside SB and VTA
exp_fbnum	q29_2_4; number of people covered by FB expenditures
exp_sundsb	q29_3_1; sundaries expenditures in SB
exp_sundvta	q29_3_2; sundaries expenditures in VTA
exp_sundout	q29_3_3; sundaries expenditures outside SB and VTA
exp_sundnum	q_29_3_4; number of people covered by sundaries expenditures
exp_fuelsb	q29_5_1; boat fuel expenditures in SB
exp_fuelvta	q29_5_2; boat fuel expenditures in VTA
exp_fuelout	q29_5_3; boat fuel expenditures outside of SB and VTA
exp_airsb	q29_5_3; air tank expenditures in SB
exp_airvta	q29_6_2; air tank expenditures in VTA
exp_airout	q29_6_3; air tank expenditures outside SB and VTA
exp_btisb	q29_7_1; bait, tackle, ice expenditures in SB
exp_btivta	q29_7_2; bait, tackle, ice expenditures in VTA
exp_btiout	q29_7_3; bait, tackle, ice

	expenditures outside SB and VTA
exp_parktot	Sum q29_1*; Total Parking
	Expenditures
exp_parktotpc	Per-Capita Total Parking
	Expenditures
exp_fbtot	Sum q29_2*; Total Food Bev
	Expenditure
exp_fbtotpc	Per Capita Total Food Bev
	Expenditure
exp_sundtot	Per Capita Total Sundaries
	Expenditure
exp_sundtotpc	
exp_fueltot	Sum q29 <sub>[L3]</sub> _4*; Total Fuel
	Expenditures
exp_airtot	Sum q29_4*; Total air
	Expenditures
exp_btivot	Sum q29_4*; Total
	Bait/Tackle/Ice Expenditures
exp_tot	Total Expenditures, All goods,
	All locations
vessel	Vessel Type; 1- Sail, 2- Power,
	3 - Motor Sail
consumpt	Consumptive Use Indicator term.
	=1 if respondent engaged in any
	kind of consump
exp_mean	Total Mean Expenditures
exp_parkmean	Mean Parking Expenditures
exp_sundmean	Mean Sundaries Expenditures
exp_airmean	Mean Air Expenditures
exp_fbmean	Mean Food/Bev Expenditures
exp_fuelmean	Mean Fuel Expenditures
exp_btimean	Mean Bait/Tackle/Ice Expenditures
exp_meanc	Total Mean Expenditures, by consumptive indicator
exp_parkmeanc	Mean Parking Expenditures, by consumptive indicator
exp_sundmeanc	Mean Sundaries Expenditures, by consumptive indicator
exp_airmeanc	Mean Air Expenditures, by consumptive indicator
exp_fbmeanc	Mean Food/Bev Expenditures, by consumptive indicator
exp_fuelmeanc	Mean Fuel Expenditures, by consumptive indicator
exp_btimeanc	Mean Bait/Tackle/Ice Expenditures, by consumptive indicator
exp_meanv	Total Mean Expenditures, by vessel type
exp_parkmeanv	Mean Parking Expenditures, by vessel type
exp_sundmeanv	Mean Sundaries Expenditures, by vessel type
exp_airmeanv	Mean Air Expenditures, by vessel type
exp_fbmeanv	Mean Food/Bev Expenditures, by vessel type
exp_fuelmeanv	Mean Fuel Expenditures, by vessel type
exp_btimeanv	Mean Bait/Tackle/Ice Expenditures, by vessel type

Summary Statistics					
Variable	Obs	Mean	Std. Dev.	Min	Max
respnum	215				
exp_parksb	155	2.006452	9.366628	0	90
exp_parkvta	153	5.071895	41.4491	0	500
exp_parkout	136	0	0	0	0
exp_parknum	172	1.976744	1.302061	0	5
exp_fbsb	149	38.92617	78.51787	0	450
exp_fbvta	161	79.62733	120.4459	0	850
exp_fbout	137	25.94891	78.20141	0	600
exp_fbnum	178	2.758427	1.74118	0	14
exp_sundsb	141	5.468085	13.88141	0	100
exp_sundvta	147	14.76871	30.31955	0	300
exp_sundout	127	4.409449	13.89607	0	100
exp_sundnum	159	2.628931	1.787982	0	14
exp_fuelsb	150	37.94667	91.40175	0	500
exp_fuelvta	157	105.1083	179.482	0	1000
exp_fuelout	131	16.64122	90.96585	0	800
exp_airsb	131	0.732824	5.038047	0	50
exp_airvta	130	1.584615	7.645016	0	60
exp_airout	128	0.507813	3.960426	0	40
exp_btisb	132	2.515152	7.56497	0	50
exp_btivta	151	12.48344	28.19713	0	200
exp_btiout	133	6.225564	35.82673	0	350
exp_parktot	215	5.055814	35.76372	0	500
exp_parktotpc	142	3.134155	15.34924	0	166.6667
exp_fbtot	215	103.1395	158.3864	0	900
exp_fbtotpc	172	49.13734	62.84415	0	420
exp_sundtot	215	16.28837	30.30207	0	300
exp_sundtotpc	148	8.68018	12.76678	0	100
exp_fueltot	215	113.3674	201.3437	0	1300
exp_airtot	215	1.706977	7.683743	0	60
exp_btivot	215	14.16279	45.52053	0	550
exp_tot	215	253.7209	340.1812	0	2470
vessel	209	1.535885	0.612297	1	3
consumpt	191	0.52356	0.500757	0	1

Summaries by Non-Consumptive					
Variable	Obs	Mean	Std. Dev.	Min	Max
exp_parksb	82	2.707317	12.36531	0	90
exp_parkvta	80	1.3125	11.18724	0	100
exp_parkout	76	0	0	0	0
exp_parknum	85	1.976471	1.272198	0	5
exp_fbsb	78	41.85897	81.52806	0	350
exp_fbvta	80	82.8125	132.9804	0	850
exp_fbout	74	35.7973	100.8942	0	600
exp_fbnum	84	2.654762	1.689757	0	14
exp_sundsb	72	4.763889	11.36772	0	50
exp_sundvta	74	16.58108	38.91227	0	300
exp_sundout	67	5.447761	16.3237	0	100
exp_sundnum	78	2.423077	1.79117	0	14
exp_fuelsb	77	20	44.50015	0	200
exp_fuelvta	78	63.01282	148.7792	0	1000
exp_fuelout	70	12.42857	73.33536	0	600
exp_airsb	70	0.714286	5.976143	0	50
exp_airvta	70	0.1	0.542405	0	4
exp_airout	68	0.073529	0.606339	0	5
exp_btisb	69	0.536232	2.570075	0	15
exp_btivta	72	5.416667	24.06139	0	200
exp_btiout	70	0.757143	3.842688	0	25
exp_parkt	91	3.593407	15.57632	0	100
exp_parkt	71	2.041549	8.301317	0	50
exp_fbt	91	137.7912	198.5412	0	900
exp_fbt	82	59.96893	70.71508	0	375
exp_sund	91	21.26374	39.47118	0	300
exp_sund	71	10.83099	16.60115	0	100
exp_fuel	91	80.49451	177.817	0	1300
exp_air	91	0.681319	5.274423	0	50
exp_bt	91	5.274725	24.27027	0	225
exp_tot	91	249.0989	336.118	0	2140

Summaries by Consumptive					
Variable	Obs	Mean	Std. Dev.	Min	Max
exp_parksb	73	1.219178	3.801486	0	20
exp_parkvta	73	9.191781	58.79382	0	500
exp_parkout	60	0	0	0	0
exp_parknum	87	1.977011	1.33797	0	5
exp_fbsb	71	35.70423	75.51866	0	450
exp_fbvta	81	76.48148	107.385	0	700
exp_fbout	63	14.38095	34.30905	0	150
exp_fbnum	94	2.851064	1.789801	0	12
exp_sundsb	69	6.202899	16.14692	0	100
exp_sundvta	73	12.93151	17.94693	0	100
exp_sundout	60	3.25	10.56958	0	50
exp_sundnum	81	2.82716	1.773345	0	12
exp_fuelsb	73	56.87671	120.3772	0	500
exp_fuelvta	79	146.6709	197.622	0	900
exp_fuelout	61	21.47541	108.164	0	800
exp_airsb	61	0.754098	3.731201	0	25
exp_airvta	60	3.316667	11.03537	0	60
exp_airout	60	1	5.734227	0	40
exp_btisb	63	4.68254	10.22462	0	50
exp_btivta	79	18.92405	30.23064	0	200
exp_btiout	63	12.30159	51.42976	0	350
exp_parktot	100	7.6	50.29449	0	500
exp_parktotpc	71	4.226761	20.0806	0	166.6667
exp_fbtot	100	96.36	121.09	0	840
exp_fbtotpc	90	39.26856	53.20186	0	420
exp_sundtot	100	15.67	21.93243	0	100
exp_sundtotpc	77	6.69697	7.287748	0	25
exp_fueltot	100	170.49	226.8942	0	1300
exp_airtot	100	3.05	9.941623	0	60
exp_btisb	100	25.65	60.73795	0	550
exp_tot	100	318.82	357.1249	0	2470

## **APPENDIX B**

### **Postcard survey**

[separate PDF file]