Recreational Carrying Capacity Evaluation of Honolua Bay

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UNIVERSITY OF HAWAI'I AT MĀNOA

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Aloha:

It is our pleasure to announce the availability of the Recreational Carrying Capacity Evaluation of Honolua Bay. The need for a carrying capacity study was identified as a priority project in Hawaii's Local Action Strategy to Address Land-based Pollution Threats To Coral Reefs.

The Land-based Pollution Strategy is one of five strategies developed in Hawaii under an initiative of the U.S. Coral Reef Task Force. The task force identified land-based pollution as one of six priority areas for future work by Federal and State Agencies to protect coral reefs in the U.S. In response to this initiative a committee of federal and state resource agencies developed Hawaii's Local Action Strategy (LAS) to Address Land-Based Pollution Threats to Coral Reefs. The strategy was developed in 2004 in collaboration with key stakeholders and included significant public input.

The action strategy is focused on demonstration projects in three ahupua'a: Honolua, Maui; Kawela to Kapualei, Moloka'i; and Hanalei, Kaua'i. The overall goal of the LAS is to improve coastal water quality and coral ecosystem function and health by reducing land-based pollution. This is being achieved through the implementation of projects that: 1. Reduce pollutant load to surface water and groundwater through site-specific actions and best management practices, 2. Improve our understanding of the links between land-based pollution and coral reef health through focused scientific research and monitoring, and 3. Increase awareness of pollution prevention and control measures statewide.

The Carrying Capacity Evaluation was funded by our watershed partner and land-owner, Maui Land & Pineapple Company. They contracted Tetra Tech EM Inc. to develop the evaluation as part of their commitment to managing Honolua Bay's natural resources.

We hope that this evaluation will improve the management of Honolua Bay and ensure that its unique natural beauty and rich biodiversity will continue to be maintained and enjoyed by future generations.

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EXECUTIVE SUMMARY

Ocean recreational overuse is considered one of the six primary threats to the health of coral reef ecosystems in Hawaii and the U.S. by the U.S. Coral Reef Task Force. Ocean recreation is increasing in Hawaii as a result of population growth and the demand for new products and destinations in a mature tourism market. Hawaii's local action strategies for addressing land-based pollution threats to (EPA et al., 2004) and recreational overuse of (DLNR and HEA 2005) coral reefs identified the need to evaluate the ocean recreational carrying capacity of Honolua Bay and other areas in Hawaii.

Honolua Bay in west Maui is a popular ocean recreational area. Maui Land & Pineapple Company, Inc. (ML&P) contracted Tetra Tech EM Inc. to evaluate the recreational carrying capacity of Honolua Bay as part of their commitment to implement priority actions in *Hawaii's Local Action Strategy*. While the recreational carrying capacity of an area has been defined as the level of use an area can withstand while providing sustained quality recreational experiences; recreational overuse is not only a function of the number of people but also their behavior.

The overall objectives of the study were to quantify current levels of ocean recreational use at Honolua Bay, evaluate the recreational carrying capacity of the area, and recommend capacity management scenarios, as warranted, for sustainable ocean recreation. Key questions addressed in this evaluation include:

- Are current recreational use levels and behavior causing unacceptable environmental and social conditions at Honolua Bay?
- What are the potential driving forces and future trends that should be considered in managing recreational use at Honolua Bay?
- Are capacity management actions needed to minimize current and potential future impacts to the Honolua Bay area?

Recreational use surveys conducted between December 2005 and July 2006 to establish "2006 reference levels" for recreational use at Honolua Bay. These surveys provided data on maximum and average levels of snorkeling, surfing, and other recreational activities, visitor counts from land- and sea-based access points, the number of vehicles parked along the highway to access Honolua Bay, the number of commercial tour boats using the bay, and anecdotal information about visitor satisfaction with the recreational experience. Information and data from the literature and previous studies conducted by other researchers at Honolua Bay were reviewed and used to characterize biophysical conditions and trends, recreational use impacts on coral reefs, and recreational use trends.

Honolua Bay maintains many distinctive features as an ocean recreational area. Few marine areas in Hawaii are characterized by calm, safe conditions for visitors to enjoy snorkeling and SCUBA diving. The bay is already designated as a Marine Life Conservation District and fishing and other extractive activities are prohibited. Land-based access to the bay provides a unique combination of an easy hike through a "wilderness setting" and a safe snorkel. The coastal bluffs surrounding the bay provide outstanding scenic vistas and support native vegetation.

Over 90 percent of the visitors to Honolua Bay area to snorkel or SCUBA dive are non-residents from the mainland U.S. and a few from other countries. Honolua Bay supports both commercial and non-commercial recreational uses that enter the bay by land and sea. The primary recreational activities at Honolua Bay are snorkeling, SCUBA diving, and surfing. Other ocean recreational activities include kayaking and recreational sailboats; however these activities are limited. Land-based recreational activities are limited to picnicking associated with visitors that access the bay for snorkeling. The types and duration of recreational activities at Honolua Bay are highly dependent on weather and sea conditions. Snorkeling and beachgoing activities are predominant during summer. Surfing activities are predominant during winter. Snorkeling and surfing activities are separated spatially and do not appear to pose any recreational use conflicts. Parking and restroom facilities are not present at the site.

Holland and Meyer (2003) quantified habitat utilization patterns for snorklers and diverse and impacts of these activities on the substratum. They concluded that snorkeling and SCUBA diving activity at 2002 levels were sustainable. The number of visitors to Honolua Bay has fluctuated over the last 10 years with 2006 reference levels higher than 2002 levels and lower than 1997 to 1999 levels. Overall, visitors to Honolula Bay are expected to increase in response to increasing visitor arrivals to Maui.

Honolua Bay maintains many distinctive features as an ocean recreational area including a calm embayment for snorkeling within a "wilderness" setting and scenic vistas. While crowding and resource use conflicts are not considered a major concern at this time; recreational use is contributing to some environmental and ecological stress in the Honolua Bay area. In order to preserve these and other significant features, improved area management is needed to minimize recreational use impacts and to proactively address future threats. The absence of area management and not necessarily the overall number of visitors is creating this condition. Key recreational carrying capacity issues at Honolua Bay include the following:

- The number of visitors to the area will likely increase as land-based and sea-based commercial tour operations respond to increased demand for ocean recreational experiences. Under current conditions, this increase could result from intensification of commercial tour operations through potential increased use by large capacity, land-based commercial tour vehicles and number of permits or vessel capacity of commercial tour boat operations.
- Coral breakage due to recreational activities is limited; however, it will continue or increase from snorkeling and SCUBA diving without consistent pre-dive briefings and supervision during a dive from both land-based and sea-based access. Coral cover in parts of the bay is declining and ocean recreational activities should not result in additional stress to coral cover in the bay.
- Mooring buoys, although planned have not been installed. Repeated anchoring by vessels in the bay may degrade the benthic environment including both soft and hard bottom communities. Mooring buoys will need to be sited near but away from coral reef areas to minimize impacts of divers entering the water and the high coral damage rates characteristic of the first 10 minutes of a dive

- Coastal bluffs serve as outstanding scenic vistas and habitat to some native terrestrial vegetation in the area should be set aside as open space and protected
- Health and sanitation problems will continue and likely increase as a result of land-based visitors. A range of low impact solutions can be developed to address these problems from signage to facilities.
- Site conditions pose safety concerns for visitors including roadside parking, absence of emergency communication facilities, challenging egress and ingress to the water, and aggressive reef fish behavior as a result of feeding
- Sediment runoff from rain events will likely continue to impact water quality in the bay. Development of any supporting facilities should adopt low impact design considerations to minimize additional water quality degradation from surface water runoff.

Current levels of recreational use could be sustained with improved area management designed to preserve the areas distinctive features, minimize the impacts of visitors on the marine and terrestrial environment, and address health and safety concerns. Four recreational capacity management scenarios are described for Honolua Bay. Specific management measures defined in each scenario will require action on the part of a range of stakeholders including government, public, and private sectors. These scenarios are as follows:

Scenario 1: Maintain recreational uses at 2006 levels with improved area management
Scenario 2: Maintain recreational uses at 2006 levels with improved area management including a parking area
Scenario 3: Maintain recreational activity at 2006 levels with improved area management including a parking area and other supporting infrastructure
Scenario 4: Revise recreational levels and access from 2006 levels based on long-term ecosystem monitoring

Overview of Key Features of Recreational Capacity Management Scenarios for Honolua Bay

<table>
<tr><td colspan="2"></td><td colspan="2">Provide parking area with capacity limited to 2006 level</td><td colspan="2">Provide parking and additional supporting infrastructure including restrooms, interpretative facility, and cultural center</td></tr>
<tr><td colspan="3">Maintain land-based and sea-based access at 2006 levels</td><td colspan="3">Revise land- or sea-based access</td></tr>
<tr><td colspan="6">Improve signage on site conditions and code of conduct
Provide on-site manager and volunteers during peak use periods</td></tr>
<tr><td colspan="6">Conduct long term ecosystem monitoring</td></tr>
<tr><td colspan="3">Maintain recreation use at 2006 levels</td><td colspan="3">Revise recreation levels based on long term monitoring</td></tr>
<tr><td>Scenario 1</td><td>Scenario 2</td><td>Scenario 3</td><td>Scenario 4</td></tr>
</table>

Scenario 1 is recommended as a necessary first step in managing recreational capacity and impacts at Honolua Bay. Scenario 1 describes a set of largely non-structural actions for improved area management of Honolua Bay. These management actions, which include: maintaining recreational use at 2006 levels through land- and sea-based access controls, providing on-site management, improving education and outreach activities, and establishing a long-term ecosystem monitoring effort, need to be put in place as a foundation for considering scenarios that propose supporting infrastructure. Furthermore, some management actions require coordinated implementation by several responsible entities.

A transparent process for involving local stakeholders should be developed and implemented to identify recreational use issues and concerns and potential solutions as well as to define the values to be protected and management goals for the area. An integrated coastal area management plan is needed to guide the coordinated actions of multiple responsible entities and to set forth a comprehensive and multisectoral set of actions to achieve these goals for both watershed and marine areas. Lastly, information management is a critical component of the sustainable use and management of Honolua Bay. Information and data needs to be consolidated in a geographic information system to enable access to and analysis of all datasets to inform management decision-making.

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1.0 Introduction

Ocean recreational overuse is considered one of the six primary threats to the health of coral reef ecosystems in Hawaii and the U.S. (Hawaii State Department of Land and Natural Resources (DLNR) and Hawaii Ecotourism Society 2005; National Oceanographic and Atmospheric Administration (NOAA) 2002). Ocean recreation is increasing in Hawaii as a result of population growth and the demand for new products and destinations in a mature tourism market. Typical ocean recreational activities in Hawaii include surfing, snorkeling, diving, kayaking, paddling, fishing, and beach activities. Ocean tourism in Hawai‘i is comprised of over 1,000 ocean tourism companies with an annual gross revenues estimated at $700 million per year (Clark and Gulko, 1999). Over 80 percent of Hawaii’s tourists participate in ocean recreational activities generating almost $364 million each year in added value (Cesar and van Beukering 2004). With the growth of ocean recreational industry statewide, conflicts between public and commercial recreational uses of Hawaii’s beaches and ocean resources are also emerging (CSV Consultants 2007).

Honolua Bay in west Maui is a popular ocean recreational area. A study to evaluate the recreational carrying capacity at Honolua Bay was recommended in *Hawaii’s Local Action Strategy to Address Land-Based Pollution Threats* (LAS; EPA *et al*., 2004) to characterize existing ocean recreational uses and management issues. As a contribution to the support of the LAS, Maui Land &Pineapple Company, Inc. (ML&P) contracted Tetra Tech EM Inc. to evaluate the recreational carrying capacity of Honolua Bay.

1.1 Study Objectives

The overall objectives of the study were to quantify current levels of ocean recreational use at Honolua Bay and provide recommendations on sustainable use levels, management actions, and the design of possible infrastructure to support recreational activities. Recreational capacity management scenarios were developed and evaluated based on previous studies as well as new data on recreational use levels. The results of recreational use surveys conducted as part of this study are presented in Appendix A. Survey protocols used to conduct recreational use surveys are provided in Appendix B.

1.2 Study Area

Honolua Bay is located on the northwestern coast of Maui, about 10 miles north of Lahaina along Honoapi‘ilani Highway (Hwy 30) (Figure 1). Mokule‘ia Bay is southwest of and adjacent to Honolua Bay. Honolua Bay, along with adjacent Mokule‘ia Bay, were designated as a Marine Life Conservation District (MLCD) in 1978 (Figure 2). Fishing is illegal inside the MLCD. The MLCD covers an area of 45 acres of coral reef habitat and extends from the highwater mark seaward to a line from ‘Alaelae Point to Kalaepiha Point, then to the point at the northwestern corner of Honolua Bay. The Honolua Bay portion of the MLCD covers an area of approximately 26.5 acres or 107,242 square meters. The rocky beach at Honolua Bay is about a third of an acre, or 1,552 square meters. The bay is also included within the boundaries of the Hawaiian Islands Humpback Whale National Marine Sanctuary, approved by the U.S. Congress in 1997.

Honolua watershed drains into Honolua Bay. The watershed covers the drainage area of Honolua Stream and Papua Gulch a land area of approximately 2,586 acres, of which 272 acres have been cultivated in pineapple since 1953 (Dollar and Grigg 2003).

Figure 1. Location of Honolua Bay and watershed on west Maui

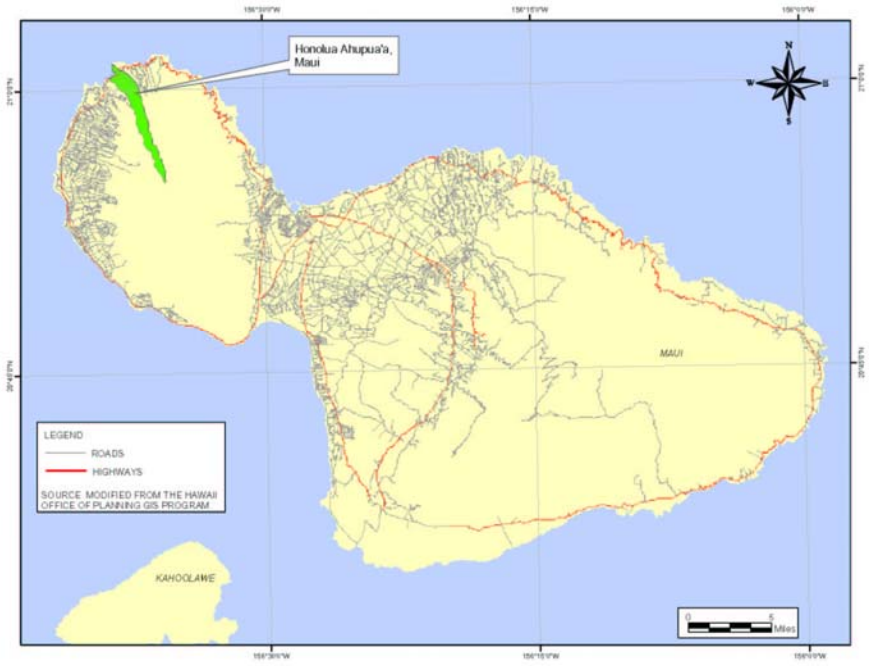
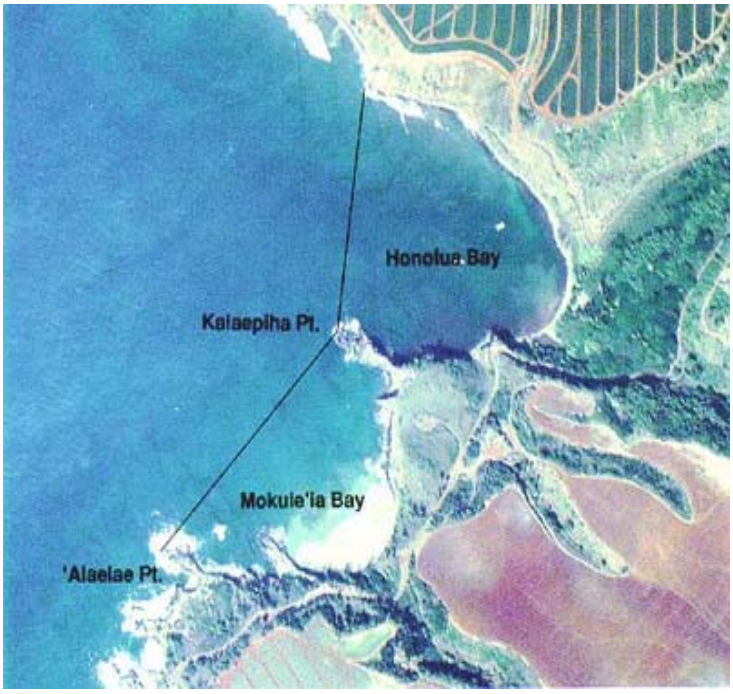


Figure 2. Boundary of Hawaii'i State Marine Life Conservation District for Honolua and Mokule'ia Bays, Maui



2.0 Study Methodology

The evaluation of recreational carrying capacity is based on information and data from previous studies and new data from surveys of recreational use levels at Honolua Bay (Appendix A). The study area is focused on Honolua Bay (Figure 3). The following tasks were performed as part of the study.

Figure 3. Honolua Bay Study Area

2.1 Information and Data Review

Information and data from the literature and previous studies conducted by other researchers at Honolua Bay were reviewed and used to characterize biophysical conditions and trends, recreational use impacts on coral reefs, and recreational use trends.

Previous surveys and methods used in the Honolua Bay area were reviewed to determine trends in recreational use levels (Brown 1999; Holland and Meyer 2002, 2003). These studies establish

1997 to 1999 and 2002 recreational use levels. The relationship between biophysical impacts of snorkeling and SCUBA diving on coral reefs at Honolua Bay and recreational use levels was derived from quantitative studies conducted by Holland and Meyer (2003). In addition, recreational use impacts and management approaches and strategies from other areas in Hawaii and around the world were reviewed to identify potential management actions for Honolua Bay.

2.2 Survey Design and Testing

A visitor use survey protocol was developed and tested to characterize resource use levels at Honolua Bay (Appendix B). The primary focus of the recreational use survey was to quantify:

- Recreational use levels including snorkeling, diving, and surfing
- Number of vehicles parking along the highway to access the bay for snorkeling
- Site management capacity

The Hawaii State Department of Land and Natural Resources (DLNR), Marine Protected Area Coordinator was consulted in the design of the recreational use survey protocol. Survey protocols used in other areas of the State were also reviewed (Komoto 2006). Information on tourist arrivals to Maui and typical weather and sea conditions were used to establish survey dates to capture peak seasons in the periods of December to January, March to April, and June to July. Sampling was conducted during known high use seasons in the winter, spring and summer.

2.3 Survey Implementation

The results of recreational use surveys conducted as part of this study are provided in Appendix A. A total of 16 survey days was completed consisting of three consecutive days, Friday, Saturday, and Sunday between December 2005 and July 2006 (see Appendix A and B). Surveys were conducted between 1000 and 1600 hours each day. Surveys planned during March 24 to 26 could not be completed due to extreme rain conditions during that time. Surveys for this 3-day period were completed for March 24th only. A two-person team conducted the surveys from two different vantage points. The survey at the cliff vantage point counted surfers and served as a backup counter for other recreational activities. This person was also responsible for counting parked vehicles. The beach vantage point counted snorkelers, beachgoers and recorded the total number of daily visitors from land. During summer months, a third person was added to the team to handle the high land-based visitor traffic to the bay and to radio boats entering and anchoring in the bay to determine their passenger count. Counts of snorkelers in summer surveys were sometimes obscured by commercial tour boats.

2.4 Recreational Carrying Capacity Evaluation

The recreational carrying capacity of Honolua Bay was evaluated based on published studies and research and new surveys conducted to characterize existing recreational use levels. The evaluation considers both the overall numbers of recreational users and their behavior combined with management actions that if implemented could minimize these impacts without altering the overall number of users. The key questions addressed in this evaluation include:

- Are current recreational use levels and behavior causing unacceptable environmental and social conditions at Honolua Bay?
- What are the potential driving forces and future trends that should be considered in managing recreational use at Honolua Bay?
- Are capacity management actions are needed to minimize current and potential future impacts to the Honolua Bay area?

Surveys conducted as part of this study (Appendix A) were used to establish 2006 reference levels for recreational use of Honolua Bay. Resource conditions and impacts of recreational users on the marine environment were summarized from previous research and studies conducted at Honolua Bay. Capacity management scenarios were developed based on a review of actions taken in Hawaii and other parts of the world. For each scenario, management actions are defined for key area features including: recreational use levels, ecosystem components, and access and facilities.

2.6 Study Limitations

This study was focused on recreational use of Honolua Bay. Recreational use surveys and the carrying capacity evaluation was characterized by a number of limitations. These limitations include the following:

- Recreational use surveys were conducted during discrete time periods and may not have characterized all recreational uses in the area. Two survey days planned for March 2006 surveys were cancelled due to extreme rain events. As a result, the number of visitors and commercial tour boats surveyed during the winter period may have been lower than would be expected.
- Surveys of parked vehicles were focused on areas that were used by snorkelers accessing the bay from land. Parking areas used by surfers at Lipoa Point were not surveyed.
- Surveys were conducted from two land-based vantage points. The number of visitors from commercial tour boats was based on radio contact with tour boat operators.
- The scope of this study did not include community outreach or stakeholder consultations that would be needed to identify and validate resource values to be protected and management goals for the Honolua Bay area.
- The quantification of impacts of snorkeling and SCUBA diving on the condition of the coral reef was based on studies conducted at Honolua Bay by Holland and Meyer in 2003. The scope of this study did not include a reassessment of these impacts in 2006 nor a determination of the occurrence of cumulative impacts. Major assumption in the present evaluation of carrying capacity is that the study conducted by Holland and Meyer (2003) defined sustainable snorkeling and SCUBA diving at use levels and coral reef substratum contact rates.
- The contribution of other stressors on the condition of Honolua Bay was not part of this study.

3.0 Review of Ocean Recreational Use Impacts and Capacity Management

Ocean recreation is one of many types of human activities in the coastal zone. Like any human activity, recreational use must be managed to preserve the benefits derived by society from the use of natural resources. This section provides a brief overview of the impacts of ocean recreation and strategies to manage recreational use. This review is intended to provide examples from other recreational areas in Hawaii and elsewhere that may be applicable to Honolua Bay and is not intended to be a comprehensive accounting of all studies.

3.1 Impacts of Ocean Recreation on Coral Reef Ecosystems

Coral reefs around the world attract tourists for snorkeling and diving. Historically, ocean tourism has been considered a low impact activity compared to fishing or other ocean extractive activities. Many studies have provided evidence; however, that ocean recreation can result in a number of impacts to the marine environment. Impacts of ocean recreation on coral reef ecosystems include:

- Coral skeletal and tissue damage from snorkeling, SCUBA diving, and anchoring
- Behavior modification of marine life from human presence or harassment such as fish feeding or disturbing threatened and endangered species.
- Water pollution from improper waste disposal and bilge water discharges from boats
- Spread of invasive marine species from boat hulls, bilge water, and diving gear

Ocean recreation can result in additional stress to the already comprised health of many coral reef ecosystems degraded from a variety of other stressors, including land-based pollution, overfishing, marine invasive species, and global climate change.

3.1.1 Coral damage

Ocean recreation can cause coral skeletal and tissue damage from snorkeling, SCUBA diving, and anchoring. Coral reefs at Eilat, northern Red Sea, are among the most heavily used in the world for recreational diving, with greater than 250,000 dives per year along only 12 km of coastline. Diver contact rates ranged from 3.6 to 5.5 contacts per 10 minutes depending on the topography. The highest average contact rate, 5.5 contacts per 10 minutes, or extrapolated to 33 contacts per hour, was measured on patch reefs. The percent of branching corals damaged as a result of SCUBA divers varied from 15 percent to 80 percent at various dive sites. Zakai and Chadwick-Furman (2002) attributed the exceptionally high proportion of diver-damaged corals on some reefs at Eilat in the Red Sea not necessarily to the number of divers but to the diver skills and in some cases marine ecosystem status. Most of the dives involved training new uncertified divers. Many certified divers exhibited poor buoyancy skills. Lastly, the dive sites investigated were small patch reefs or fringing reefs which effectively concentrated diving activity increasing cumulative impacts.

The impact of SCUBA diving and snorkeling on substrates was surveyed in Hawaii Marine Life Conservation Districts (MLCD) at Honolua-Mokuleia, Kealakekua Bay, Manele-Hulopoe, and Pupukea by Holland and Meyer (2003). Divers were followed and observed to record the number of contacts with different substrate types and the impact of those contacts. Snorkeling, the dominant activity at all sites, had significantly less interaction with the substrate on average than SCUBA diving. The most intensively used area of Honolua Bay was a 6,800 sq. m area of reef on the north side of the bay that represented 14 percent of the total reef area within Honolua Bay (Figure 4). The majority of substrate contacts, 73 percent, were clustered along the boulder shoreline where snorkelers entered and exited the water. The average substrate contacts by snorkelers and SCUBA divers combined was 6.1 contacts per dive and 3.1 contacts per hour (Table 1). Contact with live coral was 12.9 percent of the total contacts. Over half of the 1,340 total substrate contacts observed in the study were made by only 16 percent of the individuals followed.

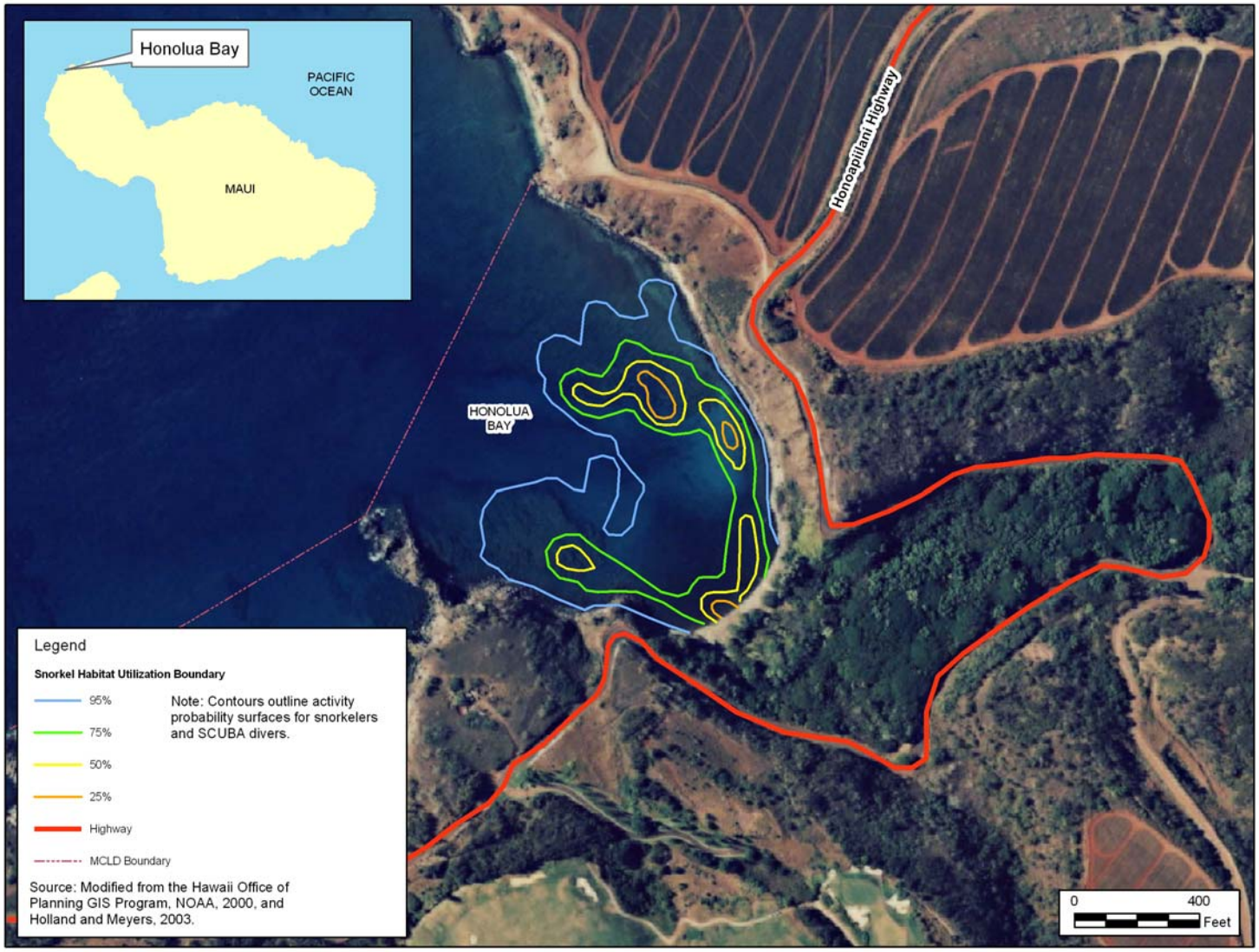
The behavior of individual snorkelers and SCUBA divers was considered an important factor in determining the overall impact of recreational activities on living coral reef cover (Holland and Meyer 2003). Underwater photographers supported the highest substrate contact rates both unintentionally and intentionally. As noted by Holland and Meyer (2003) and this study, snorkelers stand on corals unaware that it is a living organism that can be damaged or because they are tired or inexperienced. Most coral damage was identified as unintentional; however, in several cases, deliberate damage was observed.

Holland and Meyer (2003) concluded that snorkeling and SCUBA diving at Honolua Bay were sustainable. Substrate contact and coral damage rates observed were low, 0.7 percent of all substrate contacts, compared to studies from other geographic regions and considering the relatively high annual visitors (up to 100,000) to MLCDs in Hawaii. Snorkeling, the dominant activity at all sites had significantly less interaction with the substrate on average than SCUBA divers. While benthic assemblages at Honolua Bay contained relatively fragile coral species, these corals grew at deeper depths, not influenced by snorkeling activities. Holland and Meyer (2003) concluded; however, that a significant increase in number of SCUBA divers visiting Honolua Bay should be avoided because of the likelihood in increasing damage to susceptible coral species during dive activities.

Table 1. Comparison of Substrate Contact Rates in MPAs in Hawaii (Holland and Meyer2003b)

Location	Mean Total Contacts per Dive	Mean Total Contacts Per Hour
Honolua-Mokuleʻia Bay	6.1	3.1
Kealakekua Bay	12.2	5.6
Manele-Hulopoe Bay	15.2	4.5
Pupukea	14.8	8.3

Figure 4. Distribution of snorkelers and SCUBA divers at Honolua Bay (from Holland and Meyers 2003)



Diver carrying capacity is usually expressed as a maximum number of divers per site per year that a site can sustainably support without being degraded (Jameson 1999). Salm (1986) introduced the concept of diver carrying capacity. Estimates of the maximum annual number of SCUBA divers that can be sustained at a dive site without damaging corals vary by an order of magnitude from 500 (Chadwick-Furman 1996) to 4,000 to 6,000 (Dixon et al., 1994; Hawkins and Roberts, 1997; Hawkins et al., 1999, Zakai and Chadwick-Furman 2002). In selected areas the number of SCUBA divers could be as many as 10,000 to 15,000 per year (Hawkins and Roberts 1992). Hawkins and Roberts (1997) suggest 5,000 to 6,000 dives per site per year as a good rule of thumb in the absence of site specific data. The large range in the number of divers per year that can be sustainably accommodated is related to a number of factors including site characteristics, coral type and species, and the behavior of individual divers (Medio et al. 1997; Rouphael and Inglis 1997, 2001; Jordan and Samways 2001).

Hawaii's Marine Life Conservation Districts (MLCD) serve as magnets for visitors seeking a relatively safe ocean experience. Holland and Meyer (2003) estimated the total annual number of snorkelers and SCUBA divers at five MLCDs in Hawaii (Table 2). The two MLCDs with higher total number of dives were Hanauma and Kealakekua Bays, with 818,140 and 104,760 dives respectively. These numbers include both SCUBA divers and snorkelers. An estimated 2,000 SCUBA divers and 84,000 snorkelers visit the Honolua-Mokule'ia MLCD per year. This estimate is within the range of carrying capacity estimates for SCUBA divers reported from sites outside of Hawaii.

Table 2. Annual Number of SCUBA and Snorkel Dives in Hawaiian Marine Protected Areas (from Holland and Meyer 2003a)

Dive Site	Dives Per Year		Total Annual Dives	Dives Per Day	MLCD Area in Acres (DAR)	Dives/Acre per Day
	SCUBA	Snorkel				
Hanauma Bay MLCD, Oahu	-	818,140	818,140	2,241	101	22.2
Kealakekua MLCD, Big Island	1,440	103,320	104,760	287	315	0.9
Honolua-Mokule'ia MLCD, Maui	2,045	83,880	85,925	239	45	5.3
Pupukea MLCD, Oahu	22,493	47,721	70,214	192	NA	NA
Manele-Hulopoe MLCD, Lanai	1,740	28,216	29,956	82	309	0.3

3.1.2 Marine Life Behavior Modification

Ocean recreational use may impact not only the condition of the marine environment but also the behavior of marine life. Human presence may disrupt use patterns of marine life such as resting areas for spinner dolphins or nesting sites for sea turtles. Fish feeding is one of the most common activities known to result in changes in marine life behavior.

Several studies have shown fish feeding to produce negative changes in behavior. Feeding has been shown to produce changes in fish behavior (Orams 2001) including: aggression towards humans, changes in foraging patterns and home range, reproductive activity, population density, migration patterns, and species composition due to an increase in the larger, more aggressive species.

Fish abundance was significantly lower at high-use sites in Kaneohe Bay, Oahu (Rodgers and Cox 2003). SCUBA diving in Bonaire; however, did not result in significant changes in reef fish communities (Hawkins et al. 1999).

3.1.3 Water Pollution and Marine Invasive Species

Coral reefs are extremely vulnerable to pollution from both sea-based and land-based sources of pollutants. Land-based sources of pollutants, such as sediment, nutrients, and other pollutants, are one of several factors threatening the quality of coral reef ecosystems in Hawai`i. These pollutants are transported in surface water runoff and by groundwater seepage into coastal waters. Recreational and commercial tour boats may discharge human waste and gray-water to the nearshore marine environment. Marine pollutants discharged from vessels transiting offshore may be carried to nearshore marine environments. Chemical agents in sunscreen have been shown to bioaccumulate in the fish found in lakes in Germany characterized by high recreational use (Daughton and Ternes 1999). Sunscreen products may also modify a variety of biogeochemical cycling in seawater and increase virus abundance in marine bacterioplankton (Danovaro and Corinaldesi 2003).

Ballast water and fouling organisms from commercial and recreational vessels are a primary pathway for the spread of marine invasive species. Over 19 species of macroalgae have been intentionally or passively introduced into Hawaii's waters since the mid-1950s (Doty 1961, Brostoff 1989, Rodgers and Cox 1999, Russell 1987, 1992, Woo 1999, Smith et al. 2002). Five of these species have become ecologically dominant in some areas and have spread to other areas around the Hawaiian Islands outcompeting native benthic species (Smith et al. 2002). Once established, these species can spread reproductively or by breakage and reestablishment in other areas.

3.2 Social and Cultural Dimensions of Ocean Recreation

Humans interact with the environment in a number of different ways. An understanding of the nature and extent of those interactions and the forces that drive and shape them is becoming more widely recognized as an essential component in ecosystem approaches to management where humans are considered part of the ecosystem. Cordell et al (1999) identified four factors that characterize human use of the natural environment:

- ***Interactions:*** the activities that humans engage in have direct or indirect impacts on natural systems
- ***Demands:*** the forces that generate the activities that humans engage in
- ***Values:*** the significance, meaning, or priority attached by individuals or cultures to material or nonmaterial matters that form the basis for human thoughts, behaviors, and cultures
- ***Perceptions:*** what people believe or know based on experience but also culture, education, and communications. Perceptions in turn may influence attitudes and behavior

These factors can be viewed from the context of ocean recreation and the behavior of visitors to a marine protected area. Interactions between humans and the marine environment, such as through snorkeling and SCUBA diving, may result in direct and indirect impacts to the coral reef ecosystem. Increased demand for ocean recreational experiences can lead to intensification of recreational activities in a given area or expansion to pristine areas. Visitors to an area may come from different countries and cultures bringing a wide range of values about the care and protection of the ocean. Finally, visitor perceptions of the nature and quality of an ocean recreational experience is dependent on previous experiences, knowledge, and the expectations of new or repeat recreational experiences that ultimately influence visitor satisfaction.

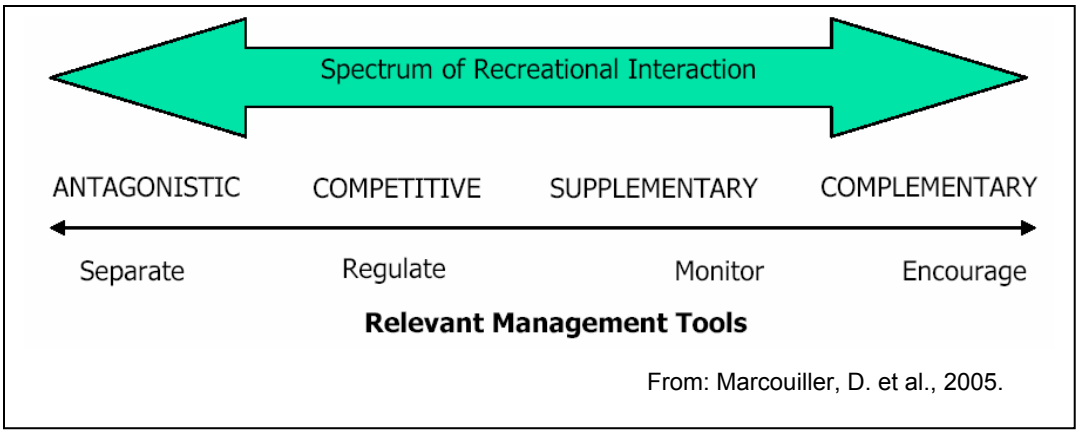
The social and cultural dimensions of recreational use provide a key challenge in defining the recreational carrying capacity of an area. Social carrying capacity has been defined as the number and distribution of visitors that provide minimal acceptable recreational experiences (Lankford et al. 2005). The social carrying capacity of a recreational area can be exceeded as reflected in decreased visitor satisfaction with a recreational experience and increased resource use conflicts. Crowding, resource use conflicts between commercial and public users as well as tourist and local users, and other social and cultural dimensions must be considered in the management of coastal areas used for ocean recreation. Relatively few studies; however, have focused on these social and cultural dimensions.

The demand for calm embayments for snorkelers on Oahu led to crowding and resource degradation at Hanauma Bay. Overwhelmed by commercial diving and snorkeling tours, as well as increasing numbers of visitors which peaked at around 15,000 per day, the City and County of Honolulu took action to reduce visitation, improve facilities, ban fish feeding, and educate users on appropriate behavior. The social carrying capacity of Hanauma Bay characterized by Lankford et al. (2005) provided a basis for restricting access to the area. One conclusion from this study was that the social carrying capacity was exceeded when more than 3,200 people per day used the bay.

Indo-Pacific surf designations have experienced crowding and other social-cultural impacts with the unrestricted access and low cost of these tourist destinations (Buckley 2002). The promotion of tourism as an economic opportunity in developing countries provides both positive and negative social and environmental benefits. Surf tourism in Indonesia's Mentawai Islands has exceeded surf break carrying capacity as indicated by conflicts between different commercial operators as well as conflicts between their clients. Buckley defined the recreational capacity of surfing in this area as the minimum number of surfable breaks under the least favorable common

weather conditions. Based on an inventory and ranking of surf breaks in the area, Buckley established that the recreational capacity of all the islands is about 10 boatloads of 10 surfers each day could be accommodated on these breaks. Crowding effects were evident beyond this level.

Interactions between user groups can elicit a spectrum of social interactions including complementary, supplementary, competitive, and antagonistic behavoir (van Kooten 1993). Marcouiller et al. (2005) developed a framework for evaluating resource use conflicts and outcomes in order to identify relevant management strategies.



3.3 Capacity Management Approaches and Strategies

Recreational overuse is not only a function of the number of recreational users but also their behavior. For this reason, capacity management approaches and strategies need to address not only the number of visitors but also their interactions with the environment and each other. A considerable body of literature on planning and managing visitor use of recreational areas has accumulated over the last 30 years. Most of the concepts and approaches have been developed and tested in national forests and wilderness areas with some applications to marine protected areas. A number of strategies and best practices have been used in Hawaii and other parts of the world to manage the growing ocean recreation industry, minimize impacts, and address the interests of the public. Hawaii's approach to managing ocean recreation includes strategies to reduce the level of use at specific sites through access restrictions or relocating activities and strategies to reduce impacts of use through regulations or education to modify human behavior (DLNR and HEA 2005). In this section, key concepts and planning frameworks that have been developed to manage visitor use in recreational areas are summarized along with specific strategies that have been used to reduce human use, minimize impacts, and address over commercialization in recreational areas.

3.3.1 Recreational Carrying Capacity

The term "carrying capacity" was originally used in an ecological context to describe the number of organisms the resources of a given area can support over a given time period. This term has been adapted for use in recreational management as the number of people who can use a given

area without an unacceptable alteration of the physical environment where unacceptable alteration would consider both ecological and social aspects (Brysek and Flumerfelt 2004). Wagar (1964) recognized that the number of people visiting a park could affect not only the ecology but also quality of the visitor experience. He defined recreational carrying capacity as the level of use an area can withstand while providing sustained quality recreational experiences. Recreational carrying capacity is generally considered to include at least two components, the biophysical component concerning impacts of visitors upon the resource, and the social component dealing with the type and quality of experience visitors received during their visit (McCool 1996) and can be further characterized into four types:

- **Ecological carrying capacity** has been defined as the maximum level of recreational use that can be supported before an unacceptable or irreversible impact in ecological value occurs (Pigam 1983)
- **Social carrying capacity** has been defined as the number and distribution of visitors that provide minimal acceptable recreation experiences (Shelby and Heberlein 1986).
- **Facility carrying capacity** refers to the types and amounts of facilities intended to support visitors such as parking lots and boat ramps (Shelby and Heberlein 1986).
- **Physical carrying capacity** refers to the number of "use units" (people, vehicles, boats) that can be accommodated within the physical dimensions of a given area (Sowman 1987)

Overall, defining the recreational carrying capacity of an area is focused on answering the question, "How many is too many? Attempts to define the carrying capacity of an area are constrained by the complexity of the management objectives and difficulty in assigning a single number to characterize the carrying capacity of an area. In most instances, recreational overuse is not only a function of the number of people but also their behavior. Recognizing the limitations of carrying capacity for defining limits on recreational use has led to the development of alternative approaches to plan and manage recreational use.

3.3.2 Limits of Acceptable Change

The Limits of Acceptable Change (LAC) process addresses recreational use questions by focusing on identifying and protecting the values for which an area is established (McCool 1996). The LAC planning system addresses a significantly different question than defining the carrying capacity: "What resource and social conditions are appropriate (or acceptable), and how do we attain those conditions?" The LAC planning system includes the following four components implemented through a nine step process.

- Specification of acceptable and achievable resource and social conditions, defined by a series of measurable parameters
- Analysis of the relationship between existing conditions and those judged acceptable
- Identification of management actions necessary to achieve those conditions
- Monitoring and evaluation of management effectiveness.

3.3.3 Other Approaches

Since the inception of the LAC process, land area managers and planners have tested, adapted, and refined the process. The Department of the Interior's National Park Service (DOI-NPS) Visitor Experience Resource Protection (VERP) framework (DOI-NPS 197) is one adaptation of the LAC process (US DOI-NPS 1997). Nine elements are integral to the VERP framework intended to prove a logic and rationale for making decisions on carrying capacity issues. These nine elements include:

- Assemble an interdisciplinary team
- Develop a public involvement strategy
- Develop statements of park purpose, significance, and primary interpretive themes, identify planning constraints
- Analyze park resources and existing visitor use
- Describe potential range of visitor experience and resource conditions
- Allocate potential zones to specific locations in the park
- Develop a monitoring plan with specific indicators and standards for each zone
- Monitor resource and social indicators
- Take management action

The VERP framework has been applied in national parks throughout the U.S. and has provided a theoretically sound and rational process for determining and managing carrying capacity in national parks and related areas (Manning 2002).

The Recreational Opportunity Spectrum (ROS) is a planning and management framework used by the U.S. Forest Service to inventory and describe recreational opportunities in a variety of settings. The ROS emphasizes that the quality of outdoor recreation can be best achieved by providing a diversity of recreational opportunities to satisfy a range of visitor preferences. The ROS framework involves the following steps:

- Define setting characteristics for each setting or class which requires an understanding of the influence of setting characteristics on visitor experience
- Define appropriate activities for each setting based on an understanding of the relationships between activities and impacts
- Define visitor experience objectives which requires an understanding of visitor expectations
- Develop management plans to reflect and preserve the opportunities

The ROS approach to visitor management has been used by the Great Barrier Reef Marine Park Authority (1999) to manage a range of recreational settings defined as developed, high use, moderate use, natural, and protected.

The Tourism Optimization Management Model (TOMM) is similar to the LAC process. The TOMM was designed; however, to work more at a regional level over multiple public and private land tenures as well as commercial operators. TOMM is comprised of three components:

- Contextual analysis is a characterization of current policies and emerging issues including community values, product characteristics, growth patterns, market trends and opportunities, and identifying alternative scenarios for tourism
- Monitoring program provides the basis for identifying and monitoring optimum conditions through a series of indicators and acceptable ranges
- Management response refers to the actions taken based on the results of monitoring

These approaches are used to provide a framework to involved stakeholders in identifying management goals and opportunities and developing strategies and actions to manage recreational use.

3.4.1 Strategies to Reduce Visitor Use

Land-based and sea-based access and capacity restrictions are strategies used to limit the number of visitors to an area. Strategies used to reduce visitor use in Hawaii are summarized *Hawaii's Local Action Strategy to Address Recreational Impacts Reefs* (Table 3). These and other examples are described in this section.

Table 3. Current and Past Strategies Used to Management Non-Extractive Activities in Hawaii (DLNR and HEA 2005)

Reduce Human Use

- **Restrict Access**
  - Determine appropriate commercial activities for sites and establish specified days and times for these regulated activities
  - Designate some sites as no access for any vessels
  - Install a limited number of moorings within no-anchoring zones
  - Regulate parking (when stalls are all full, no cars allowed in)
  - Limit or restrict the access to an area by tour busses or vans
  - Close to all users one day/week or other periods of time
  - Charge user fees
- **Relocate use**
  - Establish additional sites or zone via Ocean Recreational Management Areas
  - Work with the visitor industry to market other options
  - Rotate the use of moorings

Reduce Impact of Human Use

- **Regulations**
  - Issue permits to all commercial operations (including companies renting vessels to individuals)
  - Define allowable activities and behaviors and regulation for enforcement
  - Restrict fish feeding
  - Set aside no anchoring zones and establish a system of moorings
- ***Education***
  - Require all first time visitors to a site to go through a visitor orientation
  - Establish interpretive programs and work with the commercial operators to train their guides
  - Develop volunteer interpretive programs at popular sites
  - Develop on-site signage
  - Develop off-site signage and interpretive displays in hotels, aquariums, and other venues
  - Conduct Public Service Announcements and airline videos on sustainable recreation behavior
  - Establish reef education websites

By the mid to late 1980's, Hanauma Bay on the island of Oahu, Hawaii was experiencing extremely high levels of human use averaging about 2 million visitors per year with a peak of over 3.5 million visitors in 1984. Primary impacts to the marine ecosystem included fish feeding, coral breakage, and structural change of the reef through the installation of a submarine cable (Cesar et al., 2002). In recognition of the unrestrained use of the Hanauma Bay Nature Preserve and rapid deterioration of the resource, the City and County of Honolulu, Department of Parks and Recreation, amended the rules and regulations limiting the number of visitors to 2,000 at any one time, closing the Preserve for one day a week, restricting commercial vehicle access, and other visitor use controls (Table 4).

Table 4. Summary Excerpts of City and County of Honolulu Amended Rules and Regulations Relating to Visitor Use Levels and Controls at Hanauma Bay Nature Preserve (C&C Honolulu 1998)

Penalties (Part II, Section 4)

Convicted violators of these rules may be subjected to a fine of up to five hundred dollars ($500.00), or by imprisonment for up to thirty days, or by both fine and imprisonment, for each violation.

Temporal Restriction on Use (Part II, Section 5)

- Except holidays, Hanauma Bay Nature Preserve shall be closed to visitors every Tuesday.
- Hanauma Bay Nature Preserve shall be closed between the hours of 7 p.m. to 6 a.m. from the Memorial Day weekend through the Labor Day weekend. From the day after the Labor Day weekend through the day prior to the Memorial Day weekend the hours of closure shall be 6 p.m. through 6 a.m.
- Hanauma Bay Nature Preserve may also be closed to all visitors when:
  - The park or park facilities sustain damages; for scheduled or ongoing construction; repairs or maintenance activities; or because of other reasons
  - A state of emergency is declared by the Director or other proper authorities.
  - Natural or civil disturbances, including but not limited to, tsunamis, floods, earthquakes, storms, riots, demonstrations and employee strikes occur or threaten to occur

Fees and Admission to Lower Level (Part II, Section 6)

The following fees shall be assessed for entrance to the Hanauma Bay Nature Preserve:

- For nonresidents of Hawaii, 13 years of age and older, to enter the lower level (beyond the scenic lookout): $3 per person
- For vehicles entering the preserve, a $1 parking fee shall be assessed;
- The Director is authorized to waive the fees provided by this section and to allow entry of any person to the Hanauma Bay Nature Preserve as part of an educational or promotional program or package made available or authorized by the City.
- Hawaiians entering the Hanauma Bay Nature Preserve to exercise their traditional and customary rights for subsistence, cultural and religious purposes shall be exempt from paying admission fees; provided that nothing in this subsection shall be construed as allowing activities which may be otherwise prohibited by the Hawaii Revised Statutes or administrative rules of the Department of Land and Natural Resources.
- In order to protect the quality of Hanauma Bay Nature Preserve, no more than 2,000 people may access the lower level of Hanauma Bay Nature Preserve at any one time. This number may be adjusted based on future studies or reports.

Public Parking Lot (Part II, Section 7)

- The use of the public parking lot shall be limited to non-commercial and U-Drive passenger vehicles and authorized permittees who have obtained commercial filming, commercial scuba and snorkeling permits, in accordance with rules governing these activities. Upon request, the permittees shall show the permits to any authorized representative of the City.
- Parking shall be limited to the number of parking stalls marked within the paved area of the parking lot.
- Vehicles shall be denied entry into the parking lot when full.

Commercial Vehicle Lot and Upper Level Scenic Viewing Areas (Part II, Section 8)

- Commercial tour company vehicles are authorized to use the commercial vehicle lot and scenic viewing areas located in the upper level of the Hanauma Bay Nature Preserve.
- Taxis and vehicles displaying a disabled parking placard shall be allowed to drop off and pick up patrons in

Table 4. Summary Excerpts of City and County of Honolulu Amended Rules and Regulations Relating to Visitor Use Levels and Controls at Hanauma Bay Nature Preserve (C&C Honolulu 1998)

designated areas of the commercial vehicle lot, provided that the taxis and vehicles displaying a disabled parking placard comply with all applicable State statutes, City ordinances and Public Utilities Commission rules and regulations • Use of the commercial vehicle lot and scenic viewing areas shall be limited to sightseeing and picture taking activities. • Sightseeing and picture taking activities in the commercial vehicle lot shall be limited to a period of fifteen minutes and confined to the upper level of Hanauma Bay Nature Preserve. • The use of the lower level of Hanauma Bay Nature Preserve by commercial tour companies and their patrons shall be prohibited unless authorized under City concession. • The Department reserves the right to control the numbers of commercial vehicles, including taxis, shuttles, limousines, buses, in the commercial vehicle lot. • Vehicles shall be denied entry into the commercial vehicle lot when congestion presents a safety hazard.

3.4.2 Strategies to Minimize Visitor Impacts

A wide range of strategies and best practices have been employed around the world to minimize impacts of visitors in coastal areas. These strategies include structural and non-structural measures for recreational activities as well as supporting infrastructure and services. Strategies used to minimize visitor impacts in Hawaii are summarized *Hawaii's Local Action Strategy to Address Recreational Impacts Reefs* (Table 2). These and other examples are described in this section.

The rapid development and expansion of coastal tourism in the Red Sea and Gulf of Aqaba established an urgent need to minimize impacts from visitors. Recognizing that ocean-based tourism is dependent on promoting good practices on land as well as the water, Egypt established guidelines for development of sustainable coastal tourism (TDA 1998). Best practices promoted in these guidelines include:

Best practices promoted in marine protected areas in the Western Indian Ocean (IUCN 2004)

- Place seasonal or temporal limits on use, e.g. limiting visiting times or restricting car parking
- Regulate group size, requiring pre-registration, and providing guided tours
- Ensure visitors stay on specified routes and do not trample vegetation or coral reef, do not disturb or harass animals lights, noise, or proximity
- Use zonation to close areas to visitors
- Increase entrance fees to at peak periods
- Provide for solid waste management

- Minimize disturbance to the natural terrain
- Restore native vegetation
- Provide interpretive facilities for environmental awareness
- Protect coral reefs by providing for vessel mooring and anchoring
- Maintain public access to coastal amenities
- Maintain scenic vistas
- Locate support infrastructure in environmentally appropriate sites
- Minimize surface-water runoff from supporting infrastructure
- Collect and properly dispose of solid waste
- Design low impact facilities and manage to conserve energy and water resources


Marine protected areas are magnets for ocean recreation and tourism. Many marine protected areas are established to protect unique ecological features and therefore provide exceptional snorkeling and diving opportunities for visitors. The concentration of ocean recreational activities in these areas results in cumulative impacts to marine resources. Repeated anchoring by commercial tour boats is one such example. Hawaii's first day-use mooring buoys were installed on the Kona coast in May 1990 as an innovative partnership among community members, ocean recreation businesses, non-governmental organizations, and the University of Hawaii Sea Grant Extension Service. Over the years, other coastal communities and ocean recreation businesses throughout the state have been inspired to follow this example. The State government eventually began to provide some financial assistance so that now there is a statewide system of over 160 day-use mooring buoys with locations around all the main Hawaiian Islands.

In 1998, the state legislature passed Act 306, which requires that a system of day-use mooring buoys be established along the 150 mile-long West Hawaii coast as part of the West Hawaii Regional Fishery Management Area. An excerpt from the day use mooring rules for Molokini is provided in Table 5. Other state statutes and rules prohibit anchoring within 100 yards of each mooring. The 1998 State legislature also appropriated limited funds to the Hawaii Department of Land and Natural Resources, Division of Boating and Ocean Recreation (DLNR-DOBOR) to pay for mooring buoy hardware, including buoys, line, cable, shackles, and anchor bolts. Despite support of the State government, the maintenance and expansion of the statewide mooring buoy system still depends on private donations and volunteer efforts.

Table 5. Summary Excerpts from Day Use Mooring Rules for Molokini, Hawaii (§13—257—51 ; DLNR, 1995)

Commercial use restrictions:

- No vessel shall use a day use mooring for commercial purposes unless the owner has been issued a marine life conservation district use permit by the department
- Mooring zone “A” is designated for use by commercial vessels carrying twelve or more passengers.
- Mooring zone “B” is designated for use by commercial vessels carrying less than twelve passengers.
- The use of any one particular mooring shall be on a first-come, first-served basis.
- A commercial vessel not having a marine life conservation district use permit may be authorized occasional or infrequent use of the day use moorings, not to exceed eight times a year, when application is made and approved not less than seven days in advance of the date of intended use.

Commercial day use mooring permit fee:

- Commercial day use mooring permit fee for a commercial Molokini day use mooring shall be the greater of $100 per month or two per cent of gross receipts, provided that this fee shall be waived for commercial operators who are presently paying commercial vessel user fees for the use of state boating facilities. This fee shall be in addition to the commercial use permit fee

Recreational vessel use of Molokini day use moorings:

- Mooring zone “C” is designated for primary use by recreational vessels,
- Recreational vessels may also use vacant moorings located in zones “A” and “B” except during the period from 8:30 a.m. to 11:30 a.m.
- No vessel shall operate at a speed in excess of “slow-no wake” within the Subzone A

Anchoring restrictions:

- Anchoring is prohibited within the Molokini island day use mooring area, provided that anchoring is permitted within the designated area at locations of sand, rock, or rubble bottom types where no live corals exist until such time as new day use moorings are installed.
- Anchoring is prohibited within Subzone B of the Molokini shoal marine life conservation district.

Education and outreach are considered a fundamental strategy required to minimize visitor impacts through human behavior change. Although a single pre-dive briefing was shown to significantly reduce dive coral damage in other areas (Medio *et al.* 1997), Barker and Roberts (2004) suggest that direct intervention may be necessary to minimize physical damage to corals. An extensive study of SCUBA diver impacts on coral reefs in the Carribbean island of St. Lucia was completed out by Barker and Roberts (2004) who observed 353 divers over a period of 6 months. Key conclusions from this study included the following:

- Most contacts with the reef occurred early during the first 10 minutes of the dive
- Poor underwater swimming techniques, incorrect buoyancy, and ignorance were responsible for 82 percent of the contacts
- Night dives had more than double the contact rate as day dives
- Photographers contacted the substratum four times more frequently than non-camera users
- A one-sentence reminder in a dive briefing stressing no contact with the substratum had no effect on diver behavior
- Underwater dive-leader intervention was the only factor that reduced diver damage of corals

The need for on-site management presence in ocean recreational areas is further reinforced in Hawaii. The presence of "Reef Stewards" on weekends and holidays at the Wai'Opae Tidepools MLCD on the southeastern coast of the island of Hawai'i has reduced illegal fishing and the accumulation of litter and marine debris (Komoto 2006).

3.4.3 Strategies to Address Over-Commercialization

Hawai'i's coral reefs attract visitors from around the world and provide the economic foundation for over 1,000 ocean tourism companies, with annual gross revenues estimated at $700 million per year (Clark and Gulko 1999). Over 80 percent of Hawai'i's tourists participate in ocean recreational activities, generating almost $364 million each year in added value (Cesar and van Beukering 2004). Ocean resource use conflicts are increasing; however, as commercial ocean recreational uses compete with public recreational uses and access to beaches and marine areas. Considering the economic importance of this sector, limits on commercial ocean activities need to be developed in a manner that is fair, transparent, and enables small businesses to make long-term investments in environment-friendly operations. A variety of strategies have been used to address this issue including:

- Banning commercial uses
- Limiting commercial uses to specific times and places
- Limiting the number of permits issued for commercial activities and allowing preferential access to specific areas
- Prohibiting or limiting commercial vehicle parking to access public areas

Commercial uses are banned at roughly half of all Maui county beach parks and new legislation will control the number of commercial ocean recreation activity permits being issued at county


parks where commercial activity is allowed (CVS Consultants 2007). A specific parking area for commercial vehicles is provided at Hanauama Bay with a maximum time limit of 15 minutes (Table 4).

A study of ocean recreational user conflicts was recently completed for five focus sites across Hawaii where recreational use conflicts are occurring (CSV Consultants 2007). Primary issues of concern included: over-commercialization, surf school regulation, and commercial operator protocols. A number of strategies were proposed to address the issue of over-commercialization at these sites including: establishment of ocean recreational management areas and associated permit system and increased enforcement capacity.

Some of Hawaii's MLCDs are managed through place-based strategies to limit the number of commercial operations. Rules on mooring use at Molokini establish time limits and other conditions for use by commercial tour operators (Table 5).

The Great Barrier Reef Marine Park Authority establishes sea-based access limits to commercial tour boats operating in different types of settings of the Great Barrier Reef. Each bay, reef, and coastal area is assigned a 'setting' ranging from intensively used (Setting 1) to protected (Setting 5). Limits on vessel length and capacity are established by setting (Table 6). Recreational users are able to access Setting 5 areas; however, only a limited number of tourism operations that have relevant endorsements on their permits are able to operate in Setting 5 areas.

Table 6. Use of Limits on Vessel Length and Group Size at Great Barrier Reef (Ormsby et al., 2004)

Setting	Vessel Length	Group Size
1. Developed	Max. 70 meters	No limit
2. High Use	Max. 35 meters	No limit
3. Moderate Use	Max. 35 meters	Max. 40 people
4. Natural	Max 35 meters	Max. 15 people
5. Protected	Endorsement required	Endorsement required

Resource allocation issues, user conflicts, and stress on the marine ecosystem will become more prevalent without proactive management and the setting aside of significant and appropriate areas for conservation and public access. With new activities being developed by the tourism industry and individuals all the time, ocean users often compete for space, especially at popular sites. Unresolved user conflicts can cause hostility, leading to lower satisfaction with recreational experiences from residents and visitors. Site-specific solutions developed with active participation of stakeholder groups are needed to address recreational use conflicts and environmental and cultural concerns.

4.0 Recreational Use of Honolua Bay: Resource Status and Trends

Resource conditions at Honolua Bay, like most areas of Hawaii, reflect not only current uses of the area but a history of past practices. Today, Honolua Bay is a popular site for ocean-based recreation; however, previous uses of the bay and surrounding watershed included ranching, agriculture, and associated loading and offloading of supplies from boats moored in the bay. This section provides a summary of the status and trends in recreational use, ecosystem components, and access and facilities at Honolua Bay. This summary is based on surveys and observations conducted in 2005 and 2006 as part of this study (see Appendix A) as well as other published studies and research.

4.1 Recreational Uses

4.1.1 Status

Recreational use surveys were conducted in 2005 and 2006 (Appendix A) to establish "2006" reference levels for recreational activities in Honolua Bay. Visitors entering Honolua Bay by land are predominantly, 93.5 percent, non-residents from the mainland U.S. and a few from other countries. This percentage does not take into account surfers entering the bay from the Lipoa Point access. Honolua Bay supports both commercial and non-commercial recreational uses that enter the bay by land and sea. The primary recreational activities at Honolua Bay are snorkeling, SCUBA diving, and surfing. Other ocean recreational activities in the bay include kayaking and recreational sailboats; however these activities are limited. Land-based recreational activities are limited to picnicking associated with visitors that access the bay from land for snorkeling. The types and duration of recreational activities at Honolua Bay are highly dependent on weather and sea conditions. Snorkeling and beachgoing activities are predominant during summer. Surfing activities are predominant during winter. Snorkeling and surfing activities are separated spatially and do not appear to pose any recreational use conflicts.

Snorkeling and SCUBA Diving

Snorkeling and SCUBA diving activities are most prevalent during summer months with calm sea and clear water conditions but may also occur during winter months. The 2006 average hourly number of snorkelers during summer surveys was 50.7 snorkelers per hour (Table 7). Assuming an 8 hour day, the daily number of snorkelers would be approximately 400 snorkelers per day. The maximum count of snorkelers was 111 at any one time during a summer survey. The 2006 average hourly number of SCUBA divers was 1.6 divers per hour. The maximum count of SCUBA divers was 17 divers at any one time during a summer survey (Table 8).

Table 7. Estimated Annual Number of Divers at Honolua Bay Based on 2005-2006 Surveys (Appendix A)

Activity	Winter Surveys December 2005 – May 2006	Summer Surveys June – July 2006	Estimated Annual Number of Snorkelers and SCUBA Divers
No. of Snorkelers (Hourly Average)	8.8	50.7	
No. of Snorkelers (Est. Annual based on 8 hours per day and 360 days per year)	12,672	73,008	85,680
No. of SCUBA Divers (Hourly Average)	0.2	1.6	
No. of SCUBA Divers (Est. Annual based on 8 hours per day and 360 days per year)	288	2,304	2,592
Total No. of Snorkelers and SCUBA Divers			88,272

Table 8. Comparison of Estimated Average Hourly and Maximum Number of Recreational Users in 2002 and 2006

Users	Unit	July 2002 (Holland and Meyer 2002)	June – July 2006 (This Study)	Percent Increase
No. of Snorkelers	Average Hourly	27.5	50.7	48%
	Maximum Count	82	111	26%
No. of SCUBA Divers	Average Hourly	1.2	1.6	25%
	Maximum Count	6	17	65%
No. of Beachgoers	Average Hourly	23.5	47.5	51%
	Maximum Count	52	113	54%

Surfing

Surfing occurs when waves break along the north end of the bay, mostly during winter conditions. Surfers access the northern end of Honolua Bay by parking on Lipoa Point and walking down a cliff trail. This access is separated from the parking and trail used by snorkelers to access the bay by land. Occasionally, surfers access the bay from the trail used by snorkelers, especially if surf is up on the south side of Honolua Bay. The 2006 average hourly number of surfers conducted as part of this study (Appendix A, Table A.9; A.10) ranged from 0.1 surfers in summer and 72.8 surfers in winter with a maximum winter count of 83 surfers. In addition to different seasonal and sea conditions for recreational use, snorkeling and surfing do not occur in the same area of the bay.

Surf competitions are held twice a year at the northern end of Honolua Bay. Currently, ML&P gives land-based access permits for surf competitions limited to a total of 3 days per year. During

a surf competition, access to the surf break called "Cave" is restricted. Access to other surf breaks remain open.

Other Ocean Recreation

Other forms of ocean recreation occur at low levels at Honolua Bay including kayaking and anchoring by non-commercial vessels such as sailboats. These activities occurred intermittently during the 2005 – 2006 surveys conducted as part of this study.

Land-Based Recreation

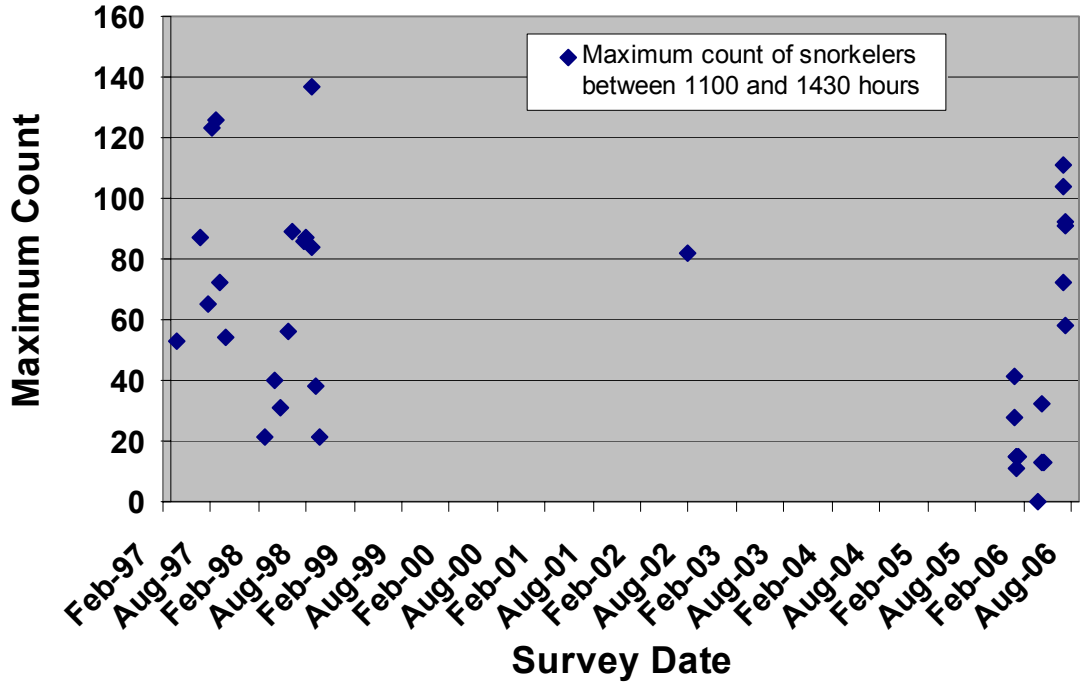
Land-based recreational at Honolua Bay is limited. There are no picnic or barbeque facilities. Before and after snorkeling, visitors sit on the rocky beach. The average hourly number of beachgoers observed at Honolua Bay was 47.5 people in summer and 16.8 in winter (Table 7) in 2005 - 2006 surveys conducted as part of this study (Appendix A). Visitors spend approximately 30 minutes to 3 hours at Honolua Bay. Over 85 percent of visitors to the area spend 1 to 2 hours at Honolua Bay (Appendix A, Figure A.5).

4.1.2 Trends

Honolua Bay has become a popular recreational snorkeling and SCUBA diving site, although the number of visitors have fluctuated somewhat over the last 10 years. Snorkeling and SCUBA diving activity levels quantified as part of this study (Appendix A) at Honolua Bay were higher than levels measured in 2002 (Holland and Meyer 2002) but lower than levels measured in 1997 and 1998 (Brown 1999). The average number of snorkelers and SCUBA divers per hour quantified by Holland and Meyer (2003) was 27.5 and 1.2, respectively during the summer (Table 7); however, these averages were based on a limited data set covering only three days of surveys conducted from July 27 to 29, 2002. Similarly, the hourly average number of beachgoers at Honolua Bay was higher, 47.5 people per hour in 2006 compared to an average of 23.5 people per hour in 2002 (Table 7).

Maximum counts of snorkelers quantified in 1997 and 1998 (Brown 1999); however, were higher than those measured in 2005 and 2006 (Figure 5). The average maximum count in 1997 and 1998 surveys was 70.6 snorkelers (Std =35.0, N=18). The average maximum count in the 2005 and 2006 surveys (this study, Appendix A) was 44.4 snorkelers (Std = 37.8; N=16). These two datasets were determined to be normally distributed and have equal variance. Using a standard Student's t test, the average maximum count for 1997 and 1998 was statistically significantly higher than the average for 2005 and 2006 ($p < 0.05$). This result was confirmed using the nonparametric Wilcoxon rank sum test.


Figure 5. Maximum Counts of Snorkelers at Honolua Bay from Different Studies (1997 - 1998 (Brown 1999); 2002 (Holland and Meyer 2002); and 2005 – 2006 (This Study, Appendix A))



Visitor arrivals to Maui were fairly constant from 1990 through 2000 dropping in 2001 likely due to the September 11, 2001 terrorist attacks in the U.S (Figure 6). Since 2001, visitor arrivals have steadily increased exceeding pre-9/11 levels. For the last 10 years, visitor arrivals have been highest in the month of July (Figure 7). The increase in recreational activity levels between 2002 and 2005-2006 surveys is consistent with the overall increase in visitor arrivals during this period. Severe rain events resulted in decreased snorkeling activity in Honolua Bay in 2005-2006 surveys compared to 1997-1998 surveys. The existing parking situation at Honolua is the primary factor that currently limits the number of land-based visitors to the bay (see Section 4.3.1). In addition, the number of permits for and capacity of commercial tour boats using the bay has been fairly constant despite the absence of Honolua Bay-specific access permits for commercial tour boats.

Overall, visitors to Honolua Bay would be expected to increase in response to increased visitor arrivals to Maui. This increase would result under the following conditions:

- Increased availability of parking
- Use of parking by high capacity commercial vehicles such as tour buses and vans
- Increased number of commercial tour boat permits
- Increased capacity of commercial tour boats permitted

Figure 6. Annual Visitor Arrivals by Air to Maui (2006 data, preliminary DBEDT 2007)

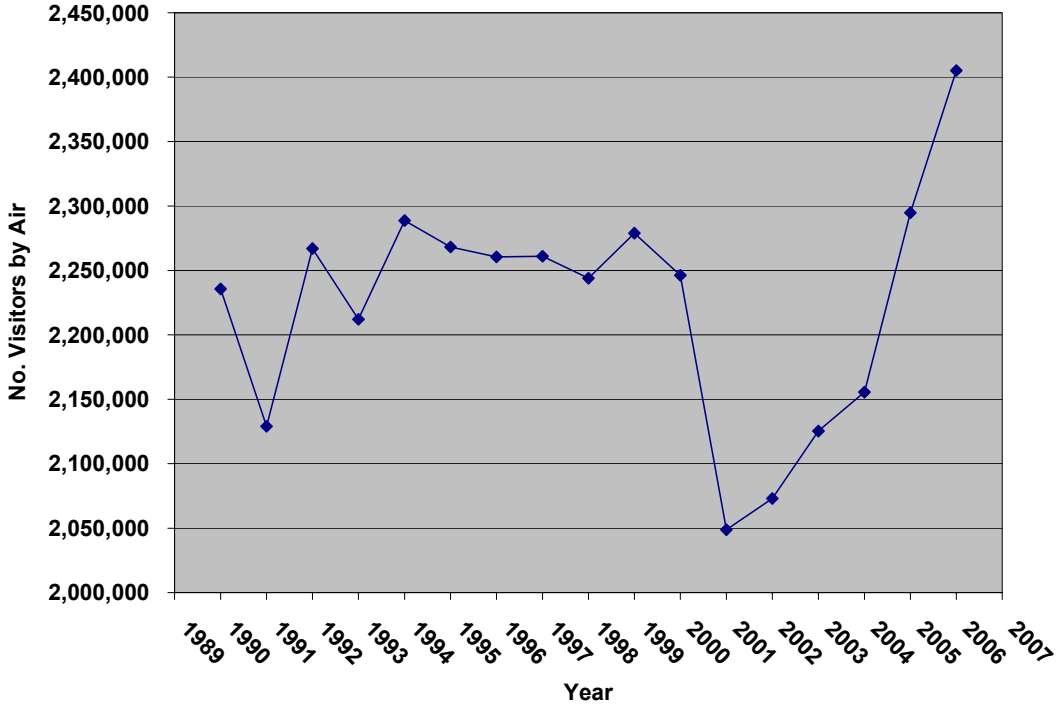
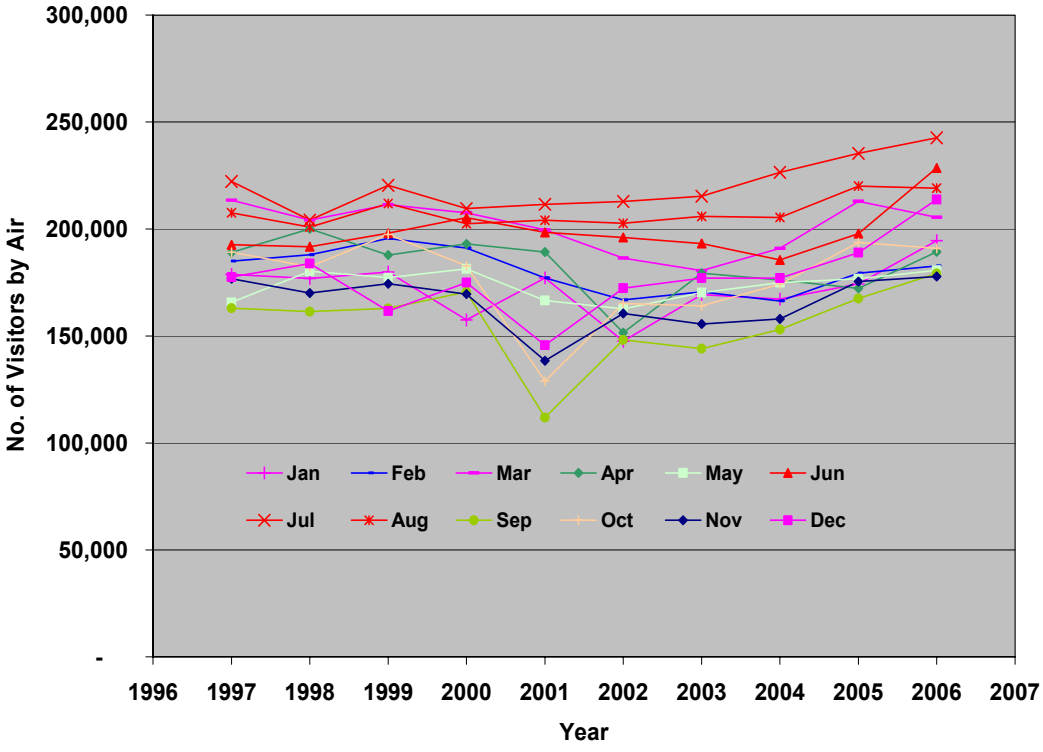


Figure 7. Monthly Visitor Arrivals to Maui by Air (DBEDT 2007)



4.2 Ecosystem Components

Recreational activities are supported by the Honolua Bay ecosystem comprised of marine, social-cultural, and terrestrial components. This section describes current status and trends for each ecosystem component.

4.2.1 Status

Marine Environment

The marine environment of Honolua Bay is composed of hard and soft bottom communities. Coral reefs fringe the north and south sides of the bay. Soft bottom communities are dominated by beds of the calcareous green alga, *Halimeda.* The condition of the marine environment at Honolua Bay has been surveyed and discussed by a number of investigators including Brown (2003), DLNR (2006), Marine Research Consultants (2007), Dollar and Grigg (2004), Friedlander and Brown (2003), Friedlander et al. (2003), Friedlander et al. (2005).

The percent coral cover varies with different investigations. Using photoquadrat transects, Dollar (2006) reported coral cover between 40 and 55 percent in 2006. In DLNR surveys, average coral cover was below 10 percent along north and south reefs in 2006 (DLNR 2006). The reef fish assemblage at Honolua Bay is characterized by abundant grazing fishes and invertebrates. In 2002, Friedlander and Brown (2003) reported 25 fish species, 15,000 fish per hectare and a biomass of 1.3 metric tons per hectare. The alien invasive algal species, *Acanthophora spicifera*, has been reported in the bay (Hunter 2000).

Honolua Bay to Lahaina has been listed on the Department of Health's (DOH) Section 303 list of impaired water bodies (DOH 2004) along with 21 other coastal water bodies in west Maui. Water quality is degraded during storm events as suspended solids are carried from the land by the stream and surface water runoff to the bay. Honolula Bay was selected as a priority ahupua`a for strategic actions under *Hawaii's Local Action Strategy to Address Land-Based Pollution Threats to Coral Reefs* (EPA et al. 2004).

Monitoring and enforcement of the MLCD regulations is not routinely conducted at Honolua Bay. Illegal fishing has been reported inside the MLCD largely occurring at night. Fish feeding is occurring at the bay; however, the extent of this activity could not be quantified during this study. Although fish feeding is not illegal it is resulting in hazardous conditions for snorkelers that are bitten by aggressive fish wanting to be fed.

Honolua Bay is part of the Hawaiian Islands Humpback Whale National Marine Sanctuary. Special status marine species frequent the bay. Green turtles and spinner dolphins were observed during recreational use surveys conducted as part of this study in 2005 and 2006.

Social-Cultural Dimensions

The Honolua Bay area is characterized by features of cultural, archaeological, and historical significance. Archaeological resources are present in the area. Twenty-three sites consisting of forty-three individual features were identified from pre-Contact Hawaiian settlement, historic ranching, and Plantation-era (Pickett and Dega 2006). All documented sites were assessed to be historically significant under Criterion D (*site has yielded or has the potential to yield information important in prehistory or history)*. These archaeological sites are currently not managed.

In 1976 the historic journey of the Hokule`a voyaging canoe set sail from Honolua Bay to the Polynesian Triangle (Maxwell 2003). The voyages sponsored by the Polynesian Voyaging Society have provided a wealth of information for scientists, anthropologists and archaeologists about traditional Polynesian migrations, documenting one of the greatest achievement of humanity--the exploration and settlement of islands in an area of over 10 million square miles during a period of over 1,000 years. At the same time, as Hokule`a traveled throughout Polynesia, they inspired among Polynesians an increased awareness and native pride in their seafaring heritage. They also sparked a revival of canoe building and sailing, arts that had not been practiced in over a hundred years. Hokule`a, the first modern replica of a voyaging canoe to make the voyage from Hawai'i to Tahiti and back, became a symbol of the richness of Polynesian culture and the seafaring heritage which links together all of the peoples of the Pacific (PVS 2003).

A user survey was implemented as part of the 2005 to 2006 recreational use surveys (Appendix A) to determine user profiles and satisfaction levels. Over 90 percent of respondents (snorklers entering the bay from land) in 2005 to 2006 surveys were non-residents from the mainland U.S. or other countries. The absence of amenities had “no effect” on satisfaction levels among 75 percent of respondents to anecdotal surveys conducted as part of this study (Appendix A). Many visitors indicated “added satisfaction” (15 percent) by the absence of amenities and the parking situation. Visitors appreciated the “wilderness” setting at Honolua Bay. The path to the bay with its large trees, overgrown vegetation, and natural streambed is considered a unique entry by many visitors to a snorkeling site. Many visitors take photographs along the trail.

Visitor satisfaction with recreational experience at Honolua Bay was relatively high with 63 percent of visitors to Honolua Bay indicating that they were “highly satisfied” with their recreational experience. The only similar survey in Hawai‘i was conducted at Hanauma Bay where only 42 percent of visitors were highly satisfied with their visit (Lankford et al., 2005).

Visitor satisfaction levels are likely influenced by a variety factors. Turbid water conditions occur from runoff and streamflow during rainfall events and through resuspension of sediments during windy conditions. Forty-six percent of survey respondents indicated that water quality detracted from their satisfaction level with the recreational experience at Honolua Bay. Seventy-six percent of survey respondents indicated that the number of people at Honolua bay had no effect on satisfaction levels. During summer surveys, an average of 535 visitors per day was recorded from both land and sea-based access with a maximum of 680 visitors on any one day (see Appendix A, Table A-23). Forty-seven percent of respondents indicated that Honolua Bay

could accommodate more visitors and 25 percent responded that they were not sure whether more visitors could be accommodated. For comparative purposes, the social carrying capacity of Hanauma Bay was exceeded when more than 3,200 people per day used the bay (Lanford et al., 2005).

Terrestrial Environment

The coastal bluffs surrounding Honolua Bay and deep gulch provide dramatic scenery for both land-based and sea-based visitors. Honolua Stream, an interrupted perennial stream, runs through the gulch and empties into the bay and is also a significant natural feature in the area. Interrupted perennial streams usually flow perennially in their upper reaches but only seasonally in parts of their middle or lower reaches, due to either downward seepage of surface flow (naturally interrupted) or to man-made water diversions (artificially interrupted) (HAR, Title 11, Chapter 54).

Visitors enjoy the wilderness setting as they walk down the dirt path from the highway to the bay. Despite the present jungle-like setting, much of the vegetation throughout the Honolua Bay area is dominated by non-native species of weedy grasses, shrubs, and trees (Hobdy 2005). The gulch bottom served as headquarters for the Baldwin Ranch between 1900 to 1912.

The coastal bluffs surrounding the bay; however, have diverse and abundant native species some of which are endemic to Hawaii. The coastal bluffs are characterized by low, wind-sculpted growth and salt tolerance. Eighteen of the thirty native species found were along the coastal bluffs. While none of the species found are Federally Endangered or Threatened, they create a distinctive habitat that along with the dramatic landscape they occupy are of scenic and biological significance (Hobdy 2005).

4.2.2 Trends

According to DLNR (2006), coral cover at Honolua Bay has declined consistently over the last 8 years from 1999 to 2006. In contract, some transects conducted by Dollar (2007) in 2006 suggest increased coral cover from the previous year. There is a need for investigators to compare methodologies, sampling locations, and data sets to provide a complete picture of the condition of the coral reef ecosystem at Honolua Bay.

Suspended solids transported to the bay during rainfall events, restricted circulation in the bay, and reef sedimentation are considered primary factors contributing to this decline. Coral breakage by snokelers and SCUBA divers adds additional stress to the coral reef ecosystem; however, Holland and Meyer (2003) concluded that the level of snorkeling and SCUBA diving at Honolua Bay was sustainable. They recommended, however, that a study be conducted to evaluate the cumulative impacts of recreational use on coral cover. This study has not been accomplished.

Invasive marine species, although not currently an issue, could threaten the coral reef ecosystem at Honolua Bay. Other Maui sites, especially Maalaea and Kahekili, have been heavily overgrown by the alien red algae, *Acanthophora spicifera.* The abundance of herbivorous fish at

Honolua Bay is considered an important factor in controlling invasive marine algae (Friedlander *et al.*, 2005). Invasive marine species control must be achieved through early detection and eradication. This requires regular monitoring to ensure invasive species do not become established. The State of Hawai‘i has developed and is implementing a comprehensive plan to control the spread of marine invasive species (DLNR 2003)

Invasive terrestrial species, especially alien vines, are also a concern in the Honolua Bay area. While most of the terrestrial flora in the area is composed of non-native species, invasive vines can choke larger established trees and other vegetation if not controlled.3 Access and Facilities Honolua Bay has limited access and facilities to support ocean recreation. Visitors access the bay from land by walking down a dirt path. Sea-based access to the bay is by commercial tour boat and private recreational use. There are no parking areas, restrooms, or other facilities in the area.

4.3.1 Status

Land-Based Access

Visitors park their vehicles along the shoulder of the highway and walk down a dirt path to the bay. A maximum of 60 to 70 vehicles can park along the highway in three areas along the highway. Visitors walk along the highway to access the trail to the bay. Parking along the highway poses a safety concern as vehicles with limited visibility speed by visitors getting into or out of their vehicles parked along the side of the road.

Sea-Based Access

The commercial tour boat fleet that regularly visits Honolua Bay consists of 10 boats permitted to carry a maximum of 49 passengers operating out of Kaanapali. These commercial tour boats visit Honolua Bay between approximately 0900 and 1400 hours (Coon, pers. comm.). High season occurs from February to April and June to July. The November and December holiday season can also be busy times for the commercial tour boat fleet. During these times, commercial tour boats may operate 7 days a week; however, weather and sea conditions often limit the number of days that can be spent at the bay.

Commercial tour operators secure one end of the vessel to a chain that has been secured at the edge of the reef structure. In order to maintain constant position while moored, an anchor is deployed off the other end of the vessel in sandy bottom. The extent of environmental briefings conducted by commercial tour operators was not determined as part of this study.

Sailboats and other recreational vessels anchor in the bay, especially during summer months. These vessels generally anchor in the middle of the bay, in the soft bottom.

Supporting Infrastructure and Services

Currently, Honolua Bay has no infrastructure or facilities to support recreational use and no regular on-site management. Visitors park along the highway and walk down a wooded dirt path and cross an intermittent stream bed. No restrooms, freshwater, garage collection, or emergency

communication facilities exist on the site. A single sign posted by DLNR at the base of the path provides information on the name of the site and use prohibitions.

The absence of supporting infrastructure and services creates sanitary and solid waste management problems. Some visitors are unaware that restroom facilities are unavailable and use the bushes as their bathroom leaving tissue paper and other sanitary products on the ground. Some visitors leave garbage, beverage containers, and lunches at the beach.

Limited educational programs are available at Honolua Bay. The only interactive educational program is being conducted by a nongovernmental organization, Project S.E.A Link, funded by the Hawaii State Department of Land and Natural Resources (DLNR). Project S.E.A Link staff set up a table at Honolua Bay, make educational materials on marine life available to visitors. Fifty-eight percent of respondents to anecdotal surveys conducted as part of this study (Appendix A) derived added satisfaction from the availability of education materials.

Safety

There are a number of safety considerations that exist at Honolua Bay. Parking along the side of the road can be dangerous especially at maximum use times. Many visitors use the boat ramp to enter the water. The ramp is slippery and degraded from wave action. Visitors frequently slip and cut themselves. Unfortunately, some guidebooks instruct visitors to use the boat ramp as an easy entrance to the water.

Fish feeding is creating hazardous conditions for snorkelers as fish are becoming aggressive. Many visitors complained of bites from chubs, *Kyphosus* sp. and the intentionally introduced blue-line snapper, *Taape*, or *Lutjanus kasmira.* The aggressive nature of these fish has also been a deterrent causing people to exit the water prematurely or not even entering the water at all.

Visitor bitten by aggressive chub

4.3.2 Trends

Honolua Bay is one of the few sheltered bays in Hawaii where visitors can snorkel and dive safely. Environmental, safety, and sanitation issues described above are likely to continue or increase without improved area management.

DLNR's plans to install mooring buoys for commercial tour boats will reduce impacts on the marine environment at Honolua Bay. With increased visitor arrivals to Maui, the number of permits issued by DLNR to commercial tour boats could increase as a result of increased demand. In addition, the capacity of each tour boat could increase. Both conditions would lead to increased recreational use of Honolua Bay.

5.0 Recreational Carrying Capacity Concerns and Opportunities at Honolua Bay

An understanding of the status and trends in resource conditions at Honolua Bay provides insights into key issues and concerns as well as opportunities for improved management of the area.

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5.1 Key Issues and Concerns

Recreational use is currently contributing additional environmental and ecological stress to the Honolua Bay area. Key recreational carrying capacity concerns at Honolua Bay are focused on impacts to coral reefs and safety and sanitation issues for visitors to the area. Furthermore, the cumulative impacts of current levels of recreational use coupled with increased demand for ocean recreational experiences in the future will likely increase stress and environmental degradation without improved area management. Key recreational carrying capacity issues at Honolua Bay include the following:

- The numbers of visitors to the area will likely increase as land-based and sea-based commercial tour operations respond to increased demand for ocean recreational experiences. Under current conditions, this increase could result from intensification of commercial tour operations through potential increased use by large capacity commercial vehicles and number of permits or vessel capacity of commercial tour boat operations.
- Coral breakage is likely to continue or increase from snorkeling and SCUBA diving. This trend will continue without consistent pre-dive briefings and a lack of supervision during a dive. Coral cover in the bay, already experiencing a long-term decline, cannot be subjected to any additional stress, although limited, from ocean recreational activities.
- Mooring buoys, although planned have not been installed. Repeated anchoring by vessels in the bay may degrade benthic environment including both soft and hard bottom communities. Mooring buoys will need to be sited near but away from coral reef areas to accommodate high damage rates characteristic of the first 10 minutes of a dive
- Illegal fishing is reportedly occurring within the bay. Any decline in the abundance or change in the composition of the reef fish assemblage could increase the vulnerability of coral reefs to marine invasive algal species.
- Coastal bluffs serve as outstanding scenic vistas and habitat to native terrestrial vegetation in the area and should be set aside as open space and protected
- Health and sanitation problems will continue and likely increase as a result of land-based visitors. A range of low impact solutions can be developed to address these problems from signage to facilities.
- Site conditions pose safety concerns for visitors including roadside parking, absence of emergency communication facilities, access to the ocean, and aggressive reef fish behavior as a result of feeding
- Sediment runoff from rain events will likely continue to impact water quality in the bay. Development of any supporting facilities should adopt low impact design considerations


to minimize additional water quality degradation from surface water runoff or groundwater discharge.

Current levels of recreational use could be sustained with improved area management designed to minimize the impacts of visitors on the marine and terrestrial environment and health and safety concerns. Management scenarios should provide a range of options that will maintain current levels of recreational use, minimize impacts, and achieve a defined set of management goals.

5.2 Management Goals and Opportunities

Honolua Bay maintains many distinctive features as an ocean recreational area. Hawaii has few embayments that provide generally calm conditions for visitors to enjoy snorkeling and SCUBA diving. The bay is already designated as a MLCD and fishing and other extractive activities are prohibited. Land-based access to the bay provides a unique combination of an easy hike through a "wilderness setting" and a safe snorkel. The coastal bluffs surrounding the bay provide outstanding scenic vistas and support endemic vegetation. The area supports significant archaeological resources and is distinguished as the site where the Hawaiian voyaging canoe, Hokule'a, began its first trip to Polynesia in 1976. Crowding and resource use conflicts are not yet a major concern at this time but could become problems in the future. In order to preserve these features, improved area management is needed to minimize current impacts of recreational use and to proactively address future threats. Illustrative management goals and indicators to preserve these values for recreation use at Honolua Bay are listed in Table 9 and could serve as a starting point for stakeholder consultation and engagement.

The current status of recreational use and ecosystem condition at Honolua Bay serves as a reference condition to define limits of acceptable change and management strategies for sustainable recreational use. Table 10 provides a range indicators and reference conditions that can serve as a basis defining the direction of change to acceptable resource conditions at Honolua Bay.

Table 9. Illustrative Management Goals and Indicators for Recreational Use at Honolua Bay

Management Goals	Indicators
▪ Minimize ocean recreational impacts and other stressors to the marine ecosystem	▪ Average hourly number of recreational users ▪ Average number of substratum contacts by divers and snorkelers per hour ▪ Percent living coral cover ▪ Presence of invasive marine species ▪ Marine water quality
▪ Preserve "wilderness" setting and scenic vistas	▪ Maintenance of scenic vistas and "wilderness" setting from land or sea-based access points ▪ Coastal bluffs and associated endemic species set aside from development ▪ Presence of alien and invasive terrestrial species
▪ Protect threatened and endangered species	▪ Number of interactions with threatened and endangered species

Table 9. Illustrative Management Goals and Indicators for Recreational Use at Honolua Bay

Management Goals	Indicators
▪ Promote broader awareness of Native Hawaiian culture	▪ Awareness levels of Native Hawaiian culture ▪ Archaeological sites undisturbed by human activity
▪ Provide a unique, positive, safe, and educational visitor experience	▪ Percent of respondents from surveys on visitor satisfaction, impacts of ocean recreation ▪ Awareness levels of marine ecosystems ▪ Incidence of reported accidents and safety issues

Table 10. Potential Indicators and Reference Levels to Benchmark Management Actions for Recreational Use at Honolua Bay

Indicator	Reference Level	Reference Year	Source
Percent living coral cover (3 m depth)	9.2%	2006	North and south reefs, CRAMP
Percent living coral cover (2 to 7 m)	30.3 – 57.9	2006	Marine Research Consultants (2007)
Percent macroalgal cover (3 m depth)	5%	2006	North and south reefs, CRAMP
No. of marine invasive algal species	1	2000	*Acanthophora spicifera*; Hunter
No. of reef fish species	25	2002	Friedlander and Brown (2003)
Density of reef fish (individuals/ha)	15,000	2002	Friedlander and Brown (2003)
Biomass of reef fish (mt/ha)	1.3	2002	Friedlander and Brown (2003)
Average No. Snorkelers per Hour (summer)	50.7	2006	This study (Appendix A)
Average No. Snorkelers per Hour (winter)	8.8	2006	This study (Appendix A)
Maximum No. Snorkelers at One Time	111	2006	This study (Appendix A)
Average No. of Divers per Hour (summer)	0.2	2006	This study (Appendix A)
Average No. of Beachgoers per Hour (summer)	47.5	2006	This study (Appendix A)
Average No. of Beachgoers per Hour (winter)	16.8	2006	This study (Appendix A)
Maximum Daily No. of Visitors from Land-Based Access (summer)	437	2006	This study (Appendix A, Table A.23)
Maximum Daily No. of Visitors from Land-Based Access (winter)	321	2006	This study (Appendix A); however, may not represent the norm for winter
Maximum Daily No. of Visitors from Sea-Based Access (summer)	268	2006	This study (Appendix A)
Average Daily No. of Visitors from Sea-Based Access (winter)	N/A	2006	This study (Appendix A, Table A.23); however, may not represent the norm for winter
Average Daily No. of Visitors from Land- and Sea-Based Access (summer)	535	2006	This study (Appendix A, Table A.23)
Average Daily No. of Visitors from	183	2006	This survey (Appendix A, Table

Table 10. Potential Indicators and Reference Levels to Benchmark Management Actions for Recreational Use at Honolua Bay

Indicator	Reference Level	Reference Year	Source
Land and Sea-Based Access (winter)			A.23); however, may not represent the norm for winter
Maximum Number of Vehicles Parked along Highway at One Time	60 – 70 vehicles	2006	This study and L. Foote, pers. Communication
No. of Permitted Commercial Tour Boats Operating out of Honolua Bay	10 boats	2006	This study (Appendix A)
Capacity Rating of Permitted Commercial Tour Boats	49 people	2006	This study (Appendix A); however, note that no regulations currently limit the capacity rating for boats in Honolua
Average Length of Commercial Tour Boats	40 – 60 feet	2006	This study
Percentage of Non-Resident Visitors (Percentage of Respondents)	93%	2006	This study (Appendix A, Table A.11)
Average No. of Substrate Contacts per Dive	5.9	2002	Holland and Meyer (2003)
Average No. of Substrate Contacts per Hour	3.1	2002	Holland and Meyer (2003)
Percent of Contacts Resulting in Coral Breakage Compared to Total No. of Substrate Contacts	0.2%	2002	Holland and Meyer (2003)
Average Percent of Visitor's Highly Satisfied with Recreational Experience (Percentage of Respondents)	63%	2006	This study (Appendix A, Table A.19)

Notes:
Reference Year – Reference year for this study is noted as 2006, although several survey dates occurred in December 2005 (see Appendix A)
Reference Conditions – Reference conditions, such as for coral cover, may vary depending on sampling methodology and location used in a particular study
N/A – Not Available

5.3 Management Roles and Responsibilities

The management of recreational uses at the Honolua Bay area will require a range of strategies and actions planned and implemented through the combined efforts of a number of public and private sector entities including the Hawaii State Department of Land and Natural Resources (DLNR), the Hawaii State Department of Transportation (DOT), the Hawaii State Department of Health (DOH), private land owners and developers. Some of the roles and responsibilities of these groups are summarized in Table 11.

Table 11. Roles and Responsibilities for Managing Recreational Use at Honolua Bay

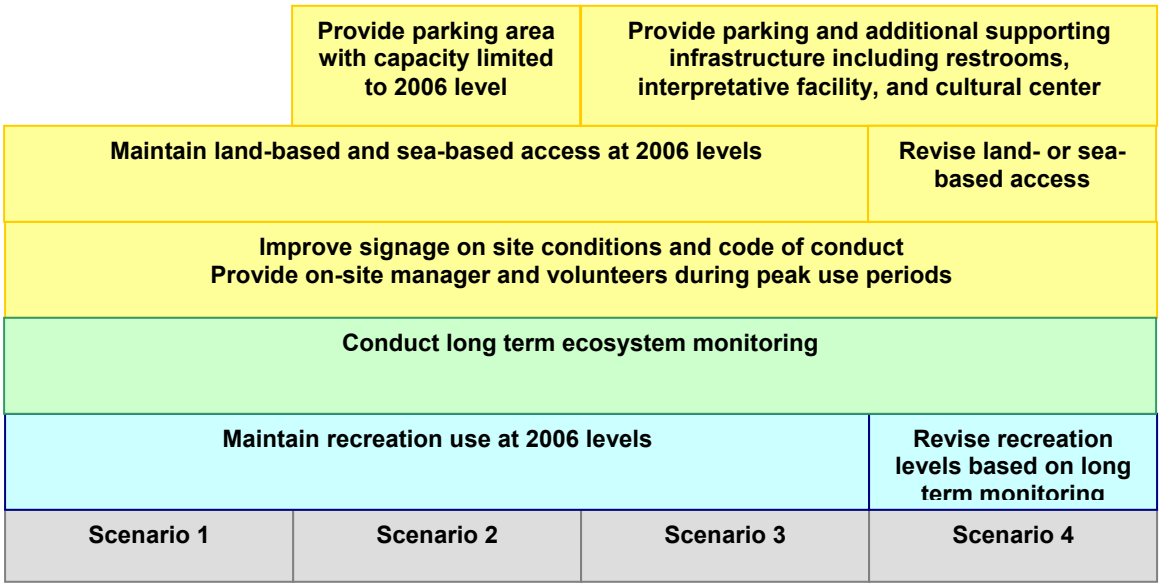
Agency/Organization	Roles and Responsibilities
Hawaii State Department of Land and Natural Resources	• Review/issue Conservation District Use Permits (CDUP) • Enforce MLCD rules and natural resource regulations • Establish and manage ocean recreational management areas (ORMA) • Establish ocean use rules and regulations including prohibitions fish feeding • Issue/review permits for commercial tour boat operators, surf schools, and land-based commercial recreational operations • Establish limits on the number of permits and specific conditions to protect sensitive environments • Establish/implement regulations on safe boating, including mooring use • Monitor recreational use and marine ecosystem status
Hawaii State Department of Transportation	• Maintain state highways with appropriate rules, signage, and other features to protect the public from hazardous road conditions • Establish prohibitions for parking along state highways
Hawaii State Department of Health	• Monitor coastal water quality conditions • Determine if water quality conditions exceed state standards • Establish total maximum daily load allocations to improve water quality
County	• Regulates Commercial Ocean Recreational Activity (CORA) through permits and prohibitions for county beach parks • Reviews special management area permits
Non-governmental organizations	• Conduct education campaigns • Provide technical assistance and funding for management interventions
Private Developers/ Landowners	• Comply with all federal, state, and county laws, rules, and regulations • Provide public access to beaches and coastal areas • Minimize impacts of development on the ecosystem
Commercial Tour Operators	• Conduct safe and environment-friendly tourism operations • Comply with permit terms and conditions • Conduct educational briefings for visitors aimed at increasing awareness of environmental and cultural values and reducing impacts on the ecosystem

6.0 Recreational Capacity Management Scenarios for Honolua Bay

Four recreational capacity management scenarios are described for Honolua Bay. These scenarios assume that current recreational use levels described in the previous section can be sustained with improved area management. Each scenario is defined by recreational use levels, ecosystem components, and access restrictions and facilities required for sustainable use. Specific management measures defined in each scenario will require action on the part of a range of stakeholders including the government, private sector, nongovernmental organizations, and the public.

Scenario 1: Maintain recreational uses at 2006 levels with improved area management
Scenario 2: Maintain recreational uses at 2006 levels with improved area management including a parking area
Scenario 3: Maintain recreational activity at 2006 levels with improved area management including a parking area and other supporting infrastructure
Scenario 4: Revise recreational levels and access from 2006 levels based on long-term ecosystem monitoring

Figure 8. Overview of Key Features of Recreational Capacity Management Scenarios for Honolua Bay



6.1 Scenario 1: Maintain Recreational Uses at 2006 Levels with Improved Area Management

Under Scenario 1, the current recreational use types and levels described in Section 4.0 could be sustained with improved area management. Improved area management would include largely non-structural management measures to address key recreational carrying capacity issues. These measures would include the following:

- Monitor recreational activities and cumulative impacts
- Establish long-term ecosystem monitoring
- Restrict the number and capacity of commercial tour boat operations to the existing fleet
- Restrict access from land-based commercial tour operations
- Improve educational and information signage for land-based visitors
- Provide on-site manager and trained volunteers during peak use periods
- Require educational briefings on commercial tour boat operations
- Add emergency call boxes

Recreational uses, ecosystem conditions, and management required for sustainable use under Scenario 1 are discussed below and detailed in Table 12.

Recreational Activities

Current types and levels of recreational use would be maintained at 2006 levels. Routine monitoring of recreational activities, especially during peak use months, would be required to identify changes in use levels or patterns. In addition, studies must be undertaken to determine the cumulative impacts of snorkelers and SCUBA divers on coral reef condition as previously recommended by Holland and Meyer (2003). Commercial diving schools from land or sea-based access would be prohibited to minimize damage to coral substratum from inexperienced divers.

Currently, in response to the request of the community, ML&P limits land-based access for surf competitions to three days per year. Commercial surf schools would be prohibited from the site to maximize public use and minimize safety considerations for inexperienced surfers.

Other non-commercial, ocean recreational users would continue to have access to the bay under Scenario 1. Kayaks have been observed on occasion and other recreational boats, such as sailboats anchor inside the bay. No other ocean recreational uses, such as jet skis, wind or kite surfers are considered compatible with existing recreational uses.

Ecosystem Components

Long-term monitoring of the marine, social/cultural, and terrestrial ecosystem components of the Honolua Bay area is essential for management decision-making. Long-term marine monitoring should include water quality, reef fish abundance and diversity, coral cover, coral diseases, and


marine invasive species. Some of these parameters are being monitored; however, there is a need to establish a consolidated data set for use in management decision-making.

The behavior and impacts of snorkelers and SCUBA divers should be monitored to determine the effectiveness of pre-dive briefings for both land-based and sea-based visitors in minimizing contact with the coral reef substratum. Educational briefings need to include information about avoiding interactions with endangered species. Visitor satisfaction levels should be periodically monitored to detect changes from 2006 levels.

The development and implementation of a preservation plan for archaeological resources is needed to ensure recreational users do not inadvertently or deliberately damage archeological resources.

Periodic monitoring of terrestrial invasive species should be conducted to minimize negative impacts of these organisms. Appropriate native vegetation should be used to restore stream banks and other land features, where feasible.

Access and Facilities

Area management activities under Scenario 1 include managing access to the bay from land and sea and improving educational outreach to minimize negative impacts of recreational use.

The availability of parking is a primary factor limiting the numbers of people accessing the bay from land. In order to ensure 2006 recreational use levels are not surpassed, the current roadside parking would continue to be limited to 60 vehicles at any one time.

The number of commercial ocean tour boats permitted and operating at Honolua Bay is a primary factor limiting the numbers of people accessing the bay from sea. Access should be maintained at current levels limited to 10 permits with a maximum operating capacity of 49 persons per vessel. Mooring buoy systems (bow and stern moorings) need to be deployed for commercial tour boats to reduce impacts from anchoring and provide additional safety measures. Mooring buoys are planned (by DLNR) but currently are not present. The use of the bay by special status marine species needs to be considered in the design and deployment of mooring buoys.

Regular education and outreach activities are needed, especially during the summer months. Improved signage and educational outreach is needed for visitors from both land and sea. An on-site manager is needed during peak use times supported by trained volunteers to assist in education and outreach activities and to monitoring in-water activities. Signs at both the top and base of the trail should highlight the absence of restrooms, need to pack all garbage out of the area, and utilize good snorkeling practices to minimize contact with the coral reef substratum.

A safe entry point could be indicated along the shoreline and information about where to snorkel. Regular maintenance programs for vegetation need to be continued along with gated controls of vehicular access to the area.

Table 12. Recreational Carrying Capacity: Scenario 1		
Site Features		**Management Actions and Design Considerations**
Recreational Uses	**1. Snorkeling**	▪ Maintain and monitor snorkeling activity at 2006 levels ▪ Conduct periodic monitoring to determine cumulative impacts of snorkelers on coral reefs and substratum contact rates
	2. SCUBA diving	▪ Maintain and monitor SCUBA diving activity at 2006 levels ▪ Conduct periodic monitoring to determine cumulative impacts of snorkelers on coral reefs and monitor substratum contact rates ▪ Prohibit entry of SCUBA diving classes ▪ Conduct periodic monitoring to determine cumulative impacts of SCUBA divers on coral reefs and substratum contact rates
	3. Surfing	▪ Continue to limit the frequency and duration of surf competitions to current levels ▪ Prohibit entry of commercial surf schools
	4. Other ocean recreational activities	▪ Enforce MLCD restrictions especially prohibition on fishing ▪ Prohibit launching of any motorized or non-motorized recreational boats such as kayaks or motor boats ▪ Maintain sea-based access to bay to kayakers, outrigger canoes, and other non-motorized vessels and prohibit anchoring by these vessels ▪ Maintain access to small non-commercial ocean recreational vessels such as sailboats and kayaks ▪ Prohibit all other forms of ocean recreational activities including wind surfing, kite sailing, jet skiing, and ski boats as incompatible with existing uses
	5. Land-based recreation	▪ No change, land-based recreation is currently limited to picnicking on the beach
Ecosystem Components	**6. Marine ecosystem**	▪ Conduct regular monitoring of coral reef and water quality conditions to monitor long term status of the marine ecosystem ▪ Conduct periodic monitoring for marine invasive species and coral and fish diseases
	7. Social-cultural dimensions	▪ Conduct regular monitoring of visitor activities and satisfaction levels ▪ Develop archaeological resources preservation plan that ensure that the location of archaeological resources remains unknown and sites are preserved
	8. Terrestrial ecosystem	▪ No change, maintain streambed and coastal bluffs in natural state ▪ Restore areas with native vegetation where feasible ▪ Monitor and control terrestrial invasive species ▪ Monitor terrestrial and stream environment to determine presence of special, rare, or endangered species

Table 12. Recreational Carrying Capacity: Scenario 1		
Site Features		**Management Actions and Design Considerations**
Access and Facilities	**9. Land-based site access**	▪ No change, maintain existing access to bay with no physical improvements including separate access at northern end of the bay for surfers ▪ Monitor the total number of daily visitors from land ensuring 2006 summer maximum counts are not surpassed ▪ Restrict entry of commercial operations
	10. Sea-based site access	▪ Limit the number and capacity of commercial ocean tourism permits to 10 permits with maximum capacity of 49 people per boat ▪ Install 5 to 8 mooring buoy systems (bow and stern buoys) for and in consultation with existing commercial ocean tourism operators and based on studies to determine placement with minimum impact to marine environment with 1 to 2 of the mooring buoy systems for non-commercial recreational uses
	11. Educational facilities	▪ Provide on-site manager and trained volunteers especially during peak seasons for education and outreach and to make direct interventions needed minimize contact with live coral ▪ Require pre-dive/snorkel educational briefings by certified guides on all commercial tours boats and covering MLCD regulations and best practices to minimize impacts on coral reef ecosystem ▪ Install interpretative signs covering site regulations (including prohibitions on fishing, fish feeding, and standing on coral reefs), best practices, and ecological and Native Hawaiian cultural information, and environmental management information at head of the trail warning visitors of the absence of restroom facilities and that all garbage must be carried off-site ▪ Emphasize need to minimize contact with reef substratum
	12. Cultural facilities	▪ No change from existing conditions
	13. Parking	▪ No change in parking compared to current conditions; maintain existing roadside parking accommodating no more than 60 to 70 vehicles at any one time ▪ Install safety signs warning pedestrians of road conditions and drivers of pedestrian activity ▪ Prohibit parking of commercial buses and other vehicles
	14. Sanitation and Solid Waste Management	▪ No change from existing conditions, no restroom or shower facilities or potable water ▪ Install signs at the head of the trail warning visitors that restroom facilities are not available ▪ Provide trash receptacles at head and base of the trail with daily trash pickup and site maintenance
	15. Picnic facilities	▪ No change from existing conditions; no picnic or barbeque facilities
	16. Safety	▪ Identify safe entry and exit points for land-based snorkelers to avoid using the concrete boat ramp ▪ Establish and enforce ban on all forms of fish feeding with commercial tour operators ▪ Maintain parking area adjacent to site entrance for emergency vehicles ▪ Install emergency call box at entrance and base of trail ▪ Install signs warning pedestrians of traffic on the road ▪ Conduct regular maintenance vegetation around the trail especially overhanging tree branches

6.2 Scenario 2: Maintain Recreational Uses at 2006 Levels with Improved Area Management and Parking Area

Scenario 2 would maintain the same recreational use levels and improved area management features as described in Scenario 1, except for the provision of a parking area to reduce safety issues related to roadside parking.

Recreational uses, ecosystem conditions, and site management required for sustainable use under Scenario 2 are described in Table 13 and discussed below. Shaded areas of Table 13 highlight differences from Scenario 1.

Recreational Uses

All recreational uses and monitoring activities are as described in Scenario 1.

Ecosystem Components

All ecosystem management and monitoring activities are as described in Scenario 1.

Access and Facilities

Under Scenario 2, a low-impact parking area would be constructed to reduce safety risks from current roadside parking conditions. Parking capacity would be limited to the existing capacity of 60 vehicles (see vehicle surveys in Appendix A). Large capacity commercial buses and other commercial vehicles would be prohibited from parking in the parking area. Current roadside parking would be prohibited by the addition of no parking signs and physical barriers. The design, site layout, and construction of a parking area would require low impact design and zero surface water discharge in order to minimize additional stress to the terrestrial and marine environment.

All other access and facilities management actions are as described in Scenario 1.

Table 13. Recreational Carrying Capacity: Scenario 2		
Site Features		**Management Actions and Design Considerations**
Recreational Uses	**1. Snorkeling**	▪ Maintain and monitor snorkeling activity at 2006 levels ▪ Conduct periodic monitoring to determine cumulative impacts of snorkelers on coral reefs and substratum contact rates
	2. SCUBA diving	▪ Maintain and monitor SCUBA diving activity at 2006 levels ▪ Conduct periodic monitoring to determine cumulative impacts of snorkelers on coral reefs and monitor substratum contact rates ▪ Prohibit entry of SCUBA diving classes ▪ Conduct periodic monitoring to determine cumulative impacts of SCUBA divers on coral reefs and substratum contact rates
	3. Surfing	▪ Continue to limit the frequency and duration of surf competitions to current levels ▪ Prohibit entry of commercial surf schools
	4. Other ocean recreational activities	▪ Enforce MLCD restrictions especially prohibition on fishing ▪ Prohibit launching of any motorized or non-motorized recreational boats such as kayaks or motor boats ▪ Maintain sea-based access to bay to kayakers, outrigger canoes, and other non-motorized vessels and prohibit anchoring by these vessels ▪ Maintain access to small non-commercial ocean recreational vessels such as sailboats and kayaks ▪ Prohibit all other forms of ocean recreational activities including wind surfing, kite sailing, jet skiing, and ski boats as incompatible with existing uses
	5. Land-based recreation	▪ No change, land-based recreation is currently limited to picnicking on the beach
Ecosystem Components	**6. Marine ecosystem**	▪ Conduct regular monitoring of coral reef and water quality conditions to monitor long term status of the marine ecosystem ▪ Conduct periodic monitoring for marine invasive species and coral and fish diseases
	7. Social-cultural dimensions	▪ Conduct regular monitoring of visitor activities and satisfaction levels ▪ Develop archaeological resources preservation plan that ensure that the location of archaeological resources remains unknown and sites are preserved
	8. Terrestrial ecosystem	▪ No change, maintain streambed and coastal bluffs in natural state ▪ Restore areas with native vegetation where feasible ▪ Monitor and control terrestrial invasive species ▪ Monitor terrestrial and stream environment to determine presence of special, rare, or endangered species
Access and Facilities	**9. Land-based site access**	▪ No change, maintain existing access to bay with no physical improvements including separate access at northern end of the bay for surfers ▪ Monitor the total number of daily visitors from land ensuring 2006 summer maximum counts are not surpassed ▪ Restrict entry of commercial operations

Table 13. Recreational Carrying Capacity: Scenario 2		
Site Features		**Management Actions and Design Considerations**
	10. Sea-based site access	▪ Limit the number and capacity of commercial ocean tourism permits to 10 permits with maximum capacity of 49 people per boat ▪ Install 5 to 8 mooring buoy systems (bow and stern buoys) for and in consultation with existing commercial ocean tourism operators and based on studies to determine placement with minimum impact to marine environment with 1 to 2 of the mooring buoy systems for non-commercial recreational uses
	11. Educational facilities	▪ Provide on-site manager and trained volunteers especially during peak seasons for education and outreach and to make direct interventions needed minimize contact with live coral ▪ Require pre-dive/snorkel educational briefings by certified guides on all commercial tours boats and covering MLCD regulations and best practices to minimize impacts on coral reef ecosystem ▪ Install interpretative signs covering site regulations (including prohibitions on fishing, fish feeding, and standing on coral reefs), best practices, and ecological and Native Hawaiian cultural information, and environmental management information at head of the trail warning visitors of the absence of restroom facilities and that all garbage must be carried off-site ▪ Emphasize need to minimize contact with reef substratum
	12. Cultural facilities	▪ No change from existing conditions
	13. Parking	▪ A low-impact parking facility would be constructed with a capacity of 60 vehicles ▪ Roadside parking would be prohibited with the installation of no parking signs and barriers ▪ Prohibit parking of commercial buses and other vehicles
	14. Sanitation and Solid Waste Management	▪ No change from existing conditions, no restroom or shower facilities or potable water ▪ Install signs at the head of the trail warning visitors that restroom facilities are not available ▪ Provide trash receptacles at head and base of the trail with daily trash pickup and site maintenance
	15. Picnic facilities	▪ No change from existing conditions; no picnic or barbeque facilities
	16. Safety	▪ Identify safe entry and exit points for land-based snorkelers to avoid using the concrete boat ramp ▪ Establish and enforce ban on all forms of fish feeding with commercial tour operators ▪ Maintain parking area adjacent to site entrance for emergency vehicles ▪ Install emergency call box at entrance and base of trail ▪ Install signs warning pedestrians of traffic on the road ▪ Conduct regular maintenance vegetation around the trail especially overhanging tree branches

6.3 Scenario 3: Maintain Recreational Activity at 2006 Levels with Improved Area Management and Supporting Infrastructure

Under Scenario 3, the current types and levels of recreational use described could be sustained with improved area management and supporting infrastructure. Improved area management would be as described in Scenarios 1 and a parking area as described in Scenario 2. This scenario would also include supporting infrastructure to address other key recreational carrying capacity issues. Supporting infrastructure would include the construction of the following:

- Picnic area
- Restrooms
- Interpretative facility
- Native Hawaiian cultural center

Recreational uses, ecosystem conditions, and site management actions proposed for Scenario 3 are summarized in Table 14. Shaded areas of Table 14 highlight differences from Scenario 1.

Recreational Uses

While recreational activity would be maintained at 2006 levels, a shift in recreational use patterns is anticipated with the addition of supporting infrastructure, such as a picnic area, restrooms, and other amenities. Visitors may extend the duration of their stay at Honolua Bay beyond 2 hours. Snorkeling activity levels from land-based access could decrease under this scenario if the composition of visitors shifts to land-based recreation. Visitors could spend a longer time at Honolua Bay, reducing the turnover rate of visitors and potentially the number of snorkelers. Also, visitors may come just to picnic and barbeque and not necessarily to snorkel.

Ecosystem Components

Scenario 3 may alter the social/cultural dimensions of the area with the percentage of resident visitors increasing over 2006 levels of 7 percent. A picnic area and other amenities provide a more family-friendly recreational experience.

Access and Facilities

The design, siting, and other factors need to be considered should parking, restrooms, or other facilities be developed.

Scenic vistas and wilderness setting at Honolua Bay is considered a valued asset by visitors to the area and should be preserved without further degradation. Supporting infrastructure, if being considered, should be sited in such a manner that it is not visible from either land-based or sea-based vantage points.

Low impact infrastructure design with a goal of zero surface water discharge has been highlighted as primary assumption for the development of infrastructure to support recreational activities at Honolua Bay. A workshop on “Innovative Technologies for Stormwater and Wastewater Management in Sensitive Coastal Areas” was conducted on October 5 and 6, 2005 at

the Ritz Carlton, Kapalua, Maui, sponsored by the Steering Committee for *Hawai`i's Local Action Strategy to Address Land-based Pollution Threats to Coral Reefs* with the support of Maui Land & Pineapple Company, Inc. and the Sustainable Living Institute of Maui. The purpose of the workshop was to explore low impact development technologies and best management practices that could be applied to the design of parking facilities, restrooms, and other amenities to support recreational activities at Honolua Bay. A summary of recommendations made by workshop participants is provided in Table 15. A compendium of low impact technologies and best management practices was provided during the workshop.

An assessment of hazards in the coastal zone, including coastal erosion, storm surges, flooding, and tsunamis, needs to be incorporated into the design and siting of infrastructure to support recreational activities and if appropriate, an early warning system for tsunamis. In addition, signage warning visitors about coastal hazards and emergency response procedures should be included as part of educational outreach activities for land-based visitors.

Public access improvements at Honolua Bay may require compliance with Americans with Disabilities Act (ADA). These requirements will need to be considered in the context of implementing low impact facilities, trail improvements, and stormwater best management practices for recreational use scenarios that involve the construction of supporting infrastructure

Table 14. Recreational Carrying Capacity: Scenario 3		
Site Features		**Management Actions and Design Considerations**
Recreational Uses	**1. Snorkeling**	▪ Maintain and monitor snorkeling activity at 2006 levels ▪ Conduct periodic monitoring to determine cumulative impacts of snorkelers on coral reefs and substratum contact rates
	2. SCUBA diving	▪ Maintain and monitor SCUBA diving activity at 2006 levels ▪ Conduct periodic monitoring to determine cumulative impacts of snorkelers on coral reefs and monitor substratum contact rates ▪ Prohibit entry of SCUBA diving classes ▪ Conduct periodic monitoring to determine cumulative impacts of SCUBA divers on coral reefs and substratum contact rates
	3. Surfing	▪ Continue to limit the frequency and duration of surf competitions at existing levels ▪ Prohibit entry of commercial surf schools
	4. Other ocean recreational activities	▪ Enforce MLCD restrictions especially prohibition on fishing ▪ Prohibit launching of any motorized or non-motorized recreational boats such as kayaks or motor boats ▪ Maintain sea-based access to bay to kayakers, outrigger canoes, and other non-motorized vessels and prohibit anchoring by these vessels ▪ Maintain access to small non-commercial ocean recreational vessels such as sailboats and kayaks ▪ Prohibit all other forms of ocean recreational activities including wind surfing, kite sailing, jet skiing, and ski boats as incompatible with existing uses
	5. Land-based recreation	▪ No change, land-based recreation is currently limited to picnicking on the beach
Ecosystem Components	**6. Marine ecosystem**	▪ Conduct regular monitoring of coral reef and water quality conditions to monitor long term status of the marine ecosystem ▪ Conduct periodic monitoring for marine invasive species and coral and fish diseases
	7. Social-cultural dimensions	▪ Conduct regular monitoring of visitor activities and satisfaction levels ▪ Develop archaeological resources preservation plan that ensure that the location of archaeological resources remains unknown and sites are preserved
	8. Terrestrial ecosystem	▪ No change, maintain streambed and coastal bluffs in natural state ▪ Restore areas with native vegetation where feasible ▪ Monitor and control terrestrial invasive species ▪ Monitor terrestrial and stream environment to determine presence of special, rare, or endangered species
Access and Facilities	**9. Land-based site access**	▪ No change, maintain existing access to bay with no physical improvements including separate access at northern end of the bay for surfers ▪ Monitor the total number of daily visitors from land ensuring 2006 summer maximum counts are not surpassed ▪ Restrict entry of commercial operations

Table 14. Recreational Carrying Capacity: Scenario 3		
Site Features		**Management Actions and Design Considerations**
	10. Sea-based site access	▪ Limit the number and capacity of commercial ocean tourism permits to 10 permits with maximum capacity of 49 people per boat ▪ Install 5 to 8 mooring buoy systems (bow and stern buoys) for and in consultation with existing commercial ocean tourism operators and based on studies to determine placement with minimum impact to marine environment with 1 to 2 of the mooring buoy systems for non-commercial recreational uses
	11. Educational facilities	▪ Construct low impact Interpretative Center to provide information on site regulations, best practices, and ecological and Native Hawaiian cultural information ▪ Provide educational briefings on negative impacts of fish feeding and contact with coral reef substratum ▪ Install interpretative signs covering site regulations (including prohibitions on fishing, fish feeding, and standing on coral reefs), best practices, and ecological and Native Hawaiian cultural information ▪ Require pre-dive/snorkel educational briefings by certified guides on all commercial tours boats covering MLCD regulations and best practices to minimize impacts on coral reef ecosystem ▪ Install interpretative signs covering site regulations (including prohibitions on fishing, fish feeding, and standing on coral reefs), best practices, and ecological and Native Hawaiian cultural information, and environmental management information at head of the trail warning visitors of the absence of restroom facilities and that all garbage must be carried off-site ▪ Emphasize need to minimize contact with reef substratum
	12. Cultural facilities and activities	▪ Construct low-impact cultural facility to provide a venue for special Native Hawaiian cultural events
	13. Parking	▪ A low-impact parking facility would be constructed with a capacity of 60 vehicles ▪ Roadside parking would be prohibited with the installation of no parking signs and barriers ▪ Prohibit parking of commercial buses and other vehicles
	14. Sanitation and Solid Waste Management	▪ Construct low impact and self-contained restroom facility constructed on mountain side of the highway in conjunction with interpretative center and parking area ▪ Ensure regular maintenance of restroom facility ▪ Provide trash receptacles at head and base of the trail with daily trash pickup and site maintenance
	15. Picnic facilities	▪ Provide picnic and barbeque facilities within a defined area inland from the shoreline
	16. Safety	▪ Identify safe entry and exit points for land-based snorkelers to avoid using the concrete boat ramp ▪ Establish and enforce ban on all forms of fish feeding with commercial tour operators ▪ Maintain parking area adjacent to site entrance for emergency vehicles ▪ Install emergency call box at entrance and base of trail ▪ Install signs warning pedestrians of traffic on the road ▪ Conduct regular maintenance vegetation around the trail especially overhanging tree branches

Table 15. Summary of Low Impact Design Recommendations for Infrastructure to Support Recreational Activities at Honolua Bay (Chaston 2005)

Restroom Facilities

- Comfort station, which includes a composting toilet located adjacent to the parking lot.
- Type: compost toilet (size depends on visitor numbers)
- Number: 5 in small clusters
- Locations: 2 at the beach
- 1 each at 2 parking areas
- 1 along trail

Parking:

- Limit parking to mauka of highway (Group 2)
- Parking lot located on makai side of road, with maintained pathway leading to the Bay (Group 1)
- Have 2 parking areas – 1 at road curve and near existing trail (Group 3)
- Roadside limits with physical structures (boulders etc. to prevent parking)
- Limit number of stalls and number of daily users
- 300 people/day (current conservation/preservation)
- Use pavers/permeable material
- Parking lot design would include a wood nitrate sequestering trench and best management practices to reduce erosion, increase permeability.
- Provide a kiosk with educator

Pathway:

- Use pavers
- Recreation and cultural trails
- Include texas crossing across the stream (concrete bars with flow of stream) (Group 2)
- Construct plastic lumber bridge over the stream/wetland leading to the Bay (Group 1)
- Include clear signage of trails

Potable water:

- Catchment – rain storage
- Roof/rainwater catchments
- Emergency haul in

Other:

- Need to consider flood zone, stream and tsunamis
- Riparian buffers – native plants
- Education at parking and person at beach

6.4 Scenario 4: Revise Recreational Use Activity from 2006 Levels Based on Long-term Monitoring of Ecological and Social Conditions

Scenario 4 establishes an adaptive management approach for the preceding three scenarios to alter area management measures based on the results of long-term monitoring of ecological and social conditions. Changes in recreational use levels from 2006 levels, infrastructure, and area management would depend on:

- Long-term biophysical monitoring of the condition of the coral reef
- Effectiveness of education and outreach programs
- Changes in other threats to the coral reefs, including sedimentation, coral bleaching, coral disease, marine invasive species

Scenario 4 assumes that the types and levels of ocean recreational activities, area management, and supporting infrastructure along with monitoring and cumulative impact studies described in Scenarios 1, 2, or 3 would be implemented for five years.

The recreational use levels would be re-evaluated at that time and possibly reduced or increased based on the results of ecosystem monitoring. Indicators and threshold levels for acceptable environmental and social conditions would be used as a basis for determining changes in recreational use levels. Reduced activity levels would be justified if recreational uses are resulting in cumulative impacts on living coral cover or other threats to the reefs at Honolua Bay emerge to further compromise the reef condition. Increased recreational use levels may be possible based on demonstrated recovery of the coral reef ecosystem and proven effectiveness of education and outreach programs.

7.0 Recommendations

The capacity management scenarios described in the previous section assume that government, private sector, and other organizations will act in a coordinated and collaborative manner to put in place the actions needed for sustainable recreational use of Honolua Bay. An integrated, participatory, and phased approach is recommended to manage recreational use at Honolua Bay.

Scenario 1 is recommended as a necessary first step in managing recreational capacity and impacts at Honolua Bay. Scenario 1 describes a set of largely non-structural actions for improved area management of Honolua Bay. These management actions, which include: maintaining recreational use at 2006 levels through land- and sea-based access controls, providing on-site management, improving education and outreach activities, and establishing a long-term ecosystem monitoring effort, need to be put in place as a foundation for other scenarios. Furthermore, some management actions require commitments and coordination among several responsible entities as well as changes in rules and regulations. For example, in Scenario 2, the construction of a parking area to accommodate 60 vehicles is dependent on prohibiting parking along the highway. Without coordination among responsible entities on parking, an increase in the number of parked vehicles and land-based visitors could result. As a starting point, a Memorandum of Agreement between responsible entities could be developed to underscore commitment and coordination needed to achieve the proposed management actions.

A transparent process for involving local stakeholders should developed and implemented to assist in defining the values to be protected and management goals for the area. An integrated coastal area management plan can then be developed to guide the coordinated actions of multiple responsible entities and to set forth a comprehensive set of actions to achieve these goals for both watershed and marine areas. Illustrative management goals are provided in Table 9. The plan should be developed collaboratively with government, private sector, and other stakeholder groups and presented as draft and final plans for public review and comment. The roles and responsibilities of various stakeholders and jurisdictional entities in plan implementation would be defined with a timetable of priority actions for a period of 5 years with a mandatory review and update every 5 years. This approach would be in line with the State's Hawai'i Ocean Resources Management Plan (Hawaii CZM Program 2006) which calls for the transition to an integrated, place-based approach to managing ocean resources involving public-private partnerships and communities in planning and implementation.

Lastly, information management is a critical component of the sustainable use and management of Honolua Bay. Information and data need to be consolidated in a geographic information system to enable access to and analysis of all datasets to improve site management and decision-making. Priority data gaps for area management need to be identified and addressed.

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Appendix A

Recreational Use Surveys of Honolua Bay, Maui

December 2005 to July 2006

Contents

Figures

Tables

1.0 Introduction

Recreational use surveys were conducted at Honolua Bay between December 2005 and July 2006 to establish a baseline of recreational activities and to provide input on the evaluation of the recreational carrying capacity of the area. The adjacent, Mokule'la Bay, was not part of the survey.

2.0 Survey Methods

Recreational use survey protocols were developed for Honolua Bay (Appendix B) based on a review of previous survey methods conducted at Honolua Bay (Holland and Meyer 2003a and 2003b). Human use survey protocols developed by the Hawai'i State Department of Land and Natural Resources (DLNR) at other sites in Hawai'i, such as Puako, were reviewed for application to Honolua Bay. The primary objectives of the recreational use surveys were to quantify the:

- Activity levels and patterns of ocean recreational use in Honolua Bay
- Number of people accessing the bay from the trail leading to the bay
- Number of commercial ocean tour boats and passengers entering the bay
- Number of vehicles parking along the highway

In addition, to recreational use surveys to quantify activity levels, a survey questionnaire was developed to characterize aspects of visitor satisfaction with their recreational experience (Appendix B). Questions on visitor satisfaction were patterned after the social carrying capacity study conducted at Hanauama Bay (Lankford et al., 2005). Visitors were asked to complete the questionnaire upon leaving the site to gather anecdotal information on their experience that day.

Recreational use surveys were conducted at Honolua Bay between December 30, 2005 and July 9, 2006. Survey dates were selected to characterize maximum use levels for visitors accessing the bay by land to snorkel. Visitor arrivals to Maui historically are highest during the summer months, June to and August, with the next highest arrivals in during December and March (Figure A.1).

Surveys were conducted on three consecutive days, Friday, Saturday, and Sunday between 1000 and 1600 hours each day. A total of 16 survey days were completed representing six, 3-day consecutive periods. Three surveys planned during March 2006 were initiated by could not be completed due to extreme rain conditions during that time. Surveys for this 3-day period were completed for March 24th only. Surveys planned during March 24, 25, and 26 could not be completed due to extreme rain conditions during that time. Surveys for this 3-day period were completed for March 24th only.

A two-person team conducted the surveys from two different vantage points. One surveyor was based at the boat ramp to count the number of visitors arriving from the

trail and to make hourly counts of recreational activities. The second surveyor counted the number of vehicles parked along the road and also made counts of surfing activity from a cliff vantage point. The survey at the cliff vantage point counted surfers and served as a backup counter for other recreational activities. This person was also responsible for counted parked vehicles. The beach vantage point counted snorkelers, beachgoers and recorded the total number of daily visitors from land. During summer months, a third person was added to the team to handle the high land-based visitor traffic to the bay and to radio boats entering and anchoring in the bay to determine their passenger count. Counts of snorkelers in summer surveys were sometimes obscured by commercial tour boats.

3.0 Recreational Activities and Use Levels

The primary recreational activities at Honolua Bay are snorkeling, SCUBA diving, and surfing. Other ocean recreational activities include kayaking and recreational sailboats; however these activities were limited during the survey dates. Land-based recreational activities were limited to picnicking associated with visitors that access the bay for snorkeling. The types and duration of recreational activities at Honolua Bay are highly dependent on ocean conditions. Snorkeling and beachgoing activities were predominant during summer surveys. Surfing activities were predominant during winter surveys. Snorkeling and surfing activities are separated spatially and do not appear to pose any recreational use conflicts.

3.1 Snorkeling

Snorkeling activity was quantified by visual counts of the number of snorkelers in the bay from a beach vantage point. During summer months, commercial tour boats sometimes obscured beach counts of snorkeling activities. A second observer also made counts of snorkelers from the cliff vantage point for comparison purposes. Three, 5-minute counts were made each hour to estimate the average hourly number of snorkelers between 1000 and 1600 hours (Table A.1). These three counts were averaged to determine the average hourly number of snorkelers for the survey period (Table A.2). The maximum count of snorkelers represents the highest number of snorkelers reported for any one 5-minute count that occurred through the day (Table A.2). Winter and summer averages and maximum counts are provided in Table A.9 and Table 4.10, respectively.

The hourly average number of snorkelers ranged from 8.8 snorkelers per hour during winter surveys to 50.7 snorkelers per hour during summer surveys (Table A.9). The maximum count of snorkelers was 111 observed on July 2, 2006 (Table A.10).

3.2 SCUBA Diving

SCUBA diving activity was quantified by visual counts of the number of SCUBA divers in the bay. Three, 5-minute counts were made each hour to estimate the average hourly number of SCUBA divers between 1000 and 1600 hours (Table A.3). These three counts

were averaged to determine the average hourly number of SCUBA divers for the survey period (Table A.4). The number of SCUBA divers from commercial tour boats was not always easy to quantify from either beach or cliff vantage points. Winter and summer averages are provided in Table A.9. The maximum count of SCUBA divers represents the highest number of SCUBA divers reported for any one 5-minute count that occurred through the day (Table A.4, Table A.10).

The hourly average number of SCUBA divers ranged from 0.2 SCUBA divers per hour during winter surveys to 1.6 SCUBA divers per hour during summer surveys (Table A.9). The maximum count of SCUBA divers was 17 observed on July 1, 2006 (Table A.10).

3.3 Surfing

Surfing activity was quantified by visual counts of the number of surfers in the bay. Three, 5-minute counts were made each hour to estimate the average hourly number of surfing between 1000 and 1600 hours (Table A.5). These three counts were averaged to determine the average hourly number of surfing for the survey period (Table A.6). Winter and summer averages are provided in Table A.9. The maximum count of surfers represents the highest number of surfers reported for any one 5-minute count that occurred through the day (Table A.6, A.10).

Surfing at the northern end of Honolua Bay was the predominant ocean activity during the winter surveys. The hourly average number of surfers ranged from 25.4 surfers per hour during winter surveys to 0.1 surfers per hour during summer surveys (Table A.9). The maximum count of surfers was 83 observed on December 31, 2006 (Table A.10).

3.4 Other ocean recreational activities

Other ocean recreational activities observed during the surveys included kayaking, one-man outrigger canoes, and several sailboats. Recreational surveys were initiated at 1000 hours. Kayak tours may be occurring at early hours in the morning, therefore, the number of kayakers visiting the bay may be underestimated.

No windsurfing, kite sailing, sailing canoes, wake boarding, waterskiing, jet skis, or recreational fishing activities were observed during any of the survey dates.

3.5 Land-based recreation

Beachgoing activity was quantified by visual counts of the number of people on the beach. Three, 5-minute counts were made at 20 minute intervals each hour to estimate the average hourly number of beachgoers between 1000 and 1600 hours (Table A.7). These three counts were averaged to determine the average hourly number of beachgoers for the survey period (Table A.8). Winter and summer averages are provided in Table A.9.The maximum count of beachgoers represents the highest number of people on the beach reported for any one 5-minute count that occurred through the day (Table A.8, A.10).

The hourly average number of people on the beach ranged from 16.8 beachgoers per hour during winter surveys to 47.5 beachgoers per hour during summer surveys (Table A.9). The maximum count of people on the beach was 113 observed on June 30, 2006 (Table A.10).

4.0 Social Dimensions of Recreational Use

Anecdotal surveys were conducted to gather information about visitor satisfaction with the Honolua Bay recreational experience. A survey questionnaire was developed for visitors to complete after their recreational experience (see Appendix B). The survey questionnaire was voluntary and completed by visitors entering Honolua Bay from the land. On each survey day, visitors were asked if they would be willing to fill out a visitor satisfaction questionnaire upon their departure from Honolua Bay. A total of 215 respondents, or 5.5 percent of the total number of visitors (3,831) over the 16 survey days, filled out all or portions of the questionnaire (Table A.11). Not all respondents completed all questions on the survey form. Due to the nature of the survey conditions, a random sampling of the survey respondents was not possible.

4.1 Visitor Profile

Most visitors to Honolua Bay, 93.5 percent, were non-residents from the mainland U.S. and a few from other countries (Table A.11, Figure A.2). Respondents learned about Honolua Bay primarily from travel guides (33 percent of respondents) and friends (27 percent of respondents) although 17 percent of respondents noted that they were driving by and stopped because of cars parked by the road (A.12; Figure A.3).

Over 50 percent of respondents indicated that this was their first experience at Honolua Bay (Figure A.4). Over 35 percent of respondents had visited Honolua Bay three times or more. The duration of the respondents visit varied from 30 minutes to over 3 hours, however, over 80 percent of the respondents visited Honolua Bay for 1 to 2 hours in duration (Figure A.5).

4.2 Visitor Satisfaction

Visitors were asked whether various site management conditions added, detracted, or had no effect on their recreational experience at Honolua Bay. The majority of respondents, 58 percent, derived added satisfaction from the availability of education materials on-site (Table A.13). It should be noted that educational materials alone were responsible for added satisfaction levels. No briefings or interpretation was provided on survey days.

Seventy-five percent of respondents derived added satisfaction from the marine life observed during snorkeling (Table A.14), while water quality detracted from visitor satisfaction among 46 percent of the respondents (Table A.15). The parking situation (Table A.17) had no effect on satisfaction levels 67 percent of the respondents. Similarly, 75 percent responded that the absence of amenities, such as restrooms, had no

effect on satisfaction levels and 15 percent noted added satisfaction from the absence of amenities (Table A.18). It should be noted; however, that portable toilets were present at the site during June and July surveys, and therefore, it is difficult to determine the overall effect on satisfaction.

The number of people at the site (crowding) had no effect on satisfaction among 76 percent of respondents (Table A.16). Furthermore, 47 percent responded that Honolua Bay could accommodate more people (Table A.19). Overall, 63 percent of respondents were highly satisfied with their recreational experience at Honolua Bay (A.19).

Correlations between the total number of people, hourly average number of snorkelers, and satisfaction levels indicate significant negative correlation between the number of people and satisfaction (Tables A.20, A.21, and A.22).

5.0 Access to Honolua Bay

Access to Honolua Bay for snorkeling and other ocean recreational activities occurs from both the land and sea. Visitors park along the highway and walk down a wooded trail to the bay. Commercial tour boats bring visitors to the bay for snorkeling and SCUBA diving. The number of land-based and sea-based visitors was quantified along with the number of commercial tour boats visiting the bay. The number of surfers entering the bay from a cliff trail at the northern end was not part of this study.

5.1 Land-Based Access

Visitors park along the highway and walk down a dirt path to the bay. There are two major land-based access points to the bay. One that leads to the dirt path that requires crossing a stream. As second path is further north and avoids the stream crossing. Both access points bring visitors to the boat ramp. During rainy periods, water height in the stream can be substantial endangering visitors during the crossing.

No tour buses or other large capacity vehicles were observed stopping or parking at Honolua Bay during any survey days. No commercial tour operations were observed bringing tourists to the bay from land-based access for organized snorkel or diving tours during any survey days; however, some dive shops are known to bring groups of snorkelers and SCUBA divers to Honolua Bay from land.

It should be noted that most surfers do not park along the road or access the bay from the dirt path that snorkelers use. Surfers park farther north on a dirt road on Lipoa Point and walk down a cliff trail to access the northern end of the bay for surfing. Occasionally, however, surfers do enter the bay from the dirt path to surf the south side of the bay. The parking area used by surfers was not surveyed as part of this study.

The number of visitors entering Honolua Bay by land was counted at the end of the dirt path where the path merges with the old boat ramp. Most visitors, 94 percent are non-

residents; however, as the survey questionnaire was voluntary, it is not know if residents were less likely to fill out the survey form than non-residents. The most visitors recorded were 440 people between 1000 and 1600 hours on July 12. The fewest number of visitors was 25 between 1000 and 1600 hours on March 24 during extreme rain conditions. Overall, a total of 3,831 visitors were recorded between December 2005 and July 2006, or an average of 239 visitors per day (n=16). The average number of visitors was higher during summer survey dates, 359 visitors per day (n=6) and lower during the winter survey dates, 168 visitors per day (n=10).

5.2 Sea-Based Access

Visitors also enter Honolua Bay for recreational activities by boat. Three types of boats were identified during the survey, commercial vessels, recreational vessels (sail boats and small motor boats), and kayaks. Some kayaks tours visit the area prior to 1000 hours and may not have been well counted during the surveys.

Commercial Tour Boats

Currently, the number and capacity of commercial tour boats that can operate at Honolua Bay is not regulated. The commercial tour boat fleet that regularly visits Honolua Bay consists of 10 boats permitted to carry a maximum of 49 passengers operating out of Kaanapali. Commercial tour boats visit Honolua Bay between approximately 0900 and 1400 hours. High season occurs from February to April and June to July. November and December holiday's can also be busy times for the commercial tour boat fleet. During these times, commercial tour boats may operate 7 days a week however, weather and sea conditions often limit the number of days that can be spent at the bay.

Boats were not observed during the winter survey dates (December 2005 and January 2006); however, commercial tour boats are known to bring visitors throughout the year. Commercial tour boats brought visitors for diving and snorkeling activities primarily during the summer survey periods. Commercial vessels cater primarily to snorkelers. Most, if not all, are catamarans. Vessels generally arrive after 1100 hours, although one vessel (Trilogy IV) does arrive early. Most vessels remain in Honolua Bay between 90 minutes to two hours. All commercial vessels anchor in the bay usually deploying a bow and stern anchors.

Commercial Vessels Visiting Honolua Bay During Summer Surveys

Trilogy IV
Shangri -La
Kiele V
Kapalua Kai
Teralani II
Teralani III
Gemini
Sweet Life – private charter
Dauntless

A maximum of 6 commercial tour boats was counted at any one time during the summer months (Table A.24); however, commercial tour boats with much larger capacity, 150 passengers are know to also use the bay.

5.3 Estimated Daily Visitor Numbers

The estimated total number of visitors to Honolua Bay from both land and sea-based access routes is highest during the summer surveys both by the increased number of land-based visitors and the seasonal use of the bay by commercial tour boats. The highest number of visitors was 680 on June 30, 2006 with 412 visitors from land based access and 268 visitors arriving by commercial tour vessel. The estimated total is based on the daily count of visitors walking down the trail to the bay between 1000 and 1600 hours and the total number of passengers on commercial vessels communicated via radio to the surveyor. The average daily number of visitors based on winter surveys was 183 visitors per day and 535 visitors per day based on summer surveys (Table A.23).

This number does not include an estimate of the total number of surfers to the bay as no daily counts were made of surfers going down the cliff path at the northern end of the bay.

6.0 Vehicle Parking

Parking facilities are not available at Honolua Bay. Visitors park their vehicles on the side of the road. The section of highway used by visitors to park and enter the bay by land for snorkeling was divided into three zones to facilitate drive-by counts. The surveyor drove along the highway and counted the number of vehicles parked in each zone.

The maximum number of parked vehicles counted at any one time during any survey day was 57 parked vehicles. Observations made during the previous summer (2005) recorded a maximum of 70 parked vehicles (Foote, pers. Communication). The minimum number of parked vehicles, 10, occurred on March 24, during the period of extreme rain. The average number of parked vehicles ranged from 6 to 40 based on 10 to 12 counts per survey day. The average and maximum number of parked vehicles were highest during surveys conducted during the summer months of June and July and lowest during surveys conducted in January, March, and April. The maximum number of vehicles counted was 57 vehicles on June 30, 2006 (Table A.25, Figure A.12). Peak daily parking occurs between 1000 to 1300 hours (Figure A.13).

7.0 Other Observations

Miscellaneous observations made during the survey days included safety considerations and the presence of large marine animals.

7.1 Safety Considerations

Many visitors use the boat ramp to enter the water. The ramp is slippery and degraded from wave action. Visitors frequently slip and cut themselves. Unfortunately, some guidebooks instruct visitors to use the boat ramp as an easy entrance to enter the water.

Fish feeding is creating hazardous conditions for snorkelers as fish are becoming aggressive. Several people exited the water bleeding after being bitten by chubs and blue-line snappers. The aggressive nature of these fish has also been a deterrent causing people to exit the water prematurely or not even entering the water at all.

Vehicles parking along the highway have blocked the entrance to the trail impeding access to emergency vehicles when responding to an emergency at the site. The DOT painted the area and placed no parking signs to maintain emergency access to the trail.

7.2 Weather and Sea Conditions

The semi-enclosed nature of Honolua Bay provides safe shelter to snorkelers even when waves are present. Windy and wavy sea conditions can create turbid water conditions by resuspending sediments in the bay. Rain events in the watershed can also create turbid water conditions from stream runoff to the bay.

7.3 Marine Ecosystem

On occasion, pods of spinner dolphins are seen at entrance of Honolua Bay. Use of the area is variable; however, with sitings occurring at different times of the day. The importance of this area to the dolphins as feeding or resting areas is not known. Green turtles frequent shallow reef areas of the bay for resting and feeding.

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Table A.1: Counts of Snorkelers at Honolua Bay

	Number of Snorkelers Counted																	
	1000 – 1100 hrs			1100 -1200 hrs			1200 – 1300 hrs			1300 – 1400 hrs			1400 -1500 hrs			1500 – 1600 hrs		
Survey Date	1000	1020	1040	1100	1120	1140	1200	1220	1240	1300	1320	1340	1400	1420	1440	1500	1520	1540
12/30/2005	14	26	31	32	41	32	32	36	28	28	30	21	15	24	8	27	11	8
12/31/2005	4	5	17	16	28	14	4	9	5	3	2	6	2	0	0	2	4	0
1/1/2006	0	0	0	3	4	5	7	5	2	2	3	11	11	5	12	11	9	5
1/6/2006	0	0	0	2	2	7	15	8	6	0	3	4	3	9	2	3	2	1
1/7/2006	2	2	3	2	4	6	7	4	14	15	14	10	7	9	10	14	13	3
1/8/2006	2	0	2	6	11	14	8	15	10	6	9	5	6	14	6	4	0	0
3/24/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/14/2006	2	3	5	10	4	6	6	12	9	9	6	13	6	9	14	10	4	2
4/15/2006	8	14	4	13	12	15	25	32	16	11	13	14	13	17	15	10	8	8
4/16/2006	3	5	4	8	5	13	9	7	7	6	13	11	11	11	10	6	2	4
6/30/2006	71	92	96	74	64	24	104	69	51	53	37	33	55	36	28	22	33	39
7/1/2006	64	41	31	40	46	44	64	72	66	25	11	18	15	14	13	8	13	3
7/2/2006	61	72	59	42	56	64	111	67	56	47	64	45	37	37	22	33	33	22
7/7/2006	36	31	38	45	50	87	62	60	92	87	54	40	38	34	31	23	18	13
7/8/2006	80	102	88	64	65	91	74	71	68	44	33	32	22	27	25	8	9	8
7/9/2006	25	29	36	42	37	34	53	58	53	56	47	35	27	8	25	48	44	17

Notes:

1. Each count represents a 5-minute count at approximately the time indicated
2. Three counts were made at 20 minute intervals per hour

Table A.2: Hourly Average Number of Snorkelers at Honolua Bay

Survey Date	Hourly Average (N=3) During Survey Time Period						Hourly Average (N=6)	STD	Maximum Count
	1000 - 1100	1100 – 1200	1200 -1300	1300 -1400	1400 – 1500	1500 – 1600			
12/30/2005	23.7	35.0	32.0	26.3	15.7	15.3	24.7	8.2	41
12/31/2005	8.7	19.3	6.0	3.7	0.7	2.0	6.7	6.8	28
1/1/2006	0.0	4.0	4.7	5.3	9.3	8.3	5.3	3.3	12
1/6/2006	0.0	3.7	9.7	2.3	4.7	2.0	3.7	3.3	15
1/7/2006	2.3	4.0	8.3	13.0	8.7	10.0	7.7	3.9	15
1/8/2006	1.3	10.3	11.0	6.7	8.7	1.3	6.6	4.3	15
3/24/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
4/14/2006	3.3	6.7	9.0	9.3	9.7	5.3	7.2	2.6	14
4/15/2006	8.7	13.3	24.3	12.7	15.0	8.7	13.8	5.8	32
4/16/2006	4.0	8.7	7.7	10.0	10.7	4.0	7.5	2.9	13
6/30/2006	86.3	54.0	74.7	41.0	39.7	31.3	54.5	21.7	104
7/1/2006	45.3	43.3	67.3	18.0	14.0	8.0	32.7	23.0	72
7/2/2006	64.0	54.0	78.0	52.0	32.0	29.3	51.6	18.6	111
7/7/2006	35.0	60.7	71.3	60.3	34.3	18.0	46.6	20.5	92
7/8/2006	90.0	73.3	71.0	36.3	24.7	8.3	50.6	32.1	102
7/9/2006	30.0	37.7	54.7	46.0	20.0	36.3	37.4	12.1	58

Notes:
1. Hourly average is the average of three counts during the survey time period from Table A.1

Table A.3: Number of SCUBA Divers at Honolua Bay

Survey Date	Number of SCUBA Divers Counted																	
	1000 – 1100			1100 – 1200			1200 – 1300			1300 – 1400			1400 – 1500			1500 -1600		
	1000	1020	1040	1100	1120	1140	1200	1220	1240	1300	1320	1340	1400	1420	1440	1500	1520	1540
12/30/2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/31/2005	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1/1/2006	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2	2	2	0
1/6/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/7/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1/8/2006	0	0	0	0	0	0	2		2	2	0	0	0	0	0	0	0	0
3/24/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/14/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/15/2006	0	5	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
4/16/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6/30/2006	3	1	3	3	2	2	2	1	0	0	0	0	0	0	2	2	2	0
7/1/2006	2	2	7	0	0	0	0	0	0	0	17	17	17	0	0	0	0	0
7/2/2006	0	0	0	0	0	6	6	6	0	1	0	0	0	0	0	0	0	0
7/7/2006	5	2	0	0	0	0	0	2	2	2	2	0	0	0	0	0	0	0
7/8/2006	2	2	2	3	3	0	0	2	2	2	2	2	0	0	0	0	0	0
7/9/2006	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

1. Each count represents a 5-minute count at approximately the time indicated
2. Three counts were made at 20 minute intervals per hour

Table A.4: Hourly Average Number of SCUBA Divers at Honolua Bay

Survey Date	Hourly Average (N=3) During the Survey Time Period						Hourly Average (N=6)	STD	Maximum Count
	1000 – 1100	1100 – 1200	1200 – 1300	1300 – 1400	1400 – 1500	1500 – 1600			
12/30/2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
12/31/2005	0.3	0.3	0.0	0.0	0.0	0.0	0.1	0.2	1
1/1/2006	0.0	0.0	0.7	0.0	0.7	1.3	0.4	0.5	2
1/6/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
1/7/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
1/8/2006	0.0	0.0	2.0	0.7	0.0	0.0	0.4	0.8	2
3/24/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
4/14/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
4/15/2006	3.3	0.0	0.3	0.0	0.0	0.0	0.6	1.3	5
4/16/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
6/30/2006	2.3	2.3	1.0	0.0	0.7	1.3	1.3	0.9	3
7/1/2006	3.7	0.0	0.0	11.3	5.7	0.0	3.4	4.5	17
7/2/2006	0.0	2.0	4.0	0.3	0.0	0.0	1.1	1.6	6
7/7/2006	2.3	0.0	1.3	1.3	0.0	0.0	0.8	1.0	5
7/8/2006	2.0	2.0	1.3	2.0	0.0	0.0	1.2	1.0	3
7/9/2006	2.0	1.3	0.0	0.0	0.0	0.0	0.6	0.9	2

Notes:
1. Hourly average is the average of three counts during the survey time period from Table A.3

Table A.5: Number of Surfers Counted at Honolua Bay

	Number of Surfers Counted																	
	1000 – 1100			1100 – 1200			1200 – 1300			1300 – 1400			1400 – 1500			1500 – 1600		
Survey Date	1000	1020	1040	1100	1120	1140	1200	1220	1240	1300	1320	1340	1400	1420	1440	1500	1520	1540
12/30/2005	7	8	8	10	11	18	15	23	14				18	8	4	12	23	20
12/31/2005	54	70	65	70	65	76				82	69	67	75	77	73	83	83	83
1/1/2006	15	22	22	26	31				42	37	40	42	50	48	46	53	47	50
1/6/2006	36	40	50	45	50	55				55	39	35	30	23	23	25	31	32
1/7/2006	42	36	30	34	32	43	38	34	29	29	28	24	19	21	24	12	24	30
1/8/2006	30	30	42	45	42	41	41	47	48	52	64	62	49	54	54	46	46	49
3/24/2006	0	0	0	0	0				0	0	0	0	0	0	0	0	0	0
4/14/2006	15	16	8	16	17				20	19	18	17	13	11	8	9	9	13
4/15/2006	4	4	3	3	4	4					7	7	8	4	1	0	0	2
4/16/2006	0	2	0	0	4	4				0	0	0	0	0	0	0	0	0
6/30/2006	0	0	0	0	0	0			0	0	0	1	1	0	0	0	0	0
7/1/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/2/2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/7/2006	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0
7/8/2006	0	0	0	0	0	0				0	0	0	0	0	0	0	0	0
7/9/2006	0	0	0	0	0	0				0	0	0	0	0	0	0	0	0

Notes:
1. Each count represents a 5-minute count at approximately the time indicated
2. Three counts were made at 20 minute intervals per hour

Table A.6: Hourly Average Number of Surfers at Honolua Bay

Survey Date	Hourly Average During Survey Time Period (N=3)						Hourly Average (N=6)	STD	Maximum Count
	1000 – 1100	1100 – 1200	1200 – 1300	1300 – 1400	1400 – 1500	1500 – 1600			
12/30/2005	7.7	13.0	17.3		10.0	18.3	13.3	4.6	23
12/31/2005	63.0	70.3		72.7	75.0	83.0	72.8	7.3	83
1/1/2006	19.7	28.5	42.0	39.7	48.0	50.0	38.0	11.7	53
1/6/2006	42.0	50.0		43.0	25.3	29.3	37.9	10.3	55
1/7/2006	36.0	36.3	33.7	27.0	21.3	22.0	29.4	6.9	43
1/8/2006	34.0	42.7	45.3	59.3	52.3	47.0	46.8	8.6	64
3/24/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
4/14/2006	13.0	16.5	20.0	18.0	10.7	10.3	14.8	4.0	20
4/15/2006	3.7	3.7		7.0	4.3	0.7	3.9	2.3	8
4/16/2006	0.7	2.7		0.0	0.0	0.0	0.7	1.2	4
6/30/2006	0.0	0.0	0.0	0.3	0.3	0.0	0.1	0.2	1
7/1/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
7/2/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
7/7/2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
7/8/2006	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0
7/9/2006	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0

Notes:

1. Hourly average is the average of three counts during the s urvey time period from Table A.5

Table A.7: Number of People on the Beach at Honolua Bay

	Number of Beachgoers Counted																	
	1000 – 1100			1100 – 1200			1200 -1300			1300 – 1400			1400 – 1500			1500 – 1600		
Survey Date	1000	1020	1040	1100	1120	1140	1200	1220	1240	1300	1320	1340	1400	1420	1440	1500	1520	1540
12/30/2005	31	35	40	48	61	42	37	36	49	42	26	34	38	27	39	24	15	18
12/31/2005	18	19	14	17	32	24	10	19	11	17	12	12	18	9	7	11	3	3
1/1/2006	0	3	2	6	4	9	8	20	14	10	18	20	10	21	20	25	21	23
1/6/2006	1	1	9	8	1	10	12	8	20	22	19	10	11	9	20	14	4	6
1/7/2006	11	14	13	7	8	2	8	22	23	13	17	25	27	18	20	20	17	15
1/8/2006	0	5	10	8	13	17	26	15	21	32	20	26	24	19	19	20	12	4
3/24/2006	0	2	0	0	0	0	0	1	5	4	8	2	2	2	1	1	1	3
4/14/2006	4	7	23	9	8	22	29	31	25	15	22	15	13	19	11	12	22	3
4/15/2006	14	22	16	23	16	22	26	31	34	35	17	24	30	21	22	19	22	20
4/16/2006	6	16	7	14	23	20	27	11	17	19	17	18	18	22	17	20	12	8
6/30/2006	59	59	74	71	78	79	61	113	75	59	43	41	34	53	48	60	50	32
7/1/2006	50	65	68	42	53	39	50	54	34	36	21	17	20	24	27	17	25	25
7/2/2006	35	34	50	52	48	77	61	73	70	55	72	52	57	39	37	52	30	42
7/7/2006	39	47	33	27	29	27	58	56	58	36	44	31	61	58	44	35	33	16
7/8/2006	30	51	101	69	55	48	58	51	47	45	34	39	48	36	19	14	17	13
7/9/2006	31	24	34	34	46	46	43	40	41	20	27	44	44	20	47	47	39	68

Notes:

1. Each count represents a 5-minute count at approximately the time indicated
2. Three counts were made at 20 minute intervals per hour

Table A.8: Average Hourly Number of People on the Beach at Honolua Bay

Survey Date	Hourly Average (N=3)						Hourly Average (N=6)	STD	Maximum Count
	1000 – 1100	1100 – 1200	1200 – 1300	1300 – 1400	1400 – 1500	1500 – 1600			
12/30/2005	35.3	50.3	40.7	34.0	34.7	19.0	35.7	10.2	61
12/31/2005	17.0	24.3	13.3	13.7	11.3	5.7	14.2	6.2	32
1/1/2006	1.7	6.3	14.0	16.0	17.0	23.0	13.0	7.7	25
1/6/2006	3.7	6.3	13.3	17.0	13.3	8.0	10.3	5.1	22
1/7/2006	12.7	5.7	17.7	18.3	21.7	17.3	15.6	5.6	27
1/8/2006	5.0	12.7	20.7	26.0	20.7	12.0	16.2	7.6	32
3/24/2006	0.7	0.0	2.0	4.7	1.7	1.7	1.8	1.6	8
4/14/2006	11.3	13.0	28.3	17.3	14.3	12.3	16.1	6.3	31
4/15/2006	17.3	20.3	30.3	25.3	24.3	20.3	23.0	4.6	35
4/16/2006	9.7	19.0	18.3	18.0	19.0	13.3	16.2	3.9	27
6/30/2006	64.0	76.0	83.0	47.7	45.0	47.3	60.5	16.4	113
7/1/2006	61.0	44.7	46.0	24.7	23.7	22.3	37.1	15.9	68
7/2/2006	39.7	59.0	68.0	59.7	44.3	41.3	52.0	11.7	77
7/7/2006	39.7	27.7	57.3	37.0	54.3	28.0	40.7	12.7	61
7/8/2006	60.7	57.3	52.0	39.3	34.3	14.7	43.1	17.3	101
7/9/2006	29.7	42.0	41.3	30.3	37.0	51.3	38.6	8.1	68

Notes:

1. Hourly average is the average of three counts during the survey time period from Table A.7

Table A.9: Comparison of the Average Hourly Number of Users by Recreational Activity

Survey Date	Snorkelers	SCUBA Divers	Surfers	Beachgoers
Winter				
12/30/2005	24.7	0.0	13.3	35.7
12/31/2005	6.7	0.1	72.8	14.2
1/1/2006	5.3	0.4	38.0	13.0
1/6/2006	3.7	0.0	37.9	10.3
1/7/2006	7.7	0.0	29.4	15.6
1/8/2006	6.6	0.4	46.8	16.2
3/24/2006	0.0	0.0	0.0	1.8
4/14/2006	7.2	0.0	14.8	16.1
4/15/2006	13.8	0.6	3.9	23.0
4/16/2006	7.5	0.0	0.7	16.2
Summer				
6/30/2006	54.5	1.3	0.1	60.5
7/1/2006	32.7	3.4	0.0	37.1
7/2/2006	51.6	1.1	0.0	52.0
7/7/2006	46.6	0.8	0.0	40.7
7/8/2006	50.6	1.2	0.0	43.1
7/9/2006	37.4	0.6	0.0	38.6
Average (n=16)	**24.4**	**0.7**	**15.9**	**28.3**
Winter Average (n=10)	**8.8**	**0.2**	**25.4**	**16.8**
Summer Average (n=6)	**50.7**	**1.6**	**0.1**	**47.5**

Note: Average number is based on six hourly averages conducted between 1000 and 1600 hours with each hourly average consisting of three, 5-minute counts

Table A.10: Comparison of Maximum Count During Any Survey Count by Recreational Activity

Survey Date	Snorkelers	SCUBA Divers	Surfers	Swimmers	Beachgoers
12/30/2005	41	0	23	3	61
12/31/2005	28	1	83	1	32
1/1/2006	12	2	53	1	25
1/6/2006	15	0	55	0	22
1/7/2006	15	0	43	1	27
1/8/2006	15	2	64	2	32
3/24/2006	0	0	0	0	8
4/14/2006	14	0	20	0	31
4/15/2006	32	5	8	4	35
4/16/2006	13	0	4	3	27
6/30/2006	104	3	1	11	113
7/1/2006	72	17	0	7	68
7/2/2006	111	6	0	5	77
7/7/2006	92	5	0	5	61
7/8/2006	102	3	0	8	101
7/9/2006	58	2	0	4	68
Maximum (all surveys)	111	17	64	11	113

Note: Maximum number is the most users counted during any 5-minute count between 1000 and 1600 hours on a given survey date.

Table A.11: Survey Question: Where are you from?

Survey Date	No. of Respondents		No. of Respondents
	Residents	Non-Residents	
12/30/06	1	25	26
12/31/06	0	14	14
1/1/06	0	8	8
1/6/06	0	8	8
1/7/06	0	11	11
1/8/06	2	9	11
4/14/06	0	8	8
4/15/06	1	10	11
4/16/06	3	9	12
6/30/06	1	15	16
7/1/06	1	10	11
7/2/06	0	17	17
7/7/06	0	17	17
7/8/06	3	20	23
7/9/06	2	20	22
No. of Respondents	**14**	**201**	**215**
Percentage of Respondents	**7%**	**93%**	**100%**

Table A.12: Survey Question: How did you hear about Honolua Bay?

Source of Information	No. of Respondents	Percentage of Respondents
Friend	37	27%
Travel Guide	44	33%
Magazine	16	12%
Snorkel shop	9	7%
Tour operator	2	1%
Drove by	23	17%
Hotel	4	3%
Other	0	0%
Total	135	100%

Table A.13: Survey Question: Please rate your satisfaction with the availability of educational materials

Survey Date	Added Satisfaction	No Effect	Detracted from Satisfaction	No. of Respondents
1/6/06	2	3	0	5
1/7/06	11	0	0	11
1/8/06	5	6	0	11
4/14/06	0	8	0	8
4/15/06	8	3	0	11
4/16/06	8	4	0	12
6/30/06	10	6	0	16
7/1/06	5	5	1	11
7/2/06	10	7	0	17
7/7/06	9	7	0	16
7/8/06	14	9	0	23
7/9/06	13	9	0	22
No. of Respondents	**95**	**67**	**1**	**163**
Percentage of Respondents	**58%**	**41%**	**1%**	**100%**

Table A.14: Survey Question: Please rate your satisfaction with the marine life

Survey Date	Added Satisfaction	No Effect	Detracted from Satisfaction	No. of Respondents
1/6/06	3	1	1	5
1/7/06	9	2	0	11
1/8/06	8	2	1	11
4/14/06	5	3	0	8
4/15/06	9	2	0	11
4/16/06	9	2	1	12
6/30/06	12	4	0	16
7/1/06	9	1	1	11
7/2/06	12	3	2	17
7/7/06	10	5	1	16
7/8/06	17	6	0	23
7/9/06	19	3	0	22
No. of Respondents	**122**	**34**	**7**	**163**
Percentage of Respondents	**75%**	**21%**	**4%**	**100%**

Table A.15: Survey Question: Please rate your satisfaction with the water quality at Honolua Bay today.

Survey Date	Added to Satisfaction	No Effect	Detracted from Satisfaction	No. of Respondents
1/6/06	0	2	3	5
1/7/06	5	3	3	11
1/8/06	1	4	6	11
4/14/06	0	1	7	8
4/15/06	1	3	7	11
4/16/06	2	3	7	12
6/30/06	5	9	2	16
7/1/06	3	2	6	11
7/2/06	3	6	8	17
7/7/06	2	5	9	16
7/8/06	4	7	12	23
7/9/06	8	9	5	22
Totals	**34**	**54**	**75**	**163**
Percentage of Respondents	**21%**	**33%**	**46%**	**100%**

Table A.16: Survey Question: Please rate your satisfaction with the number of people present at Honolua Bay today.

Survey Date	Added to Satisfaction	No Effect	Detracted from Satisfaction	No. of Respondents
1/6/06	4	1	0	5
1/7/06	5	6	0	11
1/8/06	1	8	2	11
4/14/06	1	7	0	8
4/15/06	2	8	1	11
4/16/06	6	6	0	12
6/30/06	0	16	0	16
7/1/06	1	10	0	11
7/2/06	1	14	2	17
7/7/06	2	14	0	16
7/8/06	1	19	3	23
7/9/06	5	15	2	22
No. of Respondents	**29**	**124**	**10**	**163**
Percentage of Respondents	**18%**	**76%**	**6%**	**100%**

Table A.17: Survey Question: Please rate your satisfaction with the parking situation at Honolua Bay.

Survey Date	Added to Satisfaction	No Effect	Detracted from Satisfaction	No. of Respondents
1/6/06	0	4	1	5
1/7/06	2	6	3	11
1/8/06	2	7	2	11
4/14/06	1	5	2	8
4/15/06	4	5	2	11
4/16/06	3	8	1	12
6/30/06	3	8	5	16
7/1/06	1	7	3	11
7/2/06	1	15	1	17
7/7/06	4	7	5	16
7/8/06	1	19	3	23
7/9/06	2	18	2	22
No. of Respondents	**24**	**109**	**30**	163
Percentage of Respondents	**15%**	**67%**	**18%**	**100%**

Table A.18: Survey Question: Please rate your satisfaction with the absence of amenities such as bathroom and garage receptacles

Survey Date	Added Satisfaction	No Effect	Detracted from Satisfaction	No. of Respondents
1/6/06	1	3	1	5
1/7/06	1	8	2	11
1/8/06	2	6	3	11
4/14/06	1	6	1	8
4/15/06	4	6	1	11
4/16/06	1	11	0	12
6/30/06	2	13	1	16
7/1/06	0	9	2	11
7/2/06	5	12	0	17
7/7/06	3	11	2	16
7/8/06	2	19	2	23
7/9/06	2	18	2	22
No. of Respondents	**24**	**122**	**17**	**163**
Percentage of Respondents	**15%**	**75%**	**10%**	**100%**

Table A.19: Factors Potentially Influencing Visitor Satisfaction at Honolua Bay

Factor	F1	F2	F3	S1	S2	S3	S4	
Survey Date	No. of Visitors to Honolua Counted (Land and Sea-Based)	Hourly Average No. of Snorkelers	Maximum Number of Snorkelers During Any Count	Did the number of people snorkeling negatively impact your enjoyment? (Percent Responding "Yes")	Can Honolua Bay accommodate more visitors? Percent Responding "Yes"	Can Honolua Bay accommodate more visitors? Percent Responding "Not Sure"	How satisfied were you you're your overall recreational experience? (Percent responding "Highly Satisfied")	No. of Survey Respondents
12/30/2005	321	26.5	41	0%	42%	31%	81%	26
12/31/2005	185	7.7	28	0%	64%	29%	36%	14
1/1/2006	155	4.7	12	0%	100%	0%	50%	8
1/6/2006	71	4.1	15	0%	80%	0%	40%	5
1/7/2006	142	7.3	15	0%	55%	27%	100%	11
1/8/2006	164	7.6	15	9%	36%	9%	82%	11
4/14/2006	209	7.6	14	13%	63%	13%	13%	8
4/15/2006	214	14.8	32	0%	73%	9%	55%	11
4/16/2006	187	8.2	13	0%	67%	0%	50%	12
6/30/2006	680	59.1	104	0%	63%	19%	69%	16
7/1/2006	489	37.6	72	0%	64%	27%	64%	11
7/2/2006	597	56.0	111	0%	12%	53%	71%	17
7/7/2006	457	52.3	92	6%	12%	41%	35%	17
7/8/2006	513	59.1	102	17%	30%	17%	61%	23
7/9/2006	474	37.7	58	0%	41%	41%	86%	22
All Surveys	**-**	**-**	**-**	**7%**	**47%**	**25%**	**63%**	**212**

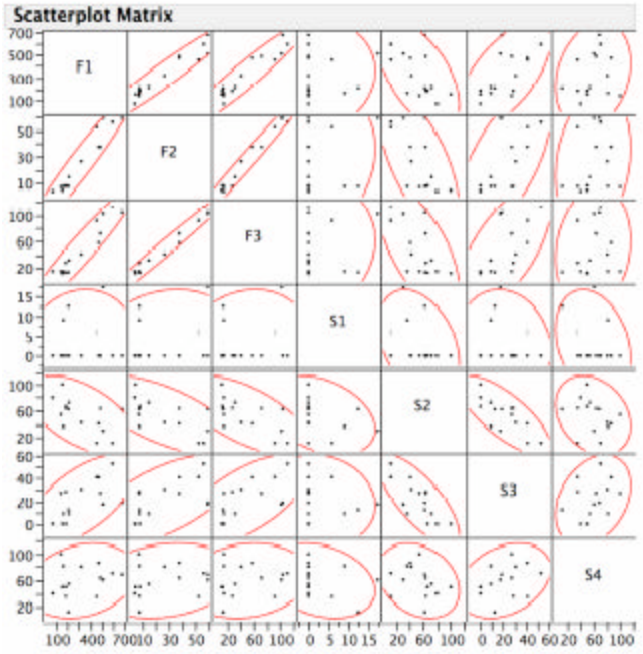
Note:
Statistical analysis of factors: F1 – F3 and S1 – S4 is provided in Tables 20 and 21.

Table A.20: Pearson Moment Statistical Analysis of Correlations between Recreational Use Levels and Visitor Satisfaction

Correlations

	F1	F2	F3	S1	S2	S3	S4
F1	1.0000	0.9636	0.9516	0.0781	-0.5571	0.6265	0.2272
F2	0.9636	1.0000	0.9873	0.1916	-0.6546	0.6219	0.1971
F3	0.9516	0.9873	1.0000	0.1540	-0.6380	0.6372	0.1496
S1	0.0781	0.1916	0.1540	1.0000	-0.3553	-0.1249	-0.2740
S2	-0.5571	-0.6546	-0.6380	-0.3553	1.0000	-0.7545	-0.2694
S3	0.6265	0.6219	0.6372	-0.1249	-0.7545	1.0000	0.3177
S4	0.2272	0.1971	0.1496	-0.2740	-0.2694	0.3177	1.0000

Scatterplot Matrix



Pairwise Correlations

Variable	by Variable	Correlation	Count	Signif Prob
F2	F1	0.9636	15	<.0001*
F3	F1	0.9516	15	<.0001*
F3	F2	0.9873	15	<.0001*
S1	F1	0.0781	15	0.7819
S1	F2	0.1916	15	0.4938
S1	F3	0.1540	15	0.5837
S2	F1	-0.5571	15	0.0310*
S2	F2	-0.6546	15	0.0081*
S2	F3	-0.6380	15	0.0105*
S2	S1	-0.3553	15	0.1938
S3	F1	0.6265	15	0.0124*
S3	F2	0.6219	15	0.0133*
S3	F3	0.6372	15	0.0106*
S3	S1	-0.1249	15	0.6574
S3	S2	-0.7545	15	0.0012*
S4	F1	0.2272	15	0.4155
S4	F2	0.1971	15	0.4813
S4	F3	0.1496	15	0.5947
S4	S1	-0.2740	15	0.3231
S4	S2	-0.2694	15	0.3316
S4	S3	0.3177	15	0.2485

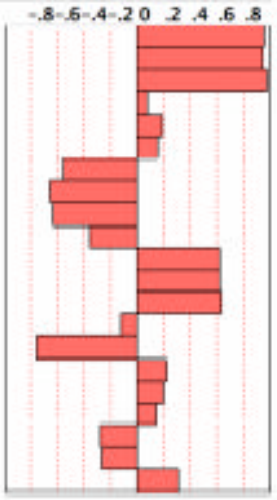
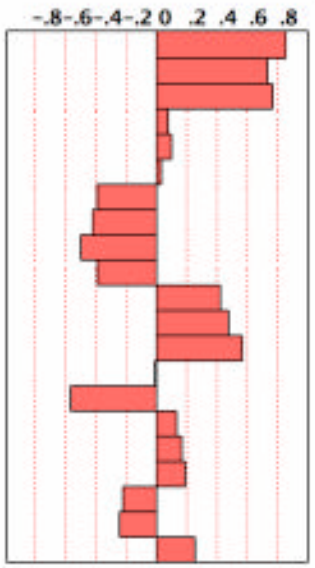


Table A.21: Nonparametric Statistical Analysis of Recreational Use Levels and Visitor Satisfaction

Nonparametric: Kendall's τ

Variable	by Variable	Kendall τ	Prob>|τ|
F2	F1	0.8613	<.0001*
F3	F1	0.7344	0.0002*
F3	F2	0.7670	<.0001*
S1	F1	0.0828	0.7005
S1	F2	0.0971	0.6533
S1	F3	0.0280	0.8976
S2	F1	-0.3942	0.0420*
S2	F2	-0.4251	0.0289*
S2	F3	-0.5073	0.0096*
S2	S1	-0.3902	0.0721
S3	F1	0.4294	0.0283*
S3	F2	0.4805	0.0145*
S3	F3	0.5644	0.0043*
S3	S1	-0.0141	0.9486
S3	S2	-0.5715	0.0038*
S4	F1	0.1340	0.4879
S4	F2	0.1635	0.3990
S4	F3	0.1845	0.3443
S4	S1	-0.2219	0.3046
S4	S2	-0.2512	0.1966
S4	S3	0.2550	0.1946



Nonparametric: Spearman's ρ

Variable	by Variable	Spearman ρ	Prob>|ρ|
F2	F1	0.9634	<.0001*
F3	F1	0.8674	<.0001*
F3	F2	0.8969	<.0001*
S1	F1	0.0963	0.7329
S1	F2	0.1170	0.6780
S1	F3	0.0368	0.8964
S2	F1	-0.5331	0.0407*
S2	F2	-0.6043	0.0170*
S2	F3	-0.6355	0.0109*
S2	S1	-0.4959	0.0601
S3	F1	0.5602	0.0299*
S3	F2	0.5921	0.0200*
S3	F3	0.7045	0.0034*
S3	S1	-0.0622	0.8257
S3	S2	-0.7140	0.0028*
S4	F1	0.1841	0.5113
S4	F2	0.2021	0.4700
S4	F3	0.2744	0.3222
S4	S1	-0.2615	0.3465
S4	S2	-0.3778	0.1650
S4	S3	0.2947	0.2863

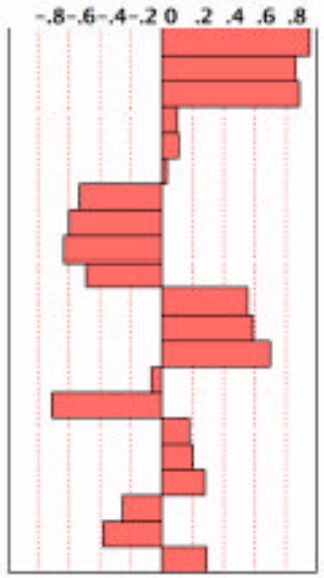


Table A.22: Visitor Satisfaction Compared to Environmental Conditions

Date	Total No. of Visitors Counted (Land and Sea-Based)	Overall Visitor Satisfaction (Percent of Responding "Highly Satisfied")	Honolua Bay Can Handle More Visitors (Percent of Responding "Yes")	Weather Conditions	Water Clarity	Other Observations
12/30/2005	321	81%	42%	Few clouds, light breeze	Clear	Streambed dry; swell reportedly coming up; pod of dolphins (approximately 23) between 1000 to 1100 hours and 1 turtle observed; teenager fell getting out of water on boat ramp
12/31/2005	185	36%	64%	Few clouds, calm	Cloudy	Increasingly turbid water
1/1/2006	155	50%	100%	Rainy, cloudy (50%), light breeze	Moderately cloudy	Water clarity better than previous day
1/6/2006	71	40%	80%	Few clouds, light breeze	Moderately cloudy	Stream running and ground wet, but not raining
1/7/2006	142	100%	55%	Few clouds, calm with occasional wind gusts	Moderately cloudy	Stream running and ground wet, but not raining
1/8/2005	164	82%	36%	Cloudy (25%), light breeze	Moderately cloudy	Drier conditions than previous day, no water in stream
3/24/2006	30	ND	ND	Few clouds, light breeze	Extremely cloudy	Beautiful weather, but extreme surface water runoff from heavy rains made bay completely brown
4/14/2006	209	13%	63%	Sunny and calm	Moderately cloudy	Brown plume of water; 1 turtle observed; women with bleeding ankle fell on rocks
4/15/2006	214	55%	73%	Cloudy (50%), light breeze, occasional gusts	Moderately cloudy	
4/16/2006	187	50%	67%	Cloudy (50%), light breeze, squalls	Moderately cloudy	
6/30/2006	680	69%	63%	Few clouds, calm	Clear	Beautiful weather
7/1/2006	489	64%	64%	Cloudy (75%), light breeze	Clear	Increasing overcast and gusty conditions later in day
7/2/2006	597	71%	12%	Few clouds, light breeze	Clear	Beautiful weather; boy bitten on toes by chubs
7/7/2006	457	35%	12%	Cloudy (100%), light breeze	Cloudy	Overcast
7/8/2006	513	61%	30%	Cloudy (50%), strong breeze	Cloudy	People feeding fish and being attacked, too many fish, too many boats
7/9/2006	474	86%	41%	Few clouds, light breeze	Clear	

Table A.23: Daily Number of Visitors to Honolua Bay from Land and Sea-Based Access

Survey Date	Daily No. of Visitors Counted Over a 6 Hour Period from 1000 to 1600 Hours		
	Land-Based Access	Sea-Based Access	Total
12/30/05	321	0	321
12/31/05	185	0	185
1/1/06	155	0	155
1/6/06	71	0	71
1/7/06	142	0	142
1/8/06	164	0	164
3/24/06	30	0	30
4/14/06	209	0	209
4/15/06	214	0	214
4/16/06	187	0	187
6/30/06	412	268	680
7/1/06	275	214	489
7/2/06	437	160	597
7/7/06	291	166	457
7/8/06	343	170	513
7/9/06	395	79	474
Average Daily – Winter	168	**0**	**168**
Average Daily - Summer	359	**176**	**535**

Notes:
1. Land-based visitor counts were tallied at the boat ramp as people walked down the trail to the bay
2. Sea-based visitor counts were tallied by radioing commercial ocean recreational vessels for counts of total number of passengers

Table A.24: Number of Passengers on Commercial Tour Vessels during Survey Dates

Survey Date	Passengers	Weather	Water
6/30/2006	268	Sunny and calm	Clear
7/1/2006	214	Cloudy and calm	Clear
7/2/2006	~160	Sunny and calm	Clear
7/7/2006	166	Cloudy and calm	Cloudy
7/8/2006	170	Sunny and calm	Cloudy
7/9/2006	79	Rain and overcast	Cloudy

Table A.25: Number of Boats Visiting Honolua Bay

Survey Date	Maximum Count		
	Commercial Tour Boats	Recreational Boats	Kayaks
12/30/2005	0	0	0
12/31/2005	0	0	0
1/1/2006	0	0	0
1/6/2006	0	0	0
1/7/2006	0	2	2
1/8/2006	0	2	2
3/24/2006	0	0	0
4/14/2006	0	0	0
4/15/2006	4	1	1
4/16/2006	0	0	0
6/30/2006	6	0	0
7/1/2006	6	0	0
7/2/2006	4	0	0
7/7/2006	5	4	4
7/8/2006	6	2	2
7/9/2006	4	0	0

Table A.26: Number of Vehicles Parked Along the Highway by Zone and Time of Day

Survey Date	Number of Vehicles Counted												Hourly Average Number of Vehicles	Std	N
	1001 - 1100		1101 - 1200		1201 - 1300		1301 - 1400		1401 - 1500		1501-1600				
12/30/05															
Zone 1	1	1	8	12	14	12			8	9	7	4	7.6	4.5	10
Zone 2	17	19	29	30	26	21			19	22	20	16	21.9	4.9	10
Zone 3	1	1	4	5	2	4			7	0	4	6	3.4	2.3	10
Total	19	21	41	47	42	37			34	31	31	26	32.9	9.2	10
12/31/05															
Zone 1	0	1	3	5			5	4	3	1	0	0	2.2	2.0	10
Zone 2	13	20	21	18			14	9	9	5	8	5	12.2	5.9	10
Zone 3	4	12	8	13			13	8	10	11	11	8	9.8	2.8	10
Total	17	33	32	36			32	21	22	17	19	13	24.2	8.2	10
1/1/06															
Zone 1	0	1	0	0		1	1	1	1	2	2	2	1.0	0.8	11
Zone 2	4	4	8	8		7	11	11	16	16	15	12	10.2	4.4	11
Zone 3	5	5	8	2		7	4	2	4	5	7	3	4.7	2.0	11
Total	9	10	16	10		15	16	14	21	23	24	17	15.9	5.1	11
1/6/06															
Zone 1	0	0	0	0			0	0	0	0	0	0	0.0	0.0	10
Zone 2	3	3	5	10			9	7	9	7	5	4	6.2	2.6	10
Zone 3	7	8	8	2			1	4	1	2	3	0	3.6	3.0	10
Total	10	11	13	12			10	11	10	9	8	4	9.8	2.5	10
1/7/06															
Zone 1	0	1	0	0	2	4	3	2	3	2	0	0	1.4	1.4	12
Zone 2	9	7	8	9	17	15	17	18	15	17	15	12	13.3	4.0	12
Zone 3	4	3	7	5	7	8	4	5	2	3	1	3	4.3	2.1	12
Total	13	11	15	14	26	27	24	25	20	22	16	15	19.0	5.6	12
1/8/06															
Zone 1	0	0	0	0	0	0	1	2	2	1	0	0	0.5	0.8	12
Zone 2	3	7	11	18	16	15	13	13	14	9	8	5	11.0	4.6	12
Zone 3	1	6	9	5	5	9	5	6	8	9	6	5	6.2	2.3	12
Total	4	13	20	23	21	24	19	21	24	19	14	10	17.7	6.2	12

Table A.26: Number of Vehicles Parked Along the Highway by Zone and Time of Day

Survey Date	Number of Vehicles Counted												Hourly Average Number of Vehicles	Std	N
	1001 - 1100		1101 - 1200		1201 - 1300		1301 - 1400		1401 - 1500		1501-1600				
3/24/06															
Zone 1	0	1	3	2	1		1	1	5	2	3	2	1.9	1.4	11
Zone 2	3	1	0	2	2		2	3	1	1	0	2	1.5	1.0	11
Zone 3	0	7	3	2	4		4	2	4	1	0	1	2.5	2.1	11
Total	3	9	6	6	7		7	6	10	4	3	5	6.0	2.2	11
4/14/06															
Zone 1	0	0	0	0			0	2	0	0	2	1	0.5	0.8	10
Zone 2	8	9	11	11			11	11	13	13	15	10	11.2	2.0	10
Zone 3	3	2	2	3			4	3	1	1	1	4	2.4	1.2	10
Total	11	11	13	14			15	16	14	14	18	15	14.1	2.1	10
4/15/06															
Zone 1	2	4	1	2			3	1	1	1	1	1	1.7	1.1	10
Zone 2	12	8	10	11			14	12	13	14	17	15	12.6	2.6	10
Zone 3	4	6	2	5			5	3	4	4	3	1	3.7	1.5	10
Total	18	18	13	18			22	16	18	19	21	17	18.0	2.5	10
4/16/06															
Zone 1	1	3	4	6			0	0	1	0	4	1	2.0	2.1	10
Zone 2	11	7	12	13			13	13	16	17	11	4	11.7	3.9	10
Zone 3	1	3	3	1			1	2	3	1	0	4	1.9	1.3	10
Total	13	13	19	20			14	15	20	18	15	9	15.6	3.6	10
6/30/06															
Zone 1	21	21	18	19	3	4	2	1	2	1			9.2	9.2	10
Zone 2	29	28	29	27	19	20	26	27	26	22			25.3	3.7	10
Zone 3	3	5	10	8	8	6	4	4	5	5			5.8	2.2	10
Total	53	54	**57**	54	30	30	32	32	33	28			**40.3**	12.3	10
7/1/06															
Zone 1	4	4	8	2	5	4	4	2	4	1	5	2	3.8	1.9	12
Zone 2	28	21	17	23	24	13	12	14	14	14	14	14	17.3	5.3	12
Zone 3	22	19	19	12	8	7	7	4	2	2	4	3	9.1	7.2	12
Total	54	44	44	37	37	24	23	20	20	17	23	19	30.2	12.4	12
7/2/06															

Table A.26: Number of Vehicles Parked Along the Highway by Zone and Time of Day

Survey Date	Number of Vehicles Counted												Hourly Average Number of Vehicles	Std	N
	1001 - 1100		1101 - 1200		1201 - 1300		1301 - 1400		1401 - 1500		1501-1600				
Zone 1	11	11	14	19			17	18	12	12	6	1	12.1	5.5	10
Zone 2	29	29	29	29			19	20	23	24	23	25	25.0	3.9	10
Zone 3	3	4	2	5			2	3	1	3	3	3	2.9	1.1	10
Total	43	44	45	53			38	41	36	39	32	29	40.0	6.9	10
7/7/06															
Zone 1	11	11	12	14			17	12	12	10	5	4	10.8	3.9	10
Zone 2	27	29	22	26			21	26	19	16	14	14	21.4	5.5	10
Zone 3	2	3	2	2			0	4	2	6	2	0	2.3	1.8	10
Total	40	43	36	42			38	42	33	32	21	18	34.5	8.8	10
7/8/06															
Zone 1	17	19	23	22			11	6	6	8	3	3	11.8	7.8	10
Zone 2	26	26	26	26			24	29	21	17	11	11	21.7	6.5	10
Zone 3	1	4	1	2			3	0	2	2	0	3	1.8	1.3	10
Total	44	49	50	50			38	35	29	27	14	17	35.3	13.3	10
7/9/06															
Zone 1	1	5	11	10			7	8	14	10	11	9	8.6	3.6	10
Zone 2	19	22	22	20			23	23	9	21	21	20	20.0	4.1	10
Zone 3	3	2	1	0			1	1	1	2	1	1	1.3	0.8	10
Total	23	29	34	30			31	32	24	33	33	30	29.9	3.7	10

Notes:

1. Number of parked vehicles were counted within three zones established with markers along the coastal highway (see Appendix 2 for map showing zone locations)
2. Two countswere made during the survey time by driving along the highway and recording the number of parked vehicles
3. The maximum number of parked vehicles counted during all surveys was 57 vehicles on June 30, 2006 between 1100 and 1200 hours
4. The maximum hourly average number of vehicles was 40.3 on June 30, 2006
5. No data collected during surveyors break between 1200 to 1300 hours

Figure A.1: Annual Visitor Arrivals to Maui by Air (2006 data, preliminary DBEDT 2007)

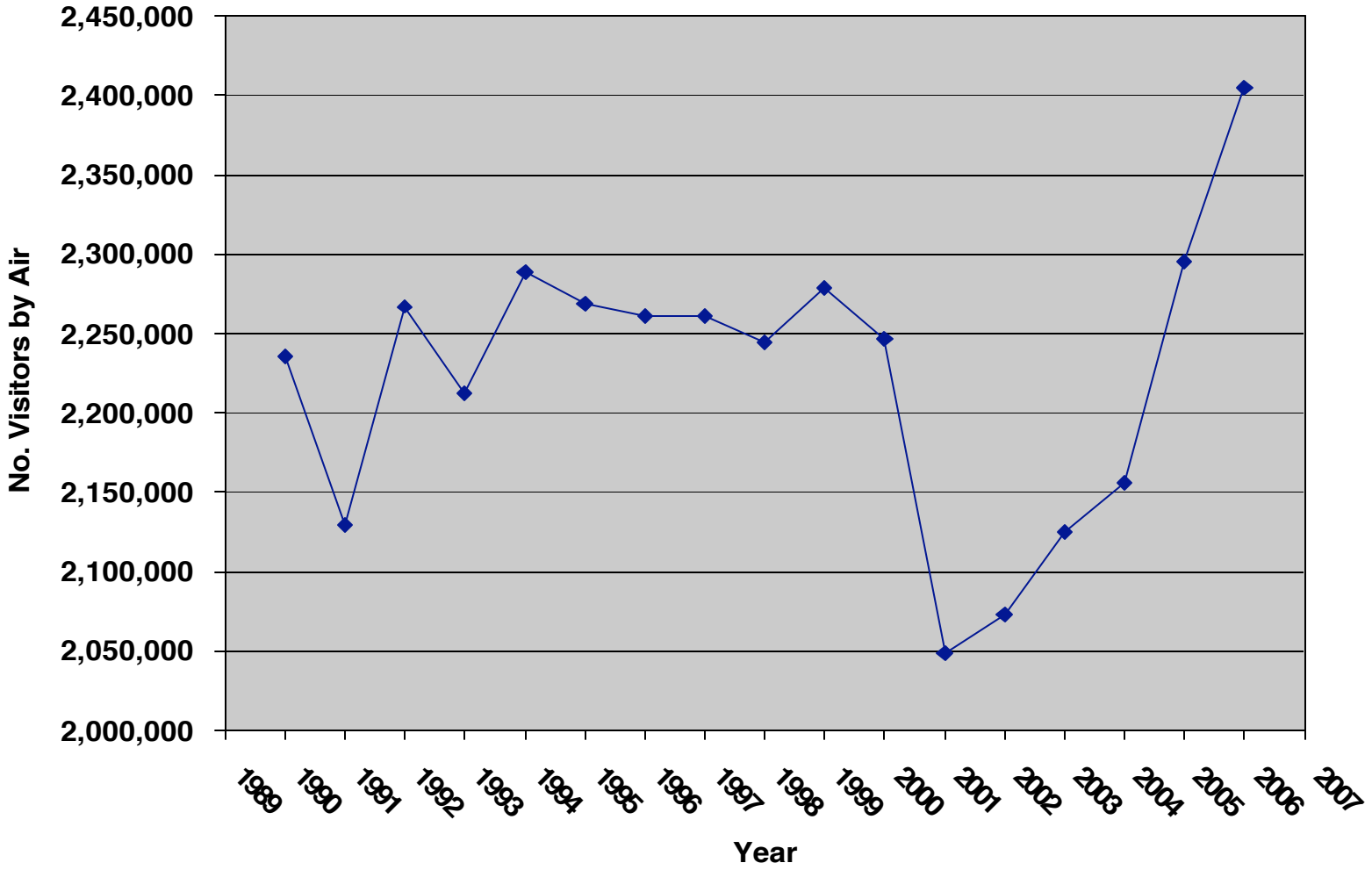


Figure A.2: Profile of Visitors Entering Honolua Bay by Land (n = 215 respondents)

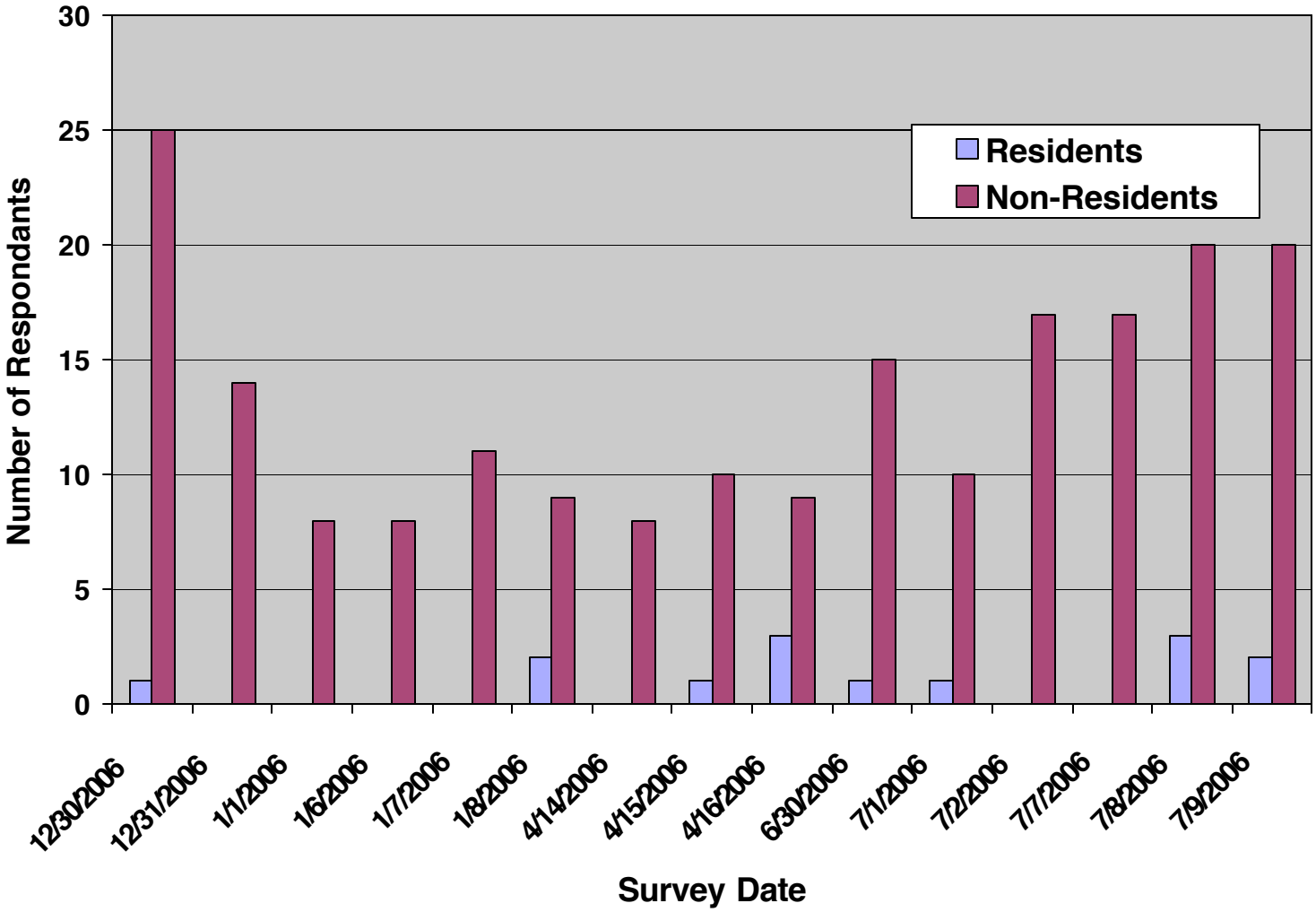


Figure A.3: Source of Information on Honolua Bay (n = 135 respondents)

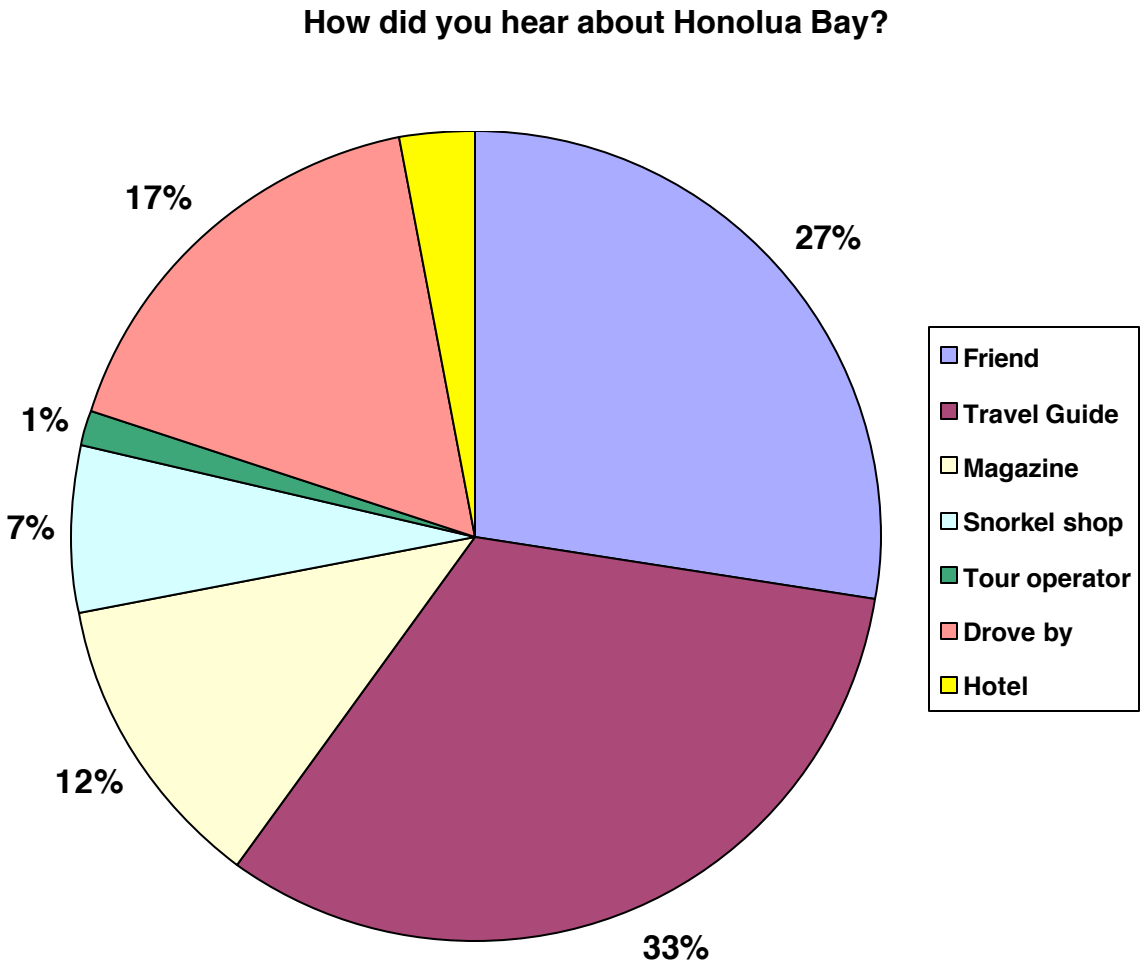


Figure A.4: Frequency of Visits to Honolua Bay (n=200 respondents)

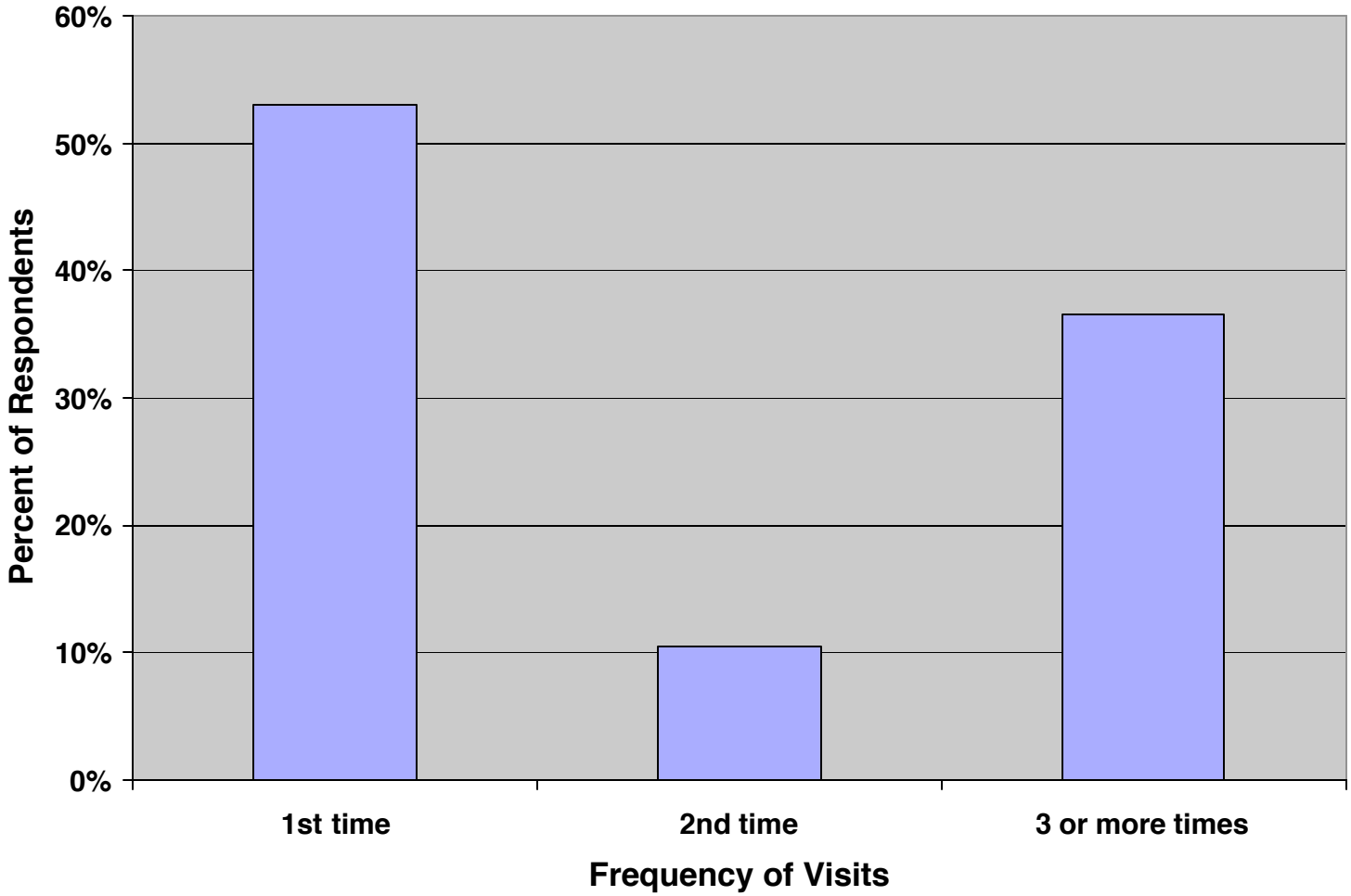


Figure A.5: Duration of Visit to Honolua Bay (n = 209 respondents)

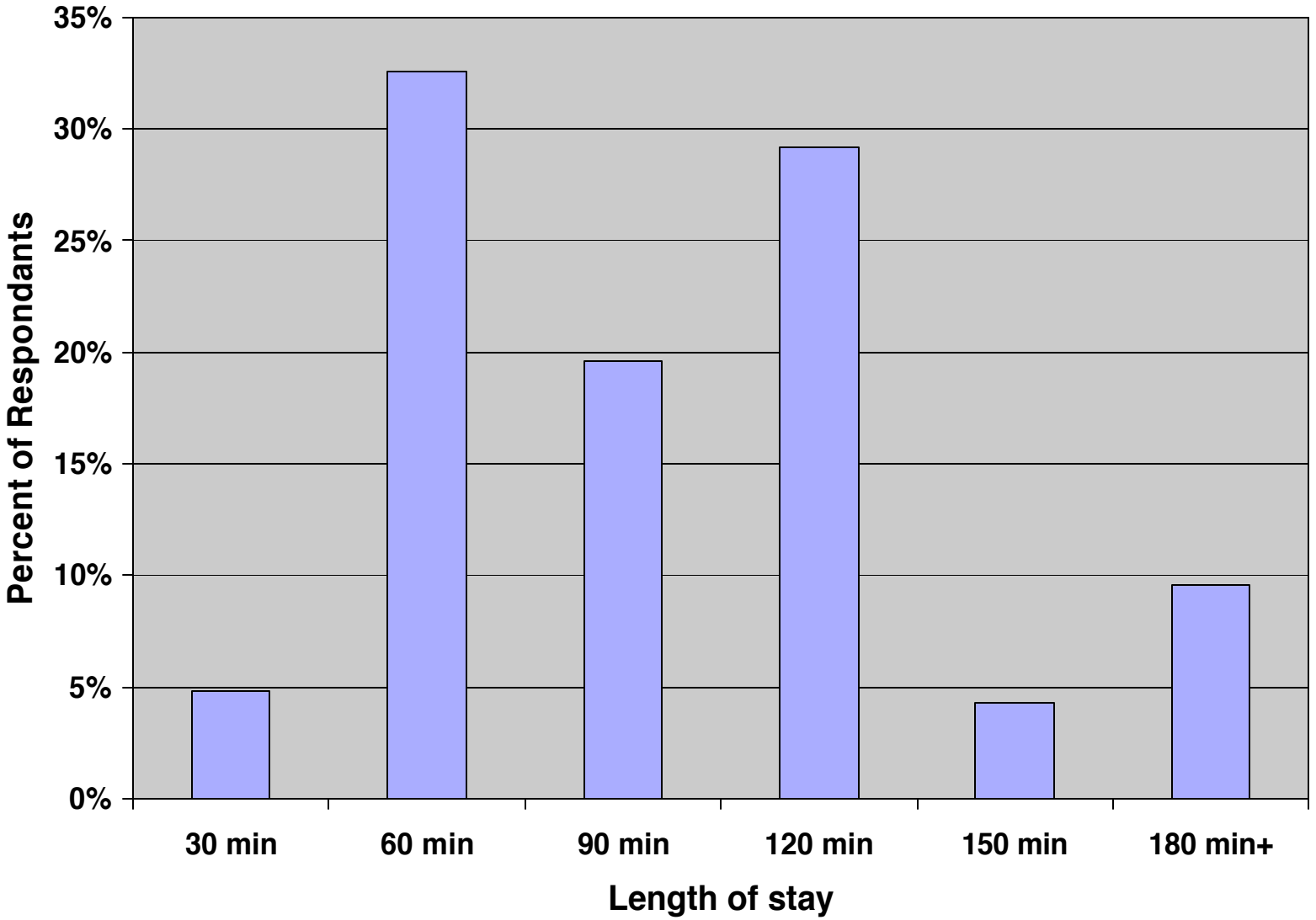


Figure A.6: Visitor Satisfaction with Facilities and Environmental Conditions at Honolua Bay (n = 163 respondents)

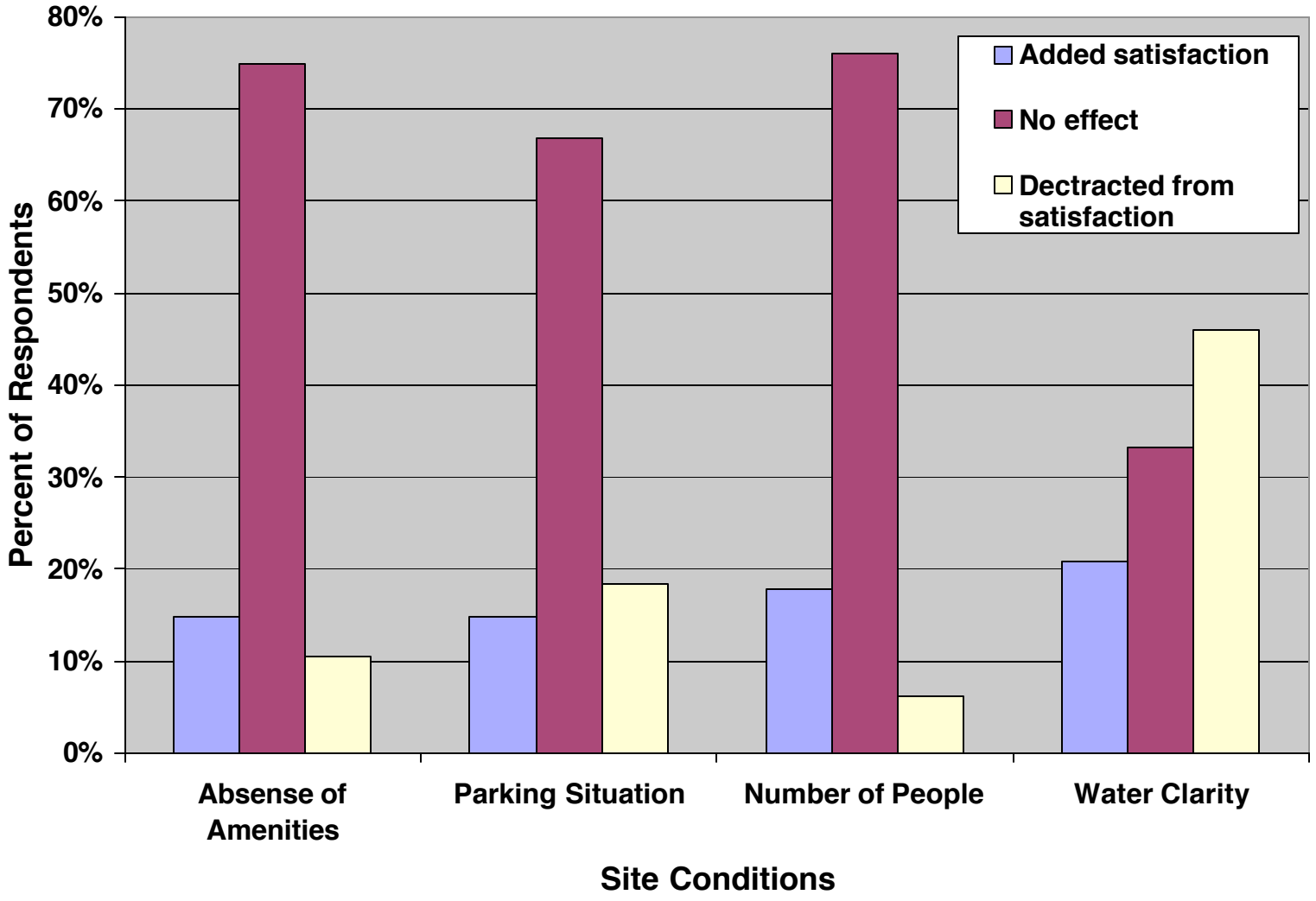


Figure A.7: Comparison of the Total Number of Visitors and Visitor Satisfaction Levels

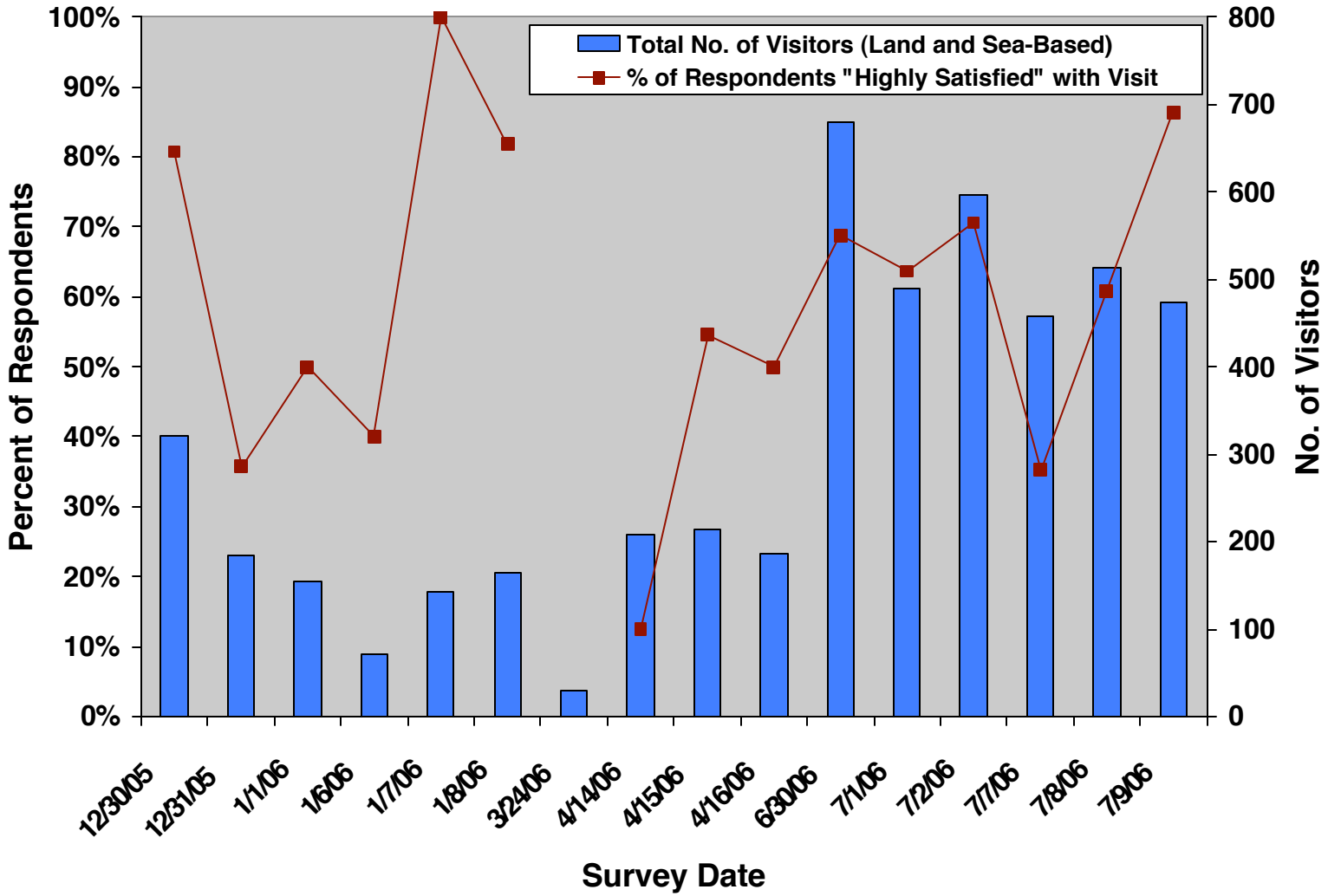


Figure A.8: Total Number of Visitors and Percent of Respondents Addressing the Question "Can Honolua Bay Accommodate More Visitors?"

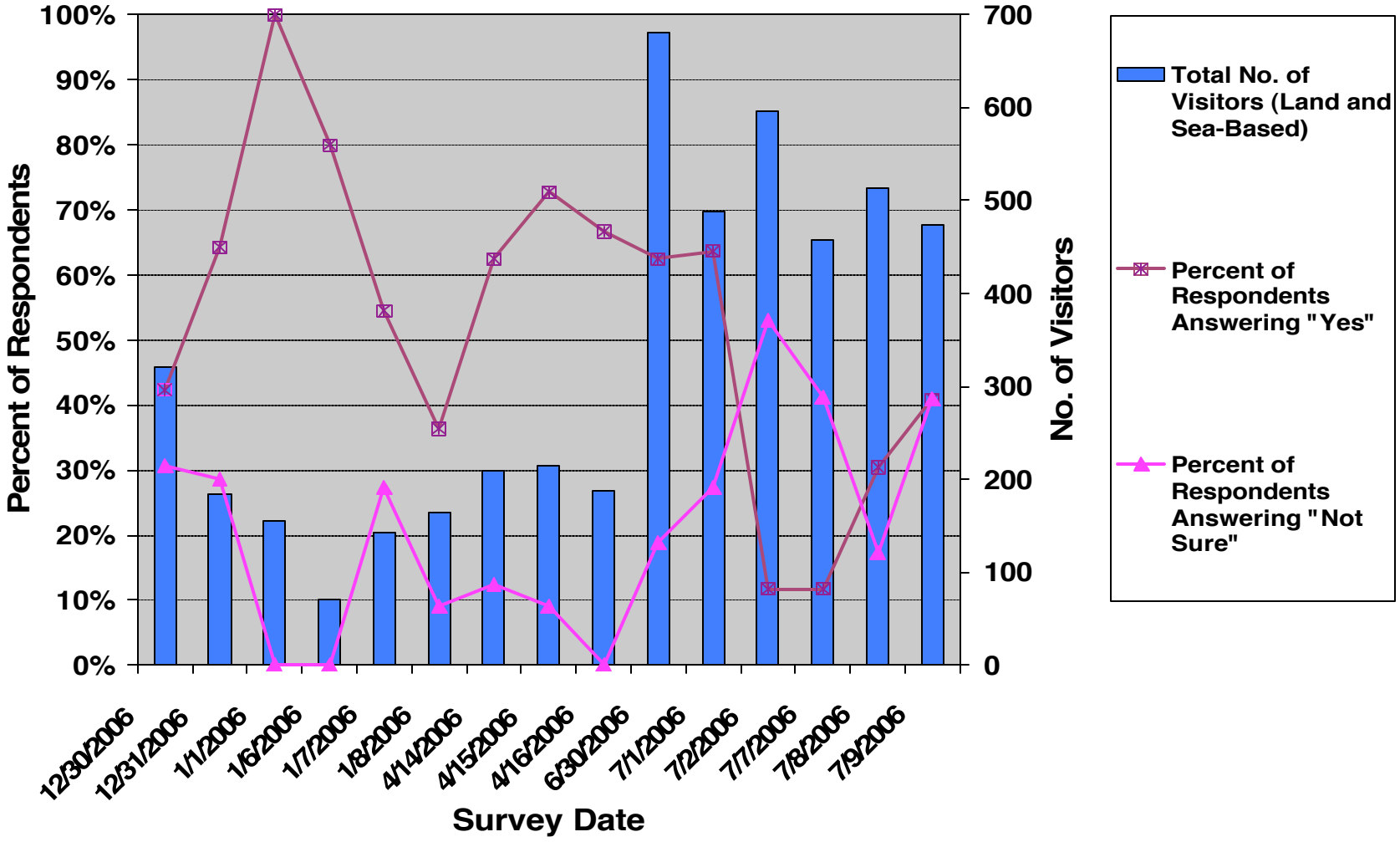


Figure A.9: Number of Visitors per Day Between 1000 and 1600 hrs from Land-Based Access to Honolua Bay

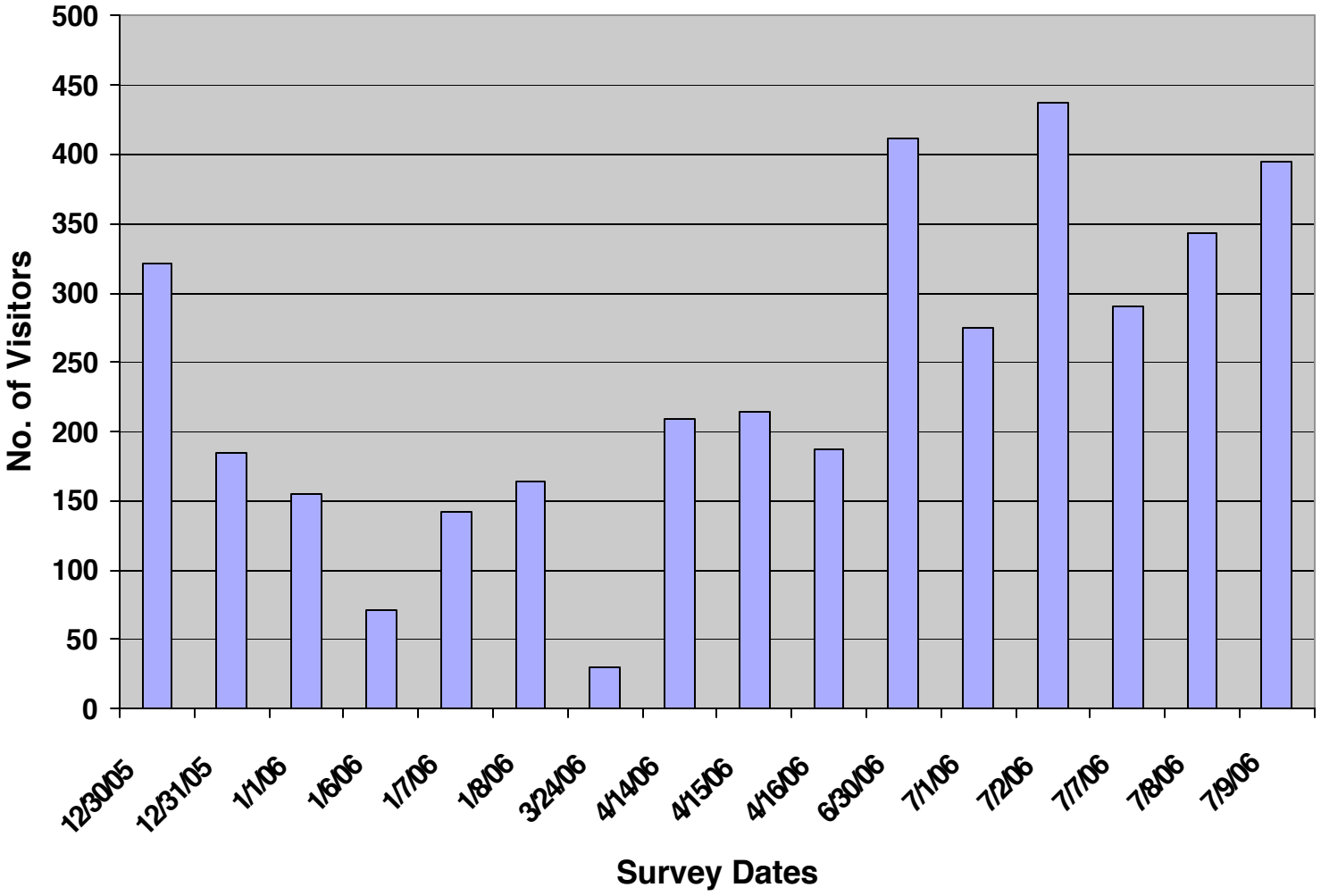


Figure A.10: Estimated Total Number of Visitors from Land and Sea Access to Honolulu Bay

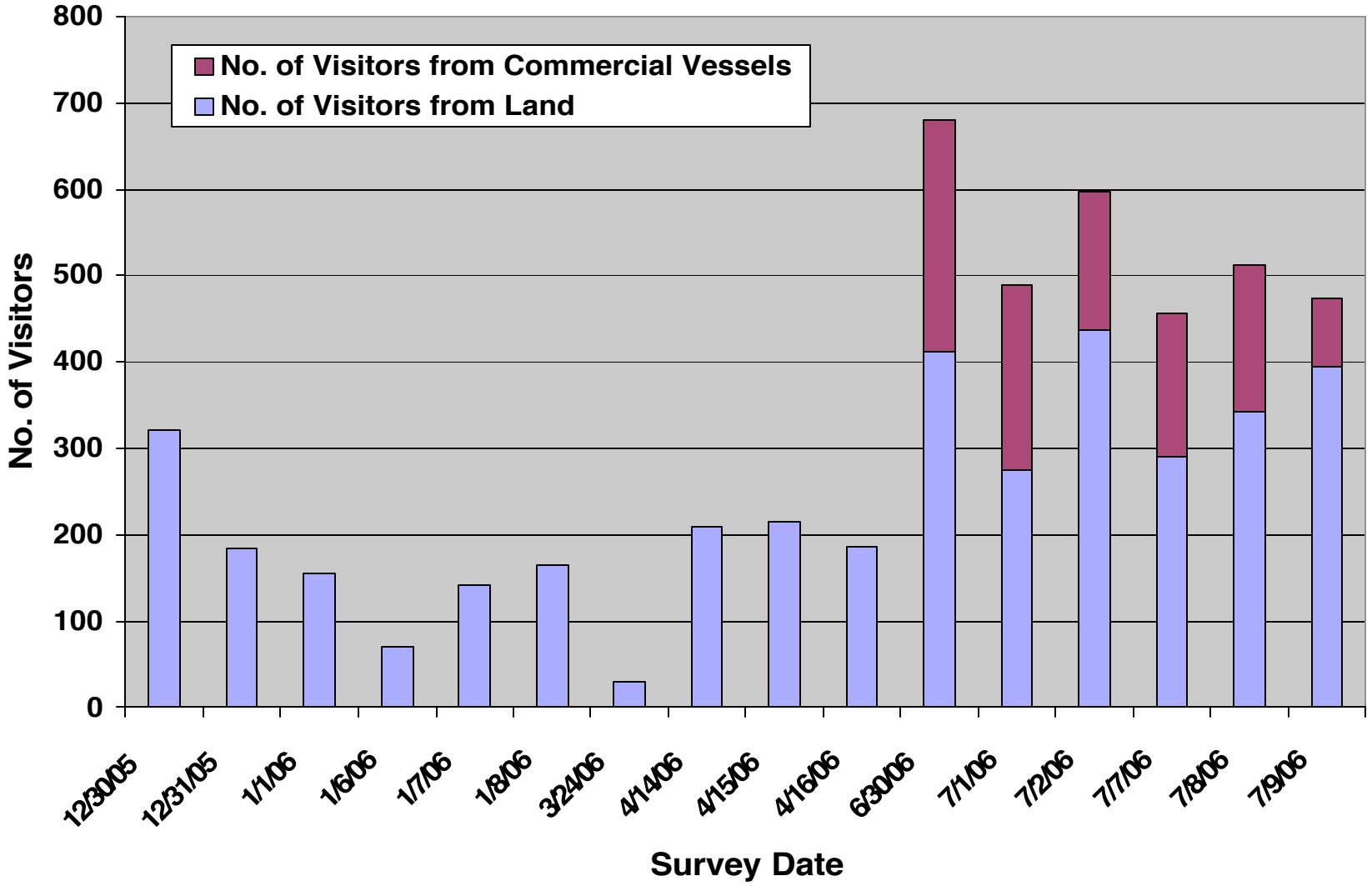


Figure A.11: Number of Parked Vehicles

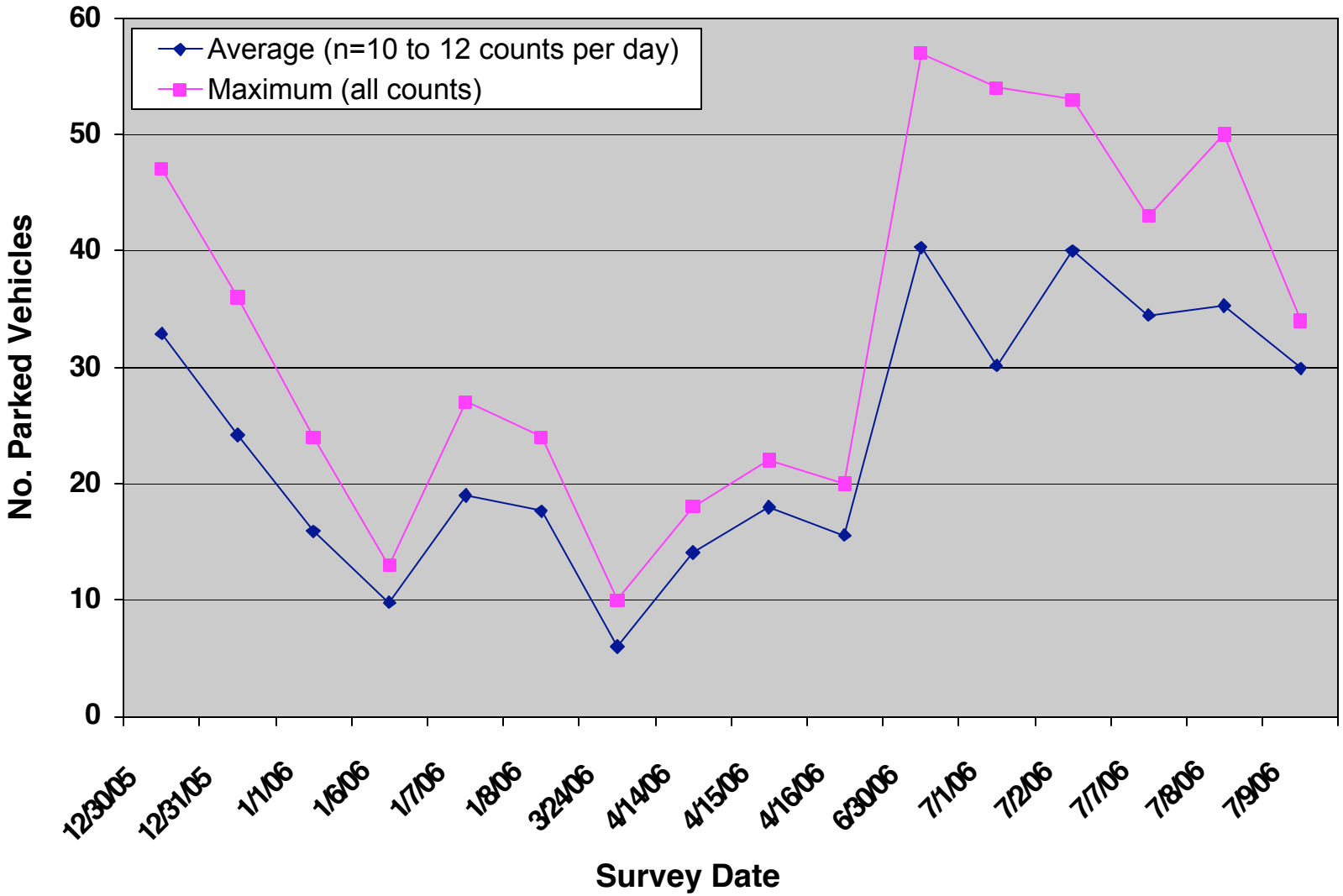
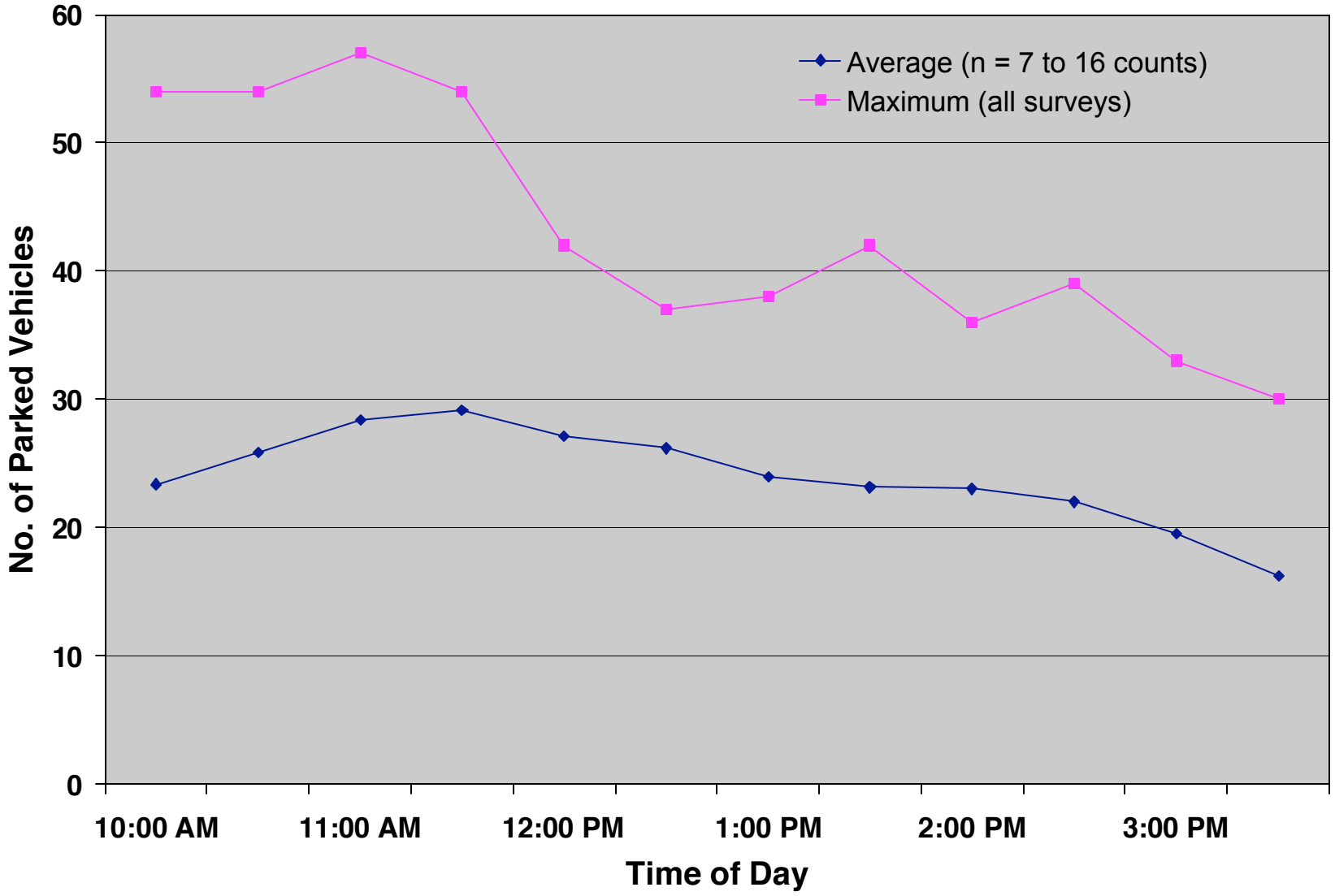


Figure A.12: Number of Parked Vehicles at Honolua Bay by Survey Time



Appendix B

Recreational Use Survey Protocols

RECREATIONAL USE SURVEY OF HONOLUA BAY, MAUI
SURVEY PROTOCOLS
December 2005

Survey Description

This recreational use survey will quantify aspects of the recreational use of Honolua Bay. The survey will quantify the number of vehicles that park along the road, number of boats that enter and anchor in the bay, and the number of people and types of activities they are engaged in. Surveys will be conducted during the months of December 2005, January 2006, March 2006, and July 2006 during peaks in visitor arrivals to Maui. Maui Land & Pineapple Company is funding the study as part of Hawaii's local action strategy to address potential threats to coral reef ecosystems from recreational activities.

Survey Methods

Two surveyors are needed to collect the data needed to characterize recreational use of Honolua Bay. Both surveyors must be in place at 0930 to begin the survey at 1000. The survey period is 6 hours from 1000 to 1600.

Survey Dates			
Month	**Friday**	**Saturday**	**Sunday**
December-05	30	31	
January-06			1
January-06	6	7	8
March-06	25	26	27
April-06	14	15	16
June-06	30		
July-06		1	2
July-06	7	8	9

Methods By Access Point			
	What to Count	**How to Count**	**Data Analysis**
Beach Access Point	Number of people entering beach area	Continuously count all people entering, record cumulative total hourly	Total number of people entering beach in 6 hours; people/hour
	Number of boats; Number of people by activity	Conduct 3 - five minute counts per hour	Average number of boats per hour; Average number of people by activity per hour
Road Access Point	Number of parked vehicles	Conduct 2 counts per zone per hour	Average number of vehicles per hour
Cliff Access Point	Number of boats; Number of people by activity	Conduct 3 - five minute counts/hour	Average number of people by activity per hour

Equipment Needed:

- Cellular telephone
- Walkie Talkies
- Parking Cones
- Binoculars
- Clipboards with datasheets, pencils
- Ziplock bags to store datasheets
- Health and safety gear including: cooler with food and plenty of water
- First aid kit
- Sunscreen, hats or visors

Surveyor 1: Beach Access Point

Surveyor 1 will be located at the base of the trail leading to the bay just mauka of the beach.

Tally Counts: Facing mauka, the surveyor will make tally counts of all incoming visitors using a counter. At the top of each hour, the surveyor will record the cumulative number of visitors on the datasheet.

Activity Counts: The surveyor will also make activity counts of boats and people engaged in specific activities on the datasheets by moving for a brief period to the beach. These counts will be made three times during each hourly interval for a period of 5 minutes. During the five minute period, the surveyor will count the number of boats and people engaged in various recreational activities. While taking activity counts, the surveyor will attempt to note any incoming visitors and add these numbers using the counter.

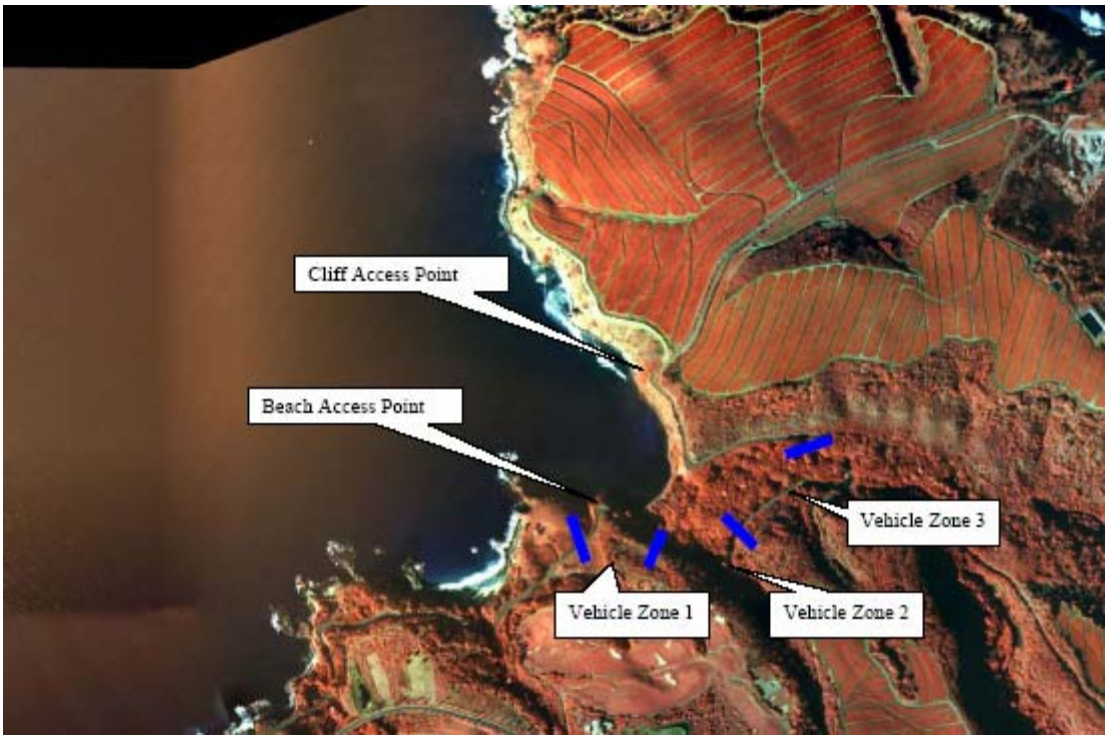
Environmental Conditions: At 1200, the surveyor will identify the appropriate site conditions on the datasheet.

Anecodotal Survey: As appropriate, the surveyor may ask a visitor if he/she is willing to answer a few questions about their experience at Honolua Bay. The surveyor should explain the purpose of the survey and ask questions and code the answers provided on the appropriate datasheet or ask the visitor to fill out the sheet.

Surveyor 2: Cliff and Road Access Points

Surveyor 2 will use a cliff access point and road zones to conduct vehicle counts and activity counts.

Vehicle Counts: The surveyor will count vehicles parked in three zones along the road. The surveyor will drive from along the road and count vehicles in each zone. The counts will be recorded on a small white board and transferred to the datasheet when the vehicle is safely parked. Vehicle counts will be conducted twice within each zone during hourly intervals.



Activity Counts: The surveyor will also make activity counts of boats and people engaged in specific activities on the datasheets from the cliff access point. These counts will be made three times during each hourly interval for a period of 5 minutes. During the five minute period, the surveyor will count the number of boats and people engaged in various recreational activities.

Violations of Statewide Fishing Rules and Marine Life Conservation District Rules

Fishing is prohibited in Honolua Bay. If you observe fishing in Honolua Bay, please call the State's Conservation and Resources Enforcement (DOCARE) Officer at (808) 587-0777. Record the details including date, time, location, and type of fishing gear.

Completed Forms

Please return completed datasheets daily to the Liz Foote, Survey Coordinator; cell. 283-1631.

HONOLUA BAY: BEACH DATASHEET **DATE:** **OBSERVER:**

Tally In *Use counter to track total number of vistors, record number at the top of the hour (1100; 1200; 1300; 1400; 1500; 1600)*

Activity Counts *Make 3 - five minute counts within each time interval (xx/xx/xx); record number of individual SCUBA divers record no. upon entry from shore or boats*

Notes *Record other activities, site conditions, human behavoir, presence of large marine animals; double/single kayaks*

TIME INTERVAL:	**10:01- 11:00**	**11:01 - 12:00**	**12:01 - 13:00**	**13:01 - 14:00**	**14:01 - 15:00**	**15:01-16:00**
Tally In	**1100:**	**1200:**	**1300:**	**1400:**	**1500:**	**1600:**
NO. OF BOATS						
Commercial	/ /	/ /	/ /	/ /	/ /	/ /
Recreational	/ /	/ /	/ /	/ /	/ /	/ /
Kayaks	/ /	/ /	/ /	/ /	/ /	/ /
Other	/ /	/ /	/ /	/ /	/ /	/ /
NO. OF DIVERS						
Snorkeling	/ /	/ /	/ /	/ /	/ /	/ /
SCUBA (no. upon entry)	/ /	/ /	/ /	/ /	/ /	/ /
NO. OF OTHER USERS						
Swimmers (wading, swimming w/o snorkel)	/ /	/ /	/ /	/ /	/ /	/ /
Beachgoer (any land-based activity; sitting/standing on beach)	/ /	/ /	/ /	/ /	/ /	/ /

NOTES:

HONOLUA BAY: CLIFF DATASHEET **DATE:** **OBSERVER:**

Activity Counts *Make 3 - five minute counts within each time interval (xx/xx/xx); record number of individual SCUBA divers record no. upon entry from shore or boats*

Notes *Record other activities, site conditions, human behavoir, presence of large marine animals; names of commercial tour boats; double/single kayaks*

TIME INTERVAL:	10:01- 11:00	11:01 - 12:00	Break	13:01 - 14:00	14:01 - 15:00	15:01-16:00
NUMBER OF BOATS						
Commercial	/ /	/ /	/ /	/ /	/ /	/ /
Recreational	/ /	/ /	/ /	/ /	/ /	/ /
Kayaks	/ /	/ /	/ /	/ /	/ /	/ /
Other	/ /	/ /	/ /	/ /	/ /	/ /
NUMBER OF DIVERS						
Snorkeling	/ /	/ /	/ /	/ /	/ /	/ /
NUMBER OF OTHER USERS						
Surfers	/ /	/ /	/ /	/ /	/ /	/ /
Swimmers (wading, swimming w/o snorkel)	/ /	/ /	/ /	/ /	/ /	/ /
Beachgoer (any land-based activity; sitting/standing on beach)	/ /	/ /	/ /	/ /	/ /	/ /
Other	/ /	/ /	/ /	/ /	/ /	/ /

SITE CONDITIONS ***Circle appropriate site conditions at 12 noon***

Water Visibilty:	***Waves:***	***Swell Height:***	***Wind:***	***Cloud Cover:***
a/Clear	a/Ripples	a/Low	a/calm	a/few clouds
b/Cloudy	b/Choppy	b/Medium	b/light breeze	b/25%
c/Very Cloudy	c/Whitecaps	c/High	c/strong breeze	c/50%
			d/strong wind	d/75%
				e/100%

NOTES:

	DATE:	**GENDER:**	Male	Female		
1	Where are you from? *(Please indicate Hawaiian Island (Maui, Oahu, etc.), State, or Country where you live)*	Location:				
2	How did you hear about Honolua Bay?	Friend TV	Travel Guide Travel Agency	Magazine Taxi Driver	Tour Operator Other:	Newspaper
3	Have you visited Honolua Bay before?	Yes	No			
4	How many times have you visited Honolua Bay?	No. of visits:				
5	What year was your last visit?	Year:				
6	Approximately how long was your visit today at Honolua Bay?	Hours/minutes:				
7	How crowded was it today at Honolua Bay?	1 - Not at all crowded	2 - Slightly crowded	3 - Crowded	4 - Very crowded	5 - Extremely crowded
8	How would you characterize your snorkeling expertise?	1 - Professional	2 - Expert	3 - Advanced	4 - Intermediate	5 - Novice/beginner
9	How often do you snorkel?	1 - Very Often	2 - Often	3 - Sometimes	4 - Not Often	5 - Never
10	How would you rate the snorkeling at Honolua Bay today?	1 - Excellent	2 - Very Good	3 - Good	4 - Acceptable	5 - Poor
11	Has the environmental quality of Honolua Bay changed?	Improving	Hasn't Changed	Deteriorating	Don't Know	
12	Did the number of people snorkeling negatively impact your enjoyment of today's trip?	Yes	No			
13	Did the number of people on the beach negatively impact your enjoyment of today's trip?	Yes	No			
14	Please rate the following items to your satisfaction today.					
	Absence of amenities (ie bathroom, garbage receptacle, etc.)	1 - Added Satisfaction	2 - No Effect	3 - Detracted from Satisfaction		
	Parking situation	1 - Added Satisfaction	2 - No Effect	3 - Detracted from Satisfaction		
	Number of people	1 - Added Satisfaction	2 - No Effect	3 - Detracted from Satisfaction		
	Water clarity	1 - Added Satisfaction	2 - No Effect	3 - Detracted from Satisfaction		
	Marine life	1 - Added Satisfaction	2 - No Effect	3 - Detracted from Satisfaction		
	Availability of educational materials	1 - Added Satisfaction	2 - No Effect	3 - Detracted from Satisfaction		
15	Can Honolua Bay accommodate more visitors than there were today?	Yes	No	Not Sure		
16	How satisfied are you overall with your visit to Honolua Bay?	1 - Highly satisfied	2 - Moderately satisfied	3 - Satisfied	4 - Moderately dissatisfied	5 - Highly dissatisfied
17	What would have improved your visit to Honolua Bay? (Please provide any comments or suggestions below; feel free to continue on the back)					

Vehicle Survey Datasheet

HONOLUA BAY RECREATIONAL USE SURVEY **DATE:** **OBSERVER:**

Sampling Freq. *Make 2 counts for each zone within each time interval (xx/xx)*

ROAD ACCESS POINT

TIME INTERVAL:	10:01- 11:00	11:01 - 12:00	12:01 - 13:00	13:01 - 14:00	14:01 - 15:00	15:01-16:00
NO. VEHICLES						
Zone 1	/	/	/	/	/	/
Zone 2	/	/	/	/	/	/
Zone 3	/	/	/	/	/	/

Notes