

**Hawaii's Local Action Strategy
to Address Recreational Impacts to Reefs**



Developed by:

**Department of Land and Natural Resources, Division of Aquatic Resources
&
Hawaii Ecotourism Association**

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LIST OF ABBREVIATIONS

Abbreviation	Definition
CORAL.....	Coral Reef Alliance
DBEDT.....	Department of Business, Economic Development & Tourism
DLNR.....	Department of Land & Natural Resources
DAR.....	Division of Aquatic Resources (within the DLNR)
DOBOR.....	Division of Boating and Ocean Recreation (within the DLNR)
DOFAW.....	Division of Forestry & Wildlife (within the DLNR)
GIS.....	Geographic Information Systems
GPA.....	Geographic Positioning System
HEA.....	Hawaii Ecotourism Association
HIRSA.....	Hawaiian Islands Recreational SCUBA Association
HTA.....	Hawaii Tourism Authority
HWF.....	Hawaii Wildlife Fund
LAS.....	Local Action Strategy
MHI.....	Main Hawaiian Islands
MPA.....	Marine Protected Area
NCL.....	Norwegian Cruise Lines
NGO.....	Non-Governmental Organization (Non-Profit)
NOAA.....	National Oceanic & Atmospheric Administration
RIR-LAS.....	Recreational Impacts to Reefs Local Action Strategy
TBD.....	To Be Determined
TNCH.....	The Nature Conservancy of Hawaii
UH.....	University of Hawaii
MCC.....	Maui Community College (within UH)
MOP.....	Marine Option Program (within UH)
USCRTF.....	United States Coral Reef Task Force

TABLE OF CONTENTS

Acknowledgements.....	ii
List of Abbreviations.....	iv
List Of Tables.....	vi
List Of Figures.....	vii
Executive Summary.....	1
Chapter 1: Introduction.....	2
1.1. RIR-LAS Vision.....	2
1.2. RIR-LAS Development Process.....	3
Chapter 2: Background.....	5
2.1. Magnitude of Marine Recreation.....	5
2.2. Impacts of Marine Tourism.....	7
2.2.1. Coral Breakage from Direct Human Contact.....	7
2.2.2. Coral Breakage from Boat Anchors.....	8
2.2.3. Marine Life Behavior Alterations.....	9
2.2.4. Water Pollution & Invasive Species.....	9
2.2.5. Other Potential Impacts.....	9
2.3. Management Techniques for Marine Recreation.....	10
2.3.1. Restricting Access.....	10
2.3.2. Dispersing Use.....	10
2.3.3. Education.....	11
2.3.4. Mechanisms for Compliance.....	11
2.3.5. Funding Challenges.....	13
2.3.6. Hawaii's Current Marine Management Strategies.....	13
2.3.7. Hawaii's Local Action Strategies.....	14
2.3.8. Other Jurisdiction's Local Action Strategies.....	14
Chapter 3: Strategy Framework.....	16
Chapter 4: Project Details.....	18
4.1. Implementation of the RIR-LAS.....	18
4.1.1. RIR-LAS Coordinator.....	18
4.2. Data Objective.....	19
4.2.1. Mooring Impact Assessment.....	19
4.2.2. Cruise Ship Impact Assessment.....	20
4.2.3. Artificial Reef Impact Assessment.....	21
4.2.4. Kayak Impact Assessment.....	21
4.2.5. Underwater Recreation Impact Assessment.....	22
4.2.6. Jet Ski Impact Assessment.....	22
4.3. Management Objective.....	23
4.3.1. Mooring Improvements.....	23
4.3.2. Carrying Capacity Tool.....	24
4.3.3. Conservation Finance Team.....	26
4.3.4. Artificial Reef Regulations.....	26
4.3.5. Kayak Logistics.....	27
4.3.6. Fish Feeding Regulations.....	27
4.4. Outreach Objective.....	28
4.4.1. Tour Operator Stewardship Program.....	28
4.4.1.A. CORAL Projects.....	29

4.4.1.A.1. Voluntary Code of Conduct.....	29
4.4.1.A.2. Interpretive Training for the Marine Tourism Industry.....	30
4.4.1.A.3. Tourism Industry E-Newsletter.....	30
4.4.1.B. Subsequent Projects.....	30
4.4.1.B.1. Eco-labeling & Certification Program.....	31
4.4.1.B.2. Hawaii Marine Tourism Website.....	31
4.4.2. Community Stewardship Programs.....	31
4.4.3. Point of Entry Education.....	33
4.4.4. Point of Rental Education.....	33
4.4.5. Audiovisual Productions.....	34
Chapter 5: Conclusions.....	35
5.1. Project Prioritization.....	35
5.2. Additional Recommendations.....	36
Appendix I: 2004 Interviews.....	38
Appendix II: 2005 Interviews.....	39
Appendix III: Selection Criteria.....	41
Appendix IV: Site Assessments.....	42
Appendix V: Newsletter Sample.....	44
Appendix VI: Eco-Rating Example.....	45
Appendix VII: Potential Funding Sources.....	49
References:.....	56

LIST OF TABLES

<u>Table</u>	<u>Page</u>
2.1. Summaries of Annual Use at Various Locations Statewide.....	5
3. Summarized Project Descriptions.....	17
4.1.1. RIR-LAS Coordinator.....	18
4.2.2. Mooring Impact Assessment.....	19
4.2.3. Cruise Ship Impact Assessment.....	20
4.2.4. Artificial Reef Impact Assessment.....	21
4.2.5. Kayak Impact Assessment.....	21
4.2.6. Underwater Recreation Impact Assessment.....	22
4.2.7. Jet Ski Impact Assessment.....	22
4.3.1. Mooring Improvements.....	23
4.3.2. Carrying Capacity Tool.....	24
4.3.3. Conservation Finance Team.....	26
4.3.4. Artificial Reef Regulations.....	26
4.3.5. Kayak Logistics.....	27
4.3.6. Fish Feeding Regulations.....	27
4.4.1.A. CORAL Projects.....	29
4.4.1.B. Subsequent Projects.....	30
4.4.2. Community Stewardship Programs.....	31
4.4.3. Point of Entry Education.....	33
4.4.4. Point of Rental Education.....	33
4.4.6. Audiovisual Productions.....	34
5. RIR-LAS Priorities.....	35

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1.	RIR-LAS Development Process	3
2.1.	Patterns of Use and Types of Use at 4 Marine Protected Areas Statewide	6
3.	RIR-LAS Framework	14

EXECUTIVE SUMMARY

In 2002, the United States Coral Reef Task Force identified six major threats to the country's coral reef ecosystems including over-fishing, land-based pollution, lack of public awareness, coral bleaching, coral disease, and recreational overuse. Subsequently each of the seven U.S. states and territories containing coral reefs agreed to prepare local action strategies (LAS) to address these threats. This document is Hawaii's Local Action Strategy to address Recreational Impacts to Reefs (RIR-LAS).

Coral reefs in the Main Hawaiian Islands are under increasing strain from recreational use as Hawaii's resident population, and thriving marine tourism industry, continue to grow at nearly exponential rates. Recreational activities have the potential to directly and indirectly impact reef ecosystem health through breakage from physical contact, alterations in marine life behavior, and degradation of surrounding water quality.

This RIR-LAS document is intended to serve as a guide for coral reef resource management in Hawaii over the next five years. The **goal** of the RIR-LAS is: *"to determine the impacts of marine recreation activities on Hawaii's coral reef ecosystems and develop innovative management techniques that increase the environmental sustainability of those activities."* Under the overarching goal, projects are organized into the following **objectives**:

1. **Data:** To improve our understanding of the links between marine recreation and reef ecosystem health, providing a scientific basis for management decisions.
2. **Management:** To implement management tools, such as regulations & infrastructure, to support a reef's carrying capacity or control user behavior at various sites.
3. **Outreach:** To increase awareness and engage stakeholders in reef education, monitoring and stewardship efforts.

Projects under the data objective address the first part of the overall goal, by supporting research that will fill important gaps in the knowledge of how various forms of recreation affect coral reef ecosystems. The management and outreach objectives apply existing knowledge as well as that gained as a result of activities conducted under the data objective. Management projects aim to increase the sustainability of reef recreation by strengthening a site's resistance to recreational impacts or reducing the intensity of those activities in the area. Outreach activities aim to enlist the recreational users as ambassadors of the reef, facilitating their understanding of appropriate reef behavior and its importance, compelling users to improve the sustainability of their behavior voluntarily. To effectively reduce recreational impacts on coral reefs, the issue must be addressed from multiple angles, incorporating and linking efforts under all three of the above objectives. The **proposed actions** are the result of literature reviews, site assessments, and extensive stakeholder input through interviews, focus groups and workshops.

This report is divided into several sections. The report begins with the intentions and logistics of the RIR-LAS process. Chapter 2 includes background information on the impact of marine recreation on coral reef ecosystems. Chapter 3 outlines the RIR-LAS framework and summarizes the project priorities. Chapter 4 discusses each project proposal in detail and finally, Chapter 5 concludes the report by summarizing the order of priority and type of actions required for each project, as well as an explanation of how the priority actions can achieve the strategy's overall goal.

CHAPTER 1 INTRODUCTION

1.1 RIR-LAS VISION

Local Action Strategies (LAS) are locally driven roadmaps for collaborative and cooperative action among federal, state, territory and non-governmental partners to reduce key threats to valuable coral reef resources. These strategies are the result of a 2002 United States Coral Reef Task Force (USCRTF) initiative, which identified six main threats to all coral reefs existing in U.S. states or territories, including: over-fishing, land-based pollution, lack of public awareness, coral bleaching, coral disease, and recreational overuse. Each state or territory belonging to USCRTF agreed to create a Local Action Strategy for each threat with local priority. Hawaii has already created or is in the process of drafting local action strategies for each of these threats, as well as one for the additional threat of alien species.

Hawaii's Department of Land and Natural Resources, Division of Aquatic Resources (DAR) spearheaded the development of Hawaii's Recreational Impacts to Reefs Local Action Strategy (RIR-LAS), and partnered with the Hawaii Ecotourism Association (HEA) and the organizations represented by the RIR-LAS steering committee, to:

- document, consolidate and share ongoing efforts to address recreational impacts to reefs in the Main Hawaiian Islands (MHI),
- identify gaps in data and management, and
- guide and facilitate the development of future initiatives through recommendations for priority funding.

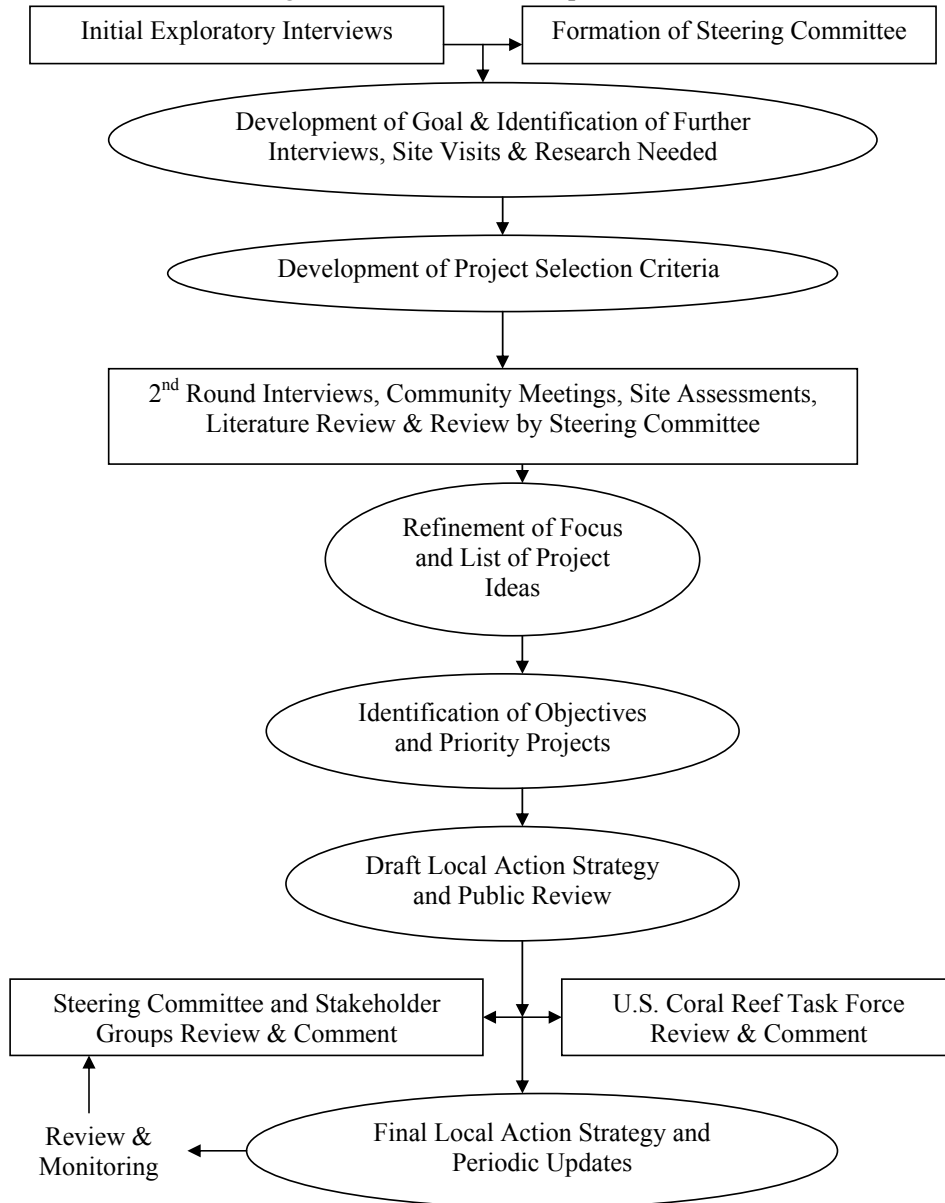
For purposes of the RIR-LAS, recreational activities are defined as all **non-extractive** activities that are performed for leisure, including activities that involve commercial operators. Examples of recreational activities include snorkeling, SCUBA diving, SNUBA, sailing, motor-boating, jet skiing, kayaking, canoeing, surfing, swimming, and wading.

This document synthesizes input from relevant natural resource managers, commercial operators, residents and tourism agencies, outlines a five-year strategy for addressing priority issues, and sets a framework for long-term management of recreational use in Hawaii's coral reef ecosystems. The long-term vision of the RIR-LAS is to reduce potential negative impacts from recreational activities on coral reefs in Hawaii. The immediate goal of the RIR-LAS is to better understand the impacts of marine recreation activities on Hawaii's coral reef ecosystems and develop innovative management techniques that increase the environmental sustainability of those activities within 5 years. Consequently, the RIR-LAS prioritizes actions by those with the greatest potential to produce measurable change within this timeframe, and then lists second-tier projects for later action. Priority actions, which include both statewide initiatives as well as site-specific projects, are organized into three broad objectives, which include data, management, and outreach.

1.2. RIR-LAS DEVELOPMENT PROCESS

A collaborative planning process was used to develop the Recreational Impacts to Reefs Local Action Strategy, incorporating existing data and input both from a roundtable of experts as well as many stakeholder groups and individuals. Below is a diagram summarizing this process.

Figure 1.2. RIR-LAS Development Process



The development for this Local Action Strategy was initiated in the summer of 2004 and completed in December 2005. The process included steering committee discussions, stakeholder input, site observations, and literature research.

A Steering Committee was formed to help guide the direction of the Local Action Strategy, offer expert insight, review stakeholder input and research conducted by the coordinators, and make final decisions on the content of the strategy. This group was composed of representatives of several sectors including government, non-governmental organizations, and the tourism industry, including:

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Tori Cullins	Hawaii Ecotourism Association & Wildside Specialty Tours
Teri Leicher	Jack's Diving Locker

Interviews were conducted with many key stakeholders, including representatives from the marine tourism industry, government resource managers, marine scientists, NGOs and community groups. Over 100 groups and individuals were consulted to obtain input into the key issue areas, sites and priority actions. In the summer of 2004, 20 key informants were surveyed for their perspectives on priority issues, potential solutions, and contacts for further research via email, telephone and face-to-face meetings in an initial round of exploratory interviews. (*See Appendix I for a summary of the 2004 interviews.*) After hiring a coordinator, forming the steering committee, and identifying a direction for the Local Action Strategy, over 80 more people provided input during one-on-one meetings as well as group discussions at community workshops. The focus of these interviews was to understand Hawaii's recreational management and research needs from the perspectives of those working and living among coral reefs, as well as to identify ongoing or planned activities for potential inclusion and support via the RIR-LAS. (*See Appendix II for a list of 2005 interviewees and a summary of responses.*)

Several site visits were made to better understand the recommendations of interviewees and evaluate the possibility for RIR-LAS projects against a set of project selection and site selection criteria developed by the steering committee. (*See Appendix III for a summary of the selection criteria and Appendix IV for a summary of site evaluations.*)

Published research on tourism, coral reefs and recreational impacts in Hawaii and abroad were also compiled and summarized to aid in the decision-making process. The Steering Committee used all of the above information, as well as their own expertise, to develop objectives for the strategy and select priority actions for funding. The draft report was then posted on the HEA website and emailed to all interviewees, as well as the entire HEA membership, for public comment. Finally, the draft was submitted for federal review, revised, and finalized.

CHAPTER 2 BACKGROUND

Coral reefs are naturally dynamic and geologically resilient ecosystems. However, these ecosystems are being threatened worldwide by a myriad of human activities happening both on land and in the ocean. One human activity with direct impacts to Hawaii’s coral reefs is ocean recreation. Both local residents and visitors participate heavily in ocean recreation. Without proper management, this high-level of recreational use has the potential for many negative impacts to coral reefs.

2.1. MAGNITUDE OF MARINE RECREATION

Tourism is the engine that drives Hawaii’s economy (DBEDT 2003). In 2004, approximately 6.7 million visitors came to Hawaii and spent more than \$11.7 billion dollars in the state, making tourism the largest-grossing industry in the State (Friedlander et al. 2005). Since 2003, with the return of Japanese and Asian travelers and the launching of new Hawaii-based inter-island cruise ships each with the passenger capacity of over 2,000 per trip (Honolulu Advertiser 06/09/2004) visitor numbers have climbed even higher and promise to continue with plans to add even more ships in the near future.

The global marine tourism and recreation industry is currently estimated to be worth \$15 billion per year (<http://www.dest.gov.au/archive/Science/pmsec/nla/ocs/ocean1.html>). Hawaii’s beaches rank number one year after year in the annual ranking of America’s best beaches (Honolulu Advertiser, 06/28/04). There are over 1,000 ocean tourism companies in Hawaii, generating an estimated \$700 million in gross revenues annually. Nearly 52% of all US tourists to Hawaii go snorkeling or diving and over 80% of all tourists participate in some form of ocean recreation from sunbathing and swimming, to snorkeling and surfing, to jet skiing and parasailing (DBEDT 2002). In addition to tourists, the majority of Hawaii’s 1.2 million residents live within two miles of the shoreline (Hawai`i Census 2000). That means that every year, over 5 million people crowd into Hawaii’s near shore waters where coral reefs exist.

Hawaii’s Marine Protected Areas (MPA’s) are highly sought after locations in which to dive and snorkel and are marketed by the visitor industry as “must see destinations” (Clark and Gulko 1998). Table 1, below, illustrates the high level of use at Hawaii’s most popular MPA’s. In addition to the reefs in Hawaii’s MPA’s, those in Kaanapali, Haena, Kailua and Kaneohe Bay are also heavily used by both residents and tourists.

Table 2.1. Summaries of Annual Use at Various Locations Statewide

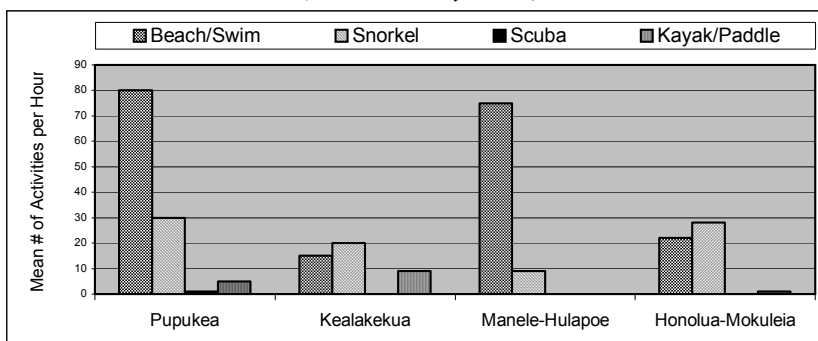
Location	Number of Visitors
Waikiki Beach, Oahu	8,355,448 ¹
Hanauma Bay, Oahu	1,751,318 ¹
Pupukea, Oahu	177,600 ²
Manele/Hulapoe Bays, Lanai	277,400 ²
Molokini Shoal, Maui	400,000
Honolua/Mokuleia Bays, Maui	160,000 ²
Kealakekua Bay, Hawaii	189,800 ²
¹ DBEDT State Data Book, 2002	
² Adapted from K. Holland and C. Meyer, 2003, based on mean hourly usage	

Many times there are trade-offs with marine tourism. Expansion of tourism can increase impacts to reefs. Increased numbers of tourists recreating in reef areas increases the potential for damage from

direct contact and sedimentation of the reefs from standing or kicking sand near coral. There are also many indirect impacts of ocean tourism expansion including, run-off from coastal development and over fishing for marine curios (e.g. the Red Sea, Hawkins and Roberts 1996). In other cases, development of resort islands can have a net positive benefit for the environment since it can lead to a discontinuation of earlier, more harmful practices (e.g. coral mining in the Maldives, Price and Riraq 1996) and the subsequent development of sustainable conservation practices. The economic value of these sites is also an important consideration. A recent economic study sponsored by the Hawaii Coral Reef Initiative Research Program found that Hawaii's near shore reefs generate about \$800 million annually in gross revenues, or \$364 million in added value annually (Davidson, Hamnet, and Minato 2003). Added value, in this case, is defined as "the net business revenues (*i.e.*, income minus costs), directly and indirectly from residents and tourists going snorkeling and diving on Hawaii's reefs" (http://www.hawaii.edu/ssri/hcri/ev/coral_reefs.htm). Using Hanauma Bay as an example, this 101-acre marine protected area and the surrounding City Nature Preserve generates over \$37 million each year in added value. Education spillover, whereby residents and visitors adopt more reef friendly practices after visiting the education center contributes \$220,000. Over the next 50 years, this translates to nearly \$2 billion in total benefits from Hanauma Bay alone (Friedlander et al. 2005).

Marine recreation in Hawaii comes in a myriad of forms. There are a variety of motorized and non-motorized boat cruises, such as beach catamaran rides, parasailing, submarine rides, dinner cruises, snorkel and dive cruises, and marine mammal viewing trips. Whale watching continues to grow in popularity on each island. There are an estimated 300,000 people who take whale watch tours in the state each year. The number of dolphin tours has recently exploded in areas where resident pods are known to rest. The new steel cage shark viewing tours now offer an extreme version of the myriad of popular marine life viewing experiences (Markrich 2004). Other above-water activities, utilizing a variety of motorized and non-motorized personal watercraft, include jet skiing, inflatable rides, boogie boarding, surfing, windsurfing, kite-surfing, paddle-boating, kayaking and canoeing. Underwater activities include snorkeling, SCUBA diving, and new technologies such as SNUBA, rebreathers, Bobs and SeaWalkers. And currently there is a proposal to develop an 80-room undersea hotel, observatory and marine research center at Ko'Olina, Oahu, illustrating the increasing demand for marine tourism and recreation on the island. The most popular activities in Hawaii's Marine Life Conservation Districts are shown in Figure 2 below and include swimming/wading, followed by snorkeling, then kayaking and SCUBA diving.

Figure 2.1. Patterns of Use at 4 Hawaii MPA's
(Holland and Meyer 2003)



2.2. IMPACTS OF MARINE TOURISM

Recreational activities can harm coral reefs by 1) breakage of coral skeletons and tissue from direct human contact such as walking, touching, or dragging gear; and 2) breakage of coral skeletons and tissue from boat anchors; 3) alteration in the behavior of marine life from feeding or harassment; 4) water pollution, and 5) potential transfer of invasive species.

2.2.1. Coral Breakage from Direct Human Contact

Several investigators have documented impacts to reefs by following divers and snorkelers and observing human-coral contacts. While reading the following paragraphs, it is important to note that not all investigators define “incidents” the same way. The definition ranges from inclusion of fin kicks that cause sediment to land on coral (Zakai and Chadwick-Furman 2002) to dislodging the coral from its substrate (Talge 1990). The most common definition is the latter. The majority of contacts are fin kicks (95%, Rouphael and Inglis 2001; 62%, Peck 2000). Other types of contact are categorized as pushing or grabbing (17%), gear dragging (10%), kneeling/standing (0.1%), and mauling (1 incident; Peck 2000).

Off the coast of Eilat, Israel’s popular coastal resort on the Red Sea, an average of 10 incidents per dive was recorded. In the Great Barrier Reef Marine Park, 214 divers were followed and 15% of them damaged or broke corals (Rouphael and Inglis 2001). Similarly, (Holland and Meyer 2003) followed 234 divers and snorkelers in four marine protected areas in Hawaii and found that 16% of them made contact with coral. But in contrast to the previous study, Holland and Meyer state that only eight substrate contacts (0.7% of contacts) resulted in visually obvious damage to coral (4 tissue abrasions, 4 skeletal breakages). This could be partly due to the fact that the most common species of coral in Hawaii are more robust than the delicate coral formations found in most other tropical marine ecosystems. Talge (1990) recorded that 26% of scuba divers had one or less interactions with corals, 10% had 11-20 interactions, and 4% had 30 or more interactions per 30 minutes of dive time. In another study in Hawaii, 5% of divers accounted for 44% of negative interactions and 20% accounted for 77% of negative interactions (Peck 2000). From these studies, it seems likely that a small percentage of divers are responsible for a large percentage of the damage.

In comparison, snorkelers have less impact than divers. In the same Talge 1990 study, 61% of snorkelers had one or fewer interactions with corals and none had more than 5 incidents. However, snorkelers treading water can stir up clouds of sediment and are more apt to stand on corals than scuba divers. Holland and Meyer (2003) found that scuba divers had almost twice as many contacts per dive than snorkelers, but they attribute this to the fact that corals are sparse in areas where most substrate contacts were observed.

While scuba divers tend to have more impact to coral than snorkelers, not all divers have the same rate of incident. Several studies have shown that inexperienced divers have greater impact than experienced divers (Zakai and Chadwick-Furman. 2002). Two studies found that impacts are much more likely from males than females (Talge 1990, Rouphael and Inglis 2001), but Holland and Meyer (2003) concluded that sex was not correlated to the number of incidents. Incidents are more frequent for specialist underwater photographers than from divers without cameras and naïve photographers (Rouphael and Inglis 2001) and more likely from divers wearing gloves (72% of interactions, Talge 1990).

Other factors have also been correlated to the rate of human-coral contact. The rate of incident is greater in the first ten minutes of the dive (Rouphael and Inglis 2001). Benthic assemblage is also

correlated to the rate of incident. For example, the rate of incident was greater at sites with a large abundance of branching corals (Rouphael and Inglis 2001) and benthic assemblage is a main factor in determining human impact in Hawaiian MPAs (Holland and Meyer 2003). Recent studies have shown that extensive damage to coral can occur in shallow, calm water sites with high levels of human use (Rodgers and Cox 2003). Trampling frequently occurs on shallow near shore reef flats, which are often algal dominated. But they may possess fragile and delicate coral species, particularly if they are in an embayment or quiet water area with restricted circulation, making them more susceptible to anthropogenic stresses (Dollar and Grigg 2004). Trampling may also occur as an offshoot of "tide pooling" explorations. In general, there are limited areas to access "tide pools" in Hawaii. Some of those areas may be reasonably robust, while others are quite fragile and not appropriate for visitors. These would include any areas that are tidal and have restricted pools such as "alkaline pools" with large populations of native and endemic species, or any pools that have a fair proportion of coral cover. The lack of depth of these pools makes it likely that any entry or use will include high amounts of contact with delicate species. According to Holland and Meyer (2003), the greatest concentration of human-substrate contacts occurs at shoreline access points where people stand or wade as they enter and exit the water. Coral mortality from substrate contact here can reach levels as high as 100% (Friedlander et al. 2005). Care should be taken to examine any local area in which water entries are to be made. Generally speaking, entry points should be over sand or robust substrate, leading immediately to a sufficient depth of water for the snorkeler or diver to swim above the substrate without touching or kicking it.

2.2.2. Coral Breakage from Boat Anchors

Anchor damage to reefs is commonly discussed among managers and among communities, but scientific references on the subject are sparse. One study, however, showed that ten years after anchor damage occurred on a reef in the Virgin Islands National Park, live coral cover in the still-visible scar (128 m long and 3 m wide) remains well below the cover found in the adjacent, undamaged reef (Rogers and Garrison 2001). Another more recent study includes a fairly comprehensive review of research on anchor impacts and presents model that can be used to forecast anchor damage according to specific criteria. This study concludes, "Anchors and their chains are so destructive to coral reefs that mooring buoys should be installed and used wherever possible" (Saphier and Hoffmann 2005).

There have also been several studies designed to replicate mechanical damage and study the impacts to reefs. The effect of mechanical damage on coral mortality is debatable. (Ward 1995) found that mortality rates increased in corals after being dislodged but remained constant in corals after fragmentation. Rodgers et al (2003) documented that coral colony and fragment mortality was very low for four Hawaiian species. Similarly, Ward (1995) found that growth rates and lipid production were decreased in corals after being dislodged but remained constant in corals after fragmentation. Rodgers et al (2003) concluded that the effect on growth rate is dependant the size and species of coral, although contact always caused significantly decreased growth rates in experimental trampling study (Rodgers and Cox 2003).

The effect on reproduction may be dependant on the extent of the damage and/or the species of coral. In one study, skeletal fragmentation decreased larval output by reducing reproductive tissue volume, and the authors concluded that repetitive mechanical damage may lead to substantially reduced sexual reproduction (Zakai and Chadwick-Furman 2000). In agreement with Zakai and Chadwick-Furman, Ward (1995) found that dislodged corals had decreased reproduction; however, Ward found that fragmented corals had increased reproduction.

On a reef ecosystem level, a decrease in live coral cover and increase in dead coral and coral rubble can lead to succession or phase change (Tratalos and Austin 2001). Bare hard substrate is more readily colonized by algae than by coral, and shifts from coral-dominance to algae-dominance can occur after considerable coral damage. Percent algal cover on a reef adjacent to a resort was positively correlated to age of the resort in the Maldives, although it should be noted that this correlation *might* be due to pollution, not mechanical damage (Price and Riraq 1996).

2.2.3. Marine Life Behavior Alterations

Recreational impacts to marine life behavior may be caused by the mere presence or harassment from users and from feeding. Studies on diver presence and fish communities have had conflicting results. Diving has not been shown to have a significant effect on reef fish communities in Bonaire (Hawkins et al. 1999), but fish abundance was significantly lower at high-use sites in Kaneohe Bay, Oahu (Rodgers and Cox 2003). Several studies have shown fish feeding to produce negative changes in behavior. Some of the effects outlined in a review of these studies (Orams. 2001) include: time spent obtaining food, the size of the animal's home range, reproductive activity, population density, migration patterns, and species composition due to an increase in the larger, more aggressive species. Fish feeding has also been shown to greatly increase the aggressive behavior of the larger species and result in fish biting hands and other extremities.

2.2.4. Water Pollution and Invasive Species

Although it has been shown that coral reefs are extremely vulnerable to impacts such as pollution from sediment, chemicals, and invasive species, the extent to which recreational activities add to these impacts has not been thoroughly studied. It is suspected that tour boats may threaten reefs in enclosed bays with human waste and gray-water discharge. Although it has not been thoroughly documented, concentrations of sunscreen in the water from snorkelers may also reduce the amount of sunlight reaching coral colonies and result in lower photosynthesis. Other sunscreen impacts that have been documented to some extent include one study in which lakes with high recreational use in Germany also had higher concentrations of sunscreen agents in the fish found in those lakes (Daughton and Ternes 1999). Another study showed that sunscreen products can modify a variety of biogeochemical cycling in seawater and increase virus abundance in marine bacterioplankton (Danovaro and Corinaldesi 2003). Hawaii's high level of endemic reef species makes it extremely vulnerable to the introduction of alien species, which could be transported in divers' wetsuits or other means but there are no studies to confirm this possibility.

2.2.5. Other Potential Impacts

In addition to the recreation-related activities that are known to impact coral reef ecosystems, there is a multitude of activities for which the impact has not been thoroughly researched or documented. For example, the damage that can occur from boat anchors has been fairly well documented and as a result, day-use moorings have been installed to discourage tour boats from anchoring at frequently used sites. However, the impacts of mooring installation or presence near reefs have not been well documented and are largely unknown. There is some concern that certain installation methods may damage the reef, and perhaps more importantly, that the resulting concentration of recreational vessels and passengers may impact the reef from trampling and water pollutants. Many other types of ocean recreation equipment, such as kayaks or jet skis, may also have negative impacts on Hawaii's coral reefs, but to date no studies have been done on these impacts.

2.3. MANAGEMENT TECHNIQUES FOR MARINE RECREATION

Literature on management and mitigation techniques is sparse compared to the literature on impacts. This section will give a brief overview of solutions but is not by any means comprehensive of all approaches or details. There are two main approaches to managing recreational use of coral reefs: 1) reducing the level of use at specific sites, and 2) reducing the impacts of use through modifications in human behavior. In order to reduce human use, access can be restricted or efforts can be made to relocate use to other sites. To reduce impacts of use, regulations can be imposed prohibiting or requiring certain actions or efforts can be made to educate users to inspire them to voluntarily modify their behavior. A few examples of these management techniques and challenges are described below.

2.3.1. Restricting Access

One approach to reducing human use is to set limits on numbers of users by determining the site's carrying capacity. This approach involves quantifying how much damage a certain level of use causes, and identifying a maximum threshold of human use to maintain a healthy reef. Thresholds are hard to calculate and may vary widely with location. Research conducted in Sodwana Bay, South Africa, indicated that 10% of diver damage occurs when use reaches 9000 dives per dive site per year. The authors took uncertainty into account and recommended a precautionary limit of 7000 dives per dive site per year (Schleyer and Tomalin 2000). In agreement with that threshold, at another site, 6000 dives per site per year resulted in "relatively minor damage" (Hawkins et al. 1999). In Kaneohe Bay Hawaii, Rodgers and Cox (2003) quantified the threshold in different units. A high-use site with 100% mortality of coral transplants had 63 people in the water per daylight hour. The low-use site with 2.6 people in the water per daylight hour had 70% survivorship of transplanted coral.

Another approach is to recommended banning types of activities, not amounts. Since 72% of impacts were caused by divers wearing gloves, Schleyer and Tomalin (2000) recommended a ban on the use of diving gloves. SCUBA photographers have also been found to have greater negative impacts on coral reefs and thus management recommendations have been made to restrict that as well (Tratalos and Austin 2001).

Still others recommend banning 100% of recreational activity in certain areas. An example of this type of management is in Eilat's Coral Natural Reserve in the Northern Red Sea. A small-scale, no-use zone policy has been implemented since 1992. After six years, the status of this closed-to-the-public reef area was compared to two nearby open-to-the-public sites by evaluating populations of one species of coral (*Stylophora pistillata*) in the strolling zone (0.5-1.5 meter depth). Results from the open sites show that: (1) Live coral cover was three times lower than at the closed site; (2) numbers of small colonies were significantly higher than in the closed site, while numbers of medium and large size colonies were significantly lower; (3) maximum radius of the coral was almost half of that in the closed site; (4) average number of broken colonies was three times higher than in the closed site; and (5) significantly fewer colonies were partially dead. Although colony breakage is reduced, the authors conclude that the no-use zone policy is not sufficient for protecting small reef areas. They recommend the initiation of novel management solutions such as reef restoration by sexual and asexual recruits (Epstein et al 1999).

2.3.2. Relocating Use

One popular method of relocating users is to create new habitat for a reef and then allowing for natural colonization of coral. This is often termed "artificial reefs." In some cases, reef substrate is created by depositing calcium minerals from the seawater by electrolysis (Hilbertz et al 1977, in (Van Treeck and Schuhmacher 1999). In other cases, existing underwater structures such as offshore oil platforms

(Bugrov, Murav'ev, and Bugrova 1994) and sunken planes or ships are converted for use as artificial reefs.

Artificial reefs are popular diving spots for many locations, including Hawaii (Brock 1994) and South Carolina (Rhodes, Bell, and Pomeroy 1994), but doubts and concerns exist over their effectiveness. Most concerns center on the species composition because artificial habitats may not produce diverse, naturally functioning systems but may favor opportunistic, invasive, and/or other types of species that produce a non-natural system. One study in the Red Sea did show that the fish assemblage on a 25-year old artificial reef was shown to be abundant and diverse, comprising 146 species distributed among 35 families (Rilov and Benayahu 1998). Other concerns include possible changes in water composition due to chemical leakage from the artificial structure and the potential imbalance they could cause on nearby natural reefs due to displacement of fish from the natural reef to the new artificial ones. More studies like this are needed.

2.3.3. Education

A classic and broadly used method for modifying human behavior to increase the sustainability of recreational activities is education. Depending on the location, the target audiences may be residents and/or tourists. Common methods of delivering educational information are:

- Signs at beach parks
- Brochures distributed through dive shops, hotels, tour groups, etc.
- Curriculum for schools and after-school care programs
- Table tents / information cards for hotel rooms
- Videos for incoming passengers on airlines and cruise ships
- Public Service Announcements on local TV, radio, and visitor channels
- Volunteer docents who talk one-on-one to users of public beaches
- Fairs and other public events
- Tour guides (including dive operators)

The success of each of these delivery tools depends on the location and situation. In Hawaii, diver and snorkeler contacts with the reef are much more common from individuals who are not associated with a tour group, indicating that tour guide briefings may be less effective than methods that target independent recreationists (Sarah Peck, UH Sea Grant, personal communication). On the other hand, a single pre-dive briefing has been shown to significantly reduce diver coral damage (Holland and Meyer 2003).

2.3.4. Mechanisms for Compliance

An important consideration in any management decision is how to compel users to cooperate with that decision. Compliance mechanisms include physical infrastructure that uses convenience and fees to encourage certain limits or behaviors, legal requirements with tangible consequences for non-compliance, as well as incentives for voluntary compliance.

Infrastructure can be built to restrict use, disperse use, concentrate users in less vulnerable areas, and alleviate the negative impacts caused by a particular use. Infrastructure often used to restrict un-guided shore users includes parking lots and controlled entry gates into the area. One successful example of these techniques can be found at Hanauma Bay on Oahu, where parking is used to control entry to the bay. Paths, walkways, land & underwater trails, and water access facilitation devices, such as ladders

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or ramps can be used to manipulate the flow of users either to disperse them or concentrate them in areas with less vulnerable substrate. In addition, ladders and ramps into the water can help to prevent users from stumbling over coral accessing a reef from shore. Other infrastructure targets the impacts of commercial tour boats specifically. For example, day-use moorings help to prevent damage caused when recreational boaters and commercial tour operators drop anchor on or near reefs.

Legal requirements can be made for limits on levels, types and time of use and other quantifiable, objective criteria, but without active monitoring and enforcement personnel, there is no guarantee that these rules will be followed. Commercial use permits can incorporate many legal requirements, and thus often provide an efficient method for monitoring and ensuring compliance from tour operators. In Hawaii, all tour operators who wish to operate in a marine protected area must have a permit. Permits normally include various criteria that the applicant must meet in order to qualify for a permit. For example, some of Hawaii's commercial tour boat permits require the permittee to conduct regular clean-ups of the sites used. In some cases, applicants must meet several minimum impact requirements or commit to certain use limits before they can receive the permit. For example, permits can require boat tour operators to require their guests to wear life vests or use floating 'noodles', which prevent snorkelers from diving down below the surface and has been shown to reduce the likelihood of contact with the substrate. In other places, such as the Great Barrier Reef in Australia, voluntary incentives for best practices have been built into the permitting process by granting permits for extended terms to those operations that have been certified by the national eco-labeling program for nature tourism (<http://www.tourismoperators.reefhq.com.au/permits/15years/index.html>).

Eco-labeling programs, also called eco-rating or eco-certification and various other names, combine education with incentives for voluntary compliance in place of legal enforcement (Honey 2002). This method uses the market to compel voluntary resource stewardship among commercial users, by promoting operators as environmentally and socially responsible if they can prove compliance with a variety of best practices. These programs normally begin with a voluntary codes of ethics developed by the tourism industry members, then expand into a larger effort that includes third-party verification and promotion of those who exceed the minimum qualifications. There are over one hundred programs like this worldwide. However, most do not focus specifically on marine tourism, but apply to all nature-based tourism in the region. One program that does focus on marine tourism is Ecuador's SmartVoyager, designed specifically to evaluate tour boats operating in Galapagos Islands (<http://www.rainforestalliance.org/programs/tourism/smartvoyager/index.html>). Another program, Blue Flag (<http://www.blueflag.org/>), is marine centered, but certifies beaches and marinas rather than the operators working within them. One of the most successful programs, as far as increasing the demand and willingness to pay for eco-certified travel experiences, is Australia's Nature and Ecotourism Accreditation Program (<http://www.ecotourism.org.au/neap.asp>). A high level of government support and focused efforts to promote Australia as an ecotourism destination, as well as the promotion of the individual certified operators through a variety of media, has led to the programs success (World Tourism Organization 2002). In most cases applicants must pay a fee to participate, which helps maintain the program and provide incentives for stewardship. In order to be successfully certified or rated, the sustainable practices and educational content of commercial tours must be verified each year. Once certified, or awarded a rating, incentives to continually improve are provided, such as various levels of achievement and training opportunities (Bauckham 2005). For an in depth overview of ecotourism certification and eco-labeling programs, including samples of requirements from several programs, go to: <http://www2.hawaii.edu/~wbauckha/Thesis/start.htm>.

2.3.5. Funding Challenges

Funding of conservation programs is always limiting, but there are several mechanisms that can be employed to increase financial capacity.

User-fees are one way to finance management projects. Assessing the willingness-to-pay of ocean recreational users has been used to estimate the possible revenue generation from creating a user fee system. In Hawaii, the average visitor is willing to pay \$3.77 per ocean experience, but very few locations charge any type of user fee (Cesar and van Beukering 2004). There are obstacles to doing this in public opinion, laws, and politics. Hawaii may need to learn from other places such as Bonaire, where their success has been attributed to collaboration between protected area managers and commercial users of the MPAs (Geoghegan 1995).

Another financing mechanism is voluntary donations into “Reef Funds” that are normally run by non-profits. For example, on the Big Island of Hawaii, several dive operators and non-profit groups are collaborating to collect donations from visitors, businesses, and concerned citizens that will be used for conservation. Because this is a relatively new program, its success is yet to be determined.

2.3.6. Hawaii’s Current Marine Management Strategies

The following is a list of current and past techniques used to manage non-extractive activities in Hawaii (Clark 2004).

- 1 Reduce Human Use
 - Restrict Access
 - Determine appropriate commercial activities for a 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
 - Work with the visitor industry to market other options
 - Rotate the use of moorings
- 2 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
 - On-site signage
 - Off-site signage and interpretive displays in hotels, aquariums, and other venues

- Public Service Announcements and airline videos on sustainable recreation behavior (currently being developed)
- Reef education websites

2.3.7. Hawaii's Local Action Strategies

A separate local action strategy is being developed to address each of the six major threats to Hawaii's coral reefs, including over-fishing, land-based pollution, lack of public awareness, coral bleaching & disease, alien species and recreational overuse. This approach divides the issue into several smaller, less infinite problems for experts and stakeholders from each area to solve. However, as the above threats do not occur in isolation from one another, efforts are being made to develop projects that cross-cut the various local action strategies and incorporate a holistic approach into the overall process. Projects from all six local action strategies are brought before the Coral Reef Working Group to review for overlapping proposals or projects from separate strategies that might be more successful if combined. The coordinators of each strategy report to the same overarching Hawaii LAS coordinator and also discuss projects and issues with each other on an on-going basis. The Lack of Public Awareness Local Action Strategy has been developed to address the impacts involved in each of the other strategies and since the visitor industry plays such a major role in Hawaii's economy, and is often the catalyst for development that exacerbates land-based pollution, for increases in the recreational and marine curious fishing industry, and for alien species introductions via hitchhiking on the bodies or gear of visiting ocean-goers, each of those strategies must consider the impact of recreational use and in turn the RIR-LAS must also recognize those types of recreational impacts within its framework. One example of this project overlap is efforts to identify and manage for carrying capacity at recreational reef sites. The Land-based Sources of Pollution LAS includes a project to identify the user and parking carrying capacity at Honolua Bay, on Maui, in an effort to reduce run-off caused in part by unregulated parking on dirt surfaces as well as human waste that gets carried into the bay with the rain, since there are no restroom facilities. This project has been slow to get started, as there is no formal method of determining recreational carrying capacity. However, the RIR-LAS includes a project to develop the methodology needed to efficiently determine and set carrying capacity limits for various recreational activities at various sites around the state, and once that is developed the Honolua Bay study can be completed. In addition, the Lack of Public Awareness LAS included a project to produce a video for tourists on how to minimize environmental impact while recreating in the ocean, which as been completed and is already airing on certain flights from the Mainland to Hawaii.

2.3.8. Other Jurisdiction's Local Action Strategies

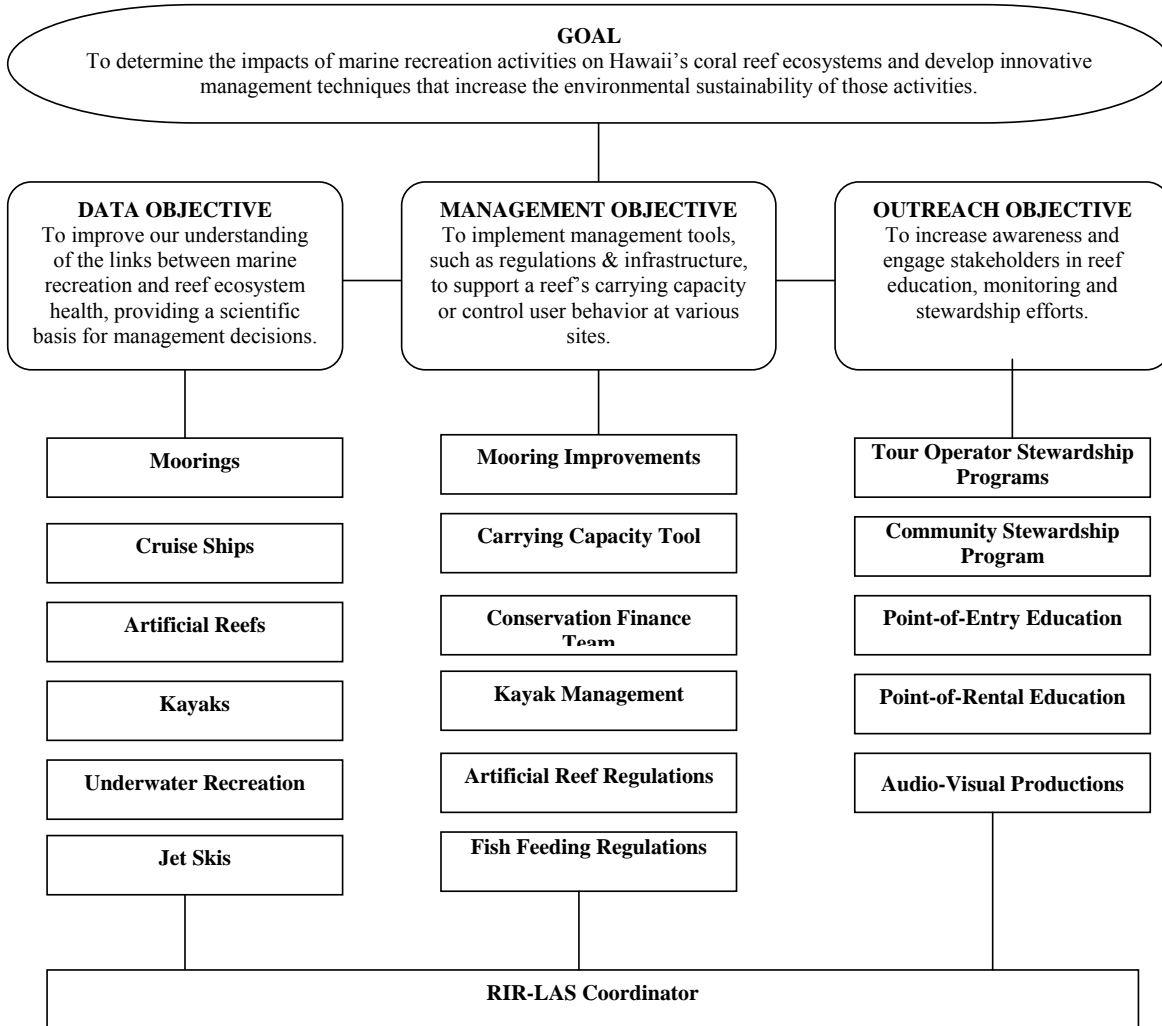
In addition to Hawaii, local action strategies have been developed for the other U.S. jurisdictions with significant coral reef resources, including the Commonwealth of the Northern Marianas Islands, Guam, American Samoa, the U.S. Virgin Islands, Puerto Rico and Florida. Management strategies recommended by local action strategies for recreational impacts completed for other jurisdictions vary in scope and focus, but all have commonalities. Every jurisdiction said that installation of mooring buoys and some form of education were important. Educational techniques recommended include signage at hotels and beaches, on-site educators at hotels and beaches, airline videos for low-impact diving and snorkeling, public services announcements for locals regarding laws and buoys, development of training programs for marine tour operators to use eco-friendly products, as well as training to assist and encourage locals in their transition from fishing to tourism employment. Some other management recommendations included video monitoring of activities at Marine Protected Area borders, increased enforcement of laws, mapping, monitoring and zoning of various recreational activities, and collection of user-fees.

The RIR-LAS projects are designed to build upon and combine the techniques already in use and incorporate emerging ideas to produce innovative and effective mechanisms for increasing the sustainability of ocean recreation occurring near Hawaii's coral reefs.

CHAPTER 3 STRATEGY FRAMEWORK

Based on the existing data and stakeholder input, the Steering Committee designed the following framework of objectives and projects under one overall goal:

Figure 3. RIR-LAS Framework



Individual project descriptions are summarized in Table 3 below.

Table 3. Summarized Project Descriptions

GOAL: To determine the impacts of marine recreation activities on Hawaii’s coral reef ecosystems and develop innovative management techniques that increase the environmental sustainability of those activities.	
RIR-LAS Coordinator:	Half-time position to facilitate successful implementation of the RIR-LAS plan.
DATA OBJECTIVE	
Moorings:	Assess impacts from various installation methods, placement of, and materials used on species distribution, water quality and physical damage to the reef before and after installation or in comparison to sites with no moorings.
Cruise Ships:	Assess reef-related shore excursion patterns, intensity of use at various sites, and identify impacts by existing cruise ship passengers.
Artificial Reefs:	Assess impacts from various installation methods, placement of, and materials used on species distribution, water quality, and health of nearby reefs before and after installation.
Kayaks:	Assess impacts of kayaks from existing portage and scrapings, as well as proposed alternatives.
Underwater Recreation:	Assess impacts of introductory SCUBA and SNUBA divers.
Jet Ski:	Assess impacts of noise, water pressure, fuel and grounding frequency.
MANAGEMENT OBJECTIVE	
Mooring Improvements:	Develop guidelines and/or regulations for buoy zoning and capacity limits, installation, site selection and use of moorings, streamline the installation permitting process, and support the development of a website including maps of existing and proposed moorings and publication of the above guidelines & regulations.
Carrying Capacity Tool:	Develop and implement a tool to set carrying capacity at priority sites (i.e. those likely to be affected by projected increases in users); expand on this tool to generate capacity estimates at other sites around Hawaii.
Conservation Finance Team:	Establish team of people with expertise in fundraising, marketing, product development and PR to work with the various segments of the tourism industry to implement innovative and effective ways to reach various reef users and garner funds to implement conservation projects.
Kayak Logistics:	Implement alternatives to, and regulations regarding, kayak portage at priority sites.
Artificial Reef Regulations:	Develop guidelines or regulations for materials used, installation methods and distribution of the artificial reefs; as well as state permitting process for installation.
Fish Feeding Regulations:	Expand restrictions on fish feeding to more locations and develop mechanism for enforcement.
OUTREACH OBJECTIVE	
Tour Operator Stewardship Program:	Develop a newsletter and/or a standardized training series for tour operators and staff, coordinate stakeholder development of a tour operator code of ethics, and design a mechanism for verifying operator commitment to the code or green-rating program.
Community Stewardship Programs:	Statewide program to assist interested communities to develop on-site reef stewardship programs, including volunteer training and infrastructure to maximize effectiveness – i.e. manage user flow toward edu-kiosk or interpretive program, less sensitive entry and exit points, and fee collection points.
Point-of-Entry Education:	Establish a working group to design an educational medium regarding reef etiquette and work with the transportation industry and coastal land managers to distribute at points of entry, such as airports, cruise ships, and the coastal access areas to reefs.
Point-of-Rental Education:	Establish a working group to garner support from distribution outlets and develop a useful and attractive product to be distributed through rental cars and/or gear rental shops, which list reef recreation guidelines.
Audiovisual Productions:	Work with Lack of Public Awareness LAS to establish a working group to design a series of commercial-length PSAs or lengthier video encouraging sustainable reef etiquette, determine most effective distribution outlets and garner support from distribution outlets to broadcast the production.

CHAPTER 4 PROJECT DETAILS

This chapter outlines the details for all recommended projects under each objective. Across the three objectives, projects are aimed primarily at a few common user groups and threats, including: guided tourists, un-guided tourists and residents, the cruise ship industry, and ocean recreation technology. Thus, there are many projects that would be most effective if implemented in conjunction with one another. The actions identified as top priorities for immediate funding include: 1) hiring a RIR-LAS coordinator for plan implementation, 2) mooring improvements & research, and the development of 3) a tool to set carrying capacity limits, 4) a tour operator stewardship program, 5) a community stewardship program, 6) a point of entry education campaign, and 7) a conservation finance & PR team.

4.1. IMPLEMENTATION OF THE LAS

Although not explicitly listed as one of the RIR-LAS objectives, hiring a half-time RIR-LAS implementation coordinator is a prerequisite to implementing any of the projects within the three RIR-LAS objectives, and is thus the most urgent action requiring funding and implementation.

4.1.1. RIR-LAS Coordinator

Proposed Action: Hire a half-time coordinator for RIR-LAS implementation.	
Significance: In order to ensure that this management plan is implemented and to facilitate collaboration between stakeholders and the steering committee during the implementation stage, a RIR-LAS Coordinator must be hired. The coordinator will revise the LAS as needed. This may include an annual re-prioritization of the un-funded projects as needed, project status updates, and inclusion of pertinent scientific findings and regulation changes into the strategy. The coordinator will also continually look for funding opportunities for under-funded projects within the LAS.	
Status: Funded Funding Sources: DAR, NOAA Coral Management Grant (\$25,000 for the first year of implementation)	Lead Organization: DAR Potential Partners: TBD
Duration: 1 year (2006)	Estimated Cost: \$25,000 Non-Monetary Needs: Office space & equipment
Indicators of Success: All projects recommended for year one implementation are funded and underway by the end of year one.	

4.2. DATA OBJECTIVE:

To improve our understanding of the links between marine recreation and reef ecosystem health, providing a scientific basis for management decisions.

The Data objective focuses on monitoring reef user behavior, patterns, and levels of use among the various users in correlation with reef health. Priority actions outlined within this objective have been identified as currently under-managed activities with the greatest potential for positive or negative impact on Hawaii’s near shore coral reefs. Results from projects within this objective will help to guide the implementation of management and outreach projects included in this Local Action Strategy.

4.2.1. Mooring Impact Assessment

Proposed Action: Fund and contract researchers to assess impacts from various installation methods, placement of moorings in relation to their proximity to the reef and each other, limits concerning the number of moorings allowed in one site or the number of passengers, or size of boat, allowed on each mooring and materials used on species distribution, water quality and physical damage to the reef before and after installation or in comparison to sites with no moorings.	
Status: Partially-Funded (funding listed below is total to be shared among this project and the Mooring Improvements project) Funding Sources: DAR, through NOAA Coral Reef Management Grant (\$30,000); Potential Funding Sources: US Fish & Wildlife Service (\$10,000); In-kind support from Tour Boat Operators, for labor & boats	Lead Organization: Malama Kai Foundation Potential Partners: government agencies, Kona & Maui Reef Funds, Oahu & Kauai community groups
Duration: 1 year (2006) in conjunction with mooring improvements described under Objective 2: Management	Estimated Cost: approx. \$20,000 (see Mooring Improvements Project, under Management Objective) Non-Monetary Needs: Boats
Indicators of Success: Results will enable the drafting of detailed guidelines for site selection, installation, use, and maintenance of day-use moorings within one year of initiation.	

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Well-managed day-use moorings are considered to be an invaluable tool for protecting reef ecosystems without imposing debilitating restrictions on tour operators. Over the past 10 years approximately 150 legal day-use moorings have been installed statewide, but the permit process, constraints on funding, and the fact that is effort has been lead mainly by volunteers from the marine tourism industry has made installation of moorings at popular sites a slow process. Tour operators continually call for the installation of more moorings and often illegally install them on their own, unwilling to endure the lengthy installation permitting process. Guidelines for installation methods already exist, but there are no guidelines regarding the placement of moorings in relation to each other and to the reef, nor have limits been established concerning the number of moorings allowed in one site or the number of passengers, or size of boat, allowed on each mooring. Placing moorings too close to sensitive reef areas, too close together, or allowing too many or too large of boats to use them can cause several indirect impacts, such as breakage by boats and people and water quality degradation from the resulting concentration of human waste, sunscreen, and boat bottom paint. Malama Kai is a non-profit organization that raises money and recruits volunteers to install and maintain legal moorings. They also work to improve the use of moorings by publishing guidelines in pamphlets and, eventually, on a website also. The website has not yet been constructed but will include a plethora of information as

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well as maps displaying the locations of existing and proposed moorings. Malama Kai has offered to pioneer this project as part of the mooring improvement project, described in the “management objective” category of projects, along with their ongoing activities.

4.2.2. Cruise Ship Impact Assessment

Proposed Action: Assess reef-related shore excursion patterns, intensity of use at various sites, and identify impacts by existing cruise ship passengers.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: (Norwegian Cruise Lines, Harbor Authorities, University of Hawaii School of Travel Industry Management, DAR)
Duration: 6 months (TBD)	Estimated Cost: \$5,000 Non-Monetary Needs: access to NCL concession policies/plans, access on board ships to interview passengers
Indicators of Success: Study completion after one year with results showing a clear pattern of cruise ship passenger activities and potential impacts. Over the long term, results will enable policy recommendations for regulating the cruise ship industry in Hawaii, establishing zoning and capacity limits at these targeted sites.	

The cruise ship industry is playing a larger and larger role in Hawaii’s tourism industry. From 2001 to 2003, before there were any U.S. flagged ships home-ported in Hawaii, the number of cruise passengers in Hawaii more than tripled, while the number of cruises around the islands grew by 166% (DBEDT 2003). In 2004 one U.S. flagged ship was home-ported in Hawaii and cruise ship passengers rose 4.5 percent from 2003. In 2005, one more ship was added and from August 2004 to August 2005 the number of visitors flying to Hawaii to board a cruise ship increased 36.5% (DBEDT News Release, September 26, 2005). There are plans to add one more in 2005. A significant increase in cruise ship tourism could cause a major shift in tourism activities toward large scale, large capacity operations, leading to much greater concentrations of users at certain places and times, which poses a serious threat to those reefs targeted by cruise ship shore excursions. It is imperative that these targeted sites are identified and current impacts from cruise ship passengers are well known in order to implement proactive management before the additional ships cause irrevocable damage. Fortunately, the largest player in Hawaii’s cruise tourism industry, Norwegian Cruiselines, is anxious to improve the cruise tourism image in Hawaii and is willing to facilitate this project by granting access to ship documents and shore excursion information. Depending on the results of this study, some management actions to consider include setting capacity limits at targeted sites, constructing infrastructure to strengthen the site to accommodate user increases, and implementing on-site or on-board educational programs to discourage cruiseship passengers from engaging in damaging behavior while at those sites. Funding for these actions could be gained by implementing a tax, similar to the 7.25% Transient Accommodations Tax that all Hawaii’s hotels pay, which would be designated for a special ocean resource protection fund. The results from this study could also be used for one component of the project to develop a tool to set carrying capacities in coral reef recreation sites, described in the management project section below.

4.2.3. Artificial Reef Impact Assessment

Proposed Action: Assess impacts from various installation methods, placement of artificial reefs in proximity to natural reefs and each other, and materials used on species distribution, water quality, and health of nearby reefs before and after installation.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: (University of Hawaii, HIRSA, DAR)
Duration: 1 year (TBD)	Estimated Cost: \$30,000 Non-Monetary Needs: laboratory equipment, artificial reef materials, donated artificial reef and installation for experimental purposes.
Indicators of Success: Results will enable policy recommendations for regulating the site selection, materials used, installation methods and use of artificial reefs in Hawaii.	

The artificial reefs and shipwrecks off Waianae and Waikiki are some of the most popular dive sites on Oahu. Plans are in the final stages of preparation for the sinking of a wreck off Lahaina, Maui. There is a high demand among dive operators to create more of these sites statewide. Artificial reefs are commonly used to disperse recreational use away from natural reefs, but it is possible that they may also cause species to move from a natural reef to the artificial reef, leaving a void in the ecosystem balance of that reef and resulting in degraded health of the natural ecosystems. It is also possible that certain materials used for artificial reefs may degrade the surrounding water quality and certain installation methods may cause direct damage to the reef. These impacts need to be better understood before guidelines and other artificial reef management projects can proceed. (See Artificial Reefs Regulations under Objective 2: Management)

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4.2.4. Kayak Impact Assessment

Proposed Action: Assess impacts of kayakers from human trampling, existing portage methods and scrapings, as well as proposed alternatives.	
Status: Un-Funded Potential Funding Sources:	Lead Organization: DLNR Potential Partners: University of Hawaii, Kayak Rental Operators
Duration:	Estimated Cost: Non-Monetary Needs:
Indicators of Success: Type and significance of kayaker impacts will be clearer after one year. Over the long term, results will enable recommendations for regulating kayak users and implementing portage etiquette and infrastructure in high use sites.	

Ocean Kayaking has become an extremely popular activity for both residents and tourists in the last 10 years. Most people who engage in kayaking in Hawaii do so independently, without a guide. With the improvements in kayak technology, kayaking has become more and more accessible to inexperienced ocean users. Kayaking provides users access to previously inaccessible islands and coves with little management in place to mitigate impacts. Most kayakers attempt to land or secure their boats on these remote coastlines to rest, explore on land, or snorkel. In areas with concentrated kayak use and portage, such as Kealahou Bay, remnants of plastic kayak underbellies are scraped off and left on the rocks and end up drifting around the bay. The impacts of these scrapings are unknown. Reef trampling is also a concern where kayak portaging occurs. Alternatives to portaging have been

developed, such as kayak moorings, floating docks, etc. However, the benefits of these alternatives are also unknown. In addition to portaging, the increasing numbers of kayakers in certain areas may be impacting the water quality from increased concentrations of sunscreen or human waste. A better understanding of all the above impacts will not only enable managers to identify the infrastructure and rules needed to increase the sustainability of kayaking, but if we can quantify the impact significance of each additional kayaker per unit area, the results of this study can be used in the project to develop a tool for setting recreational carrying capacities, described below in the section on management projects.

4.2.5. Underwater Recreation Impact Assessment

Proposed Action: Assess impacts of introductory divers using breathing technology, including SCUBA, SNUBA, and seawalkers.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: (HIRSA, DAR, University of Hawaii, Dive & SNUBA operators, Reef Check)
Duration: 1 year (TBD)	Estimated Cost: \$20,000 Non-Monetary Needs: donated diving equipment and/or free participation in diving tours for observation purposes.
Indicators of Success: Study completed less than one year after initiation and results will confirm or negate the need for zoning of various levels of diving expertise and SNUBA.	

As mentioned in previous chapters, divers tend to have more impact on the reef than snorkelers, and less experienced divers tend to cause more damage than experienced divers. This is due to a lack of buoyancy control and an increased sense of insecurity or panic leading these divers to act on self-preservation instincts without consideration for the preservation of the reef. With the introduction of new technologies such as SNUBA, sea walkers and other types of tethered air apparatus, the impacts have become greater since these activities are available to less experienced ocean users with little training in the use of such equipment and often undertaken while walking across the bottom. Currently, there are no zoning regulations in place to limit the damage caused by these inexperienced divers. Research must be conducted to assess the most appropriate areas, numbers and skill requirements for these activities.

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4.2.6. Jet Ski Impact Assessment

Proposed Action: Assess impacts of noise, water pressure, fuel and grounding frequency.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: (DOBOR, DAR, University of Hawaii, commercial & non-commercial Jet Ski operators, Reef Check, lifeguards)
Duration: 1 year (TBD)	Estimated Cost: \$30,000 Non-Monetary Needs: donated jet ski for experimental purposes, free participation in jet ski tours for observation purposes.
Indicators of Success: Study completed less than one year after initiation and results will confirm or negate the need for zoning of jet skis	

There is some concern that the loud noise of jet skis, the increased water weight and turbulence along common jet ski paths, water pollution and coral breakage from groundings could be causing considerable damage to Hawaii's coral reefs, but research has not been done to confirm these concerns so it is unknown what, if any, further management techniques need to be implemented.

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4.3. MANAGEMENT OBJECTIVE:

To implement management tools, such as regulations and infrastructure, to support a reef's carrying capacity or control user behavior at various sites.

This objective employs management tools such as regulations, enforcement, or infrastructure to manipulate user concentrations or facilitate sustainable behavior and prevent damaging behavior. Priority actions outlined within this objective target user groups and activities with greatest potential for impact and measurable improvement.

4.3.1. Mooring Improvements

Proposed Action: Develop guidelines and/or regulations for buoy zoning and capacity limits, installation, site selection and use of moorings, streamline the installation permitting process, and support the development of a website including maps of existing and proposed moorings and publication of the above guidelines & regulations.	
Status: Partially-Funded (funding listed below is total to be shared among this project and the Mooring Improvements project) Funding Sources: DAR, through NOAA Coral Reef Management Grant (\$30,000); Potential Funding Sources: US Fish & Wildlife Service (\$10,000); In-kind support from Tour Boat Operators, for labor & boats	Lead Organization: Malama Kai Foundation Potential Partners: DLNR-DAR, US Fish & Wildlife Service, Big Island & Maui Reef Fund, community groups.
Duration: 1 year (2006)	Estimated Cost: \$50,000 Non-Monetary Needs: Labor, Boats, Printing, GIS/Web expertise
Indicators of Success: An increased amount of legal and ecologically sustainable moorings will be available for boaters within 3 years, while limiting concentrations of boats and passengers at any one site at one time. Monitoring will also report decreased incidences of anchoring in sensitive areas. A survey of boaters will show an increased number who are aware of the existence of moorings in the areas they use and who understand how to properly use the moorings. Products will include guidelines for site selection, installation and use of moorings, a website to disseminate information on these guidelines and inform potential users on available moorings and plans. Also regulations on zoning specific buoys for various boat sizes and passenger capacities will be implemented where needed.	

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Day-use moorings are a valuable management tool for preventing the damaging practice of anchoring on reefs and have been implemented widely in Hawaii. Tour operators appreciate the convenience and resource sensitivity of the moorings and continuously request that more be installed, and some install their own moorings illegally because the current installation permitting process is too cumbersome. Installing and maintaining moorings is very costly so employing the help of mooring users (tour operators), and allowing them to install and maintain moorings themselves could be a big help to

government resource managers. However, mechanisms need to be in place to ensure that they will be installed properly and used sustainably. Thus guidelines for site selection and installation must be developed and incorporated into a streamlined permitting process. In addition, regulations on zoning the moorings for various boat sizes and site carrying capacities need to be developed.

A successful model to follow has been developed by the Great Barrier Reef Marine Park Authority. They use surface buoys that are color-coded to indicate the vessel class permitted to use that mooring. The classes range from “T”, meaning “tender only” with a maximum vessel length of 6m and maximum wind speed of 24 knots, to “D” class which can accommodate mono-hull vessels up to 35m long or multi-hull vessels up to 30m long and wind speeds up to 34 knots. The color-coding is visible on the buoy itself as well as the mooring tag attached to the pick-up line (Public Moorings and anchoring: protecting coral in the northern Great Barrier Reef 2002). This system, not only ensures equitable access to moorings, but it also facilitates enforcing carrying capacity limits for various areas. It has also been suggested that mooring use permits include additional requirements, such as using only bungee or scoped lines and user reports of passenger numbers and maintenance needs. This information must also be disseminated efficiently to potential installers and users and volunteers, for which a website would be ideal. Malama Kai has already done much work to improve the use of mooring buoys in Hawaii, including developing guidelines and working on funding and design development for a website including the guidelines, procedures, and GIS maps of existing and proposed moorings.

4.3.2. Carrying Capacity Tool

Proposed Action: Hire consultant to spend one year developing a tool to set carrying capacity at pilot sites, identified as high priority by steering committee, then spend a second year applying this tool to set carrying capacities at sites statewide. A working group from various government agencies and marine resource managers will also convene to discuss and determine management solutions to limit use once the carrying capacity at the pilot sites has been identified.	
Status: Un-Funded Potential Funding Sources: DAR, through the NOAA Coral Reef Management Grant (\$70,000) Hawaii State funds (\$10,000)	Lead Organization: UH & RIR-LAS Committee Potential Partners: (DOBOR, DAR, Hanauma Bay Managers, marine tourism industry members, Hawaii Ecotourism Association, Reef Check)
Duration: 2 years (2006 & 2007)	Estimated Cost: \$55000 per year for consultant salary & expenses \$5,000 for working group travel TBD for additional research required Non-Monetary Needs: TBD
Indicators of Success: Optimal level of use is identified within 2 years and regulations and/or infrastructure to limit use are in place within 4 years. The products would include a tool for determining optimal carrying capacity of various users at various sites and associated management actions based on the use of this tool. Management actions may include limits on commercial permits available or other permits restrictions, such as limiting the passenger capacity or frequency of use. Commercial use may also be restricted through boat capacity zoning of moorings. Other actions could include limits on independent recreationists through regulated parking or entry to the site. This project seeks to not only develop the tool for identifying carrying capacity at a site, but also identifying and implementing the best strategy for adhering to that limit.	

Over the last 30 years, the rapid growth of tourism and infrastructure development has severely impacted coastal areas and coral reefs throughout Hawaii (Clark and Gulko, 1998). Coastal ecosystems are facing pressure from daily visitor traffic and some of Hawaii's popular coral reef sites receive as many as 1,000 - 2,000 snorkelers and divers per day. Use at other sites varies widely according to the seasonal wave activity, such as Honolua Bay, which receives an annual average of 250 tourists per day, but up to 700 per day during peak season (Brown, 1999).

One approach for minimizing human impact on natural resources is to set limits on numbers of users by determining the site's ecological carrying capacity. While studies have been undertaken globally to attempt to set standards and develop a sound methodology to set carrying capacity limits, thresholds are very difficult to calculate, and progress to date has been slow. In addition, the conditions from one site to another may vary widely so that implementation at one site is not necessarily applicable at another, as previously mentioned in Chapter 2. This project seeks to define a methodology that takes into account the various recreational activities and the unique physical conditions at a particular reef site, providing a sound scientific basis for proactive management, and allowing managers to identify optimal levels of use and set limits for various sites before projected increases in use occur or even retroactively to scale back use in sites already exceeding thresholds. This study will build upon several previous impact studies, but may also require additional work to address the gaps in impact data, such as impacts from kayakers and various other 'newer' forms of ocean recreation technology.

While this project does indeed attempt to solve a large and long-standing issue, there is one model that we may be able to work from, and thus increase this project's potential for success. The "MPA Report Guide" was recently developed by the Coastal Conservation and Education Foundation, Inc for reefs located in the Philippines (Marine Protected Coast, Reef and Management Database - MPA Report Guide 2005). This guide is a 20-page form that managers and the average reef user can fill out annually to assess a particular site and rate them against other sites as far as its ecological health and non-environmental benefits derived from the site. The form includes checklists and open-ended questions regarding the physical features of the site, a rating sheet regarding the management of the site and scoring levels according to the number of boxes checked, and finally a user perception survey. Once these forms were adapted to the specific organisms, users, and management found in Hawaii, the only step remaining would be to combine and calculate the results of each section to produce an overall use level and management recommendation.

It has been suggested that the above-adapted model be tested for applicability at a number of sites, exhibiting the spectrum of natural and human features typically found among Hawaii's reef recreation sites. Some sites to consider for these case studies include Kealakekua Bay on the Big Island of Hawaii, Honolua Bay on Maui, and Pupukea on Oahu. All three are sites where conservation efforts have been recently mobilized among managers, the community and the tourism industry and a variety of work that should both facilitate the progress of this project and increase the need for a project like this, is underway at all these sites. Among these three sites most of the various types of recreational use and physical features likely to affect the relative impact of human use are exhibited, though a few other sites should still be included to complete the spectrum.

4.3.3. Conservation Finance Team

Proposed Action: Hire a team of people with expertise in fundraising, marketing, and product development to work with the various segments of the tourism industry to implement innovative and effective ways to reach various reef users and garner funds to implement conservation projects.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: (Community Conservation Network, Hawaii Tourism Authority, Hawaii Visitors and Conventions Bureau, University of Hawaii, Hawaii Public Television, Hawaii Small Business Association)
Duration: Indefinite, depending on results after one year	Estimated Cost: \$75,000 for salary and travel expenses per team member per year Non-Monetary Needs: office space and equipment
Indicators of Success: Within 5 years, Increased amount of new initiatives, increased capacity of on-going efforts, and monitoring results and demonstrate effectiveness of initiatives developed by team.	

In order to ensure that management and outreach efforts are effective, those designing them need to have marketing and interpretive expertise and in order to pay for these efforts we need people with fundraising and PR expertise. By establishing a team of focused on finding creative ways to promote reef sustainability and pay for the management thereof, all of the actions recommended in this strategy will have greater potential for success. One example of a funding initiative spearheaded by this team might include lobbying to establish the cruise ship transient accommodations tax and special fund for ocean resource protection mentioned above.

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4.3.4. Artificial Reef Regulations

Proposed Action: Develop guidelines or regulations for the appropriate use of materials, installation methods and distribution of artificial reefs; as well as state permitting process for installation.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: University of Hawaii, DAR, HIRSA
Duration: 1 year (TBD)	Estimated Cost: Non-Monetary Needs:
Indicators of Success: Within 1 year, produce a set of guidelines or regulations for proper placement and installation of artificial reefs. Artificial reef materials and installation methods will be standardized to prevent negative impacts.	

Construction of artificial reefs is a popular method of moving recreational activity away from fragile reef ecosystems while creating valuable diving experiences for users. However, the negative impacts of building these structures, especially the potential fish displacement effect, is largely unknown and needs to be better understood in order to ensure the sustainable use of artificial reefs in the future (see Artificial Reefs project under Data Objective). Once these impacts are known, guidelines or regulations must be established in order to ensure that this knowledge is implemented.

4.3.5. Kayak Logistics

Proposed Action: Implement alternatives to, and regulations regarding, kayak portage at priority sites	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: DLNR Potential Partners: DAR, community residents, Kayak Rental Operators, Boat Tour Operators, University of Hawaii
Duration: 1 year (TBD)	Estimated Cost: TBD Non-Monetary Needs: TBD
Indicators of Success: Monitoring of kayak impacts once the management action has been implemented should show that kayakers are concentrated in low impact areas, and damage to substrate is reduced.	

Ocean Kayaking has become an extremely popular activity for both residents and tourists in recent years. In 2004 at Ahihi-Kinau, a popular snorkeling site and conservation district on Maui, the concentration of kayakers and concern over their impacts became such a heated issue that kayaking was entirely banned from the area and rangers were installed to enforce the ban. One place currently exhibiting an especially high concentration of kayakers is Kealahou Bay, on the Big Island of Hawaii. Often there are over 20 kayakers perched on rocks near the Captain Cook Monument on the remote end of the bay, where people leave them in order to go snorkeling in the pristine waters nearby. It is evident that better management is needed and once the research results are available (see the Kayak project under the Data objective), the specific type of management needed will be clearer. Management strategies currently being discussed include portage alternatives, restroom facilities, rangers and/or docents on land and boat, parking improvements, entry/exit point infrastructure, and zoning restrictions.

4.3.6. Fish Feeding Regulations

Proposed Action: Expand restrictions on fish feeding to more locations and develop mechanism for enforcement.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: DLNR, DAR, HIRSA, HTA, Hawaii Hotel Association
Duration: 1 year (TBD)	Estimated Cost: TBD Non-Monetary Needs: TBD
Indicators of Success: Monitoring after 3 months of project completion reports less people engaging in fish feeding at targeted sites and over time natural fish diversity and behavior returns and water nutrient levels are healthier.	

As noted in the previous section on marine recreation impacts, fish feeding can have many negative impacts on reef communities, yet it is still widely practiced throughout the Hawaiian Islands and especially on Kauai. Outside of select Marine Protected Areas and Fishery Management Areas, there are no regulations against fish feeding. In some areas, it is discouraged, but in others it is encouraged by guides on commercial tours and through the availability of fish food for purchase at hotels, gear shops, and convenient stores. Regulations and effective enforcement mechanisms must be established and funded.

4.4. OUTREACH OBJECTIVE:

To increase awareness and engage stakeholders in reef education, monitoring and stewardship efforts.

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The Outreach objective focuses on influencing reef user behavior through education and engagement. Priority actions outlined within this objective target user groups (both guided and un-guided), activities and dissemination channels with greatest potential for impact and measurable improvement.

4.4.1. Tour Operator Stewardship Programs

Developing a Tour Operator Stewardship Program is necessary to increase ocean-based tour operators' level of resource stewardship. Resource managers continually struggle with a lack of available resources and tools to effectively reach all reef recreationists and ensure appropriate behavior. Since tour operators are responsible for many of the people that recreate on our reefs, these operators should be encouraged to provide assistance to the resource managers through effective interpretation, monitoring and management. Historically, Hawaii's ocean tourism industry has been fairly responsive to the need to provide clientele with a quality experience that is both environmentally sound and sustainable. As mentioned in the introduction, there are over 1,000 ocean tourism operators offering a variety of tourism experiences to both visitors and residents who travel throughout the Hawaiian Islands. However, there are very few affordable and accessible sources of quality information, such as coral reef facts, conservation issues, and best practices. In addition, operators have found it somewhat cost prohibitive to implement many of the sustainable practices they would like to incorporate into their businesses, due in part to the high costs of living and doing business in Hawaii, limited accessibility to sustainable goods and services, and an absence of the demand from the traveling public required to result in an adequate return on investment.

The RIR-LAS steering committee outlined a number of different programs to overcome these different stewardship obstacles, including: 1) stakeholder development and promotion of a Voluntary Code of Conduct for the marine tourism industry; 2) the implementation of standardized, on-going, and affordable interpretive training for guides; 3) the development and dissemination of a tourism industry e-newsletter; 4) the development of an eco-certification or eco-labeling program to provide mechanisms for verifying operators' commitment to standards expanded from the code of conduct; and 5) and developing a website to incorporate the above information, assistance, and incentives.

As a result of on-going discussions with several Maui reef conservation organizations and the RIR-LAS coordinators, the Coral Reef Alliance (CORAL) has developed a multi-faceted pilot program on Maui and incorporates several of the RIR-LAS Tour Operator Stewardship Programs listed above, as well as one other RIR-LAS project listed below as "Point of Rental Education". By collaborating with CORAL, these actions will capitalize on the existing momentum ignited during an informal educator's project they conducted jointly in 2005 with Maui's reef conservationists and marine recreation providers. Starting with the stakeholder driven Voluntary Code of Conduct should create a sense of ownership of the CORAL project among the marine tourism industry, garnering support for the other parts of the project and resulting in strong and lasting partnerships for reef conservation. The tour operator training program will then create a consortium of informal environmental educators. Finally, the e-newsletter will serve to continually build on the resources available to these informal educators, keep them abreast of new developments in reef conservation, and reinforce their sense of community. Due to CORAL's international expertise and institutional capacity for implementing management projects like these, it is in Hawaii's best interests to partner with them and launch this aspect of the RIR-LAS as a pilot project, which can be expanded to other islands at a later time. Thus, CORAL has been identified as the lead organization for the first three programs mentioned above, for immediate

action and priority as additional funding becomes available. The last two programs listed above will build upon the programs initiated by CORAL, but will require considerably more time to develop, and thus preliminary work should be identified and initiated as soon as possible.

4.4.1.A. CORAL Projects

<p>Proposed Actions: Partner with the Coral Reef Alliance to coordinate stakeholder development of a Voluntary Code of Conduct for the marine tourism industry, create a <i>Coral Reef Leadership Network</i> of educational trainings to ultimately target the tourists recreating within Hawaii’s reefs, and develop an e-newsletter to distribute to members of this network as a regular reminder of the importance of sustainable practices and a resource to increase the industry’s capacity to effectively and accurately educate their clientele.</p>	
<p>Status: Partially-Funded Potential Funding Sources: NOAA (Potential \$20,000) Coral Reef Alliance (Potential through NOAA \$54,992 with matching funds from Tiffany Foundation & Packard Foundation) Hawaii Tourism Authority (Potential \$14,000 for Voluntary Code of Conduct only) In-kind support equivalent to \$70,000 from Underwriters Laboratories Inc. (UL) for use of their online standards development software.</p>	<p>Lead Organization: Coral Reef Alliance Potential Partners: RIR-LAS Steering Committee, DAR, Hawaii Wildlife Fund, Project S.E.A.-Link, the Coral Reef Alliance, Hawaii Ecotourism Association, and UH Sea Grant, Maui Community College Marine Option Program, American Reef Coalition, Hawaiian Islands Humpback Whale National Marine Sanctuary, Pacific Whale Foundation, Maui Ocean Center, Ed Robinson's Diving Adventures, Extended Horizons, Maui Dreams Dive Company, Octopus Reef, Trilogy Excursions, Lahaina Divers, Kai Kanani, Prince Kuhio, Mike Severns Diving, Pacific Dive, Kapalua Dive Company, Maui Dive Shop, Wild Dolphin Foundation/Wildside Specialty Tours)</p>
<p>Duration: 1 Year (2006)</p>	<p>Estimated Cost: \$110,000 for initial project, plus another \$30,000 per year to support on-going tour operator training. Non-Monetary Needs: Printing supplies/services & Meeting Facilities</p>
<p>Indicators of Success: By the end of 2006 50% adoption of voluntary Code of Conduct by Maui marine recreation operations At least 8 CORAL Reef Leaders trained; At least 100 CORAL Reef Associates trained</p>	

A.1. Voluntary Code of Conduct: CORAL will engage representative groups of reef tourism stakeholders in a consensus process to develop best practices and a Voluntary Code of Conduct for marine recreation providers in Maui. These best practices will define performance-based objectives and specific practices for operations catering to the consumer of coral reef tourist activities. Upon project completion, the Voluntary Code of Conduct will be translated into a self-assessment checklist and practical guide to sustainable practice for marine recreation operators in Hawaii. Funding will also be sought to print a voluntary contract, proclaiming operator commitment to the code, and produce posters and/or staff badges, t-shirts, etc., illustrating the code for distribution among those who sign the contract. Participating operators would then be required to display these materials in places where their clients are likely to

notice them, as a testament to the business's commitment to that code and informal mechanism of holding participants accountable to the code.

A.2. Interpretive Training for the Marine Tourism Industry: CORAL will work with Maui community conservation leaders to lead a five-day intensive training to provide a small group of local educators with the knowledge and skills to effectively convey educational curriculum about reef conservation to marine recreation providers. These leaders will then provide seminars and hands-on workshops to tour operators and guides on an on-going basis. Hawaii may also want to consider revising the tour operator permit process to require that the applicant provide this training to their staff on a regular basis. Reef Resource Guides, certificates, t-shirts and other educational resources and promotional materials will be provided to training participants.

A.3. Tourism Industry E-Newsletter: Through additional funding sources identified by DAR, CORAL will collaboratively develop, test, and produce an electronic newsletter that will include information on regulations, sustainable guidelines, facts about Hawaii's marine resources, and related events to facilitate communications, and strengthen the sense of community among reef users and managers. The content of this e-newsletter may be modeled after the successful newsletter published for the tourism industry operating in the Great Barrier Reef, Australia. See Appendix V or go to: www.epa.qld.gov.au/publications/p00820ac.pdf for a sample of the Great Barrier Reef newsletter.

4.4.1.B. Subsequent Projects

Proposed Actions: Expand, or incorporate, the Voluntary Code of Conduct into a statewide eco-labeling program, including a set of quantifiable minimum standards to which any operator must meet in order to obtain a permit to operate in Marine Protected Areas, as well as advanced criteria employed for voluntary rating beyond the minimum passing level, granting increasing promotional benefits and privileges depending on the rating level awarded to participants. Then revise the permitting system to incorporate these programs as incentives for higher permit priority or longer permit terms, and publish all of this information on a marine tourism handbook website.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: TBD Potential Partners: DLNR, DAR, HEA, HIRSA, Native Hawaiian Hospitality Association, various marine conservation organizations and tour operators
Duration: 2 Years (2007 & 2008)	Estimated Cost: Eco-Certification Program: \$50,000 for start-up & \$20,000/year to subsidize participation by operators with less financial resources; Website: \$10,000 Non-Monetary Needs: TBD
Indicators of Success: By the end of 2008 - Establishment of regional pilot eco-rating program with participation from majority of operators associated with region, monitoring results show high level of satisfaction from operator participants, improved interpretive and stewardship efforts from participants, as well as decreased impact from participants' clients. Permits have been revised, website launched and monitoring reports high level of hits on website and high level of awareness of the site by operators.	

B.1. Eco-labeling & Certification Program: Based on the Voluntary Code of Conduct, a detailed list of standards and best practices can be developed and incorporated into a comprehensive eco-rating program for marine tour operators in Hawaii. Such a program would provide both a tool for evaluating the positive and negative environmental and social impacts of operators, as well as incentives for the industry members to continually enhance the environmental and social benefits provided by their operations. The list of rating criteria would provide the evaluation tool by designating different levels of specific best practices and incorporating them into a checklist that can be used to evaluate a company’s net positive or negative impact on Hawaii’s resources, as well as their degree of excellence in each of the following areas: environmental conservation, cultural appreciation, community benefits, and educational experience. *(See Appendix VI for a sample of the checklist used in Costa Rica’s Certification for Sustainable Tourism program)* The program would also provide an incentive for operators to strive for improved sustainability and educational quality through a suite of promotional and educational rewards granted to participants, depending on the rating received.

B.2. Hawaii Marine Tourism Website: A website should be developed to raise awareness for all these opportunities, requirements, and resources for sustainable marine tourism. The RIR-LAS proposes that the website be modeled after the “Onboard” site developed by the Great Barrier Reef Marine Park Authority. This website has been developed as an on-line handbook for tour operators within the Park (see: <http://www.tourismoperators.reefhq.com.au/>). This site will increase the transparency of the permitting process, increase operator awareness of reef conservation issues, and share the resources available to increase operator sustainability.

4.4.2. Community Stewardship Programs

Proposed Action: Statewide program to assist interested communities to develop on-site reef stewardship programs, including volunteer training and infrastructure to maximize effectiveness – i.e. manage user flow toward edu-kiosk or interpretive program, less sensitive entry and exit points, and fee collection points.	
Status: Un-Funded Potential Funding Sources: Hawaii Tourism Authority Product Development Grant	Lead Organization: Community Conservation Network Potential Partners: DLNR/DAR, Hawaii Wildlife Fund, The Nature Conservancy of Hawaii, Malama Hawaii, University of Hawaii
Duration: 6 months to launch first site and hire statewide coordinator (2006); 1 year for implementation each additional site	Estimated Cost: \$50,000 per year for statewide coordinator + \$50,000 per site Non-Monetary Needs: meeting facilities for training workshops
Indicators of Success: Establishment of statewide program coordinator; test of program design/plan via establishment of community stewardship programs at 2 new sites by 2008, each of which includes: a site coordinator, community volunteer corps, edu-kiosk, user-fee collection point, completion of volunteer training series & evidence of program functionality (full volunteer schedule, #s of interpretive contact made per day etc). Monitoring reports showing improved interaction with resource after participating in program (follow users that experienced outreach from the program vs. users that did not, showing less negative behaviors in users who received outreach).	

Among some members of reef destination communities, there is currently a lack of interest or personal connection to their reef resource, some negative sentiment towards recreational users in their communities, and a lack of community stewardship of local resources. Additionally, many resource managers lack appropriate resources to effectively monitor activities & behaviors at reef sites with existing funding/staff. Many of these reefs suffer from high use, trampling, litter, pollution, and users who are unaware or uninterested in learning more about the reef ecosystem. By establishing community stewardship programs at these sites, community members will become more empowered and engaged in the preservation of the resource, providing valuable assistance to resource managers and serving as ambassadors of goodwill for the reef tourism industry.

The Department of Land and Natural Resources (DLNR), The Nature Conservancy of Hawaii (TNCH), the Community Conservation Network (CCN), and the Hawaii Wildlife Fund (HWF) are already collaborating to create a statewide Makai Watch Program, thus, any resources garnered due to this section of the Local Action Strategy would go towards supporting the nascent Makai Watch Program. The program will be designed to involve the public in the oversight and management of important marine areas in the following areas: 1) Education and Outreach, 2) Surveillance and Enforcement, and 3) Biological and Human Use Monitoring.

There are currently two communities on the Big Island that have active Makai Watch Programs: 1) Miloli'i in South Kona, and 2) Wai Opae in Kapoho on the East Side of the island. Both programs are approximately one year old, have trained community members working on Makai Watch, have raised a combination of public and private funds to run their programs, and are coordinating with DLNR and at least one private NGO. An important lesson learned from working with these two communities is that it takes a significant investment of time and resources from community members and their NGO partners to establish an effective Makai Watch program. *The greatest challenge and limiting factor in taking this program statewide will be the capacity of the NGOs and DLNR to provide follow up for each of the interested communities.* To address this issue, we need to allocate significant person-hours for oversight, coordination, and follow-up at the statewide level. Priority for technical assistance will focus primarily on those communities with near shore marine resources of statewide significance. For other interested communities, group training opportunities and a "how to" manual for them to start their own programs will be provided. To be effective, each community will, however, require training from and a direct link to DOCARE to ensure that violators will be cited and prosecuted.

4.4.3. Point of Entry Education

Proposed Action: Establish a working group to design an educational medium regarding reef etiquette and work with the transportation industry and coastal land managers to distribute and post at points of entry, such as airports and inter-island flights, cruise ships, and the coastal access areas to reefs.	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: Hawaii Living Reef Program Potential Partners: DLNR/DAR, Norwegian Cruise Lines, Airport Authorities, local airlines, Hanalei Watershed Hui; watershed
Duration: 1 year (TBD)	Estimated Cost: TBD Non-Monetary Needs: TBD
Indicators of Success: The message produced by the working group is strategically placed in all of Hawaii's international airports, all cruise ships, and at priority sites within 1.5 years. Interviews with reef recreationists at those priority sites demonstrate that most are familiar with the message, with a significant amount of respondents also reporting that they changed their behavior as a result of experiencing that message.	

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In order to ensure that unguided reef recreationists are not only seeing and hearing appropriate messages about proper reef behavior, but also that the message is re-enforced at critical times and places, such as when they arrive in the islands and right before entering the water, point of entry education programs need to be developed. For the most part, these messages will be designed on static displays at key entry points such as harbors, beach access points, in the airports, and at other locations where visitor traffic is heavy.

Deleted: which requires sending the message through multiple channels and reaching them as soon as they arrive in the islands as well as right before entering the water, and maybe then the awareness will actually influence their behavior.

4.4.4. Point of Rental Education

Proposed Action: Partner with CORAL and/or local conservation organizations to garner support from distribution outlets to provide training to, and develop a useful and attractive product to be distributed through, rental car companies and/or gear rental shops, which list reef recreation guidelines.	
Status: Un-Funded Potential Funding Sources: CORAL (Potential \$4213, including \$2107 from NOAA & \$2107 in matching funds)	Lead Organization: DAR Potential Partners: Coral Reef Alliance Car Rental Companies, Gear Rental Shops; Hanalei Watershed Hui; watershed councils & marine resource managers from each island
Duration: 1 year (2006-7)	Estimated Cost: \$10,000 for salaries and local expertise in development, then \$10,000 per year for reproduction and distribution of materials. Non-Monetary Needs: local connections and relationships with rental agencies for obtain support and participation.
Indicators of Success: At least 50% of Maui marine recreation gear and car rental operations providing Point of Rental environmental briefings and/or guidelines by the end of 2007. Approximately 543,000 tourists impacted each year by Point of Rental (gear and automobile) environmental briefings and guidelines, by the end of 2007.	

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Multiple channels must be utilized in order to ensure that unguided reef recreationists are not only seeing and hearing appropriate messages about proper reef behavior, but also that the message is re-enforced at critical times and places. Thus, placing this message on or with a collector's item or product that the unguided reef recreationists are likely to look at or use many times, may bridge the gap between awareness and action. [This project seeks to find key points to display messages at sites where visitors are renting gear or cars.](#) As this project has also been embraced by the CORAL Maui pilot project, described above in the section entitled, "Tour Operator Stewardship Programs," the RIR-LAS proposes that local entities collaborate with CORAL to ensure a product that will be appropriate and successful in Hawaii.

4.4.5. Audiovisual Productions

Proposed Action: Work with Lack of Public Awareness LAS/Living Reef Program to establish a working group to design a series of commercial-length PSAs or lengthier video encouraging sustainable reef etiquette, determine most effective distribution outlets and garner support from distribution outlets to broadcast the production.	
Significance:	
Status: Un-Funded Potential Funding Sources: TBD	Lead Organization: Hawaii Living Reef Program Potential Partners: (DLNR/DAR, Hawaii Tourism Authority, Hawaiian Airlines, Aloha Airlines, Local TV Stations, Hawaii Student Film Festival, Olelo)
Duration: 1 year (TBD)	Estimated Cost: \$100,000 Non-Monetary Needs: TBD
Indicators of Success: Design is pre-tested, within 6 months, on sample target audience with positive results and monitoring after launch shows increased awareness of reef conservation issues and appropriate behavior among those target audiences within 6 months of launch. Intercept interviews demonstrate that a significant number of reef recreationists had seen one of the commercials at least once before entering the water that day and a significant number reporting that they learned something new from the commercials.	

Mass media is one way that coral reef conservation messages can reach both residents and visitors repeatedly, ultimately leading to positive changes in reef behavior.. The Hawaii Living Reef Program has already developed one video to be aired on certain flights to Hawaii, but considering the short attention spans of most people and especially children, a series of short, commercial length PSAs could be very useful in both getting the message to people repeatedly on local TV, at the movie theaters, or on the visitor channels in hotels.

**CHAPTER 5
CONCLUSIONS**

5.1. PROJECT PRIORITIZATION

Projects included in this Local Action Strategy have been prioritized by urgency and potential to produce measurable improvement in user-reef interactions in the short term, in order to achieve a measurable improvement in reef ecosystem health over the long term (see Appendix III for the list of project selection criteria). The table below summarizes the RIR-LAS priorities and illustrates the type of action and intended target users of the proposed actions.

Table 5.1. RIR-LAS Priorities

Priority	Project Name	Type of Action								Target Audience			
		Data Collection		Management			Outreach			Guided Tourists / Tour Operators	Un-Guided Tourists & Residents	Cruise Ships/Passengers	Ocean Technology Users
		Impact Assessment	Use Patterns	Guideline Development	Infrastructure Construction	Regulations / Zoning	Guideline Publication & Dissemination	Educational Resource Development	Human/\$\$ Resource Recruitment				
High	RIR-LAS Coordinator	x	x	x	x	x	x	x	x	x	x	x	x
	Day-Use Moorings	x		x	x	x	x	x		x		x	x
	Carrying Capacity Tool	x		x		x		x		x	x	x	x
	Tour Operator Stewardship Program			x			x	x	x	x		x	x
	Community Stewardship Programs				x		x	x	x		x	x	
	Point of Entry & Rental Education				x		x	x	x		x	x	
	Conservation Finance Team						x	x	x	x	x	x	x
Medium	Cruise Ships/Passengers	x	x	x		x						x	
	Artificial Reefs	x		x		x	x	x		x	x		x
	Kayaking	x		x	x	x					x		x
	Audiovisual						x	x		x	x	x	x
Low	Fish Feeding	x		x		x	x			x	x	x	x
	Underwater Recreation	x		x		x	x						x
	Jet Skis	x		x		x	x						x

The top four projects listed as “High Priority” are those for which funding should be sought first and implementation should begin as soon as possible. Although hiring an RIR-LAS Coordinator is not directly associated with any of the three objectives, this action is of utmost priority as it is a prerequisite for ensuring that any of the other projects get done. In the above table, the Day-Use Mooring project refers to the combined Data and Management Mooring projects and has been listed as

high priority primarily due to the fact that there is already much momentum and funding opportunities for these activities. The Carrying Capacity Tool project is another action that would facilitate the success of several other projects and also has some interested parties to spearhead its development. The Tour Operator Stewardship Programs encompass a variety of actions that target an important user group, has a high level support and momentum from community, non-profit, and industry groups as well as solid financial support. The case is similar for the Community Stewardship Program project, as this project, or elements of it, have already been implemented at a few sites around Hawaii. The Point of Entry & Point of Rental Education projects have been combined as content of each will be somewhat similar and thus the potential funding available for the Point of Rental Education project could probably be used to jump-start both projects. Conservation Finance Team, like the Carrying Capacity Tool, is another project that could greatly increase the potential for success of many of the other projects, and thus is given higher priority. Projects in the “medium priority” category are projects seen as important, but not as urgent and with less potential impact to coral reef health than the high priority projects. Most of the medium priority projects have little project momentum already underway. Projects in the “low priority” category are still considered to be important threats to address, but given the much smaller proportion of recreationists who participate in jet skiing or underwater recreation, such as SNUBA or SCUBA, they have been assigned less priority.

A major priority of the RIR-LAS was to include a balanced mix of projects that would address a variety of significant users and threats. Thus, the RIR-LAS projects are focused on a variety of projects that together address:

- guided recreationists through commercial tour operators;
- un-guided recreationists through mass media and on-site education;
- the major issues relevant to each of the Hawaiian Islands;
- gaps in data;
- gaps in management;
- gaps in education and outreach; and
- impacts from activities that are currently experiencing rapid growth, or are projected to experience large increases in the near future, such as ocean kayaking, boat based tours and activities undertaken by cruise ship passengers.

5.2. ADDITIONAL RECOMMENDATIONS

Several of the projects outlined above would be augmented by, or even require, government or agency policy changes. The RIR-LAS would like to recommend the following policy changes:

- Review, simplify and standardize permits for recreational use of reefs:
 - Transfer authority to develop, manage, and make changes to ocean resource permits to the Division of Aquatic Resources.
 - Establish a permit system for use of moorings, which would include zoning regulations, requirements to use the color-coded surface buoys for all moorings, and use permit revenues for installation and maintenance of moorings.
 - Establish separate resource use permits for each commercial user group, such as commercial tour boats, kayak tours & rentals, SNUBA & SCUBA, jet ski operations, parasailing, sport fishing tours, and non-commercial reef users as well. At present all boaters must obtain the same permit to use the harbor facility, and revenues go toward maintenance of the facility. The RIR-LAS recommends that the harbor permit be replaced by a harbor user fee and a new type of permit system established with the focus on use of the natural resource, incorporating a variety of requirements for obtaining the permit depending on the type of user.

- Incorporate reef stewardship incentives into the permitting system, such as extended permits for those operators who have been through specific trainings or have been certified as an eco-sustainable business, or even requiring operators to complete certain trainings or prove awareness of the regulations that pertain to them and sites they wish to use in order to obtain or renew a permit.
- User fees & Taxes: establish a transient accommodations tax applicable to cruise ships and direct revenues into a special fund specifically for ocean resource protection.

For a comprehensive list of potential funding sources, see Appendix VII.

APPENDIX I: 2004 INTERVIEWS

	BIG ISLAND	MAUI	OAHU	KAUAI	
INTERVIEWEES	DOBOR (1), DAR (2), Industry (2), SeaGrant (1), Parks (1)	DOCARE (1), Industry (2), County Agency (1), NGO (5), DOFAW (1), DAR (2), Community (20)	State Parks (1), County (1), DAR (1), general DLNR (1), UH (1), DOFAW (1), NGO (1), Industry (1)	NGO (4)	
IMPACTS OF CONCERN	Anchor Damage	X	X	X	
	Trampling	X	X	X	
	Large Animal Disturbance	X			
	Fish Feeding		X	X	
	Other		Sunscreen	Grey water discharge; vessel groundings; spread of invasives by recreational users	Recreational off-roading up mauka increases sediments reaching reefs
REASONS FOR IMPACTS	Inadequate Education	X	X	X	
	Inadequate Mooring		X		
	Inadequate Enforcement		X	X	
	Other		DOBOR/DAR jurisdiction issues; Tourist info has pictures of coral contact and animal harassment	Too many users	Lack of MPAs
SUGGESTED PROJECTS	Mooring Installation	X	X		
	Community Monitoring	X	X		
	In-flight or Cruise-line Video	X	X		
	Collection of User Fees	X		X	X
	Signs at Beaches	X	X	X	X
	Hotel Cards or Video		X		X
	Point of Rental Education	X	X		
	Reef Fund	X	X		
	Docents / Ambassadors	X		X	X
	Other	TV Shows; Get more Trampling Data	Study to see if damage is from anchor, storm, or other threat; Artificial Reefs	Mandatory dive operator certification; zoning system; snorkel concession agreement to incl reef education	Educational materials in rental cars

OTHER COMMENTS

Big Island: Dive operator community is well-organized and motivated; Too many commercial operators (user-conflict); focus on cruise liners, not just airlines; focus on education more than enforcement; trampling impacts are greatest from those not associated with commercial tour; spread mooring project to other islands.

Maui: Implementation is key - public and neighbor island DAR has sore ears; Trampling may be secondary to storm and wave damage

Oahu: one person said fish feeding is only issue in very few sites; one person said it was major issue everywhere

Kauai: Focus on Makena/Tunnels and Ke'e

APPENDIX II: 2005 INTERVIEWS

	NAME	AFFILIATION	SUGGESTED PROJECTS											PROJECT SITES			
			Management					Research									
			Operator Training & Certification	Point of Entry/Rental Education	Audiovisual Productions	Anti-Fish Feeding Campaign	Mooring Improvements	Limits / Laws / Enforcement	Sunscreen Impacts	Dolphin/Seal Interaction Impacts	Beach Education Impacts on Behavior	Above Water Recreation Impacts	General User Impacts		Volunteer Monitoring Program of user behavior	Mooring Buoy Impacts	
STATEWIDE	Carl Meyer	The Hawai'i Institute of Marine Biology						X									Kealakekua, Honolulu, Cathedrals, Pupukea, Moanalua Bay
	Kristine Davidson	Hawaii Coral Reef Initiative - Statewide											X				Moanalua Bay
	Scott Atkinson	Community Conservation Network												X			Kealakekua, Honaunau, Honolulu, Pupukea, Moanalua Bay
	John Naughton	National Marine Fisheries Service					X	X			X		X				Lehua Islet
	Noelani Puniwai	Hawaii Natural Heritage Program - Marine Gap															
BIG ISLAND	Bill Walsh	DAR	X							X			X			X	Kealakekua
	Jan Ostman-Lind	TNCH Marine Coord, KulaNaia Foundation	X					X		X							Kealakekua, Honaunau
	Karen Hand	Adventures in Paradise Kayak Rentals						X									Kealakekua
	Mendy Dant	Fairwinds Cruises						X									Kealakekua
	Sara Peck	Sea Grant												X			Kahaluu
MAUI	Anne Fielding	Island Explorations	X														
	Cheryl Sterling	Maui County Economic Development/Tourism	X														
	CORAL Workshop Participants	Coral Reef Alliance & West Maui Community	X	X	X								X		X		Honolua
	Donna Brown	MCC Coordinator of MOP	X														
	Hannah Bernard	Hawaii Wildlife Fund, Maui Reef Fund, Maui Community College	X					X									Molokini, Honolulu
	Jim Coon	Trilogy	X					X									Honolua
Jonathan Hultquist	Maui Ocean Center (prev Pacific Whale Foundation)															Molokini, Olowalu, Kahekili	

	Liz Foote	Project Sea-Link	X														Honolua	
	Liz Smith	Maui Ocean Center	X						X									
	Randy Bartlett	Maui Land & Pineapple												X			Honolua	
	Robin Newbold	West Maui resident & coral reef activist & teacher	X					X									Kahekili	
	Russell Sparks	DAR - Maui					X	X			X		X				Molokini, Olowalu, Kahekili, Ulua, Honolua	
	Sherry Flumerfelt	Coral Reef Alliance																Molokini, Honolua
	Skippy Hau	DAR - Maui	X				X		X						X			
LANAI	Trilogy Lanai Crew	Live on Lanai and teach at school also															Cathedrals	
OAHU	Brent Dillabaugh	Hawaii Alliance for Community-Based Economic Development																
	George Balazs	National Marine Fisheries Service & Pacific Islands Fisheries Science Center												X				
	Hui Mālama o Pūpūkea-Waimea	Community group supporting conservation in Pūpūkea-Waimea ahupuaa															Pūpūkea, Moanalua Bay	
	Pauline Sato	The Nature Conservancy, Oahu															Moanalua Bay	
	Tori Cullins	Wildside Specialty Tours, Hawaii Ecotourism Association	X			X	X	X		X				X			Kahe Point, Makua, Makaha	
	William Aila	Waianae Small Boat Harbor Master					X				X						Kahe Point, Makaha	
KAUAI	Carl Berg, Makaala Kaaumoana & Scott Rubson	Hanaiei Watershed Hui & North Ocean Recreational Marine Area		X	X	X		X										
	Cheryl Lovel, Rhoda (Nani) Libre & Don Heacock	Nawiliwili Bay Watershed Council, West Kauai Watershed Council & DAR						X	X			X	X					
	Linda Marsh (Bale)	Bubbles Below Kauai																
	Micco Godinez	Kayak Kauai, Hawaii Ecotourism Association						X									Kee	
	Paul Clark	Save Our Seas	X	X		X									X		Ke'e, Ho'ai Bay, Koloa Landing, Lawai Kai	
	Rick Haviland	Na Pali Kayak Tour Operators Association & Outfitters Kauai					X										Poipu Beach, Lawai Kai	
TOTAL VOTES			14	3	2	3	8	11	4	2	3	3	5	6	2			

APPENDIX III: PROJECT SELECTION CRITERIA

1. Project should address **numerous and/or important** recreational impacts/threats to reefs:
2. Project will effectively address **numerous and/or important** user groups:
3. Balance between existing project momentum & need for LAS support for success:
4. Project permanency (long-term participants and/or funding mechanisms identified):
5. Project is financially feasible:
6. Project is politically feasible:
7. Project can achieve measurable success in 3 – 5 years:
8. Other arguments for project:

APPENDIX IV: SITE ASSESSMENTS

	Big Island			Maui				Lanai		Oahu			Kauai								
	Kealahou Bay	Honaunau (Two step)	Kahaluu	Molokini	Olowalu	Kahekili Beach Park	Honolua	Ulua Beach	Manele Bay / Cathedrals	Hulopoe	Kahe Point (Electric Beach)	Makua	Pupukea	Ke'e	Haena / Makua (Tunnels)	Ho'ai Bay	Poipu Beach Park	Koloa Landing	Beach House	Lehua Islet	
Rating: blank=non-existent; 1= very low; 2=low 3=medium; 4=high; 5= very high																					
SELECTION CRITERIA																					
1	management projects needed at site	4	3	2	3	2	2	3	2	1	1	2	2	3	3	2		1	3	4	1
2	research on human use/behavior needed at site	1	2	1		2	2	1	1	3	1	3	3	3	3	2	2		3	3	3
3	research on recreational impact on species needed at site	3	2	1	3	2	2	2	1	2	1	2	4	3	2	1	1		3	2	3
4	existing site-specific project momentum	4		2	2			5				1	5	1		1		3	1		
5	existing local organized group support & commitment (residents, resource managers, businesses)	4		3	3			5	2			1	2	5	2	1	1		3	2	
6	dependence on RIR-LAS support for project success (blank if no site-based project plans/desires fr locals)	3		4	3			1				1	3	4		2		4	2		
7	available base-line data	5	1	4	5	3	2	4	1	4	3	2	2	4	3	3	2	2	2	2	
8	possibility of measurable change in behavior	4	4	3	3	3	2	3	4	2	2	3	3	4	4	2	1	1	3	4	2
9	possibility of measurable change in reef health	2	2	2	3	2	2	2	3	2	3	2	2	2	2	1	1	1	3	3	1
10	site conducive to projects aimed at shore-based users	3	3	3	1	4	1	5	4		3	3	1	4	3	2	1	3	3	3	
11	high user/per area ratio	3.5	3	5	5	3	3	4	4	2	3	3	3	4	3.5	2		3	4	3	
12	high existing threat	2.5	2	5	5	3	3	2	3	3	2	2	3	5	1		1	1	4	4	1
13	access area conducive to mgmt	4.5	4	4	4	2	3	4	4.5	3	4	4.5	2	4	5	1	1	4	5	5	
14	area easily accessible to users	3	4	5	1	5	5	3	5	1	3	4.5	2	4	5	4	3	5	5	5	
15	extraordinary reef system/species	5	4.5	3	4	2	1	4	4	4	3.5	3.5	2	3				4	3	2	
16	coral depth easily touchable by users present	2		5	3	5	2	2	4.5	4	1	2	4	4	3	5	2		4	4	3
17	currents/waves add to coral risk	2		1		2	4	3	3.5		3	4	1	5	3	4	3			3	
18	presence of infrastructure increases project success	2	1	4	3		3	1	4		4	2		3	3	1		2	1	2	1
19	lack of infrastructure increasing project need	4	4	2	2	5	1	3	1			4		3	1	3		2	3	1	1
TOTAL # CRITERIA MET AT SITE		19	14	19	17	15	16	19	17	12	15	17	16	19	18	15	14	11	18	19	10
SITE CRITERIA SIGNIFICANCE SCORE		62	40	59	53	45	38	57	52	31	38	48	34	71	52	34	22	25	60	56	18

Rating: blank=non-existent; 1= very low; 2=low; 3=medium; 4=high; 5= very high	Kealakekua Bay	Honaunau (Two step)	Kahaluu	Molokini	Olowalu	Kahekili Beach Park	Honolua	Ulua Beach	Manele Bay / Cathedrals	Hulopoe	Kahe Point (Electric Beach)	Makua	Pupukea	Ke'e	Haena / Makua (Tunnels)	Ho'ai Bay	Poipu Beach Park	Koloa Landing	Beach House	Lehua Islet
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POTENTIALLY EXISTING IMPACTS

1	Anchor damage	2			3	2	1	1		2		3	2	3								3
2	Vessel Groundings	3			3	2		1		1												1
3	Human Trampling			5	3	5	3	3	3.5	3	0.5			4	4	4	2	1	3	4	1	
4	Animal Stress & Behavior Modification	4	3.5	3	4	3	3	3	2.5	3	3	4	4	3	3	3		2	2	5	2	
5	Sunscreen in Water	3	2.5	3	5	3	4	3	4	1	3	3	1	4	2	2		3	1	3	1	
6	Grey Water Discharge		1		5	2	1	3		1		4.5	2	1								3
7	Spread of Invasives by Recreational Users		2	1	4	2	4	3	1	2	2	2	2	3					4	2	3	
8	Artificial Reefs											3										
9	New Technology	1			3	1	2			1		1		2				1	1	5		
10	Noise	2.5	1		5	2		1		1			3	1								2
11	Reef Sedimentation due to recreation use			5		5	2	1	3		1	1		4							3	
	TOTAL # IMPACTS AT SITE	6	5	5	9	10	8	9	5	9	5	8	6	9	3	3	1	4	5	6	8	
	IMPACTS SIGNIFICANCE SCORE	16	10	17	35	27	20	19	14	15	9.5	22	14	25	9	9	2	7	11	22	16	

RECREATIONAL USERS

1	Tour Groups	3	2	4	5	3	2	4		3	3	2	3	2	3	2		1	4	3	2	
2	Cruise-ship Passengers	3		2						2			1					3				
3	Independent Recreationists (tourists & residents)	5	4	5		3	4	4	4		2	2	2	5	4	3	1	3	1	3		
4	Snorkelers	5	4	5	5	3	3	4	4	3	3	3	3	4	3	3	1	3	1	3	2	
5	SCUBA Divers	3	3		4	2	4	3	1	3	1	2	3	4	2	3		1	4	1	3	
6	SNUBA Divers	2			2	1	2					2	2	2	1			2	1	2		
7	Swimmers / Waders		2	2		2	4	2	3		2			3	4	3		3		2		
8	Kayakers	5				1	2		3				3	2								
9	Motorized Boaters	3	3		5	3	2	2		3		2	3	1		1					3	
10	Surfers			2		1		1				1		2	1	2		3				
	TOTAL # TYPES OF USERS AT SITE	8	6	6	5	9	8	7	5	4	6	7	7	10	7	7	2	8	5	6	4	
	USER INTENSITY SCORE	29	18	20	21	19	23	20	15	12	13	14	19	26	18	17	2	19	11	14	10	
	GRAND TOTAL # CRITERIA ETC. AT SITE	33	25	30	31	34	32	35	27	25	26	32	29	38	28	25	17	23	28	31	22	
	GRAND TOTAL SIGNIFICANCE SCORE	106	68	96	109	91	81	96	81	58	60	83	67	122	79	60	26	51	82	92	44	

APPENDIX V: NEWSLETTER SAMPLE

Go to: www.epa.qld.gov.au/publications/p00820ac.pdf/ to download and read the full document,

or go to:

http://www.epa.qld.gov.au/parks_and_forests/world_heritage_areas/wet_tropics/tropical_topics_newsletter/

to learn more about the newsletter and view a complete listing of issues available on-line.

Tropical Topics

An interpretive newsletter for the tourism industry



Challenges facing the Great Barrier Reef (GBR)
No.70 November 2001

Notes from the Editor

Coral reefs throughout the world are under threat and are being rapidly degraded by a combination of factors from dynamite fishing to climate change. Here in Australia our coral reefs have escaped many of the pressures found elsewhere but we cannot be complacent. A number of issues are of concern and it is the job of researchers and research institutes to evaluate those issues and to advise on courses of action which could be taken to protect the reef.

The CRC Reef Research Centre is a co-ordinating body for researchers and many of the research priorities involve those issues which are of most concern. This Tropical Topics therefore draws on reports and research produced by the CRC Reef.

There is a limit to how much information can be packed into one Tropical Topics so what you find here is an overview of the subject. In recent years many of the research findings have been posted on the web. If you would like more detail on these topics, check out the sites listed in Bookshelf, page 8.

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Battling the COTS

For the past few years, tour operators, particularly in the offshore Cairns and Port Douglas areas, have been battling armies of coral-munching crowns-of-thorns starfish.

Crown-of-thorns starfish (COTS) have been causing alarm since they were first noticed in vast numbers, destroying large areas of coral at Green Island, in 1962. Since then there have been several outbreaks of unusually high numbers, typically at 15-17 year intervals. These intervals gave the corals time to recover but the latest outbreak, which peaked during 2000, came just five years after the previous one. It was also unusually widespread, covering 4 degrees of latitude, previous outbreaks had begun in the north and takes a decade to move south along the GBR.

Government money has been committed to the problem. A three-month pilot program of removal during which 12000 COTS were removed from a number of sites, finished at the beginning of October. The aim was to demonstrate that reefs could be protected, given sufficient effort, and it is hoped that further funding will allow the work to continue.

The future is uncertain. Recent surveys on nine reefs between Lizard Island and Port Douglas have indicated lower numbers of COTS juveniles, but it appears that live coral cover of only 5-10 percent on these reefs is insufficient for development of young COTS. On the other hand, the presence of large numbers of different age groups suggests that the latest outbreak was not the result of one single event but that favourable environmental

factors and conditions are persisting.

There is concern about how long recovery will take. Limited live coral means a limited potential for production of the next generation of coral. Juvenile COTS are showing an alarming taste for newly developing coral colonies and, even in low numbers, they are causing significant loss of remnant corals. Looking at the bigger picture, since it has been suggested that human practices play a role in increasing COTS numbers, these issues are high priorities for future research.

Controlling the COTS

The total number of COTS killed or removed in the Cairns/Port Douglas area during the latest outbreak has reached about 450 000. Larger animals are injected with sodium borate, a chemical which will not harm the reef environment. Smaller animals are removed, using a hook, collected in bags and killed later. Buffer zones are maintained around cleared areas because the animals move quickly. A chemical stimulus produced by COTS when they feed seems to attract others to join the feast.




APPENDIX VI: ECO-RATING EXAMPLE

Costa Rica's Certification for Sustainable Tourism QUESTIONNAIRE

*Note: This is only a sample of the program questionnaire – for the full document please go to:
<http://www.turismo-sostenible.co.cr/EN/home.shtml>*

Physical and Biological Environment

1. Policies and programs

- 1.3 The company continuously participates in programs of environmental improvement of its surrounding areas or other areas of the country.
Weight: 2 []yes []no

2. Emissions and wastes

- 2.5 The residual water is appropriately re-utilized (recycled).
Weight: 2 []yes []no []n/a

4. Natural areas (National parks and protected areas)

- 4.2 The company has detailed information about natural areas of interest for tourists.
Weight: 1 []yes []no
- 4.6 The company participates in or supports the maintenance or management of a natural protected area (private or public).
Weight: 3 []yes []no

5. Protection of flora and fauna

- 5.1 The company implements specific actions to promote the no extraction of native flora or fauna by tourist or any other people.
Weight: 1 []yes []no
- 5.2 The company shows its resolution to prevent any commercialization of natural products (animals, plants, and their products) forbidden by law.
Weight: 2 []yes []no
- 5.4 The company implements activities to prevent the artificial feeding of wild animals.
Weight: 1 []yes []no []n/a

Company facilities

7. Water consumption

- 7.3 The company has a water usage plan with specific saving goals.
Weight: 1 []yes []no
- 7.7 The company uses faucet water saving devices.
Weight: 2 []yes []no

8. Energy consumption.

- 8.5 Natural illumination systems are used wherever is possible.
Weight: 1 []yes []no
- 8.8 An energy-efficient illumination system in at least 80% of the company facilities.
Weight: 2 []yes []no
- 8.9 The company uses new technologies for energy saving. For instance, automatic switches for illumination systems and electric/electronic equipment.
Weight: 2 []yes []no
- 8.10 The company is using alternative energy systems (i.e. solar energy) for illumination.
Weight: 3 []yes []no

- 8.11 The company is using alternative energy systems (i.e. solar energy) for water heating or other energy needs.
Weight: 3 []yes []no
- 8.16 Energy efficient electric equipment is used to cover at least 50% of the company's needs.
Weight: 2 []yes []no

9. General supplies consumption

- 9.4 The company does not use or sell products that are harmful for the environment.
Weight: 1 []yes []no
- 9.5 At least 50% of the printed material used by the company is made with free chloride recycled paper.
Weight: 2 []yes []no

Food and beverages

- 9.7 The company certified organic food products.
Weight: 3 []yes []no []n/a
- 9.8 The company menu offers national or regional dishes.
Weight: 2 []yes []no
- 9.9 The "canned" food bought by the company is acquired in "full" (industrial) size containers that are preferable made of glass or recyclable steel.
Weight: 1 []yes []no
- 9.10 The reuse or recycling of containers is a standard practice. The company also has specific suppliers of recycling services.
Weight: 2 []yes []no
- 9.12 The kitchen, restaurant and bar of the company use reusable dishes, glasses, cups, etc.
Weight: 2 []yes []no []n/a

Cleaning and cosmetic products

- 9.13 The company used non-toxic, non-corrosive biodegradable cleaning products.
Weight: 1 []yes []no

10. Management of solid wastes

Organic wastes

- 10.6 The organic wastes generated are composted or recycled.
Weight: 2 []yes []no []n/a

Inorganic wastes

- 10.7 The company has separated containers for classifying different kinds of inorganic solid wastes (glass, paper, plastic, and steel).
Weight: 2 []yes []no
- 10.10 The company participates on a recycling program.
Weight: 3 []yes []no

11. Training

- 11.1 All the employees are informed and know about the sustainability policies of the company.
Weight: 2 []yes []no
- 11.5 The company has a strategy that provides incentives to the employees to suggest improvements to company's sustainability program.
Weight: 2 []yes []no

Customers

12. Communication and involvement

- 12.1 Customers are provided with cultural, historic and ecological information about the area where company is located.
Weight: 1 []yes []no
- 12.2 The company has an information program for the guests, which provides details of its sustainability goals.
Weight: 2 []yes []no
- 12.6 The company provides the customers with information about the environmental protection actions developed in the region.
Weight: 2 []yes []no
- 12.7 The company provides information about the socio-cultural activities developed in the region to the customer.
Weight: 2 []yes []no

14. Management of guest groups

- 14.2 The company has specialized tourist guides to provide detailed information to the customers about these natural areas.
Weight: 1 []yes []no
- 14.4 The guests are provided with information about proper ways of behavior and their responsibilities when visiting natural areas.
Weight: 2 []yes []no

Socio-economic environment

16. Direct economic benefits

- 16.1 60% of the company's employees are people from the local community.
Weight: 3 []yes []no
- 16.2 The company provides training to local people so that they can effectively work at the company.
Weight: 2 []yes []no
- 16.3 The administrative employees of the company are Costa Ricans.
Weight: 1 []yes []no

17. Indirect economic benefits

- 17.1 The publicity material of the company informs about leisure activities organized by the local community or local enterprises.
Weight: 1 []yes []no
- 17.3 The company actively participates supporting the development of cultural, artistic and sport activities.
Weight: 2 []yes []no
- 17.4 The company takes advantage and promotes the consumption of inputs produced locally.
Weight: 2 []yes []no
- 17.5 The company's store sales handicrafts and other products from the local region. Local people and businesses produce these products.
Weight: 3 []yes []no []n/a
- 17.7 The company has specific programs that promote national tourism. It offers reduced rates for Costa Ricans.
Weight: 1 []yes []no
- 17.8 The company supports or has permanent commercial relation with at least one national micro-enterprise.
Weight: 3 []yes []no

18. Contribution to cultural development

- 18.1 The promotion of the company integrates cultural elements from the local region and communities.
Weight: 1 []yes []no
- 18.4 The company publicizes and promotes cultural activities and expressions.

Weight: 1 []yes []no

19. Contribution the public health

19.1 The demand of basic services (water, electricity, roads) is not competing with those of the local communities.

Weight: 2 []yes []no []n/a

20. Infrastructure and security

20.3 The company is involved in associations or committees that work to improve the condition of the local community.

Weight: 2 []yes []no

APPENDIX VII: POTENTIAL FUNDING SOURCES
Inventory of Key Federal Funding Opportunities for Possible Use
to Support/Implement Local Action Strategies

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
NOAA				
	NOAA Coral Reef Conservation Program	Aug. / Sep. for the next FY		
	Coral Reef Conservation Fund - NFWF	Jan. 31	http://www.nfwf.org/programs/grant_apply.htm	
	State and Territory Coral Reef Ecosystem Management Grants	Mar. 12	www.coralreef.noaa.gov/grants.html	
	State and Territory Coral Reef Ecosystem Monitoring Grants	Mar. 12	www.coralreef.noaa.gov/grants.html	
	Coral Reef Ecosystem Research Grants		www.nurp.noaa.gov/naacoral.html	
	Projects to Improve or Amend Coral Reef Fishery Management Plans	Mar. 12	www.coralreef.noaa.gov/grants.html	
	General Coral Reef Conservation Grants	Mar. 12	www.coralreef.noaa.gov/grants.html	
	International Coral Reef Conservation Grants	Mar. 12	www.coralreef.noaa.gov/grants.html	
	NOAA Coastal Ocean Program	various deadlines	www.cop.noaa.gov/funding.html	
	NOAA Community Based Restoration Program Individual Project Grants	Sept. 12	www.nmfs.noaa.gov/habitat/restoration/funding_opportunities/funding.html	check website for updates
	NOAA Community-based Habitat Restoration National and Regional Partnership Grants	Dec. 5	www.nmfs.noaa.gov/habitat/restoration/funding_opportunities/funding.html	check website for updates
DOI				
FWS	Pacific Islands Coastal Program		http://pacificislands.fws.gov/worg/orghc_conpart.html	
	Partners for Fish & Wildlife Program		http://www.fws.gov	
	Private Stewardship Grants Program		http://www.fws.gov	
	Hawaii Biodiversity Joint Venture		http://www.fws.gov	
	Sportfish Restoration Program		http://www.fws.gov	
	Wildlife Restoration Program		http://www.fws.gov	
	Clean Vessel Program		http://www.fws.gov	
	Coastal Wetlands Conservation		http://www.fws.gov	
	State Wildlife Grants Program		http://www.fws.gov	
	Endangered Species Section 6		http://endangered.fws.gov/grants/private_stewardship/index.html	
	Landowner Incentive Program		http://www.fws.gov	
OIA	Coral Reef Initiative Program		http://www.doi.gov/oia	
	Marine Resources Pacific Consortium		http://www.uog.edu/marepac	
	Technical Assistance Program			
	Capital Improvements program			

**Inventory of Key Federal Funding Opportunities for Possible Use
to Support/Implement Local Action Strategies (Continued)**

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOI (Continued)				
NPS	Wild & Scenic Rivers program		http://www.nps.gov	
USGS	Cooperative Water Program		http://www.usgs.gov	
	State Water Resources Research			
USDA				
	Environmental Quality Incentives Program (EQIP)		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Conservation Reserve Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Wetlands Reserve Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Grassland Reserve Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Wildlife Habitat Incentives Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Conservation Security Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Forestry Incentives Program		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	Resource Conservation and Development Program		http://www.nrcs.usda.gov/programs/	
	NRCS Watershed Programs		http://www.nrcs.usda.gov/programs/	grant subject to 2.5 million AGI cap
	NRCS Coral Funding -NFWF		http://www.nfwf.org/programs/grant_apply.htm	***new grant - 3 million - details pending check website for updates Contact: Howard C. Hankin National Aquatic Ecologist USDA - NRCS email: howard.hankin@usda.gov
	Environmental Education	Spring	www.epa.gov/enviroed/grants	
EPA				
	Environmental Justice Small Grants	December	http://yosemite.epa.gov/r9/fsfc.nsf/fundingsources?ReadForm	
	Environmental Justice Collaborative Problem Solving Grants	September	www.epa.gov/compliance/environmentaljustice/grants/ej-cps-grants.html	

**Inventory of Key Federal Funding Opportunities for Possible Use
to Support/Implement Local Action Strategies (Continued)**

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
EPA (Continued)				
	Integrated Pest Management and Sustainable Agriculture Projects	Spring	www.epa.gov/pesticides/grants/r9_agfqpa.html	
	Star Grants	various deadlines	http://es.epa.gov/ncer/grants/rfa/	
	Pesticide Environmental Stewardship Program (PESP)	Summer	www.epa.gov/opppbd1/PESP/grants.htm	
	Resource Conservation Funds	Spring	www.epa.gov/region09/waste/solid/funding.html	
	Water Quality Cooperative Agreements	Spring	www.epa.gov/region09/funding/water_quality.html	
	Watershed Initiative		www.epa.gov/owow/watershed/initiative/	
	Wetlands Protection Grants (State/Tribal/Local)	March 19	www.epa.gov/owow/wetlands/initiative/#financial	
	BEACH Act Grants		www.epa.gov/waterscience/beaches	
	Clean Water Act State Revolving Fund		http://yosemite.epa.gov/r9/fsfc.nsf/fundingsources?ReadForm	
	Nonpoint Source Water Pollution Control	Jan. 15	http://yosemite.epa.gov/r9/fsfc.nsf/fundingsources?ReadForm	
	Water Quality Assessment and Planning	Continuous	http://aspe.os.dhhs.gov/cfda/p66454.htm	
	OSWER Innovation Initiative	December	www.epa.gov/oswer/iwg.htm	
	Multi-agency watershed grants page		www.epa.gov/watershedfunding/	
	General EPA grants page		http://www.epa.gov/ogd/	
DOJ				
	Law Enforcement Training Grants			
DOD				
ACOE	Work for Others	State deadlines	US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriations are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw/ ; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Corps performs work for State as a contractor. State Funds. Work acceptance at the District Level

**Inventory of Key Federal Funding Opportunities for Possible Use
to Support/Implement Local Action Strategies (Continued)**

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOD (Continued)				
ACOE	Planning Assistance to the States	State deadlines		Technical assistance to State on coral ecosystem or watershed planning. Annual funding approved at Division level. Supports 1 - 2 year projects.
	Ecosystem Protection and Restoration; Section 1135, WRDA 1996; PL 104-303			Authorizes and funds cost sharing projects to modify existing state-federal projects to mitigate for past damages not previously considered in the project implementation. Project approval at the Division Level. Funds 1-2 year projects.
	Ecosystem Protection and Restoration; Section 206, WRDA 1996; PL 104-303			Authorizes and funds restoration of anthropogenic damages to the aquatic environment. Project approval at the Division Level. Funds 1-2 year projects.
	Estuarine Habitat Restoration; Estuary Restoration Act of 2000; PL 106-457			Funds Corps Technical assistance to a NOAA and State estuary habitat restoration program. Annual funding approved at Division level. Supports 1 - 2 year projects
	Beneficial Uses of Dredged Material; Section 204, WRDA 1992		US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriations are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Authorizes and funds protection, restoration and creation of aquatic and ecological habitats using dredged material. Annual funding approved at Division level. Supports 1-2 year projects.

**Inventory of Key Federal Funding Opportunities for Possible Use
to Support/Implement Local Action Strategies (Continued)**

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOD (Continued)				
ACOE	Beneficial Uses of Dredged Material; Section 204, WRDA 1992		US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriations are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Authorizes and funds protection, restoration and creation of aquatic and ecological habitats using dredged material. Annual funding approved at Division level. Supports 1-2 year projects.
	Watershed Studies, General Investigations			Multiyear general investigations authorized and appropriated by Congress. Study process from start to finish may take longer than 5 years.
	Ecosystem Protection and Restoration; Section 210, WRDA 1996: PL 104-303			Specifically authorized projects. Multiyear general investigations approved by Congress. Supports projects of more than 5 years.
	Streamflow Restoration; Section 102, Clean Water Act 1972; PL 92-500: Section 103, WRDA 1986; PL 99.662			Authorizes streamflow regulation from authorized projects for environmental restoration; Multiyear general investigations approved by Congress. Supports projects of more than 5 years.
	Aquatic Plant Control Program		US Army Corps of Engineers is not a granting agency and does not have specific Congressional authorities and appropriations for coral research or protection. Congressional authorities or appropriations are available to the States, local governments or other non-profit entities to solve specific water resource problems in cost-sharing partnership with the ACOE. Information can be found in: US Army Corps of Engineers, Civil Works Policy, Pocket Reference Source; www.usace.army.mil/inet/functions/cw; For Caribbean, contact Jacksonville District: George Strain (904) 232-3833; For Pacific Islands, contact Honolulu District: Paul Mizue (808) 438-8880.	Corps technical assistance program provides 2 weeks consultation services to the Division initiated by request from the District and State.

**Inventory of Key Federal Funding Opportunities for Possible Use
to Support/Implement Local Action Strategies (Continued)**

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
DOD (Continued)				
ACOE	General Permit Authorizations			States can use this Corps permit authority to support its regulatory and planning programs. State must develop and enforce a program or plan prior to applying for a permit.
NASA				
	Office of Earth Science Research Division Office of Earth Science Applications Division	Continues	http://research.hq.nasa.gov/research.cfm	
NSF				
Geosciences (GEO)	Ocean Sciences (OCE) - Biological Oceanography Marine Geology and Geophysics - Chemical Oceanography - Oceanographic Technology & Interdisciplinary Coordination (OTIC) Earth Sciences (EAR) - Geology and Paleontology	See program for deadlines	http://www.nsf.gov/od/lpa/news/publicat/nsf04009/geo/start.htm	
Biological Sciences (BIO)	Environmental Biology (DEB) - Systematic and Population Biology - Biodiversity Surveys and Inventories - Long-term Ecological Research Biological Infrastructure (DBI) Molecular and Cellular Biosciences (MCB) Integrative Biology and Neuroscience (IBN)	See program for deadlines	http://www.nsf.gov/od/lpa/news/publicat/nsf04009/bio/start.htm	
Social, Behavioral & Economic Sciences (SBE)	Science and Society International Science and Engineering	See program for deadlines	http://www.nsf.gov/sbe/start.htm	
Foundation-wide	Biocomplexity in the Environment (BE) - Coupled Biogeochemical Cycles - Dynamics of Coupled Natural and Human Systems - Genome-enabled Environmental Science and Engineering	See program for deadlines	http://www.eng.nsf.gov/be/index.htm	

**Inventory of Key Federal Funding Opportunities for Possible Use
to Support/Implement Local Action Strategies (Continued)**

Federal Agency Task Force Member	Existing Funding Sources	Deadlines	Information Sources	Note
Hawaii				
Department of Health	Polluted Runoff Control Program (Program) administers grant money it receives from the EPA through Section 319(h) of the Federal Clean Water Act.	new request for proposals coming out in March	http://hawaii.gov/doh/eh/cwb/prc/index.html	
Hawaii Coral Reef Initiative Research Program			http://www.hawaii.edu/ssri/hcri/ah/request_for_proposals.htm	

** Last Update: 12/03

** Prepared by the Steering Committee, U.S. Coral Reef Task Force **

** Information may change. Please be sure to check sources for most recent information **

** Contact: Secretariat, US Coral Reef Task Force (www.coralreef.gov)

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