Hawai'i Community Foundation

PEOPLE AND THE SEA:

A Review of Expert Opinion of What It Will Take to Enhance the Conservation of Marine Resources in the Main Hawaiian Islands

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This Document**:**

This document is the result of a study on the state of coastal and nearshore marine management in the Main Hawaiian Islands (MHI). The study was commissioned by the Hawai‘i Community Foundation (HCF) to help the foundation further develop its grant making program for coastal and nearshore marine resources in the MHI. The study has drawn its conclusions based entirely on a review of relevant literature and the opinions of experts on Hawai‘i’s marine resources. Interviews have been the primary source, and the study does its best to reflect the recurring themes and shared views discovered during the process. This study is not meant to be definitive but rather a summary of expert opinion of how to strengthen coastal and nearshore marine management in Hawai‘i. Some areas of the study may be noticeably limited because experts or literature were unavailable, or may have been overlooked. You will notice that the document is not highly referenced. We have purposely kept citations to a minimum (with the exception of published documents) to maintain the privacy of those interviewed.

During the course of this study, common themes and ideas emerged. Similar issues and needs arose with such regularity that Hawai‘i’s marine resource conservation community seemed to be speaking with a common voice about marine management needs.

During the course of the study, it became evident that nearly every aspect of marine conservation management is being worked on in the State; however, major threats and obstacles remain. This appears to be the case, primarily because the ongoing work, while important and extremely valuable, is not sufficiently coordinated and is not of sufficient scale to eliminate these threats and overcome these obstacles. It therefore appears that a key to successful marine management in the State is the strengthening and deepening of existing and planned conservation and resource management efforts. While there is a need for some new initiatives, it is extremely important that the good work that is ongoing and planned be provided with sufficient resources and be better coordinated so that it can have the most significant impact possible. The recommendations section of this study echoes this finding and discusses ways to extend and build from the existing foundation of marine conservation and management in the State.

We hope the marine resource management community of Hawai‘i will find this study useful and a step in the process of enhancing both collective and individual action to secure the future of marine resources in the MHI.

Acknowledgements:

All of the experts interviewed in this study are working extremely hard at managing and conserving Hawai‘i’s marine resources. Each in their own way have dedicated their lives, or a portion of it, to ensure that Hawai‘i’s marine resources are here for all to use and enjoy. While at times this work can be frustrating these people continue, because they believe this place can be more effectively managed and can maintain or regain its ecological integrity.

However, nearly all of them have expressed that the scale of the problems overwhelms them, and they do not have the resources or support they need to solve these problems. In its own small way, HCF hopes to assist in overcoming these problems. We both applaud and support the continued efforts of these people who are doing so much to ensure that our children have a healthy Hawai‘i.

The author would like to thank all of the people interviewed for their warm and open acceptance, and for their understanding of his extremely steep learning curve. Everyone interviewed was exceptionally helpful and supportive. A full list of interviewees is provided in the Reference section. Some individuals were particularly helpful in providing recommendations on the design of the study. To them, a special thanks goes out. Others persisted in the face of several callbacks and were patient and responsive despite their unbelievably busy schedules. You know who you are, and again, a heartfelt thanks.

A study like this can never be comprehensive and I know that we may have missed something critical, or were not able to interview everyone who could have contributed excellent ideas. I trust in providing this review draft that you will again be extremely helpful in correcting mistakes, elaborating on particular points or suggesting people who simply must be interviewed. While this document may go to press, I hope its contents remain live and active in the discussions and strategies that you develop over time. This has been a rich and rewarding experience for me. I greatly valued meeting and talking with all of you and I hope the product you are about to read meets your expectations and contributes in some way to your ongoing efforts.

Aloha,

Scott Atkinson

Chapter 1: Hawai‘i’s Marine Resources at a Crossroads

The Biological Value of Hawai‘i’s Marine Resources:

The Hawaiian Islands are among the most unique and fragile ecosystems on earth. Isolated by thousands of miles of ocean, Hawai‘i is an oasis for a startling array of life forms both on land and in the sea. Its rare and unique species are testimony to the incredible evolutionary force of isolation. The islands are famous the world over for their native terrestrial species, with as many as 90% of them existing nowhere else on Earth.

A lesser known fact is that Hawai‘i’s marine realm is also outstandingly rich and highly unique. Although often overshadowed by the more species-rich marine ecosystems of the Western Pacific, Hawai‘i has one of the world’s most outstanding marine environments. In coral reef fish alone, these islands boast an unparalleled endemism of more than 25%. When corals, algae, macroinvertebrates, various types of reef fish and other species are included, we soon realize that, depending on the group, between 14 and 62% of Hawai‘i’s marine species exist nowhere else on earth (See Table 1). These high rates of endemism make Hawai‘i a global priority for marine conservation.

Table #1. Endemism in Hawaiian Marine Species (from Clark and Gulko, 1988).

Species Group	Percent Endemism
Butterfly Fish	14 %
Reef-Building Corals	20%
Marine Snails	21 %
Angel Fish	25%
Sponges	25%
Gobies	40%
Parrotfish	40%
Damselfish	44%
Blennies	62%

Endemism results from geographic isolation and speciation, when the genetic composition of populations changes over time in response to localized environmental conditions. High levels of endemism are not that common in the marine realm. Marine species are able to disperse relatively easily, maintaining some degree of genetic exchange between distant populations. For this reason, endemism is not typically an important criterion when determining marine conservation priorities. In the case of Hawai‘i however, extreme isolation has resulted in such high percentages of endemism that the entire Hawaiian archipelago is a global conservation priority. If these rare and unique species are lost from Hawai‘i, they will be lost from the entire planet, greatly diminishing our collective biological heritage.

Hawai‘i holds another important distinction. It hosts some of the most northerly coral reefs on the planet, which offer potential refugia for corals in the face of global outbreaks

of coral bleaching. Bleaching occurs when environmental conditions extend beyond the range of tolerance for coral animals and their symbiotic photosynthetic algae, known as zooxanthelae. [The zooxanthelae provide essential nutrients to the coral polyp however, if the local water becomes too hot, too polluted, insufficiently saline, or off balance in some other way, the polyps often purge their zooxanthelae.] If conditions remain out of the range of tolerance for corals and their zooxanthelae, in time the coral animal will die.

In 1997 and 1998, vast portions of the world's coral reefs bleached in association with the raised water temperatures caused by the severe El Nino event. In some parts of the world as much as 80 to 90% of corals bleached (Wilkinson, 2000).

Given its northern location, Hawai'i was fortunate to maintain its typically cooler water temperatures even in the face of the most severe El Nino period. As a result, Hawai'i recorded relatively little coral bleaching. While the region is not immune to coral bleaching, some biologists have predicted that in the long-term Hawai'i's reefs will be among the most naturally resilient on Earth due to their northerly location. This fact should not be underemphasized given predictions that El Nino events will increase in number and severity in tandem with global warming. The severe bleaching of 1997 and `98 sent a shock wave through the coral reef conservation community, drawing into question our ability to protect healthy coral reef ecosystems.

Cultural and Economic Importance of Hawai'i's Marine Resources

In addition to its global importance as highly unique among marine systems, Hawai'i's marine areas have always been a critical component of the archipelago's history and culture. As a voyaging people, early Hawaiians maintained an intimate relationship with the sea that is at the very root of Hawaiian culture. The Hawaiian myth of creation places the origin of life in the sea with the first creature being a coral polyp. The people of this archipelago have always depended on the sea and its riches for their survival. Today, as many as two thirds of all people living in Hawai'i engage in ocean recreation, and as many as one third fish. Experts have suggested that a majority of residents in the state include wild caught fish as part of their diet, and that on islands such as Molokai as much as 30% of the diet is comprised of subsistence foods from agriculture and fishing. Likewise, traditional feasts, such as weddings and baby luaus, require large quantities of fish and other marine species.

Marine related tourism is the mainstay of Hawai'i's economy, as its famous beaches attract up to 3 million visitors annually (nearly half of all people who visit Hawai'i). Many of these visitors focus directly on marine recreation, including diving, snorkeling, surfing, and sailing. Hawai'i is consistently cited in diving industry publications as one of the top ten dive destinations in the world, and supports a healthy population of local divers and snorklers. Marine related tourism generated gross reciepts estimated at nearly $800 million in 1998 and supports approximately 1000 small businesses and 7,000 jobs across the State (Clark and Gulko, 1998). Pūpūkea, Hanauma Bay or Molokini on an average day demonstrate that Hawai'i's marine resources, especially its coral reefs, are in

great demand recreationally. These Marine Life Conservation Districts are visited by over one million people annually.

Near shore environments in Hawaii support both commercial and recreational fishers. An estimated 5,000 commercial fishers depend on the near shore environment for their catch. These in turn support untold numbers of shops selling gear, supplies, and catch. While the direct value of the commercial catch from the near shore environment may only approach $5 million annually, numerous related industries also benefit from this fishery.

Surveys in the MHI have shown the recreational and subsistence catch to be equivalent or exceed the commercial catch (Hamm and Lum, 1992, cited in Gulko, et. al, 2001). There were an estimated 260,000 recreational fishers in 1998, which suggests that as much as one forth of all Hawaiian residents fish recreationally (Clark and Gulko, 2001).

Fishing had significant social and cultural value to Hawaiians traditionally and is one means by which cultural idenity is maintained in modern times. Traditional harvest systems in Hawai‘i emphasized social and cultural controls with a strictly enforced code of conduct. Harvest management was not based on the amount of take of any one species but on the places and times where and when fishing could occur as not to disrupt basic ecological processes that supported fish production (Friedlander et. al. in prep. cited in Gulko, et. al, 2001). In modern times, the traditional social and cultural controls have been replaced largely by species-based management techniques and few areas are managed through traditional social controls.

Hawaii’s coral reefs also play a particular utilitarian function in protecting coastal areas and beaches from excessive storm impacts and erosion. Live reefs form natural sea breaks that help to reduce the velocity and impact of offshore waves. Under particularly severe weather and waves, reefs can help buffer the coastal zone from extreme impacts. When reefs die, they eventually break up thus reducing the natural buffer system that previously protected the coastal zone. While no specific estimates were uncovered by this study the possible difference in real economic terms could be enourmous if the buffering function of reefs is reduced or eliminated.

The Uncertain Future

Many of the same factors that have created Hawai‘i’s incredible biological wealth have also left it vulnerable to myriad threats. Isolation, highly specialized species, unique and rare habitats, restricted habitable area, and a limited resource base coupled with anthropogenic factors, such as impacts from trade-route traffic, introduced species and a history of colonization, have imperiled Hawai‘i’s natural systems. Hawai‘i now holds the distinction of the being the extinction capital of the United States. Having lost a large percentage of its native species, the natural systems of these islands are truly in crisis.

That said, when we compare Hawai‘i to other parts of the world such as the Philippines and Indonesia, our marine systems are in comparatively good condition. However, when

we compare Hawai‘i’s marine systems to the near-pristine systems of the central Pacific, including Kiribati and many areas of the Marshall Islands, we realize that Hawai‘i is on a slippery slope of decline.

O‘ahu provides perhaps the best example of what human activity can do to the marine realm. The natural marine systems of O‘ahu have been vastly altered by human activities, including overfishing, coastal development, the introduction of alien species, and stream alteration. In many areas of the island, the reef community structure appears to be completely altered from its natural state. Top level predators are for the most part absent and only small predators, herbivores, and small coralivores remain. In many areas, corals are covered in invasive algae, and live coral cover is as low as a few percent in sites that once harbored flourishing reefs. One need only visit Kāne‘ohe Bay or Waikīkī to understand how severe the degradation has become. In both sites, huge areas of coral are covered in invasive algae, and ecosystems that were once dominated by coral are now dominated by algae. Even in the healthier areas, such as Hanauma Bay, populations of certain fish species have decreased by as much as 60 % and threats of overuse continue to jeopardize the persistence of the area’s ecological viability. This is not to say that important areas do not remain on O‘ahu. They do, and they can be managed for everyone’s benefit. Many experts cited parts of Kāne‘ohe Bay and areas of the North Shore and ‘Ewa as high priorities for conservation. But for the most part, human activities have completely changed the natural condition of O‘ahu’s marine ecosystems, drawing into question our ability to restore and maintain them. Restoration of O‘ahu to any sort of natural state will require a massive effort that first arrests degradation and then moves to restore a minimum complement of the biotas, habitats, and ecosystem processes that characterize the natural systems of this island.

Fortunately, other islands, such as Kaua‘i and Hawai‘i, maintain a much higher complement of their natural marine systems. These areas are generally in very good shape and with some effort can be maintained for all to enjoy. Given the correct combination of management and time, areas throughout these islands are highly likely to maintain or recover their natural biological character.

Box 1: Marine Resources in the Main Hawaiian Islands at a Glance

1. Geographic isolation is believed to have resulted in the high endemism notable in Hawai‘i’s marine phyla. High endemism in the marine realm is not common as most marine species are wide ranging. Only extremely isolated places such as Hawai‘i and Galapagos experience high endemism.

2. Coral reefs in the MHI constitute a full 15% of the coral reefs of the United States.

3. Kāne‘ohe Bay hosts every major reef type present in the Hawaiian Islands: barrier reef, fringing reef, and patch reef.

4. Precious Corals can be found off the South Shore of Kaua‘i and the North Shore of Lana‘i.

5. Mangroves are non-native and have replaced numerous native coastal species.

6. According to the Coral Reef Assessment and Monitoring Program, the MHI host 18% Live Coral Cover

7. The restricted ranges of some corals suggest the possibility of extirpation from the MHI .

8. Hawai‘i’s marine ecosystems are so unique that the Hawaiian Islands are classified as a unique ecoregion.

9. Acropora, which is dominant in much of the Western Pacific, is largely absent in the MHI and porites are the dominant corals present.

10. Species Present: 400 species of marine algae (majority are red algae) – high endemism; 55 species of stony corals – majority occurring in the MHI; over 100 species of sponge; 1071 species of marine mollusks; 884 species of crustaceans; 278 species of echinoderms; 557 species of reef and shore fishes.

11. Many ecologists agree that nearshore reefs around the MHI, remain in relatively good to very good condition compared to other parts of the world. However, many areas of the MHI are extremely degraded and threats are significant and growing rapidly.

12. Due to their northerly location and current patterns around the islands, Hawai‘i’s coral reefs have largely escaped bleaching events that have impacted reefs in many areas of the Pacific in recent years.

13. Degradation of marine resources in the MHI began as long as 200 years ago as Western influence on the islands began to grow.

Chapter 2: Threats and Obstacles to Effective Marine Conservation in Hawai'i

The threats to Hawai'i's marine resources are well known and well documented. *Hawai'i's State of the Reefs*, (Clark and Gulko,1999) and the not yet published *Status of Coral Reefs in the Hawaiian Archipelago* (Gulko et. al. 2001, in prep.), provide excellent overviews and many details regarding threats to Hawai'i's coral reefs and associated marine environments. As a result we limit our description of threats primarily to those emphasized by experts interviewed and encourage readers to refer to these other volumes for a detailed treatment of threats. Obstacles to effective marine conservation and management are less discussed in the literature but were widely discussed by experts interviewed by this study and are summarized below.

While there are many threats to nearshore marine ecosystems, the highest priorities cited by experts were: Alien Species, Overfishing, Coastal Development, and Water Quality. The most commonly cited obstacles tended to fall into one of three categories: Limited Awareness, Limited Capacity, and Limitated Application of Biologically Appropriate Management. A more complete list of threats and obstacles cited by experts includes the following:

Threats:

1. Introduction of Alien Species and the Spread of Invasive Species (Marine Algae, Marine Invertebrates, Fishes, and Others)
2. Overfishing and Destructive Fishing of Nearshore Species
3. Coastal Development
4. Water Quality
5. Boat- and Ship-Based Pollution: The Shipping and Cruise Industries
6. Marine Debris

Obstacles:

1. Limited Awareness at All Levels of Society of the Importance of Marine Management, Prevailing Attitudes that Reject Marine Management, and Little Demand for Effective Management

- Diffuse Support Base versus Strong Minority Voices
- Limited Political Will
- The Sliding Baseline Syndrome

2. Limitations in the Application of Biologically Appropriate Management

    - The Need for Comprehensive Ecosystem Management

- Limitations in Organizational Capacity to Implement Comprehensive Ecosystem Management
- Limitations in the Number and Extent of No Take Areas
- Limitations in the Biological Appropriateness of Fisheries Regulations
- Complications of Species Specific Regulations
- Limitations in Regulatory Reach: Lack of Recreational Licenses and Lack of Gear Specific Commercial Licenses

3. Limited Capacity for Effective Marine Management

- Limited Enforcement of Existing Laws designed to Protect Coastal and Nearshore Marine Areas and Species
- Limitations in Funding including Funding through Annual Appropriation Cycles
- Limitations in Organizational Capacity to Effectively Manage Natural Resources including ability to Implement Comprehensive Ecosystem Management
- Jurisdictional Conflicts and Limited Communication/Coordination in Marine Conservation Efforts.

THREATS

Alien Species and Invasive Native Species

Over the past 50 years, Hawai‘i’s marine ecosystems have experienced a wave of alien species introductions including algaes, mollusks, sponges and sea grass. In the past decade managers and researchers have increasingly recognized how significant this threat has become as alien and invasive species are competing with native species for dominance in marine systems. Alien species invasions are of particular concern in areas, such as Hawai‘i, with high rates of endemism. Efforts to understand and manage alien marine species are relatively new in the state but are essential to addressing this major threat. There is a growing effort to address invasive marine species; however, it is generally felt that there is limited awareness, activity, and capacity in this area given the vast potential alien species have to decimate the natural systems and marine tourism economy of the state.

Consistently, experts interviewed for this study identified invasive alien species (particularly algae) as one of the top three threats to Hawai‘i’s nearshore marine resources (along with destructive fishing and coastal development). It is not surprising that given its position as the center for commerce and shipping in the MHI, O‘ahu is also the center for introduction of alien species. Since 1950, O‘ahu has experienced 19 introductions of alien macroalgaes with four of these becoming particularly successful. Some species have spread to all the MHI while others have remained only on O‘ahu. A number of species were introduced purposely for aquaculture projects while still others have been introduced accidentally, most likely from hull fouling or ballast water. O‘ahu has experienced the introduction of at least four species of alien bivalves, at least five sponges, at least seven crustaceans, and many other types of organisms. Likewise at least

three species of fish have been introduced, some of which have become aggressive competitors with native endemic species. Ta‘ape (blue lined snapper) for example is now a common reef fish in Hawai‘i but was introduced purposely by the State. Ta‘ape is a fierce competitor with native fish and has potential to extirpate some native species from particular areas.

“Alien Alga are of particular concern currently as in many areas of the MHIs they have caused phase shifts. Healthy coral reef habitats that are normally dominated by coral and coraline algae have been converted to mono-specific alien alga beds. According to the UH Alien Algae web site, long-term consequences of the resultant phase shifts from coral to invasive alga dominance include loss of productivity and biodiversity, a decrease in the intrinsic value of the reef, changes in the community structure of reef fishes dependent upon corals and algae, and ultimate erosion of the physical structure of the reef.

Waikīkī and Kāne‘ohe Bay for example have experienced phase shifts with algae now being the dominant organism in parts of these areas. Likewise a massive algae bloom of *Hypnea musciformis* in Maui during the mid-1990s caused considerable concern not only for ecosystem health but also for human health. Government agencies have moved to address algae blooms by improvement of water quality through programs that reduce nutrient loading. Unfortunately, another algae bloom was underway at the time of this writing in West Maui suggesting factors contributing to alga blooms have not been adequately addressed.

Fortunately, not all islands have been effected by all species of introduced alga. Despite the large blooms of the alien red alga *Hypnea musciformis* in Maui, the nearby islands Kaho‘olawe and Molokini have no recorded incidents of any alien algae species (Smith 1998, Smith in prep).

With enough eutrophication, native species of algae also have the potential to become "invasive", leading to massive blooms and coral overgrowth as occurred with *Dictyosphaeria cavernosa* in Kāne‘ohe Bay (Smith et al. 1981, Hunter and Evans 1995, Stimson et al. 1996) and *Cladophora sericea* on Maui.

A major problem underpinning and perhaps contributing to the introduction of alien species is the limitation of coordination between agencies tasked with management of alien species. The Department of Agriculture is responsible for issuing permits for the introduction of non-native species, while the Department of Land and Natural Resources is responsible for managing for the ecosystem and other biological impacts of these introductions. Voluntary standards for off-shore ballast exchange offer some hope for limiting alien species introductions; however, limited inspections and lack of mandatory standards has left Hawai‘i open for continued accidental introductions.

A number of experts also suggested that the algae problem is largely one of water quality. Eutrophication of water bodies such as Kāne‘ohe Bay are believed to be a major contributing factor in the expansion of alien and invasive native alga. Water quality issues are addressed below. Likewise experts have indicated that overfishing of

herbivorous fish can also contribute to the invasiveness of native or alien algae. Experts have suggested that many species of algae could be kept in check better through natural grazing. One expert called the combination of fewer grazers and increased nutrients in coastal waters as the one-two punch that enables alien and native alga to become invasive.

Overfishing and Destructive Fishing of Nearshore Species

Overwhelmingly experts reported that overfishing, facilitated by a number of gear types, is among the most significant threats to Hawai‘i’s nearshore marine ecosystems and resources. Hawai‘i hosts an extensive commercial, recreational, and subsistence fishing community with as many as 5,000 commercial fishers targeting nearshore species and an estimated 260,000 recreational fishers in the state. In Hawai‘i there are no requirements for recreational fishing licenses and as a result, the number of recreational fishers remains only an estimate. However, surveys have indicated that nearshore catch by recreational and subsistence fishing is equal to or exceeds the catch of commercial fishers and also targets a wider variety of fish types. The most heavily exploited nearshore species include uhu (parrotfish), weke (goatfish), moi (pacific threadfin), palani (eyestripe surgeonfish), manini (convict tang), u‘u (soldierfish) and he‘e (octupus) (Clark and Gulko, 1998) .

The majority of experts highlighted two gear types as the most threatening to the coral reef ecosystem and coral reef fish populations: gill nets, and spear fishing on SCUBA.

Currently nearshore fisheries management is carried out through a number of primary regulations and strategies:

- Species-specific minimum size regulations,
- Species-specific bag limits,
- Gear restrictions and
- Managed areas, which primarily have species and gear restrictions.

Hawai‘i is the last state in the nation to allow recreational gill netting and is the only state to allow spearfishing on SCUBA. Experts recommended that these gear types are overly efficient at catching fish and other marine species and can remove so many individuals that a population may not be able to recover.

Spear fishing on SCUBA allows fishers to access fish in areas that would otherwise act as refugia from skin divers. Likewise, spear fishing on SCUBA at night allows fishers to catch fish while they are asleep. New technology in SCUBA diving such as rebreathers and mixed gas allow people to stay longer and go deeper thus opening previously unexploited areas to exploitation. This increased access to previously inaccessible fish may result in overexploitation of reef fish leading to declines in populations and changes in the reef ecosystem processes.

Gill nets catch fish and other marine species indiscriminately and therefore can remove a relatively large percentage of the organisms found in a nearshore marine area. Current

gill net regulations try to limit impact by requiring fishers to periodically check nets, and by limiting the length of the net and the time of deployment. Unfortunately the reality is that many nets are left in place for long periods of time and ghost or derelict nets continue to capture and kill marine creatures long after they have been lost.

One expert, an avid fishermen and conservationist, indicated that a gill net can be good or bad depending on how it is used. According to this expert, a small gill net properly deployed and checked can be species-specific gear and will not take an entire school of fish but leave others for future catch. A very large gill net deployed improperly and not regularly checked can catch and kill numerous species including non-target species, turtles, sharks, and even monk seals.

Other fishing techniques and general overfishing were cited as threats as well. Some fishers use poisons or toxins to catch fish, although this practice is not believed to be widespread. Likewise, underreporting of commercial catch is also an issue of concern. Experts have suggested underreporting may range as high as between 200 to 10,000 percent for certain fisheries.

Both anecdotal evidence from fishermen and fisheries data suggest that numerous nearshore stocks are overfished. Long-term catch trends suggest that there has been a dramatic decline (approximately 80%) in coral reef fisheries. While restrictions on certain gear types may be resisted by some portion of the fishing community, many interviewed by this study believe added restrictions will be required if Hawai‘i’s nearshore marine resources are to persist in the long-term and remain viable for generations to come.

Aquarium Fishing

Most of the marine ornamental fish originating in the U.S. are collected in Hawai‘i. Hawai‘i is well known for its high quality fish and rare endemic species. For nearly 20 years, public concern over collecting of aquarium species has highlighted the need for increased study and regulation of this industry (Tissot, et. al, 1999). In 1973, the Division of Aquatic Resources (DAR) started requiring monthly collection reports to better regulate the industry. Despite these efforts, experts interviewed indicated the industry has remained largely unregulated. Since the inception of monthly collection reports in 1973, the industry has more than quadrupled from 90,000 fish collected in 1973 to over 400,000 collected in 1995 (Tissot et. al).

The results of a study by Tissot and others indicated that aquarium fishing is having a significant impact on eight of ten species examined (Tissot et. al, 1999). However, the researchers reported that additional knowledge is needed about the location and intensity of collection to be sure if the abundances of fish recorded are clearly the result of collection activities.

Experts have indicated current reporting systems greatly underestimate the harvest of aquarium fish highlighting the need for some more effective method of harvest

assessment. Finally, experts recommended that additional conservation measures are needed in this fishery and that managed areas are likely to be an effective approach.

Although the industry collects a wide variety of fish in excess of 100 different species, the industry is centered on approximately a dozen species, of which the Yellow tang alone accounts for up to 50% of the total of all collected fish. This high intensity collection of a small number of target species draws into question the sustainability of the harvest.

Fortunately, as much as 30% of the Kona Coast of the Big Island (the major center for marine ornamentals collection) has been set aside in Fisheries Replenishment Areas (FRAs) and these areas provide potential for effective management and repopulating of overfished species. Long-term studies of the impact on these areas are underway. These areas also apply other fisheries regulations on non-aquarium fish, and some sections are put aside as complete "no take" zones. This is a very positive example of addressing impacts of industry on certain species groups, and Marine Protected Areas (MPAs) have been widely recommended as a way to manage for coral reef sustainability and one of the best ways to promote sustainable harvest of reef fishes. These FRAs may also provide a foothold for the eventual expansion of complete "no take" zones and provide a foundation for ecosystem management on the Big Island.

Coastal Development

A large percentage of Hawai‘i's coastal zone has been developed either for tourism, residential areas, or commerce. On O‘ahu the majority of the coastline has been altered through the filling of reef flats, coastal dredging, building of sea walls, construction of marinas, homes, harbors, and industrial areas. On other islands, coastal development ranges from almost negligible levels on Ni‘ihau to significant levels, for example Maui's Kā‘anapali Coast and Kona's "Gold Coast." As a result, experts indicated that very few natural estuaries or coastal wetlands remain undeveloped. Highly altered estuaries include Kāne‘ohe Bay, Pearl Harbor, Waikīkī, Hawai‘i Kai, O‘ahu Harbor, and many others. Remaining natural estuaries include Hālawa Bay on Molokai, Waipi‘o and Waimanu valleys on Hawai‘i Island, the Hanalei River, and a handful of other areas that have not been developed.

According to experts at the Department of Land and Natural Resources (DLNR), research on beach erosion has indicated that up to 25% of Hawai‘i's beaches have been lost in the past 70 years. Hawai‘i lacks the aggressive beach management programs that other states have which typically include both restoration and regulatory components. Hawai‘i does have a Coastal Erosion Management Program. Likewise, DLNR is proposing a process to map erosion sensitive beaches and to develop a manual to inform the public and developers how to avoid coastal erosion.

This study did not uncover any studies designed to identify ecologically sensitive coastal areas that should be included in conservation strategies or carefully managed when it

comes to development. However, we were not able to meet with the Coastal Zone Management Program.

According to experts, developers and county regulators are not sensitive to the importance of shoreline management.

Stream channelization in the coastal zone poses another threat to Hawai‘i’s marine resources. Throughout the MHI, a large number of streams have been channelized. This process is undertaken by county governments as a flood control measure, but unfortunately results in a much greater amount of fresh water runoff reaching the coastal zone. This fresh water runoff can lower salinity levels and negatively affect corals and other marine species.

Coastal development and channelization severly restricts the absorption and cleansing action of natural vegetation and soil. As a result large fresh water outflows can occur during high rain seasons and kill coral reefs while water born sediment and pollution are more directly deposited in coastal and nearshore environments and can severely impact these areas (see Water Quality section below).

Water Quality

Problems in water quality, most of which eminate from land-based sources of sediment, nutrients, fresh water, toxins, or other pollutants is a major contributing factor to the decline in Hawai‘i’s nearshore marine resources. In the MHI, high nutrient levels are known to encourage algae growth. Massive algae blooms on Maui in the mid-1990s and occurring currently are believed to be directly linked to high nutrient loads coming from non-point sources such as injection wells, cesspools, and agricultural lands. High nutrient loading from homes in and around Kāne‘ohe Bay is also thought to be a major factor in the phase shift from a coral-dominated ecosystem in much of the bay to an algae-dominated system.

High sediment loading into the nearshore environment is a persistent problem throughout the MHI. Decades of agriculture, ranching, coastal development, military activity, and overgrazing by alien species have caused massive sediment problems throughout the MHI. Sediment runoff was estimated by the USFWS in 1996 at more than 1 million tons per year (cited in Gulko, et. al. 2000). The problem is particularly severe on Molokai, Lana‘i, parts of O‘ahu, and Kaho‘olawe due to agricultural practices, coastal development, and the repeated military bombing of Kaho‘olawe. Fortunately, some experts estimate sediment loads will decrease in the future as agricultural practices are changing in the state.

As mentioned earlier, high freshwater flows to coastal and nearshore areas can alter salinity and kill reefs. According to Gulko et. al, 2000, two major freshwater kills of corals were recorded in Kāne‘ohe Bay in the last 40 years due to large storms that raised fresh water runoff and lowered salinity for several days. According to observations, this runoff was exacerbated by coastal development and stream channelization.

Boat- and Ship-based Pollution

Several of the experts interviewed expressed considerable concern about the possible impacts of the boating and shipping industries. Cruise ships were more regularly cited as a possible threat than were container or tanker vessels, perhaps because this is a relatively new industry to Hawai‘i and is growing significantly. Concerns ran the gamut from hull fouling/ballast water and the introduction of alien species to gray water pollution washing up into nearshore areas to possible fuel spills due to ship and boat groundings. According to cruise industry representatives, the ships themselves are in compliance with all regulations regarding waste disposal and ballast exchange. According to these industry representatives, the companies that run or plan to run cruises in Hawai‘i want to work hard to comply with all environmental regulations and want to reach out to the public at large to show themselves as good corporate citizens.

The shipping industry also poses considerable threat both in terms of introduction of alien species as well as in pollution. While gray water levels are much lower in the shipping industry, the potential for significant environmental damage due to oil and chemical spills is much greater. The shipping industry was not contacted as part of the study and therefore did not comment on their compliance with waste and spill safety regulations. However, ship groundings and oil spills have increased over the past two decades and a few large spills have caused damage to coastal areas. Chemical spills including spilling of PCBs, sulfuric acid, and other chemicals have also been spilled in past years (Gulko et. al. 2000). Some of the experts interviewed feel ship- and boat-based pollution and potentials for oil and chemical spills are threats that should be more carefully assessed. According to experts, the National Oceanic and Atmospheric Administration (NOAA) is conducting a coastal sensitivity analysis for oil spill hazards.

The Environmental Protection Agency is currently conducting a study of the most polluted water bodies in the State as an initial mechanism to improve pollution control and cleanup. We were not able to interview the EPA regarding this study.

Marine Debris

Marine Debris was regularly cited as more of a threat in the Northwestern Hawaiian Islands (NWHI) and was not emphasized as a major threat in the MHI. However, the literature on threats does emphasize marine debris as a concern, especially derelict fishing nets that either continue to ghost fish, entrapping and killing wildlife, or was up on reefs and nearshore ecosystems. Other debris include plastics, wood, rubber, metals, and cloth that originate from land, industrial waste, waste disposal sites, and storm drains. According to experts marine debris has increased in the past decade due to wind shifts and changes in current patterns associated with El Nino.

OBSTACLES:

Experts interviewed identified a wide range of obstacles to more effective marine conservation. The ways they suggested that we overcome these obstacles are discussed in Chapter 3: Recommendations.

Limited Awareness of the Importance of Marine Management and Little or No Demand for Effective Management

According to the vast majority of experts interviewed, the single biggest obstacle to effective marine resource management is the limited awareness of its importance at all levels of society, the limited demand by the public for effective management, and prevailing attitudes that are ambivalent to or reject marine management.

Many experts said that the attitude in the public is that there is not a problem with marine resources currently, or that regulations don't the have a role in solving the problem. Other experts have said that the difficulty of managing a common property resource has led the fishing community to have the attitude that if I don't take it, some one else will, so I might as well take it.

Still other parts of society don't fully appreciate how marine resources affect their lives in terms of helping to support the economy and culture of the state, and therefore do not demand proper management.

Other experts said that they would like to institute more effective ecosystem management and more MPAs but that interest groups including fishers, native Hawaiians, gear suppliers, and others often resist both MPAs and other fishing regulations.

One expert said that the conservation and management community is really bucking the tide in terms of getting more areas into protection because of public opposition or public ambivalence.

Specifically, experts said that a lack of awareness about the economic and resource importance of effective marine management seems to plague marine conservation in the state. Experts feel proper resource management would both improve or maintain many economic sectors including tourism and fishing and would provide more fish for cultural and recreation use. However, they feel that people do not recognize the long-term economic benefits of these measures.

Diffuse Support Base versus Strong Minority Voices

According to some experts interviewed, the limited awareness of the importance of effective marine management manifests itself in limited or diffuse support for conservation versus the strong voices of special interest groups against particular conservation measures. Experts said that when asked specifically, the public generally supports marine conservation. While this support base is present, it is diffuse. In other words, individuals might support conservation if asked, but tend not to go out and

actively campaign on the behalf of conservation issues. Interest groups on the other hand, are well organized and do lobby on issues of concern to them. For example, on the gill net issue, there was a strong lobby both by fishermen and by gear manufacturers not to limit gill net use. Conservation organizations believe that the majority of non-gill net fishers supported restrictions on gill nets; however, they did not actively make their position known.

Many other people might also support gill net restrictions if they understood the issue and recognized the effect that gill nets have on their lives, both economically and culturally. However, since gill nets and restrictions on gill nets do not impact their daily lives, there was no urgency or concern among the general public to support gill net restrictions. In the end, while the vast majority of conservationists interviewed feel gill nets must be restricted, and many in the fishing community agree, the gill net task force recommendations are believed by many interviewed to be insufficient to solve the problem caused by the use of gill nets.

Experts suggested that the problem of harnessing diffuse support could largely be addressed by raising awareness on particular issues and organizing grass roots support for enhanced conservation. Please see Chapter 3: Recommendations.

Limited Political Will

According to experts, awareness and attitude issues also manifest themselves as limitations in political will for effective resource management. This limited political will translates into limited financing and limited recognition of the need for appropriate salaries and resources for management and for support of changes in laws and regulations that will improve management.

In many cases, experts said that conservation and environmental protection measures are viewed by political decision-makers to be at odds with economic interests including tourism, coastal development, and manufacturing or primary resource industries. As a result, this limited awareness of economic benefit translates into decisions that negatively impact these resources further.

Among government bodies, experts have cited that limited awareness and understanding exists in the legislature, which plays a major role in approving many marine management laws and until recently was mandated to approve or disapprove many regulatory changes, the Governor's office, and agencies that have overlapping jurisdiction on marine issues such as the Department of Agriculture, the Health Department, and the Department of Land and Natural Resources.

According to several experts, the legislature is a particularly important target for raising awareness. They are often involved in marine management regulations, yet not a single member has expertise in this area. In addition, experts suggested that the Governor's office is an important target for raising awareness regarding the economic importance of marine resources in Hawai‘i.

The Sliding Baseline

Experts interviewed suggested that Hawai‘i is experiencing a phenomenon known as the sliding baseline syndrome and this may have considerable impact on perceptions of the need for marine conservation in the state. The idea behind this concept is that each individual envisions a pristine or good condition environment to be synonymous with the conditions of marine resources when they were young. In other words, a person's perception of what is natural is based on what they knew early in life or early in their interaction with marine resources. In essence for them this was the baseline for the condition of marine resources. It may equally apply to a researcher studying the conditions of marine resources as it might to an individual simply noting the condition of marine resources.

The problem is the baseline condition of marine resources slides with each generation or each new observer. As each generation of observers looks back on the condition of marine resources, they come to expect less and less from marine resources since marine resources have declined with each generation.

As time goes by and marine resources decline, individuals may no longer be aware of the characteristics of a natural environment and therefore do not expect that a natural environment should be maintained or restored.

Once the baseline slips too far, it will be increasingly difficult to interest people in environmental protection and restoration.

A critical component of any educational campaign should be to ensure that people become aware of what natural systems can and should look like before the baseline slips out of control.

Overall, experts have strongly suggested that a lack of awareness of the importance of marine conservation underpins all other threats and obstacles to effective long-term conservation management in the state. This includes a lack of support for biologically appropriate management, limited funding for proper management and enforcement, insufficient laws and regulations, and several other threats and obstacles summarized in this study. Based on this initial assessment, a lack of awareness and a lack of support for effective resource management appear to be a root cause of continued resource degradation in the state. Raising awareness and changing attitudes will be key to effective long-term management.

Limitations in the Application of Biologically Appropriate Management

The Need for Comprehensive Ecosystem Management

In Hawai‘i marine management is done on a species-by-species basis and does not take into consideration the ecosystem processes that serve to maintain species populations. According to one senior marine manager, even attempts to change size limits and bag limits on a species-by-species, basis, while useful, will not solve the problem of declining

resources in Hawai‘i’s marine realm. Many experts felt strongly that ecosystem management is essential to effectively manage Hawai‘i’s marine resources.

Increasingly, conservation managers around the world are recognizing the need to shift from species- and site-based management approaches to ecosystem-based management.

All ecosystems are comprised of interconnected natural communities and multi-species interactions that are linked together by ecological processes (TNC, 2000). The complex mosaic of habitats, biotas, physical features, and ecological processes that interconnect these features are all important to the continued functioning of the natural system. To manage from an ecosystem approach, agencies must consider not only the needs of one element of the ecosystem such as a particular species, but also the integrated needs of the entire set of ecosystem components including multi-species interactions.

While the move to manage ecosystems has taken hold in many conservation arenas, in the case of fisheries management, stock management based on individual species remains the norm. Individual species populations are typically managed by assessment of their size and in many cases regulation of the amount of take or the gear type is the management regime of choice. Increasingly, fisheries managers are recognizing the inadequacies of this type of management and moving toward ecosystem approaches, particularly in the coral reef environment.

Coral reef fishes tend to grow slowly and live a long time (see Box 2: The Coral Reef Ecosystem on page 25). This is the case for most coral reef fish in Hawai‘i. As a result, highly sought after coral reef fish are vulnerable to eradication through overfishing. This can have significant ecosystem level impacts as removal of too many herbivores, predators, or coralivores may throw off the complex multi-species interactions that characterize the coral reef ecosystem.

Marine Protected Areas (MPAs) have been widely recommended as the best way to manage for ecosystem features and serve as a particularly important tool for effective management of coral reef areas and coral reef fishes. As a result, many experts interviewed feel that the management of Hawai‘i’s nearshore ecosystems would benefit greatly from an ecosystem approach and an increased number of appropriately sited MPAs.

Limitations in Organizational Capacity to Implement Comprehensive Ecosystem Management

A number of organizations and agencies in Hawai‘i are devoted to the conservation and management of marine resources. Several groups are pursuing outstanding efforts to protect important resources and raise attention about the need for more effective management of marine resources. While these activities are critical to the long-term persistence of Hawai‘i’s marine resources; this study did not identify any group that is focused primarily on the conservation of marine biological diversity or ecosystem processes in a comprehensive way.

Most conservation organizations and agencies have focused on particular environmental issues, resources of concern, or the interface between cultural and resource issues. A range of highly important approaches have been pursued in Hawai‘i; including advocacy on certain resource issues, grassroots organizing for the conservation of particular sites, education and outreach on issues of concern to the marine environment; research on persistent problems such as alien species; and impacts on certain fisheries. Likewise, many local groups have focused on watershed management, which includes a focus on moving to broader ecosystem management. However, this study did not identify any well-established efforts to extend these approaches to the marine environment, although it is important to note that many groups are very interested and enthusiastic to do so.

To date, no organizational entity (governmental or non-governmental) has focused its full attention on the maintenance of a representative set of Hawai‘i’s critical marine habitats.

Given the need that experts have highlighted to more effectively promote an integrated ecosystem management approach, there is a need to also develop organizational capacity in this area.

Limited Number of “No Take” Areas

Current estimates by experts suggest that less than 0.3% of the coral reef area of the MHI are in full no-take (Clark and Gulko, 1999). In other words, it is legal to fish in some manner in the remainder of the MHI. Where they exist, “no take” areas have proven to be effective in increasing fish stocks (Gulko et. al. in prep), whereas experts indicate that fish populations have not increased significantly in areas that are not full “no take”. In fact some experts have suggested that current Marine Managed Areas (MMAs) (such as Marine Life Conservation Districts [MLCDs]) may have actually decreased fish standing stocks when compared to un-managed areas as these areas have increased access to the marine environment.

Currently managed marine areas in Hawai‘i include:

Marine Life Conservation Districts
Marine Natural Area Reserve (1)
Fisheries Management Areas
Marine Laboratory Reserve (1)
National Wildlife Refuges
Marine Parts of National Parks
The Hawaiian Islands Humpback Whale Sanctuary
Community-Based Marine Area (1)

[INSERT MAP – REFERENCE ATLAS OF HI, p.155]

Very few of these areas constitute full “no take”, no harassment areas. Hanauma Bay is a full “no take” area as is Molokini off the coast of Maui, but both areas are likely to have significantly altered ecology due to high level of tourism and fish feeding.

Many experts have cited that the creation of additional no-take MPAs or fisheries replenishment areas is largely constrained by limited awareness and public attitudes.

Limitations in the Biological Appropriateness of Fisheries Regulations

Many of Hawai‘i’s current fisheries regulations do not adequately address the biological needs of the species under management. One example of this is the minimum allowable catch size. For example, moi (pacific threadfin, *Polydactylus sexfilis*) can be caught at 7 inches. Unfortunately, moi do not become reproductive females until at least 11 inches (Friedlander, 2001). As a result, moi are being caught before they reach sexual maturity. Despite bag limits, size limits, seasonal closures, and an active stock management program, catches of moi have declined dramatically over time (Friedlander and Zeiman, in press).

Fortunately, DAR is currently making changes to the take size limits of various species to more adequately respond to the biological needs of the species (see Chapter 3, Recommendations).

Complications of Species Specific Regulations

Several experts interviewed cited the complexity of Hawai‘i’s fisheries regulations as a major problem. Every species has a different regulation on take size and bag limit. While fishermen interviewed said that responsible fishermen do in fact follow these regulations, they have also said that less responsible fishermen find them too complicated and may not pay much attention to them. Other fishers simply may not be aware or interested. This again leads us to the constraint posed by individual species management. Given the complexity of fisheries regulations and the limited capacity for awareness raising and enforcement, experts suggested that it simply may be too difficult to manage effectively through these means.

Limitations in Regulatory Reach: Lack of Recreational Licenses and Lack of Gear-Specific Commercial Licenses

In Hawai‘i there are no requirements for recreational fishing licenses. As a result, it is impossible to provide an accurate estimate as to the numbers of recreational fishers or recreational catch. It is therefore impossible to effectively regulate recreational fishing. Experts however, estimate that recreational fishing has a more significant impact on nearshore marine ecosystems than commercial fishing, because more people are involved in this fishery and it likely has the highest take and on a more diverse set of species.

Likewise, permits for commercial fishing are not gear specific. This limits the ability of DAR to effectively manage commercial fishing. Catch reports are believed to be significantly under-reported, which makes regulation and management extremely difficult.

Box 2 The Coral Reef Ecosystem: Important Information for Management

In Hawai'i's, coral reef ecosystems are among the top priorities for nearshore marine conservation. There are many excellent volumes that provide overviews of coral reef ecology both generally and specifically for Hawai'i's. One of the best resources is *Hawaiian Coral Reef Ecology* by Gulko. While we are not able to give a comprehensive overview, we summarize some fundamental aspects of coral reef ecology that play a major role in how these systems can be most effectively managed. Much of this information comes from Birkland, 2001.

Based on the amount of biomass produced, coral reefs are generally highly productive systems, but their potential fisheries yields are relatively low, because of their high diversity and complexity. A great deal of energy is lost between trophic levels and is therefore not available to be exported in the form of fisheries catches (Birkland, 2001).

Populations of animals on coral reefs are annihilated quickly and often do not return. Coral reef species are vulnerable to overfishing because their life history strategies tend to favor multiple reproduction through longevity and large-size. Because coral reef systems have a prevalence of predatory species, young have low survival rates. Therefore a strategy of multiple reproductions is important to survival. To reproduce effectively a number of times however, an individual fish must live for a long time and to a sufficient size to produce a high number of eggs. As a result, these fish are around for a long time and there is lower population turnover on coral reefs than in other marine ecosystems. Removing large fish removes critical reproductive adults. Removing all or most of these adults may completely eliminate the species from a reef system.

In turn overfishing of certain species or guilds on coral reefs can have ecosystem level impacts. For example overfishing of herbivores can lead to an overabundance of marine algae that can inhibit coral recruitment thus having cascading effects on the food chain and precipitating changes in populations of other species or guilds. As a result, coral reefs cannot be managed effectively on a species by species basis, but must be managed as ecosystems.

Reserves with "no take" are one of the best mechanisms to manage coral reef ecosystems, because they allow for the natural system processes to proceed without needing detailed knowledge or management of specific species, multi-species interactions, or ecosystems functions (Birkland, 2001). Given that biologists don't adequately understand species' needs, species interactions, and ecosystem processes on coral reefs, "no take" is the only way to ensure effective management of the system overall.

Given that fishers desire access to coral reef fishes for livelihood, cultural, and recreational reasons, there is a need to balance these interests with the needs of the ecosystem. Scientists must be brought together to identify those areas that when managed as no-take zones will help to support ecosystem processes overall and can help to support fishing in other areas. These can be established as fishery replenishment zones and can be designed to meet the dual purposes of ecosystem management and improving fish catch in adjacent areas. For this concept to work however, there is a need to scientifically determine how many, how large, and in what orientation fishery replenishment zones must occur.

Limited Capacity for Effective Marine Management

Limited Enforcement of Existing Laws Designed to Protect Coastal and Near Shore Marine Areas and Species

Unfortunately, this study was unable to interview officials from the Division of Conservation Area and Resources Enforcement (DOCARE). We would have much prefered to provide direct information from DOCARE itself; however, since an interview was not possible, the study can only make inferences about enforcement capacity within the State based on the opinions of other experts interviewed. Several experts interviewed indicated that in their opinion there is extremely limited capacity to effectively enforce the State's regulations on marine management. This is confounded by the fact that the regulations are complicated and the number of DOCARE agents is insufficient to fully cover all the marine managed areas of the state. One expert suggested that citizen volunteers could be placed at key MLCDs to help raise awareness and provide educational materials. When it was suggested that these individuals could also provide surveillance on regulations and contact DOCARE agents if a violation was observed, the expert indicated that it was unlikely that DOCARE agents would be able to respond in a timely manner if contacted by a citizen. While this was only annecdotal, it reinforces the perception in the state that DOCARE does not have sufficient capacity to effectively enforce marine regulations. Most experts interviewed felt this stemmed from two primary causes. 1. DOCARE is insufficiently funded and therefore there are too few agents. 2. DOCARE agents may not want to always enforce fisheries regulations because fishing is seen as a way of providing livelihood even in the case of high tech fishing methods such as spear fishing on SCUBA. As a result, few people want to interfere with someone making a livelihood. As mentioned, these statements are not those of DOCARE staff or officials and are the perceptions of the experts that were interviewed. To find out more about DOCARE's capacity, needs, and interests a full series of interviews with DOCARE should be conducted.

Limitations in Funding including Funding through Annual Appropriation Cycles

The current situation of limited financing was highlighted by several individuals as an obstacle that must be overcome to effect considerable change. Currently, the State of Hawai‘i is ranked around 47th or 48th (estimates by experts varied) in the nation in terms of its budget for marine/aquatic resource management, yet Hawai‘i has the third longest coastline of any state. DAR which is responsible for management of all of Hawai‘i's nearshore marine resources has an annual budget of only $5 million and is missing several key staff positions that it feels are critical to management.

Estimates indicate that the marine conservation NGO sector generates under $300,000 annually. Again, an extraordinarily small sum of money given the importance of Hawai‘i's marine resources, the severity of threat, and the number of obstacles that must be overcome. That said, even with small budgets, both the State and the NGO sector have managed to generate a great number of conservation initiatives and accomplish a significant amount.

Relative to the needs, marine science in the State of Hawai‘i is much better resourced than conservation or marine management. Considerable funding for research is generated by the Hawai‘i Institute of Marine Biology, the Oceanic Institute, the University of Hawai‘i and other institutions. Only a small amount of this money however is focused on marine conservation. Experts have suggested that there is insufficient training funds generated by the research community to fully meet the needs of building a new generation of researchers, particularly ones with a focus on marine management.

The Hawai‘i Coral Reef Initiative (HICRI) has been a much welcomed source of financing for marine research providing approximately 1 million dollars annually. However, the Coral Reef Initiative is designed to support research and to date has not directly supported conservation or resource management activities. Although the research it has supported is directly applicable to management. In coming years, the HICRI is planning on supporting more conservation and management related activities; however, the focus will remain on management oriented research, so this will not be a significant source of funds for direct management.

Annual Appropriation Cycles

Several experts cited annual appropriation cycles as a major obstacle to effective conservation and research. Understandably, this obstacle is most significantly felt among government agencies and academic institutions that depend primarily on annually appropriated federal or state funds. Several projects have been started that would ideally need longer than one year to be fully effective. While government funding helped to initiate several projects, some were cut in subsequent years resulting in less than optimal outcomes. One example includes studies on alien algae. One year of funding enabled researchers to identify areas that are impacted by alien algae, but follow up research on the relationship between land-based sources of pollution and nutrients has not been possible since funding was not approved for the following year.

Fortunately, NGOs and Universities are largely able to access funding over longer periods of time. Foundations and private individuals tend to fund for longer periods of time, providing the opportunity to phase conservation work. Currently there are relatively few Foundation funders operating in Hawai‘i, so to access more flexible funding will be critical to develop partnerships between NGOs, foundations, government and academic institutions.

Limitations in Organizational Capacity to Effectively Manage Natural Resources

Capacity limitations in terms of funding, human resources, organizational and strategic planning skills, and several other aspects of institutional development were emphasized by numerous experts as a major constraint to effective conservation management.

Limitations in capacity that were mentioned by experts include limitations in:

1. Knowledge of marine resources in the state and data basing and dissemination of this information

2. Strategic planning for resource management, including the setting of biologically meaningful targets and indicators for biodiversity conservation.
3. Predictive Capacity (modeling of future impacts and coastal and habitat sensitivity).
4. Monitoring Capacity to understand change over time
5. Human resources, including the development of skilled conservation practitioners to work at all levels, including government and NGOs.
6. Financial Support to all levels, including government (focus on state) and NGOs.
7. Capacity to enforce compliance with Hawai‘i’s marine resource regulations.
8. Capacity to adequately encourage voluntary compliance with regulations
9. Capacity to develop a positive and proactive attitude at all levels of society
10. Capacity among various stakeholder resource groups to effectively participate in management
11. Capacity to address multi-cultural issues in resource management
12. Capacity to adequately resolve conflicts between interest groups.

In general, capacity limitations in parallel with limitations in awareness of the importance of marine conservation where the most commonly mentioned obstacles or constraints to effective marine management. As a result both of these elements tend to pervade discussion of all other obstacles as well as the recommendations provided in Chapter 3.

Jurisdictional Conflicts and Limited Communication/Coordination in Marine Conservation Efforts

According to many experts, there is insufficient communication between and among several government agencies as well as between and among non-governmental organizations (NGOs). Many felt improved communications and collaboration would improve the situation of resource management.

Some indicated that there are several Government agencies with different but overlapping mandates and jurisdictions, yet they have insufficient coordination to ensure effective management. For example, the Department of Health is responsible for water quality, but the DLNR is responsible for ecosystem management. Numerous ecosystem management issues are a direct result of water quality and likewise ecosystem impacts can tend to effect water quality. Experts recommended some sort of improved communication to ensure effective cross-agency management of this and many other similar issues. Another example is the issue of alien species. Several different agencies have jurisdiction over alien species including introductions and management. According to experts, there is little if any communication between these agencies about alien species issues, and as a result, management is not as effective as it could be.

Experts also indicated that current management efforts are disjointed or uncoordinated initiatives rather than a strategic set of interventions. While experts greatly support most management efforts that are underway, some commented that these initiatives could benefit from a more targeted and strategic approach.

Chapter 3: Recommendations to Improve the Condition of Coastal and Nearshore Marine Systems in the MHI.

This study has tried to capture expert opinion both on the additional conservation projects that need to be undertaken in the short term and the efforts needed to build capacity for long-term conservation.

Collectively, these recommendations represent the opinions of a broad group of experts on nearshore marine and coastal resources management. However, they do not represent all opinions. As a result, one of the main overarching recommendations is to stimulate and maintain an open process of communication and strategic discussion about the ideas summarized in this document.

A Major Theme: Addressing Immediate Needs in Conservation Management While Developing a Long-Term Comprehensive Strategy for More Effective Management

A major theme that overarches all the recommendations collected in this study is the need to address immediate high priority or urgent issues while developing a comprehensive strategy that sets a solid foundation for long-term improvements in management. This approach will be critical in the State as there are some things that can and should be addressed right away and many others that will take long-term measured attention and collaborative strategic planning to fully address. For example, right now experts are aware of a number of high priority initiatives that could be undertaken right away. These include more research and monitoring on alien species, enhancing capacity within the NGO sector for effective institutional management and fundraising, assessing the replicability of community-based conservation approaches, developing citizen marine conservation action committees on each island, developing arguments for conservation through socioeconomic research and monitoring, assessing and developing opportunities for enhancement of protection regimes, and several others. Efforts that will require long-term collaborative planning approaches for conservation include developing an ecosystem prioritization and a comprehensive ecosytem-based conservation strategy, raising awareness in specific sectors of the importance of marine conservation, and building capacity in targeted sectors for more effective ecosystem-based management. In addition to this general theme there were numerous specific recommendations.

RECOMMENDATIONS

Below we provide a short synopsis of the current activity under each recommendation area, gleaned from expert interviews and literature. The synopsis is then followed by a list of summarized recommendations made by experts. In some cases, the same recommendations have been made by most, if not all, experts. In some cases, only one or a few experts made a particular recommendation. While we do not provide an accounting of how many experts made a particular recommendation, we do indicate the general level of expert enthusiasm for particular recommendations. In some cases, recommendations made by only one or two experts were subsequently cross checked with other experts for general applicability.

Recommendations from experts fell into several readily distinguishable categories, each with several individual supporting recommendations:

- Create Awareness and Demand for Conservation Management at all Levels of Society from the Public to Decision Makers
- Encourage Comprehensive Marine Ecosystem Planning and Implementation
- Specific Marine Protected Area Recommendations
- Improve Communications and Collaboration Among Stakeholder Groups
- Build Capacity for Effective Natural Resources Management
- Address Alien and Invasive Species
- Expand Community-based Coastal and Nearshore Marine Management including the Documentation of Indigenous Knowledge
- Effectively Manage Nearshore Commercial and Recreational Fishing
- Address Coastal and Upland Development and Land-based Effects on the Sea
- Additional Recommendation from the Consultant: Develop Sustainable Financing Mechanisms to Support a Massive Scaling Up of Marine Conservation Activity in the State.

Create Awareness and Demand for Conservation at All Levels of Society from Public to Decision-Makers.

Overwhelmingly, experts interviewed reported that creating awareness and demand for conservation is the highest priority activity to be undertaken to improve marine conservation management. As discussed in the obstacles section of this document, numerous experts independently identified a lack of awareness, attitudes that are ambivalent or opposed to marine management, and limited political will as key constraints to effective management of marine resources.

Current Status

Based on the interviews conducted, it appeared that many people have been thinking about the need for more effective environmental awareness and education. There are several ongoing programs that are delivering excellent education. However, experts indicated that none of the current initiatives are of the scale that will be needed to create change in attitudes. They suggested a much larger and more strategic initiative should be developed to target different levels of society.

The Division of Aquatic Resources (DAR) and other organizations are currently in conversations about how to put such an initiative together. They have noted a need to build a bridge between many different stakeholder groups, including academia, the community, the government, and other interested parties. DAR has recognized its limited capacity to design such an initiative and, as a result, has expressed the need to involve highly skilled public relations and marketing experts.

Recommendations

The development of targeted and effective awareness efforts is complex and must be pursued with care and purpose. However, based on expert comments several recommendations have emerged. Each of the following recommendations should be pursued with the assistance and advice of professional public relations and communications experts who know how to effect change through awareness efforts and who understand the situation in Hawai‘i.

Conceptual recommendations from experts included:

a. **Develop campaigns and communications strategies with professional public relations experts who know how to get messages out, and target specific results.** While general campaigns to raise awareness are important, there is also a need for campaigns that target specific results. These campaigns and awareness efforts should be logically linked to upcoming or proposed changes in management that will result in more effective marine management. In other words, some of the awareness campaigns that are pursued should be designed specifically to create demand for change and/or to create an environment for the creation of more effective marine resources management strategies.

b. **Clearly articulate the biological and social objectives that must be achieved to improve the condition of nearshore resources as a guide to developing an effective communications strategy.** We discuss this in detail in section Number 2 of this chapter. Remember, the conservation community is only one set of stakeholders. Other users of marine resources depend on the existence of marine resources. This is to the advantage of the conservation community. However people’s motivations for management may stem from the desire to use resources not to conserve them. Environmentalists must remember this and work toward the overlap between environmental concerns and use concerns.

c. **Precede any proposed regulatory changes with significant public awareness and outreach campaigns.** All proposed changes in regulations or management strategies must be prefaced with well thought out communications efforts. Budgets for resource management in the state are very small and often outreach and education is not affordable. However, experts feel these are essential to effecting change. If you can’t effect change you might as well not bother doing the research and developing the proposed measures. Preparation and follow through with education and outreach is absolutely essential.

d. Do not pursue resource conservation education and outreach from the environmental angle only. Pursue a much larger vision than environmentalism. We must couch appropriate resource management in a way that appeals to a number of stakeholder groups, garnering the largest amount of support possible. Messages that emphasize the goal of protecting our current way of life and the future for our children may be some of the most effective messages, but we should test these and other messages in focus groups to ensure that we can get our points across.

e. Develop mechanisms that allow people to come to their own conclusions regarding the need for environmental measures such as take limits or fisheries replenishment zones. Providing people with the information they need to come to their own conclusions is the best and most effective approach. Ellyn Tong and the Western Pacific Fisheries Coalition have done an excellent job of this through their series of posters. These posters never tell people what they should do to protect fish. They simply show that fish don't reproduce until a certain size and that they produce more eggs if they are larger. The conclusion to leave small fish and some large fish can be made by people independently. The key is to get enough of these types of messages out that a large-sector of society can make its own conclusions and that these conclusions will help support improvement in the condition of the resource.

f. Highlight the economic value of marine resource including working with the tourism industry to help them recognize their potential losses as marine resources decline and to increase their demand for improved environmental protection. Inform the public and decision-makers of the economic value of the intact marine environment to the state. NGO/industry partnerships and private-public partnerships may be a good way to move forward. According to experts there is a need to build up awareness and demand for improved conservation in the tourism industry. If the tourism industry demands greater responsibility in marine management, this may have some impact on creating political will among the state decision-makers. One expert reported an unofficial statistic that up to 15% of tourists on Maui actually have left because of the algae bloom. According to the same expert, the dive industry is reported to be losing money due to diminished environmental quality.

g. Encourage fishermen to fish responsibly through numerous techniques

- Highlight and publicize the apprehension and penalties on violators.

- Provide youth with tools to encourage their parents into fishing responsibly.
- Conduct and publicize an independent review of fisheries status relative to past stock conditions.
- Create awareness whereby peer pressure will help to influence fishing practices.
- Launch an emotionally appealing public campaign with a well-known and respected Hawaiian figure and with fishermen from many walks of life**.**
- Educate judges on the seriousness of marine violations and the existing public demand for adequate punishment.

h. Publicize assessments of the condition and marine resources in the MHI. Evoke pride in what Hawai‘i has and concern in how resources are declining.

i. Utilize existing MMAs and other entry points to the marine environment, such as harbors, as effective platforms for marine education through volunteer programs. One expert suggested that school groups or others could be stationed at MPAs, such as Pūpūkea, on weekends and provide outreach and awareness materials. While it would need to be studied and carefully designed, there is a possibility that these groups could provide surveillance to report on resource violators. The new take size and bag limits may provide an excellent test case for developing a program to expand awareness and better enforce compliance through use of citizen volunteer groups stationed at key MLCD's and other entry points to the sea.

j. Support NGOs to more actively and publicly question why things are not changing. Even though funding has come in, things simply are not changing. NGOs should emphasize this.

k. Develop a Series of Public Meetings to Promote Public Support: Once some degree of awareness has been raised, a series of public meetings should be held across the state linked to specific environmental initiatives. These meetings could be a tool to galvanize public support. This recommendation was made based on a belief that local communities are the moving force behind conservation initiatives. Local people also need a way to influence decision-makers in their areas. Public meetings could provide communities with an opportunity to speak to legislators and other decision makers about their concerns. For example, public reaction to the Maui algae bloom resulted in improved sewage treatment on Maui.

l. Hold more discussions about these issues, keeping in mind the recommendations made by various experts that are summarized

above. A small group of key marine conservation organizations could consider discussing a communication strategy, and do so with the advice of a trained public relations expert.

This study confirms that the conservation community of Hawai‘i is very interested in further developing effective awareness and education strategies. The overall recommendation is:

Develop a targeted working group of relevant actors to develop a comprehensive communications strategy with the assistance of public relations experts who understand the Hawaiian context. Such a strategy should take into consideration all the recommendations summarized above.

Initially it's important to keep the group small enough to be workable and expand the group later if needed. One important way to develop such a group and also be careful not to take too much of anyone's time is to form a small committee with a group of advisors that can be brought in on specific issues.

Encourage Comprehensive Marine Ecosystem Planning and Implementation

As noted previously, experts expressed that a major obstacle to the long-term conservation of Hawai‘i's marine biodiversity is the lack of a comprehensive ecosystem perspective. Experts interviewed have reported that species and site-based management approaches are important, but unlikely to be effective in the long-term. An ecosystem approach takes into consideration the needs of the overall ecosystem including persistence of large enough areas of natural habitats to support viable populations of species, multi-species interactions, outstanding biological phenomenon such as altitudinal movements and migration, and other biological features that are critical to maintaining an intact ecologically viable ecosystem. Conservation actions under this type of management typically include development of a mosaic of interacting protected areas that are large enough to ensure conservation of key features of the overall system (see Box 3 Ecoregion Conservation Approach on page 42).

Current Situation

In Hawai‘i, traditional community management techniques followed an ecosystem-oriented approach. They responded to the cycles and fluxes of larger areas of sea and coast and numerous species populations, rather than tracking the population fluxes of any one species. The ahupua‘a approach is a well-known example of how Hawaiian people managed on a more comprehensive ecosystem basis. However, modern management techniques in Hawai‘i, have focused more on individual species management and there are few if any areas across the state that are currently effectively managed with an integrated ecosystem approach.

There have been several attempts to move toward integrated ecosystem management, and state agencies, such as the Division of Aquatic Resources, want to pursue this approach.

In interviews for this study, DAR staff identified Marine Protected Areas (MPAs) as one proven way to effectively move toward improved ecosystem management. Complete adoption of this style of management has been constrained by limitations in funding, human resources, public sentiment, and political constraints. These attempts have also been constrained by the perception that ecosystem management is only for the benefit of the biological system, and not for the benefit of people. As a result, experts suggested that any move to ecosystem management must consider biological priorities, human needs, and be accompanied by targeted outreach and education programs. (see Section 1 in this chapter).

One of the primary recommendations of the 1991 Ocean Resources Management Plan (ORMP) was to "Implement a Regional Management Approach" that embodies the concept of integrated ocean and coastal resources management. This recommendation was based on the finding that Hawai'i's ocean and coastal management had been "reactive and issue-driven rather than anticipatory" and that management responses had been isolated and relatively ad hoc. While the ORMP laid out a comprehensive and progressive vision for integrated ecosystem-based management, most experts interviewed felt that the steps to implement this had not been fully put in place, and as a result Hawai'i still does not manage marine resources in an integrated way.

Emerging efforts to manage marine ecosystems in a comprehensive way include attempts to manage larger areas of the nearshore marine environment, and attempts to link land and watershed management to marine management. For example, the Mo'omomi program and the Kona Coast Fisheries Replenishment Areas attempt to manage relatively large marine areas and include consideration of biological needs as a primary management element. However these examples do not include full no-take and comprehensive ecosystem management as they have not been delineated with all biological features in mind.

The resurgence of the ahupua'a system has played an important role in promoting ecosystem and landscape/seascape approaches. The government and numerous community groups and NGOs are supporting ahupua'a approaches to watershed management and want to link these efforts to the marine realm, although currently no efforts to do this are fully developed.

Identification of Important Areas for Conservation and Ecosystem Management

According to experts, there have been a number of exercises to identify priority areas for conservation. These include a multi-stakeholder process carried out prior to the initiation of the Hawai'i Coral Reef Initiative (HICRI). Likewise, according to other experts, NOAA is initiating a process to redo the Hawai'i Atlas Maps that were originally developed in the 1970s. In addition, there are ongoing efforts by NOAA to map the bathymetry and the coastal and nearshore habitats of the MHI.

Several experts stressed that the consensus-building process involved with HICRI was particularly useful at generating an ongoing discussion of priorities. However, this discussion and consultation process was carried out without any long-term funding or

staffing and, as a result, tended to break down once HICRI was in full implementation. As a result, experts recommended that efforts continuing this process must be adequately funded to ensure follow-up and prevent participant frustration.

The Ocean Summit

Currently, the Coastal Zone Management (CZM) Program of the Department of Business and Economic Development and Tourism (DBEDT) is planning to revise the Ocean Resources Management Plan to "provide a more strategic approach to ocean resource management that coordinates the management of ocean resources by government, private industry, the scientific community, and the public," (Ocean Summit Investigative Subcommittee (OSIS), 2001). A key element of this revision process will be the Ocean Summit, as well as pre-summit and post-summit workshops, that will bring together various ocean-related sectors of government, private industry, the scientific community, and the public. The Ocean Summit and related workshops will generate amended goals, objectives, priorities, and guidelines to ensure successful implementation of the revised ORMP (OSIS, 2001).

The Ocean Summit intends to:

1. Facilitate integrated ocean and coastal management, including watershed and ahupua'a management
2. Incorporate public input through citizen participation in pre-summit workshops and post-summit focus groups
3. Incorporate elements of pre-existing projects and programs (local and abroad) that have been successful; and
4. Develop strong partnerships in order to successfully complete and implement the updated ORMP.

In particular, element number one will support the further development of an integrated ecosystem management approach. Number four is important, as the CZM program has no legal mandate to implement resource management. Implementation will depend on partnerships with other agencies and demand from public and private sectors that marine resources be managed appropriately.

Conceptual Recommendations

a. **Develop a more comprehensive ecosystem-based marine management approach that balances the objectives of various user groups.** Many experts felt maintenance of ecological systems and biological resources should have an equal footing with demands for economic and social uses of marine resources. Currently, social and economic interests outweigh biological interests in resource management decisions. However, the social uses and economic value of marine resources depends on the biological health of those resources. Demonstrating this and reconciling biological needs and human interests is the key to effective long-term ecosystem management.

b. **Give various interest groups an opportunity to articulate their objectives and share their ideal vision of nearshore marine resources.** By providing different groups an opportunity to articulate their objectives, various interests can be better reconciled, by demonstrating that the needs and interests of all groups are being considered. According to experts with a socioeconomic perspective, attempts to put science and biology before social issues have not, and will not, work. According to experts with a scientific background, identifying important areas for marine conservation based on socioeconomic and other non-biological criteria will dilute biological priorities and set the bar for conservation management artificially low. As a result, one expert recommended that both sets of interest groups be allowed to voice their objectives in a separate but linked process. Efforts could then be made to give proper attention to all sets of objectives and find a compromise.

c. **Work with Hawaiian and fishing groups to encourage their support for improved ecosystem management and provide support for these organizations to enhance ecosystem management.** Many experts said that efforts by conservation organizations or by non-Hawaiians and non-fishermen to promote ecosystem management are likely to be rejected by these groups. As a result, there is a need to support both fishers and Hawaiians who support these efforts.

d. **Efforts to promote greater ecosystem management must be based on science and accurate information.** Currently several groups are arguing against improved marine resource management, claiming a lack of data or sufficient information to justify a change in policy. As a result, any effort to improve ecosystem management must be supported by accurate information, including information generated by government agencies. This may require the hiring of researchers to gather and synthesize this information.

e. **Demonstrate that ecosystem management benefits all stakeholder groups.** A productive ecosystem is the foundation upon which all human uses of natural resources depend. Therefore, it is critical to demonstrate to various stakeholder groups, including fishers and native Hawaiians, that ecosystem management is designed not just to conserve important biological areas, but also to ensure their long-term access to important resources.

The following set of recommendations, based on expert opinion, suggests ways to begin moving toward more integrated ecosystem management.

Specific Recommendations

a. **Create a task force or working group of key individuals and organizations to focus on biodiversity conservation and ecosystem management.** Experts suggested that there have been many useful group processes on ocean resources management, but some have been constrained by trying to involve too many

stakeholder groups. Therefore, experts suggested that smaller task groups be formed on specific issues, such as expanding ecosystem management.

b. **Continue and/or update the process of identifying important areas for biodiversity conservation and ecosystem management.** Several experts noted a need to build on past efforts when identifying important areas for conservation and develop a science-based ecosystem assessment of priority areas. Some indicated that earlier exercises while very useful, did not include enough input from marine scientists who understand the role particular areas may play in the biodiversity and ecosystem processes of the MHI. Others have suggested that the earlier processes need updating as new threats, such as alien species and major sedimentation, have emerged. Other experts have said that people may be tired of group processes because many of the previous attempts seemed to have little affect. Agreeing with this, other experts have said the key will be to adequately resource the next steps in this process. Earlier attempts were mostly done on a volunteer basis and, while outstanding, were not able to sustain the level of activity. Experts recommended that this identification/prioritization process should be in parallel process to the ORMP revision.

c. **Develop a strategic action plan for achieving comprehensive ecosystem management**. It is not possible to adequately pursue effective ecosystem management until there is a clear articulation of priorities, goals, objectives, milestones, and indicators of success in this arena. As a result, several experts recommended that a strategy be developed for more comprehensive ecosystem management. Some referred to it as a plan, while others suggested it is best called an Action Strategy. Experts suggested that this process should be pursued in parallel to the revision of the ORMP. While the revision of the ORMP is a good vehicle for more comprehensive ocean management, it involves a large number of sectors, such as harbors and ocean safety, that may not need to be directly involved in the ecosystem management decisions. Therefore experts recommended that a parallel process to identify objectives and criteria, as well as important biological areas, should be pursued.

d. **Conduct a valuation of the economic and cultural importance of Hawai‘i’s marine natural resources.** More than any other state in the U.S., Hawai‘i depends on its ocean resources for its economic stability. Tourism is Hawai‘i’s largest industry and a very large percentage of these tourists engage in marine-related activities. Many of these activities, such as sport fishing, snorkeling, diving, surfing, beach going, depend directly on healthy coastal and nearshore marine ecosystems. By clearly articulating the economic value of the intact marine environment, the marine resource conservation community will be better armed with convincing arguments for ecosystem management. It should be noted that efforts to economically value coral reefs will be funded by HICRI this year. The principal investigators on this study should be contacted to determine the scope of their study before pursuing additional valuation studies.

e. **Support the revision of the ORMP.** Link this process to adequate public outreach and awareness building. Create a demand for effective marine resources management and adoption and the full implementation of the ORMP.

f. **Support community and other attendance at Ocean Summit.** This is a fee-based summit. Fees often dissuade participants who would contribute to and benefit from such an event. A support program for attendance should be developed and highly publicized. It should include grants for travel and accommodations from neighbor islands, and other pacific countries.

g. **Support efforts on habitat mapping of coastal and nearshore areas around the state.** Work with the Marine Ecosystem GIS Working Group to do so.

h. **Through the data synthesis and prioritization process, identify additional needs for biological and socioeconomic research**.

i. **Assess the current biological, socioeconomic, and political situation of areas that have been identified as high priorities for conservation.**

Create New Marine Protected Areas

Overwhelmingly experts interviewed proposed the need for MPAs. Many experts cited data from around the world that demonstrates the benefits of "no take" reserves, with increases in fish biomass and fish catch to improvements in live coral cover and biodiversity. One expert stated that the lack of full "no take" zones in Hawai‘i is a major obstacle to long-term effective management. Still another expert said that we would best serve ourselves and the next seven generations if we set aside as many "no take" zones as possible. And yet another expert cited data that indicates partially protected areas in Hawai‘i may actually be in worse shape than completely unprotected areas, because the current protected areas promote access. Other people while supportive of these reserves, suggested that the name itself immediately turns people off and therefore must be amended.

Specific Recommendations on MPAs.

a. **Develop a common language for MPAs in the state that is less threatening to various user groups.** Various terms have been suggested, including Marine Managed Areas, Fishery Replenishment Zones, and others. The key is to use a terminology that does not immediately set interests groups against the initiative. For the sake of discussion we use the term Marine Managed Area (MMA).

b. **Partner with Hawaiian groups and fishing groups to promote the expansion of the State's current system of MMAs.** Several experts said that these groups rather than mainland-based NGOs or the State should be at the forefront of efforts to improve ecosystem management and develop a larger MMA system.

c. **Initiate a collaborative process to identify and designate MMAs that serve an ecosystem management role. Tie this specifically to efforts recommended above to identify which areas are critical to conserving the marine resources of the MHI.**

d. **Support the creation of a Marine Managed Area Unit within the DAR and support the planned DAR process to improve MMA management in the state.**

e. Undertake a Marine Managed Area Gap Analysis to investigate how adequate the current marine management regime is in meeting the needs in ecosystem management: This is being pursued by DAR for Maui County, but may need additional support and partnerships. Link this to the DAR Marine Protected Area Project.

f. Investigate the legal and financial possibility of creating a Learning Reserve or a network of learning reserves across the MHI. One expert who is very involved in marine education suggested that having areas set aside as learning reserves for the education of children and others is an excellent way to achieve to objectives simultaneously, i.e. the comprehensive conservation of an area and the education of the next generation of resource stewards.

g. Investigate the feasibility of creating more community-based MMAs, such as Mo‘omomi. Many individuals have said Mo‘omomi is a unique case that might not be generally applicable. Given its success to date, it would be very useful to investigate the feasibility of expanding this model to other places throughout the state. If it proves to be an applicable model for other places, it would be important to adequately support efforts to replicate parts of this model in other areas.

h. Adequately study the economic and biological value of MPAs. The Hawai‘i Coral Reef Initiative Research Program will sponsor efforts this year to better understand the economic value of coral reefs in the state. Experts suggested that there is also a need to better understand the economic and biological value of MPAs.

i. Link all efforts to enhance MMAs to strategic public relations and awareness raising efforts. This includes raising awareness of the value of MMAs to key sectors of society including the government, the fishing community, the tourism sector, and the public at large.

j. Study the role of large artificial reefs in providing ecosystem benefits, such as protection of populations of multi-species and their interactions. One expert suggested that large artificial reefs could create natural refuges for large fish, because fishermen couldn’t get to them in the interior. This creates a refuge with no need for a “no take” zone. The expert also suggested that reseeding of coral

can create a thriving ecosystem that would be acceptable to fishermen, because they could still fish on them. Permitting is a major constraint to setting up an artificial reef program. This expert also said that current regulations on artificial reefs are very difficult to comply with, and there is a need to simplify the permitting process.

DAR MPA Analysis

In addition to updating the ORMP, the DAR is making an effort to better understand the effectiveness of existing MPAs and identify where additional MPAs may be needed. This effort will focus on Maui County initially and is working to identify areas that would be appropriate for revised types of marine management. Activities under this project will include classification of habitats that are important for biological conservation, mapping habitat ranges for a number of important species groups, a gap analysis between areas important for conservation and existing MPAs, and development of a new framework for MPA designation based on biological and social criteria. Possible categories of MPAs include recreational (these already exist), biologically determined MPAs, limited-use MPAs that will support fish replenishment, and culturally important MPAs. This study will allow DAR to make recommendations for new classes of marine managed areas and will provide information needed to identify new areas to be managed.

Box 3 The Ecoregion/Ecosystem Conservation Approach

In recent years, a number of major conservation organizations including the World Wildlife Fund, the Nature Conservancy, the World Conservation Union, and others have increasingly recommended scaling up conservation efforts to protect larger integrated ecosystems. Historically conservation has focused on specific sites for protection and these are rarely larger than individual national parks or MPAs. Conservationists feel these approaches are not enough however, to protect a representative complement of the world's outstanding biodiversity. We must collectively move behind these site-based approaches and protect ever larger areas in a biological logical way that ensures that important species, habitats, ecosystem processes, and other features are not lost. These larger areas are referred to as ecoregions and are delineated by biologically distinct and interdependent habitats and species assemblages. Through rigorous scientific analysis, Conservation Biologists have identified a large number (hundreds) of ecoregions across the world. Examples, include the Galapagos Islands, the Chihuahuan Desert in Mexico and the U.S., the Bering Sea, between Russia and Alaska, and many others. Due to its isolation, Hawai'i's marine realm has been identified as a distinct ecoregion and conservation priority.

Now that a large number of the world's high conservation priority ecoregions have been identified, conservation scientists felt we must establish a methodology to conserve these large areas. Recognizing we cannot conserve everything in such vast areas (for example, the Chihuahuan Desert includes several large towns and cities as does Hawai'i's marine ecoregion), a methodology was developed to identify which areas within an ecoregion must be protected to maintain the biological character of the system overall. The goal of this Ecoregion Conservation approach is to protect a biologically logical mosaic of important places that will include a representative set of the species, habitats, unique biological phenomenon, ecosystems processes of an ecoregion. By establishing such a mosaic of protection we can be sure that no key element of the system overall is lost and as a result fifty, one hundred, or even one thousand years from now ecoregions that are conserved through this approach should continue to be ecologically viable and maintain the biodiversity that made them so distinct to begin with. Putting this theory into practice is extremely challenging given competing human interests; however conservationists feel it will be necessary or we will continue to lose our outstanding natural heritage.

The process to conserve an ecoregion includes:

1. **Prioritization of Important Conservation Areas through an Ecosystem Approach**: An ecosystem approach takes into consideration the needs of the ecoregion/ecosystem (its processes, habitats, and species) overall.

This prioritization is guided by the basic goals of conservation biology. These include:

- Conserving areas that represent the full range of habitats and ecosystems
- Maintaining viable populations of key species
- Protection areas that are large enough to ensure resilience to stochastic events, such as cyclones, bleaching events, earthquakes etc.

2. **Analysis of Threats, Socioeconomic and Political Feasibility, and Obstacles to and Opportunities for Conservation**: Conservation dollars are unfortunately limited. As a result, we must utilize them where we feel, they will be most effective. To do this, conservationists want to have a good understanding of the degree of threat to any one priority area and the feasibility of making conservation work. For that reason, we must carefully analyze the socioeconomic and political situation across the landscape of priority conservation areas and develop our strategies keeping in mind any obstacles to and opportunities for effective conservation.

3. **Development and Implementation of a Collective Conservation and Management Strategy**: Once the priority conservation areas of an ecoregion have been identified, and the socioeconomic aspects have been assessed, a collective conservation and management strategy can be developed and implemented. This strategy should set the road map for the collective action by a large suite of actors to effectively conserve high priority areas over time.

Hawai'i has never gone through such a process and many experts have recommended that some contextually appropriate variation on this approach be pursued.

Improve Communications and Collaboration among Stakeholder Groups

An obstacle mentioned by several experts is the limited communications and coordination between the various agencies and organizations involved in marine management. Many initiatives have required a high degree of coordination and collaboration, such as the development of the ORMP and the identification of important areas for conservation. While experts cited satisfaction with many of these processes, they still cited a lack of consistent communication and collaboration as an issue of concern. Given the relatively limited amount of funds available in the State for marine conservation, some experts felt more collaboration could help to increase efficiency and efficacy of marine management actions.

Current Situation

Recognizing the general interest among the marine management community for increased communication and collaboration, the Secretariat for Conservation Biology at the University of Hawai‘i successfully secured private foundation funding to help enhance coordination and communication on marine management activities. The Secretariat has formed an interim steering committee and is currently developing a strategy for increased information exchange and collaboration between agencies and organizations that have an interest in Hawai‘i’s marine resources.

Steps in this process will include: An Inventory of All Current Activities; Design for a Communications Network; Develop a Strategic Plan for a Communications/Collaboration Network (focused on managing information); Develop Proposals to Implement the Plan; Outline Priority Issues for Research and Action in Marine Management.

Recommendations

a. **Capture lessons learned from previous collaborative efforts for marine and coastal management in Hawai‘i.** To be successful, many of the recommendations of this study require collaborative efforts between and among the major stakeholder groups in marine conservation in Hawai‘i. As a result, we recommend a short review of previous efforts to collaborate on marine conservation in Hawai‘i. A few simple lessons learned from earlier attempts to collaborate, suggest that collaboration appears to work best if:

    - Participants see a clear benefit to their direct daily activities. In other words, participants can do their job better as a result of the collaboration.
    - Participants recognize a clear benefit to conservation. While an improved ability to do one’s job is critical, to remain motivated participants must feel the collaboration will create results that exceed the outcomes the individual agencies would achieve independently.

- Participants appear to respond best on collaborative efforts if they are specific, and roles and responsibilities are somewhat predictable.

- In areas where the need for collaboration is open-ended, collaborative activities should not be fully dependent on securing outside resources. These resources may be a long time in coming or may not ever become available. In these cases, if the outside resources do not become available, the collaboration may simply fail. If the collaborators can find some means by which they can work together using existing resources, this is generally more effective.

b. Support and participate in efforts by Secretariat for Conservation Biology to improve communication and collaboration. The group sponsored by the Secretariat for Conservation Biology has made some progress in initiating a communication network. While the broad spectrum of marine resources stakeholders are not yet part of the process, the initiative intends to do all that it can to be inclusive. If well designed and supported, this group should serve the function of improving communication and provide a forum for increased collaboration.

Within this context, the following additional initiatives to increase collaboration are recommended.

- An annual gathering on the state of ocean resources in Hawai‘i with adequate representation and presentations from all stakeholder communities.
- A quarterly newsletter or supplement on the state of Hawai‘i’s marine resources and current efforts to effectively manage these resources.
- Periodic topical meetings on particular conservation and management strategies including participation of other Pacific Islanders. At least two experts interviewed suggested that the people of Hawai‘i would be well served by increasingly looking to the rest of the Pacific to learn and share about resource management.

Building Capacity for Effective Long-Term Resource Management

Capacity building is a broad and crosscutting topic that spans all aspects of natural resources management. For the purposes of this study we defined capacity building as any effort to create a set of skills or abilities that enables an individual, organization, or stakeholder group to be more effective at natural resources management. Under this broad definition, capacity building activities can range from the short term, such as supporting attendance of a workshop with new modes of thinking, to the long-term, such as supporting students pursuing graduate training in natural resource management.

With this as background, the study asked a broad range of stakeholders what they feel should be pursued to build capacity for more effective management of Hawai‘i’s nearshore marine and coastal resources. Some recommendations for skill building are

discussed in previous chapters. However, recommendations specific to building institutional capacity across a range of conservation activity areas are discussed below.

Current Situation

According to experts, the current situation in the State is one of extremely limited capacity to adequately address the needs of marine conservation and management.

Specific Capacity Limitations at the State Government Level

a. DAR has a total budget of only $5 million annually and has relatively few staff on islands other than O‘ahu. For example, there are only two coral reef biologists (one on O‘ahu and one on Hawai‘i) in the entire state.

b. There are a number of key positions that DAR has not been able to create due to financial constraints. According to DAR these include Community Outreach Coordinator, Marine Protected Areas Coordinator, Endangered Species Specialists, Alien Species Coordinator, and Human Dimensions Coordinator. There is also a need for greater GIS and databasing capacity, sufficient fresh water biologists, and sufficient biologists and coordinators on each island.

c. DAR does not have a strategic plan and has not developed biologically based objectives and targets. DAR did develop a vision of what it would like to pursue, but discovered this would require twice their current budget.

d. When strategic plans have been developed, numerous sets of constraints and obstacles, including lack of staff and financial resources, generally result in the plans not being fully implemented.

e. The existing Ocean Resource Management Plan (ORMP) does not include targets or indicators that are biological in nature, but primarily focuses on process targets and activities. This plan also has no indicators of success. As a result, there is no comprehensive way to determine if the plan is achieving its goals. Finally, the plan does not carry the force of law and, therefore, has never been implemented. Also, this plan is so comprehensive in nature that it does not provide sufficient detail on biological and ecosystem concerns.

f. There is no effective mechanism in place for government agencies with overlapping jurisdictions to coordinate or communicate on issues of concern to both.

g. Government salaries, particularly at the state level, make it difficult to find and retain staff with sufficient training and expertise. It also limits the agencies’ abilities to be as effective as possible.

h. Opportunities for staff training and professional enhancement are limited by financial resources and, in some cases, by attitudes.

Capacity Limitations Emphasized at the Non-Government Level

a. NGOs are constrained by limited staff and financial resources. For example, one organization interviewed, felt their limited ability to raise funds was directly related to the limitations of their staff and board. They felt they needed to hire new staff to guide the organization strategically, while also helping them to raise funds.

b. NGO boards are not well-equipped and often do not fully understand their roles.

c. Burnout is highly likely for the staff of many small NGOs. In these organizations, staff serve a wide range of functions from programmatic, to diplomacy, to community outreach, to administration, to accounting, to fundraising. Many small NGOs have only one or two full-time staff and it is extraordinarily difficult for any one person to maintain work in all these areas.

d. Time constraints make it extremely difficult to train people to work more effectively. Also, annual funding cycles often mean that staff can only be brought on for a year, making it difficult to invest in training.

e. Many small NGOs are formed by concerned citizens around specific issues. Some may go dormant or disappear if the issue is addressed or if the lead individuals burn out or refocus on other issues in their lives. However, in many cases, particularly in legal battles, the issues may go on for years and years. Many NGO staff work other jobs, and find it difficult to continue addressing their original objectives over many years.

NGOs identified through this study that are working on marine conservation issues in the MHI include:

- **KAHEA -** KAHEA is a new NGO that has focused most of its marine attention on the North West Hawaiian Islands, but is pursuing some projects in the MHI and has plans to further develop its portfolio in the MHI.
- **Western Pacific Fisheries Coalition** (Organized by the Hawai‘i Audubon Society) - The Coalition raises awareness and advocates for fisheries issues, such as shark finning. Upcoming efforts include advocacy for fishery management in the nearshore environment in the MHI. The Coalition also organizes a biannual Aquatics Conference (to be held in November of this year).

- **National Audubon Society** - National Audubon has a representative from the Living Oceans Program in the state. To date their program has focused primarily on pelagic fisheries and seabird by-catch issues.
- **Sierra Club** - supports marine conservation through one coral reef volunteer, who also represents Reef Check in the state. The Sierra Club has a grassroots volunteer network that can be organized both for advocacy and volunteer environmental activities.
- **Earthjustice Legal Defense Fund** - ELDF focuses its efforts on legal aspects of environmental conservation. They litigate against entities that do not comply sufficiently with environmental regulations. They provide an excellent vehicle to pursue legal sanctions against environmental abuses.
- **The Nature Conservancy** - TNC is Hawai‘i’s largest conservation organization, and has focused primarily on terrestrial conservation. In 2001, TNC is working to develop a Hawai‘i Marine Conservation Program.
- **The International Marinelife Alliance** - IMA has built its program and strong reputation in Southeast Asia and the Pacific addressing destructive fishing practices and the live fish trade. IMA has recently opened an office in Hawai‘i and may work on Hawai‘i issues. This is yet to be determined.
- **Environmental Defense Fund** - Environmental Defense Fund (EDF) has one staffer devoting some portion of time to Hawai‘i environmental issues. EDF has played an important role on marine advocacy issues in the state.
- **The Oceanic Institute** - The Oceanic Institute (OI) has one researcher that devotes a large amount of his time to conservation and conservation-related research in the MHI.
- **The Social Science Research Institute of the University of Hawai‘i** - The SSRI has staff who oversee the HICRI program and can provide consulting services to support marine conservation in the MHI.
- **The Heritage Program** - The Heritage Program currently does not devote much time to marine and coastal issues, but has both data and expertise to support efforts in this area on a contract basis.
- **The Waikīkī Aquarium** - The Waikīkī Aquarium has both an active research program that focuses considerable attention on conservation related research in the MHI, and a marine education program that reaches a high percentage of school children on the island of O‘ahu.
- **The Polynesian Voyaging Society** (Ocean Learning Center) - PVS is currently establishing an Ocean Learning Center that will develop a comprehensive marine education curriculum.
- **Hawaii Wildlife Fund -** supports various marine life research projects, coordinates a volunteer turtle monitoring program and trains marine naturalists.
- **Hui Malama O Mo‘omomi** - The Hui has focused its attention on the community-based management of the marine resources of Mo‘omomi, a coastal area on West Molokai (see Box 4 on page 65).

We apologize if any descriptions are inaccurate or if we have missed any important groups and will gladly update this list based on your comments.

Recommended Activities to Build Capacity for Long-Term Conservation Impact

Focal Areas for Conservation Capacity Building

Experts have cited a wide range of areas where skills and competancies need to be built to be more effective at conservation management. Their recommendations include:

a. **Hold an NGO brainstorming session to discuss the institutional capacity needs of local organizations.** Many local organizations suffer from similar constraints, such as difficulties in strategic planning, fundraising, administration, board relations and responsibility, and many others. As a result, bringing various NGOs together to discuss issues that they face in building their institutional capacity and sustainability would be very useful. This input can then be used to develop mechanisms to support NGO capacity strengthening in the state.

b. **Develop mechanisms to support capacity building for organizational development.** To address current capacity limitations in NGOs and people's associations, it was recommended that some sort of facility be established to provide institutional development support and skills strengthening support for NGOs. This program would assist local NGOs and people's associations to develop particular skills, such as fundraising, board development, and accounting.

c. **Support DAR to increase their ability to more effectively manage biodiversity and natural resources.** According to the DAR, a number of programmatic needs are not being served due to staff and financial constraints. DAR also does not have a strategic plan and has not developed clear biological objectives and indicators for their programs. Given DAR's critical position and mandate, this agency must have sufficient capacity to do its job properly if we want the condition of marine resources to improve. Experts suggested supporting DAR through a multi-tiered effort that includes strategic planning and goal setting, support to key positions, and creating public demand for increased funding support for marine and aquatics management.

   Because the State is not able to completely perform the tasks of its mandate, the private sector can help to fund key positions. However, this should be an interim arrangement and efforts to increase DAR funding should come directly from the public and from industry as awareness of needs in marine management is raised in these sectors.

   DAR specifically highlighted the following positions that can be funded by the private sector. Each position should have an accompanying program with staff and resources:

   - Threatened and Endangered Species coordinator
   - Community Affairs coordinator
   - Alien and Invasive Species Coordinator
   - Marine Managed Area Coordinator
   - Information and Education Coordinator

- Human Dimensions Coordinator

Many other states have programs that focus on the human dimensions of resource management. However, DAR has no staff to focus on this area. Conflicts between DAR and the public have been common over the years and could have been more effectively dealt with, or perhaps prevented, had DAR had staff to support information and education, community affairs, and the human dimensions of resource management.

d. Strengthen enforcement capacity. According to a large number of experts interviewed, the current enforcement capacity of the State is extremely limited. Unfortunately, we were not able to interview the Division of Conservation and Resource Enforcement for this study. There are financial and human resource, as well as attitudinal and motivational, constraints that limit effective enforcement and accountability. Experts have suggested that there is a need for increased funding for enforcement, which can mostly be achieved through the public demanding effective enforcement. Likewise, experts have also suggested that public demand for effective enforcement may improve accountability, attitudinal and motivational concerns. Enforcement agents may not currently be motivated to enforce since they may perceive negative public sentiment toward resource law enforcement. Greater public demand may help agents feel they have support and a mandate from the public. Training public groups to provide surveillance roles may be an effective tool as well.

e. Build community capacity to participate effectively in resource management. According to experts there are numerous communities across the state that want to protect marine resources in their local areas, however they are constrained by many factors, including limited resources, a limited knowledge on how to organize themselves, and limited time to work on issues. In most cases local communities pursue environmental activities completely on a voluntary basis. Experts recommended providing some sort of facility to provide these groups with institutional, financing, and programmatic expertise, so they can conserve local resources and/or defeat efforts, such as coastal development, that may threaten local resources. Some experts suggested funding a centralized group that could subsequently work with and fund local groups while others recommended funding each group independently. Another related recommendation was to develop community task forces to undertake monitoring, surveillance, awareness raising, and environmental advocacy. According to one expert, an excellent way to organize with communities is to form regional task forces that can work on monitoring, surveillance, awareness raising, advocacy, and other elements of environmental protection. These groups can not only be supporters of the improved management, but also bring an intimate knowledge of local areas to the environmental movement. Combining this recommendation with a central pool of resources as proposed above will be an excellent mechanism to effect community-based change throughout the islands.

f. **Educate judges as to the importance of marine management and the need for stricter penalties.** Many experts have cited the limited penalties for environmental violations as a major constraint to effective deterrence. Other experts cited that there are a shocking number of environmental law violations that go in the state regularly, but that many are never reported and others are not prosecuted. Those that are often do not receive sufficient penalty to constitute a significant deterrent to further violations. As a result, there is a serious need to educate judges as to the importance of environmental management and the need to levy considerable penalties in prosecutions.

g. Support student training and internship programs. Students are not only important resource users, but can also be excellent stewards. Currently, the marine conservation community in the state has very few human resources. Building a cadre of well-trained students who are motivated to work on marine resource conservation is an excellent means to create more capacity in the state. Of course such an initiative must also be accompanied by growth in the NGO and other sectors that will eventually be able to provide meaningful employment for these trainees. Supporting an internship program at the high school, college, and graduate levels is an excellent way to create support for immediate efforts and to build capacity for long-term involvement in the conservation movement in the state.

h. Develop a marine conservation scholars/fellows program for Hawaiians. Experts also noted that a limited number of people of Hawaiian ancestry are working in marine management and conservation. As a result, several experts suggested establishing some sort of program to enable Hawaiian's to bring their skills to bear on marine resource management and learn more about marine conservation.

Address Alien and Invasive Species

As discussed in Chapter 2, invasive alien species are a recently identified but significant threat to Hawai'i's nearshore marine ecosystems. In some areas, alien algaes are so widespread that ecosystems have experienced complete phase shifts from coral dominated systems to systems dominated by one or a few species of algae. In other areas, exotic fish species are out-competing native species and could potentially lead to extirpation of native species. The majority of experts that were interviewed emphasized developing strategies to understand and address alien species. Most experts focused their attention on alien algae during interviews. However, experts also expressed a need to better understand and address alien fish, macro-invertebrates, marine plants, corals, and other species.

Current Situation

There have been a number of studies on alien species in the MHI. A partnership program between the University of Hawai'i, the Waikīkī Aquarium, and the Hawai'i Institute of

Marine Biology (HIMB) has worked to identify the distribution of alien algae in the MHI. The partnership is initiating studies this year to experiment with eradication methods for 5 species in Kāneʻohe Bay and Kahala Reef (Hunter and Smith, 2001). Efforts by the Bishop Museum have focused on better understanding alien sponges, invertebrates, and shipping as a means of transport for alien species. Other efforts not identified by this study may also be ongoing or planned.

While these research efforts have made progress in understanding alien and invasive species, experts have stressed that there is a dearth of information available regarding alien species. This includes which species have been introduced, the causes of alien and native species outbreaks, the current distribution of these species, the ecology of alien and invasive species, the relationship between alien, invasive, and native species, and many other topics. Likewise, there is an extremely limited budget to identify, research, and manage alien species. There is also insufficient monitoring of new introductions and the spread of species to new areas, as well as many other limitations in addressing these issues.

Currently, the primary activity on alien species is carried out by a handful of researchers at UH, HMBI, the Waikīkī Aquarium, and the Bishop Museum that, in collaboration with DAR, are trying to research and develop management techniques for these species.

Likewise, there is a partnership between the US Fish and Wildlife Service and others, such as the University of Hawaiʻi, the Bishop Museum, and the Waikīkī Aquarium, to develop management strategies for alien algae. A meeting to discuss this will be held on October 5th as a follow up to a workshop held last May that highlighted the extent of the problem and covered the identity and distribution of alien and invasive species.

According to some experts there was an earlier process to address alien species through the Alien Species Task Force which involved a representative set of stakeholders. However, this task force has not been active recently.

Some experts feel that the recognition of the problem and the increased action and resources may enable the conservation community to adequately manage for alien and invasive species expansion (at least in the case of algae). Fortunately, many species of algae remain isolated in Kāneʻohe Bay or in West Maui and are not believed to have spread to other islands. If mechanisms for eradication can be developed quickly enough, this may enable managers to eliminate or control 5 major species in Kāneʻohe Bay, preventing further expansion of their populations.

There is less activity focused on alien invertebrates and vertebrate species, including mollusks and fish species. These species have not yet caused large visible impacts, such as the algae blooms of West Maui, and therefore may garner less attention. However, the resource management community of the state is well aware of the potentially devastating impact these species could have and would devote attention to these issues if resources were available.

Recommendations

a. **Support and expand studies on eradication methods.** Well-designed and controlled studies on eradication will be funded by the HICRI this year. It is suggested to work with these researchers, to support any elements of these studies that are insufficiently funded and to help them expand these studies if needed.

b. **Raise the profile of alien species issues with state and federal decision makers:** Currently there is insufficient understanding regarding the potentially devastating impact of these species, both biologically and economically. Attention must be raised to ensure more funding and action when decision-making bodies are called on.

c. **Once effective eradication methods are understood, support implementation of these approaches**. Once eradication methods are well-tested and it has been determined which methods are the most appropriate, a full scale eradication program should be put in place. Again, this must be carefully controlled as algae can reproduce by fragmentation and therefore control and caution are immensely important in any eradication effort.

d. **Support studies on the relationship between alien algae spread and land features, such as geography, development, nutrient sources, and other land-based features.** At this point, experts believe land-based sources of nutrient are a major contributing factor in the expansion of alien algae. However, it is important to do studies that can determine the relationship between land-based features and algae outbreaks in the state.

e. **Support studies on the relationship between herbivory and algae spread.** Another potentially major cause of the spread of both alien and native invasive algae is a reduction in herbivore populations in recent years as a result of fishing pressure. To better understand how to manage alien algae, it is important to understand the role of herbivory in the control or release of certain species.

f. **Develop a comprehensive multi-stakeholder strategy to address alien and invasive species.** While there are several ongoing efforts to better understand alien and invasive species, there has not been an effort to bring together all relevant stakeholders to develop a strategy to address these issues in the long-term. Given the complex nature of alien and invasive issues and the multiple agencies that are involved in prevention and management, it was suggested by many experts that a collaborative public-private partnership be developed.

g. **Create a stronger linkage and partnership between various agencies with jurisdiction on aspects of alien species introductions and spread**. Experts regularly mentioned that there are a number of different agencies involved in alien species issues and limited coordination may result in continued

introductions and spread. The Department of Agriculture regulates legal introductions, while the Divison of Aquatic Resources is tasked with managing against invasive species (alien or native), and the Department of Health is responsible for the management of water quality (which is believed to be in part responsible for outbreaks of alien species, particulary algae). Improved communication should be encouraged and required as part of the effort to develop a comprehensive multi-stakeholder strategy for more effective alien and invasive species management.

h. **Conduct additional surveys and follow-up surveys to understand the distribution of alien species, particularly in high priority environments such as intact reefs.** Several surveys have been undertaken at different sites around the MHI. However, many areas remain under-surveyed, while still other important marine sites need to be resurveyed. For example, Kahoʻolawe was surveyed in 1988, nearly 4 years ago. Given that early detection is a key to protection, important areas such as Kahoʻolawe, Lanaʻi, Molokai, and others with intact natural communities should be resurveyed regularly to ensure no new introductions and no invasions by existing or native species.

i. **Organize communities in key areas around the state to take on monitoring for new introductions.** Given the difficulty and expense of mounting full-time monitoring in all parts of the MHI, local communities can act as an important early warning system. Through existing mechanisms, like Reef Check and other community organizing groups, local communities can be organized to monitor for alien species and native species invasions in several areas around the MHI.

j. **Maintain natural populations of grazing fish to combat algae outbreaks.** Several experts stated that depletion of herbivorous fish is one of the main contributing factors to outbreaks of alien or native algae. As a result, maintaining natural populations of these grazers will be a key to effective management and control of alien algae. This will be particularly important in areas that have other contributing factors such as high nutrient loads, and in areas that house important habitats where alien algae would be devastating. Again Molokai, Kahoʻolawe, Lanaʻi, Niʻihau, and Kauaʻi come to mind as important places for ensuring that herbivorous fish populations remain healthy, as these places still maintain healthy reef systems that would be deeply impacted by alien algae outbreaks.

k. **Support scholarships and post-graduate training for phycologists and taxonomists who can work on alien species issues.** According to experts, a major limitation in addressing alien species is the number of people who are trained to identify these species. There are very few adequately trained phycologists or taxonomists in the state. Therefore, a program to train individuals in these fields is an important step in early identification of alien species.

l. **Undertake more thorough surveys of marine ecosystems to understand the distribution of both native and alien species.** Experts suggested devoting more time and funding to surveys and collections of marine species (both native and alien) to help further understand the full suite and the distribution of species present in the state. On most surveys, new species are discovered and to date, experts believe nowhere near the full complement of Hawai‘i’s marine biodiversity has bee surveyed or collected. These efforts will help to establish a baseline understanding of the biodiversity of the state from which to monitor change over time.

m. **Develop capacity to limit introductions by hull fouling and ballast water.** Currently, there is relatively little regulative authority to control the introduction of alien species through hull fouling or ballast water. Likewise, there is little capacity to adequately inspect and enforce existing regulations. As a result, vessels carrying alien species are very likely to regularly dock and exchange ballast in Hawai‘i’s nearshore waters. A strategy to more adequately address these threats should be developed and communication between various agencies with regulatory authority be strengthened.

Expand Community-Based Marine Management Including the Documentation of Indigenous Knowledge

Several experts suggested that local communities are a overlooked resource in terms of coastal and nearshore management. There are currently, only a few examples of community-based natural resource management in the state. The Mo‘omomi case was cited by several people as an important example, while Limahuli on Kaua‘i is another example that experts say offers promise. Likewise, many experts expressed that the critical knowledge of fishermen and others is being lost as people are growing older. As a result, many people invterviewed recommended that there must be efforts made to document this knowledge and pass it on to younger generations. Many experts cited examples of community-based management that depend in part on traditional knowledge to promote marine resource management.

Current Situation

Western/modern resource management regimes view resources very differently than traditional systems. Under western/modern systems species-specific resource management is the norm, focusing on how many fish or how much of a particular resource can be extracted. Traditional resources management regimes in Hawai‘i tended to focus more on identifying times and places that fishing could [and could not] occur so fishing would not disrupt biological processes and habitats. Likewise, traditional management includes human beings as an integral part of the ecosystem and its functioning, where as western/modern management tends to separate humans from the environment under management.

Traditional systems of management are much more in tune with the natural rhythms of the coral reef ecosystem and should be revived wherever possible. These traditional systems can be combined with Westernized strategies such as "no take" and temporal and spatial closures to help integrate traditional and modern knowledge.

The Mo'omomi Demonstration Project has successfully applied traditional knowledge to effective management of an ecosystem and its resources on Molokai (see Box 4 on page 64). Much can be learned from this project in an attempt to conserve Hawai'i's natural resources. Given the political and financial constraints associated with starting new MPAs, it may be useful to consider the community model as a starting point for coastal ecosystem protection. Mo'omomi is a rare case where several important factors led to its success. However, experts suggest that Hawai'i's natural resources managers must take it upon themselves to investigate other communities where elements of this model may be applicable. According to the State, there is some disagreement about whether a community from a particular area has jurisdiction of the marine resources adjacent to that area. As a result, the State has indicated that community-based management may not be a universally applicable approach to marine conservation such as the Mo'omomi case, but these seem to be effective. As a result, experts recommended investigating the positive and negative elements of these examples and investigating the feasibility of replicating these examples or elements thereof in new areas.

There are several publications that have recorded traditional Hawaiian knowledge on marine resources management. However, there remains a vast body of knowledge in the minds of older Hawaiians that will soon be lost if not recorded. The recording of traditional knowledge is important both for historical purposes and to inspire Hawaiians of all ages to take a more active interest and role in resources management. Application of traditional resource management in combination with western/modern techniques is a promising way to enhance resources stewardship.

Recommendations

a. **Assess positive and negative aspects of community-based marine management efforts and feasibility of expanding these approaches to other sites.** Most experts interviewed felt the Mo'omomi case and other similar efforts are very positive and effective for marine conservation. Others, particularly officials with the State were not yet convinced of the applicability and legality of this approach. As a result, it is recommended that this approach be thoroughly assessed through a collaborative effort that involves the State and NGOs, both from a legal and efficacy standpoint. The feasibility of expanding this approach to new areas will in large part depend on the sufficient participation of both the State and NGOs, and therefore both are key players in conducting some initial assessment of the efficacy of this approach.

b. **Create a cadre of technically experienced community outreach workers to help new communities initiate and maintain conservation efforts.** Experts recommend creating a cadre of technically experienced community outreach

workers to facilitate community-based conservation. Few experts were trained in how to initiate community-based conservation efforts and there is relatively little capacity in this area in the State. As a result, outside training by experts may be necessary to help this cadre of people build the necessary skills in community entry, community-based conservation, monitoring and evaluation, and other aspects needed to replicate these models in new areas.

c. **Learn lessons and apply them from community-based conservation efforts in other parts of the Pacific where more traditional management may be more applicable.** There is a great deal more experience with and capacity for, community-based conservation in the Pacific than there is in Hawai‘i. While the political and economic context of Hawai‘i is very different from the rest of the Pacific, there are many lessons that can be learned and applied from other Pacific Island experiences. Likewise, Hawaiians also feel a connection and bond to other Pacific Islands and their people. As a result, looking for support, experience, and expertise from other Pacific Islands may be a good way to inspire and support community-based marine conservation in Hawai‘i.

d. **Initiate an effort to document traditional knowledge of fishing and other marine resource management techniques.** Experts highly recommended initiating a process of recording traditional knowledge of marine resources and fishing. Suggestions included making video interviews of fishers, writing journals, and producing television documentaries. Likewise, one expert recommended the creation of a learning reserve where young people would learn traditional marine lore, fishing techniques, and other important elements of traditional knowledge. This would provide an excellent venue for the collection and documentation of indigenous knowledge as well as the sharing of it with younger generations. The documentation of this information could help to inform outreach, education, and public awareness.

Effectively Manage Nearshore Commercial and Recreational Fishing

Overfishing and the use of particular gear types that are destructive or facilitate overfishing (such as gill nets and spear fishing on SCUBA) were mentioned by many experts as major problems. Strategies to address fishing as a threat to marine species and ecosytems must be carefully developed as there are strong interest groups who support unregulated fishing in the State. It is important that fishing interests be brought into the circle of organizations and individuals who support more effective fisheries management. To do this, fishers must believe that regulating some areas and some species will benefit them in the long-term.

Current Status

Most fishermen now recognize that there are problems and that the fishing is no longer as good as it used to be. Much more effort is now required to catch the same or smaller amount of fish.

According to experts who spend a significant amount of time fishing, and used to or still do fish commercially, there is a bell curve of opinions. A relatively small number of fishermen on one end of the curve will say there are no problems with fisheries stocks, that there are still plenty of fish and no reason for conservation measures. Others at the far end of the spectrum will say that the fish populations are heavily depleted, and we must take action right away to prevent further degradation. The majority however, feel that there is a decline in fish, but that there are still relatively good populations. Many will say that although it's not as easy to get fish as it used to be, they can still get all the fish they need by going to different areas. These fishermen are likely to believe that some management should occur, but would not feel that we are in a crisis mode.

Current efforts to more effectively manage fishing include the DAR's recently released revisions to the State's fisheries regulations. These updated regulations more adequately address the biological needs of the species that are under regulation. For example, under the new regulations, moi (pacific threadfin) could only be caught and kept once it's 11 inches. Previously, moi could be caught at 7 inches. However, the fish does not sexually mature until it is 11 inches. The new regulation takes the biology of the fish into account and is therefore much more appropriate. The key will be successfully keeping this and other regulations and communicating these new regulations and the reasons for their enactment to as many people as possible so people are aware of the change and can comply.

A Gill Net Task Force has also recently developed updated guidelines for the use of gill nets. These include restrictions of the length of the net, the time the net can be down and how often it must be checked. Some experts interviewed were happy with these new regulations and feel the key to making them effective is educating people about them and enforcing them. Other experts are not satisfied with these new regulations and feel more stringent measures on gill nets are necessary.

With the support of NOAA, the DAR is undertaking a survey of recreational fishing. As has been mentioned in the study, currently there are no recreational fishing liscences in the State. As a result, there is no way for DAR to know exactly how many people fish recreationally or how many and what kind of fish are caught by recreational fishers. As a result, it is impossible for DAR to adequately manage recreational fishing. With the support of NOAA, the DAR is currently launching an effort to survey recreational fishers about their effort and catch. This is an excellent step to better understanding recreational fisheries in the State.

Conceptual Recommendations:

a. **Manage fishing based on the biological needs of the resource including multi-species interactions and Ecosystem Dynamics:** While there are increasing signs that DAR is working to manage fisheries based on biological needs, there is a long way to go to ensure that the biology of target species, their habitats, and the ecosystem overall is adequately considered in fisheries management decisions. We need not reiterate the points made earlier in the ecosystem management

section of the study, but it is important to note that a large number of the experts interviewed stressed these points.

b. **Work with fishers to help them meet their needs while demonstrating that fisheries conservation is in their best interest:** A large number of people in the state fish regularly and many depend on wild caught fish for some portion of their diet. While many fishers will claim there is not a problem with fish populations, an equal if not greater number of fishers recognize the decline in fishery resources and would like to do something about it. Understanding the needs and desire of these individuals as well as the broad spectrum of fishers will be critical to conserve the resource. It is critical to help fishers come to the conclusion that their fishing future is dependent on conservation and resource management measures today.

Specific Recommendations:

a. **Launch an effort to adequately address destructive fishing gear types.** Many experts recommended that the conservation community should launch an all out effort to address destructive gear types. The most common recommendation is to aim for the complete ban of gill nets and greater restrictions on spear fishing with SCUBA. Such an effort would have to be elegantly orchestrated to be effective. As a result, no one group should take this on without careful and consistent consultation with other organizations. A collaborative strategy is more likely to succeed than an effort by any one group.

b. **Create a recreational fishing license.** The establishment of a recreational fishing liscense would be of significant assistance in the management of near shore fish species. Most recreational fishing happens close to shore and much of it in or near coral reef environments. The creation of such a license is a critical step to improving fisheries management and must be accompanied by the establishment of sufficient capacity to manage distribution and sales of the license and the collection and analysis of data resulting from the license. Periodic surveys about catch amount and species should be pursued as well to help managers better understand the situation with recreational fishing.

c. **Accompany changes in fisheries regulations with awareness building and educational messages so people are aware of both the changes and the reasons underlying it.** Experts who fish regularly said that many responsible and respectful fishermen will follow regulations if they are adequately made aware of them. As a result, they recommended that an outreach and awareness campaign accompany any changes in fisheries regulations. This campaign should focus on places where fishers frequent and congregate such as gear shops, harbors, and fishermen's clubs. Messages should be imparted so that fishermen can relate to them. Fishers and respected Hawaiian figures would be the best spokespeople.

d. **Greatly enhance DOCARE's capacity to effectively enforce fisheries regulations.** Updates to fisheries regulations will not be fully effective unless DOCARE has sufficient capacity to enforce them. As discussed in other sections, DOCARE's capacity to adequately enforce existing and new regulations must be built.

e. **Develop Citizen Action Groups to help support DAR and DOCARE by undertaking surveillance and education about new fisheries regulations as they come out.** In previous recommendations, we highlighted the suggestion that Citizen Action Groups be formed to monitor marine ecosystems, assist with education and awareness raising, help in lobbying and advocacy, and be involved in other conservation activities as appropriate. Helping to support DAR and DOCARE by raising awareness of new regulations and reporting on violators is a good use of volunteer citizen time. A local NGO should be supported to help organize, train, and deploy Citizen Action Groups in cooperation with DAR and DOCARE.

f. **Develop more "no take" and managed areas.** Overwhelmingly, experts expressed the need to put more areas in the MHI into "no take". Many stated that no degree of fishery regulation will fully protect the marine resources of the MHI unless they are accompanied by easily discernable and enforcable "no take" areas. Given various interest groups, it will be difficult to create new no take zones in the state; however, if these efforts are pursued as part of a comprehensive strategy that includes awareness, education, biological prioritization, community-based management and other activities, there is some hope for the creation of new managed areas with "no take" zones as a part of their designation.

g. **Develop an immediate strategy to ensure conservation of top priority sites for nearshore fisheries.** There are many areas in the state that are important to the maintenance of healthy fish stocks. As part of the biological prioritization under the ecoregion/ecosystem management approach, high-priority areas should be identified and protected. Given the complexity of protection sites in the state, strategies for the conservation of these known high priority areas should be developed and implemented with participation of appropriate stakeholders.

Address Coastal and Upland Development and Land-Based Effects on Water Quality in the Nearshore Environment

A common threat mentioned by experts is the impact of land-based activities on the near shore environment. According to Hawai'i's *State of the Reefs*, (Clark and Gulko, 1998), no place in Hawai'i is more than 29 miles from the coast. As a result, nearly all land-based activities eventually impact the sea. Urban and residential development is typically within a few miles from the sea, while seawall construction, channelization, harbor

development, agriculture, sewage disposal, chemical spills, road runoff, and many other land-based activities have major impacts on nearshore environments.

While coastal development and resulting water quality impacts stressed by numerous experts as major threats, this is perhaps the most difficult threat to address. While point source pollution is relatively well regulated by the EPA, non-point pollution resulting primarily from coastal development, agriculture, and industry remains an extremely difficult problem to address.

Ongoing programs that are attempting to address water quality issues include watershed partnerships that have brought together landowners to cooperatively improve watershed management. A goal of many of these efforts is to reduce sedimentation, and the runoff of agricultural products. These efforts include reforestation, fencing programs to reduce wildlife grazing, and reducing the use of these pesticides and fertilizers. Other citizen partnerships have been organized to clean and landscape streams and stream banks to reduce debris and sediment outflows. DLNR has formed a Coastal Lands Program to conserve the State's beaches, while the advisory support on coastal zone management is provide by the State Coastal Zone Program, and the Fish and Wildlife Service Coastal Program helps support efforts around the state to manage coastal development, reduce sediment, reduce coastal grazing, and other measures to protect the coastal zone. In addition the Hawai‘i Department of Health, the EPA, and NOAA produced an excellent reference document, The West Maui Watershead Manual, in 1997, to help watershed residents including individuals and companies better protect their water quality.

While all of these efforts represent an excellent suite of activities, none is of sufficient scale to adequately address the coastal development and water quality issues facing the state. A number of additional activities are needed to help adequately address these concerns. Perhaps more than any other issue, addressing coastal development and water quality concerns require collaboration and partnerships.

Recommendations:

Conceptual Recommendations:

a. **Empower citizens to protect watersheds and reduce their impact on nearshore waters.** One of the best ways to empower people who live in watersheds is to educate them about how to help protect water quality. The West Maui Watershed Owners Manual is an excellent example of how agencies can work together to provide specific advice to individuals and companies. More education and outreach materials are needed to demonstrate the importance of watershed protection and to show people what steps they can take to do their part. Simple but important steps include reducing the use of household and agricultural chemicals, leaving riparian zones vegetated, participating in re-vegetation efforts, and replacing septic tanks with municipal sewage treatment.

Specific Recommendations:

a. **Undertake a coastal sensitivity analysis.** Across the state are sites that are coastal conservation priorities because of the uniqueness of their habitats, or because they are vulnerable to impacts such as development and oil spills. To understand how best to protect a representative network of important conservation sites across the state, a coastal sensitivity analysis should be completed as part of the Ecoregion/Ecosystem Planning Process.

b. **Conduct an analysis to overlay priority marine areas with key watersheds.** There are a number of watershed partnerships and ahupua`a initiatives either emerging or on-going in the state. This study did not uncover any efforts to identify priority marine sites and overlay those with priority watersheds. However it should be noted that when priority watersheds and priority marine areas are connected, this elevates their conservation importance even more.

c. **Work with State and County authorities to limit development in sensitive coastal areas.** Once sensitive coastal areas have been identified, it is important that state and county entities are aware of these areas, and commit to regulating development in these areas. Current development practices have had a huge impact on sensitive coastal areas. NGOs should support education, outreach, and public advocacy efforts to encourage state and local governments to limit on development in sensitive coastal areas. Likewise, commercial developers and the consumers of commercial development should be educated about sensitive coastal areas and encouraged to support appropriate development regulations.

d. **Develop education and incentive programs to promote responsible watershed management practices.** Experts on water quality strongly suggested the development of incentive programs particularly for farms and ranches which are a major source of fertilizers and pesticides. These incentives could include payments, tax breaks, technical assistance, and other support programs for land owners willing to put in place watershed management practices such as reducing the use of pesticides and fertilizers, replanting denuded lands, fencing out ungulates and grazers that promote erosion, and maintaining riparian buffer zones along water courses.

e. **Enhance efforts to manage urban storm water.** Urban storm water is a significant source of non-point source pollution and excessive fresh water flows. Several things can be done to reduce storm water runoff, and the amount of pollutants in this water. These include building water retention ponds in developed areas to reduce the negative affects of hardened surfaces on water flow, labeling drains to warn against dumping, reducing the amounts of household, lawn, and agricultural chemicals used, and constructing streets and parking lots to shunt water to vegetated areas rather than into storm drains. In general, awareness and a willingness to follow some simple practices such as these will

greatly reduce marine impacts from storm water. Educational efforts on storm water issues should also accompany educational efforts on watersheds in general.

Additional Recommendations: Develop Sustainable Financing Mechanisms

While the point of this study was to synthesize the opinions and recommendations of experts in the field of marine management, the consultant would like to make one recommendation that was not made by any of the experts interviewed on the topic of conservation finance.

Effective marine and coastal conservation in Hawai‘i will require a massive scaling up of conservation activity. The current budgets and staffs devoted to marine management are not sufficient to address the large-scale system problems facing nearshore environments in the MHI. A large amount of additional funding will need to be raised to adequately address this problem. Given the current economic situation, we cannot expect this funding to come from any one sector, but must work with a number of sectors including government, foundations, and the private sector. While we make a few recommendations regarding the generation of conservation finance from foundations and government, we focus our recommendations on a sector that is conspicuously underrepresented in funding marine conservation in the state. This is the private sector. Considering that over six million visitors a year come to the state and that the majority of them engage in some ocean-related activity, it is in the tourism industries best interest to help ensure that the marine environment remains attractive to tourists.

Experience from conservation finance projects around the world has indicated that various private sector interests can be motivated to support conservation if they can be shown how it will benefit them directly. Industries such as the dive and cruise industries are particularly dependent on an attractive marine environment. As a result, it should be possible to interest these entities in funding marine conservation. Many companies are already actively involved in marine conservation both directly and through providing funding support. However, several experts have cited a general reluctance on the part of these industries because they feel they are already taxed enough and they also may not see the direct benefit. Several recommendations may help these industries to more directly see the benefit of providing significant support for conservation.

a. **Develop a comprehensive marine conservation finance strategy focused on the private sector and other donors such as foundations and government.** Currently, most conservation financing in the state is generated by individual organizations or entities for specific operations, programs, or projects. While this type of fundraising will no doubt continue, it can be very effective in the long-term to develop both a comprehensive marine conservation strategy and a collaborative funding strategy. In essence, existing organizations need to identify what must be done to conserve Hawai‘i's outstanding marine resources, and calculate how much it would cost to do so. A fundraising strategy that focuses on

achieving the goals necessary for broad marine conservation, may be more compelling to large-scale donors than individual projects. Likewise, a strategy that involves a number of donors to build a sustainable financing mechanism may offer some promise in the long-term. The following recommendations comprise elements of a comprehensive strategy.

b. **Establish a Hawai'i Natural Heritage Trust Fund.** Currently, conservation donors fund projects on an annual or multi-year time frame, generally never exceeding three to five years. Three-year projects are typical, and it is also common that funders will provide for two, three year phases. There is a major problem with this type of funding in that, it generally takes between three to six years to achieve conservation success and by the time success has been achieved funding is exhausted. This funding approach does not recognize that some highly important conservation actions have a recurring cost that will never go away. For example, whether or not you build excellent partnerships for conservation action, there will always be a cost for boat fuel, paying staff salaries, and other essential activities. It is rare for a particular conservation area to generate sufficient funding to pay for its recurring management. As a result, conservation trust funds that provide sustained funding are an important mechanism to help ensure that conservation costs can be met on an annual basis.

c. **Generate public support and lobby for increased government appropriations.** Any comprehensive fundraising strategy will require a number of donors but should not be a substitute for increasing government funding. Currently in Hawai'i, Government funding is extremely low for marine management. Expert recommended a targeted lobby effort be launched to focus on all levels of government and should be accompanied by an awareness and outreach campaign.

d. **Launch awareness campaign to demonstrate that pro-environment is pro-tourism.** As mentioned, experts currently feel that the tourism industry is opposed to environmental conservation because they feel it will negatively affect their business. It is true that in some areas of the state, opposition to coastal development has and may continue to impact the tourism industry. However, tourism and environmental conservation can go hand in hand to protect the local environment, and produce a profit. Experts felt that pilot projects are needed to demonstrate to tourism operators that environmental conservation supports tourism. In addition, an economic analysis of the value of intact marine environments to the tourism industry could help to prove this, and enhance support from the tourism sector.

e. **Work with industries to understand their needs and provide conservation products that help to meet those.** One recurring problem between conservation and tourism is that conservationists rarely understand the needs and interests of tourism operators. Likewise, different operators have different needs depending on the scale of their business. It is extremely helpful if conservationists can try to

better understand the needs of the industry in developing strategies to work with them. One way to help accomplish this is to work with consultants who have a lot of direct experience in the tourism industry.

f. **If willing industries can be identified, enter into partnership agreements to generate conservation finance.** One of the best ways to demonstrate the efficacy of conservation finance partnerships is to enter into trial partnerships. Typically, these partnerships focus on generating funding through conservation fees on tourism. Trial partnerships with "early adopters" can help to test the waters of working with industry, and help them understand how larger partnerships or mandatory fees may eventually work. It will also demonstrate to other industry members that conservation finance can be pursued without diminishing profits or the number of guest arrivals.

g. **Work with industry to develop a conservation fee structure.** One way to build the tourism industry's confidence is to conduct "willingness to pay surveys," in which tourists are asked how much they would be willing to pay for particular conservation benefits. For example, cruise industry participants could be asked what amount they would be willing to pay to help ensure that the coastal and marine environment of the Hawaiian Islands is conserved and protected. Typically, tourists are more than willing to pay what in essence is a tiny fraction of their whole vacation package to help ensure that the beauty of the place they are visiting is maintained. Tourism operators are often afraid that an extra fee will make tourists go to another destination or chose another operator. However, experience indicates that this is not the case, and that tourists are unlikely to shift their vacation destination because of a small conservation fee. Likewise, industry wide mandatory fees can help to limit issues of competition between operators.

Box 4 Moʻomomi: Community-Based Marine Conservation on Molokai

The Moʻomomi Demonstration Project on Molokai is perhaps Hawaiʻi's best example of the integration of traditional resource management and Western/modern resource conservation. The project was designed to demonstrate that more responsible fishing could be achieved through revitalization of community-based management. While there are several documents that provide excellent summaries of the history, objectives, and lessons of the project, here we summarize a few key points that should be considered in the continuing effort to conserve Hawaiʻi's natural resources. The majority of the following information came from a report prepared by Hui Mālama O Moʻomomi in 2001. It should be noted that while the majority of experts interviewed cited Mo'omomi as a positive example of progressive marine conservation, there is a diversity of opinions on how applicable and appropriate this model is. Some State officials indicated that a local community may not have a defacto right to manage marine resources adjacent to their land area, as marine resources are a common property in the state. As a result, the applicability of this approach must be further assessed before it can be declared an unmitigated success.

A progressive law, passed in 1994, created an opportunity for communities to undertake local management of marine resources. Hui Mālama O Moʻomomi also formed in 1994, to revitalize subsistence fishing and traditional values in the Moʻomomi area of Northwest Molokai.

A key feature of the Moʻomomi community is its relative dependence on fish protein and other marine products for subsistence. While many people fish for local consumption, few communities depend on local fish for subsistence. However, at Moʻomomi, farming and fishing provide approximately one third of the food for a community of approximately 1,000 people.

The objectives of the project were to:

- To establish a marine resources monitoring program that integrates traditional observational methods and understanding with science-based technical data,
- To foster consensus about how fishing should be conducted in order to restore community values and stewardship, and to demonstrate the communities commitment and ability for self-management, and
- To revitalize a locally sanctioned code of fishing conduct and to make a cooperative agreement for community-based management of shoreline and nearshore fisheries in and around Moʻomomi Bay.

Throughout Hawaiʻi, before the imposition of Western law, the traditional kapu system helped ensure that marine resources were well managed. Traditional systems operated in tandem with the ecological processes of nearshore areas, creating closures of areas during important life cycle events, such as spawning. While the kapu system is no longer be practiced in Hawaiʻi, a code of conduct developed by the local community and enforced through respect, peer pressure, education and continual community feed backing has proven a successful management tool at Moʻomomi. The project has been successful at enhancing responsible fishery management through community-based methods. Western/modern conservation approaches have primarily been used to help monitor resources.

Fish populations and diversity appear to be in better condition at Moʻomomi than many places on Oʻahu and other islands. For example, fish biomass is up to 50% greater at Moʻomomi than at any other site sampled in the MHI by DAR, while diversity is between 30% and 50% greater. Likewise, highly sought after moi (pacific threadfin) were shown to be much larger at Moʻomomi than other sample sites (10.64 inches at Moʻomomi versus 9.42 inches on Oʻahu). While this higher biomass and diversity cannot be fully attributed to the two-year tenure of the demonstration project, the project has shown the ability to address unsustainable fishing through peer pressure. In one case, local fishermen who broke the code of conduct were reported and admitted their guilt. One of the illicit fishers actually ended up joining the board of the Hui.

Primary lessons learned from the project are:

- Community building and proper cultural protocol are essential to understand and revitalize marine conservation traditions.
- Young practitioners who are committed to the community's basic values and to the longevity of Hawaiian culture must be recruited.

While Moʻomomi is a unique place with special conditions of community cohesiveness as well as pride and interest in traditional management, there are other communities where elements of traditional management can be effective. Given the political difficulties of creating new MPAs and the current limitations of western/modern management techniques to conserve fish stocks, community-based management may be one of our best hopes for effective management of nearshore ecosystems in Hawaiʻi.

Information for this case study came from Hui Malama O Moʻomomi, 2001.

Chapter 4: Successes and Opportunities in Nearshore Marine Management

To avoid overwhelming readers with the threats and obstacles, it is important that we turn to the good news. The good news is that there is significant activity either ongoing or developing in marine conservation locally. Several projects have already achieved successes in marine management, and others have set a solid foundation from which marine management can be improved over time. One key to successful conservation management appears to be the strengthening of ongoing marine management projects and programs in the state.

Several experts, as well as this consultant, perceive a palpable energy and enthusiasm that is building for more effective marine management. Several experts noted a definite increase in interest and energy for marine management in recent years and months.

Many people interviewed indicated that the conservation community is at a pivotal time, and is ready to make an outstanding and significant difference in marine management. Much of this has already started. For example:

- increasing numbers of people and NGOs are starting to work on marine issues;
- well-established NGOs are creating new programs such as the Western Pacific Fisheries Coalition;
- the State is developing new ways to manage marine areas such as the Kona Coast Fisheries Replenishment Zones, and new funding is being provided to work on marine managed areas;
- for the first time we have monitoring programs that are revealing the condition of the MHI's marine resources, and
- energy and enthusiasm are building in a variety of sectors to improve management of marine resources.

Perhaps the best analogy is that Hawai'i is experiencing a ground swell of interest and enthusiasm for marine management, and there seems to be a great opportunity to work collectively to make a difference.

The following examples of successful or promising initiatives offer great hope that we can collectively overcome threats and obstacles and effectively manage Hawai'i's natural resources. One of the keys to overcoming these obstacles appears to be magnifying several existing efforts to a scale that more adequately addresses the threats and obstacles to effective management. The following list is not comprehensive and provides just a short summary of some of the activities that are going on in the state:

1. **Mo'omomi Demonstration Project on Molokai**. A local community is working to develop a community-based marine managed area. Many people suggested this as a model for community-based resource management that could be replicated in other areas (see Box 4: Mo'omomi on page 65).

2. **Limahuli Watershed Initiative**. This initiative on the North shore of Kauaʻi is working to extend a terrestrial watershed conservation initiative to the nearshore marine environment. The initiative has benefited from outreach and support by the Hui Malama O Moʻomomi. This effort has considerable potential to succeed given the intactness of the watershed and nearshore marine environment, the backing of a well established NGO (the National Tropical Botanical Gardens), the support of the local community, and the interest of funders. Both this initiative and Moʻomomi should be watched and assessed carefully to determine their broader applicability.
3. **Hawaiʻi Coral Reef Initiative (HICRI)**. This initiative has funded several important efforts such as coral reef assessment and monitoring, multi-stakeholder decision-making processes for conservation of Kāneʻohe Bay, research on alien algae distribution, and will be funding assessments of the economic value of coral reefs, continued monitoring, and experiments on how to best remove alien algae.
4. **Coral Reef Assessment and Monitoring Program (CRAMP)**. Funded in large part by the Hawaiʻi Coral Reef Initiative, CRAMP is the first comprehensive effort to assess and monitor the condition of Hawaiʻi's coral reefs. This program has developed a monitoring protocol that enables the collection of detailed information about the condition of coral reef ecosystems in the MHI.
5. **Cooperative Research on Alien Algae**. A partnership between the University of Hawaiʻi, the Waikīkī Aquarium, and the Hawaiʻi Institute of Marine Biology has been pursuing studies on the distribution and spread of alien algae and with support of HICRI will work this year to better understand how to eradicate alien algae species. The program has set up an excellent website that is the most comprehensive and up to date source of information on alien algae in the state.
6. **Initiative to Understand and Manage for Alien Algae**. In tandem with the partnership program discussed above, the National Fish and Wildlife Service, the Bishop Museum, and other agencies are supporting a series of public workshops on alien alga. The first workshop held in May of 2001 focused on educating resource managers and the public on the issue of alien marine species, particularly algae. A second meeting to be held in October, 2001 will focus on developing management strategies to more effectively address the introduction and spread invasive algae.
7. **Western Pacific Fisheries Management Coalition**: This program of the Hawaiʻi Audubon Society is focused on fisheries management and marine advocacy, outreach and education. This program played a significant role in the effort to ban shark fining and plans to work on gill net issues in the future.
8. **Northwest Hawaiian Islands Rapid Ecological Assessment**: This multi-agency assessment of the Northwest Hawaiian Islands was a particular success in collaborative planning and coordination. It involved several federal and state government agencies including the National Marine Fisheries Service, the Fish and Wildlife Service, the Northwest Hawaiian Islands Reserve Commission, the Division of Aquatic Resources, and others. This represents the first comprehensive effort to survey and document the resources and biodiversity of the Northwest Hawaiian Islands.

Box 5 The Kona Coast Fishery Replenishment Areas: A Conservation Success Story

In 1999, a landmark law and associated rules were created, placing almost one third of the West Hawai‘i coastline under fisheries management to conserve species collected by the aquarium industry. This Fisheries Management Area and the subsequent Fisheries Replenishment Zones became the single largest managed coastline in the MHI and have created a precedent for improved fisheries management throughout the state.

This law was the result of 20+ years of conflict between aquarium fish collectors and dive operators in West Hawai‘i. Dive operators and biologists argued that collection was rapidly depleting species of coral reef fish, while collectors claimed that they were unfairly singled out as the cause of depletion. After years of complaints, the 1996 Legislature directed the DAR to create a West Hawai‘i's Reef Fish Working Group to develop recommendations on managing the fishery. Several meetings were held between May 1996 and September 1997 and numerous recommendations were offered; however, none were adopted due to opposition by the fishing industry.

In 1998, community groups such as the LOSTFISH Coalition and the Hawai‘i Conservation Association began a campaign to limit aquarium collection and improve management of the industry. Statistics showing declines in the top ten aquarium species provided powerful arguments for improved management. Between the late ‘70s and 1998 in selected areas of West Hawai‘i, populations of these ten most populous species had dropped 54 percent at Ke‘ei and 59 % at Honaunau. Other data indicated that Yellow Tang, Potter's Angels, Long Nose Butterflies, Moorish Idols, and Achilles Tangs had decreased by 45 to 63% over only a two year period (*Environment Hawai‘i*, 1999).

In 1999, after considerable outreach, education, and negotiation, a law was passed establishing the West Hawai'i Regional Fishery Management Area, requiring that a minimum of 30% of the West Hawai‘i coastline be set aside as fish replenishment areas (FRAs) (*Environment Hawai‘i*, 1999). This law also required the establishment of a community advisory group, the West Coast Fisheries Council. This Council subsequently identified nine areas to be managed as FRAs, where aquarium fish collection would be completely prohibited. Likewise, these areas would establish separate rules for other fisheries, including the use of gill nets and other techniques thought to be destructive. The successful passage of this law and the subsequent rule making authority to delineate FRAs, represent a significant conservation success, where citizens acting together initiated and saw through the creation of new conservation areas.

According to those involved in the West Hawai‘i case, a number of factors came together to enable this success. These included an educated and involved citizenry that extended well beyond the immediate stakeholder groups, solid data demonstrating declines in the fishery, excellent community organizing by the LOSTFISH Coalition, and supportive delegates in the legislature. In West Hawai‘i, concern about the impact of aquarium collection had become quite widespread and as a result, citizens were attuned to the issues and willing to participate to help resolve it. Organized community-monitoring teams and monthly reef talks at public venues helped to raise the level of awareness in the community. Finally, having solid data demonstrating declines in the fishery provided nearly irrefutable evidence that collecting was impacting populations of key species.

According to experts, other communities around the state would like to establish their own Fishery Management Areas. Many lessons learned from West Hawai‘i can be applied in these new efforts, but there is also a significant need to ensure these efforts have the capacity they need in community organizing, education and outreach, and information gathering and presentation as these were key elements of success in the West Hawai‘i case and may lead to new successes in fisheries management across the state.

9. **Designation of the Northwest Hawaiian Islands Reserve**. The designation of this reserve, resulted from the efforts of numerous groups including state and federal government and NGOs. The original management plan was prepared by an NGO representative and NGOs lobbied a great deal for this designation. Numerous Government Agencies supported public meetings and the necessary processes to enable the designation through Executive Order.
10. **Marine Ecosystem Geographic Information Systems Group (MEGIS)**. This group is working to more fully document and database information on the Hawaiian Islands in spatial (GIS) format to help managers have more accurate and up to date information for management. This effort is working in tandem with National Ocean Service efforts to map the bathymetry of coastal and near shore marine habitats through remote sensing methodologies such as hyper-spectral imaging.
11. **New forms of marine management**. There are new forms of MPAs related to marine ornamentals collection, tourism impacts and assessment, and long-term monitoring programs involving partnerships between scientists, community groups, and management agencies. Perhaps the best example of this is the development of Fisheries Replenishment Areas on the Kona Coast. This effort provides an excellent example of a combination of citizen and government action to improve management of a threatened resource (see Box 5 on page 68 for a full description).
12. **New take size and bag limits currently being rolled out by DAR**. DAR has recently developed new fisheries regulations based on science and biological considerations, such as sexual maturity. These new regulations include new take sizes and bag limits. While it is possible that not all the changes proposed by DAR will be maintained, it is very positive that DAR is implementing more biologically appropriate regulations.
13. **New projects under Federal Coral Reef Funds to assess gaps in existing MPAs and further develop the State's MPA program**. DAR is also rolling out an effort to enhance MPA management with a focus on Maui County. This project will assess gaps in the efficacy of existing MPAs, and recommend new classes of MPAs based on the conservation of biological features, cultural heritage, and other functions. This project will set the foundation for eventually declaring new MPAs in the state.
14. **Efforts by the Secretariat for Conservation Biology**. These include facilitating improved communication and collaboration between various marine resource management agencies and organizations. With private foundation funds the Secretariat is working with a group of stakeholders to set up a more effective means for communication and collaboration.

Other important efforts that we do not have as much detail on include:

15. **Surveys of recreational fishing catch that are being initiated by DAR**
16. **The consultative process that lead to the Ocean Resource Management Plan (ORMP)**
17. **Effort to revise and update the Ocean Resources Management Plan**
18. **Annual publishing of the Status of Coral Reefs in the Hawaiian Islands**

19. **A coastal sensitivity analysis of areas that are particularly vulnerable to oil spills that is being pursued by NOAA**
20. **An effort by DLNR to map erosion-prone beaches across the state and develop guidelines to reduce beach erosion related to development**
21. **Coastal Management efforts of the Fish and Wildlife Service with the State and private landowners, including re-vegetating areas and fencing out alien grazers.**

Many of these efforts were emphasized by experts as key successes that should be further developed and built upon to ensure long-term conservation efficacy in the state. Many experts felt that one of the best things that can be done with new funds is to help ensure that existing efforts are sufficiently resourced, and people already working in the marine conservation community are sufficiently paid, so they can work on these issues full time.

Box 6 Conservation Success: The Campaign Against Shark Finning

Across the State of Hawai‘i, the marine conservation community has achieved a number of significant successes. One of the most commonly mentioned by experts is the campaign that has essentially ended the practice of shark finning in the state. According to the Western Pacific Fisheries Coalition, sharks have never been a target fishery in the state but in the early 1990s, economic growth in parts of Southern China fueled an increased demand for the delicacy shark fin soup which in turn sparked a world wide increase in shark finning. This surging demand reached Hawai‘i, and sharks once caught primarily as by-catch in the long-line fishery were increasingly finned rather than released.

In 1997, a group of mainland-based foundations visited the state and discussed conservation priorities with a number of groups. Addressing the practice of shark finning emerged as a conservation priority and the next year, the foundations came together to fund the Western Pacific Fishers Coalition. This coalition, which is coordinated by the Hawai‘i Chapter of the Audubon Society, placed shark finning on its agenda and by 1998 was into a full swing campaign to ban the practice. But this wasn’t the only priority of the small coalition. They also chose to work on other issues including pushing for all regulatory authority on marine issues to be fully vested with the Division of Aquatic Resources and to empower the Division to have regulatory authority on ballast water (a major potential source of alien introductions). Taking on these issues was challenging, but as success started to emerge in the shark finning case, it became clear that the effort was worth it.

As the coalition carried out its advocacy, outreach, and lobbying efforts on the shark finning issue, a number of synergies started to come together. A State Bill to require that sharks be landed whole was introduced and was tantamount to banning the fin trade since boats could not afford to transport entire sharks given the relatively small value of each fin. The Coalition put out a full-page article in the local paper raising public attention to the issue, and in February of 1999 a conference on sharks was held. At this conference, new video footage showing the practice of finning was aired. News media picked up the grotesque film and people across the state could see in with their eyes the waste and cruelty associated with the practice of finning. This combination of advocacy and timing with the conference raised the attention of a number of lawmakers, strengthening the arguments of advocates to ban the practice.

Another factor that helped lead to the ultimate success of the campaign was support from local fishermen. Hawaiian fishermen have a long tradition of not wasting and Hawaiian culture reveres sharks. As a result, a number of outspoken local fishermen spoke strongly against the practice. Despite the strong support from the public and a major sector of the fishing community, some fishermen and the restaurant industry opposed the legislation. Fortunately, through negotiation, the coalition was able to resolve differences with the restaurant industry that wanted packaged shark fin to still be allowed into the state. Likewise, the lobbying of the local fishermen outweighed that of those in favor of finning, as most of these were mainlanders or relatively recent Asian immigrants.

By the 2000 legislative session, over two years after the campaign started both a State and Federal law banning the landing of any shark part and requiring the landing of the animals entire body were put into force. In essence, this regulation eliminated the practice of shark finning in Hawai‘i. Rule making for the federal law continues and strong lobbies such as the Western Pacific Fisheries Council still oppose the ban. In fact several bills have been introduced recently that would allow filleted shark to be landed thus opening a loophole for the landing of fins. Despite these attempts to weaken the current law, conservationists are hopeful that these attempts will be defeated and continue to work to protect sharks and uphold the new law that has essentially done away with the practice of finning in the state.

APPENDICES

APPENDIX I: IMPORTANT AREAS FOR MARINE BIODIVERSITY AS IDENTIFIED BY INTERVIEWEES

Box Inserts: (Insert among the Priority Areas for Marine Conservation in Hawai‘i).

Based on expert opinion, this section highlights important areas for nearshore and coastal marine conservation for the MHI. The study has not undertaken any primary surveys, nor has it undertaken habitat assessments. Important areas have not been prioritized and were not assessed based on their contribution to the overall ecological processes and biodiversity of the Hawaiian Islands. It is recommended that a more detailed, ecosystem-based prioritization be undertaken to support increasing efforts to pursue ecosystem-based management in the state (see Recommendation Category 1).

The study explicitly asked experts to identify their priority area based on the following criteria:

* Biodiversity (high species richness or endemism),
* Natural habitats,
* Ecosystem processes,
* Natural resources, and
* Unique or rare species?

Common Themes:

Many common themes emerged regarding priority areas. Overwhelmingly people recommended islands other than O‘ahu and Maui as having the most intact marine ecosystems and suggested that remote areas within those islands are generally in the best condition and should be conserved. Most of the experts focused on areas that are still in relatively good condition and likewise mentioned a few areas that are priorities for restoration.

Important Areas for Conservation Summarized by Island

Ni‘ihau, Lehua Rock, and Kaula

For an excellent summary of the biological features of Ni‘ihau and several other of the MHI please see the CRAMP website.

Many experts recommended that Ni‘ihau, Lehua Rock, and Kaula are major priorities for conservation. The West Side of the Ni‘ihau was particularly recommended as having intact reefs and relatively healthy fish populations. One expert recommended that the marine area surrounding the entire island would be a good candidate for community-based management and marine protected area status. Many experts recommended that

because Niʻihau is privately owned, there is potential to work with the owners and the resident community to develop a marine conservation program for the island.

The coastline of Niʻihau is approximately 45 miles in length. Niʻihau experiences a great deal of wave energy from all directions, and as a result, reefs are not well developed. There are numerous pinnacles, overhangs, underwater caves and vertical walls along the northwest shoreline, and biologically rich reef communities are said to occur off the south end of the island (Naughton, J. Personal communication 2000, cited in CRAMP, 2001). Unfortunately, there is relatively little biological information about the marine resources of Niʻihau.

Currently, threats to the island include fishing by people from other islands in the MHI, which has the potential to reach unsustainable levels. Little is currently known about the fishing pressure on Niʻihau, but some experts suggested it might already be heavily fished. Other experts suggest that Niʻihau is likely to have light fishing pressure when compared to the other MHI. Rough weather is a deterrent to fishing during some parts of the year. Dive operators mostly take visitors to the Northwest tip of the island or to Lehua Rock.

This diversity of opinions suggests a resource condition and resource use survey is necessary to fully understand the situation on Niʻihau. Second, while fishing pressure may in fact be low currently, as other areas in the MHI become more degraded, fishing pressure in Niʻihau may increase.

Recommendations for possible conservation actions for Niʻihau, Lehua Rock, and Kaʻula include:

1. Surveys to better understand the biodiversity as well as the condition of the marine resources of Niʻihau, Lehua Rock, and Kaʻula;
2. Resource use assessments to understand fishing pressure and its impacts
3. Quantification of the reef fish stocks in lightly fished areas are needed to establish a baseline comparison to more heavily fished areas in the MHI.
4. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
5. Discussion with the owners and residents regarding possible protection or management of the nearshore marine environment. Given the relatively low commercial fishing pressure.
6. If there is interest, development of a plan to effectively manage the area.

Kauaʻi

Kauaʻi was also stressed by experts as a priority as it lacks the massive development and population pressure of Oʻahu and the growing pressures on Maui. As a results, its marine areas are in relatively good shape. Kauaʻi is also home to both precious corals and one of two barrier reefs in the state. Kauaʻi's reefs were badly impacted by hurricane Iniki; however experts suggested these reefs have show signs of natural recovery.

A few areas were particularly emphasized by experts. These include the barrier reef offshore from Hāʻena, the Napali Coast, and the reef complex off the Northeast end of Kauaʻi. The beaches on Hāʻena and the South Shore of Kauaʻi also offer refuge for resting monk seals in the MHI. The Hanalei River was also mentioned as important area because it is one of only a handful of remaining natural rivers in the MHI. An ahupuaʻa program at Limahuli is of particular interest as it has potential to link an intact watershed to a marine system.

Recommendations for Kauaʻi:

1. Surveys to better understand the biodiversity as well as the condition of the marine resources of Kauaʻi
2. Resource use assessments to understand human activities and their impacts
3. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
4. Discussion with stakeholders about possible protection or management of the nearshore marine environment
5. Development of a multi-stakeholder strategy for the long-term conservation of Kauaʻi
6. Support to the community-based conservation project at Limahuli and other similar efforts on the island.

Oʻahu

As has been mentioned several times in this study, Oʻahu is the most degraded island in the MHI. However, there remain priority areas for conservation. Likewise, Oʻahu is an excellent area in which to study the long-term impacts of human activity on marine systems.

Areas mentioned as priorities by experts include:

Kāneʻohe Bay: This bay harbors all major reef structures in the MHI – patch reefs, barrier reefs, fringe reefs. While poor water quality and significant invasive algae degrade it, this area is still considered a major priority by almost all experts interviewed.

Kaʻena Point: Many experts mentioned Kaʻena Point as an important place because of its relatively intact fish populations. Due to weather, it is normally only possible to fish in this area, during part of the year. As a result, fish populations in this area are still in good condition. Experts suggested that this would be a good place to create a “no take” MPA.

Hanauma Bay: This bay was cited by many experts as a success story in marine management for Oʻahu. While millions visit it annually, it was reported by several experts to maintain healthy fish populations and intact coral reefs particularly away from shore. Reefs near the beach have largely been degraded by foot traffic from snorklers. Many experts suggested that Hanauma should be more strictly regulated to prevent further degradation but also cited the “no fishing” regulations and local government

management as significant success factors. Ecosystem impacts from fish feeding have been cited as one of the main threats to restoration of a natural system in Hanauma Bay.

One expert stressed the importance of the finger coral beds near Kō Olina in Waiʻanae. According to the expert, these beds are in good shape and should be conserved as a matter of priority.

Threats on Oʻahu are well known and include coastal development, water quality resulting from the high human population, overfishing, and the spread of alien species.

Recommendations:

1. Surveys to better understand the biodiversity as well as the condition of the marine resources of Oʻahu
2. Resource use assessments to understand human activities and their impacts
3. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
4. Enhanced research on the impacts of human activities on marine resources in Oʻahu
5. Development of a multi-stakeholder strategy for the long-term conservation of Oʻahu
6. Experiments on restoration in Oʻahu and the use of large artificial reefs as natural refugia for fish.
7. Surveys of Kaʻena and discussion with relevant stakeholders about developing this area as a possible protected area
8. Support including education for roll out of new minimum fish sizes and other DAR regulations
9. Education and outreach to fisheries, decision makers, and public since Oʻahu is the population center for Hawaiʻi.

Molokai

Several sites on the island of Molokai where recommended as high priorities for conservation. According to experts, Molokai's is one of if not the most intact of any of the MHI, but is suffering primarily from the impacts of significant sedimentation and now has some introduced species of algae as well. Generally speaking, the community on Molokai has an interest in conservation and there are several opportunities in this area. As a result, Molokai is one of the top priorities for working on marine conservation.

Priority areas mentioned by experts include:

South Coast: Molokai's south coast is home to the state's most extensive and best-developed fringing reef. Several experts highlighted this entire reef as a conservation priority. The reef areas with the highest known coral cover in Hawaiʻi (Pālāʻau and Kamalō, both of which are CRAMP sites) are located along this fringing reef in South Molokai.

Experts have cited the east end of the South Shore as a major priority for marine conservation as it harbors as much as 100% coral cover and its reefs are in relatively good condition. Also, according to several experts this area is a prime candidate for conservation as the community in the area is interested in conserving their natural resources. Already some people in the community are working on the restoration of fishponds in this area.

According to one expert, off the South Shore of Molokai various impacts on the reef can be seen, as well as more natural reef communities. Splitting the reef area into quarters, the expert reported that the quarter closest to the shore is impacted by sediment, the second quarter by alien algae, and the third and forth quarter are home to more natural reef types. Also according to one expert, the Southwest point on Molokai is a priority for fisheries management, harboring relatively intact populations of reef fishes.

North Coast: Conservation priorities on the North Shore of Molokai include Kalaupapa, which is important for soft corals, Hālawa, which was reported by experts to be one of Hawai‘i’s last naturally functioning watershed/estuaries, and the Northwest Point of the island, which is an important area for fisheries. Likewise, Mo‘omomi on the Northwest end of the island stands out as an important conservation area for marine turtles and reefs but also as a model for community-based management. (See Box 4 on page 65). The area to the east of Mo‘omomi is reported to be another important site for green turtle nesting. Although the North Shore experiences much more wave energy and has several areas of high cliffs, its marine resources are still of importance and should be considered in marine conservation strategies. Molokai also has the advantage of an active community-based marine and coastal management effort at Mo‘omomi as well as community-based efforts to restore fish ponds, and watershed partnerships formed to protect upland areas.

Experts reported that subsistence fishing is a major activity on Molokai. Reports from the Mo‘omomi community indicate that as much as 30% of the protein in the diet of 1000 people in this community comes from wild caught fish. Fishing techniques practiced in Molokai included pole and line, bottom fishing, netting, spearing, and gathering of shellfish, crustaceans, and limu. Local residents practice limited commercial fishing however, increases in both commercial and recreational fishing by people from other islands has been reported.

Fortunately, Molokai is not as heavily impacted by human caused threats as several of the other MHIs including O‘ahu and Maui. According to experts interviewed, Molokai’s comparatively moderate threat pressure does not suggest that Molokai is not at risk. Many people interviewed felt efforts should be made immediately to increase conservation action on this island before threat factors escalate.

Sedimentation is one of the most significant threats to the marine systems of Molokai as lands degraded by ranching and over-grazing by alien species, such as axis deer, are dumping large amounts of sediment onto the South Shore reefs. Studies are underway to understand the impact of this sedimentation; however, no efforts were identified by this study that focus specifically on reducing the amount of sedimentation into the nearshore

environment. Fortunately, existing watershed partnerships that are focused on the protection and restoration of upland areas may offer potential for extension to lowland and coastal areas and may offer some opportunities to limit sediment runoff in the nearshore environment.

Several species of alien algae are known to be present on Molokai, including *Acanthophora*, the most widespread and successful alien algae in Hawai‘i; *Gracilaria salicornia*, which is very successful in calm waters and competes with a native species; *Hypnea musciformis*; and several others. Fortunately, alien algae are not believed to have caused phase shifts from a coral-dominated system in Molokai to an algae-dominated one; however, the immediate eradication of as many alien algae species as possible is recommended before their populations smother and decimate Molokai's coral reefs.

Overfishing in Molokai has potential to be a significant threat. Some local inhabitants are concerned about fishers that come from other islands with extremely long gill nets. While adequate data is not available on the impact of commercial and recreational fishing on Molokai, anecdotal reports suggest that fishing on all shores is on the rise. One of the best strategies to address overfishing in the nearshore environment may be local community management as practiced in Mo‘omomi. Given that some community members have already expressed a concern about fishing by outsiders, it may be possible to assist these groups to organize management of their nearshore resources.

Given the combination of extensive reefs, important intact estuaries, undeveloped coastline, important nesting sites for marine turtles, and the general good condition of Molokai's marine resources, Molokai stands out as one of the greatest marine conservation priorities in the MHI.

Recommendations for possible conservation actions for Molokai include:

1. Synthesis of existing knowledge about Molokai and possibility of additional surveys to better understand the biodiversity as well as the condition of the marine resources of O‘ahu
2. Resource use assessments to understand human activities and their impacts
3. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
4. Assessments of fishing pressure including tracking the origin and impact of fishing groups
5. Discussion with community groups to investigate feasibility of expanding the Mo‘omomi community-based management approach to other areas
6. Full biological inventory of the Hālawa Valley, stream, estuary, and nearshore marine environments (This was cited as one of the last natural functioning estuary systems in the MHI.)
7. Support monitoring efforts on alien species (especially algae) and investigation of ways to eradicate alien species that have already been detected on the island (South Shore reefs).
8. Formation of a marine partnership program for Molokai

9. Full study of the origin and impact of sediments on the coral reefs of the south shore and the marine environment of the Northwest shore
10. Extension of watershed partnership programs to include critical areas that are sources of sediment

Maui:

The island of Maui is the second most developed island in the MHI. Experts stressed that Maui's marine environments are severally stressed particularly in the most developed area of West Maui. During the past decade at least two major algae blooms have occurred threatening the marine area of West Maui. It is believed these are related to the levels of nutrients in the water from coastal runoff. However, efforts to ameliorate the amount of nutrients, including the upgrading of sewage treatment facilities have not been sufficient to eliminate outbreaks. An outbreak was going on during the months that this study was underway. Experts did not mention that many priority sites on Maui. As a result, the summary below is definitely inadequate. There are likely far more important sites on this island that simply were not mentioned by experts. It is recommended that a more detailed assessment of priority sites on Maui be synthesized or carried out. Priority Areas mentioned by experts include Molokini, areas of north Lahaina, and Pā'ia, and Kīhei.

In upcoming months and years the DAR is planning to enhance marine protection in Maui County through the creation of new categories of marine managed areas. Overtime, priority sites of Maui may be more adequately managed through this process. Also, experts suggested that there are many opportunities for citizen and community based advocacy and marine conservation in Maui. According to experts many communities are concerned about degradation of marine areas but are not yet well organized to support and encourage the protection of these resources. One expert suggested that NGOs with capacity to engage and support community-based management would find numerous enthusiastic community members willing to work together for improved marine management.

Recommendations for possible conservation actions for Maui include:

1. Additional interviews with experts to identify other priority sites
2. Surveys to better understand the biodiversity as well as the condition of the marine resources of Maui
3. Resource use assessments to understand human activities and their impacts
4. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
5. Enhanced research on the impacts of human activities on marine resources in Maui
6. Continued studies and monitoring of the spread of alien algae
7. Extension of watershed partnership programs to reduce nutrient and sediment flows into the marine area
8. Development of community partnerships with citizen groups and others across the island to support and encourage marine conservation actions

9. Development of a multi-stakeholder strategy for the long-term conservation of O‘ahu
10. Support including education for roll out of new minimum fish sizes and other DAR regulations.

Hawai‘i

The island of Hawai‘i was offered by many experts as a very high priority for marine conservation. While the youngest island with the least developed coral reefs, Hawai‘i is home to a number of healthy marine and coastal areas. Likewise, Hawai‘i has not suffered the explosion of alien species that has occurred in O‘ahu and Maui. As a result, Hawai‘i is a high priority for conservation.

Hawai‘i is also home to one of the best examples to date of an effective marine managed area initiatives. The Kona coast Fisheries Management Area and Fisheries Replenishment Areas have been highlighted by the majority of experts as one of Hawai‘i’s marine conservation success stories (see Box 5 on page 68). Having observed the formation of these protected areas, other communities have also now become interested in developing their own marine management areas.

Experts placed an emphasis on the Kona coast as being important for marine conservation almost in its entirety. Numerous areas where mentioned including Makalawena, which is important for alkaline pools, Kīholo Bay which is important both for alkaline pools and for green turtle nesting, as well as the Kapoho tide pools. In addition, experts mentioned Puakea as an important area for tide pools and for almost 100% coral cover in certain areas. Puakea is already a Fisheries Management Area but was cited as a place that could use additional conservation management.

In general, experts indicated that areas that are remote even on the Big Island, which is one of the least-developed islands, are generally the most important for conservation.

Recommendations for possible conservation actions for the Big Island are similar to those for other islands and include:

1. Additional interviews with experts to identify other priority sites.
2. Surveys to better understand the biodiversity as well as the condition of the marine resources of Hawai‘i
3. Resource use assessments to understand human activities and their impacts
4. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
5. Enhanced research on the impacts of human activities on marine resources in Hawai‘i
6. Continued studies and monitoring of the spread of alien algae
7. Development of a multi-stakeholder strategy for the long-term conservation of Hawai‘i
8. Support, including education, for roll out of new minimum fish sizes and other DAR regulations.

Kahoʻolawe

While Kahoʻolawe is believed to suffer from the greatest sedimentation of any Hawaiian island, it remains a major priority for marine conservation for several reasons. Because the area has been off limits to fishing for as much as 50 years, the fish populations and ecosystems that support them are in relatively good shape. There is evidence that the island's use as a bombing target did affect the marine environment, yet much of the area's marine systems remain largely intact. Likewise, sedimentation from the island, while severe, remains largely limited to natural drainage areas. As a result, extensive reef and marine systems escape the worst of the sedimentation. Fortunately, protection of the marine resources of Kahoʻolawe will continue as long as the area is well managed by the Kahoʻolawe Island Reserve Commission (KIRC). It is possible that the area could be opened up for fishing, in fact several individuals have already started lobbying for rights to fish in the area. To date however, those requests have been denied and the area remains under a no fishing regulation.

As part of its program, the KIRC is undertaking regular marine monitoring. Unfortunately, these monitoring reports were not accessed s part of this study.

Recommendations for Kahoʻolawe:

1. Cooperative surveys with KIRC to better understand the biodiversity as well as the condition of the marine resources of Kahoʻolawe
2. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
3. Development of a multi-stakeholder strategy for the long-term conservation of Kahoʻolawe
4. Support, including education, for roll out of new minimum fish sizes and other DAR regulations.

Lānaʻi:

Lānaʻi was not mentioned by many experts, although those that did mention it suggested that the Northern coast is an area that may be a priority for marine conservation. The main suggestion was to undertake surveys to better understand the extent of the resources and the condition of the resources in Lānaʻi. Lānaʻi suffers from the same sedimention stress as Molokai and Kahoʻolawe.

Recommendations for Lānaʻi (recommendations remain general as very little information was provided by experts):

1. Discuss with owners their interest in possible marine conservation efforts.
2. Surveys to better understand the biodiversity as well as the condition of the marine resources of Lānaʻi
3. Resource use assessments to understand human activities and their impacts

4. Threat and opportunity assessments to better understand how to more effectively develop conservation programs
5. Development of a multi-stakeholder strategy for the long-term conservation of Lānaʻi.

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LIST OF EXPERTS INTERVIEWED

Non-Governmental Organizations

Lu Eldredge: Bishop Museum
Stephanie Fried: Environmental Defense Fund
Alan Friedlander: Oceanic Institute
Eric Gilman: National Audubon's Living Oceans Program
Scott Godwin: Bishop Museum
Isaac Harp: KAHEA
Cindy Hunter: Waikiki Aquarium
Linda Paul: Hawaii Audubon Society
Dave Raney: Sierra Club
Cha Smith: KAHEA
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