NOAA FISHERIES

Grade Level

- 7-12

Timeframe

- 60 minutes, plus one homework assignment

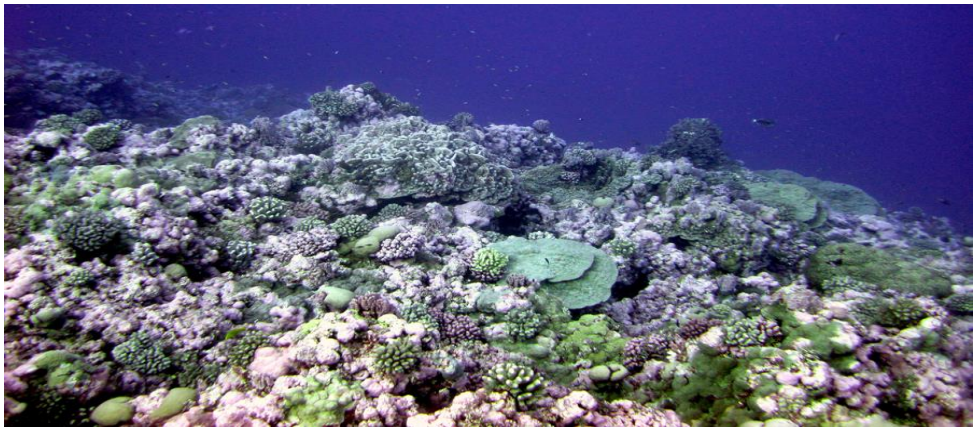
Materials

- Google Earth
- Two articles
- Presidential Proclamation
- MPA Classification Fact Sheet

Key Words

- Marine National Monument
- Marine Protected Area
- Traditional Ecological Knowledge
- Environmental Management

Rose Atoll Marine National Monument – Marine Protected Areas



Activity Summary

This group of lessons has focused on the natural ecosystems found in Pacific Marine National Monuments and the research being conducted there, and has provided background information on what it means to for an area to be designated as a Marine National Monument (MNM) or a Marine Protected Area (MPA). This lesson will go into more detail about MNMs and MPAs and some of the management options for them. It will also cover why they are important for people who live nearby and far away, the different types and uses in protected areas, and discusses the way Rose Atoll is protected. Following a discussion about both modern and traditional marine management practices, students will design their own MPA.

Learning Objectives

- Understand why we need Marine Protected Areas;
- Explore the different options for managing and using resources in protected areas;
- Investigate the use of protected areas in a variety of cultures; and
- Practice using scientific information to make environmental management decisions.

Background Information

As growing demands are placed on our natural resources, it becomes increasingly important to ensure that natural areas are protected. Unique marine ecosystems have environmental, cultural, and economic value and they provide valuable ecosystem services to humans. Because of those benefits, as well as the intrinsic value of marine ecosystems, some areas are being protected and given higher levels of regulations than their

Outline

ENGAGE – Use Google Earth to explore Marine Protected Areas around the globe.

EXPLORE – Class discussion of the types of Marine Protected Areas.

EXPLAIN – Divide into groups and read articles on traditional marine conservation methods.

ELABORATE – Group discussions about the articles.

EVALUATE – Design your own marine protected area writing assignment.

Vocabulary

MARINE PROTECTED AREA – Any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.

MARINE NATIONAL MONUMENT – A type of Marine Protected Area designated by Presidential Proclamation through the Antiquities Act of 1906.

TRADITONAL ECOLOGICAL KNOWLEDGE – Indigenous or aboriginal knowledge of the environment, natural resources, and landscapes acquired over a long period of time through contact with the environment.

ENVIRONMENTAL MANAGEMENT – Managing the interactions between humans and the environment and the impact that humans have on the environment and its resources.

surrounding waters. Environmental protections on land and water can come in a variety of forms; when it's a marine or large freshwater area the term Marine Protected Area, or MPA, is used most commonly to describe a variety of types of protections.

Marine Protected Areas (MPAs) can be organized with a variety of activities permitted within the area, but typically conservation and protection are the top priorities. The regulations may outline if and how people can fish and what other recreational or commercial activities are allowed. MPAs can have different names as well; the Marine National Monuments featured in these lessons are one type of MPA, National Marine Sanctuaries are another. They are not limited to salt water; there are also marine sanctuaries in large fresh water bodies like the Great Lakes. As of early 2015, there were 437 areas listed within the United States national system of MPAs. In the U.S., a classification system also exits in order to understand the different types of protections and activities that take place in MPAs. You can find out if there are any MPAs in your area by going here: http://marineprotectedareas.noaa.gov/dataanalysis/mpainventory/.

There are a variety of legal methods available for local, tribal, state, and federal governments to create MPAs. The Pacific Marine National Monuments (PMNM), for example, were created by a Presidential Proclamation under the Antiques Act. NOAA manages the Marine National Monument Program (MNMP) and coordinates the management, research, and conservation efforts occurring throughout the waters of the Monuments. The mission and goals of the MNMP program are:

MISSON STATEMENT:

Understand and protect the unique natural and cultural resources within the Marine National Monuments through the advancement of scientific research, exploration, and public education.

VISION:

Strong partnerships that promote healthy ecosystems through science based management by 2016

GOALS:
1. Collaboratively develop and adaptively manage governance structures for the Marine National Monuments.
2. Develop a program for scientific exploration and research.
3. Increase stakeholder awareness, engagement, and support for the Marine National Monuments

NOAA Marine National Monument Program
http://www.fpir.noaa.gov/MNM/mnm_index.html

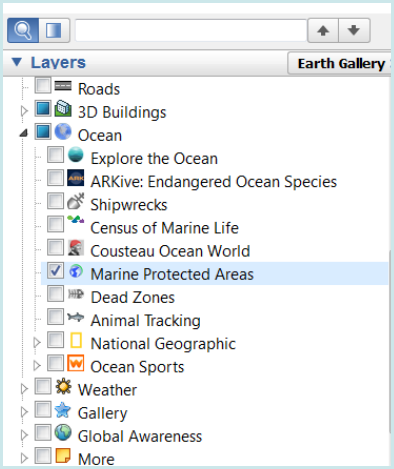
Like many of the Monuments and other MPAs, Rose Atoll is managed through a collaborative partnership. In addition to NOAA, the US Fish and Wildlife Service, the Department of State, Department of Defense,

and the government of American Samoa are part of the management of Rose Atoll.

Preparation

- Read the introduction to Rose Atoll and the Presidential Proclamation creating the Monument.
- Familiarize yourself with Google Earth.
- Make the Presidential Proclamation creating Rose Atoll available for the class to read.
- Read the two articles your class will be reading during the Explain section and print enough copies for your students. You will need to divide your class into four groups; half of the students should get copies of one article and the other half should read the second article. There are suggestions for how to break the articles into sections; you may wish to modify them based on the reading skill level of your class. Perhaps you may want to read one article together as a class, and if so, there is no need to make copies of the second one.

Learning Procedure



Engage

Start Google Earth without any layers showing. Use the globe as a reference as you have a brief discussion. If you have completed other lessons on the PMNMs, your students should already be familiar with the idea of Marine Protected Areas. Give an introduction that is appropriate to their experience with this topic.

- Why do we protect certain areas of our ocean and Great Lakes?
- We've been focused on the Pacific Marine National Monuments. Are all Marine Protected Areas in tropical waters? The islands and atolls of the PMNM are uninhabited. Can people and protected areas coexist?

Under the ocean layer, check Marine Protected Areas. Rotate the globe and look at the Marine Protected Areas. They will either be ocean areas outlined in white or small boxes along the shoreline. You should zoom in close to see some of the smaller areas. Let you students direct the investigation and ensure that they understand that protected areas come in a variety of sizes, can be areas besides coral reefs, and that the United States is not the only country that has MPAs. If you have not done the other lessons on Rose Atoll, spend a few minutes on Google Street view exploring the reef and beach as well.
https://www.google.com/maps/streetview/#remote-islands-of-the-world/rose-atoll

Explore

Now that you've explored where MPAs are located, have a deeper discussion about environmental protections in general. What does it

mean to be a national monument or a protected area? What does it mean for issues like access, activities, and plants and animals that live there? Pass out copies of the Presidential Proclamation creating Rose Atoll Marine National Monument and have your students read it either together as a class or quietly by themselves.

Lead a discussion with your students to discuss these general themes. Suggested questions follow:

- What do you think a protected area is and do you know of any, either in your local area or elsewhere in the country?
- Do you think it is important to have protected areas set aside? Why or why not?
- What are the pros and cons of protected areas?
- What activities do you think should be allowed in a protected area?
- Think about the ocean versus the land; what are the differences and challenges associated with protecting marine areas as opposed to protecting parks on land?
    - *Possibilities include the fact that you can buy land and own land but you can't own part of the ocean, enforcement of rules can be more challenging, boundaries harder to define. Even if someone means well they may fish in a protected area due to lack of knowledge.*
- What criteria would you use if you were deciding what areas to protect?

Share the slide showing NOAA's definition of a Marine Protected Area (MPA). There are many types of designations that are considered to be MPAs: National Marine Sanctuaries, National Marine Monuments, and marine reserves or parks.

Differences among MPAs include:

- Conservation Focus
- Level of Protection
- Permanence of Protection
- Constancy of Protection
- Scale of Protection

Ask your students to think of parks in your state or local area. Are there differences between the parks with regards to who they are managed by and what you are allowed to do there?

- *They may not recognize that some parks are managed by the state, or federal government and others by their local county or city, but hopefully students will know that rules can vary for activities such as camping, fishing, campfires, and pets, to name a few.*

Reading Materials and Recommended Sections for Students

Traditional Knowledge, Use, and Management of Living Marine Resources in American Samoa: Documenting Changes Over Time through Interviews with Elder Fishers

Suggested sections:

Section 1 - Introduction through *Fishermen's Explanations for Changes in Abundance*

Section 2 - *Fishermen's Explanations for Changes in Abundance* through the end

Everyone should look over the graphs of the results from the interviews with the fishermen.

Customary Marine Resource Knowledge and Use in Contemporary Hawai'i

Suggested sections:

Section 1 – Introduction through *Renaissance of Customary Management in Hawaii*

Section 2 - *Renaissance of Customary Management in Hawaii* through *Ways Forward*

Section 3 – *Ways Forward* through the end

Everyone should look over Table 1 on page 447.

Explain

The modern American methods of designing and managing MPAs are not the only ways of designating a marine area for protection. There are multiple cultures in the Pacific that have their own traditions of marine management. Some of those management practices included temporary closed areas like the practice of *tabu* areas in Fiji, *kapu* in Hawaii, or *bul* in Palau. Divide the students into four groups and pass out the articles on traditional management practices so each article is read by two groups. One focuses on traditional marine management practices in Hawaii and one is a study based upon interviews with fishermen in American Samoa. The articles are not too long, but since your students are probably not used to reading academic articles a few suggestions follow that may make it easier.

- Divide the articles into sections and have a few students within each group read the sections. Then have them teach their part of the article to the rest of the group. Or have the whole group concentrate on only a part of the article together.
- If you have internet access and computers within your classroom, encourage the students to take their time and look up words they do not understand. A dictionary will work well too.

Elaborate

After the groups have read the articles, combine groups that have read each article so you now have two larger groups. Have the students give a short summary to the other group about their article and how it addressed how a particular culture managed and protected its marine resources and environment. Encourage them to think about the following themes while reading and sharing with their classmates.

- Background and explanation of the traditional management practice.
- How does this compare/contrast with the modern methods discussed earlier?
- What are the challenges and advantages associated with the traditional versus modern method?
- Can your group propose some combination of the two practices?
- What are the general perceptions of the fishermen in American Samoa?
- What goals do both traditional and modern management practices share?

- What sort of traditions do you have in your family or community that have been handed down from your grandparents or other older relatives?

Evaluate

Design your own MPA. You can have your students do this in class in small groups or as individuals, or assign it as homework. Include the "Classification of MPAs" handout with the assignment to provide guidance on the objectives and goals of MPAs. Options for modification based upon class age, academic background, and how rigorous you would like this writing assignment to be include:

- There is no length requirement on the assignment; you can decide what is appropriate. In order to answer all the questions with at least some explanation, one page is probably a minimum length.
- Ask your students to do additional research and provide scientific rationale to support their decisions. This could include protection decisions based on the life history of some species, based upon predicted environmental change, or some socio-economic factors.

Design your own Marine Protected Area and describe how it will be managed. You can pick a real location or create one, but you should start by explaining where it is and why this place deserves protection. Explain the goals, objectives, and protection of your MPA by answering the following questions:

1. What is the conservation focus?
2. What is the level or protection?
3. What is the permanence of protection?
4. What is the constancy of protection?
5. What is the scale of protection?

Use the "Classification of MPAs" handout to understand what your options are. Do not simply write the category from that handout, but explain why you have chosen it and why it is the best option for your MPA. Remember to consider the environment as well as the people who may be affected by the creation of your MPA. Will it affect anyone's livelihood or recreation options? Explain how you have balanced those considerations into your MPA.

Closing

Recap what you have discussed about Marine Monuments. While they are not going to be the solution to all of the issues that the ocean faces, they are one tool in the toolbox to protect special ecosystems.

Extending the Lesson

- Read some of the articles from this theme issue about MPAs from the Marine Education Journal *Current* http://marineprotectedareas.noaa.gov/resources/education/current/welcome.html
- Video: The National System of MPAs: An Introduction http://marineprotectedareas.noaa.gov/resources/multimedia/
- Video: Protecting our Planet http://marineprotectedareas.noaa.gov/resources/multimedia/

Connections To Other Subjects

- Ecology
- Biology
- Policy
- Environmental Management

Related Links

Google Underwater View of Rose Atoll
MPA Inventory
NOAA Fisheries Rose Atoll
NOAA Fisheries Pacific Islands Regional Office
NOAA National Marine Sanctuaries Education

For More Information

NOAA Fisheries Pacific Islands Regional Office
NOAA Marine National Monument Program
1845 Wasp Blvd., Building 176
Honolulu, HI 96818
(808) 725-5000, (808) 725-5215 (fax) pirohonolulu@noaa.gov

Acknowledgement

This lesson is one in a series exploring the geology, biology, oceanography, and ecology of the Pacific Marine National Monuments. It was developed for the NOAA Fisheries Pacific Islands Regional Office.

This lesson was developed by Mary Engels of the University of Idaho and Laura Nelson of the University of Washington.

further questions or need additional information, email pirohonolulu@noaa.gov.

All images are from NOAA unless otherwise cited.

Thank you to all the reviewers for their feedback and assistance.

Education Standards

Next Generation Science Standards	• MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. • MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. • HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. • HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
Ocean Literacy Principles	• 1H. Though the ocean is large, it is finite and its resources are limited. • 6C. the ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of many cultures. • 6D. Humans affect the ocean in a variety of ways. Laws, regulations, and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, nonpoint source, and noise pollution), changes to ocean chemistry (ocean acidification), and physical modifications (changes to beaches, shores, and rivers). • 6G. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

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Review Article

Marine Resource Management in the Hawaiian Archipelago: The Traditional Hawaiian System in Relation to the Western Approach

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Over a period of many centuries the Polynesians who inhabited Hawai'i developed a carefully regulated and sustainable "*ahupua'a*" management system that integrated watershed, freshwater and nearshore marine resources based on the fundamental linkages between all ecosystems from the mountain tops to the sea. This traditional scheme employed adaptive management practices keyed to subtle changes in natural resources. Sophisticated social controls on resource utilization were an important component of the system. Over the past two centuries a "Western system" gradually replaced much of the traditional Hawaiian system. There are major differences between the two systems in the areas of management practices, management focus, knowledge base, dissemination of information, resource monitoring, legal authority, access rights, stewardship and enforcement. However, there is a recent shift toward incorporating elements of the traditional scheme using methods and terminology acceptable and appropriate to present day realities. This trend is exemplified by the management plan for the newly formed Papahānaumokuākea Marine National Monument in the Northwestern Hawaiian Islands. This is one of the largest protected areas in the world and is being managed with a focus on Native Hawaiian cultural values in relation to conservation, ecological, historical, scientific, and educational resource protection.

1. Introduction

For the past century Hawai'i has been dominated by a "Western" model of marine environmental management. Recently, however, there has been a renewed interest in the traditional management practices of ancient Hawaiians. Throughout Hawai'i, a growing cultural, sociological, and scientific movement is working to investigate and revive some of these traditional management tools and to integrate them with modern scientific methodology. The native islanders had devised and implemented every basic form of what are now considered modern marine fisheries conservation measures centuries ago, long before the need for marine conservation was even recognized in Western nations [1]. Traditional restrictions on fishing in Hawai'i were achieved by the use of closed seasons, closed areas, size restrictions, gear restrictions, and restricted entry. Additional social, cultural, and spiritual controls strengthened the conservation ethic under the old system. Ancient Hawaiians used a holistic approach that we might now recognize and strive for as integrated coastal management. Bridging the gap between traditional management and Western science represents a challenge to researchers, government agencies, resource managers, cultural practitioners and organizations, and to the people of Hawai'i. This paper was undertaken in order to define, describe, and clarify primary differences and similarities

between the traditional and Western systems in various areas such as management practices, management focus, knowledge base, dissemination of information, resource monitoring, legal authority, access rights, stewardship, and enforcement methods. Finally, we summarize evidence that a synthesis of the two management systems is slowly occurring throughout the Hawaiian Archipelago.

2. Description of the Traditional System

Elements of the traditional Hawaiian management system for managing nearshore resources are known from several sources. The primary historical literature translated to date contains written descriptions of various practices and customs used in ancient times. The most important accounts were written between 1830 and 1870 as reported by Kamakau [2–4], I'i [5], and Malo [6]. Additional information on marine resource usage is contained in works by Beckely [7], Kahā'ulelio [8], Cobb [9], Handy [10], Titcomb [11], Kawaharada [12] and E. S. C. Handy & E. G. Handy [13]. Recent ethnographic studies include K. Maly and O. Maly [14, 15], Peterson and Orr [16] and Glazier [17]. Thousands of additional primary source documents and newspaper articles written in the 100 year old Hawaiian language remain to be translated and studied and will one day reveal more than is known today. An oral tradition also persists, especially in the more isolated areas of the Hawaiian Islands.

Certain traditional Hawaiian words are used in this discussion because of nuances in meaning that do not translate into the English language. These Hawaiian terms are increasingly used within the State of Hawai'i and within the U. S. Government in reference to various management practices. For example, the Hawaiian word *pono* does not have a suitable direct English language meaning and refers to actions that are "appropriate, correct, and deemed necessary by traditional standards in the Hawaiian culture". Therefore this word was included in the regulations that established the Northwestern Hawaiian Islands Marine National Monument as published in the Federal Register [18]. Likewise the native Hawaiian name *Papahānaumokuākea* was subsequently chosen for the monument in keeping with the intent to manage the area using traditional values. This name has deep spiritual and cultural meaning (http://papahanaumokuakea.gov/about/name.html/) that is relevant to past and present management practices in that region of the archipelago.

2.1. Tenure and Management Concepts. The predominant traditional system in the eight high islands of the Main Hawaiian Islands (MHIs) was based on the *ahupua'a*, which is a unit of land that extends from the mountains to the sea and generally includes one or more complete watershed(s) and all nearshore marine resources [19, 20]. Each *ahupua'a* contained a broad cross section of island resources and was managed within a complex social system associated with each area. The general belief is that each *ahupua'a* met the needs of the local population with an excess for tribute and trade. At present the traditional cultural, economic, and social structure of the *ahupua'a* are no longer in general use although the land boundaries continue to be informally recognized in the State of Hawai'i. However, a resurgence of interest in traditional Hawaiian resource management during the last decade has led to wide use of the term *ahupua'a* in reference to integrated coastal management based on individual watersheds and their offshore waters.

The modern concept of the *ahupua'a* may not be totally accurate compared to what it meant to the ancient Hawaiians. The *ahupua'a* can be viewed as a unit for production of goods. Maintaining ecological integrity led to sustainable production of foods and other material which could be offered in *ho'okupu.* Pukui and Elbert [21] define *ho'okupu* as tribute, tax, or ceremonial gift given as a sign of honor and respect. An alter (*aha*) was located at the edge of each *ahupua'a* with a likeness of a pig's head (*pua'a*), and it was here that tribute to the ruling chief was deposited each year during the *makahiki* as the long god circled the island [13, 22]. However, the smaller strips within the *ahupua'a*, the *'ili*, represented the true basic unit of land division to which the local people retained fidelity over long periods of time. The various *ahupua'a* were redistributed to secondary chiefs after every major power shuffle on an island, so that frequently the *ali'i* (chiefly caste) that ruled an *ahupua'a* did not actually come from that *ahupua'a*, or even from the island on which it was located [2]. There were times when *ali'i* from Maui controlled many of the *ahupua'a* on O'ahu [13]. By contrast, the *'ili* were inhabited by the same extended families, or *'ohana*, for many generations. Just as with our modern concept of the *ahupua'a*, the *'ili* required a cross-section of available resources—they generally incorporated a piece of the mountain, a piece of the valley, and a piece of the shoreline. If this condition could not be accommodated in a single narrow mountain-to-shore strip (*'ili pa'a*), then an *'ili* could be set up as a series of two or three disconnected units (*'ili lele*) that provided the necessary components; in some cases these separate pieces comprising a single *'ili* could be in separate *ahupua'a*. Thus a family's traditional near shore gathering grounds might be some distance from their upland fields (or even at the mouth of another valley).

Prior to Western contact all land and ocean resources were held in trust by the *ali'i* (chiefs) with harvest rights overseen by a *konohiki* (an expert resource manager for each area) who was responsible for the coordinated stewardship of all extractive natural resources. Although the *konohiki* was originally considered to be merely a manager of the *ahupua'a*, the term eventually came to mean landlord/chief of the *ahupua'a* [23]. The *hoa'āina* (native inhabitants) had rights to the resources for subsistence and tribute. The *konohiki* was advised by *kūpuna*, who were elders acknowledged for their knowledge and wisdom. The *po'o lawai'a* (master fishermen who held and transmitted knowledge) also consulted with the *konohiki* on matters concerning management of marine resources.

Knowledge was developed over centuries and handed down from generation to generation. Decisions were based on detailed information on the local area and a keen understanding of natural cycles. Transmission of knowledge occurred through an oral tradition and by direct teaching and experience. One of the primary management tools was

the *kapu* which was a decree that imposed restrictions on extraction of resources at certain times and places. The term *hoʻomalu* is found in announcements by *konohiki* when reserving fish for themselves as was articulated in the laws of 1839-40. Certain marine resources (e.g., turtles, octopus, dolphins, and jacks), were also *kapu* for women and those not of the *aliʻi* caste. Violation of *kapu* was often punishable by death [24]. Enforcement often was immediate and severe.

2.2. Spiritual and Cultural Values. Deeply ingrained traditional sociospiritual aspects of the culture provided a further safeguard against overexploitation. The *kānaka maoli* (native Hawaiians) demonstrated a deep spiritual connection with nature that was expressed through offerings and prayers that were an integral part of the fishing effort. *Koʻa* (fishing shrines) were built along the coast. Help from ocean creatures was sought for success in the fishing effort. Sharks, turtles, and various fishes served as *ʻaumākua* (family guardians). *ʻOli* (chants) and the *hula* (dance) were important parts of the Hawaiian oral transmission of information concerning the importance of the sea. For example, the predominant Hawaiian creation chant, the *Kumulipo* [25], describes the first creation of life following the male and female as the coral polyp, which in turn gave rise to subsequent organisms.

> *Hānau ka ʻuku koʻakoʻa, hānau kāna, he ʻakoʻakoʻa, puka.* (Born was the coral polyp, born was the coral, came forth.)

Cultural values and concepts were also shared and practiced through *ʻōlelo noʻeau* (proverbs). Many of these traditional sayings [26] refer to the lifeline of the native people:

> *Mālama i ke kai, a mālama ke kai iā ʻoe!* (Take care of the ocean and the ocean will care for you.) [15].

The term *kuleana* refers to specific responsibilities that accompanied the privilege of sharing in the resource. *Kuleana* also means "interest" as in having a shared interest in some entity. The Hawaiian concept of *kōkua* requires sharing of resources with those in need, and the responsibility of all resource users to maintain the systems that produced those resources [27]. *Mālama* is the practice of caring for the land.

2.3. Management Practices. In ancient Hawaiʻi, the art of fishing was passed along family lines. Fishermen were of a special lineage and trained for years as an apprentice. During this time they were taught to observe subtle and major changes in the condition of the marine resources. They were educated in the life cycle, diet, daily, and seasonal feeding habits, preferred habitat, and growth conditions. They obtained knowledge of the appropriate season, time of month, time of day, and method for harvesting of the many species of fishes, invertebrates, and seaweeds. Harvest management was not based on quota, but on identifying the specific times and places that fishing could occur so that it would not disrupt the basic habits of important food resources nor deplete fish stocks. Until training was complete, young fishermen were only allowed to observe the process and hold the catch. Fishing activities were often regulated by the moon calendar [28] which emphasized repetitive biological and ecological processes (e.g., fish spawning, aggregation, and feeding habits). Social and cultural controls assured compliance of a strictly imposed code of conduct. Behavior of the fishermen before, during and after fishing was controlled. The belief was held that resources were limited and there was a social obligation to exercise self-restraint in resource exploitation. The ancient Hawaiians viewed themselves as an integral part of nature [12, 14, 15, 19, 22].

2.4. Transmission of Knowledge. Based on centuries of trial and error and astute observation, Hawaiians incorporated their understanding of the oceans into self-sustaining management practices. Hawaiians possessed a complex understanding of the life histories of fishes. Perceptive observations led to a keen familiarity of physical (e.g., weather patterns, currents, tides, wind, waves), biological (e.g., spawning seasons, recruitment, and growth), and ecological (e.g., foraging patterns, behavior, and habitat) factors that influence fisheries. In these areas the traditional knowledge of Hawaiian fishermen may have surpassed what is known by modern marine biologists [29, 30]. Knowledgeable *kūpuna* also consulted with *poʻo lawaiʻa* (master fisherman) who had intimate awareness of the status of various populations of reef organisms. When populations declined to low levels, a *kapu* (forbidden practice) was placed on extraction to allow the resource to recover [14, 15]. Knowledge and management practices were place specific, and kept secret. Kamakau reported that Hawaiian fishermen would paddle out of sight before pulling up their catches so that no one would know exactly where the fish were taken: "In this way those who had secret fishing grounds kept their locations from becoming common knowledge" [3]. Families and communities found especially fertile areas above seamounts, information of which they passed on orally to their offspring but tried to keep secret from others [31].

2.5. Effectiveness of Traditional Management System. Historical accounts from the nineteenth century attest to the abundance of the marine resources of precontact Hawaiʻi and the sustainability of the fisheries [15]. This would also be true for the coastal pelagic and open ocean species given their widespread distribution and abundance and the limitations in the harvesting technologies of the day. For nearly a millennium, Hawaiʻi's fishers and gatherers helped to sustain a native population, which according to some accounts reached between 500,000 and 1 million [19], but more likely was in the range of 150,000 to 250,000 [32–35]. The current population of the State of Hawaiʻi is 1.3 million, but it is estimated that over 90% of the food and seafood consumed by the population come from outside of Hawaiʻi. It is difficult to know with certainty the status of inshore and coral reef associated resources during the precontact period and whether the supply decreased as the Hawaiian

population grew. Evidence from archaeological excavation suggests that nearshore marine resources in Hawai'i and the Pacific were susceptible to human overuse [36–38]. Early overexploitation of marine food sources in Oceania might have led to increased dependency on more reliable and predictable terrestrial food resources [39]. The widespread construction and operation of fishponds [40–44] supplied the *ali'i* and others with fresh fish during times when the reef resources were under *kapu* and during times when severe weather prevented fishing. Also, such ponds augmented or replaced wild caught stocks, as is the case for modern analog aquaculture and stock enhancement programs. The placing of permanent or temporary *kapu* on various species and life stages of marine life [6] was motivated by various economic, cultural, and spiritual factors, but certainly the maintenance of fishery stocks was an important motivation. During post-contact times there are accounts of periodic famine [13] and reports of a "deficiency of fish" [36] suggesting that resources were sensitive to overexploitation at that time if not managed properly.

2.6. Breakdown of the Traditional System. The breakdown of the traditional marine management system was precipitated by major cultural changes following Western contact. The abolishment of the traditional kapu system in 1819 by Kamehameha II (Liholiho) and Ka'ahamanu was one of the most significant and transformative events in Hawaiian history [45, 46] that set the stage for further changes. The Hawaiian Kingdom attempted to resist colonialism and adapt to the changing global political environment through modification of traditional structure using Hawaiianized Euro-American practices to suit their own needs [47]. For example, the mapping of the lands was largely conducted by the *ali'i* and other Hawaiian nationals as a means for the Hawaiian State to secure national lands in the face of colonial pressures [48]. A key element in the breakdown was the redirection of the activities and energies of the *hoa'āina* (native tenants) to produce products for trade in order to acquire foreign goods for the *ali'i* and their *konohiki* [10]. Contemporary writers and the historian Kuykendall [49] considered this redirection as one of the prime causes of famine, sickness, and depopulation of the Hawaiian Kingdom prior to 1829 [10].

Subsequent changes in land tenure led to a further erosion of the *ahupua'a* as a social unit. The *Māhele 'Āina,* (division of the land) in 1848 was followed by the *Kuleana Act* in 1850, which established fee simple ownership in which land could now be sold to parties with no historical interest in sustaining the *ahupua'a* as a whole. This transfer of land created large plantations. Importation of workers resulted in a rapid ethnicity shift. Hawaiian communities were diluted, eroding traditional management. Foreigners brought new technology and unfamiliar concepts of resource exploitation, replacing centuries old sustainable management practices.

Although the *ahupua'a* concept of management began to break down on land, elements of the system still persisted in the marine environment. In laws published between 1839 and 1859, King Kamehameha III codified fishing rights and divided the fishing grounds amongst the people of Hawai'i. The King granted fishing rights within the reef (or to one mile offshore in those areas without a reef) to the *konohiki* and the tenants of the *ahupua'a* (known as the *hoa'āina*). The *konohiki* could *kapu* a single species of fish for his exclusive use or after consultation with the tenants prohibit fishing during certain months of the year [23]. During the 1848 land division, the Land Commission received over 1,000 claims for ocean resources. These fisheries records also document the testimonies of the *ali'i* and *konohiki* that were awarded *ahupua'a*. Public notice was issued concerning the *i'a ho'omalu* (*kapu* or protected fishes). A plethora of information about Hawaiian fisheries and traditional practices were recorded in 1874 when the Commission of Boundaries was established to ascertain the location of each of the *ahupua'a* that had been awarded in the *Māhele 'Āina.*

Following the overthrow of the Hawaiian kingdom and annexation to the United States in 1898, fisheries management was delegated to various government agencies. As was the case with colonial powers throughout much of Oceania traditional fishing rights were systematically extinguished in the name of the discredited "freedom of the seas" concept and because such customs prevented newcomers from expropriating the islanders' resources [1]. Ocean tenure practices based on regulation of fisheries through control of fishing rights were replaced by unlimited entry, often referred to as the "tragedy of the commons," leading to eventual resource depletion through overharvesting. The traditional system based on cooperation for the good of the community was slowly replaced by commercial forces and competition to benefit the individual. The subsistence-based, locally governed economy was converted to a cash-based economy controlled by remote global market demand. As time progressed, technology provided refrigeration and more efficient fishing gear, further accelerating the shift from subsistence to profit-based economies. A dramatic decline in Hawaiian fisheries stocks and fishery production occurred during the period of commercialization of fisheries [15]. The spiritual connection to the ocean slowly deteriorated, along with the concepts of *kuleana*, *kōkua*, and *mālama* (responsibility, sharing, and caring) with the increasing disconnect between neighbors. The social pressure to support the traditional system was reduced as fisheries management switched from within the local community to a more remote and poorly enforced organizational scheme. The Hawaiian Organic Act of 1900, passed a year after Hawai'i's annexation as a United States Territory, further limited most *konohiki* fishing rights through condemnation of *ahupua'a* fisheries. [50]. The 1900 law repealed earlier laws conferring these exclusive rights and opened the fisheries of the Territorial waters to all citizens of the United States. Specifically excluded were fisheries which were already vested and filed with the circuit court within two years, but even these fisheries could be condemned for public use upon payment of just compensation. As recently as the 1940's several of these *konohiki* fisheries were still extant [15]. The Organic Act and subsequent state court decisions effectively eliminated *konohiki* and *hoa'āina* fishing rights, but more recent federal courts have taken a broader view and continue to recognize them as a legal form of property ownership [23]. The breakdown of *mālama* coupled with

the loss of traditional guidance from *kūpuna* (knowledgeable elders in the community) further removed social controls on fishing and hastened the decline of traditional near-shore fisheries resources. The dismantling of this system undermined native Hawaiian lifestyles, values, and culture.

Between 1898 and 1905 detailed reports on the condition of the fisheries and management recommendations based on commercial values of catch were prepared by the U. S. Fish Commission. These data [51] provide an important baseline that has been used to document an 80% reduction in coastal fish catch (Figure 1) between 1900 (1,655,000 kg) and 1986 (285,000 kg).

2.7. Management of Offshore Waters. A different management scheme existed in offshore waters beyond the boundaries of the traditional *ahupua'a* of the MHI. Native Hawaiians located and utilized offshore fishing grounds above banks and seamounts that were located far from the coastline of the MHI [2–4, 52–56] extending into the NWHI. At that time all inhabitants were free to fish on the high seas so long as they respected specific restrictions set by the ruling class and observed cultural and religious taboos. Locations of deep sea fisheries were the proprietary knowledge of individual fishermen [3, 31], not the communal property of the *ahupua'a*. These management policies were eventually codified into written law by King Kamehameha III.

Deep water snappers in Hawai'i are only found in localized areas (known as a *ko'a*) that are characterized by proper depth range, presence of rock outcrops and other conditions that are favorable to the fish. These locations were the guarded knowledge of single families [4], and as such were probably more closely associated with the *'ili* to which the families were bound. Bottom fishing was not linked to the spawning cycle as was the case for inshore species due to unpredictability of offshore weather conditions which could limit access [8]. Bottom fishing continued through the summer, a season of fine weather, but also the season in which most of the deep water species were spawning. Given the simple technology in use at that time (e.g., *olonā* hand lines that were woven from native plant fibers, hooks made of bone or shell, and dugout canoes), this arrangement appears to have had no major impact on fish stocks.

3. Description of the Contemporary System

The existing Western-based management system must deal with social and economic conditions that did not exist in ancient times. Major changes in land use and alterations of stream and near-shore environments have occurred almost everywhere. Waste disposal, invasive species, major shoreline construction, and other major environmental changes are presently occuring at a rapid rate. Hawai'i has experienced massive immigration of various cultural groups, fundamental changes in government, and advances in technology that have changed fishing practices and essentially eliminated past harvesting limitations of depth, distance, weather conditions, and darkness. Multiple interest groups vie for recognition and major shifts have occurred in societal perceptions. Conflicts arise with mandated protection for endangered species, difficulties with enforcement transpire, and national and global influences combine to create an environment that can be counterproductive to sustainability.

3.1. Structure and Functioning of Contemporary Management System. Under the present Western scheme, management responsibility of the marine environment is split between numerous agencies. The Hawai'i State Department of Land and Natural Resources (DLNR) administers all marine resources within 3 miles of land through the activities of various divisions. The DLNR Division of Aquatic Resources (DAR) is the primary agency responsible for management of living marine resources throughout the archipelago within 3 miles of land, with the exception of waters around the island of Kaho'olawe which are administered by the Kahoolawe Island Reserve Commission (KIRC). The DLNR Office of Conservation and Coastal Lands (OCCL) is responsible for overseeing approximately 2 million acres of private and public submerged lands that lie within the State Land Use Conservation District and for beach and marine lands out to the seaward extent of the State's jurisdiction. The DLNR has overlapping responsibility with other state and federal agencies. The U. S. Federal Government manages waters from 3 to 200 miles offshore (the U. S. Exclusive Economic Zone). The recently created Papahānaumokuākea Marine National Monument encompasses 137,792 square miles of U. S. waters, including over 4,500 square miles of relatively undisturbed coral reef habitat and is administered jointly by the U. S. National Oceanic and Atmospheric Administration (NOAA), the State of Hawai'i and the U. S. Fish and Wildlife Service. The U. S. Environmental Protection Agency (EPA) and Hawai'i State Department of Health are responsible for enforcing laws on water quality. Additional management responsibility in certain areas falls to the U. S. Army Corps, National Park Service, and the U. S. Coast Guard. Certain marine areas are under partial military jurisdiction. In addition there are numerous agencies involved in the regulation of activities affecting watersheds and streams that have an impact on marine resources.

In the MHI the DAR utilizes several management tools including full or partial closure of a reef area as a marine protected area (MPA), rotational and seasonal closures, restrictions on fishing gear or methods, size and bag limits, and rules preventing the take of certain species. Identifying and addressing a resource problem is a protracted process that requires surveys and scientific studies to establish the cause of decline, as well as the "buy in" of various user groups and interested parties through public meetings. Fishermen blame pollution and introduction of alien species for reductions in fish stocks and demand unequivocal evidence that overfishing is the cause of decline. Often the proper course of corrective action is unclear or controversial, and the problem is studied or debated for years. The "trigger" for management action is ill-defined and, based on available data, must often involve a devastating decline in the resource before action can be initiated.

Once there is sufficient scientific data to identify a problem and the appropriate course of corrective action, the DAR has two alternative procedures for establishing new

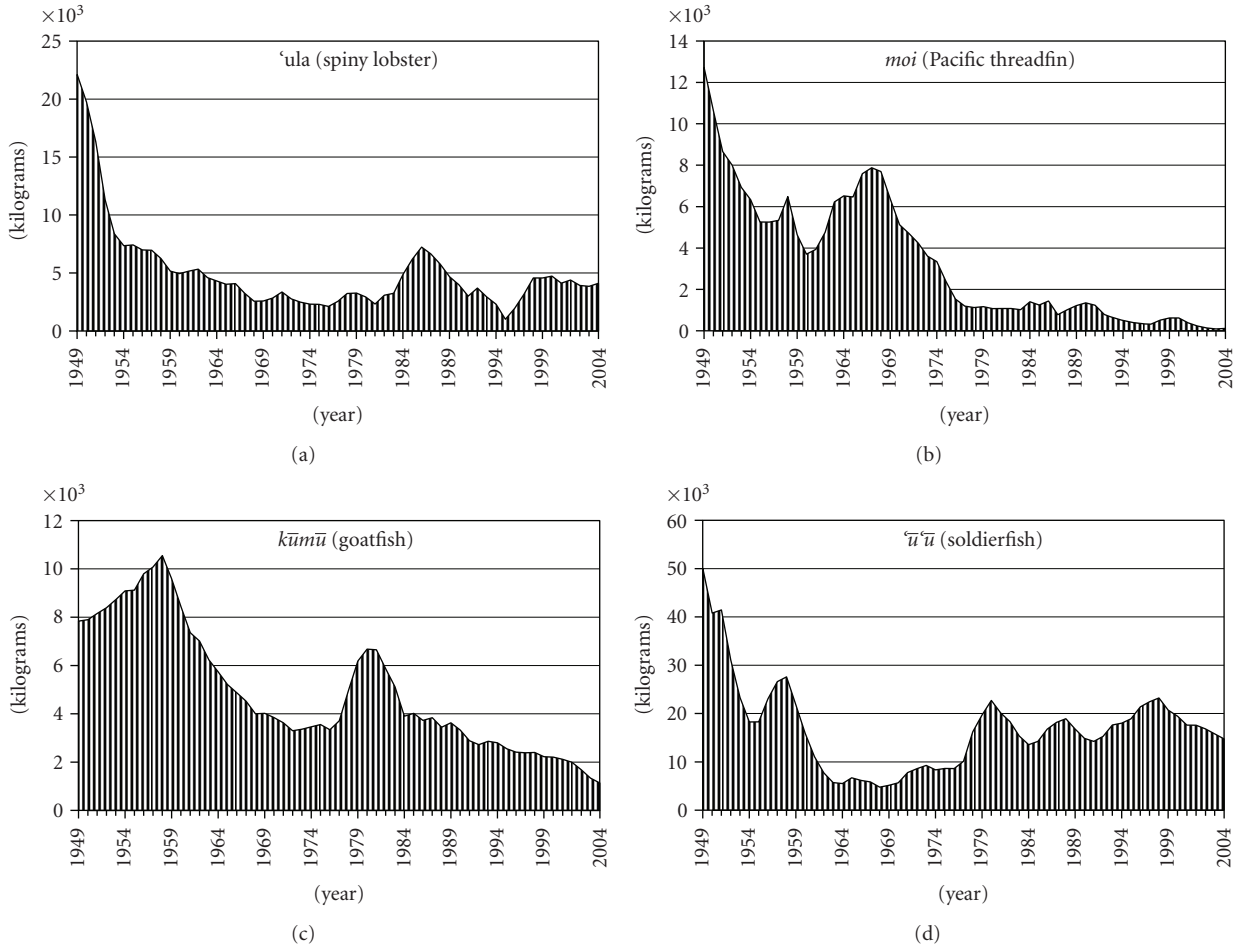

Figure 1: Main Hawaiian Islands commercial marine landings 1949–2005 for the *ʻula* or spiny lobster (*Panulirus* spp.), *moi* or Pacific threadfin (*Polydactylus sexfilis*), *kūmū* or goatfish (*Parupeneus porphyreus*) and *ʻūʻū* or soldierfish (*Myripristis* spp.). Data presented as 3 yr. moving average. Source: Division of Aquatic Resources unpublished data.

rules and regulations. The first method is to propose and draft a bill as an element in the Governor's legislative package that is developed internally each year from September to December. The bill is introduced when the legislature convenes in January. No public hearing is required for this process, but the legislature typically holds several public committee meetings. A legislative bill must be passed by both houses and be signed by the Governor to become law. The process takes approximately six months following the time that the bill is introduced and is effective immediately after being signed into law. It is up to the individual fisherman to know which bill passed and which laws are in effect. New laws may be published in the newspapers but this is not mandatory. The Hawaiʻi Revised Statutes which contains such laws can be accessed by the public and is updated annually, as is the rulebook published by the DAR. Those with a personal agenda often prefer the legislative process because bills can be introduced by any legislator on their behalf. Furthermore, all activity and discussion on a bill occurs in Honolulu, the seat of the Legislature. Time and travel constraints effectively reduce the opportunity for input from people living on the neighboring islands, particularly in remote areas. If a bill is not passed during a legislative session it can be introduced again in a later session, so a persistent minority of the population can potentially change regulations, given enough time.

The second means of establishing new regulations is the Administrative Rules Process which involves a series of public meetings and public testimonies. This process generally takes from one to five years to implement a new rule. DAR prefers this approach because it addresses concerns of all stakeholders and incorporates the public's point of view. Simple matters such as modification of zones within an MPA can take a year while more complex and controversial issues that have a great impact (such as gill net ban or establishment of fishery management areas) can take over five years. The process generally leads to compromise on all sides. Once the laws or administrative rules are enacted they can subsequently be repealed, amended or new rules can be initiated.

3.2. Effectiveness of the Contemporary Management System. Even though a much smaller proportion of the population presently fishes or consumes local fish products relative to

ancient times, marine resources have steadily declined over time coincident with the shift away from the traditional Hawaiian management system [14, 15, 51]. Early in the 20th century Jordan and Everman [57] noted that the fisheries of Honolulu were falling rapidly due to localized overfishing. Titcomb [11] relates that in 1923 one Hawaiian wrote to the Hawaiian newspaper *Ka Nūpepa Kuokoa* inquiring "why there was so much fish in the days of our ancestors and so little in our time…?" Responding to concerns over the high cost of fish in the markets in the 1920's, Hercules Kelly, Territorial Fish and Game Commissioner noted that wasteful methods, destructive fishing techniques, pollution, and overfishing had reduced the abundance of fish in Hawai'i's waters [27]. In 1927 it was reported that the fish fauna of Hawaiian reefs was much less abundant than several decades earlier and many common species were now rare [58]. Declining marine resources were acknowledged again by resource managers in the 1950's when they reported that desirable food and game fishes were "on a declining trend and have deteriorated to such an extent that the need for sound conservation measures is urgent" [59].

In Hawai'i only commercial fishers are required to file catch reports. Catch reports for several key species over the past 60 years are shown in Figure 1. Since the termination of ocean tenure practices and the associated controls on fisheries, the harvest of many species has decreased [51]. The largest declines in reported catch occurred in the first two decades after World War II. Commercial catch in more recent decades has remained relatively stable [60] albeit at a much lower level than in the preceding decades. Comparison of fish abundances in the MHI to those of the relatively unexploited Northwestern Hawaiian Islands (NWHI) also points to abnormally low levels of fish stocks near the populated islands [61].

Catch data are not available for recreational and subsistence fisheries. However, reconstruction of the noncommercial catch for both inshore and bottom fishes indicates that total landings in this sector are approximately three times that of the commercial sector. The commercial catch underwent a 70% decline from 5,641,000 kg 1950 to 1,868,200 kg in 2002 [62]. Fishermen and other ocean users are well aware of declining reef resources. Surveys of both commercial and noncommercial fishers [63, 64] have clearly documented this perception. In the 1998 survey 57% of respondents felt inshore fishing was now poor to terrible. Overfishing is most often cited as the prime cause of resource depletion [64, 65].

In contrast to the technological limitations in ancient times, modern fishing technology has depleted bottom fish stocks throughout the MHI and even in remote areas of the NWHI [65]. The National Marine Fisheries Service (NMFS) determined that overfishing was occurring on the bottom fish multispecies complex around the Hawaii Archipelago, with the primary problem being excess fishing effort. NMFS requested the Western Pacific Regional Fishery Management Council to take appropriate action to end the overfishing. An interim seasonal closure was placed in effect from May 15, 2007 to October 1, 2007, and the fishery has been managed by an annual total allowable catch since 2007.

4. Comparisons between the "Traditional" and "Western" Systems

Available information from various sources consistently identifies the same dominant features of the traditional management method versus the current Western management scheme. Both systems were developed in an attempt to ensure protection and sustainability of marine resources. However, tabulation of the dominant characteristics graphically shows fundamental differences in nearly every important respect (Table 1). There are positive and negative aspects of each system, so the comparison is intended as an objective means of sorting out the differences without a bias towards either the traditional system or the Western system. Each major aspect of the management comparison of Table 1 is discussed in more detail as follows.

The Western system of management is based on federal, state, and local laws and regulations implemented by various agencies or departments, which is a reality that hampers effective management. In contrast, the traditional system was based on the authority of the ruling *ali'i*. The central feature of the traditional system was that reef tenure as well as land tenure was in the hands of the residents of the watershed (*hoa'aina*) and under the rule of a single authority (*ali'i)* and his manager the *konohiki*. When fishing regulations were formalized in law, the *ali'i* were required to consult with the *hoa'aina* before closing the fishery which suggests that the local community traditionally had input into the process. Nevertheless sources generally acknowledge that the traditional system was highly autocratic and has features that would not be acceptable in a democracy.

Under the traditional system local inshore marine resources were held in common with equal access to all people living within the boundaries of the *ahupua'a*, but with certain management restrictions. Inhabitants of the *ahupua'a* in consultation with *ali'i* limited access to others, but outsiders could gain access by permission from chiefs and local villagers. This aspect of the traditional system provided another means of limiting the impact of humans on the resource. In the Western system, access is unrestricted, so any person from any district can fish in other districts, so a given area can be heavily exploited by the entire population with no control of outsiders.

Under the Western system, trained professionals in multiple government agencies are the managers with responsibilities defined by law. They generally have responsibility for very large areas and cannot possibly be knowledgeable about local conditions and local resources. In contrast, under the traditional system a very knowledgeable *konohiki* (district manager) was appointed by *ali'i* to manage a very specific geographic area for a specific community of people. Stewardship was supported by an individual sense of *kuleana* or responsibility for the local resource.

Under the Western system enforcement of any rules that are in place is generally weak and inconsistent due to concern for "due process" and rules of evidence. The positive social outcome is that rights of individuals are respected, but there is a negative impact on natural resources. In contrast the traditional system was based on the absolute authority in

Table 1: Comparisons between major aspects of "Traditional Hawaiian" and "Western" management systems in Hawai'i for inshore reef fisheries.

Management component	Western management system	Traditional Hawaiian management system
(1) Authority	Federal, state, and local laws and regulations implemented by various agencies or departments.	*Ali'i* (chiefs)
(2) Access rights	Reef held in common, equal access to all.	Inhabitants of the ahupua'a (district) in consultation with *Ali'i*. Limited access by permission from chiefs and local villagers.
(3) Managers-stewardship	Trained professionals in multiple government agencies with responsibilities defined by law.	*Konohiki* (district manager) appointed by *Ali'i*.
(4) Enforcement	Generally weak and inconsistent due to concern for "due process" and rules of evidence.	Authority in the hands of *Ali'i*. Punishment is immediate and can be severe. Conservation ethic reinforced by ingrained cultural rules of social behavior and spiritual principles.
(5) Management focus	Commercial as well as recreational fishery, economic development, conservation, endangered species, environmental protection, sustainability, and maintain biodiversity.	Limit take to only what is needed by inhabitants to insure sustainable yield. Focus entirely on plants and animals used for food, medicine, selling and trade.
(6) Management theory	Established western science of management (e.g., Catch Per Unit Effort)—Accepted theory and practice subject to revision with new information.	Traditional management practices that were developed and applied locally over many generations of trial, experimentation, study, application and observation.
(7) Knowledge base	Published reports, records, data bases, documents, objective measurements and observations, and quantitative analyses of data.	Oral transmission with restricted access to information—knowledge generally kept within family lineage.
(8) Primary fishery management tools	"Regulated inefficiency" to reduce harvest. Restrictions on gear type, number of fishing days, and marine protected areas.	Intermittent complete reef closures of reefs as indicated with *Kapu* (forbidden take) of certain species at certain times.
(9) Fishery management target	Generally single species. Increasing focus on ecosystems.	Generally entire reef ecosystem with species specific *kapu* at certain times.
(10) Resource monitoring	Infrequent quantitative surveys of environmental parameters and stocks, direct underwater observations. Perception of "insufficient data" required for decisive management actions.	Continuous daily interaction with reef resources, perception that accurate knowledge of resource is held by the local master fishermen (*po'o lawai'a*), elders (*kūpuna*), and *hoa'āina* of that place.

the hands of *ali'i*. Punishment was immediate and could be severe [24]. This conservation ethic was reinforced by ingrained cultural rules of social behavior and spiritual principles.

Western management focus has been heavily driven by perceived gain from economic development, although tempered by concern for conservation, endangered species, environmental protection, and sustainability. In the traditional system commercial exploitation was unknown. Only what was needed was taken from the reef, which was considered to be a storehouse for food. These actions protected the resources from over-exploitation. The management focus was entirely on plants and animals used for food, medicine, selling, and trade, with the view that all elements of the *ahupua'a* were interrelated.

An established, science-based Western management scheme (e.g., Catch Per Unit Effort) drives the Western system of management. Decisions and regulations are based on accepted theory and practice subject to revision with new information, which is a positive feature of the system. Traditional management embraced practices that were developed and applied locally over many generations. These regulations were seen to be practical as evidenced by centuries of trial, experimentation, study, application, and observation. This system functioned well so long as there were no major social changes.

The knowledge base of the Western system consists of published reports, records, data bases, documents, objective measurements and observations, and quantitative analyses of data. Information is exchanged freely and major effort is expended at making all information available. Shared databases, frequent meetings, networking, and outreach are key aspects of the Western system. In stark contrast, oral transmission with restricted access to information was the norm in the traditional system. In general, marine resource knowledge was kept within a family lineage [3, 31].

In the past the primary fishery management tool in the Western system has been called "regulated inefficiency" to reduce harvest. Restrictions were placed on gear type and closed seasons for certain species. The Western model previously was focused on single species fisheries. In recent years there has been an enormous effort underway to use MPAs, including no-take reserves for all species, to augment regulations. This recent effort is reminiscent of the traditional system which maintained fishery stocks through closures of reefs that allowed the ecosystem to recover as a whole.

The traditional system also placed a *kapu* (forbidden take) on certain species, generally based on spawning cycles.

There is a strong contrast between the two systems in the area of resource monitoring. The Western system must depend on infrequent quantitative surveys of environmental parameters and assessment of stocks. There is always a perception of "insufficient data" required for decisive management actions. The traditional system operated at the other end of the spectrum with continuous daily interaction between the managers, fishermen, and the reef resources. Practitioners of the traditional system had the perception that accurate knowledge of resource is held by the local master fishermen (*poʻo lawaiʻa*), elders (*kūpuna*), and commoners (*hoaʻāina* of that place), and had confidence in difficult management decisions such as reef closures.

5. Evidence of Increasing Synthesis

Over two centuries that have passed since first penetration of westerners into Hawai'i, traditional ways of managing fisheries have been replaced with Western and scientific methods at the formal level. However, traditionally informed ways still exist and continue to be exercised in the everyday practices of individual fishermen and their families. A great deal of information still exists in the oral tradition and written documentation. The past thirty-five years have witnessed a renewed interest in traditional ancient Hawaiian culture and practices. Voyages by the *Hōkūleʻa*, which was the first replica of a traditional double-hulled canoe, have been instrumental in this renaissance. Throughout Hawaiʻi there has been a resurgence in the study and practice of the Hawaiian language, ancient chants, hula, and other aspects of the Hawaiian culture. With this shift has come a reevaluation of traditional marine resource management [28, 66] and the previously unquestioned superiority of contemporary management regimes.

There is a growing awareness that traditional management of marine resources contained features that even today may be more effective than the Western management schemes that replaced them. Initial descriptions of the traditional versus Western systems suggest that the two systems are diametric opposites in almost every category (Table 1), yet we are beginning to observe the beginnings of a synthesis of the two systems that incorporates their best features. During the past decade the Western system of management in Hawaiʻi has adopted many aspects of the traditional system that it replaced, albeit using modern terminology and following practices acceptable in our contemporary democratic society. Perhaps the rapidly increasing human population and resulting resource depletion in Hawaiʻi is creating an environmental crisis similar to that which led to development of management in ancient times. The major features of this renaissance are as follows.

5.1. Ecosystem-Based Management (EBM). The emerging Western practice of EBM integrates ecological, social, and economic aspects in reference to humans as a major component of the ecosystem. This approach is philosophically the same as that of the traditional management scheme. EBM is concerned with the sustainability of human as well as ecological systems, which is a key feature of the traditional system. The EBM approach incorporates adaptive management in order to deal with uncertainties due to changes in the natural environment and changes caused by humans. This aspect is analogous to what is known of the traditional method. Tissot et al. [67] note that there has been progress toward key elements of ecosystem-based management (EBM) in Hawaiʻi, including a network of MPAs and community-based co-management. Progress has been slow and driven mainly by increased awareness of the risks facing coral reef ecosystems, which has led to new legislation as well as emergence of increasing local engagement in fishery issues. Key elements of EBM in Hawaiʻi include enhanced coordination among multiple agencies, establishment of place-based and community-based, co-management, and acquisition of data on both the ecology of the nearshore system and the role of human impacts for use in management decisions.

5.2. Integrated Coastal Management. The integrated coastal management concept is in many ways a modern variation of the ancient *ahupuaʻa* system, but lacking some of the cultural and spiritual dimensions of the traditional approach. Nevertheless, there is a growing appreciation among managers and within local communities of the whole-system approach to resource management. This approach includes an integration of the watershed, streams, and coastal regions. Recognition of the impact of land-derived materials on nearshore areas is a central theme in today's ecological science that is analogous to the traditional understanding of the native Hawaiian people. A statewide plan has been formulated by a consortium of the Federal and State management agencies, the Hawaiʻi Local Action Strategy [68]. Other contemporary examples include the Hanalei Watershed Hui (http://www.hanaleiwatershedhui.org/), East Maui Watershed Partnership (http://eastmauiwatershed.org/), and the Waiʻānae Sustainable Communities Plan (http://www.honoluludpp.org/Planning/Waianae/Waianae5yr/Waianae.pdf).

5.3. Education and Outreach. Contemporary managers recognize that the social and spiritual values of the individual are vital in the promotion of a sustainable environment. This was a key feature of the traditional system of management. Today there is increasing emphasis on the importance of public outreach and education. Standards-based curriculum development by the State of Hawaiʻi's Department of Education currently includes the teaching of traditional Hawaiian values and cultural practices. Integrated, interdisciplinary studies based on ancient Hawaiian concepts include "Project *Ahupuaʻa*" which stresses sustainability. The project's motto "*Mālama I Ka ʻAina*" refers to taking individual responsibility for stewardship of our natural resources (Hawaiʻi Department of Education http://www.k12.hi.us/~ahupuaa). Traditional values such as love of nature, preservation of the environment, recycling, proper disposal of waste, exercising voluntary restraint on catch, and so forth, are widely promoted by all natural resource management agencies. Most granting agencies require an education and outreach

component for every project that receives funding. Thus, the key traditional social concepts of *mālama, kōkua,* and *kuleana* are being instilled in the younger generation as part of contemporary Western management practice as a means of achieving sustainability.

A program called "Navigating Change," is an education and outreach partnership created in 2001 among NOAA, FWS, the State of Hawai'i, the Polynesian Voyaging Society, Bishop Museum, and many other groups [69]. The program includes classroom curricula and multimedia materials and utilizes native Hawaiian voyaging traditions and cultural values to engage students and the public in learning about and caring for the NWHI as well as the MHI. As part of the project, voyages have been undertaken by the traditional Hawaiian double-hulled voyaging canoe *Hōkūle'a*, to and through the NWHI as well as the associated educational outreach efforts for the voyages.

5.4. Community-Based Management. Community-based fisheries management schemes that involve fishermen and other ocean users in decisions and give them responsibility for care of resources have been most effective in fairly remote communities with a high level of subsistence activity and limited outside intrusion. The community-based management of the *Hui Mālama o Mo'omomi* on Moloka'i incorporated knowledge from expert fishermen and marine scientists to implement conservation measures that would provide sustainable yields [28, 66]. The concept of *mālama* was employed to restore community stewardship, coupled with a science-based resource monitoring program. In addition, it applied the seasonal changes from the Hawaiian moon calendar to plan fishing activity. This holistic approach to the natural rhythms of the ocean, based on centuries of experience, revolve around the shifting tidal patterns and other environmental cues. Its success however has been challenged by both internal and external difficulties.

A more common model is that of local community organizations which voluntarily take on responsibilities for many aspects of resource management and community planning. For example, the Hanalei Watershed Hui (http://www.hanaleiwatershedhui.org/) on Kaua'i is directly involved in identifying environmental problems in the marine, freshwater, and terrestrial environments and has undertaken corrective action. The West Hawai'i Fisheries Council (WHFC) on the Island of Hawai'i is an example of a volunteer community advisory group encompassing a large geographic area (147 miles of coastline) with a diverse population. Formed in 1998, the stated mission of the WHFC includes goals such as "to effectively manage fishery activities to ensure sustainability, enhance nearshore resources, and minimize conflicts of use in the area". The Council has successfully addressed several contentious issues such as aquarium fish collecting and gill netting and has been instrumental in developing and recommending management actions [70, 71]. Government agencies are also promoting the "grass roots" approach through other volunteer programs such as "adopt a stream" beach cleanups and "*makai* watch", an ocean awareness program similar to urban neighborhood watch programs.

The development of community-based co-management and an MPA network along the western Kohala-Kona coast of the island of Hawai'i provides an excellent model for development of EBM through an incremental approach [67]. There are major challenges to scaling up the West Hawai'i model to other islands within the state due to the limited extent of community involvement as well as legislative and administrative support of community-based co-management and MPAs. Furthermore the complexity of conflicts is much greater on more populated islands with diverse stakeholders.

The Executive Order that designated the NWHI Coral Reef Ecosystem Reserve in 2000 required that native Hawaiians, among others, provide advice regarding management and ensuring the continuance of native Hawaiian practices [69]. This mandate is being carried out through partnerships with native Hawaiian organizations and institutions aimed at identifying and integrating native Hawaiian traditional knowledge and management concepts into management actions.

5.5. Enforcement. Enforcement of management regulations under the traditional system was immediate and severe. Violation of certain *kapu* could mean instant death [24], although less severe penalties could be invoked. Under the traditional system, the importance of obeying environmental management restrictions was clearly understood. The present social system in Hawai'i is based on individual legal rights and due process. No one is advocating a return to some of the more extreme traditional practices, but there is growing support for more consistent enforcement of existing rules. An essential and fundamental premise of all fisheries management whether contemporary or traditional is that pertinent rules and regulations must be enforceable and effectively enforced. In Hawai'i, public concern over the lack of effective enforcement of fishing and marine resource laws is widespread and frequently voiced and reflected in surveys of both recreational [64, 72] and commercial fishers [63]. The Division of Conservation and Resources Enforcement (DOCARE) is the state's primary agency for enforcement of natural resource regulations. Organized initially in 1925 within the Division of Fish and Game, it was established as a separate division within the Department of Land and Natural Resources (DLNR) in 1978. In 1981 Act 226 of the Hawai'i State Legislature expanded DOCARE's traditional duty of enforcing only laws, rules, and regulations relating to the preservation and conservation of natural resources to enforcing all state laws and county ordinances on all state lands, beaches, shore waters, and county parks. As a result, the proportion of citations (including arrests) issued for natural resource violations decreased markedly and is presently among the lowest of all U. S. coastal states. To further hinder enforcement, Hawai'i DOCARE officers are prohibited from inspecting the bags, containers, or vehicles of noncommercial fishermen unless there is "probable cause" that a violation has in fact taken place. Preemptory inspections to determine compliance with regulations governing seasonal closures, bag and size limits, and so forth are thus prohibited. Ongoing enforcement trends and inspection

limitations undermine the effectiveness of existing and future marine resource regulations. Major structural impediments remain to be resolved for enforcement to be truly effective.

There is a growing movement on the part of government to enhance enforcement by taking such steps as increasing the number of officers, entering into a joint enforcement agreement with NOAA/NMFS, placing interns with a legal background into the management agency and implementing rules permitting administrative handling of resource violations rather than through criminal procedures. An example of the positive shift toward stricter enforcement of environmental regulation in Hawai'i is provided by the unprecedented action taken by the government and the community in response to illegal grading that caused a 2001 mudslide which damaged Pila'a reef on the island of Kaua'i. The cost to the landowner for not complying with environmental laws exceeds $12 million, which includes state fines of $4 million, county fines of $3,075, state criminal penalties of $0.5 million, and $8 million in remediation costs as a result of settlement of a federal Clean Water Act lawsuit brought by Kaua'i community groups [73]. The settlement is believed to be the largest storm-water settlement in the country for violations at a single site by a single landowner and a major precedent for future enforcement action. As evidenced by these actions, the Western management system in Hawai'i has the same ability as the traditional system to bring about severe penalties for the breaking of a modern *kapu* if there is a will to enforce regulations.

5.6. Adaptive Management. Adaptive management is an iterative process of decision-making with the aim to reducing uncertainty over time through monitoring the response of the system to management actions. Using this approach, decision-making simultaneously maximizes one or more resource objectives and, either passively or actively, accrues information needed to improve future management. The ancient Hawaiians intuitively devised and operated such a system. The ponderous legal process currently used in Hawai'i for adopting and changing natural resource laws and regulations needs to be modified into a more responsive adaptive system. Some initial steps have been taken in this direction. One such example is the 2005 rule for harvesting sea urchins in a formerly closed Marine Life Conservation District (MLCD) in West Hawai'i. Based on input from urchin harvesters and the community, the West Hawai'i Fisheries Council developed a proposal which permits noncommercial harvesting from June 1 to October 1. Significantly, a moratorium on harvesting can be quickly implemented by the Board of Land and Natural Resources (BLNR) if conditions warrant it (e.g., overharvesting). In many respects this adaptive management parallels the traditional system.

Another example is an effort on the island of Kaho'olawe, which is one of the main eight Hawaiian Islands but is unpopulated due to its former use as a military target range. In 1993 the Hawai'i State Legislature created the Kaho'olawe Island Reserve consisting of the island itself and the submerged lands and waters extending two miles from its shore. A Kaho'olawe Island Reserve Commission (KIRC) was also created to manage the reserve while it is held in trust pending establishment and recognition of a native Hawaiian sovereign entity. Recently the island was returned to the Hawaiian people. The KIRC is in the process of instituting traditional Hawaiian management practices based on effective adaptive management. With the input of *kūpuna* (elders, keepers of wisdom), the Commission initiated the first state regulations that allow for the use of the traditional Hawaiian system of closing access to a resource by *kapu*. *Kapu* provides for flexible and responsive management of natural and cultural resources within the Kaho'olawe Island Reserve. The ability to provide for *kapu* closures protects any resources under pressure from overextraction. In addition, different practices of resource use, for instance traditional extraction methods versus modern methods will be allowed in designated areas, providing an opportunity to evaluate the impact of different resource extraction practices and methods on resource stocks. Thus far the *kapu* system has not met with a high degree of compliance. Fortunately, the remoteness and difficult accessibility limit the number of poachers in the Kaho'olawe reserve. Management has joined with researchers that work together with *kūpuna* to assess the status of resources, supplementing traditional techniques and values with quantitative scientific methods. Further, measures are being taken to increase enforcement and instill a greater conservation ethic on the part of the public using Hawaiian ethical principles described previously.

There is a long-standing awareness on the part of the DAR that effective management requires intimate contact with the resource. Although final authority is still centralized in the DAR, a process of involving local communities in decisions is in effect involving public meetings and participation of stakeholders in the decision process. There is an overall trend of decentralization of management with local authority on each island. Biologists assigned to the various islands and districts are intimately involved in field work and with those people using the resource. Often this includes working closely with local organizations who are taking increasing responsibility for stewardship of natural resources. There is a general awareness that managers are more effective when they get away from the desk and meetings and spend more time in the field.

Unfortunately in some areas of the state, adaptive management is hampered by various legal and bureaucratic restrictions as previously described. Nevertheless there is continuing interest in the possibility of constructing laws and regulations that describe trigger mechanisms that will immediately lead to a management action such as closure to fishing in areas that are depleted to a dangerous level.

5.7. Limited Entry, Granted Authority to Fish, and Fishing Licenses. A number of mechanisms existed under the traditional system that restricted fishing access. A family lineage existed among the *po'o lawai'a* (master fishermen who held and transmitted knowledge), which limited entry into fishing activity. Permission to extract resources was generally limited to those people living within the district, and under certain circumstances they were expected to share their catch with the management authority. Some analogies can be drawn with the Western system which has similar

tools available for use. Freshwater fishers in Hawai'i are required to purchase a fishing license, but noncommercial salt water fishers are not. Commercial fishers are required to purchase a commercial marine license for a nominal fee ($50) and are required to file monthly catch reports. Movement to a paid marine noncommercial fishing license with funds going to management of the resource would be a step closer to the traditional system which was based on the concept of *kuleana* which emphasized the responsibilities that accompanied the privilege of sharing in the resource. A recent survey of *kūpuna* and *kama'āina* with extensive experience in fishing and marine resources recommended the establishment of just such a license to support fishery management [15].

5.8. Fishing Closures. The Western system of management continues to utilize regulations governing closures during spawning of certain species as well as size limits and gear restrictions. These regulations are occasionally updated and posted on the DAR website (http://hawaii.gov/dlnr/dar/regulations.html). In ancient times the bottom fishery was not closed during the spawning season because the primitive technology of the time did not deplete the resource. A paradox is that current management practice has placed a "*kapu*" or total closure on bottom fish during the spawning season because modern fishing technology has depleted stocks throughout Hawai'i. In this case the Western management approach mirrors the ancient traditional practice in dealing with a depleted resource.

In addition to the *kapu* placed on the catching and consumption of specific resource species, traditional Hawaiian practices also involved the closing of entire reef areas for varying lengths of time. Although there are relatively few details known of the workings of these closures, they appear to be directly related to allowing resources time to recover from heavy harvesting or fishing pressures. The traditional system of closing (*kapu*) and reopening reef areas either as short-term or seasonal closures seemingly holds more appeal to fishers than long-term or permanent closures. Closure during the spawning season of a particular species is generally accepted. Seasonal closures by themselves are unlikely to be effective in protecting fish stocks [74]. A rotational closure system of alternate periods of open and closed fishing has been in place at the Waikīkī-Diamond Head Shoreline Fishery Management Area (FMA) on O'ahu for 28 years. The results of this rotational closure have not been favorable. While fish biomass increased during the closure periods, these increases were insufficient to compensate for declines during open periods. The net effect was that between 1978 and 2002, total fish biomass in the FMA declined by about two-thirds and large food fishes (>40 cm) virtually disappeared from the area [75].

In the practice of Hawaiian resource management, permanent closures did exist for certain species as restrictions and prohibitions related to gender or social status. In addition, technological limitations of those times created numerous natural "permanently closed refuges" in the form of areas where harvesting was difficult or impossible. The modern development of boat engines, depth finders, GPS units, diving gear, underwater lights, and other modern fishing gear in conjunction with the emergence of a market economy have greatly changed the nature of fishing and the ability of fishers to impact the resource. Such natural marine refuges no longer exist due to modern technological ability to extract fish and other resources.

The Western management system in Hawai'i has attempted to achieve the same result as the traditional *kapu* method through a variety of management strategies (e.g., size and bag limits, seasonal closures, gear restrictions, etc.) and a system of MPAs. The underlying concept of MPAs is that closed areas provide a refuge where fish can multiply in number, live long and reach optimal reproductive size. The protected areas serve as a source of renewal for fished areas through spillover and larval dispersal. In the MHI a total of only 0.4% of all coral reefs have complete no-take MPA status [76, 77]. The closed areas include a few small MPAs, military security restricted areas and the Kaho'olawe Island Reserve which constitutes the bulk of such closures. An additional 5.7% of the reefs have restrictions on one or more types of gear or fishing activity (e.g., no gill netting, no aquarium collecting, etc.). Recent evaluations of some of Hawai'i's MPAs have shown that they can be very effective in terms of increasing fish biomass within MPAs [76] and abundance and fishery yield outside [78].

5.9. Creation of the Papahānaumokuākea Marine National Monument. On June 15, 2006 President George W. Bush signed a proclamation that created the Papahānaumokuākea Marine National Monument. This area encompasses 137,792 square miles of USA waters, including over 4,500 square miles of relatively undisturbed coral reef habitat. This is the largest protected area under the U. S. jurisdiction and one of the largest no-take MPAs in the world (http://www.hawaiireef.noaa.gov/). It also represents an immense step forward in bringing traditional practices into contemporary marine environmental management. Preservation along with education and outreach centered on the traditional Hawaiian spiritual and cultural values are major themes in the management of this Marine National Monument [69]. The Monument's management plan is focused on engaging the Native Hawaiian community in active and meaningful involvement in the management process. There is an emphasis on increasing the understanding and appreciation of Native Hawaiian histories and cultural practices related to Papahānaumokuākea Marine National Monument. There is a major effort to cultivate an informed, involved constituency that supports and enhances conservation of the natural, cultural, and historic resources [69]. This program is engaging the Native Hawaiian community in active and meaningful involvement in management through its cultural working group comprised of Native Hawaiian practitioners, scholars, teachers, *kupuna*, fishermen, and community members. The Monument also sponsors multi- and interdisciplinary research projects that bring scientists and cultural practitioners and fishermen together to conduct research that is relevant to both groups, synthesizing approaches to knowledge acquisition, data, and ultimately developing an understanding of the natural environment.

In partnership with the University of Hawai'i at Hilo, the Monument is training students to develop research projects that require the study of both marine science and primary traditional Hawaiian source material. A central management goal is to cultivate an ocean ecosystem stewardship ethic founded on traditional Hawaiian principles, contribute to the nation's science and cultural literacy, and create a new generation of conservation leaders through formal environmental education.

6. Discussion

This paper presents a paradox in that two systems that are seemingly incompatible are presently showing the beginnings of integration that potentially involves the best features of each system. The emerging concepts that are readily recognized as features of the traditional system include adaptive management, integrated coastal management, community-based management, strong enforcement of regulations, ecosystem-based approach, fishing closures, and limited entry. Strong and shared cultural, social and spiritual values and a conservation ethic are the goals of the growing education/outreach program that will foster sustainability of resources in a manner found in the traditional method. Concepts of *pono* and *kuleana* are valuable tools for sustaining the environment. The strong and direct linkage between management, monitoring, enforcement and those utilizing the resource characterizes the traditional Hawaiian system and is a goal of the Western system.

The Western system that has gradually replaced the traditional system is centralized, often cumbersome, overly complicated and has many elements that could shut out community and "neighbor island" participation. In this area we can learn much from the ways of ancient Hawai'i. It is now clear that some of the limitations and inefficiencies of the Western management system stem from the absence of the linkages found in the traditional system. Western managers are responsible for large areas and frequently have little direct contact with the resource except through data supplied by occasional surveys, catch statistics, environmental impact statements, and so forth. Management authority often is fragmented between many agencies and enforcement is widely regarded as weak and ineffective. Those using the resource in common are not given any responsibility for stewardship and are often only concerned with exploiting the resource to their private advantage at the expense of the resource. Decision-making is largely "top-down" in the Western management system. However, these decisions are increasingly influenced by the public through active participation in the political process, and by a growing environmental awareness that is manifesting itself by increasing community action in local areas. Thus, the Western management system has the ability to receive input from the community and can be responsive to social and environmental change. The major strength of the traditional system was the ability to be place-specific and sensitive to local issues as well as its ability to deal with any transgression with immediate action by local experts (*kupuna*). A major strength of the contemporary Western system is its ability to adapt to changing social, political, and economic conditions, and to threats presented by pollutants, shoreline construction, invasive species, human pathogens, and so forth that were not components of the original ecosystem. Further, the Western system has the potential to adapt regulations to deal with the major advances in fishing technology (high power boats, GPS, sonar fish finders, power winches, inexpensive monofilament gill nets, self-contained breathing apparatus, etc.) that have eliminated many of the controls that prevented overexploitation in ancient times. Anthropogenic impacts have steadily increased with the increase in human population and technological development to the point where global climate change is now a serious concern. Western management practices must be open to incorporate approaches that have been proved successful in the past.

Perhaps the best evidence of the growing synthesis of Western and traditional management is being provided by the Papahānaumokuākea Marine National Monument mission statement:

"Carry out seamless integrated management to ensure ecological integrity and achieve strong, long-term protection and perpetuation of NWHI ecosystems, Native Hawaiian culture, and heritage resources for current and future generations." [69].

Delegates to the United Nations Educational, Scientific and Cultural Organization's (UNESCO) 34th World Heritage Convention in July 2010, inscribed Papahānaumokuākea Marine National Monument as one of only 26 mixed (natural and cultural) World Heritage Sites in the World and the first mixed World Heritage Site in the nation. This action recognizes Papahānaumokuākea's globally significant natural attributes that incorporate its living, indigenous, cultural connections to the sea and underscores the fact that for many indigenous peoples, nature and culture are one.

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Traditional Knowledge, use, and Management of Living Marine Resources in American Samoa: Documenting Changes Over Time through Interviews with Elder Fishers

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Traditional Knowledge, Use, and Management of Living Marine Resources in American Samoa: Documenting Changes over Time through Interviews with Elder Fishers[1]

Arielle Levine[2,4] *and Fatima Sauafea-Le'au*[3]

Abstract: We interviewed elder fishermen in American Samoa to better understand their perspectives on traditional use and management of marine resources and changes in the status of certain species over the course of time. Elder fishermen provide an important source of information in a context of limited catch data, declining fishing effort, and evolving local fishing traditions. Most fishermen interviewed during the study described a decline in the quality of various nearshore habitats, a general decrease in abundance of edible reef fish, and diminished abundance of locally valued *palolo*, *atule*, giant clams, and octopus. Populations of reef sharks and turtles are typically seen as stable or increasing. Fishermen from the relatively densely populated island of Tutuila tended to report a greater decrease in abundance of marine resources in general than did fishermen from the more remote Manu'a Islands. Elder fishermen commonly reported deterioration of nearshore and shoreline habitats as an issue of concern. Many interviewees also asserted that past use of destructive fishing methods has led to a decline in marine resources in the region. The fishermen generated various recommendations for improving local fisheries, including: reducing runoff-related pollution and sediment, preventing destructive fishing methods, and establishing marine protected areas. Although traditional marine tenure systems are no longer as influential in American Samoa as they were in the past, various rules regarding appropriate use of local marine ecosystems and associated resources continue to be implemented across the islands.

American Samoa and independent Samoa compose the Samoa archipelago, which is located immediately east of the international dateline between about 11° and 14° South latitude (see Figure 1 and Figure 1, of the Pacific basin, in Kittinger 2013 [this issue]). American Samoa is an unincorporated U.S. territory, with a total land area of just over 76 square miles (197 km^2), with a population estimated at 55,519 (according to the 2010 US Census). The main inhabited islands of American Samoa include Tutuila, the largest and most populous island in the territory, as well as Aunu'u and the Manu'a group of Ta'u, Olosega, and Ofu Islands. Remote Swains Island is sparsely inhabited, with a population estimated at only 17 persons in 2010.

As in many Pacific island settings, use of marine resources for dietary and sociocultural

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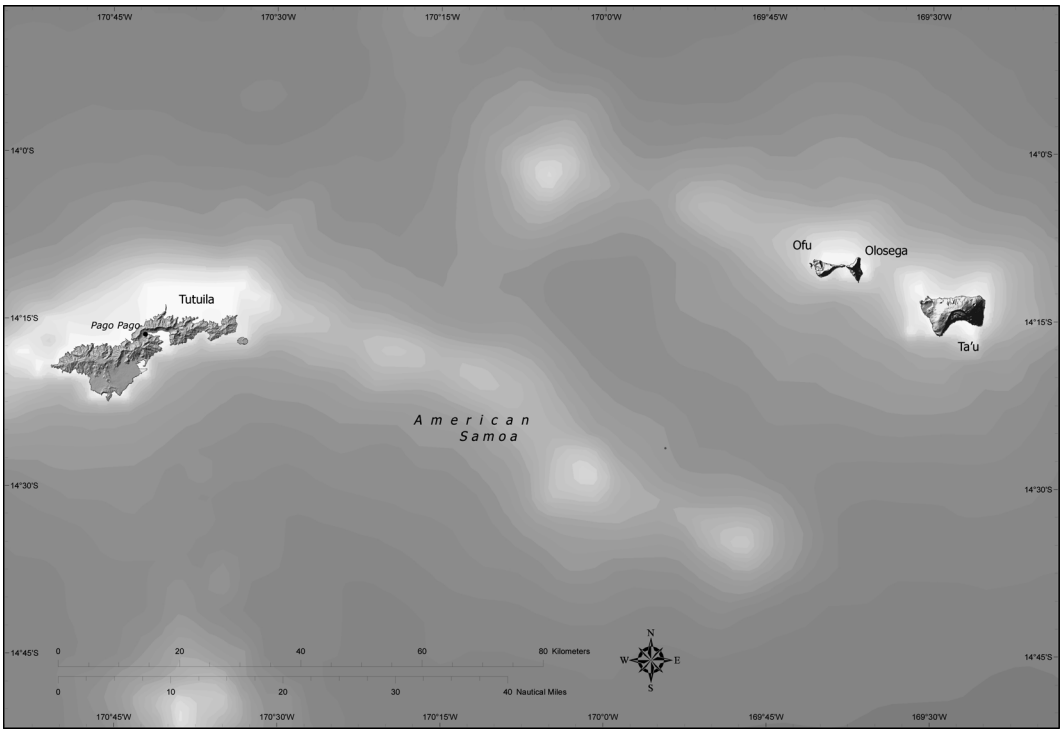

Figure 1. Map of American Samoa.

purposes is common among residents of coastal villages throughout American Samoa (Levine and Allen 2009). Historically, villagers throughout Samoa held tenure and enacted rights to use marine resources available in the adjacent coral reef ecosystems. Fishing activities were managed in accordance with local rules and regulations (Armstrong et al. 2010). Samoans continue to practice a number of traditional fishing methods, and village councils still exert influence over the management of local marine resources. However, local economies, resource use patterns, and the Samoan way of life have evolved over the past century.

Local control over marine resources or customary marine tenure is a traditional aspect of life in island regions throughout the Pacific (Johannes 1978), including Samoa (Johannes 1982*a*). But descriptive accounts of marine tenure, resource use rights, and resource management strategies as these were developed and implemented in the Samoa Islands in years past are limited in number. W. von Bulow briefly described Samoan fishing rights in a German-language periodical published in 1902, wherein he stated that "fishing rights are a peculiarity of Samoan customary rights . . . the regulations relating to fishing are as many and various as regulations relating to customary rights concerning the possession, acquisition, and disposal of land" (von Bulow 1902:40–41).

Perhaps the most thorough descriptions of historical fishing practices in Samoa come from Krämer (1994, 1995), who described fishing methods as they were practiced during the late 1890s, and from Te Rangi Hīroa (1930), also known as Peter Buck, who described fishing practices observed during his visit to the islands in 1927. Holmes (1974) described fishing methods, taboos, and restrictions used in Samoa in the 1950s, and he documented diminishing fishing effort and

increasing reliance on canned fish then taking place on the islands. Armstrong et al. (2010) provided a comprehensive review of archival sources documenting the pursuit and use of marine resources in the Samoa Islands, including descriptions provided by missionaries, anthropologists, and colonial administrators before 1950. Dye and Graham (2004) reviewed archaeological data and ethnohistoric accounts to describe patterns of use of reef-associated fish in the region. Finally, Auapa'au (1956) described traditional pursuit, use, and management of marine resources from the perspective of a native Samoan.

Although certain historical sources address fishing activities and resource management strategies as these were undertaken generally or in specific areas across the archipelago, no readily available sources focus specifically on islands in what is now known as American Samoa. Moreover, recent trends in the region's nearshore fisheries are not abundantly documented for any part of the Samoa Islands. To fill these gaps in the literature and to provide information of potential utility for local fishery management programs, we conducted a series of in-depth interviews with elder fishermen living in coastal villages throughout American Samoa. The goal of the interview process was to improve understanding of the past and current status of select marine resources to American Samoans and to document local perspectives on changes in the use and management of such resources over time.

As noted by Johannes (1982*a*), it is difficult to obtain reliable catch statistics for many Pacific island nearshore fisheries because these typically involve multiple species, numerous fishing methods, and undocumented distribution of the catch. American Samoa is no exception, and baseline data regarding catch and effort in the nearshore zone are largely absent for the region. But because elderly Samoan fishermen typically have had regular contact with the marine environment and its resources over the course of many years, they are capable of providing information regarding long-term changes in the status of such resources. Such information can be particularly valuable to fishery managers when other pertinent data sources are lacking (cf. Johannes 2003). Elder fishermen are also well suited to provide information about past and current resource management strategies, and they can provide informed suggestions for effectively managing local resources in the future.

MATERIALS AND METHODS

Between November 2007 and March 2008, our interview team conducted in-depth semi-structured interviews with 78 elder fishermen residing in 28 villages across American Samoa. Although roughly 20% of the research participants were female, the term "fishermen" is used for sake of simplicity throughout this article. Given our interest in local perspectives regarding long-term changes in local resources and fisheries, criteria for inclusion in the sample required that participants be long-term fishermen and at least 40 yr old. The age of participants ultimately ranged between 40 and 86 yr; 90% were over the age of 50, and the average age was 62. Some 60% of respondents were from the island of Tutuila, and 40% were residents of Ofu, Olosega, or Ta'u in the Manu'a group.

Public officials working in regional marine resource management agencies assisted in the identification of pertinent resource management issues to be addressed during the interview process. Such persons and two interviewers (who were also experienced local fishermen) helped to develop valid and culturally meaningful questions regarding the nature and status of the marine environment, fishing practices, and resource management strategies. Perspectives on changes occurring in local fisheries and marine ecosystems relate to a time frame of the past 25 to 50 yr, depending on the age of the discussant. The interviews ultimately focused on the following topics:

- Changes in the general nature and frequency of fishing activities over time and space;
- Changes in levels of abundance and catch rates for reef fish in general, and for locally important species such as

atule, *palolo*, giant clams, sea turtles, octopus, and reef sharks.
- Changes among species of concern to local resource managers, including bumphead parrotfish, humphead wrasse, and giant grouper;
- The nature and location of "special" fishing areas and changes in the condition of such areas over time;
- Local restrictions on whether or how marine resources can be harvested;
- Traditional or historic methods of managing local marine resources;
- The importance of marine resources to Samoans and to *Fa'a Samoa* (the Samoan way of life);
- Other elements of traditional knowledge, such as fishing techniques and attributes of local and regional marine ecosystems.

Interviews were conducted primarily in the Samoan language by two-person teams of trained local interviewers. One interviewer asked questions while the second documented the discussions. Information provided during the interviews was translated, reviewed, coded, and subjected to qualitative and quantitative analysis.

RESULTS

Perceived Trends in Nearshore Reef Species

Just over 60% of fishermen interviewed during the project reported that populations of reef fish have declined in abundance since they began fishing or observing such species earlier in their careers. This was most notable among fishermen residing on Tutuila, where nearshore ecosystems have been subject to pressures typically associated with extensive population growth and development (Figure 2).

Perspectives regarding changes in abundance tended to vary based on the species be-

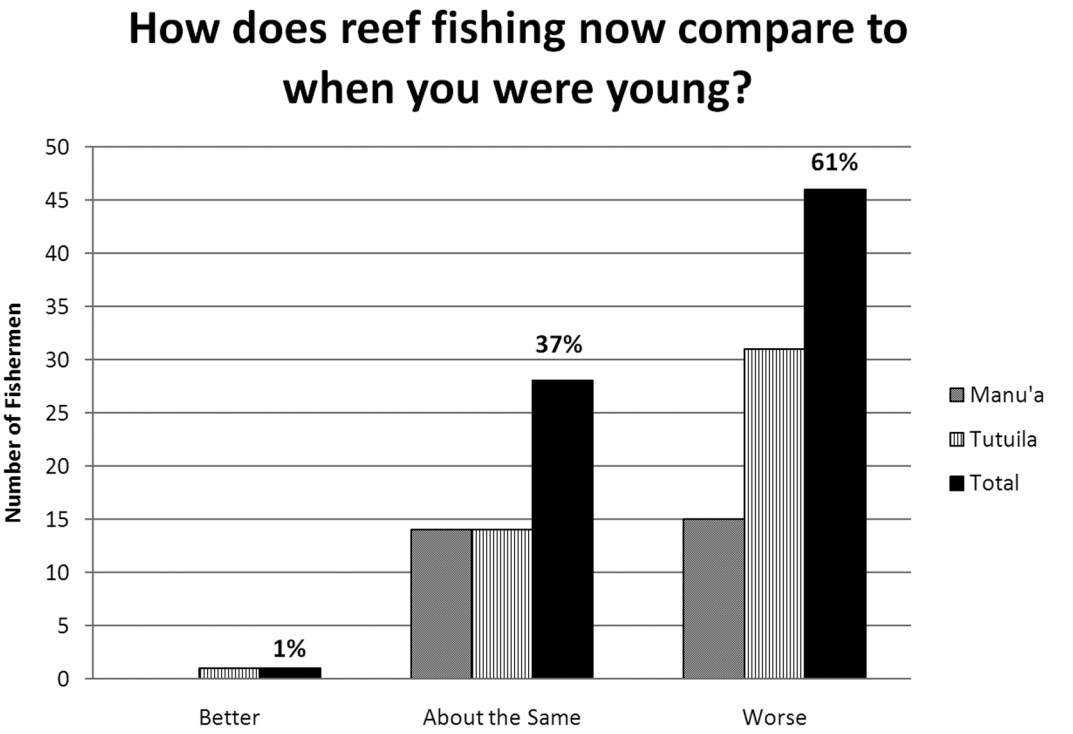

FIGURE 2. Elder fishermen's perceptions of changes in the condition of reef fishing over time in American Samoa.

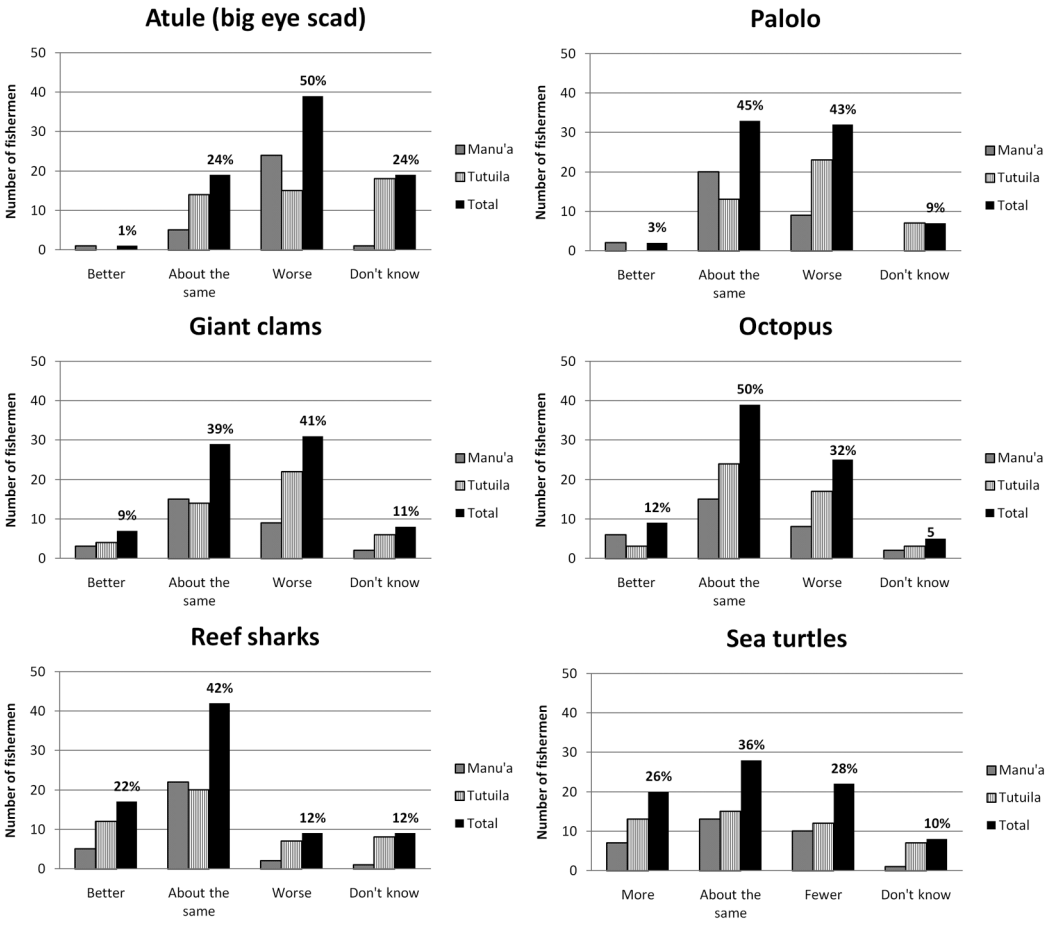

FIGURE 3. Fishermen's perceptions of changes in overall status of reef species over time: charts show results for the Manu'a Islands, Tutuila, and all interviews combined (total).

ing considered (Figure 3). For instance, many fishermen, particularly those residing in the Manu'a Islands, asserted that *atule* (bigeye scad [*Selar crumenophthalmus*]) fishing has declined over time and that people in a number of villages have not harvested the species in many years. This is unlike years past when persons in many villages around American Samoa regularly cooperated to catch *atule* using braided *lau* (fronds) to force the fish into weirs for harvest. Although this type of coordinated effort continues to occur in villages such as Fagasa and Ofu, many fishermen interviewed during the project stated that *atule* fishing is increasingly conducted with gill and throw nets. Some fishermen stated that use of nets and other modern methods of harvesting have led to diminished abundance of *atule*, but others believe that changes in coral reef ecosystems have caused an apparent state of decline. For instance, one fisherman stated that *atule* are no longer seen on the reef flats because the predatory species that would otherwise chase them there are declining in number.

Palolo, a polychaete worm, *Palola* (*Eunice*) *viridis*, is harvested during the creature's annual spawning period. In the Samoa Islands, this takes place 1 week after the October or November full moon, at the start of the rainy

season (*vaipalolo*). *Palolo* begin to swarm to the ocean surface just after midnight, and in contemporary American Samoa, the creatures are harvested by villagers using lights and scoop nets in the nearshore zone and along the shoreline. Interviewees living in villages on Tutuila typically asserted that *palolo* have been declining in abundance over time, and some stated that the situation is largely associated with a decline in the condition of important coral reef habitat. Fishermen living in villages in the Manu'a group generally did not report that *palolo* populations have declined in abundance during recent decades.

From a cultural perspective, certain fishermen involved in the current study lamented the erosion of traditions associated with the *palolo* harvest. Interviewees stated that, in the past, villagers prepared for the harvest by bathing, dressing in good clothing, and wearing flower leis made of *moso'oi* (ylang-ylang) and other fragrant blossoms. One elder spoke of *palolo*-related traditions of the past: "To catch *palolo* you needed to 'style up' and be clean; you couldn't just walk in the ocean and catch *palolo* with a dirty shirt; you need to look as if you are going to dance! The *palolo* was abundant back in the days. Sometimes people couldn't harvest all of it . . . but nowadays, once the *palolo* comes, wherever you are, you just go out and catch it without following the traditional ways."

Erosion of certain traditions notwithstanding, the *palolo* harvest continues to be a festive time in many villages around American Samoa. Notably, it was traditionally forbidden to sell *palolo* because the harvest was meant to be shared with family members, neighbors, and village clergy. Although many residents of Tutuila and the Manu'a group continue to share *palolo*, a market has developed, and some harvesters freeze the worms and sell them in local markets at a high price.

Research participants were also asked about the status of giant clams (*Tridacna gigas*), *faisua* in Samoan. Responses varied extensively between interviewees residing on Tutuila and those residing in the Manu'a Islands. Forty-one percent of Tutuila fishermen reported that the population status of *faisua* is worse than in the past, but only 7% of fishermen residing in the Manu'a group believed this to be the case. Fishermen in both areas commonly stated that giant clams are now smaller than they were in decades past, and that the creatures are now being found and harvested on the reef slope at increasingly greater distances from the shoreline.

Most fishermen interviewed during this study did not perceive octopus (*fe'e*) to be declining in abundance on either Tutuila or in the Manu'a Islands, although fishermen based in the Manu'a group typically asserted that local populations of *fe'e* are healthier than those around Tutuila. Moreover, regardless of place of residence, fishermen aged 70 and above were more likely than younger fishermen to assert that octopus populations are currently declining in size.

Elderly fishermen frequently described traditional methods for harvesting *fe'e*. These included use of cowrie shell lures (*mataife'e*), which were lowered by line and shaken in front of holes and crevices in the reef to lure the creatures from their lairs. Another method involved placement of containers on the reef; these were designed to mimic the sheltering holes in which *fe'e* usually reside. Once in the container, the octopus was easily harvested. Although such methods continue to be employed in certain areas, spears are now commonly used to glean *fe'e* from the reef. This activity, called *ta'igafe'e* in Samoan, is culturally appropriate for both men and women. Much of the octopus harvest takes place in March or April; *taife'e* is the term for the octopus season.

Reef shark populations were commonly reported to be in good condition in both island areas. Forty-two percent of all fishermen interviewed during the study said the status of reef sharks was about the same as earlier in their lives, and 22% stated that the populations had increased in size over time. These observations run counter to apparent trends in shark and other apex predator populations around the world, which are believed to be in a state of decline (cf. Robbins et al. 2006).

Shark fishing is called *lepaga* in Samoan. A traditional method of harvest called "*sele*" involved the use of bonita chum, pig innards,

or other odorous bait, and a long noose, which was used to snare the shark once it surfaced alongside a fishing vessel. Although they continue to be caught on an incidental basis by fishermen in American Samoa, sharks reportedly are not frequently targeted.

Sea turtles are commonly referred to as *laumei* in Samoan. However, in certain proverbs and in relation to ceremonies, they are referred to as "*i'asa*," which translates to "sacred fish." None of the interviewees indicated that turtles were considered a sacred species, but many mentioned a Samoan myth that holds that sea turtles have the power to guide lost fishermen back to land and safety. Four species of sea turtles are found in waters around American Samoa: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), and olive ridley (*Lepidochelys olivacea* [rare]).

Elder fishermen living in American Samoa have observed turtle populations throughout their lives. But there was little overall consensus among interviewees regarding perceived changes in abundance over time: 36% of fishermen interviewed during the study asserted that the number of sea turtles observed in the region was about the same as earlier in their lives; 26% stated that turtles were more abundant than in the past; and 28% stated that fewer turtles were now present in the waters surrounding American Samoa. Perceptions were similar between fishermen living on Tutuila and in the Manu'a Islands. However, although the majority of fishermen under the age of 60 believed that sea turtle populations are currently stable or increasing in size, interviewees over the age of 70 were more likely to report that turtles are now less abundant than in years past. This suggests a possible change in the size of sea turtle populations over time (Figure 3).

An executive order was recently passed to ban shark fishing and harvest of large herbivorous species such as bumphead parrotfish (*Bolbometopon muricatum*), humphead wrasse (*Cheilinus undulatus*), and giant grouper (*Epinephelus lanceolatus*) in the study region. Recent biological surveys indicate that large herbivores are rare in American Samoa, possibly due to local fishing pressure and possibly due to natural constraints. Archaeological data from sites in American Samoa suggest that prehistoric and contemporary harvest patterns are similar in terms of targeted species (cf. Morrison and Addison 2008, Nagaoka 1993), but the data do not clearly indicate the nature or extent of early harvest of large herbivores.

Given a paucity of prehistoric and historic data regarding the status of large herbivores, we asked elder fishermen if they were familiar with the species and, if so, what they knew about them and whether they had observed changes in their abundance over time. Most respondents grouped the three species when they responded to the question and provided little consensus regarding the status of the overall population (Figure 4). Nearly 20 interviewees did discuss the individual status of bumphead parrotfish and humphead wrasse populations, with roughly half asserting that these species are uncommon or in a state of decline in areas with which they are familiar. Of the 25 fishermen who specifically discussed the status of giant grouper, 20% stated that the fish are uncommon or declining in number across the region, and 36% stated that the populations had not changed in size in recent years. Most stated that juvenile giant grouper were found on the reef flat, but adults were found only in deep water.

Fishermen's Explanations for Changes in Abundance

Overfishing is cited as a key contributor to the decline of numerous marine species around the world, particularly those associated with nearshore coral reef ecosystems (see Jackson et al. 2001, Pauly et al. 2002, Bellwood et al. 2004). With regard to the current study, however, only 6% of interviewees stated that they perceived overfishing to be a problem for reef fish populations in American Samoa (Figure 5). Rather, it was commonly reported that certain *types* of fishing have diminished reef fish populations in the region. For instance, 48% of respondents living on Tutuila asserted that past use of fishing methods involving use of poisons and dynamite negatively affected reef fish populations around the island. This

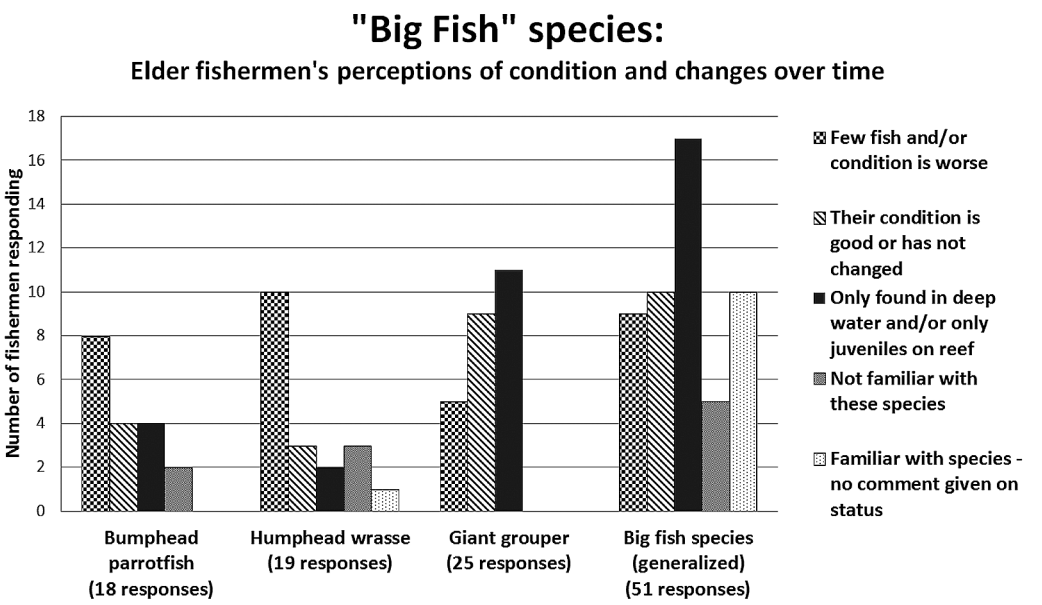

FIGURE 4. Perceived changes in status of large herbivorous species in American Samoa.

problem was not mentioned by fishermen residing in the Manu'a Islands nor was it thought to be a pervasive problem in any part of American Samoa today.

Notably, many elders interviewed during the course of this project offered the perspective that the quality of local coral reef ecosystems had declined substantially during their careers as fishermen. One fisherman described a dramatic decrease in live coral cover since he was young: "You could hardly walk on the reefs in the past because of sharp corals. Nowadays, there are no more [sharp] corals . . . In the past, if you stood ashore with your fishing pole at any time you'd surely catch fish; today, it's a waste of time . . . ." Many fishermen discussed the apparent deterioration of coral reef habitat. Just over 40% of all interviewees discussed this issue, with 19% specifically mentioning the deleterious effects of sediment and pollution runoff resulting from land-based development. Numerous fishermen residing on Ta'u discussed concerns with construction of a new wharf on the island. The destructive impact of hurricanes and tsunamis on coral reef ecosystems was mentioned as a problem by respondents on all islands.

Fishery Management Issues

Fishermen were asked about traditional means for managing local marine resources. The most commonly mentioned strategies included various village-based strictures, such as the banning of destructive fishing practices, preventing outsiders from fishing in nearshore waters adjacent to their village, prohibiting fishing on Sundays, and seasonal limitations on the harvest of certain species. Regarding the latter, harvest of species such as *atule* and *i'asina* (juvenile goatfish [*Mulloidichthys vanicolensis*]) was seasonally prohibited in certain areas to allow for spawning. An elder from the Manu'a Islands described this process in terms of a localized curfew: "When the *i'asina* are sighted near our shore, our village has a traditional curfew. This curfew will prevent people from using the *i'asina* as bait for fishing. The curfew forbids this until

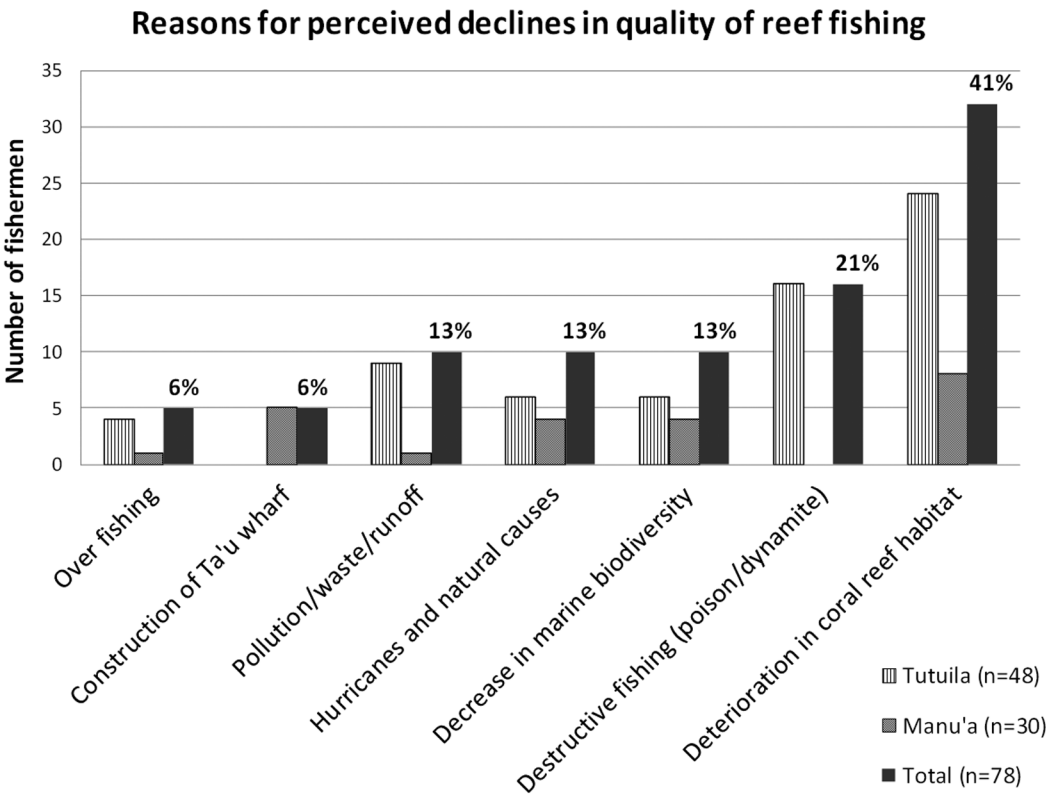

FIGURE 5. Fishermen's perceptions of causes for perceived declines in the quality of reef fishing over time in American Samoa.

the catch is sufficient and equally distributed amongst the villagers . . . then the chiefs will advise the mayor to let everyone use the catch however they desire: they can use it for bait and also package some up to send to our families on Tutuila. This is still practiced up to the present."

Fishermen were also asked about practical means for improving management of local marine resources (Figure 6). Of the 52 fishermen who provided suggestions, 28% stated that land-based sources of pollution and sediment needed to be controlled, and another 21% recommended establishing some form of marine protected area. Other recommendations included a return to the generalized traditional approach of taking only what is needed from the ocean, harvesting fish for consumption or sharing rather than commercial sale, and better enforcement of existing regulations. Fishermen residing on Tutuila generally asserted the need for new and/or more stringent regulations, and Manu'a-based fishermen often stated that they had been successful in managing local resources in the past and should be allowed to do so in the future.

DISCUSSION

Traditional ecological knowledge and local perspectives regarding the status of marine resources constitute critically important sources of information for persons involved in the management of small-scale and traditional fisheries around the Pacific (cf. Johannes et al. 2000). Moreover, traditional marine tenure arrangements and restrictions on

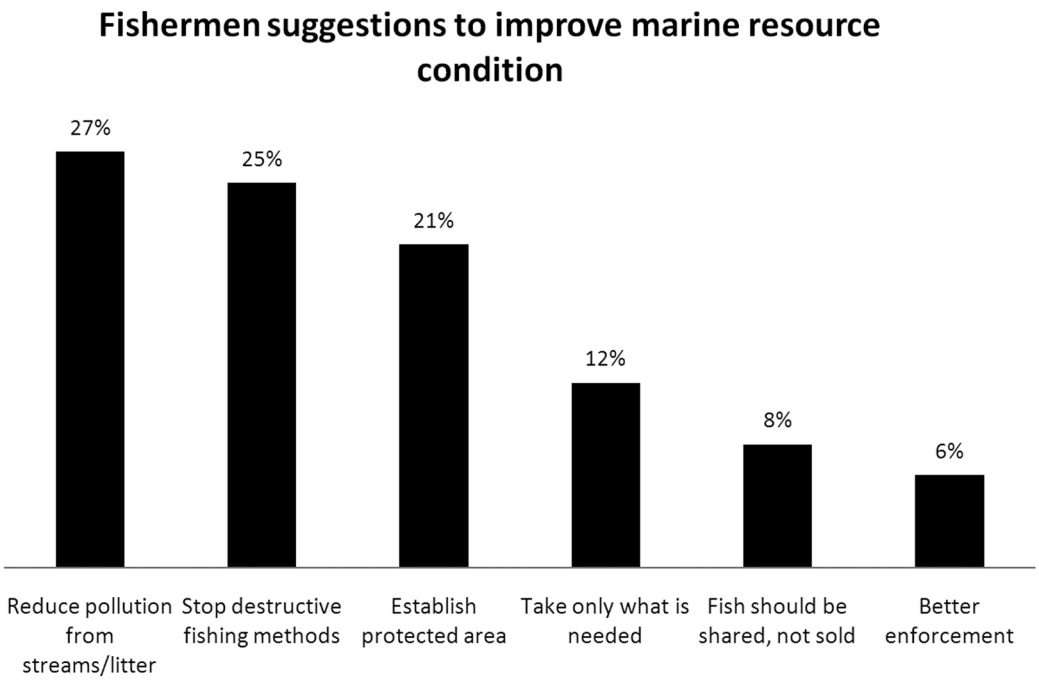

FIGURE 6. Fishermen's suggestions for improving the status of marine resources in American Samoa.

certain kinds of fishing activities have been used by many Pacific island societies to enable sustainable harvest of local nearshore fish and other species. According to Johannes (1982*b*:259): "Throughout most of Oceania, the right to fish in a particular area was controlled by a clan, chief or family. Generally this control extended from mangrove swamps and shorelines across reef flats and lagoons to the outer reef slope. It would be difficult to overemphasize the importance of some form of limited entry such as this to sound fisheries management. Without some control over fishing rights, fishermen have little incentive not to overfish since they cannot prevent others from catching what they leave behind. This is a central tenet of modern fisheries management."

In the early 1980s, Johannes (1982*b*) stated that traditional fishing rights had largely disappeared from island areas such as Hawai'i, the Marianas, and American Samoa. But there has since been some resurgence and/or rediscovery of localized fisheries management strategies in such areas. Our interviews indicate that certain traditional fishing rights and resource management strategies survive in American Samoa in the twenty-first century. In some cases, traditional means of managing marine resources have become integrated in community-based fisheries management programs. These have been established in 12 villages across the study region and function to revive traditional village authority in a way that complements authority provided through the territorial fisheries management agency (Amituana'i and Sauafea 2005, Richmond and Levine 2012). Moreover, customary authority continues to be implemented on an informal basis in many American Samoa villages, and outsiders are typically expected to ask permission from the village council and/or local leaders before undertaking fishing activities next to the village in question. In some communities, local fishing restrictions primarily address schooling fish such as *atule* and *i'asina*. Of note, fishing activities continue to be forbidden in all villages on Sundays, and fishing

is often forbidden when important village events such as funerals are taking place.

Local fishermen provide an important source of information regarding long-term environmental changes in a context of otherwise limited ecological and harvest data. Berkes et al. (2000:1252) argued that the extent to which such information can be considered "traditional" is not important; rather, the question is whether local knowledge can help resource managers to "monitor, interpret, and respond to dynamic changes in ecosystems and the resources and services that they generate."

Many fishermen involved in the current study asserted that the health of coral reef ecosystems and the abundance of associated reef fish species have diminished over their lifetimes, with the exception of sharks and sea turtles. Regarding sentinel species such as humphead wrasse, bumphead parrotfish, and giant grouper, elder fishermen generally did not express extensive concern about the relative lack of abundance of such fishes. This suggests that the species may not have been historically important food sources or commonly observed species in the region.

Although fishing methods have been modernized (Wass 1980), certain traditional fishing-related practices continue to be undertaken around American Samoa. For instance, residents of Ofu and Fagasa continue to harvest *atule* in the traditional way, involving the entire village in a mass fishing event. In Fagasa, special rocks continued to be ceremonially bathed in connection with the local *atule* harvest. Harvest of *palolo* also continues in village settings around American Samoa, although elders state that some of the traditions surrounding the harvest are eroding and that traditional gear, such as woven baskets and torches, have been replaced by modern materials such as scoop nets, buckets, and flashlights.

Analysis of interview data suggests that fishing is undertaken less frequently in contemporary American Samoa than it was in the past. Indeed, creel surveys and other sources of information indicate a decline in shoreline fishing effort in the region over the past 30 years (Craig et al. 1993, Kilarski and Everson 2008). Many factors were discussed in relation to this trend, including greater local involvement in paid employment opportunities, increasing availability of seafood for purchase, and greater difficulty catching fish. This apparent trend is unusual among contemporary Pacific island societies and is likely due to American Samoa's unique territorial economy, which involves numerous employment opportunities in the public sector and in the tuna-canning industry (Levine and Allen 2009).

Local knowledge of marine resources and traditional means for ensuring the sustained use of such resources have the potential to inform and thereby improve contemporary resource management decisions. It is therefore essential that the knowledge held by elder Samoan fishermen continue to be documented before it is lost in the course of time. It is also important to understand how local fishermen perceive the historic and contemporary status of coral reef ecosystems and associated species. This information can assist scientists and resource managers to better understand changes in species abundance and provide insight needed to develop and/or perpetuate resource management approaches that are culturally appropriate and therefore more likely to be supported by local residents. Community-based management approaches, such as the territory's Community-Based Fisheries Management Program discussed by many fishermen during this study, hold promise in this regard. This type of approach combines the cultural acceptability of customary marine tenure with the support of modern territorial legislation and enforcement. To be effective, such approaches must incorporate thorough understanding of historical and contemporary fishing and resource management practices and other forms of local and traditional knowledge about the marine environment.

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Definition & Classification System for U.S. Marine Protected Areas

www.mpa.gov

Toward a Common Language for Marine Protected Areas

Faced with widespread declines in ocean health and a growing interest in place-based ecosystem management, many nations, including the United States, are establishing marine protected areas (MPAs) to conserve vital marine habitats and resources. Familiar examples of U.S. MPAs include national marine sanctuaries, national parks and wildlife refuges, many state parks and conservation areas, and a variety of fishery management closures. Over the past several decades, a variety of legal authorities and programs have been established at all levels of government resulting in a dramatic increase in the number of MPAs. More than 1,600 such federal and state/territory sites exist today.

This complex assortment of different MPA types and purposes poses many challenges to policy-makers and stakeholders alike. Chief among these is terminology. Although MPAs have long been used for decades in the U.S. as a conservation and management tool, the nation still lacks a straightforward and consistent language to accurately describe the many types of MPAs occurring in our waters and to understand their effects on ecosystems and the people that use them.

For example, the official programmatic names of many U.S. MPAs (such as sanctuaries, parks, preserves, or natural areas) rarely reflect the area's actual conservation purpose, allowable uses, or management approach. Similarly, the term "marine protected area" is frequently assumed to mean "no-take reserves," when in fact, no-take MPAs are rare in the United States, occupying only about 3% of U.S. waters. This chronic confusion over MPA terms continues to unnecessarily complicate the critically important national dialogue about whether, when, and how to use this promising ecosystem management tool.

In response, the National Marine Protected Areas Center has developed a Classification System that provides agencies and stakeholders with a straightforward means to describe MPAs in purely functional terms using five objective characteristics common to most MPAs:

- Conservation Focus
- Level of Protection
- Permanence of Protection
- Constancy of Protection
- Scale of Protection

For most MPAs in the U.S. and elsewhere, these five functional characteristics provide an accurate picture of why the site was established, what it is intended to protect, how it achieves that protection, and how it may affect local ecosystems and local human uses. Combining elements of several domestic and international MPA classification schemes, this approach to describing U.S. MPAs is intended to augment, but not replace official programmatic names and terms. It is designed to provide a neutral, intuitive, common language with which to describe, understand, and evaluate proposed and existing MPA sites, networks and systems.

NOAA's National Marine Protected Areas (MPA) Center's mission is to facilitate the effective use of science, technology, training, and information in the planning, management, and evaluation of the nation's system of marine protected areas. The MPA Center works in partnership with federal, state, tribal, and local governments and stakeholders to develop a science-based, comprehensive national system of MPAs. These collaborative efforts will lead to a more efficient, effective use of MPAs now and in the future to conserve and sustain the nation's vital marine resources.

NATIONAL Marine Protected Areas CENTER

Office of Ocean and Coastal Resource Management, NOAA Ocean Service, 1305 East West Hwy (N/ORM), Silver Spring, MD 20910, U.S.A. March 2011

WHAT IS A MARINE PROTECTED AREA?

The term "marine protected area" encompasses a variety of conservation and management methods in the United States. In practice, MPAs are defined areas where natural and/or cultural resources are given greater protection than the surrounding waters. In the U.S., MPAs span a range of habitats including the open ocean, coastal areas, inter-tidal zones, estuaries, and the Great Lakes. They also vary widely in purpose, legal authorities, agencies, management approaches, level of protection, and restrictions on human uses.

In order to better define the term "marine protected area" for the purpose of building and implementing a national MPA system, the MPA Center uses criteria based on the official definition of a marine protected area in MPA Executive Order 13158:

"...any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein."

The MPA Center further defined five key terms from this definition in its ***Framework for the National System of MPAs:*** area, marine environment, reserved, lasting, and protection.

Key Term	Definition
Area	Must have legally defined geographical boundaries, and may be of any size, except that the site must be a subset of the United States federal, state, local or tribal marine environment in which it is located. Application of this criterion would exclude, for example, generic broad-based resource management authorities without specific locations and areas whose boundaries change over time based on species presence. The area must be one over which the U.S. has jurisdiction, consistent with international law.
Marine environment	Must be: (a) ocean or coastal waters (note: coastal waters may include intertidal areas, bays or estuaries); (b) an area of the Great Lakes or their connecting waters; (c) an area of submerged lands under ocean or coastal waters or the Great Lakes or their connecting waters; or (d) a combination of the above. The term "intertidal" is understood to mean the shore zone between the mean low water and mean high water marks. An MPA may be a marine component part of a larger site that includes uplands; however, the terrestrial portion is not considered an MPA. For mapping purposes, an MPA may show an associated terrestrial protected area. For the purposes of the national system, NOAA and DOI intend to use the following definition for the term "estuary": "part of a river or stream or other body of water having unimpaired connection with the open sea, where the sea water is measurably diluted with fresh water derived from land drainage, and extending upstream to where ocean derived salts measure less than 0.5 parts per thousand during the period of average annual low flow." Application of this criterion would exclude, for example, strictly freshwater sites outside the Great Lakes region that contain marine species at certain seasons or life history stages unless that site is a component of a larger, multiunit MPA. Upon request, the agencies will work with individual federal, state and tribal MPAs and programs to examine unique conditions which may affect applicability of the term "estuary" or "coastal waters" for sites that have national or regional significance or representativeness. Estuarine-like sites on tributaries of the Great Lakes will be considered for inclusion if they are located within the eight-digit U.S. Geological Survey cataloging unit adjacent to a Great Lake or its connecting waters.
Reserved	Must be established by and currently subject to federal, state, local, or tribal law or regulation. Application of this criterion would exclude, for example, privately created or maintained marine sites.

Lasting	For natural heritage and cultural heritage MPAs, the site's authority must clearly state its intent to provide permanent protection. This definition recognizes that subsequent to establishment, MPA designation and level of protection may change for various reasons, including natural disasters that may destroy or alter resources or changes in societal values. Should any of these changes occur, the status of the MPA relative to the national system could be re-evaluated. Sites and/or protections that must have a specific legislative or other administrative action to be decommissioned shall be considered to have been established with the intent to provide permanent protection. This would include, for example, sites that have a requirement for periodic renewal contingent on evaluation of effectiveness, with no specified expiration date. For sustainable production MPAs, the site must be established with the intent at the time of designation to provide, at a minimum, the duration of protection necessary to achieve the mandated long-term sustainable production objectives for which the site was established. For all MPAs, the site must provide the same level and type of protection at a fixed location and fixed and regular period of any duration during a year.
Protection	Must have existing laws or regulations that are designed and applied to afford the site with increased protection for part or all of the natural and submerged cultural resources therein for the purpose of maintaining or enhancing the lasting conservation of these resources, beyond any general protections that apply outside the site. Application of this criterion would exclude restricted areas that are established for purposes other than conservation. The term would not include, for example, areas closed for navigational safety, areas closed to safeguard modern human-made structures (e.g., submarine cable no-anchor zones), polluted shellfish-bed closure areas, areas closed to avoid fishing gear conflicts, and areas subject to area-based regulations that are established solely to limit fisheries by quota management or to facilitate enforcement.

User's Guide to the Classification System

Much of the information needed to classify and understand any specific MPA in the U.S. is publicly available through the MPA Center's MPA Inventory, which contains more than 1,600 individual sites and is available on www.mpa.gov. In addition, the MPA Center's interactive MPA Mapping Tool allows users to visualize MPA boundaries and provides access to the MPA Inventory data in an interactive web-based mapping environment (available at: http://www.mpa.gov/dataanalysis/mpainventory/mpaviewer/mpaviewer.swf). Other relevant information can be found in official programmatic documents including management plans, regulations, designation documents, and statutes.

The MPA Classification System can be applied to a single MPA site, or to individual management zones established within a larger MPA site. In a zoned MPA, each zone is classified independently based on its own characteristics and attributes. The overall MPA site then reflects the aggregate characteristics of its component management zones. Four of the five classification characteristics require unique, site-specific selections for the associated attribute options. One (Conservation Focus) allows multiple attribute selections in recognition of the complexity and variety of MPA applications. MPA examples are presented here for illustrative purposes only and may not always correspond to specific local sites.

The MPA Classification System uses five key functional characteristics to describe any MPA. Taken together, these characteristics influence the site's effects on local ecosystems and human users, and thus its role in contributing to the conservation of healthy marine ecosystems. Among these five site characteristics, the first two – the site's Conservation Focus and its Level of Protection – reflect many of the issues of greatest interest to stakeholders in local, regional, and national MPA dialogues.

(a) Conservation Focus

Most MPAs have legally established goals, conservation objectives, and intended purpose(s). Common examples include MPAs created to conserve biodiversity in support of research and education; to protect benthic habitat in order to recover over-fished stocks; and to protect and interpret shipwrecks for maritime education. These descriptors of an MPA are reflected in the site's Conservation Focus, which represents the characteristics of the area that the MPA was established to conserve. The Conservation Focus, in turn, influences many fundamental aspects of the site, including its design, location, size, scale, management strategies and potential contribution to surrounding ecosystems. U.S. MPAs generally address one or more of these areas of Conservation Focus:

Natural Heritage: MPAs or zones established and managed wholly or in part to sustain, conserve, restore, and understand the protected area's natural biodiversity, populations, communities, habitats, and ecosystems; the ecological and physical processes upon which they depend; and, the ecological services, human uses and values they provide to this and future generations.
Examples: Natural Heritage MPAs include most national marine sanctuaries, national parks, national wildlife refuges, and many state MPAs.

Cultural Heritage: MPAs or zones established and managed wholly or in part to protect and understand the legacy of physical evidence and intangible attributes of a group or society which is inherited and maintained in the present and bestowed for the benefit of future generations.
Examples: Cultural Heritage MPAs include some national marine sanctuaries, national and state parks, and national historic monuments.

Sustainable Production: MPAs or zones established and managed wholly or in part with the explicit purpose of supporting the continued extraction of renewable living resources (such as fish, shellfish, plants, birds, or mammals) that live within the MPA, or that are exploited elsewhere but depend upon the protected area's habitat for essential aspects of their ecology or life history (feeding, spawning, mating, or nursery grounds).
Examples: Sustainable Production MPAs include some national wildlife refuges and many federal and state fisheries areas, including those established to recover over-fished stocks, protect by-catch species, or protect essential fish habitats.

(b) Level of Protection

MPAs in the U.S. vary widely in the level and type of legal protections afforded to the site's natural and cultural resources and ecological processes. Any MPA, or management zone within a larger MPA, can be characterized by one of the following six levels of protection, which will directly influence its effects on the environment and human uses.

Uniform Multiple-Use: MPAs or zones with a consistent level of protection, allowable activities or restrictions throughout the protected area. Extractive uses may be restricted for natural or cultural resources.
Examples: Uniform multiple-use MPAs are among the most common types in the U.S., and include many sanctuaries, national and state parks, and cultural resource MPAs.

(B) Level of Protection, continued

Zoned Multiple-Use: MPAs that allow some extractive activities throughout the entire site, but that use marine zoning to allocate specific uses to compatible places or times in order to reduce user conflicts and adverse impacts.
Examples: Zoned multiple-use MPAs are increasingly common in U.S. waters, including some marine sanctuaries, national parks, national wildlife refuges, and state MPAs.

Zoned Multiple-Use With No-Take Area(s): Multiple-use MPAs that contain at least one legally established management zone in which all resource extraction is prohibited.
Examples: Zoned no-take MPAs are emerging gradually in U.S. waters, primarily in some national marine sanctuaries and national parks.

No-Take: MPAs or zones that allow human access and even some potentially harmful uses, but that totally prohibit the extraction or significant destruction of natural and cultural resources. This includes Papahanuamokuakea Marine National Monument, which allows very limited subsistence fishing activities by Native Hawaiians by permit.
Examples: No-take MPAs are relatively rare in the U.S., occurring mainly in state MPAs, in some federal areas closed for either fisheries management or the protection of endangered species, or as small special use (research) zones within larger multiple-use MPAs. Also called marine reserves or ecological reserves.

No Impact: MPAs or zones that allow human access, but that prohibit all activities that could harm the site's resources or disrupt the ecological and cultural services they provide. Examples of activities typically prohibited in no-impact MPAs include resource extraction of any kind (fishing, collecting, or mining); discharge of pollutants; disposal or installation of materials; and alteration or disturbance of submerged cultural resources, biological assemblages, ecological interactions, physiochemical environmental features, protected habitats, or the natural processes that support them.
Examples: No- impact MPAs are rare in U.S. waters, occurring mainly as small isolated MPAs or in small research-only zones within larger multiple-use MPAs. Other commonly used terms include fully protected marine (or ecological) reserves.

No Access: MPAs or zones that restrict all human access to the area in order to prevent potential ecological disturbance, unless specifically permitted for designated special uses such as research, monitoring or restoration.
Examples: No-access MPAs are extremely rare in the U.S., occurring mainly as small research-only zones within larger multiple-use MPAs. Other commonly used terms for no access MPAs include wilderness areas or marine preserves.

(C) Permanence of Protection

Not all MPAs are permanently protected. Many sites differ in how long their protections remain in effect, which may in turn profoundly affect their ultimate effects on ecosystems and users.

Permanent: MPAs or zones whose legal authorities provide some level of protection to the site in perpetuity for future generations, unless reversed by unanticipated future legislation or regulatory actions.
Examples: Permanent MPAs include most national marine sanctuaries and all national parks.

(c) Permanence of Protection, Continued

Conditional: MPAs or zones that have the potential, and often the expectation, to persist administratively over time, but whose legal authority has a finite duration and must be actively renewed or ratified based on periodic governmental reviews of performance.
Examples: Conditional MPAs include some national marine sanctuaries with 'sunset clauses' applying to portions of the MPA in state waters

Temporary: MPAs that are designed to address relatively short-term conservation and/or management needs by protecting a specific habitat or species for a finite duration, with no expectation or specific mechanism for renewal.
Examples:Temporary MPAs include some fisheries closures focusing on rapidly recovering species (e.g. scallops).

(d) Constancy of Protection

Not all MPAs provide year-round protection to the protected habitat and resources. Three degrees of constancy throughout the year are seen among U.S. MPAs.

Year-Round: MPAs or zones that provide constant protection to the site throughout the year.
Examples:Year-round MPAs include all marine sanctuaries, national parks, refuges, monuments, and some fisheries sites.

Seasonal: MPAs or zones that protect specific habitats and resources, but only during fixed seasons or periods when human uses may disrupt ecologically sensitive seasonal processes such as spawning, breeding, or feeding aggregations.
Examples: Seasonal MPAs include some fisheries and endangered species closures around sensitive habitats.

Rotating: MPAs that cycle serially and predictably among a set of fixed geographic areas in order to meet short-term conservation or management goals (such as local stock replenishment followed by renewed exploitation of recovered populations).
Examples: Rotating MPAs are still rare in the U.S.They include some dynamic fisheries closures created for the purpose of serially recovering a suite of localized population to harvestable levels.

(e) Scale of Protection

MPAs in the U.S. vary widely in the ecological scale of the protection they provide. MPA conservation targets range from entire ecosystems and their associated biophysical processes, to focal habitats, species, or other resources deemed to be of economic or ecological importance.The ecological scale of a site's conservation target generally reflects its underlying legal authorities and, in turn, strongly influences the area's design, siting, management approach, and likely effects.

Ecosystem: MPAs or zones whose legal authorities and management measures are intended to protect all of the components and processes of the ecosystem within its boundaries.
Examples: Ecosystem-scale MPAs include most marine sanctuaries, national parks and national monuments.

Focal Resource: MPAs or zones whose legal authorities and management measures specifically target a particular habitat, species complex, or single resource (either natural or cultural).
Examples: Focal-resource MPAs include many fisheries and cultural resource sites, including some national wildlife refuges and marine sanctuaries.

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Presidential Documents

Title 3—

The President

Proclamation 8337 of January 6, 2009

Establishment of the Rose Atoll Marine National Monument

By the President of the United States of America

A Proclamation

In the Pacific Ocean approximately 130 nautical miles east-southeast of Pago Pago Harbor, American Samoa, lies Rose Atoll—the easternmost Samoan island and the southernmost point of the United States. This small atoll, which includes the Rose Atoll National Wildlife Refuge with about 20 acres of land and 1,600 acres of lagoon, remains one of the most pristine atolls in the world. The lands, submerged lands, waters, and marine environment around Rose Atoll support a dynamic reef ecosystem that is home to a very diverse assemblage of terrestrial and marine species, many of which are threatened or endangered.

One of the most striking features of Rose Atoll is the pink hue of fringing reef caused by the dominance of coralline algae, which is the primary reef-building species. Though there are roughly 100 species of stony corals, the shallow reefs are dominated by crustose coralline algae, making them distinctive and quite different from those found at other Samoan islands. The marine area provides isolated, unmolested nesting grounds for green and hawksbill turtles and has the largest number of nesting turtles in American Samoa. Its waters are frequented by numerous large predators: whitetip reef sharks, blacktip reef sharks, gray reef sharks, snappers, jacks, groupers, and barracudas. Species that have faced depletion elsewhere, some of which have declined worldwide by as much as 98 percent, are found in abundance at Rose Atoll, including giant clams, Maori wrasse, large parrotfishes, and blacktip, whitetip, and gray reef sharks. Humpback whales, pilot whales, and the porpoise genus Stenella have all been spotted at Rose Atoll. There are 272 species of reef fish, with seven species first described by scientists at Rose and dozens more new species discovered on the first deep water dive to 200 meters. Recent submersible dives around Rose Atoll have revealed abundant marine life, deep sea coral forests, and several new fish and invertebrate species.

Rose Atoll supports most of the seabird population of American Samoa, including 12 federally protected migratory seabirds, five species of federally protected shorebirds, and a migrant forest bird, the long-tailed cuckoo. Rare species of nesting petrels, shearwaters, and terns are thriving at Rose Atoll and increasing in number. The atoll is known to Samoans, who have periodically visited over the past millennium, as ''Nu'u O Manu'' (''Village of seabirds''). It is believed that Polynesians have harvested at Rose Atoll for millennia and several species, such as the giant clam, were used for cultural celebrations and events. Few relatively undisturbed islands remain in the world and Rose Atoll is one of the last remaining refuges for the seabird and turtle species of the Central Pacific. Threatened Pisonia atoll forest trees are also found at Rose Atoll.

WHEREAS the lands, submerged lands, and waters of and marine environment around Rose Atoll contain objects of historic or scientific interest that are situated upon lands owned or controlled by the Government of the United States;

WHEREAS the United States continues to act in accordance with the balance of interests relating to traditional uses of the oceans recognizing freedom

of navigation and overflight and other internationally recognized lawful uses of the sea;

WHEREAS section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431) (the ''Antiquities Act'') authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected;

WHEREAS it is in the public interest to preserve the lands, submerged lands and waters of, and marine environment around Rose Atoll as necessary for the care and management of the historic and scientific objects therein:

NOW, THEREFORE, I, GEORGE W. BUSH, President of the United States of America, by the authority vested in me by section 2 of the Antiquities Act, do proclaim that there are hereby set apart and reserved as the Rose Atoll Marine National Monument (the ''monument'' or ''marine national monument'') for the purpose of protecting the objects described in the above preceding paragraphs, all lands and interests in lands owned or controlled by the Government of the United States within the boundaries that lie approximately 50 nautical miles from the mean low water line of Rose Atoll as depicted on the accompanying map entitled ''Rose Atoll Marine National Monument'' attached to and forming a part of this proclamation. The Federal land and interests in land reserved consists of approximately 13,451 square miles of emergent and submerged lands and waters of and around Rose Atoll in American Samoa, which is the smallest area compatible with the proper care and management of the objects to be protected.

All Federal lands and interests in lands within the boundaries of this monument are hereby withdrawn from all forms of entry, location, selection, sale, or leasing or other disposition under the public land laws to the extent that those laws apply.

Management of the Marine National Monument

The Secretary of the Interior shall have management responsibility for the monument, including Rose Atoll National Wildlife Refuge, in consultation with the Secretary of Commerce, except that the Secretary of Commerce, through the National Oceanic and Atmospheric Administration, shall have the primary management responsibility regarding the management of the marine areas of the monument seaward of mean low water, with respect to fishery-related activities regulated pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq.*), and any other applicable authorities. The Secretary of Commerce shall initiate the process to add the marine areas of the monument to the Fagatele Bay National Marine Sanctuary in accordance with the National Marine Sanctuaries Act (16 U.S.C. 1431 *et seq.*), including its provision for consultation with an advisory council, to further the protection of the objects identified in this proclamation. In developing and implementing any management plans and any management rules and regulations, the Secretary of Commerce shall consult with the Secretary of the Interior and shall designate and involve as cooperating agencies the agencies with jurisdiction or special expertise, including the Department of State, the Department of Defense, and other agencies through scoping in accordance with the National Environmental Policy Act (42 U.S.C. 4321 *et seq.*), its implementing regulations and with Executive Order 13352 of August 26, 2004, Facilitation of Cooperative Conservation, and shall treat as a cooperating agency the Government of American Samoa, consistent with these authorities.

The Secretary of the Interior shall continue to manage the Rose Atoll National Wildlife Refuge consistent with the protection of the objects identified in this proclamation. The Secretary of the Interior shall, in developing any

management plans and any management rules and regulations governing the Rose Atoll National Wildlife Refuge, comply with the National Environmental Policy Act and consult with the Secretary of Commerce.

For the purposes of protecting the objects identified above, the Secretaries of the Interior and Commerce, respectively, shall not allow or permit any appropriation, injury, destruction, or removal of any feature of this monument except as provided for by this proclamation or as otherwise provided for by law.

Regulation of Scientific Exploration and Research

Subject to such terms and conditions as the Secretaries deem necessary for the care and management of the objects of this monument, the Secretary of the Interior may permit scientific exploration and research within the monument, including incidental appropriation, injury, destruction, or removal of features of this monument for scientific study, and the Secretary of Commerce may permit fishing within the monument for scientific exploration and research purposes to the extent authorized by the Magnuson-Stevens Fishery Conservation and Management Act. The prohibitions required by this proclamation shall not restrict scientific exploration or research activities by or for the Secretaries, and nothing in this proclamation shall be construed to require a permit or other authorization from the other Secretary for their respective scientific activities.

Regulation of Fishing and Management of Fishery Resources

The Secretaries shall prohibit commercial fishing within the monument. Subject to such terms and conditions as the Secretaries deem necessary for the care and management of the objects of this monument, the Secretaries may permit noncommercial and sustenance fishing or, after consultation with the Government of American Samoa, traditional indigenous fishing within the monument. The Secretaries of the Interior and Commerce, respectively, in consultation with the Government of American Samoa, shall provide for a process to ensure that recreational fishing shall be managed as a sustainable activity consistent with Executive Order 12962 of June 7, 1995, as amended, and other applicable law.

This proclamation shall be applied in accordance with international law. No restrictions shall apply to or be enforced against a person who is not a citizen, national, or resident alien of the United States (including foreign flag vessels) unless in accordance with international law. The management plan and implementing regulations shall impose no restrictions on innocent passage in the territorial sea or otherwise restrict navigation and overflight and other internationally recognized lawful uses of the sea in the monument and shall incorporate the provisions of this proclamation regarding Armed Forces actions and compliance with international law.

Nothing in this proclamation shall be deemed to diminish or enlarge the jurisdiction of the Government of American Samoa. The Secretaries of the Interior and Commerce shall, in developing any management plans and any management rules and regulations governing the marine areas of the monument, as described above, consult with the Government of American Samoa.

Emergencies, National Security, and Law Enforcement Activities

1. The prohibitions required by this proclamation shall not apply to activities necessary to respond to emergencies threatening life, property, or the environment, or to activities necessary for national security or law enforcement purposes.

2. Nothing in this proclamation shall limit agency actions to respond to emergencies posing an unacceptable threat to human health or safety or to the marine environment and admitting of no other feasible solution.

Armed Forces Actions

1. The prohibitions required by this proclamation shall not apply to activities and exercises of the Armed Forces (including those carried out by the United States Coast Guard).

2. The Armed Forces shall ensure, by the adoption of appropriate measures not impairing operations or operational capabilities, that its vessels and aircraft act in a manner consistent, so far as is reasonable and practicable, with this proclamation.

3. In the event of threatened or actual destruction of, loss of, or injury to a monument living marine resource resulting from an incident, including but not limited to spills and groundings, caused by a component of the Department of Defense or the United States Coast Guard, the cognizant component shall promptly coordinate with the Secretary of the Interior or Commerce, as appropriate for the purpose of taking appropriate actions to respond to and mitigate any actual harm and, if possible, restore or replace the monument resource or quality.

4. Nothing in this proclamation or any regulation implementing it shall limit or otherwise affect the Armed Forces'; discretion to use, maintain, improve, manage, or control any property under the administrative control of a Military Department or otherwise limit the availability of such property for military mission purposes.

The establishment of this monument is subject to valid existing rights.

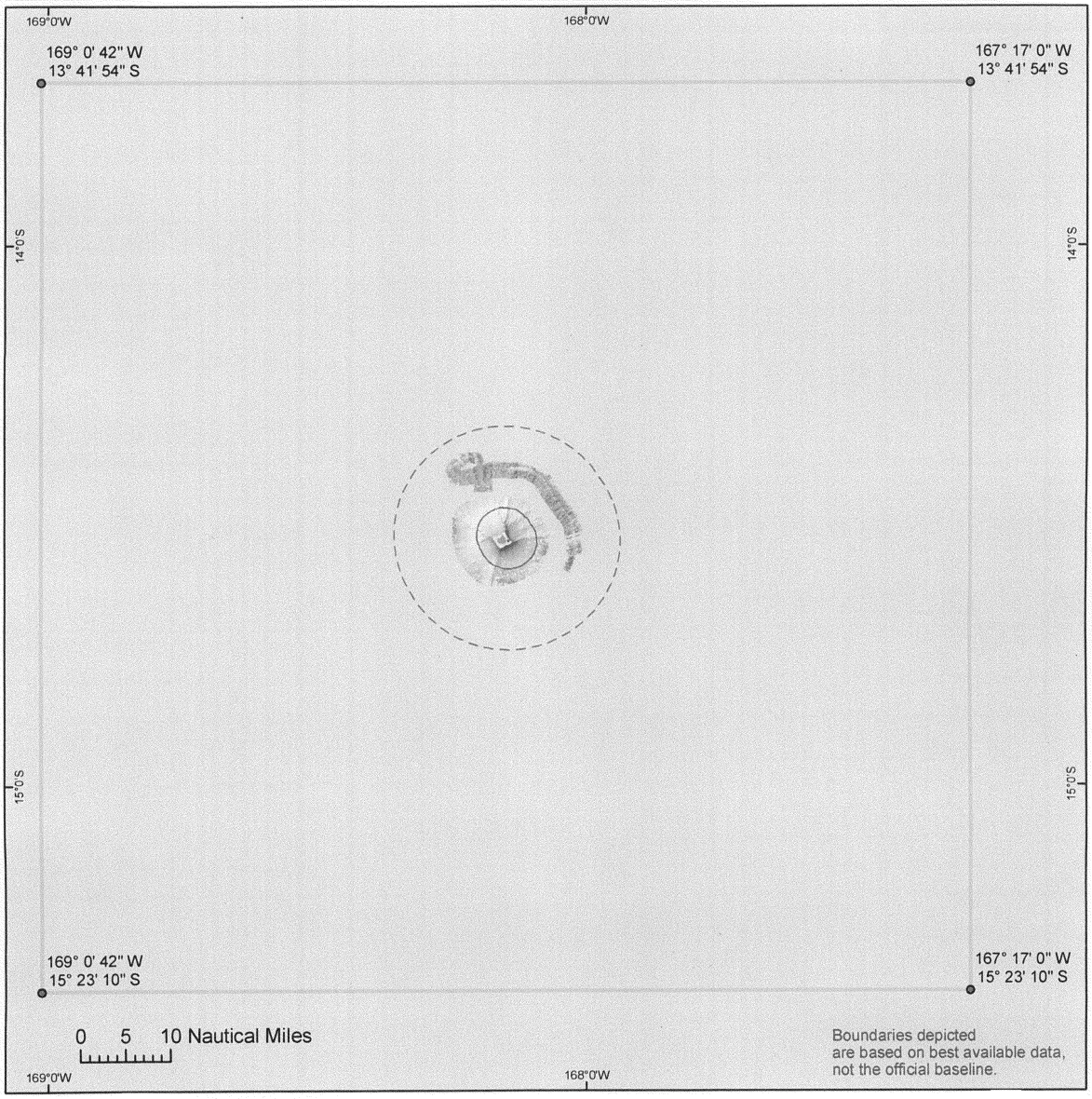
This proclamation is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity, by any party against the United States, its agencies, instrumentalities, or entities, its officers, employees, or agents, or any other person.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be dominant over any other existing Federal withdrawal, reservation, or appropriation.

Warning is hereby given to all unauthorized persons not to appropriate, excavate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any lands thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this sixth day of January, in the year of our Lord two thousand nine, and of the Independence of the United States of America the two hundred and thirty-third.

Rose Atoll Marine National Monument



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NOAA FISHERIES

Rose Atoll Marine National Monument: Design Your Own Marine Protected Area

Name_____ Date_____

Design your own Marine Protected Area and describe how it will be managed. You can pick a real location or create one, but start by explaining where it is and why this place deserves protection. Explain the goals, objectives, and protection of your MPA by answering the following questions:

1. What is the conservation focus?
2. What is the level or protection?
3. What is the permanence of protection?
4. What is the constancy of protection?
5. What is the scale of protection?

Use the "Classification of MPAs" handout to understand what your options are. Do not simply write the category from that handout, but explain why you have chosen it and why it is the best option for your MPA. Remember to consider the environment as well as the people who may be affected by the creation of your MPA. Will your MPA affect anyone's livelihood or recreation options? Explain how you have balanced those considerations with the need to protect the environmental resources in your MPA.