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Pacific Islands Fisheries Science Center National Marine Fisheries Service National Oceanic and Atmospheric Administration U.S. Department of Commerce

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Pacific Islands Fisheries Science Center National Marine Fisheries Service National Oceanic and Atmospheric Administration U.S. Department of Commerce

# The Sociocultural Importance of Spearfishing in Hawai'i

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I love fish, to eat 'ama'ama wrapped in ti leaves and broiled on hot coals...

- Sam Alama's "'Ama'Ama"

Hail to the manini and the popolo Fish that live in the coral reef flats...

- Lot Kauwe's "Aloha Ka Manini"

I used to go spear *uhu*, I used to give 'em. Sometimes I would go just for...some of the Hawaiians those days when you go down, you walking on the road. They tell, E, hele mai 'ai!" They call you, come eat. When I go inside there they no more nothing only salt and poi.

-Fred Kaimalino Leslie, interviewed by Kepa Maly

## **INTRODUCTION**

Hawaiian songs and stories are filled with allusions to the connection between humans and marine ecosystems. Recognition of that strong historic and contemporary connection encouraged scientists from the National Oceanic and Atmospheric Administration (NOAA) to initiate an indepth examination into a specific group of Hawai'i fishermen, a group often perceived to be underrepresented in the policy process yet they play an integral role in commercial, recreational, and subsistence fisheries. This realization guided the development of research objectives which focused on identifying the sociocultural importance of spearfishing and spearfishermen throughout Hawai'i. The result of this effort demonstrates that Hawai'i residents have always been and remain today connected to marine ecosystems in a manner that extends far beyond the simple need for food provisions.

Data suggest that marine species and fishing are important components of the historic and contemporary local culture and that many current fishing methods and fisheries management strategies are adaptations of methods and strategies dating back to the first kings and chiefs. The findings of this research develop a basic understanding of contemporary local dependence on and engagement in Hawai'i's spearfish fisheries and specifically address 1) the historic and contemporary importance of spearfishing and spearfishermen; 2) a description of local spearfishermen; and 3) the major concerns and issues held by local spearfishermen.

Data from the Hawai'i Marine Recreational Fishing Survey (HMRFS) suggest that, depending on the island, spearfishing trips comprise at least 10 to 20% of the total recreational trips conducted; of all shore-based recreational trips made by recreational and subsistence fishermen, spearfishing is one of the most popular methods. These

numbers possibly underestimate the total number of spearfishing trips conducted, as few of the members of various spearfishing clubs indicated having been interviewed by HMRFS surveyors, and a majority of these fishermen spearfish at least once a week. It may also underestimate the total number of trips where spearfishing occurs because it may not take into consideration those trips that are made to "blue water" sites where multiple gear strategies are employed, especially in the case of fishing for pelagic species. Regardless, the estimated percentage of recreational trips conducted by spearfishermen, coupled with a desire to understand this group's role in the local fisheries and their perceptions of the current state of the environment, encouraged the development of this research effort. Recent studies have explored numerous other fisheries in Hawai'i, but none have focused on spearfishing.

This research project has five main objectives:

- Develop a better understanding of the spearfish fishery and community;
- Identify key players and organizations associated with the fishery;
- Provide information to assist the State of Hawai'i and the Western Pacific Regional Fishery Management Council in making decisions based on increased understanding of the ways people are socioeconomically affected by fishery policies;
- Document the perspectives/concerns of local spearfishermen and resources users;
- Contribute to the development and refinement of the fishing community profiles for Hawai'i in response to The Magnuson-Stevens Act, National Standard 8.

These objectives are directly and indirectly addressed throughout the report in a number of different sections. Each section is designed to provide important and relevant data about the relative sociocultural importance of spearfishing in Hawai'i. Ultimately, the findings from this report can not only educate policy makers, stakeholders, and other researchers, but can lead to recommendations about strategies for continuing to build on accomplishments.

# BACKGROUND

Historic and contemporary Hawaiians have always maintained a strong tie to the sea and its resources. When the first Polynesians came to Hawai'i, they relied on the sea for a majority of their food, initially while crossing the ocean and then afterwards in the establishment and maintenance of the first communities. They brought with them knowledge of marine species and harvesting critical to the successful crossing and subsequent establishment and sustainability of the first communities in Hawai'i. They were skilled artisans with a vast array of knowledge and fishing techniques. Their expertise in sailing and navigation, their ability to harvest marine resources, and their physical, psychological, and cultural connection to the ocean and its resources are key components of what characterized and characterizes Hawaiian people as well as subsequent ethnic groups.

Previously, local environmental knowledge of fishing areas, seasons, and gear strategies, which included the use of hooks and lines, lures, nets, basket traps, poisonous plants, and spears, made it possible for fishermen to supply their families and their *ali*'*i* with fish and shellfish from streams, fishponds, reefs, and the ocean (Manu, 1992). In some instances, catches were so large that the excess was used to feed animals as well as dried for use as food or even fuel for fire. Those fishermen that could supply large amounts of fish from ponds or catches at sea were believed to possess *mana kupua* (supernatural power) because of their ability to attract fish at will or even make them multiply. Successful fishing gears, such as hooks or cowry shell lures became famous and were prized and were even passed on to heirs and sometimes fought over among family members (Manu, 1992).

Hawaiians have always relied on agriculture, gathering, and marine harvesting as strategies for providing sustenance. Prior to the introduction of *Haole* food, food was separated into two specific categories; '*ai* and *i*'a; '*ai* (vegetable food) or *i*'a (seafood). The '*ai* was considered to be the bland staple, and *i*'a was described as the "tasty accompaniment that made eating a delight" (Manu, 1992). During this time, seafood was a main source of protein and a key consideration in sociopolitical decisions.

Understanding the sociolinguistic relevance of these two categories leads to the conclusion that even if you knew little about the people in your study, use of these two categories indicates that seafood was not only an important part of their diet but their culture as well. Seafood and other foods have a cultural dimension by which people choose what they eat not only by flavor or nutritional value but by cultural, religious, economic/social status, and environmental factors. As a Hawaiian stated, "I can always tell when I am not home (in Hawai'i)...I walk into a 7-Eleven and I can't find fresh sushi."

Among saltwater fishing techniques, spearfishing establishes an especially close connection to the ocean (Tanabe, 2011). Spearfishermen do not just fish on the water, they fish in the water, and see their individual prey before harvesting it. Bycatch is nonexistent. Maly and Maly (2003) described spearing as one of the "unusual ways of fishing:"

It is impossible to explain all the ways of fishing of *ka po'e kahiko*, but some of the more unusual ways will be described. Spearing fish—'o *i'a*—was one of them. The spearfisherman searched for a piece of hard wood...Some spears were longer, and some shorter and were three, four, five, or six inches in circumference, made very straight, and tapered to a sharp point. They had iron points or bone points made from dog or human bone, lashed on with coconut fiber. The spearfishermen went out to sea ten fathoms or more to where there were many fish. Most of the men swam, but some went on canoes. Some of them stayed in one spot, some waded about, and some really chased the fish in the sea. Some swam out to where it was deep and when they saw many fish, took a deep breath and dived headlong. They crouched sideways with one foot thrust out for support, with the spear (*la'au 'o i'a*) held upward in the right hand—like a man shooting plover—and lunged with the spear and pierced whatever fish they chose, whether *uhu*, *ulua*, *kahala*, or some small fish. Sharks were the "fighting companions" (*hoa hakaka*) of the spear fisherman; they remained quiet and did not trouble them. Those who fished with spears did not kill sharks, nor did they spear and kill whales. Spearfishermen were as strong as those who dived in fishing with the *'upena waha nui* and the *'upena maomao*; they could go down twenty or thirty fathoms, and could reach depths of two hundred feet and more. They could swim like fish in the sea, as Kawelo proved. (p. 46)

#### **RESEARCH METHODS**

Fielded research was conducted on Oahu and Hawai'i in 2007 from January 9 to April 9, while author Brent Stoffle was on a NOAA Fisheries rotational assignment to the Pacific Islands Fisheries Science Center's Human Dimensions Research Program. The majority of time was spent on Oahu with a week spent on the Big Island. A result of working on two islands was the realization that cultural and social distinctions vary from place to place. There is no doubt that based on the nature of the ecosystem distinctions, spearfishing is not practiced in an identical manner. This led to the conclusion that to better address the socioeconomic importance of spearfishing in Hawai'i, attention needs to be paid to the other islands; they are likely to have unique approaches to spearfishing, based on variables such as population size, amount of available reef, status of local stocks, and access to the marine environment.

A number of research methods were used in the collection of primary and secondary data. The following is a list of the methods employed followed by a brief discussion of how each was used.

#### **Primary Data Collection**

A variety of ethnographic methods were utilized in the collection of the primary data. These methods included:

- Informal semi-structured interviews
- Group interviews
- Key informant interviews
- Participant observation

Informal interviews were conducted with individuals as well as groups. While there was no set format to the interview, as most interviews evolved from simply getting together and "talking story" about fishing, some specific topics of conversation were broached on almost every occasion. These topics included but were not limited to the following:

- Changes in the marine environment
- Perceived status of fish stocks
- Perceived factors affecting fish stocks
- Most popular targeted species
- Gear used/fishing method
- Fishing location
- Fishery policy

More than 100 people were interviewed during the course of the research. Opportunistic and intercept samplings were common methods for meeting new people and discussing spearfishing. Key informants were sought out, based on recommendations from "dialed-in" locals and agency personnel who knew of people's specific knowledge and proficiencies. Discussions with key informants varied from general discussions with local fishermen in that they often were much more in-depth and covered specific issues. Some of the interviews occurred over multiple days in a variety of settings in an effort to fully address and explore certain issues.

During the research, participant observation was used as a manner of collecting observational data, building rapport with local spearfishermen, developing a personal assessment of the status of a variety of reef fish stocks, and gaining a familiarity with the unique Hawaiian marine environment. This included spearfishing with local fishermen on the eastside of Oahu, participating in a three-prong spearfishing tournament, fishing for "big game" fish on a private fishing boat, spearfishing alone around Oahu, and free diving with locals.

All of these techniques were used as a part of a multifaceted approach to achieving the research objectives. No one method can create a holistic comprehension of the spearfish fishery; however the use of multiple methods certainly assists in the development of an in-depth description and understanding

# **Secondary Data Collection**

The secondary data collection targeted fishery dependent and independent sources. These include data from places such as the HMRFS database, the web, background literature, television programs and fishing magazines. Each of these sources was useful in providing data regarding the local people's level of engagement and dependency on the fishery. Moreover, the magazines and television programs provided an insight into a host of other variables that impact local fisheries and helped introduce the researcher to issues on the forefront of many fishermen's minds.

Throughout the report, data on spearfishing trips and catch collected through the Hawai'i Marine Recreational Fishing Survey from 2002 to 2007 (2007 data through June 30 only) is incorporated with the ethnographic results. During this time period, 705 interviews

were conducted with fishermen on spearfishing trips. The sample size varies by analysis based on response rates for individual questions. It should be mentioned that the HMRFS data examine spearfishing across all islands and may at times appear to create discrepancies with the ethnographic data. While this may be the case, it does not necessarily mean either data set is incorrect, simply that these were different perspectives from which to view the fisheries. The HMRFS surveys were broader-based and systematic, but did not delve as deeply into spearfishing as the ethnographic portion; thus, the two methods were quite complementary. Allen and Bartlett (2008) provide an overview of the data collection methods.

During the 6 years of HMRFS data, 145 trips (21% of the total) occurred on the Big Island, 169 (24%) on Oahu, 55 (8%) on Kauai, 324 (46%) on Maui, and 9 (1%) on Molokai. During 2002 and 2003, HMRFS interviews were conducted only on Oahu, the Big Island, and Maui; interviews on Kauai and Molokai began in 2004. Thus of the total number of interviews conducted, nearly 18% were on Maui during 2005 and an additional 14% were on Maui in 2006. Spearfishermen were interviewed on Molokai only during 2004 although fieldwork there continued from 2005 to 2007. No spearfishermen were interviewed on Kauai during the first 6 months of 2007. As a result, the interviews should not be viewed as representative of all islands during all of the survey years.

#### **DESCRIPTION OF THE SPEARFISH FISHERY**

It is difficult to accurately quantify the total number of spearfishermen in the Hawaiian Islands. In an article in the Miami Herald, Terry Maas, a renowned freediver and member of the Alii Holo Kai Spearfishing Club, estimates that there are approximately 5000 recreational spearfishermen in Hawai'i (all islands). However, it is difficult to ascertain how this figure is derived, and estimates of the total number of recreational fishermen (let alone the total number of spearfishermen) are uncertain. NOAA estimates of residents who are recreational fishermen in Hawai'i range from 260,745 in 2003 to 139,858 in 2009, with 172,696 in 2006

(http://www.st.nmfs.noaa.gov/st1/recreational/queries/index.html). However, a survey conducted every 5 years for the U.S. Fish and Wildlife Service found that 89,000 saltwater fishermen were estimated to have resided in Hawai'i in 2006, the most recent year in which the study was conducted (U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce; U.S. Census Bureau, 2006). Neither of these surveys produces estimates for the number of people who spearfish.

As will be discussed in greater detail in the section on fishermen's issues and concerns, the lack of a recreational licensing program is one reason why limited data are available on recreational and subsistence effort. The findings also document networks that are directly and indirectly impacted by the existence of spearfishing as well as the concerns, issues, and perceptions of those engaged in the fishery.

#### Hawai'i Spearfishermen Demographics

Throughout the research, it became apparent that people from all class and ethnic backgrounds participate in spearfishing. On Oahu, spearfishermen and other fishermen were queried about ethnicity as it related to participation in the fishery. The most common response to these questions was that "everyone participates," regardless of ethnicity. Oahu is described as "the real melting pot" as it is ethnically diverse with people from all over the world, especially Asia, as is shown in the following table. This table examines the ethnic composition of the City and County of Honolulu (the Island of Oahu).

Table 1.--Sociodemographic data from Honolulu County, Hawai'i; U.S. Census, 2000.

	Estimate P	ercent	115	Margin of Error
Total population	873 177	ercent	0.0.	*****
Male	427,895	49.0	49.0%	+/-1.006
Female	445,282	51.0	51.0%	+/-1,006
Median age (years)	38.5	(X)	36.4	+/-0.3
Under 5 years	65,344	7.5	7.0%	+/-167
18 years and over	665,310	76.2	74.6%	*****
65 years and over	122,994	14.1	12.1%	+/-438
One race	702,339	80.4	98.1%	+/-10,636
White	179,491	20.6	74.7%	+/-2,362
Black or African American	22,922	2.6	12.1%	+/-1,049
American Indian and Alaska Native	2,033	0.2	0.8%	+/-710
Asian	416,194	47.7	4.3%	+/-9,053
Native Hawaiian and Other Pacific Islander	72,281	8.3	0.1%	+/-3,809
Some other race	9,418	1.1	6.0%	+/-1,989
Two or more races	170,838	19.6	1.9%	+/-10,636
Hispanic or Latino (of any race)	61,827	7.1	14.5%	****

The ethnic makeup differs on the Big Island (Table 2). These differences may become even more distinct when comparing these two islands with the remaining islands in the Hawaiian chain, especially as it relates to those engaged in the fishery. Regardless of one's ethnic background, spearfishing on the Big Island is something many young boys (and increasingly, girls) are exposed to and grow up learning and experiencing. As one Hawaiian stated "it is as common as children learning to play sports on the mainland," or perhaps an even more succinct analogy is children playing soccer in Europe or Latin America.

	Marrin of				
				margin or	
	Estimate P	ercent	U.S.	Error	
Total population	164,437			*****	
Male	83,038	50.5	49.0%	+/-651	
Female	81,399	49.5	51.0%	+/-651	
Median age (years)	38.0	(X)	36.4	+/-0.8	
Under 5 years	11,035	6.7	7.0%	+/-38	
18 years and over	122,740	74.6	74.6%	+/-226	
65 years and over	21,471	13.1	12.1%	+/-461	
One race	115,747	70.4	98.1%	+/-4.424	
White	57,450	34.9	74.7%	+/-1,725	
Black or African American	1,113	0.7	12.1%	+/-248	
American Indian and Alaska Native	201	0.1	0.8%	+/-190	
Asian	38,599	23.5	4.3%	+/-2,788	
Native Hawaiian and Other Pacific Islander	14,768	9.0	0.1%	+/-2,162	
Some other race	3.616	2.2	6.0%	+/-1.958	
Two or more races	48,690	29.6	1.9%	+/-4,424	
Hispanic or Latino (of any race)	19,220	11.7	14.5%	*****	

Table 2.--Sociodemographic data from Hawai'i County, Hawai'i; U.S. Census, 2000.

An interesting point made by people from both Oahu and Hawai'i relates to the perception that a growing number of people moving to the islands engage in spearfishing, some for the first time. Dive shops and spearfishing specialty stores reported many cases of "new" people/arrivals coming to purchase gear and learn about safe locations where they and their kids can spearfish. This coincides with locals' responses to perceptions of trends in participating in the activity, with most people contacted stating that numbers were increasing.

While spearfishing is dominated (in numbers) by men, it is a sport becoming increasingly popular among females. The Wahine Divers Club (wahinedivers.com) is reaching out to the community to encourage everyone, including young boys and girls as well as adult women, to participate in the sport. And, it is not just the effort by the Wahine Club that is having an impact on women; more women are joining other local diving clubs and participating not only in fishing activities but administrative aspects of the clubs as well. At least two spearfishing tournaments were held on Oahu during the course of the field research. At least one woman participated in the competition for each of these tournaments, successfully landing prized species.

The age range of those engaged in the fishery is broad, with children as young as 5 and adults as old as 80 reported to participate in or seen while spearfishing. People express a real love for the sport and suggest that as long as they can swim and the drive is there to fish, they will be doing it. Examining the age of participants and noting that the younger people of the islands are increasingly involved in spearfishing highlight the belief held by older fishermen that there is a responsibility to teach and culturally transmit knowledge about marine ecosystems to the younger generation. Spearfishing is not just a sport but a vehicle for learning about the environment and the appropriate ways humans should interact with it, use it, and protect it.

Spearfishermen in Hawai'i believe that spearfishing is more than just learning to fish; it is learning the appropriate ways to fish, the life cycles of fish, and how to carry oneself as a responsible fisherman (an important part of one's identity as a "good" and "respected" fisherman). An interesting example of how knowledge is culturally transmitted is the father/son fishing tournament hosted by the club, Alii Holo Kai. In this tournament,

young boys come with their fathers or uncles and learn to spearfish and compete. For many, it is indoctrination into the spearfishing community and becomes a lifelong pursuit and association, and for some it lasts beyond the point where their bodies allow them to do it anymore. It is a mechanism for entry into certain social networks, networks that can extend beyond one's own family and friends into a larger and more diverse group who share similar values and perspectives regarding natural resource use and conservation.

What makes these groups even more important to recognize and involve in policy decisions is that there are cumulatively hundreds if not thousands of years of knowledge of fishing in these waters, not only serving as an information source for teaching new participants, but for fisheries management—an untapped source of observational data on fishery and environmental assessment and change.

The spearfishermen interviewed through HMRFS reported fishing an average of 45 days in the past year (median 36), and had fished an average of 7 days (median 5) in the previous 2 months. One-hundred-ten fishermen reported fishing 12 times (once a month) or less over the past year, while 66 reported having fished 100 or more times in the past 12 months, including 4 who said they fished 300 days—3 who lived on Maui and 1 from Molokai. The fishermen on Kauai and Oahu reported slightly higher levels of fishing compared to residents of Maui and the Big Island, but the differences were not statistically significant and the range of participation was comparable across all islands.

#### **Gear Used**

Spearfishermen use a variety of fishing gear and target many species, often dependent on the fishing locale. Spearing is one of several methods, such as trolling (hook and line) or nets, that can be used on the same trip. During the 2007 field research, fishermen shared their experiences of multigear/multispecies trips. On one occasion, a local recreational fisherman shared information about the relationship between spearfishing and trolling for pelagic species on offshore trips. He mentioned that on some of the trips where "big game" pelagic species such as marlin, dolphin and tuna are targeted, fishermen like himself will bring along spearing equipment because "there are times when fish are all around the buoys but just won't take bait or lures. This is when we go over the side of the boat and try to get close enough to spear one."

A local television show highlighted just such a trip during the course of the fieldwork. Fishermen were traveling to an offshore location where a high point arose from the sea floor. At this location, they trolled for a variety of species but were only somewhat successful in getting the fish to bite. They agreed to "gear up" and go over the side with spearguns to see what they could land. They successfully shot two very large ulua as well as a number of other species.

Recreational fishermen are not the only ones to employ spearing on a fishing trip where the primary gear is different. A local commercial fisherman described how he would use his speargun as a means of targeting species and for protection while fishing his nets. His style of fishing with nets required that he get into the water with scuba tanks to position the nets around schooling fish. During this time, other species are often encountered, causing the fisherman to refocus his attention to target that specific species (if only for a few moments). In addition, his speargun was used to protect himself from aggressive species that appeared interested in both him and his catch. During these instances, he might spear or use his speargun as a prod to encourage the animals to leave the area.



Figure 1.-- Spearguns made by local manufacturer Daryl Wong.

Fishermen use a variety of gear, and the same can be said of spearfishermen. Spearfishermen most commonly use either a pole spear (also called a three-prong because of the type of tip commonly used) or a banded speargun (some designed for small reef species and others built much bigger and more powerful for targeting larger pelagic species). There were no examples of pneumatic guns nor Hawaiian slings (as known in the Caribbean and Florida) being used or observed. Many spearfishermen use wetsuits; although Hawaiian waters are warm, the water cools as divers progress deeper, and with wetsuits they can stay in the water a long time.

## **Species Targeted and Caught**

The most common reef species/fish targeted are parrotfish, squirrelfish, tangs, snappers, jacks, flagtails, surgeonfish, chubs, filefish, goatfish, peacock grouper, eel, octopus, and lobster. The pelagic species that are targeted include, wahoo, dolphin, tuna, and marlin. Big game spearfishing has been an ever- growing sport in Hawai'i as an increasing number of people are using a variety of strategies to target these species by using spearguns.

The HMRFS data revealed that across all Hawaiian Islands, 69% of the fishermen sampled said they had no specific target species in mind on the trip. These fishermen were likely opportunistic, looking to see what kind of fish was available on a given day, at a given place. The proportion differed greatly by island; 51% of the Maui fishermen said they had a target species, compared to just 7-16% from the other islands (although 100% of the 9 fishermen on Molokai said they had a target). A majority (62%) of those who said they had a target species named the tako (or octopus) as their main target. This proportion varied greatly from island to island, another reflection of the variability in the fishery (and supporting an expanded study which pays attention to the islands not addressed in the present study).

About 80% of the fishermen said they were targeting finfish on this trip. Of the 20% of the fishermen who said they were not targeting finfish, 97% of those who had a target species said that target was tako. Of the fishermen who said they were targeting finfish on this trip, 43% still said tako was their main target. Another way to look at this relationship is that 45% of those who reported targeting tako said yes when asked if they were targeting finfish on this trip, while about 55% of those targeting tako had reported they were not targeting finfish. This is one example of how the HMRFS survey form is not geared toward spearfishermen targeting tako. As another example, although the spearfisherman may have a target, he is not going to pass up a good shot at something else that's desirable.

The HMRFS data showed that spearfishermen caught 74 species, with tako caught on 142 (of the 705) trips, convict tangs caught on 76 trips, goldring surgeonfish caught on 42 trips, bluefin trevally caught on 36 trips, whitesaddle goatfish caught on 30 trips, and parrotfish caught on 27 trips.

Fishermen had no catch on 52% of the trips, caught only 1 fish (or tako) on 10% of the trips, caught 2 fish on 6% of the trips, caught 3 fish on 5% of the trips, caught 4 fish on 5% of the trips, and caught 5 fish on 2% of the trips. Just 8 fishermen caught 50 or more fish on the trip. The assumption might be that these were commercial quantities, but of these 8, none said they planned to sell the fish; in fact, only 5 people out of the 644 who answered the question said they planned to sell the fish from the trip, and none of these had reported catching more than 20 fish on the trip. Further analysis showed that of the 5 who said they planned to sell 1 or more fish, 2 said they sometimes sell fish (to cover costs only and not make income) and 3 had said they never sell fish.



Figure 2.--Junior cleaning Kole.

# **Spearfishing Locations**

Conversations with local fishermen and stories in local fishing magazines and on local fishing television programs bring to light the popularity of spearfishing in Hawai'i, regardless of its purpose (sport, food or commercial enterprises). While the popularity extends to all islands (see Hawai'i Skin Diver Magazine or Hawai'i Fishing News for examples of spearfishing), there is great variability in the amount and kinds of fish habitat available for local fishermen. Not every island has the same amount of reef and hardbottom, perceived to be largely related to the structure and age of each island.

In addition, access to inshore reef areas is not the same on each island and is largely related to construction of roads generally associated with coastal development. For example, the Big Island fishermen state that there are numerous places around the island where access to certain areas is limited if, in fact, not impossible to get to by land. Fishermen state that this is very different on Oahu where coastal development is so prevalent, allowing almost unlimited access to coastal areas (this coupled with the number of inshore fishermen is believed to be a major factor in the difference in abundance of species between the islands).

In general, fishermen from all the islands fish a variety of inshore and bluewater locales. Bluewater locations often vary in terms of where drop-offs, spikes or ledges are located but can also be related to manmade variables, such as buoys, fish aggregating devices (FADs), and floating debris. Fishermen will also seek grass lines, birds, and currents as positive indicators of pelagic species. Often, it is possible to access bluewater locations in a very short amount of time because of bottom structure and steep drop-offs on some of the islands; there is no continental shelf. This is supported by articles from local fishing magazines and television shows as well as through interviews.

The location of a spearfishing trip, whether conducted from shore or from boat, is linked to the climate, as described in the following section. For example, on the Big Island, fishermen from the Hilo side will sometimes go spearing in the calmer conditions on the Kona side.

Spearfishermen use various methods for accessing fishing locales. Based on the variation in bottom structure, fish habitat and access to coastal areas, fishermen will swim, kayak or use private boats to access fishing locations. On Oahu, observations and interviews suggest that the main method for accessing fishing grounds is by swimming from shore. In many cases, spearfishermen were spotted leaving from or returning to a variety of common public locales, taking advantage of the highly productive inshore fishing locations. Some of the more accomplished fishermen have been known to swim out to locations such as Rabbit Island on Oahu's windward coast, an estimated distance ranging from <sup>3</sup>/<sub>4</sub> to a mile each way (this does not include the amount of swimming and diving done during fishing days).

Kayaking has become increasingly popular among spearfishermen because it is relatively inexpensive compared to owning a private wood or fiberglass fishing vessel, and it provides fishermen access to certain areas that were once difficult or impossible to get to by swimming, especially in Hawai'i. There are those that will target bluewater fish from kayaks by heading out to deepwater where current and bottom structure is conducive for pelagic fishing, especially mahimahi.

Private boats offer access unparalleled to the other modes of fishing. For example, it is possible to travel far offshore to buoys where billfish, wahoo, tuna, and mahimahi often congregate. The Hawai'i Fishing News has documented efforts and rewards of this kind of fishing, touting local fishermen who have landed or competed for state or world record catches in these offshore locations by spearfishing off privately owned boats.

The HMRFS survey found that the majority of spearfishing trips (55%) were conducted from shore and 45% from private boats, but the proportion varied by island. Nearly 70% of the Oahu-based trips were taken from private boat, compared to 14% on Kauai, 34% on the Big Island, 41% on Maui, and 56% (of the 9 trips) on Molokai. When asked whether most of their spearfishing effort took place in the ocean or in a bay, fishermen who were intercepted for the HMRFS survey reported that 83% of their effort occurred in the ocean and about 17% in a bay. Fishermen reported that 96% of the trips took place in state waters (within 3 miles of shore). Only one person (on the Big Island) reported spearfishing on a FAD.

# **Spearfishing Timing**

Spearfishing occurs year round. Certain areas are more amenable to spearing during the course of the year based on weather, wind, and waves. For example, on the north shore of Oahu, a popular summer fishing locale, it is difficult to fish in the winter based on the number of high-surf days. While the big winter swells may in effect close a majority of the inshore fishing on the north shore, points along the southeast, southwest, and south may be ideal, depending on the swell direction.

Fishing is not limited to time of day. Some prefer to target certain species at night and others during the day. For example, parrotfish is a popular species targeted during the day. However, they are a favorite species to target at night because they tend to sleep in areas where they are easy to locate and approach.

A Big Island fisherman explained that the ocean was a place that people turn to in times of crisis. So while the concept of time can be discussed in terms of 1) hours, 2) day or night, and 3) season, such as winter versus summer, it is also possible to perceive the notion of time in terms of 1) times of few/plenty, or 2) times of boom/bust. For example, the Big Island fisherman argued that during times of economic hardship people turn to spearfishing (and fishing in general) as a means of providing food or extra income for themselves and their families. He believed that fishing pressure, especially spearfishing, correlates with economic conditions on the island. This also occurs at a household level; some are more likely to fish when the last paycheck is running out.

This comment was supported by other fishermen and a dive shop owner, who independently stated that the increase in housing construction in Hawai'i may cause fewer people to fish. The dive shop owner stated that many of the "older guys" are off making money working 6 or 7 days a week and have no time or energy to fish. He said that these guys realize the construction boom won't last forever and they need to take advantage of it while it lasts. It is important to note how land-based forces affect fishing pressure, especially considering the need to focus fishery management on an ecosystem approach to create sustainability. Relationships may exist between land and lower levels of fishing pressure.

Spearfishing intercepts in the HMRFS survey were distributed fairly evenly throughout the year, although the largest proportions of interviews took place in August (13%) and June (11%). Most (60%) of the spearfishermen were interviewed between 12:01 and 4:00 p.m., while 26% were interviewed between 8:01 and 12:00 p.m. and 14% between 4:01 and 8:00 p.m. (although these proportions may reflect sampling intensity rather than effort across the year).

The HMRFS data also found that spearfishing trips averaged 3 hours (median also equaled 3). However, spearfishermen took longer trips on Oahu (average 3.76 hours) than on Maui (2.85 hours), Kauai (2.48 hours) or the Big Island (2.75 hours). This may have been caused by the much higher percentage of spearfishing trips on Oahu taken on private boats. Not only may these trips have been longer, but the shoreline spearfishing

trips may not have been completed at the time of the interview, whereas all of the spearfishermen on private boat trips likely were interviewed after all fishing had been completed.

## **Spearfishing Motivations**

Why do people select spearfishing as a fishing method? Historically, the primary reasons were likely related to the provision of food and/or generating extra income. While these are certainly important reasons to spearfish, more and more people are engaging in the activity for the pure sport aspect. Fishermen have observed a growing number of younger participants, especially high school boys and girls, who are engaging in the sport that is now perceived as the "cool thing to do." Local television shows and magazines illustrate the beauty and artistry of spearfishing, a sport that challenges both the mind and body. The reward for this activity is not limited to the prized fish brought home or the trophies associated with competition; in many cases, participation is about the process and the stories that accompany the effort. As one local fisherman states, "I can fish all day long without shooting anything. If I get a fish that is great, but the reason I go out there is because it is absolutely beautiful. If I can catch something that I can bring home to eat that is a bonus. But I am not going out there to shoot a bunch of fish just to shoot them, I want to get something special."

There is a sense of pride associated with spearfishing, placing value on being identified as a "good spearfisherman," whether it is through competition (i.e., striving to be a member of the State or National Spearfishing Team) or as someone who provides prized species for friends and family for the dinner table or social gatherings. However, there are those who fish to be part of a hunt and part of the pure enjoyment of the physical activity. Their selectivity is counter to the notion that spearfishermen simply take anything they can line up on the end of their spear.

Fishermen from both Oahu and Hawai'i explained how it is common for young boys to be brought up learning how to spearfish. For many of the youth it is a part of "who you are" and an important part of growing up. These fishermen believe that spearfishing teaches important lessons about the ocean while providing a skill that can be called on throughout their lives, especially in times of economic hardship. One local fisherman commented that for young boys in Hawai'i, growing up in and around the ocean is a natural "thing," and spearfishing is simply an extension of that natural process.

The increase in the "total" number of spearfishermen, especially among women and youth, suggests that it cannot be only attributable to male involvement in the fishery. The popularity of the sport, as well as heightened interest in participating in the commercial and subsistence fisheries, has created a greater amount of effort placed on the resources, and warrants further examination into the impact of increased participation in the fishery and its subsequent impacts on marine ecosystems and social networks. Spearfishermen cited commercial, recreational, and subsistence connections to spearfishing. There are, however, some distinctions in the manner in which they engage in the fisheries. For the commercial fishery, there is a greater reliance on scuba as a means for targeting species. Also, commercial spearfishermen (including those who target lobster) primarily scuba dive at night to take advantage of the ease with which they can catch certain desired reef species. They are also much more likely to engage in a multigear strategy, especially nets and traps. Their goal is not to target the largest of a single individual species, but to target an abundance of fish to sell. Commercial fishermen, unlike recreational and subsistence, sell the majority of their catch and these catches are sold both formally and informally to restaurants, markets, stores and to individuals (who may be acting as an intermediary).

However, spearing fish commercially is not as easy as it seems. In many cases, the restaurant owners or buyers (intermediaries) are very particular about the appearance of the fish, and a spear shot that runs through the center of the body or one that ruins the aesthetics of the fish will not be purchased or will be viewed as less valuable, regardless of species. For this reason, it is important for fishermen to be highly skilled and adept to receive top dollars for their catch.

Although freediving is the primary means of fishing, in the recreational spearfish fishery fishermen scuba and freedive. There is great debate about the use of scuba when spearing is related to the perception that those who use scuba often dive at night and target species that are easily harvested, thus causing an unnecessary or inappropriate amount of fish to be taken. For this reason, many would like to see spearing with scuba, for recreational purposes, outlawed. To many fishermen, this is a nonrecreational method of fishing and engaged in solely as a means of generating illegal income. Spearfishing with scuba gear is prohibited in the Commonwealth of the Northern Mariana Islands and American Samoa because of the ease of harvesting some species, but it remains legal in the State of Hawai'i.

People who fish primarily for recreation sometimes choose to sell their fish after a good trip. Because a commercial license is readily available (a commercial marine license from the State of Hawai'i costs \$50 annually), fishermen who might classify themselves as recreational or subsistence fishermen can sell a portion or all of their catch to help cover costs or generate income. A commercial license also allows fishermen to write off certain expenditures on their taxes, as long as they demonstrate a profit in 1 of 3 consecutive years. This is especially lucrative for those that invest in private vessels for bluewater fishing and others operating under the table.

The catch of the day will more commonly end up on the dinner plate of the fisherman's and family. Fishermen are likely to share their catch, especially if it includes species favored by people in the fisherman's social network. In the discussion of historical use of marine species, the notion of catching certain species for ceremonies, parties, and festivals was highlighted as a part of the culture of sharing.

This same practice occurs today. Many of the fishermen interviewed mention that they would often go fishing with the intention of catching specific species for a *pupu* platter (an appetizer sampler platter) for an upcoming party hosted either by a family member or friend. During the field research, one of the local fishermen asked if the interviewer was interested in going fishing for *uhu* (parrotfish) early one Saturday morning. When asked why *uhu*, he said that his friends were getting ready to have a party and they wanted *uhu* to make a *pupu* platter for guests. For this reason, a specific location was selected and the fishermen went out and collected the fish for their friend, keeping only a small amount for their own dinner that night.

Interviews with local fishermen and dive shops indicate that there is no for-hire industry for spearfishing (where a guide takes out a spearfishing client), primarily because insurance for such an activity far outweighs the current demand for the service. While there are those that can foresee an expansion into for-hire, a strategy for reducing the risk and responsibility placed on the service provider must be put in place.

Spearfishermen interviewed during the HMRFS survey did not sell many fish—not surprising given that the survey targets recreational fishermen. When asked if they ever sell any of the fish they catch, 93% said they did not. Across the islands, this ranged from 100% of the fishermen interviewed on Molokai to 88% of those interviewed on the Big Island. Of the other 7% of the total sample (47 fishermen) who said they have sold fish, 35 said they sell to cover expenses and 12 said they sell fish for the income; just 5 of these 12 considered themselves to be full-time commercial fishermen—3 from the Big Island and 2 from Maui.

## SOCIAL ASPECTS OF SPEARFISHING

As is the case with other types of fishing in Hawai'i, spearfishing both establishes and maintains relationships among people, formally and informally. This section talks about the role of clubs, tournaments, other events, and networks of spearfishermen that develop through a love of the sport. This helps to maintain links among fishermen and between fishermen and the community, perpetuating and contributing to the evolving culture of the islands.

#### **Clubs and Organizations**

A number of spearfishing and dive clubs are located on Oahu and Hawai'i. According to Frank Farm of the Alii Holo Kai Club, the number of clubs on Oahu has been greatly reduced over the last 30 years, while certain clubs such as the North Shore Underwater Club and the Alii Holo Kai have maintained a presence for many decades. Clubs exist formally and informally, some even harnessing the internet and webpages as a form of disseminating information. Within the Alii Holo Kai (http://aliiholokai.ning.com/) is a group of fishermen who have formed their own club called Head Shot, a group of friends

who frequently meet on Thursday nights as a part of a regular social gathering (they get together, talk story, and share food and drink). Many of these participants regularly fish together and share a common set of beliefs, values, and norms about the way members should carry themselves, be it on land or in the water.

While many clubs are based on social and competitive interests, they also serve a key function for educating the current and future membership about various issues. Some of the most important issues discussed during club events are fishery policy, upcoming events related to state and national competitions, and club status (most often centered round discussions of the economic status of the club). As mentioned earlier, the clubs serve as a means for disseminating information and knowledge about the sport itself, as well as educating (new) members about a variety of issues related to the health, safety, and appropriate use of the marine environment.

The North Shore Underwater Club has been in existence for more than 50 years and is adamant about training local divers. They train new members not only on how to spear the various species of fish, handle sharks, learn currents and depths but also make sure that members understand bag and size limits, protected species, and, most important, water and diving safety (http://210.15.250.58/spear/nshore/about.html).



Figure 3.--Mission statement of the Alii Holo Kai Spearfishing Club.

Many of the clubs have designated people responsible for disseminating information about past and future events. These people often develop and write articles for formal media outlets, especially the Hawai'i Fishing News. These articles serve to update the public about a variety of issues, some celebrating certain accomplishments, while the somber tones of others convey information about the loss of freedivers known throughout their tight networks. Often, the articles provide information about events as most clubs engage in monthly tournaments and events such as beach cleanups. Some clubs produce their own newsletters which advertise upcoming tournaments and events, describe the results, and inform fishermen about meetings such as those sponsored by the Western Pacific Regional Fishery Management Council.

Although a regular component of recreational spearfishing, tournaments are held for several reasons and its membership. Most are promoted and supported by spearfishing clubs, and local and international businesses. Some tournaments exist to establish a record of accomplishment so that formal diving organizations are able to view documentation of individual accomplishments that qualify individuals to compete in state, national, and international competitions.

# Holo Holo Dives and Other Spearfishing Competitions

Holo holo (recreational) dives are the most basic tournament organized by a local club that bring its members together to socialize and compete. These events often include prizes for the top fishermen but more importantly brings the group together to spend a day fishing and afterwards share in the camaraderie of talking story while sharing a meal (and drink).

Holo dives are excellent ways to introduce new people to the fishery and the club. One way clubs educate members and new (potential) entrants is through events and tournaments, such as the father/son tournament. In this tournament, fathers and sons and uncles and nephews participate in a freediving competition where elder participants swim (but do not fish) with the younger counterpart (who fish). The elder member has an obligation to instruct his counterpart on fishing methods and the locations for finding certain species. The catch is landed solely by the younger member as it is his obligation to shoot and land specific species. This tournament is described as one of the most popular among members because it incorporates the lessons of fishing, teamwork, and safety, while at the same time allowing for the younger generation to be indoctrinated into a group made up of spearfishermen who share a set of core beliefs about safety and conservation.



Figure 4.-- Bill of fare for tako tournament held by the Alii Holo Kai.

Clubs also host events centered around pure competition, such as qualifying events eligible for certain state, national and international teams. These events are much more competitive, requiring participation and success if a fisherman wishes to qualify for a specific team or future competition. These events may be hosted or organized by a single club, but membership is not required to participate. Considered an "open" event, in this competition any accomplished diver can vie for a spot on a team based on the dive results. Some participate in these events with no desire to make a team. They compete primarily for the purpose of testing their abilities and comparing their skills against those who represent Hawai'i in other competitions. Regardless of the reason, the divers often are incredibly diligent and regimented in their efforts to train for competition, similar to those who train for high-level competition in other sports.

Other events held on Oahu and Hawai'i, both open and invitational, garner a great deal of interest and participation. For example, the Bluewater Invitational brings invitees together to compete for prizes and, arguably more importantly, for prestige. Other longstanding invitational events are well known, especially on the Big Island, and are said to attract some of the top spearfishermen to compete in a tournament where the results are considered an indication of "who's who of tournament spearfishing."



Figure 5.--Tako (octopus) caught in a local tournament

Finally, there are tournaments that recognize those who have given their lives in pursuit of what they love. Memorial tournaments, such as the Gene Higa Tournament, are about recognizing people instrumental in the promotion of the sport yet who lost their lives in this pursuit. On Oahu, Gene Higa was known as a special person, more than just an accomplished freediver and spearfisherman. He was a figurehead for the sport and the aloha spirit he embodied. During a competition, Gene appears to have suffered shallow water blackout, which led to his death. As Sterling Kaya comments, the danger associated with spearfishing and the likelihood that it can happen to any diver is only even more apparent in the loss of Gene:

Shallow water blackout is a sudden loss of consciousness without warning caused by a breath-holding dive. Unconsciousness strikes most commonly within 15 feet of the surface, where expanding, oxygen-hungry lungs literally suck oxygen from the diver's blood. Once the diver loses consciousness, he or she is likely to drown if no one is around to help. The blackout occurs quickly, insidiously and without warning, and the victims of this condition die without any idea of their impending death.

With shallow water blackout, some people used to think that it only happens to rookies, but it really happens to the best. Gene Higa is a prime example of that. He died 2 years ago (during a tournament in waters off Haleiwa). Gene was the greatest free-diver, not only because of his skills in the water but also because of his willingness to share his knowledge with everyone else.

Safety is a key feature of any club. For example, the Alii Holo Kai's mission statement is based on the protection of natural resources and the safety of people who use them (including, but not limited to, spearfishermen). Clearly outlined in a poster board present at every tournament gathering is a list of principles to which members strive to adhere.

An ethos of natural resource conservation permeates the fishing clubs and their members. During tournaments, size limits are often increased beyond the prescribed size limit of formal regulations. For example, in a *tako* (octopus) tournament sponsored by the Alii Holo Kai, for a *tako* to be considered for the competition it must weigh at least 2 pounds, 1 pound heavier than the formal size limit for *tako*. Other species, such as *uhu*, have an additional 1-2 inches to the formal size limit if it is to be considered for competition. This addition allows fishermen to select and shoot fish that have matured past at least 1 reproduction cycle and encourages fishermen to be increasingly selective in their hunt. In many cases, bag limits are also reduced, only allowing fishermen to qualify a specific number of fish, or a specific number of select fish.



Figure 6.--Photo of tko tournament finalists.

Previously, people have criticized the amount of fish taken in these tournaments, but it should be mentioned that all of the fish are distributed among its membership or sold by a licensed fisherman so profits can go back into the club's treasury. At the three-prong tournament held on Oahu in February 2007, all of the chubs (nenue) were donated by the

local competing fishermen. They collected, cleaned, packaged and shipped these fish for a funeral of a Hawaiian individual who had passed away. The individual's family asked if the fish could be sent to the site of the funeral ceremony (held at the deceased individual's residence in Las Vegas, Nevada).

One of the best-known tournaments with a clear conservation focus is the Roi Roundup, held regularly on Maui since 2008. Roi, a species introduced from French Polynesia in the 1950s, thrived in Hawaiian waters and became a top predator of Hawai'i reef fish. They also are prone to ciguatera, which makes them toxic. The Roundup started as a fundraiser to send Hawai'i spearfishermen to nationals, but the focus on Roi contributed to conservation efforts, with hundreds of thousands of reef fish reportedly saved by reducing this population of predators. Because of the way they behave, roi also present a challenge to spearfishermen. The fishing is followed by a party, with awards, music, food, drink, a raffle, and silent auction, with the proceeds going to a current worthy cause.

#### Socioeconomic Networks

In this report, references are made to the socioeconomic networks that directly and indirectly impact local spearfishermen. Indoctrination into these networks begins in the home or the local community. Commonly, fishermen interviewed said they were taught how to spearfish by an elder male family member, especially a father or an uncle. The learning process continues throughout the lives of the fishermen; however, as the young boys grow in age and experience and reach a point when they are deemed responsible enough to fish on their own, they commonly stop fishing with the elder male family member and begin to fish with their friends. Their fishing practices are often guided by the forces that encourage both appropriate and inappropriate behaviors.

In many cases, involvement in clubs assists in educating new participants; informal sanctions of inappropriate behavior are as important as formal enforcement measures. Safety and conservation lessons are shared, but the reality is that it is up to the individual fisherman, regardless of participation in a club, to determine if that individual is going to fish in an appropriate manner. As renowned author and freediver Terry Maas suggests, for the majority of spearfishermen, as age and experiences increase, the numbers of fish taken will decrease. Fishermen become increasingly selective and their knowledge about their actions and relationships that impact on the marine environment becomes more apparent. Some fishermen do not mirror these sentiments and take without regard to consequence; however, people like Frank Farm of Alii Holo Kai believe it is the obligation of spearfishermen to alert these individuals to the consequences.

The socioeconomic networks of spearfishermen are tied to the formal and informal economies of Hawai'i in many ways. Some use spearfishing as a primary means for generating income and others supplement household income by engaging in or supporting the fishery. Outside of the revenue generated by targeting certain desirable species, businesses rely on the fishery and fishermen as a means of supporting specific economic interests. Numerous local businesses cater to spearfishermen by providing gear as well as outlets for the catch.

Formally and informally, both commercial and recreational fishermen sell their catches in a variety of settings: communal, local, regional or even international markets. Catches are sold as a means of supplying a strong demand for fresh seafood, especially local markets, restaurants and hotels that cater to a demand for certain reef and pelagic species often targeted by local spearfishermen.

Outside of the sale of certain species for local consumption, many local businesses rely on the productivity of the fishery as an alternative or "side" revenue-generating activity. In Oahu and Hawai'i, numerous stores pay special attention to the spearfish fishery; businesses that are located in the continental United States are not likely to support or market to this fishery. For example, the Ace Hardware store in Kapolei, Oahu, maintains an entire section of spearfishing equipment. In addition to selling pole spears, an assortment of other spearfishing and fishing gear is also available for local spearfishermen, such as floats, flags, spear tips, and rubbers for both spearguns and pole spears. When the store manager was queried as to why these objects were being sold in the store, he replied that the people interested in spearfishing initially enter his store for other reasons and, having seen the availability of certain equipment, are often cognizant that they may need something for a future trip and purchase the needed equipment in addition to other nonfishing related items which brought them to the store in the first place.

Ace Hardware is not unique; local drugstores and other shops in Kapolei, as well as throughout the island (e.g., Sports Authority) sell spearfishing equipment. On the west side of Oahu many stores/shops such as surf shops, tackle shops, and boating supplies provide various equipment for other water sport activities. Often, these stores will provide equipment for spearfish fishermen.

Some businesses formally market to spearfishermen as a primary clientele. On Oahu and the Big Island, several dive shops and spearfish specialty stores rely on the spearfish fishery as a major part of their sales/revenue. This is benefited by the overlap between equipment required for recreational diving and spearfishing. In Kona, Hawai'i, many fishing and diving stores also market spearfishing equipment, but one store is owned and operated by a well-known spearfisherman whose clientele is almost 100% tied to spearfishing.

This store owner's uniqueness and specialization as well as his website and the internet enable him to successfully market products to local community members, including a large number of clients who purchase a significant portion of equipment from the U.S. mainland or other countries. His success is, in large, partly based on his reputation as an accomplished bluewater spearfish fisherman, and locals as well as nonlocal spearfish fishermen rely on his expertise in the selection of specialized gear. This obviously comes from the knowledge that he not only owns quality equipment but he also has a prominent reputation based on multiple state records for landing certain prized pelagic species. In Hilo, one store is owned and operated by unarguably one of the most accomplished female spearfishers in the world. Men and women alike come to the store to take advantage of the wide array of equipment as well as her knowledge of the local environment. Her involvement in the education of fishermen is without question when it comes to the need to protect and conserve marine species, while at the same time engaging in an extractive activity. She is an advocate for reducing fishing effort in the recreational fishery, especially in spearfish tournaments, as she perceives that a "quality" and educated spearfisherman is able to be even more selective and conservation-minded than other types of recreational fisherman, attempting to debunk the notion that spearfishermen are overly harmful to the ecosystem.

Her perspective mirrors that of Terry Maas; she believes that experienced fishermen should share their knowledge in whatever format possible. She readily shares this perspective with people who enter her store, for she recognizes that she is economically tied to those who wish to participate in the fishery. At the same time, she is also aware that inappropriate fishing practices can only damage the fishery and, ultimately, the longterm success of her business. For this reason, she also engages in a number of educational outreach events that train fishermen both in and out of the water.

On Oahu, many of these same sentiments are part of the discourse of spearfishing found in the spearfishing specialty stores. Many of the stores employ well-known local spearfishermen who spend a great deal of time "talking story" about spearfishing and the appropriate behavior for participating in the fishery. An interview with an employee of the Maui Sporting Goods spearfishing store highlights the fact that if people hope to continue spearfishing, they must adhere to certain principles of conservation. As he explained,

It does me no good to sell a gun to someone without mentioning that there is a responsibility attached to it. If you are going to go out and shoot undersized fish that then can't reproduce and repopulate the fishery, sure you might have a large *Kui* (stringer) of fish today, but what will you have tomorrow. Ignoring this relationship will force you to just hang your gun on the wall.

He, like many others interviewed over the course of the research, recognize the balance between the sport and the desire for fish for home consumption relative to the long-term relationship between the health of the environment and the continued existence of the fishery. Moreover, he sees the relationship with the continued economic success of the store and his employment.

Many individuals and local businesses are tied to the formal economy of spearfishing, but even more people generate income or supply local social networks because they are capable of providing a consistent supply of seafood based on informal economic relationships. Local markets in Hilo and many Asian restaurants in Oahu are frequent purchasers of local products. While spearfishermen target a variety of species, the presentation of the fish is often as important as the species themselves. The value of the species, especially the smaller reef species such as the goatfish, decrease in value based on the quality of the "kill" shot of the fisherman. A highly sought-after species may be overlooked or rejected because the fish is tainted due to a "shot" that either grossly damages the body of the fish or makes the fish unsightly. Although there is a great demand for certain species, quality control based on the potential presentation often allowing those more experienced and skilled (precise) fishermen to sell their catches.

In addition to the sale of fish, there is an aspect of the formal and informal economy centered around people who can provide local fishermen with homemade, high-quality fishing gear. These skilled artisans were found on both Oahu and the Big Island. On Oahu, a local craftsman relies on the local, state, regional, and international demand for high-quality, specialized fishing equipment. He operates his business without a storefront, creating and assembling specialized gear from his home. Primarily through word of mouth advertising, he has created a strong clientele, based on successfully providing local fishermen with gear that can be called on day or night. As he explained,

What makes me different is that at two in the morning you can call me, wake me out of bed, and tell me that you need something for your trip. I will immediately gather what's needed to make sure you have it for your trip. You see the people who fish often work during the day and can't make it to a local fishing store to buy what they need. They will call me and I will bring it to them...sometimes they might even break something in the middle of a dive and they will swim to shore to call me and ask me to bring them something. Because they only get to fish every so often they don't want to end their fishing trip so they might ask for a new spear or tip and I will drive it out to where they are (regardless of where they are on the island). I provide great equipment and excellent service...that's why they keep calling me. It's because of them that I am always about 20 orders behind in my day-to-day construction of spearfishing equipment.

When examining the economic connection to the fishery, it is possible to overlook supporters of the fishery in ways that may not be readily visible yet integral to the success of the fishery. These people are as likely to be impacted by fishery policy as are those more easily observable to policy makers. For this reason, an in-depth examination of the fishery is valuable because it highlights aspects of the fishery that may not be immediately evident.

Many of the top local spearfishermen are sponsored by local, national, and international businesses/companies that market diving and spearfishing gear. While there are no local fishermen who receive salaried contracts, as is common in other sports where endorsement of products is part of a formal economic relationship, spearfishermen in Hawai'i are provided gear and sometimes financial support for participating in certain events because these fishermen use the company's products.

Spearfishing tournaments and events are also sponsored by many of these same companies but can include local businesses and individuals who may simply support the club or event itself. Usually sponsor involvement includes the provision of gear for prizes for the top finishers in the tournament, but it is also common to find local businesses that support the event by providing food, drink or financial backing. For example, Paradise Beverages and Hawai'i Skin Diver are just some of the sponsors that support the Alii Holo Kai father/son tournament because the club mission mirrors their values and beliefs.

## SPEARFISHERMEN'S CONCERNS, INTERESTS AND ISSUES

Fishermen expressed concern about various fisheries issues that affect policy, socioeconomic networks and environmental issues/concerns. The most frequently mentioned issues, not listed in order of importance, were tourism development, marine ecosystems conditions, one-size-fits-all management, lack of enforcement, the need to increase education, runoff, pollution and coastal development, recreational licensing, and the interisland ferry which was being considered at the time of the study.

These issues are described in greater detail below. This was not a random sample of fishermen, and a standard set of questions was not used, so we cannot say the extent to which these concerns are present in the entire spearfishing population. However, some of the concerns appeared universal in our limited conversations, suggesting that talking to more fishermen would confirm the initial results. Still, these findings should be viewed as a stimulus for more research and discussion with fishermen.

#### **The Condition of Marine Ecosystems**

Fishermen and divers from Oahu and Hawai'i were nearly unanimous in stating that they were seeing declines in certain desired species and coral reef habitats. While the responses about the condition of the ecosystem varied, from a slight decline in health to a drastic need for immediate attention (often correlated with the age of the respondent), they all would like to see local stakeholders and management come together to discuss culturally and economically acceptable strategies for creating sustainable environments. Local stakeholders argue that there needs to be increased collaboration about management strategies, and because spearfishermen spend such a large portion of time observing the conditions of certain species and areas, perhaps they are as qualified as any to assist in this process.

Fishermen feel night spearing with the use of scuba is another factor that leads to the decline of certain species, especially reef fish. Fishermen feel that scuba diving is a method that allows for inappropriate levels of efficiency. Coupled with its use at night to target various species that sleep in rock/reef cracks or under ledges, scuba spear makes it even more efficient and, in the opinion of many of the fishermen, creates an opportunity

for fishermen to take much more than necessary. Many fishermen feel that scuba spearfishing should be outlawed altogether, but if there had to be a compromise, they would prefer that people were only able to scuba spearfish during the day.

#### **One-size-fits-all Fishery Management**

As previously mentioned, regulating local fisheries is nothing new for Hawaiian people. Since the first chiefs there has always been fishery management, often in the forms of marine protected areas, seasonal closures, species restrictions, and restrictions on how much is acceptable for take (Manu, 1992). One of the main reasons for these restrictions was a perceived need to conserve marine resources and keep a sense of ecological balance. However, policy was often based on island-by-island differences; in some places, a rule may be more effective than in others. This is not a sentiment that is lost on today's spearfishermen in Hawai'i.

Fishermen seemed to share a similar perspective regarding conservation and marine management. Many of the fishermen agree that there is need for fishery management but are apprehensive about the apparent attempt to regulate the various fisheries of the Hawaiian Islands as if they were all the same. According to the fishermen, fish populations, human populations, environmental conditions and potential socioeconomic impacts all differed across the islands, so it was inappropriate to enact some fisheries regulations statewide without taking these differences into account.

Working only on Oahu and the Big Island provided a limited glimpse into these kinds of concerns. Based on observations that highlighted numerous types of distinctions between the two islands as well as discussions held with fishermen from both islands, the two islands were viewed as incredibly different. Variables such as population density, numbers of fishermen, access to fishing grounds, distinctions in availability of certain types of fish habitat (said to relate to the age and structure of the islands), and the overall impact of various kinds of development made it clear that while fishermen from the two islands may target similar species, the host of other variables affects the way they do so and the overall impact on the abundance of marine resources.

## Lack of Enforcement

Enforcement was a key concern for the spearfishermen. Fishermen perceive that a lack of adequate enforcement leads to a decline in fish stocks and potentially damages marine ecosystems as a whole. When fish stocks are deemed to be overfished or overfishing occurs, it prompts management to react, most often by enacting new fishery regulations. While fishermen recognized the need for regulatory restrictions, they suggested that adequately enforcing illegal fishing behavior would be more effective than setting up new regulations. While fishermen recognize the impact of other nonfishing related activities on fish stocks and marine habitat, many surmise that for a majority of species targeted by local spearfishermen, proper enforcement of current policies would eliminate the need for

creating new more restrictive regulations (which they believe would also not be adequately enforced).

During the course of the 4-month study, it was noted that the fishermen held an almost unanimous belief that an insufficient number of enforcement officers were available to cover the vast amount of territory. Their first recommendation was to create more positions for enforcement officers. Their impression is that enforcement positions are often created without financial support, a façade that makes it appear as though government is addressing the problem.

Another concern expressed was the amount of responsibility by enforcement officers as a result of conducting other activities or tasks outside of fishery monitoring. The perception is that officers are regularly reassigned to tasks in addition to preventing illegal fishing and, as a result, there is no real fear of reprisal. In essence, the fishermen feel that because of the lack of adequate enforcement and a continued need to regulate the fishery based on the results of stock assessments, fishery policy ultimately punishes the "good" fishermen who adhere to the rules and rewards the "bad" fishermen who do not.

On the Big Island, dive shop owners and fishermen agreed that enforcement officers are placed in a precarious position when it comes to enforcing regulations. It is perceived that favoritism exists by the way illegal fishing is handled, causing enforcement officers to sometimes ignore illegal fishing practices. This conduct was dubbed by many interviewed as the "Local Look-a-way." They believed that because many of the officers are locals and live among the fishermen, they also share the same social networks, thus making it difficult for them to enforce the rules. Although rarely mentioned on Oahu, this topic was brought up frequently on the Big Island.

Fishermen believed that adequate enforcement, coupled with appropriate negative sanctions, would both control certain types of behavior negatively impacting the health of marine resources, while reducing the need to develop new policies or regulations. Again, this research only took place on Oahu and the Big Island and perhaps there are a whole slew of other concerns related to enforcement, maybe even indicating that enforcement on the other islands adequately controls deviant fishing practices. Perhaps the social networks on the other islands are more interconnected and alternative strategies can be pursued before formally punishing certain behaviors.

#### **Need for Increased Education**

During the research, it became increasingly apparent that to varying degrees, fishermen were concerned with the status of the fish stocks and the apparent inability for regulatory action, coupled with enforcement to adequately address the problem. To this a simple question was then posed: if the stocks need help, more fishermen are entering the fishery, and policies do not address the conservation of the stocks because of a lack of enforcement, then how do you solve the problem of overfishing or illegal fishing? Across the board the answer was "increased education." As the sport gains popularity,

especially among the youth, there is a concern that more programs are needed as well as more informal mentoring of youth about the ways to appropriately fish.

Respected fishermen such as Frank Farm argue that fishermen have a certain responsibility to the education of youth and new entrants to the fishery regarding the appropriate spearfishing methods. Education should begin in the home or in the community as a majority of the young fishermen are introduced to spearfishing by an older (usually male) family member. Mr. Farm suggests "it is their responsibility to teach the youth about the human/fish relationship." Adults can do this first self-educating on certain important established rules (formal regulations). A second step should be to teach the children about the fish, especially educating them on fish size that will allow for first-time fish reproduction. This visual representation/lesson should be engrained into the minds of every fisherman as it is simple mathematical logic that fish species cannot sustain their populations if they are not allowed to reproduce.

## Impacts of Pollution/Runoff/Coastal Development

Fishermen were increasingly concerned with effects of pollution and runoff on the health of inshore reefs and the remaining nursery areas. In 2006, 42 consecutive days of rain on Oahu caused massive flooding and runoff, bringing pollutants and pesticides as well as soil and sediment into inshore ocean areas. A real question was raised about the extent to which this rain impacted the health of the marine environment. Fishermen hope that fisheries management would consider the impact of such natural perturbations on fish populations. In their opinion, it is easy to assume that reductions in inshore species are caused by fishing pressure without taking into account the impacts of pollution and runoff events.

In highly concentrated areas of tourism, waste disposal can be a serious problem, and improper disposal of waste can be a major despoiler of the natural environment—rivers, scenic areas, and roadsides. For example, cruise ships in the Caribbean are estimated to produce more than 70,000 tons of waste each year. Solid waste and littering can degrade the physical appearance of the water and shoreline and cause the death of marine animals (http://www.uneptie.org/pc/tourism/sust-tourism).

Fishermen are aware that construction of hotels, recreation and other facilities can lead to increased sewage pollution. Waste water pollutes seas and lakes surrounding tourist attractions, damaging the flora and fauna. Sewage runoff seriously incurs damages to coral reefs because it stimulates algae growth, covering the filter-feeding corals and hindering their ability to survive. Changes in salinity and siltation can have wide-ranging impacts on coastal environments. And sewage pollution can threaten the health of humans and animals (http://www.oceansatlas.com). During the field visit, news accounts described local politicians' concerns over another sewage leak similar in magnitude to the one that occurred during the rains of 2006 and aired these concerns to several media outlets. This led to a call for tax increases to revamp the sewage pipes and ensure that a leakage of this magnitude did not reoccur.

Many fishermen interviewed described the effects of coastal development. The development of tourist facilities such as accommodation, water supplies, restaurants, and recreation facilities can involve sand mining, beach and sand dune erosion, soil erosion and extensive paving. Additionally, road and airport construction can lead to land degradation and the loss of wildlife habitats and deterioration of scenery (www.uneptie.org/pc/tourism/sust-tourism).

On the Big Island, fishermen were concerned with the potential impact of the increase in coastal housing development on the inshore reef areas, especially on the west side of the island between the Kona Airport and Waikoloa Resort area. Currently, efforts to develop areas along the coastline on top of the lava flows consist of using backfill and soil brought in to landscape the housing areas. The concern is that this activity will increase and that without proper monitoring, inshore reefs may be silted. Although this type of development will create many job opportunities and encourage economic growth through tourism, new businesses, and increased tax revenue, the real question is what is more important—the "for sure" economic growth or the "maybe" environmental degradation or decline.

The long-term impact of this type of development on the inshore reefs and marine resources of the west coast raises concern for many fishermen, especially those taking advantage of the employment/business opportunity. Coral reefs are said to be especially fragile marine ecosystems that are suffering worldwide at the hands of reef-based tourism developments. Evidence suggests impacts to coral resulting from shoreline development, increased sediments in the water, trampling by tourists and divers, ship groundings, pollution from sewage, overfishing, and fishing with poisons and explosives that destroy coral habitat (www.uneptie.org).

#### **Recreational Licensing**

We observed heated debate about the issuance of a federal recreational fishing permit, referred to by fishermen as a license. The Hawai'i Fishing News, an important local magazine that covers a number of issues related to recreational fishing (including spearfishing), opportunistically sampled a portion of its readership to glean public perception on the issuance of a recreational license. The outcome suggested that readers were not in favor of a licensing system, because most people believed that it was their right to recreationally fish without having to pay a fee.

However, after numerous conversations about the recreational license, almost everyone agreed that the recreational license program would be acceptable under certain conditions. First and foremost, the license needed to be set at an affordable price. Second, the revenue generated by the license would help to increase the number of enforcement positions. Third, the license needed to be accompanied by a collection of data to better quantify the number of recreational fishermen and identify the main gear strategies and species targeted. The third condition is the most interesting component of the license

program because recreational fishermen want to be able to quantify their numbers to strengthen their case if species ever get placed into a management strategy that requires allocation between commercial and noncommercial sectors.

## CONCLUSIONS AND OBSERVATIONS

When asked about the future of spearfishing in the islands, fishermen discussed issues such as increased activity based on increasing popularity of the sport (especially as it is promoted through such media outlets as the Hawaiian Skin Diver Magazine and local television programs), the need for increased enforcement in inshore areas that are likely to be negatively impacted by increased activity, and a need to find a new generation of local leaders willing to stand up, organize, and assume the responsibility of conveying the perspectives and concerns of the spearfishing community (especially in the case of Frank Farm of Oahu. Known to many as the Grandfather of Fishing, Frank Farm is looking to limit his role in the policy process).

Spearfishermen also recognize that certain kinds of activities can be implemented to improve the fishery, especially the implementation of slot limits. In their opinion, fish size restrictions would allow fish to grow and reproduce while the older larger fish, the most efficient reproducers, would be protected. Because of the recognized competitive nature of spearfishing between fisherman and fish, the allowance of a one-fish bag limit that allows a fisherman to catch at least one fish (depending on the species) outside of the slot limit should be considered. If fishermen and policy makers worked together to create sustainable harvesting strategies, this might be the kind of negotiated policy that would achieve biological objectives while still allowing for fishermen to conservatively target species while still maintaining the opportunity to catch a "trophy" fish.

The outcome of this research is a document that provides building blocks of a baseline and methodology to managers, researchers, and concerned local stakeholders not only on Oahu and Hawai'i but the other Hawaiian Islands not addressed in this study.

This document has developed a better understanding of the local fishery by describing the sociodemographic composition of its users. It also provides insight into the gear, seasonality, and species desired and targeted. Thus, it allows insight into the formal and informal social and economic networks that exist and how these networks work to promote, educate and conserve natural resources so that its membership transmits ecological knowledge regarding the appropriate manner in which to spearfish.

This document also introduces some key groups and organizations such that policy makers can locate key persons influential to accessing knowledge about the environment and the fishery by providing a description of the fishery and some of the organizations presently involved with many local community members. In essence, we have provided decision makers with a guide to people who have a great deal of knowledge about the local resources as well as people who are most likely the best to assist in determining the policy implications of certain types of management strategies, especially as it relates to MPAs.

Local concerns, issues, and perspectives are an important part of understanding the nuances of a fishery. These often reflect certain insights into several issues, issues that might not be readily apparent through fishery independent and dependent quantitative databases. During the course of this research, several issues of concern, especially as they affect the local fisheries, were discussed. These issues and perspectives highlight the fact that fishermen are very aware of the changes in their environment and of those forces that threaten the sustainability of the local fisheries.

A key feature of the research is an awareness of local fishermen's willingness to proactively assist in addressing management concerns and the development of potential solutions. It should be recognized that there is no other group that spends as many total hours in the ocean interacting with the environment (scientists included). This kind of observational data and analysis could prove to be extremely useful for developing a set of management alternatives that best achieves sustainability goals.

One aspect of sustainability important to the fishermen was allowing fisheries populations to reproduce. One way this lesson could be successful is through the distribution of a poster illustrating the actual life-size of popular reef species at the first age of reproduction. At a presentation for the State of Hawai'i, the interviewer was approached by a young woman who had created such a poster, yet was looking for a positive outlet for it. Such a poster could be a sound visual representation of a minimum fish size for capture that is "burned" into the minds of every fisherman who uses a spear, especially when the mask lenses magnify an image. A similar tool could assist spearfishermen in training participants in the fishery and demonstrating that this fishing style is the most selective and conservation-minded fishing method if done appropriately.

Fishing clubs are taking an active role in educating youth and newcomers to the fisheries. The Alii Holo Kai, the North Shore Underwater Club, the Eastside Freedivers Club, the Wahine Club, and many others work actively to educate members on several issues relating to conservation, sustainability and safety. Some educate by paying specific attention to certain issues in their meetings; others go as far as holding clinics. The care and respect of the environment shown by these clubs ensures a leadership that educates on the appropriate use of marine resources.

These lessons demonstrate that various factors impact fish abundance and the health of coral reef ecosystems. Focusing on issues such as coastal development, fishing pressure, and pollution, students can turn their attention to a myriad of forces that impact marine ecosystems while addressing issues faced by contemporary fishery and natural resource managers. Engaging the younger generation in this manner perhaps alters the mindset about the future of ecosystems and creates discussions that may become increasingly more relevant and real in their lives, from both utilization and cultural perspectives. This is arguably an important strategy for incorporating increasingly relevant scenarios into

classroom settings by taking full advantage of the knowledge possessed by many Hawaiian elders.

The perceptions of the lack of enforcement, especially on the Big Island, could be used as an opportunity to utilize the strength and closeness of members of certain networks, creating an alternative strategy for guiding long-term behavioral change. This strategy does not initially call for punitive enforcement and instead focuses on education. Enforcement officers could use these networks as an agent for altering the mindset of these fishermen, encouraging fishermen to realize the impact of their actions. If an enforcement officer finds a fisherman (especially a younger fisherman) in violation of regulations, key respected fishermen in the local community could be approached to engage the violating fisherman in a discussion about the environmental and legal ramifications of such actions.

Illegal fishing could be related to a lack of awareness about the rules or a lack of awareness about the consequences of their actions. A partnership developed between law enforcement officers and learned fishermen could result in a more effective strategy for changing this behavior rather than the immediate punitive sanction associated with a citation. If the violations continue, at least the fisherman has been warned, both by law enforcement officers and respected fishermen.

Evidence in fishing communities worldwide shows that in communities where social relationships and networks are tightly bound, informal sanctions can be as effective as (if not more than) formal enforcement (Dyer and McGoodwin, 1994; Stoffle, 1993; Stoffle et al., 1994). Future research efforts could test this hypothesis by examining not only the concerns of local fishermen but identifying the social networks that exist.

Finally, this report can be used as a part of the measures to address the community profiling research and designation process mandated by the Magnuson-Stevens Act's National Standard 8. It provides an initial examination into the spearfishing community, as well as contextualizes how spearfishing has been, and continues to be, a part of the local fisheries and overall cultural framework. It also delves into the history of fishing and the connection local people have to the ocean and its resources. These important aspects of understanding historic and contemporary dependency of local fisheries help to define a "fishing community."

As a final note, this project should be viewed as one step in an iterative research process. Systematic data collection can be accomplished in a more formal sense if the local community is built into the process and recognizes the value of their inclusion and participation. As well, the research highlights many differences between the two locales of study. Taking this research a step further would likely identify many additional differences that occur in the local spearfish fisheries of the other islands—including not just Hawai'i, but Guam, CNMI, and American Samoa.

For policies to truly strive to create sustainable fishing practices, at a minimum, a study similar to this one should be conducted so that there is a basic description and

understanding of those who participate in the fishery, the local concerns associated with the fishery and fishing, and a measurement of dependency and engagement for all of the islands. This is a worthy undertaking; it does not appear that the reliance, dependency and desire for marine species will ever wane.

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