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Preliminary Assessment of Monk Seal–Fishery Interactions in the Main Hawaiian Islands

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Preliminary Assessment of Monk Seal–Fishery Interactions in the Main Hawaiian Islands

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ABSTRACT

Growth of the endangered Hawaiian monk seal population within the main Hawaiian Islands (MHI) is leading to an increased frequency of interactions between the species and members of fishing communities. An assessment of the types of interactions is needed to assist marine resource managers, scientists, and outreach specialists involved in monk seal recovery efforts. This research effort focused on scheduled interviews with knowledgeable fishermen and intercept interviews at select fishing tournaments and locations. A review of secondary source literature was also conducted and included surveys previously undertaken with the fishing community and landing reports of commercial marine license (CML) holders. We discuss nine nearshore fishing methods and categorize them in terms of different kinds of potentially negative consequences for monk seals (injury or death due to fishing gear) and fishermen (damage of fishing gear and/or loss of catch). Additionally, we discuss fishing respondents' perspectives on select management measures undertaken to date. This report represents a preliminary assessment of human-monk seal interactions as reported on Oahu and Kauai.

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STUDY RATIONALE AND INTENT

Partly as a result of successful efforts to encourage recovery, the population of Hawaiian monk seals (*Monachus schauinslandi*) resident in the main Hawaiian Islands (MHI) has been steadily increasing in recent years. Current estimates place the MHI population at 200[1] with an annual population growth rate of 6.5% (NMFS 2016). The National Marine Fisheries Service (NMFS)[2] has established a goal for the MHI of 500 individuals for the species to be down-listed from endangered to threatened (NMFS 2007).

Already, the growing monk seal population and their increasing habitation in areas of human activity is giving rise to growing management concerns regarding a variety of human related impacts. Fisheries interactions have been identified as a serious threat to monk seal recovery.[3] Negative fisheries interaction in the form of hooking and entanglement are low frequency but consistent events. Additionally, the growing monk seal population and various current and proposed monk seal management measures have created ill feelings amongst some in the fishing community as some fishermen perceive the monk seal as a threat to their way of life and livelihoods. These perceptions may result in animosity and lead to intentional harming of monk seals.

This research was formulated to assist marine resource managers, scientists, and outreach specialists involved in monk seal recovery efforts.[4] The intent of this assessment is to improve understanding of how, when, where, and why problematic interactions between fisheries and monk seals tend to occur in the MHI. Focused attention was applied to improving understanding of:

(1) The likelihood of interaction and nature of resulting impact to monk seals and fishermen per fishing method;
(2) Potentially viable means for mitigating problematic interactions between monk seals and fishing activities in the MHI; and
(3) Variability in the perspectives of local fishery participants toward monk seals and monk seal management actions.

[1] This represents the best minimum abundance estimate based on the documentation of individually identifiable seals.
[2] The National Marine Fisheries Services (NMFS) is located within National Oceanic and Atmospheric Administration NOAA. The agency is also commonly referred to a NOAA Fisheries. The Pacific Island Regional Office (PIRO) and Pacific Islands Fisheries Science Center (PIFSC) are two offices within NOAA Fisheries that are involved in Hawaiian monk seal management and recovery efforts, and scientific research and monitoring programs, respectively.
[3] The other ten threats identified in the recovery plan are: food limitation, entanglement, shark predation, infectious disease, habitat loss, male aggression, human interaction, biotoxins, vessel groundings, and contaminants (NMFS 2007).
[4] This research was funded by National Standard 8 of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006. This act requires that federal marine resource management decisions consider any potential social and economic changes that may impact adjacent fishing communities.

Efforts were also made during research to identify additional venues and means to promote outreach and educational activities within the fishing community. The study was funded for 300 hours and research was conducted February through June 2015.

BACKGROUND

Overview of Nearshore Fisheries

The following overview of fishing effort and types of fishing methods in the MHI is included to provide the human context for possible fisheries-monk seal interactions.

Nearshore fishery participants fish for a combination of reasons: recreation, family consumption, sharing with others, and may also engage in commercial sale to provide part-time income or cover operating costs. Fishermen who sell fish are required to be licensed and submit catch reports to the State of Hawaii. Additionally, fishermen who fish recreationally for bottomfish in federal waters must comply with federal licensing and catch reporting requirements. There are currently, however, no other licensing or reporting requirements for non-commercial fishermen.

Estimates for the total number of resident recreational fishermen in Hawaii vary. In 2006, the last year that NMFS provided estimates based on the Marine Recreational Fisheries Statistics Survey (MRFSS), there was an estimated 172,696 recreational fishermen in Hawaii.[5] For the same year, the U.S. Fish and Wildlife Service estimated the resident recreational saltwater angler population at 89,000. In their most recent survey (2011), the U.S. Fish and Wildlife Service provide an estimate of 104,000 resident anglers (over 16 years of age) in Hawaii (U.S. Department of Interior et al. 2011). According to the most recent data from the State of Hawaii Division of Aquatic Resources (DAR), there were 1723 commercial marine license (CML) holders in 2013.

NMFS also provides estimates on fishing effort, measured by angler trips. Table 1 below provides information on number of angler trips in state waters for 2005-15.

Table 1.—Angler effort measure by trip.

Year/Mode	Shoreline	Private/Rental Boat	Total
2005	**1,892,365**	**201,844**	**2,094,210**
2006	**2,074,280**	**189,027**	**2,263,307**
2007	**2,101,730**	**147,949**	**2,249,679**
2008	**1,966,120**	**172,804**	**2,138,924**
2009	**1,721,919**	**167,886**	**1,889,805**
2010	**1,906,698**	**208,616**	**2,115,313**
2011	**1,157,684**	**87,356**	**1,245,040**
2012	**1,194,534**	**125,754**	**1,320,289**
2013	**1,215,738**	**116,785**	**1,332,522**
2014	**1,050,598**	**136,133**	**1,186,732**
2015	**1,157,857**	**120,364**	**1,278,221**

Source: NMFS Fisheries Statistics Division 2016.

[5] The estimates (203,666 in 2005 and 223,481 in 2004) suggested a great deal of annual variation or uncertainty (cf. NMFS Fisheries Statistics Division 2015).

Fishermen use a variety of different methods and gear types in nearshore waters of Hawaii. Fishermen who fish from shore utilize three primary methods: hook and line; spear; and net, in that order of prevalence. The boat-based fisheries operating in nearshore waters (within three miles of the coast) utilize nets, traps, handlines, and to a lesser extent troll gear. The State of Hawaii fishing method list, through which fishermen report catch for sale, include eleven methods within the line category; nine methods with the net category; and five methods within the trap category. Fishermen also spear and hand pick various marine species (cf. DAR nd).

Shore and boat-based hook and line fishing encompasses a wide variety of hook types, line strength, rig configurations, and handling actions (cf. Rizzuto 1983, 1987). Methods vary with target species, fishing habitat and bathymetry, and preferences of the fisherman. For example, hook types vary from fine feather hooks, multi-barbed lures with multi-pronged hooks, to large J and circle hooks. Depending on target species, a fisherman use bait of various sizes, alive or dead, or no bait at all. Shore based line fishing can involve such actions as jigging; whipping; dunking; slide-baiting; and casting with or without the assistance of balloon, plastic bag or sail. Boat based line methods include: handline, deep – sea handline; inshore handline; *kaka* line; shortline; vertical line; *ika-shibi*; *palu ahi*; and trolling with bait, lures or greenstick.

Net fishermen utilize a number of different configurations of nets: throw nets, which are deployed by a single fisherman from shore; lay gillnets of a variety of different configurations, which are typically deployed for a period of time within a current or tide and entangle fish; and seine or *hukilau* nets, which are typically deployed by groups of fishermen working from shore to corral fish. Fishermen also use traps to target fish, crabs, lobster, and shrimp. Traps vary in size, materials, and configuration (for example, large drums, square cages etc.).

Spear fishermen typically use either a three-prong pole spear or a banded spear gun[6] to target fish and will use a stringer attached to a buoy or one's waist, or a hand-held T-bar to secure their catch while diving. Spear fishermen also frequently dive from or with the assistance of boogie boards, kayaks, or motorized vessels and will, in that case, use coolers, buckets or other storage containers to secure their catch outside of the water. The vast majority of divers in Hawaii do not utilize scuba gear. Older divers, divers pursuing octopus for use as bait, and adults introducing children to the activity, will typically confine diving to reef areas of ten feet or shallower.

The above nearshore fisheries are not currently of equal concern when considering the likelihood of a monk seal interaction or potential for negative impact to the monk seal or fisherman. The fisheries of interest for monk seal interactions are discussed below in a review of secondary data sources and interview findings.

[6] Of note, the mechanics of the two kinds of gear are different. To activate the three-prong spear pole, one releases one's grip. In contrast, to engage a spear gun, one presses down.

REVIEW OF SECONDARY DATA SOURCES

This section reviews secondary sources focusing on surveys conducted with fishery participants regarding attitudes about and interactions with monk seals and commercial fish catch report data on monk seal predation. This information provides context for the research results presented below.

2007 Phone and Dockside Survey

In 2007, the University of Hawaii Sea Grant Program conducted telephone and dockside surveys with boat-based nearshore fishermen regarding marine mammal interactions (cf. Rhodes et al. 2007).[7,8] Interactions were defined as an encounter directly related to fishing such as bait or catch stealing, loss of or entanglement in gear, or accidental hooking.

Three hundred seventy-nine (379) fishermen were included in the phone survey, of which 14 (3.7%) reported an interaction with a marine mammal during the past 12 months. None reported interactions involving a monk seal.

Two hundred ninety-two (292) fishermen were included in the dockside interviews. 216 respondents (74%) reported having experienced a total of 254 interactions with marine mammals in their lifetime (including various species of dolphins and whales, and monk seals).[9] Twelve interactions were identified as having occurred with monk seals: three by rod and reel; three by pole and line; two by net fishing; and four spear fishing. Of the 12 interactions, 10 involved respondents who identified themselves as recreational fishermen and two involved respondents who identified themselves as mixed recreational/commercial. In one case, the interaction was identified as an accidental hooking. Monk seal interactions were reported by respondents residing on Oahu and Molokai. Although the survey protocol did enquire of fishermen's responses to marine mammal interactions, the reporting of survey data does not include an analysis of response by marine mammal species.

2011 Public Perception and Attitudes about the Hawaiian Monk Seal Survey

In 2011, a perception and attitudes survey was conducted among beach going residents and tourists, fishermen, and boat tour and lodge operators (cf. Sustainable Resources Group International 2011).[10] A total of 469 fishermen were interviewed in the study's in-person survey effort that included Oahu, the island of Hawaii, Maui, Molokai, and Kauai. Respondents included recreational, subsistence, and commercial fishermen. Survey questions germane to this study include: sighting of monk seals in the wild (on shore or in the water and how often in the past five years); the appropriateness of fishing around monk seals; the appropriateness of

[7] Telephone interviews were conducted on a randomized, anonymous basis as part of NOAA's Fisheries Coastal Household Telephone Survey and included all six main Hawaiian Islands. In-person interviews were conducted opportunistically at select docksides on the island of Hawaii, Oahu, Molokai, and Maui.
[8] Nearshore is defined by the authors as within 25 nautical miles of shore.
[9] No specified time frame was given for the interaction to enhance fisherman participation (Rhodes et al. 2007:7)
[10] Research was funded by the Protected Resources Division of NOAA Fisheries to assist in conservation efforts.

prohibiting certain forms of fishing when in the area of a monk seal; belief that monk seals reduce fish catch; willingness to use barbless hooks to reduce hooking damage; and effect of barbless hooks on catch success. Additionally, respondents were asked what action they would take if a monk seal was hooked on a fishing line. [11]

Eighty-nine percent of fishermen reported having seen a monk seal on the shore or in the wild within the past five years. Eighty-four percent of the respondents indicated that fishing is not appropriate "around" monk seals. Fishing respondents, however, were not generally in favor of regulating fishing around monk seals: only 25% were in favor of regulating spear fishing; 24% fishing with hook and line; and 38% fishing with nets. Additionally, 34% of surveyed fishermen reported being willing to use barbless hooks. Table 2 below provides fishermen's responses to what they *would do if* a monk seals was hooked on a fishing line.

Table 2.—Fishermen's reported response if they hooked a monk seal.

Fisherman response	All Islands	Oahu	Kauai
Cut the line	56%	57%	53%
Try to get the hook free	37%	37%	41%
Call the authorities	21%	38%	20%
Try to scare the seal away	3%	2%	3%

Source: Sustainable Resources Group International 2011

Commercial Fish Catch Reports (2003-2014)

As of late 2002, fishermen are required to include information regarding loss of catch due to predation – specifically the amount of fish and source of predation – in commercial fish catch reports. The commercial fish catch report data were used (Boggs et al. 2015) to summarize predation by fishing method, seasonality of interactions, and statistical area. Of note, predation does not denote that hooking or entanglement or any other harm occurred to the marine mammal involved. Predation may be widely underreported on commercial fishing reports. There is no assurance that fishermen can accurately identify species. And the summarized data on loss due to predation do not take into account the amount of fishing effort by method, season, area, or year which may largely explain the observed.

The most common marine mammal species named in the commercial fishing catch reports are listed here in descending order: porpoise, dolphin, monk seal, pilot whale, false killer whale, and pygmy killer whale. [12] These are all interactions that would be expected in off-shore rather than in-shore fishing. Table 3 below provides information on the number of records and number of commercial marine license (CML) holders that reported monk seal predation.[13] Due to the less

[11] Other questions in the SRGI survey asked fishermen: if they believed they were knowledgeable about monk seals; if they believed monk seals were native to the main Hawaiian Islands; if they believed the population was increasing or declining; if they believed monk seals were adequately protected by regulations and what measures were appropriate for protecting monk seals; what kinds of behaviors and activities were appropriate around monk seals; what they would do if they encountered a monk seal in distress; and how effective various educational methods are.
[12] Commercial fishing trip reports include three options for reporting predation: sharks, unknown, and other.
[13] Predation occurring on multi-day and single day fishing trips appears as one record. The number of records is likely an underestimation of the number of fishing days that the fishermen encountered predation.

frequent reportage of interactions with monk seals, information was reported in three year periods to assure confidentiality requirements.[14]

Table 3.—CML reports of monk seal predation of catch (2003–2014).

Three-year Period	Monk Seal	
	# of records	# of CMLs
2003-2005	5	3
2006-2008	6	6
2009-2011	20	15
2012-2014	43	27
Total	74	51

Source: Boggs et al. 2015.

The most common fishing method reported for interaction with monk seals was deep sea/ bottom handline. However, this does not necessarily imply that deep sea/bottom handline was inherently more likely to be involved in loss of catch due to monk seals than other fishing methods. It could simply be that there was more fishing by this method than other methods. Boggs et al (2015) did not analyze the amount of fishing by each method, season, area or year, as would be required to draw such conclusions. The breakdown by fishing method is provided below in Table 4. Not included were reports including more than one method due the inability to determine which method was associated with predation.

Table 4.—CML reports of monks seal predation by gear type (2003–2014).

Gear Type	Monk Seals	
	# of records	# of CMLs
Trolling –Lure	3	3
Deep-Sea/ Bottom Handline	39	28
Inshore Handline	12	8
Kona Crab Net, Loops	3	3

Source: Boggs et al. 2015.

The locations of reported interactions with monk seals are aggregated composites of the State statistical areas. For details see Boggs et al. (2015). Table 5 below details the geographic location and number of reports and CML holders who reported interactions.

[14] In accordance with standard confidentiality requirements, species named by fewer than three commercial license holders, for a queried time period or statistical area, were not included in data results and analysis.

Table 5.—CML reports of monk seal predation of catch by geographic area (2003–2014).

# of Records	# of CML holders	Geographic Area
15	12	Offshore[15] south and west Maui County[16]
12	3	Offshore north and east Kauai County[17]
11	8	Inshore[18] south and west Kauai County
9	4	Inshore south and west of Honolulu County
7	5	Inshore north and east of Honolulu County
4	4	Offshore south and west of Honolulu County
4	3	Inshore south and west of Maui County
3	3	Inshore north and east of Maui County
3	3	Offshore and inshore combined of Hawaii County

Source: Boggs et al. 2015.

Fisheries Caused Mortality and Serious Injury Statistics: Annual Marine Mammal Stock Assessment Reports

Between 1976 and 2014, 140 hookings and entanglements in active fishing gear, have been documented (NMFS 2016). Between 1988 and 2014, 83 (28%) of the 297 identified monk seals resident in MHI, had been in a documented hooking event (Gobush et al. nd).

Annual marine mammal stock assessments provide data on the number of incidental observations of mortality and serious injury within MHI that could be attributed to a fishery interaction. From 2008 on, information is further delineated to include gear type of nearshore fishery and the severity of the injury. Table 6 below provides a summary of the two categories of data (2003-13). In 2012, there were four documented hook-related mortalities (NMFS 2015). Note, no mortalities or serious injuries have been attributed to the bottomfish fishery. Reports of hookings have increased with increases in the monk seals population, human population, and the number of volunteers involved in monk seal conservation efforts.[19]

[15] Offshore fishing grids include waters from approximately two to twenty miles from the shore.
[16] Maui County includes: Maui, Lanai, Molokai, and Kahoolawe.
[17] The island of Niihau and Kaula Rock falls within Kauai County.
[18] Inshore statistical areas include waters from the shore approximately two miles out.
[19] The human population of MHI has increased from an estimated 1,211,537 persons in 2000 to 1,431,603 in 2015 (U.S. Census Bureau 2000, 2015).

Table 6.—Monk seal serious injuries by gear type (2003–2013).

Year	Gear Type and Outcome		
	Hook (nearshore) Mortality/serious/non-serious	Spear Non serious/serious	Gillnet Number/outcome
2013	0/6/8	0/1	
2012	4/1/11		
2011	0/0/9		
2010	0/0/11		1/mortality
2009	0/4/8		
2008	0/3/6		
2007	7 total no indication of severity		1/mortality
2006	5 total no indication of severity		1/mortality
2005	7 total no indication of severity		1/severity undetermined
2004	5 total no indication of severity		
2003	4 total no indication of severity		

Source: NMFS U.S. Pacific Marine Mammal Stock Assessments. Available online at: http://www.nmfs.noaa.gov/pr/sars/region.htm.

According to data collected by NOAA Fisheries Pacific Island Fisheries Science Center (PIFSC), monk seal injuries have been associated with a variety of hook types from small *damashi* (fly) hooks, which are frequently used to target *menpachi* and *akule* (bigeye scad); J hooks of various sizes which are used to target any number of species by various methods; and large circle hooks which are frequently associated with the *ulua* (trevally) fishery.[20]

To summarize, there are no consistent data collection efforts regarding the full possible range of fisheries-monk seals interactions. Current ongoing data collection efforts focus on different aspects of interactions such as catch predation by monk seals and fishing gear injuries of monk seal. Other survey efforts do not uniformly provide information on the specific nature of the interaction. In total, fishermen do not report frequent interactions with monk seals but interactions have occurred in many of the primary fishing methods: rod and reel, pole and line, handline, net, and spear fishing.

METHODOLOGY OF THIS RESEARCH STUDY

Research process and methods are outlined below.

- Discussion with persons within the State of Hawaii Division of Aquatic Resources and NOAA Fisheries to: (1) develop a research protocol; (2) identify fishermen who are highly knowledgeable of monk seal-fisheries interactions; and (3) identify suitable intercept venues and locations;

[20] It should also be noted that hookings could conceivably occur on non-active fishing gear (i.e. gear that may be lost while fishing) or when monk seals prey on fish that got away but have an embedded hook.

- Scheduled interviews with experienced and knowledgeable shore-based, and inshore small vessel fishermen in Kauai and Oahu;
- Intercept interviews at fishing tournaments and popular shoreline fishing locations.

Ethnographic research efforts were focused on Oahu and Kauai due to high monk seal presence and high number of observed/reported monk seal fishery interactions. In 2014, an estimated 35-45 identified monks seals were observed on both islands (cf. Chandler et al. 2015). Additionally, Oahu has high intensity of fishing effort relative to other main Hawaiian Islands.

Information was gathered through in-depth interviews with: key respondents in resource management and outreach; club representatives and/or tournament organizers; and owners/staff at gear stores. Interviews of shorter duration were taken at shore-side intercept locations and three tournaments. Table 7 below details the number of interviews by type.[21] It should be emphasized that the scope of this research is such that results cannot be used to estimate frequency of monk seal fishery interactions in the region or any parts of the region.

Table 7.—Number of interviews by type and location.

Interview Type	Oahu	Kauai
Science/Management/Outreach	11	5
Club representative/tournament organizers/ *hui* representative	2	3
Gear Store	3	1
Misc. Other [22]	0	5
Fisherman Gear Type		
Hook and line- shore	5	2
Spear fishing	21	3
Net	1	4
Hook and line- boat	2	5
Total	**45**	**28**

In accordance with ethical standards of anthropological research, all respondents were informed of the nature of the research at the outset of the conversation. Open ended questions were asked regarding presence of seals in fishing area, impact of seal presence on fishing experience, direct interactions, and responses by respondent and monk seal. Notes were taken during or immediately following interviews. Due to small sample size and limited topics of enquiry, the data was not computer coded; rather analysis was subsequently carried out on the major themes as they were identified in the interview data.

[21] Respondents may be noted for more than one category if they spoke from more than one capacity or were knowledgably about more than one gear method/fishery.
[22] Miscellaneous includes lifeguards and persons, not affiliated with resource management agencies that have conducted fisheries related research.

The disproportionate ratio between the low number of monk seals and high number of near shore fishery participants, especially in Oahu, means that many fishermen have had no fishing related interactions with monk seals. Additionally, the general reluctance of fishermen to speak about interactions with protected species makes an enquiry of this nature challenging. In many cases, "talk story" focused on the big one that was caught, the big one that got away, various fishing challenges facing fishermen, etc. with respondents having little to say about observations or interactions with monk seals.

INTERVIEW FINDINGS

The purpose of this research was to understand fishermen's direct observations of, interactions with, and responses to monk seals. Other research efforts have focused on understanding perceptions of monk seals, held by the public generally and fishermen and native Hawaiians more specifically (cf. SRGI 2011, Kittinger et al. 2011); and identifying and analyzing public concerns regarding monk seals (cf. MCI 2014; Chandler et al. 2015).

What followed our direct enquiries, however, often had little to do with monk seal fisheries interactions and more about fishermen's experiences with a variety of changes undergoing the communities in which they lived. As one community resource spokesman explained "complex and intangible forces of change are being represented by the seal." Two respondents, involved in resource management, opined that the monk seal is a "scapegoat" for many of these changes. This was particularly the case for respondents in Kauai. It is therefore important, in detailing findings and formulating recommendations, to discuss these disparate aspects of the monk seal as an animal and as a symbol.

Monk Seal as Symbol

Fishermen frequently associated the monk seal with loss - loss of land, coastal access, fishing resources, and local self-determination. This was particularly the case for older fishermen and for respondents in Kauai. Loss of land and coastal access is frequently associated with relatively recent increases in tourism and numbers of homeowners from the mainland, but in some cases older forces of western colonization and US military presence.[23] Many respondents were familiar with the existence of translocation efforts whereby monk seals were moved from the Northwestern Hawaii Islands (NWHI) to MHI.[24, 25] For some older fishermen, the resurgence of the monk seal parallels the decline in fisheries they have witnessed in their lives. And more than

[23] Kauai respondents note that overnight access to *ulua* fishing spots have been lost due to changes in land ownership particularly in the west side of the island. Oahu respondents noted the loss of fishing access in places of high tourist density. Additionally, west side residents mentioned that large homeless populations residing on beaches were impacting the use of the beach for fishing.

[24] Beginning in the 1980s, Hawaiian monk seals have been translocated within and between the NWHI and MHI. The majority of translocations between 1984 and 2009 have occurred within NWHI. Of the 247 cases during this time period, 21 cases involved the translocation of monk seals from NWHI (Laysan Island) to the MHI (Hawaii -6, Maui -4, Molokai – 5, Kahoolae -2, Oahu -2, Kauai -2). All 21 cases involved males and were undertaken in response to adult male aggression (Baker et. al. 2011).

[25] For those respondents who do recognize that the monk seal to be native to MHI, the lack of clear documentation regarding what Hawaiian's did to protect their fisheries resources from monk seals leave them at a loss. There also remains the mystery of where the monk seals went.

one respondent noted that Hawaii had become overrun by invasive plant, fish, and bird species that threaten native ecosystems. The association of the monk seal with outside forces, often beyond their control, is often reinforced by the ethnic, class, and gender make-up of the monk seal volunteer network and the program staff.

The Federal monk seal programs in NOAA Fisheries (Pacific Islands Fisheries Science Center and Pacific Islands Regional Office) – their goals and methods – are not easily separable from other federal actions, which many respondents feel have threatened the ability of the community to locally manage their own resources. For example, the establishment of the Papahānaumokuākea Marine National Monument in 2006 is still felt strongly amongst members of the fishing community in Kauai. Respondents' views of monk seals are also colored by local affairs. For example, a number of respondents questioned the stewardship role the Robinson family has taken on regarding monk seals in Niihau, a small island near Kauai, suggesting their desire to use the growing monk seal population to close state waters surrounding Niihau to fishing.

A number of respondents took issue with the notion of federal protection, questioning if protection was actually good for a species in the long run and why some behaviors are deemed as "protective" rather than harmful to a species. Protected status runs counter to respondents' notions of how the natural world should work through Darwinian selection or within a Hawaiian concept of *pono.* According to one cultural practitioner, *pono* denotes a sense of balance in the environment and that many actions taken as part of the program, for example, cordoning off beach access, threatens or disrupts this balance. Some respondents questioned the wisdom of protecting seals in a way that will lead them to have no fear of humans and, in their minds, encourage further interaction with humans. (There seemed to be little recognition on the part of respondents that the public might be protected from the seals with ropes and signs.) Simply put, from the perspective of the fisherman, monk seals should fear humans. Rather than protection, many fishermen-respondents preferred the notion of "just letting be", meaning letting both monk seals and fishermen interact without regulation.

In contrast to older respondents, younger respondents spoke less negatively about monk seals and program methods. One fishing respondent noted that he appreciated the cordoning off of seals because then he knew where it was "okay to fish." Two older fishing respondents who described seals as a "nuisance" added that their child or grandchild "likes" them.

Fisheries of Concern

Monk seal-fisheries interactions can be divided into three categories, each of which represents a different kind of potentially negative consequence for monk seal and fishermen. The three categories are as follows:

1) Fisheries that are particularly attractive to monk seals, due to: use of bait (type, amount, or soakage time); type of target species; and utilization of gear that is potentially lethal to monk seals. Fisheries in this category also are fished in a time, manner, or place that can impede the ability of the fishermen to detect and respond to monk seal presence;

2) Fisheries that involve fishermen in the water and thus interaction may represent a danger to fishermen. Due to the nature of the interaction, monk seals may also come to associate human presence with a feeding opportunity;

3) Fisheries that may increasingly experience high rates of predation but do not utilize lethal gear types. Fisheries in this category are conducted on a subsistence or commercial basis where fishermen depend on their catch to feed and/or support their families.

To date, the primary fishery gear types of concern have been: shore hook and line; lay gillnet; and spear fishing.

Shore Hook and Line Fishery

Slide baiting fishing represents a fishery of concern due to the potential appeal of the bait to a monk seal, and potential lethality of hooking, especially if the hook is ingested.[26] Additionally, resource managers report that slide bait fishery has a large number of participants.

The slide bait method is considered to be the most productive method for catching the popular game fish *ulua* (trevally) (cf. Rizutto 1983:129). The method entails leaving large chunks of bait (6 oz to 1.5 lbs in size) often for long periods of time in the water. A wide variety of baits are used in shoreline *ulua* fishing – dead bait of eels, octopus, or even chicken and live baits of fish; some of which overlap with the diet of monk seals (cf. Rizutto 1987; cf. Sprague et al. 2013). The slide bait *ulua* method typically involves the use of large barbed circle and J hooks attached to wire or cable leaders.

Slide bait fishing takes place on cliffs and typically fishermen are quite distant from the terminal gear. Fishermen will often fish two to three poles at a time and slide additional bait intermittently. Moreover, *ulua* fishing occurs frequently at night making it difficult for fishermen to see monk seals in the area. According to Rizutto (1987:29) "most *ulua* are hooked after dark, which is when the fish become highly predatory after dark." After dark, *ulua* come closer to shore to feed on eels, fish, lobsters and octopus (*tako),* species that are easier to prey on at night.

One challenge for fishermen is to discern when activity on a fishing line is due to a monk seal versus some other unwanted predator, such as an eel or shark. Five respondents described, based on their own experiences or others, monk seals taking or "nibbling" on bait; one respondent reported that monk seals may surface when doing so. One respondent, who reported having hooked a monk seal, observed that unlike *ulua* or shark, the seal, when hooked in the mouth area, did not "run" causing the reel to "zzzzzzz", but surfaced rather quickly. This kind of information may help fishermen better identify monk seal presence and mitigate a potentially negative interaction.

Lay Gillnet Fishery (also Called Set, Cross, "Paipai," and "Moemoe" Nets)

Lay gillnet fishery represents a fishery of concern due to the appeal of large amounts of fish typically trapped in the net; potential lethality of entanglement; and frequent lack of attendance

[26] Recent cases of young monk seals swallowing hooks suggest that seals as they learn to forage may be more prone to swallowing hooks than adult seals.

by fisherman. Between 1998 and 2011, there were 12 documented cases of interaction (cf. MCI 2014) and six cases of entanglement from actively fished lay nets. Two respondents reported losing catch to monk seals when lay gillnet fishing.

Spear Fishing (Shore and Boat (Motorized or Kayak)

Spear fishing represents a fishery of concern due to potential danger to the diver and potential lethality of spear gun. Additionally, the presence of persons with fish in the water may encourage monk seals to seek interaction with any human in the water. The identification of spear fishing as a fishery of concern by outreach staff is relatively recent and reflects in part the growing popularity of this form of fishing. It should be noted, that unlike interactions with hook and line fisheries, the in-water nature of spear fishing leaves little doubt of the cause of predation.

Research efforts in Oahu focused on the spear fishing community due to increasing concerns that predation by monk seals may lead to the conditioning of monk seals. Respondents reported a full range of experiences in a continuum from never having seen a monk seal while diving to having regular encounters within the water to having a seal follow one's dive boat. A number of locations on the island were identified by respondents as dive areas with seals often in the vicinity.

Of eighteen divers interviewed on Oahu, seven had experienced predation by monk seals. In local parlance, this is referred to as "having been taxed;" the term is also frequently applied to sharks. Of the seven, one respondent reported "having been taxed" more than once, four reported having catch taken from a stringer attached to a buoy, one reported having catch taken from a stringer attached to his body; and one reported having catch taken from the end of the spear shaft.[27]

In Kauai, five spear fishermen were interviewed. Three spearfishermen reported having lost catch to monk seals. Respondents who dive in waters of Niihau, which are accessed by boat, reported commonly having interactions with seals. As one respondent put it, "monk seals are more notorious than sharks" for stealing catch in the area.

Respondents who have encountered monk seals in the water have reported various reactions from being thrilled to have a seal playfully swim around to being scared by the sudden appearance and being "barked" at by a seal. Respondents who have had catch stolen have remarked on the speed and stealth of monk seals. Because divers do not have a consistently high rate of encountering monk seals and they typically have more than one type of fish on a stringer, no diver interviewed was able to identify a fish preference for monk seals. Respondents reported stopping fishing until the seal left or moving to another location, especially if the monk seal showed any interest in the catch. Because monk seal encounters are not high enough, fishermen are not considering other mitigation strategies. Furthermore, diver respondents reported being unsure of how best to deter monk seals. When faced with the likelihood that catch is about to be taken by a monk seal, as one respondent put it, divers typically "suck it up [because] we know monk seals are protected."

[27] Typically the spear shaft, when released, will travel a distance of fifteen feet because the catch is a short distance from the diver.

Other Fisheries

There are a number of other fisheries of concern with regards to predation that have been identified through this research and aforementioned data collection efforts. These include: seine net (*hukilau),* lobster net, trap, troll, inshore handline, and deep-sea/bottomfish handline.[28,29] The foremost is engaged in primarily for subsistence purposes whereas the lattermost are often engaged in for commercial purposes. A brief discussion of the fishing gear and handling activities is provided below.

Seine (*hukilau)* net is used primarily in bays and river mouths and involves at least two, if not a group of, fishermen. Typically one fisherman will enter the water and swim across the bay or river trailing out a net from an inner tube. Others will corral fish in the net through sounds and motions while bringing in the net. Much like the lay gillnet, the method is used for collecting a variety of fish or a school of *akule* and often associated with provisioning the community for a celebratory occasion. Unlike the gillnet method, the *hukilau* net is not left unattended. Two respondents in Kauai reported loss of catch to monk seal; one of the respondents also reported being "chased" by a seal while in the water retrieving a net.

Lobster nets are set in relatively shallow reef areas along the bottom secured by metal hooks. Customarily, nets are set in the afternoon and left to be retrieved in the morning. Although these nets are currently regulated as lay gillnets, subsistence fishermen in some rural communities may still be deploying them at night. Reportedly, fishermen view empty nets as likely due to monk seal predation. Because the nets are left unattended at night, the cause of predation cannot easily be verified.

Trap fisheries use bait to catch reef fish, lobster and crab in inshore waters. According to resource managers, at least one commercial fisherman has reported interactions with monk seals that resulted in cage damage and loss of catch. No respondents in this study participated in a trap fishery.

The Kona crab net fishery is conducted on small boats operating typically up to one mile from shore of the coast. Small collapsible nets, baited with fresh bait, are strung on one mainline and set at depths of 75 to 150 feet over sand bottom. The nets are soaked for a short amount of time (30 minutes) with the vessel operator in the vicinity. According to catch reports, three CML holders indicated having lost catch to monk seals (2003-2014) (cf. Boggs et al. 2015). Octopus

[28] An additional shoreline fishing method of potential concern is the *kaka* line. The *kaka* line configuration is comprised of a mainline with multiple branch lines and baited hooks. The method typically involves setting the line from the coast on the bottom or in shallow mid water. The *kaka* line is used to target *opelu* and reef fish, and may also catch *ulua.* Typically the line is set for a number of hours and is largely left unattended. The location of fishing, use of baited hooks which are soaked, and the lack of attendance suggests the fishery could be of concern for monk seal interactions. There have, however, been no reports of interactions in surveys or commercial fish landings and there were no respondents in this study that participate in the fishery. In 2013, there were 15 CML holders (DAR nd). Due to limited participation and confidentiality requirements, little information is available regarding the location of current fishing activities.

[29] One respondent wondered about community response to and possible mitigation strategies if a monk seal entered into a coastal fish pond to feed. Coastal fish ponds (*loko i'a)* were an important source of fish in pre-contact days. Currently there is a movement to restore traditional fish ponds as a way to support native Hawaiian cultural tradition.

and other fish will also predate on crabs. No respondents in this study participated in the Kona crab net fishery.

The boat-based troll fishery for pelagic fish species occurs in nearshore waters of MHI. There have been a number of reports of interaction with the troll fishery even though monk seals tend to be in the demersal zone and bottom feeders. One respondent in Kauai reported encountering a monk seal while reeling in catch approximately ¾ mile offshore in waters of 240 feet. The fisherman was able to retrieve the catch when the seal attempted to get a better grip on the fish. As noted above, three CML holders reported monk seal predation in conjunction with lure trolling (2003-2014) (cf. Boggs et al. 2015).

Boat-based handline fisheries are conducted nearshore for *akule* and *opelu* (mackerel scad) and deepsea for bottomfish species. Fishing is frequently conducted at night with use of lights. Both fisheries typically involve the deployment of more than one line with each line having a series of branch lines with baited hooks. Most commercial fishermen use power assisted reels to retrieve handlines when targeting bottomfish. Both nearshore and deepsea handline fisheries also reportedly experience predation by shark, porpoise/cetacean, and other fish species (cf. Boggs et al. 2015).

One nearshore handline fisherman on Oahu reported losing catch to a monk seal; another reported a curious seal that "just swam around the boat." In Kauai, nearshore handline fishermen reported regular monk seal interaction with the night-based *akule* fishery that affects approximately six fishermen. In the Kauai case, fishermen respond by turning off lights (a common response to cetacean predation).[30] The respondent also reported that the six vessels that frequently fish together would share information regarding location so others can avoid predation. As noted above, eight CML holders have reported monk seals predation while nearshore handlining (2003-14) (cf. Boggs et al. 2015). No respondents reported first hand incidents of monk seal predation by deep sea bottom handlining. According to catch reports, 28 CML holders indicated having lost catch to monk seals (2003-14) (cf. Boggs et al. 2015).

Mitigation Measures to Date and Community Perceptions of Management Measures

Shore Hook and Line Fishery

NMFS provides the following guidelines to reduce the possibility of interaction with hook and line fisheries: 1) avoid areas of seal presence; 2) take a short break from fishing or change locations if a monk seal appears; and 3) report seal interactions to help identify conditioned seals (cf. NMFS 2013). Respondents report that these guidelines are not always realistic. In the case of *ulua* fishing, lines and bait are frequently distant, horizontally and/or vertically from the angler, and in combination with the popularity of night fishing means anglers are not always in a situation for easily seeing seals when they are present. Of note, when targeting *ulua* at night, fishermen generally will not flash their headlamps in the direction of the water to avoid scaring *ulua* from the area. Additionally, the ability and ease of removing slide gear varies considerably

[30] By turning of lights, the fisherman stops attracting the target species, *akule*.

by location and number of poles set. The retrieval of equipment in reef locations can result in loss of costly gear due to snagging.

Guidelines distributed in Kauai, where a number of young monk seals have swallowed hooks, are as follows:[31]

- Don't fight it – never try to reel in a seal that may be hooked (as this may set the hook causing serious internal injury or death);
- Hook set? Cut the line. If the hook is set, carefully take in any slack line and then cut the line as close to the seal as safely as possible;
- Not set? If the hook is not set, put slack on the line and give the seal time to release itself.

Moreover, NMFS promotes the use of barbless circle hooks to reduce chances of severe internal damage should hooks be swallowed and increase the chances that any hookings to the mouth or other areas are naturally dislodged (cf. NMFS 2013). The barbless circle hook program was initiated in 2004 by an avid fisherman who is a fishery biologist at NMFS's Pacific Islands Fisheries Science Center to mitigate interactions between shoreline fisheries and sea turtles and monk seals. The program is currently supported by staff at the State's Division of Land and Natural Resources, and distributes hooks and provides information on how to make your own barbless hooks.[32] The program is represented at 6-7 hook and line tournaments annually on Oahu and an additional 6-7 tournaments on the other Hawaiian islands (cf. NMFS Pacific Islands Fisheries Science Center 2013). Outreach benefits children through science classes, school clubs, summer fishing courses, and community events. Major tournament wins by fishermen using barbless circle hooks to target a variety of species have been recorded across the state and highlighted in the major fishing magazine *Lawai'a.* Winners of the largest *ulua* caught on barbless hooks have also become important promoters at fish and seafood festivals, expos and other events. Supporting tournaments have created a "barbless challenge" and participation rates have grown from less than 20% of entrants to 40-50% (cf. Bulletin of Marine Science 2012).

The success of the program has been attributed to the effectiveness of barbless circle hooks; association with longstanding outreach personnel; appealing messaging; fishermen's involvement; support by clubs, organizations, and many tackle shops; and multi-year funding. The program's messaging emphasizes multiple reasons to use barbless circle hooks: conservation of fisheries resources (increased survival rate of fish that get away); mitigating damage to protected species; safety, especially for children; and showing the non-fishing public that fishermen care about resources and are part of the solution. The effectiveness of the barbless circle hook to mitigating hook damage was shown in 2007 when a seal was able to self-shed a hook (cf. NMFS Pacific Islands Fisheries Science Center 2013). Fishermen have been involved in hook testing and outreach efforts. Respondents report that the effectiveness of the program is based on the role of key outreach personnel who have worked long hours to create trust. Many note that the program would not be successful if it were staffed by short term personnel. Program

[31] This information is distributed by the Monk Seal Foundation in coastal fishing locations to fisherman in the form of a tide calendar.
[32] In 2014, 35,000-40,000 hooks were reportedly distributed.

staff hope that education and outreach will be taken over by local organizations to ensure long-term sustainability.

Lay Gillnet Fishery (also Called Set, Cross, "Paipai," and "Moemoe" Nets)

In 2007, regulations were established to conserve nearshore marine resources and protect sea turtles and Hawaiian monk seals. These regulations including spatial and temporal closures, net length restrictions, net soaking time limits, licensing requirements, and rules regarding attending nets every 30 minutes (cf. DAR 2007). Fishermen report that spatial closures in Oahu (from Portlock Point to Keahi Point, Kailua Bay, and Kāneʻohe Bay) and restrictions against night fishing represent an effective ban on gillnet fishing (cf. Bruggencate 2007). Respondents also report that restrictions on net fishing has affected customary gathering of a large variety of night and day fish for celebratory occasions such as baby luaus and graduations. Currently, fishermen must target species individually by rod or reel. Additionally, it is hard to catch the highly valued red *menpachi* that must be targeted at night.

Resource managers report concerns that many gillnets are not properly registered and that illegal use of gillnet fishing still occurs. Additionally, some fishermen may continue to fish in ways they were taught rather than in accordance of or with knowledge of fishing regulations.[33]

Spear Fishing (Shore and Boat (Motorized or Kayak))

NMFS offers the following guidelines for spear fishermen: 1) avoid taking a shot with a seal nearby; 2) try not to let seals take catch off your spear, stringer, or float; and 3) it may help to use enclosed bags or sealable containers for catch, instead of stringers (NMFS 2013).

Respondents report that reef habitat frequently makes it difficult for divers to see monk seals. Additionally, masks tend to obstruct divers side vision. Respondents note that tying catch to one's belt rather than a distant float may help deter predators. That, however, is not a common practice amongst divers due to concerns about impeding one's movement and attracting sharks. Respondents also note that some divers use boogie boards as a platform for one's flag and will tie fish on top. The effectiveness of this to deter monk seal predation has not been tested. Additionally, buoys with wells for fish storage are currently being marketed as a means to secure fish from sharks. They are, however, reportedly expensive. Furthermore, the use of above water containment systems may not be suitable for certain ocean conditions, such as strong currents.

Clearer rules regarding acceptable deterrence methods are needed as more divers are likely to encounter monk seals that are intent on taking catch in close encounters. Staff within NMFS Monk Seal Program report facing difficulty developing or promoting any kinds of deterrence methods for public use due to legal penalties for harassing protected species. Currently NMFS is the process of developing formal guidelines for safely deterring marine mammals from damaging property, including fishing gear and catch, and endangering personal safety. This process involves the development of criteria to evaluate the potential lethality of various deterrence methods, the identification of effective non-lethal deterrence methods for pinnipeds, and

[33] Resource managers also note that the effectiveness or necessity of banning gillnet fishing has not yet been demonstrated in so far as no entanglements have occurred in locations where gillnet is still permitted.

consideration of the suitability of deterrence measures for species listed and those not listed under the Endangered Species Act.

During the course of this research, respondents identified dive tournaments and dive clubs as potential outreach and educational opportunities for the monk seal program. Five dive tournaments are held on Oahu and one on Kauai annually. Oahu has a number of spear fishing clubs (cf. Stoffle and Allen 2012). Alii Holo Kai, the oldest dive club on Oahu, holds monthly club tournaments; before each tournament a different topic regarding diver safety is covered to educate club members. Tournaments also cover safety issues before dives begin. Of note, clubs and tournaments attract a small percentage of the total number of spear fishermen.

Respondents reported that, with suitable messaging covering predation problems and safety in general, the dive community would likely be eager to develop and test possible gear modifications that could mitigate the potential for negative interactions with monk seals. Respondents suggested slogans such as "Don't get Taxed" and "Keep your Catch" to capture divers' interest. Additionally, many dive clubs are internet based and the dive community frequently communicates via online forums. One Oahu respondent noted that the support of a single website for divers to record monk seal information might assist divers in choosing dive locations and being better prepared to respond to monk seal interactions. The diving community could also play a role in identifying seals in the water that have been hooked.

Other Fisheries

Commercial fishery participants in trap fisheries and inshore handline fisheries have reportedly contacted NMFS program staff about monk seal interactions. In the trap fishery, there was some discussion about placing cameras on traps to identify the problem monk seal(s). No further action was taken. In the case of the nearshore handline fishery, program staff and fishery respondents reported initial conversations about predation problems. Communication has reportedly stalled largely due to differing expectations of what is needed to proceed. Program staff report needing more information from fishermen about the nature of interaction problems, while fishery respondents report needing to know more about what NOAA Fisheries can offer as a solution to monk seal predation. As reported by respondents during this research, the lack of clear communication between staff within the program and fishing community regarding what constitutes a problem and what can be done has resulted in ill feelings and feelings of frustration on both sides (cf. Jenkinson 2010).

Currently, a key mitigation measure being promoted by program staff involves responding with medical care to hooked and entangled seals and trans-locating problem seals.[34] This requires community members to report, in a timely manner, instances of gear contact to identify potentially injured seals and seal interactions to help identify nuisance seals (cf. NMFS 2013). Resource managers and fisheries respondents report reluctance on the part of fishermen to report

[34] A discussion of the deterrence measures taken by the agency to date are outlined in Jenkinson 2010. Most deterrence measures have been taken when monk seals have appeared on land in areas that come in conflict with or pose a danger to people. The commonly used measures involve clapping, yelling, waving palm fronds and have largely been ineffective. Boards are also occasionally used to move seals off of crowded beach areas.

problem seals to the hotline. [35] Reasons given include: cultural disconnect between fishermen's dialect and "mainland people" who staff hotlines for reporting monk seal interactions; perception of or experience with agencies not responding to fishermen's other reports, mainly of fishing violations; and disapproval of the monk seal program goals and/or methods (cf. Chandler et al. 2015).

Respondents have said, "The whole monk seal program is so silly, I would never think of calling NOAA about a problem seal" and "I would not call NOAA because the idea of relocating monk seals is what caused the problem in the first place." One respondent noted that he had reported a problem seal (who stole catch) and was told to wait in the location for someone to respond. He reported waiting for approximately an hour and leaving without receiving a response or follow-up call.

Resource managers also report that there is a general fear in the fishing community that fishermen will be prosecuted or that information will result in closing a fishery. Of note, only one individual has been prosecuted for a monk seal death; the case involved the intentional shooting of a seal. Two respondents in Kauai noted that the public information regarding who to call for monk seal interactions is not widely known or consistently circulated.

The lack of information from fishermen has a number of consequences. It hinders the ability of the program to: respond to an injured seal; appreciate the likelihood for fisheries interactions to happen; and understand the mechanics of the interaction and possible mitigation opportunities. NMFS Pacific Island Fisheries Science Center has supported research to address community perceptions of monk seals and their perceived negative impact on marine resources and fishermen's livelihoods. These include social science research on historical references to monk seals on the MHI and research on monk seal eating habits – amounts and preferences (cf. Kittinger et al. 2011 and Sprague at el. 2013).[36] NMFS staff also fixed camera equipment, called a "crittercam", to a monk seal to transmit video footage of monk seal feeding behavior.

Interviews suggest that most fishermen-respondents were not familiar with or convinced by these research efforts. One community resource spokesman explained "the loss of a way of life - which is deeply emotional and spiritual - cannot be changed by logic or scientific evidence." Few respondents were aware of the diet research. The most frequently used term by fishermen to describe monk seals was "opportunistic" in reference to catch predation, suggesting that fishermen believe that monk seals will feed on whatever fish species is most easily available. Those respondents that were aware of the crittercam felt the images were effective in dispelling some myths, held by fishermen, regarding monk seal foraging behavior.

[35] The public are encouraged to report monk seal sightings, strandings, interactions, and other events to the Marine Mammal Response Network. The network has a toll free hotline and local phone numbers where calls are received by staff of NOAA Fisheries Pacific Island Regional Office (PIRO) and island coordinators of the Marine Mammal Response Network (cf. Chandler et al. 2015).

[36] The purpose of the Sprague et al. (2013) study was to estimate biomass eaten by total population and degree of overlap with commercial and recreational fisheries.

Research Results Suggest:

1) Fishermen in many fisheries have not experienced regular or any interaction with monk seals. In most cases, fishermen are more concerned with other sources of predation (sharks, eels), other types of marine species interactions (sea turtles, cetaceans), and/or other types of dangers. As a result, fishermen are not able to identify a pattern of interaction or effective monk seal mitigation solutions that work best for their gear type and fishing locations.
2) Some commonly held perceptions regarding monk seal behavior may result in fishermen engaging in avoidance behavior – some of these perceptions may be accurate, for example, regarding monk seals' tendency to stay in a location for a few days and then move on, while others are not, for example, monk seals scare fish away. Other commonly held misconceptions may encourage fishermen to be less vigilant in assessing their environment before engaging in fishing – for example, monk seals do not feed at night.
3) Many respondent fishermen report a deep disconnect between their world views of the natural environment and their perceptions of the goal and methods of NMFS management. Fishermen frequently said that monk seals "should be scared of humans." From this perspective, the establishment of spatial buffers on beaches, and the illegality of using certain deterrence methods, only encourages seals to get used to and approach humans and thus increases the potential for loss of catch and danger to fishermen.
4) Some types of fishing (conducted in some locations) may have communication networks that facilitate (or could be used to facilitate) information regarding monk seals. For example, the spear fishing community in MHI has an active internet based community that frequently exchanges information regarding diving conditions; small boat vessel operators also frequently fish in groups that exchange information regarding fish bite and predation; and according to respondents, net fishermen share information regarding monk seal presence within their community.[37]
5) Without clearer rules regarding deterrence, it is likely that fishermen will react to protect their catch, gear, and themselves by attempting to distract monk seals by offering fish. This can result in monk seals learning to associate people with fish and becoming aggressive in seeking it out.
6) Current effective outreach strategies suggest that a variety of stakeholder and community engagement activities will be necessary, and that attention should be paid to children and young adults, as the next generation of fishermen are capable of influencing parents and grandparents. Outreach goals may vary from creating of a sense of stewardship for monk seals to creating a level of tolerance for monk seals.

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