# Final Progress Report

**A Field and Household Assessment of Non-commercial Fishing, Per Capita Consumption and Trade Patterns for Coral Reef Fishery Management Improvement in Pohnpei, Micronesia**

**NOAA Coral Reef Conservation Grant NA08NMF4630458**
**Socioeconomic Assessment and Resource Evaluation**

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# Table of Contents

# Executive Summary

Field and household assessment conducted in 2009 and 2010 succeeded in establishing non-commercial (subsistence) catch levels in Pohnpei, Micronesia. Based on surveys, the annual volume of subsistence catch is approximately 227 mt (500,000 lbs.), with per capita coral reef fish consumption levels of 17-20 ± 2.0 kg $cap^{-1}$ $yr^{-1}$. In combination with previous findings from market surveys, the total reef fish volume in Pohnpei is *ca.* 725 mt $yr^{-1}$. If these estimates hold true following final assessments, current levels of catch are 149% over sustainable yield, basically equivalent to total subsistence catch. In all, five survey components were completed to generate the previous estimates: (1) a survey of 585 households to establish the demographic profile of the fishing communities and per capita consumption levels; (2) a 1-month airport survey of 72 individuals to detail export volumes, origins, destinations and contents; (3) a survey of 21 businesses and schools to determine additional non-marketed, non-subsistence volumes from the reef fishery; (4) a fisher perception survey of 647 fishers to establish views on resources and management; and, (5) a field-based subsistence fishery survey to examine catch composition, volumes and methods. Among findings, the fisher perception survey found widespread concerns about reef resources and broad support for a range of management measures, including marine protected areas, gear restrictions, species bans, size limits and limits on foreign fishing. Fisher licensing and boat registration were given substantial support and would prove a valuable tool in monitoring and enforcement. Fishers perceived reef fish resources and reef quality to be in decline, with unsustainable fishing practices and environmental degradation the main factors mentioned. Unlimited catch volumes and fishing across all of the available size range were the most commonly mentioned causes of resource decline. In short, fishers mentioned that too many fish are being taken and most are too small, a departure from traditional fishing practices. Fishers expressed an interest in participating in developing management plans and their involvement would improve the potential for management success. Fishers were supportive of co-management options that include greater responsibilities in monitoring and enforcement by local (municipal) government, with state government favored in

handing out punishment. Fines and jail time were the most highly mentioned form of punishment for management violations. Few fishers thought fishing violations should go unpunished. Support was strong for municipal marine tenure across all municipalities, whereby municipalities have greater authority to restrict and monitor fishing activities within their waters. Broad support was also shown for catch, sale and export bans of all sizes of bumphead parrotfish (*Bolbometopon muricatum*) and humphead wrasse (*Cheilinus undulatus*), two locally important species that are in rapid decline and in danger of local and regional extinction. In the view of fishers, the legislative response to development and passage of marine management laws needs substantial improvement. Business surveys showed that approximately 7% (38 mt) of the demand for reef fish is from industry and academia, with the majority of fish purchased directly from markets. This represents a relatively insignificant component of the overall demand. In comparison, airport export volumes are estimated to be *ca.* 21 mt reef fish $yr^{-1}$, or 4% of the total extracted reef fish volume. Primary destinations for exported fish were Hawaii and Guam (50% of the combined total), and the US mainland. Similar to businesses, most exported fish was purchased directly from markets. The survey results provide the basis and support for the development and implementation of a comprehensive marine resource management strategy.

# Introduction

Assessments of catch statistics and trends in fish populations provide the basis of decision-making for fisheries management. In the tropical Pacific, however, few nations record catch statistics accurately or systematically, such that changes in fisheries and fish populations often go undetected (Zeller et al. 2006). This is particularly true for nearshore coral reef fisheries that form the basis of food security, income and recreation for millions of coastal Pacific communities (Munro 1996). To improve the ability to properly manage fisheries and maintain coastal fishing livelihoods, there is an urgent need to gather reliable fisheries statistics, particularly given the impact to small-scale commercial and subsistence fishers from fish population declines or loss.

In Pacific locales where statistics are available, or have been reconstructed, substantial declines have been noted (e.g. Zeller et al. 2006). In other instances where statistics are lacking, anecdotal reports of declining populations, individual fish size, catch per-unit-effort and spawning aggregation loss point to dramatic, yet unrecorded changes to fisheries resources. Such is the case for Pohnpei (Micronesia), where there are plausible anecdotal reports of declines in fisheries and where local populations are increasingly reliant on fishing and associated industries. Indeed, at least 10% of the total population and up to 30% of the municipal workforces are dependent on fisheries-based resources—an increase of greater than 400% from 1980 (Pohnpei State Government 1996). Despite the increasing reliance on nearshore marine resources and the importance of these resources to the state economy, resource managers have not kept adequate statistics, making management decision-making problematic and increasing the potential for catastrophic shifts in local reef ecosystems (Bellwood et al. 2005). Therefore, at a minimum, records of current catch and consumption and greater details of the fishery are sorely needed to provide a baseline for future comparison and allow informed decision-making to proceed.

A systematic market survey of the Pohnpei nearshore coral reef fishery in 2006 provided marine resource managers with reliable baseline statistics for the small-scale commercial fishing sector (Rhodes and Tupper 2007; Rhodes et al. 2008). Findings from

those surveys showed that greater than 1,520 kg $d^{-1}$ (>500 mt $yr^{-1}$) are extracted and sold from reef and lagoon areas immediately surrounding the main island. The survey also utilized standardized market surveys to provide spatial and temporal details of fishing effort by municipality and reef area and highlighted the predominance of juveniles in catch and an overwhelming use of unsustainable fishing methods (i.e., nighttime spearfishing), both requiring immediate management attention. However, several facets of the coral reef fishery remain undocumented, particularly the subsistence fishery. Since variations in target species and areas may exist and because the volume of catch within subsistence fisheries is often substantially greater than commercial catch, an examination of the sector is warranted prior to enacting comprehensive management reforms for the coral reef fishery. Thus, the picture of Pohnpei's coral reef fisheries remains incomplete, including household consumption and other non-market uses (e.g., export, academic and hospitality consumption). For management, it is imperative that non-commercial fishing and marine resource usage be documented to fully comprehend where and how management should be applied and to provide a complete baseline dataset for informed future comparisons. Moreover, several management recommendations that have been proposed for the commercial sector are pending, since management changes in lieu of subsistence and other non-market statistics may be ineffective or alter the current manner of fishing and marketing, e.g., increase subsistence fishing levels (Rhodes et al. 2008).

## Objectives

The primary objective of the survey were to determine the amount of reef fish being extracted from Pohnpei's surrounding reef and lagoon by the non-commercial (subsistence) fishing sector, and to document per capita consumption values and other non-market exchanges of reef fish in Pohnpei. Non-commercial volumes are to be added to previous volume estimates from commercial fishing (Rhodes and Tupper 2007; Rhodes et al. 2008). These values will provide a total extraction volume of coral reef fishes from Pohnpei surrounding reefs. These totals will, in turn, direct and gauge management needs by fishing sector and develop educational and awareness materials for

stakeholder involvement in, and understanding of, management decision-making. Total consumption values (volumes) will also be used to estimate the current sustainability level for reef fish resources in Pohnpei, based on local reef productivity and consumption values, as determined through marine ecological footprint analysis (e.g. Warren-Rhodes et al. 1999). In addition to estimating non-commercial volumes of reef fish taken, the proposed project also examines fisher perceptions of recent changes in the fishery, current and future management, and marketing practices for improving fisher participation in the development of management, monitoring and enforcement initiatives. These (and recent past) findings will form the basis of discussions for the development of a comprehensive marine resource management strategy.

# Methods

The project determined reef fish consumption patterns, subsistence catch volumes, non-marketed fish exchange and fisher perceptions of market and management practices, using household, airport, market and field surveys in Pohnpei, Micronesia (***Figure 1***). Survey instruments were designed and then translated into Pohnpeian prior to field-testing. Pre-testing was conducted over a 2-week period prior to actual surveys. During the same period, local staff was trained in basic, standard research techniques. Staff was trained in response interpretation, recording and evaluation. Training and surveys were coordinated with the Office of Fisheries and Aquaculture. Prior to field trials, questions were presented to local NGO Conservation Society of Pohnpei staff familiar with local customs and experienced in conducting local surveys. The sample size for household-per capita consumption (***Appendix A***) and fisher perception surveys (***Appendix B***) was set at 10% of the total number of households (FSM 2000) and conducted over *ca.* 5-week periods (February-May 2009). Other surveys were conducted for *ca.* 1-month each and overlapped with household surveys. Business (***Appendix C***) and airport surveys

(***Appendix D***) were conducted by different personnel than those used in other surveys.

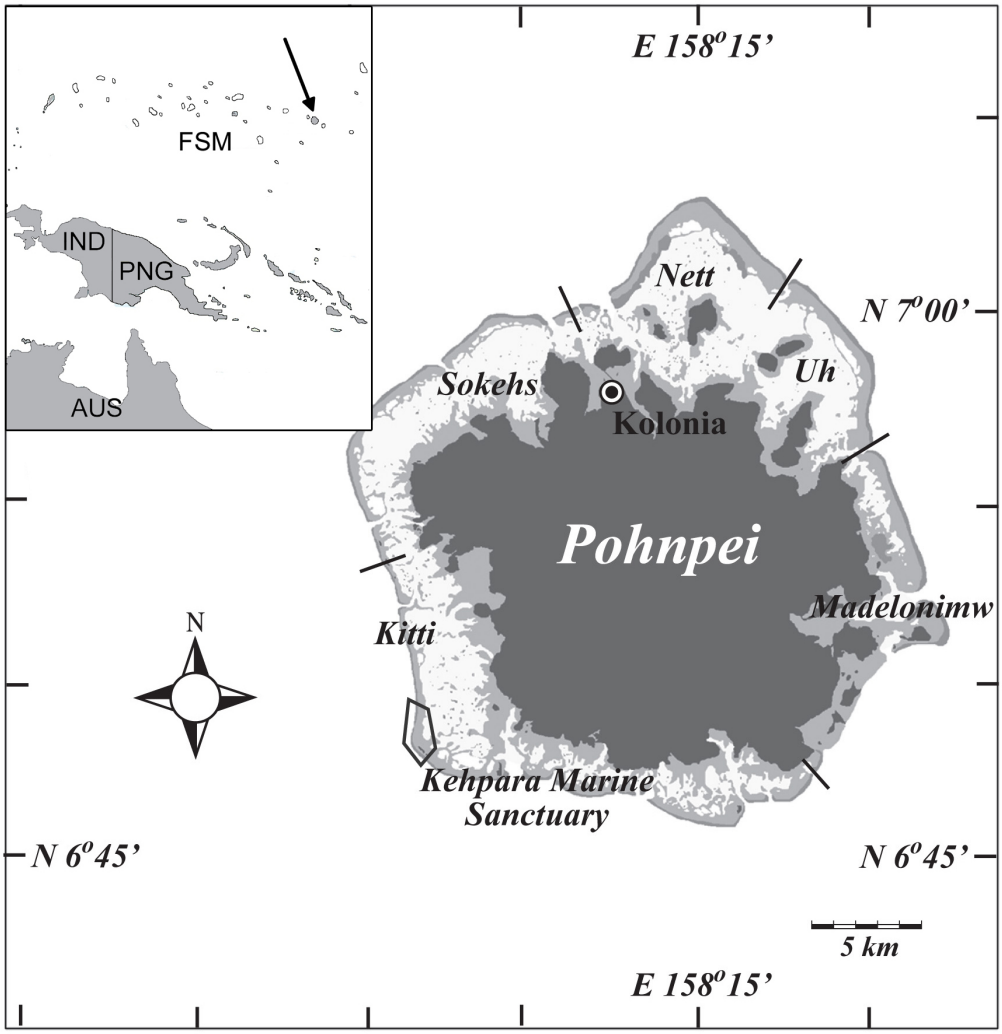


*Fig. 1. Map of Pohnpei showing the commercial center, Kolonia, and listing each of the five municipalities.*

Subsistence fishing surveys (***Appendix E***) were conducted in 2010 between February and May. The latter surveys were conducted by Marine Conservation Unit officers and assisted by local fishers. All interviews were conducted under a confidentiality agreement, with respondents and responses remaining anonymous. Previous fisher participation, i.e., during 2006 market surveys, did not result in any known negative impacts to participating fishers or the fishing community.

## Household surveys/Per capita fish consumption

Household surveys were conducted haphazardly within each of Pohnpei's five municipalities using standardized interview questionnaires (***Appendix A***). The aims of household surveys are to determine (1) the number and percent of subsistence fishers in Pohnpei relative to both the commercial sector and population as a whole, (2) per capita reef fish consumption values, and (3) the origin (caught or bought) and type (species) of reef fish consumed. Household survey data were also structured to provide information on spatial and temporal subsistence fishing patterns. According to the 2000 FSM Census of Population and Housing, there are approximately 37,000 individuals in Pohnpei and approximately 6,000 households (extrapolated from 2000 census data). The household survey targeted 685 households, equivalent to 11.4% of the population. Sampling effort was stratified within each municipality, based on population. The household survey strategy allows relative comparisons among municipalities, for example, of subsistence fishing methods, locales, target species and effort, and helps guide management and awareness efforts. Findings from the study will be used together with those from the commercial sector (Rhodes et al. 2008) to provide a more complete picture of Pohnpei's coral reef fish fishery. Surveys also provide a detailed demographic profile of fishing household, since records now exist for the number of family members, income and education level, primary occupation, preferred and targeted reef fish, fishing times, frequency and locales, gear, boat and motor type (if motorized). To ascertain the true number of subsistence fishers, fishers will also be asked whether they participate in commercial fishing and, if so, the percentage of the time devoted to commercial and non-commercial fishing. Surveys were conducted in-home.

## Fisher perception survey

During the fisher perception survey (28 March and 11 May 2009), individual fishers were asked their opinions about the condition of the fishery, the reef community over their fishing history, market practices and management, and government response, using a semi-structured survey. Surveys also requested information on fishers' experience level,

age, and municipality, among others (***Appendix B***). Questions were also asked in support or opposition to various types of management for bumphead parrotfish (*Bolbometopon muricatum*) (local name: *kemeik*) and humphead wrasse (*Cheilinus undulatus*) (local name: *merrer*). Questions were tested prior to field sampling to gauge sensitivity, improve responses and reduce potential bias. Fishers targeted for surveys were those identified during household surveys. Survey personnel were the same as those used during the household survey. Various types of management were included in questions to identify where awareness training is needed and to highlight which of the management options may be forwarded immediately. Fishers (primarily commercial fishers) were also asked their perceptions of current marketing practices and pricing. The latter questions were asked to determine the potential for development of fishing cooperatives in the state as one possible measure to help alleviate current fishing pressure. All participants were provided a description of the survey and given the choice to decline participation (***Appendix F***). All surveys were conducted in Pohnpeian.

## Business and Airport Surveys

To determine relative non-market trade volumes and origin and frequency of reef fish purchases, airport and business surveys were conducted over a *ca.* 1-month period each. Business surveys (***Appendix C***) entailed interview with fish buyers or owners. A similar survey was used successfully during commercial fish market and preliminary business surveys in 2006 (Rhodes et al. 2008). Business surveys included primary, secondary and tertiary institutes (e.g., College of Micronesia, Pohnpei Island Central School), and restaurants and hotels identified or listed by the Pohnpei Chamber of Commerce and Department of Education.

Airport export surveys (***Appendix D***) targeted outbound Continental Airline flights, the sole carrier for the island. To determine reef fish volume and identify the composition of exports, outbound passengers were approached and asked to participate in the surveys. The objectives of the survey were explained to each passenger, along with an option to decline an interview. Igloo-type coolers (used to transport marine products) were then examined for contents weight (nearest kg), with fish sorted to species. Records

of the two most common families were recorded. Simultaneously, surveyors interviewed individuals exporting products. Questions included the origin of capture or purchase, the intended destination, the approximate number of trips taken per year and the approximate number of trips that fish are exported.

### Subsistence use

The project documented subsistence fishing practices and catch through haphazard field surveys (***Appendix E***). Surveys were conducted by trained Marine Conservation Unit officers with the assistance of local fishers. The survey objectives were explained to individuals to be interviewed and each person was given the choice to opt out. Participants were asked a series of questions from the survey and each catch was examined and recorded, with weights taken for each fish family. The information was intended to provide a snapshot of catch method and composition and to allow comparisons to data taken in 2006 from the commercial fishery.

Catch-per-unit-effort (CPUE) was ascertained through interviews that provided fishing time, the number of fishers and catch volumes. Records were taken on fisher origin, gear and vessel type, along with the frequency of trips per week and average time fishing.

## Results

### Household surveys

Information from a total of 593 (out of 685 total) households was analyzed to provide a demographic profile of Pohnpei and provide per capita consumption values (***Figure 2***). Of the respondents 59% were male and 41% were female. The mean number of persons residing in each household was 8.3 and the mean number of employed persons per household was 1.4. ***Based on combined surveys, the mean annual reef fish consumption for 585 households for 2009 is 17-20 ± 2.0 kg cap$^{-1}$ yr$^{-1}$.***

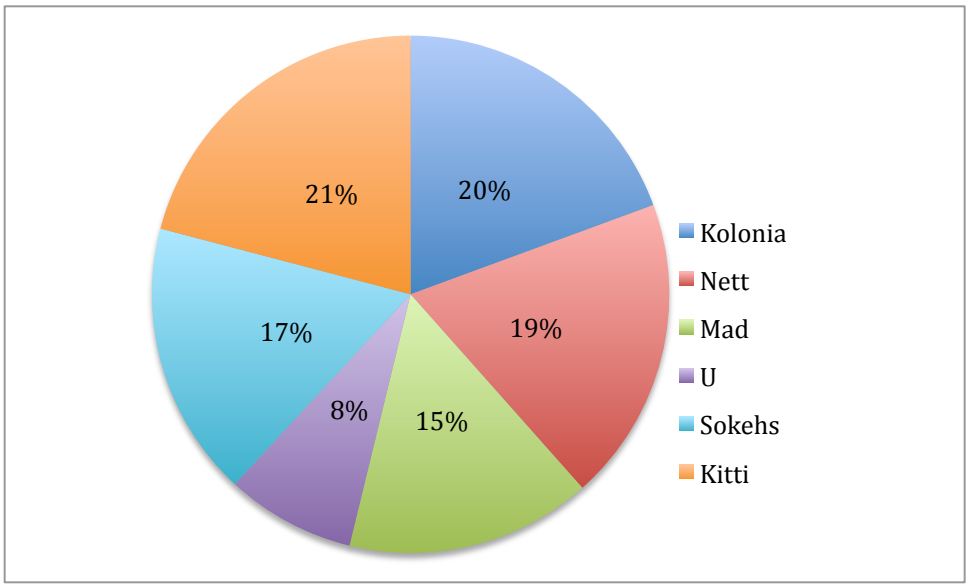


*Fig. 2. Percent of households interviewed by municipality.*

Of the total number surveyed, 376 households included fishers (n=1436 fishers). The average number of fishers per household was 1.3 persons, with an average of 63% of all households surveyed having at least one fisher in the household. Overall, 92% of fishers in the household were male and 8% were female.

Madelonimw Municipality had the highest percentage of households with fishers (88%), followed by Uh (69%), Sokehs (68%), Nett (64%) and Kitti (62%). Kolonia Town had only 39% of households with fishers (***Figure 3***). Similarly, Madelonimhw and Uh had the highest percentage of female fishers (11-13%), whereas Sokeh's had the lowest (3%)

Roughly 50% of all fishers interviewed had a primary school education, *ca.* 30% a high school education and *ca.* 15% had some tertiary schooling (beyond high school) (***Figure 4***). Fishers on average fished 1.8 days per week for reef fish (***Figure 5***), with 1.2 of those days strictly for food. Fisher from Kitti municipality on average fished for reef fish most frequently (2.4 days per week), versus those from Nett most infrequently (0.78 days per week).

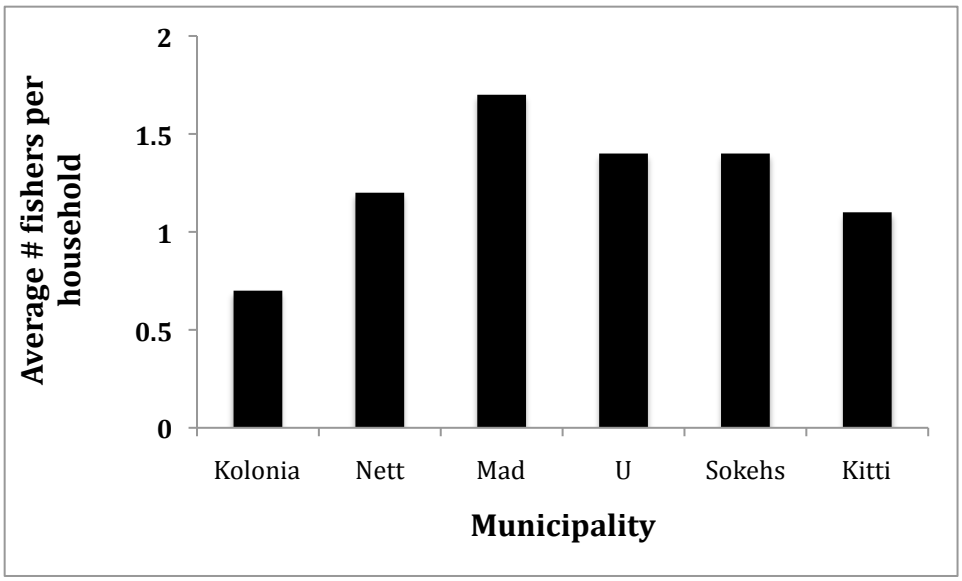


*Fig. 3. The average number of fishers per household by municipality.*

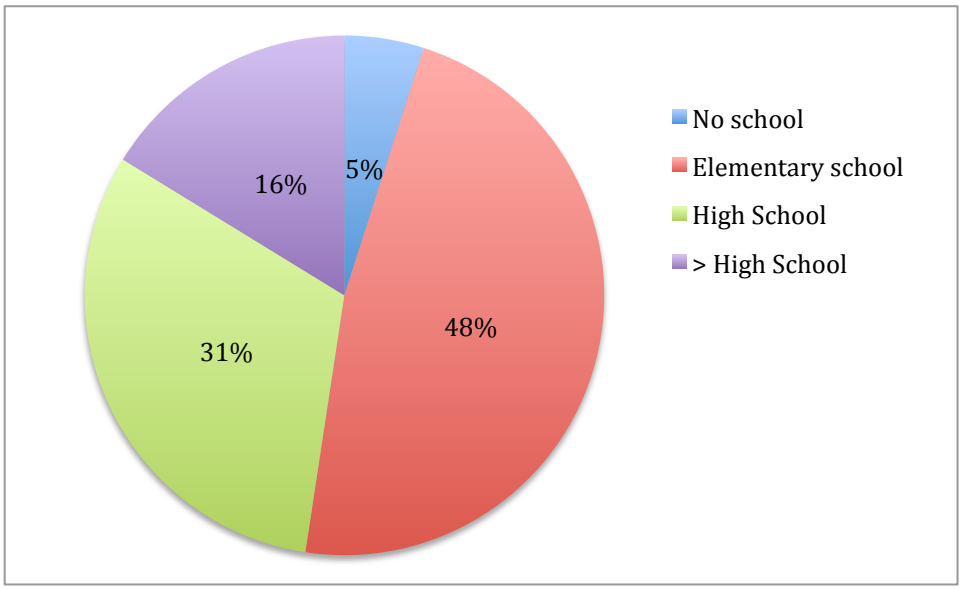


*Fig. 4. Educational backgrounds of fishers in all six municipalities.*

On average 57 lbs (25.9 kg) of reef fish is caught per week by fisher in all municipalities (***Figure 6***), with Kitti fisher catching 93 lbs $wk^{-1}$ (42.2 kg) and those in Nett the least at 36 lbs $wk^{-1}$ (16.3 kg). Roughly 40% of all reef fishers sell their catch, but this varied significantly between municipalities, with 40% of fishers interviewed in U municipality

and 70% of fishers in Kitti indicating they sold reef fish (***Figure 7***). (The percentage of households selling catch was roughly similar).

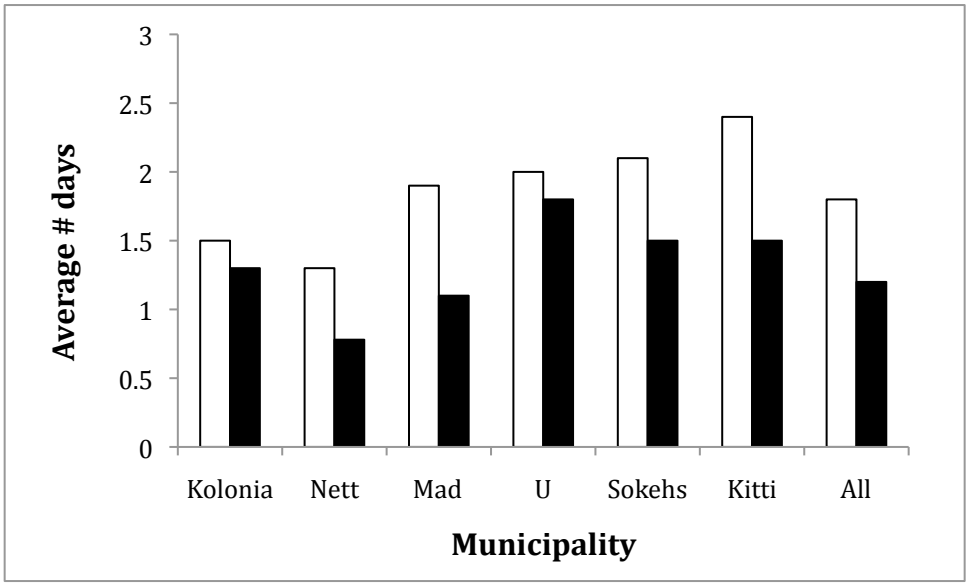


*Fig. 5. The average number of days of fishing per week by fishers surveyed. White= All reef fishing; Black = subsistence fishing only.*

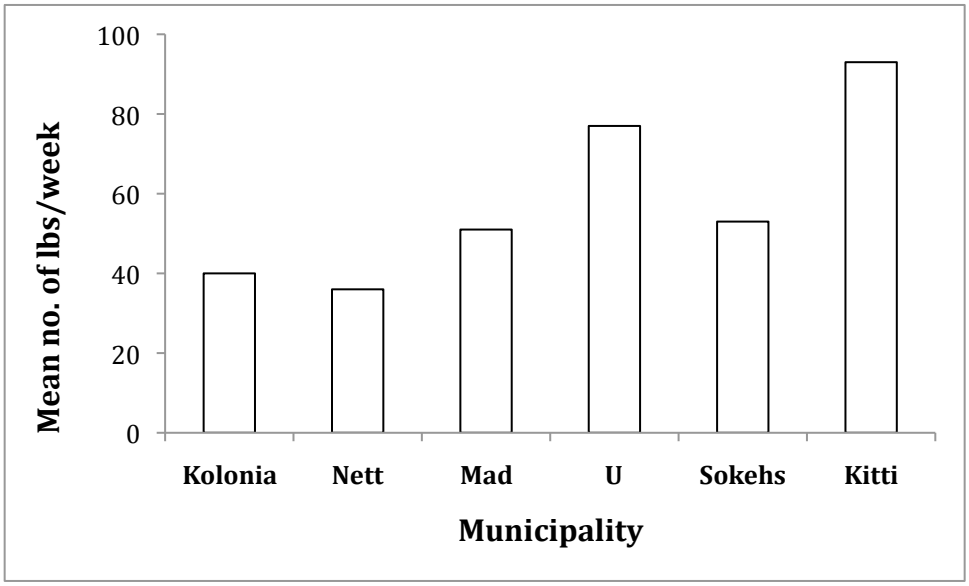


*Fig. 6. Mean number of pounds of reef fish caught per week by fisher.*

Overall, fishers indicated that 60% of their reef fish catch was kept for household consumption, whereas *ca.* 25% was sold and 15% given away to friends and relatives. Only six respondents indicated they traded/bartered reef fish, usually about 5% but up to

25% for one fisher. Kitti fishers, known to contribute the most to the commercial fishery, claim that 72% of their household incomes, on average, comes from the sale of reef fish (***Figure 8***).

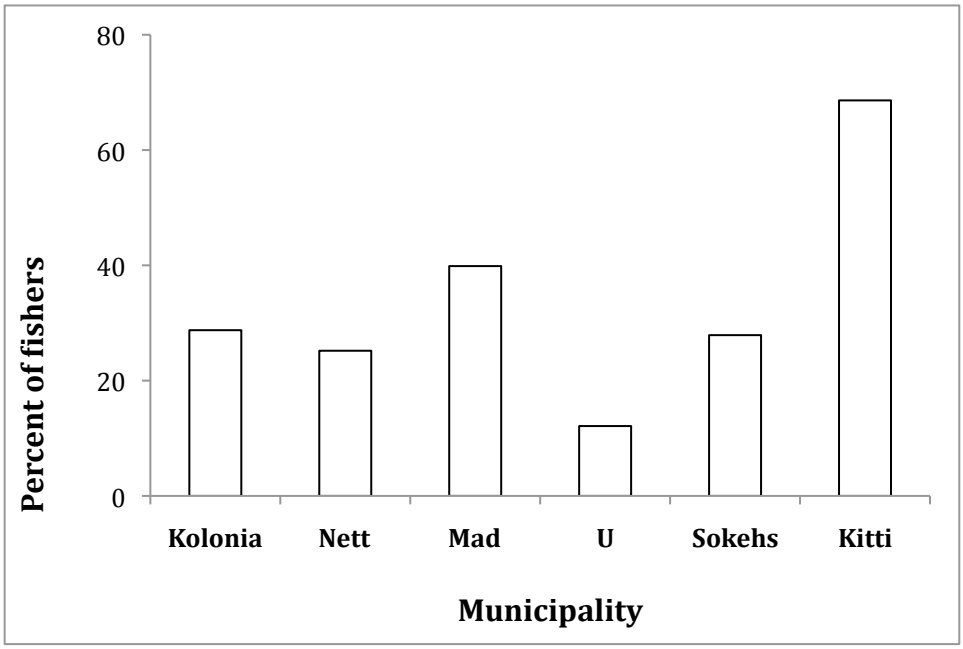


*Fig. 7. Percent of fishers selling catch by municipality.*

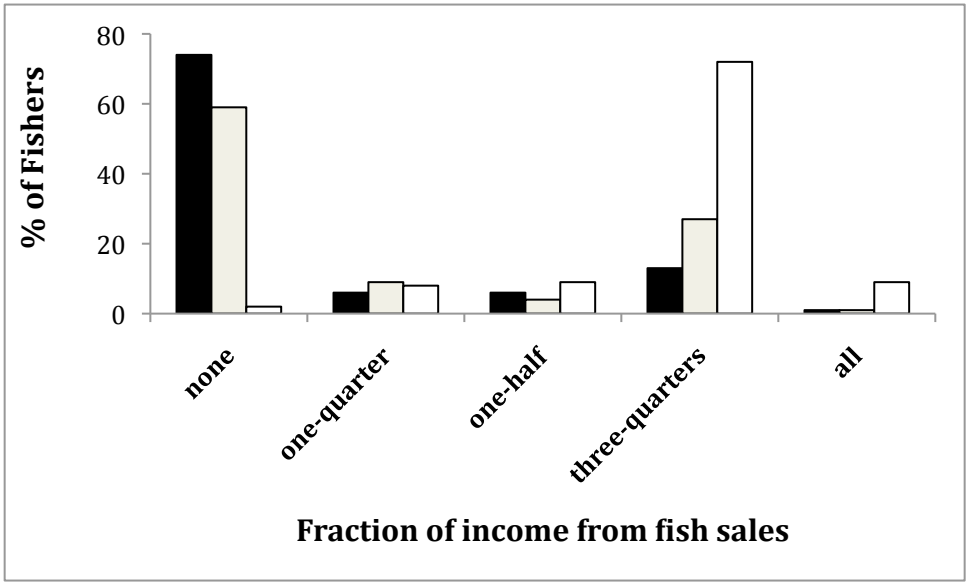


*Fig. 8. Fraction of total fisher income coming from sale of reef fish. Black =Nett Municipality, Grey = Madelonimw Municipality, White = Kitti Municipality.*

In terms of reef fishing, the top gear method of choice was (50% of all fishers) was spear, followed by hook & line (***Figure 9***). This differs substantially from the

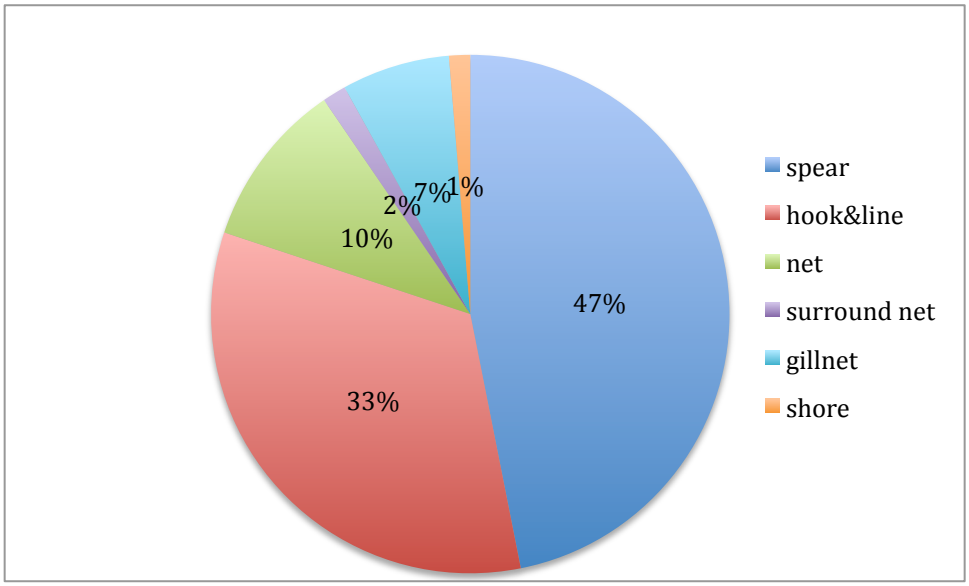


*Fig. 9. Proportional distribution of fishing effort by gear.*

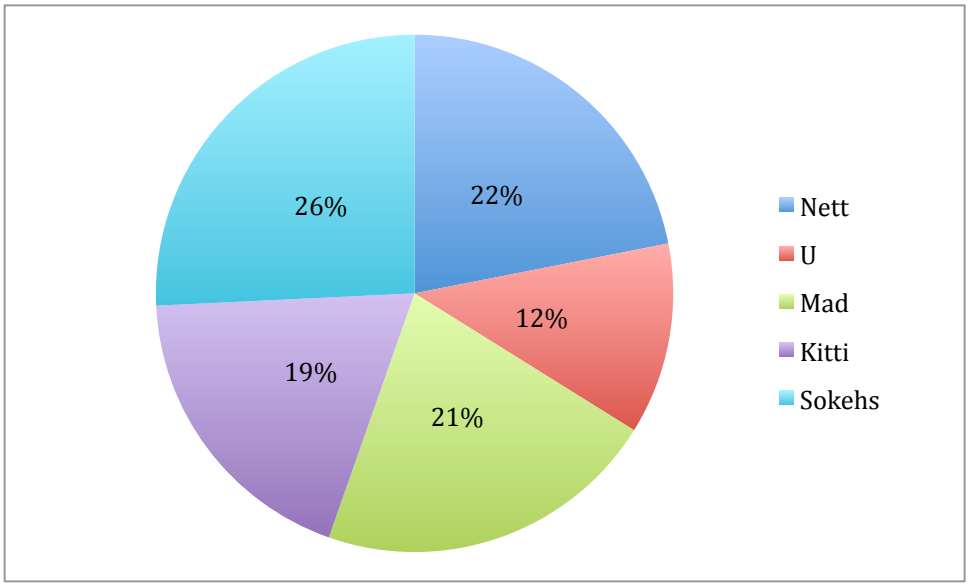


*Fig. 10. Percentage of fishing effort by area in the coral reef fishery.*

commercial fishery, where 70% of fishing is conducted by spear and only a minor proportion by net (Rhodes et al. 2008). Net is the preferred method of catch in U and Madelonimw, where subsistence fishing exceeds commercial fishing.

Overall, most fishers fish within their own municipalities (***Figure 10***). Only three fishers (Kolonia, Kitti) mentioned fishing at Ant Atoll and Pakin. These results differ somewhat from the commercial fishery alone, where nearly 50% of Kitti fishers live and fish in Kitti, but otherwise fish in outlying municipalities. An overwhelming preference for inside lagoon reef fishing was found in the survey (70% of fishers) for all fishers for all municipalities, with about 30% fishing coral reefs both inside & outside. Only Kitti Municipality indicated an approximately equal preference, with 54% indicating they regularly fished both inside and outside reefs. These results are similar to previous findings from the commercial sector.

The top five fish families preferred in catch were similar between the fishery as a whole and the commercial sector. Families mentioned, in order of importance to fishers: 1) groupers (16% of all fishers), 2) parrotfish (16%), 3) surgeonfish and unicornfish (15%), (4) rabbitfish (15%), and 5) snappers and emperors (9%). These data concord with previous findings from the commercial sector, with surgeonfish the most frequent in catch, followed by parrotfish, grouper and snapper.

A roughly equal (*ca. 1/3*$^{rd}$) share of reef fish was obtained by being caught (27%), bought (35%) or given to them (33%). Only 5% of households indicated they had obtained fish through barter or trade. With the exception of urban Kolonia, where nearly half of all households bought reef fish for consumption, there was no significant difference in the relative proportions by municipality.

Overall, *ca.* 60% of households surveyed bought reef fish exclusively from public reef fish markets, whereas 40% also obtain their reef fish from other sources, namely friends, relatives, or direct from fishers. These results differed by municipality. When asked if recent price increases had changed how much reef fish the household buys, *ca.* 70% said that price increases had impacted their buying habits. The shift in habits was generally buying less fish or buying salt tuna. While the former is unlikely to affect respondents overall health, the increase in salt from changing habits is of concern.

## Fisher Perception Survey

A total of 647 fishers were interviewed across Pohnpei (main island) between 28 March and 11 May 2009. Approximately 100 interviews were conducted in each municipality (range=99-111), with a total of 139 villages visited (***Figure 11***). Interviews typically lasted 15-20 minutes each.

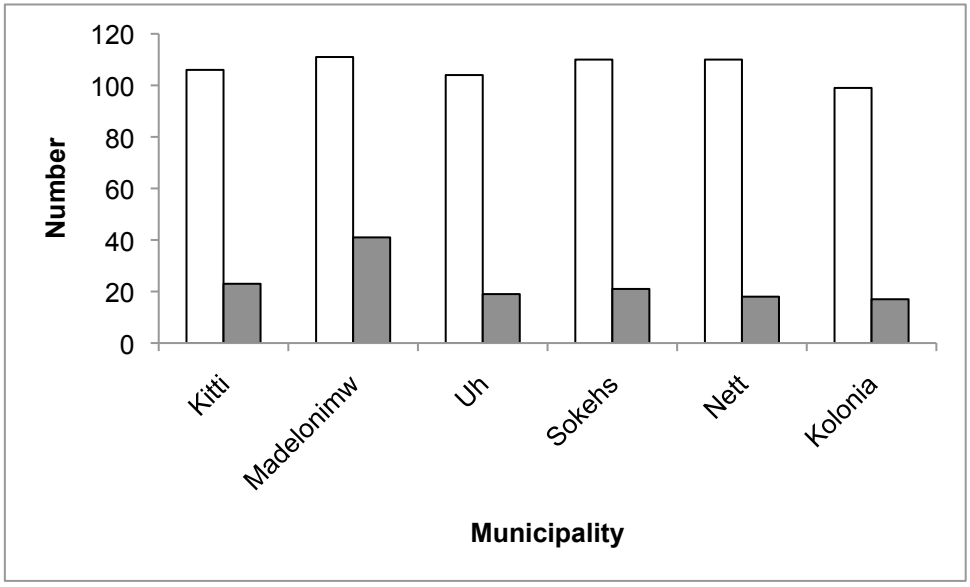


*Figure 11: Number of interviews by municipality (white) (n=647) and number of villages by municipality (grey) (n=139).*

Fishers interviewed ranged in age from 10 to 80 years old, averaging 39 years old (***Figure 12***). Approximately 60% of fishers were below 40 years of age. The average age that fishers began fishing was 13 years old. Fisher experience ranged from 1-60+ years, with an average of 26 years of fishing experience by all individuals. Most fishers had either an elementary of high school level education (***Figure 13***).

Among fishers interviewed, 45.1% were subsistence fishers, 0.5% were exclusively commercial fishers, while the remaining 54.1% were combined commercial and subsistence fishers. Most fishers interviewed used spear, followed by net, and then

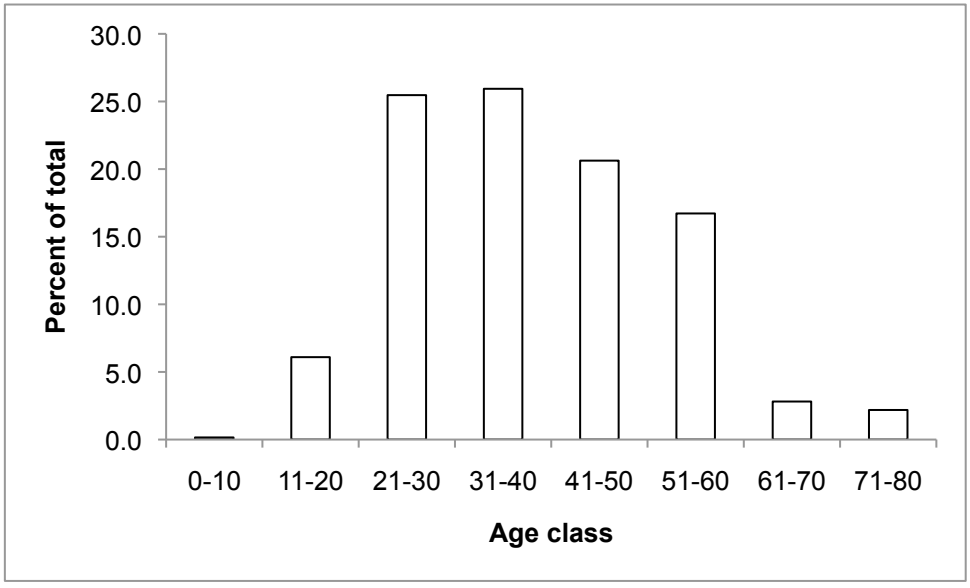


*Figure 12: Age structure of fishers interviewed (n=640). (Corresponds to Question #2 in Appendix B).*

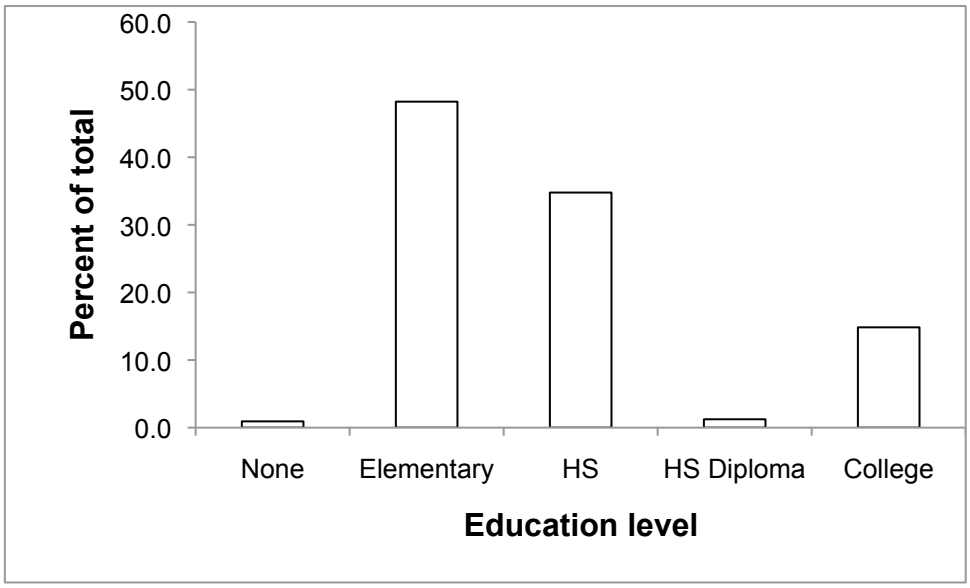


*Figure 13: Education level of fishers interviewed. (Corresponds to Question #2 in Appendix B).*

hook and line (***Figure 14***). During interviews, the use of handgun (local spear) and imported 3-prong Hawaiian sling were often combined, such that the contribution to gear use by local spear may be underestimated. When asked about the quality of reef resources

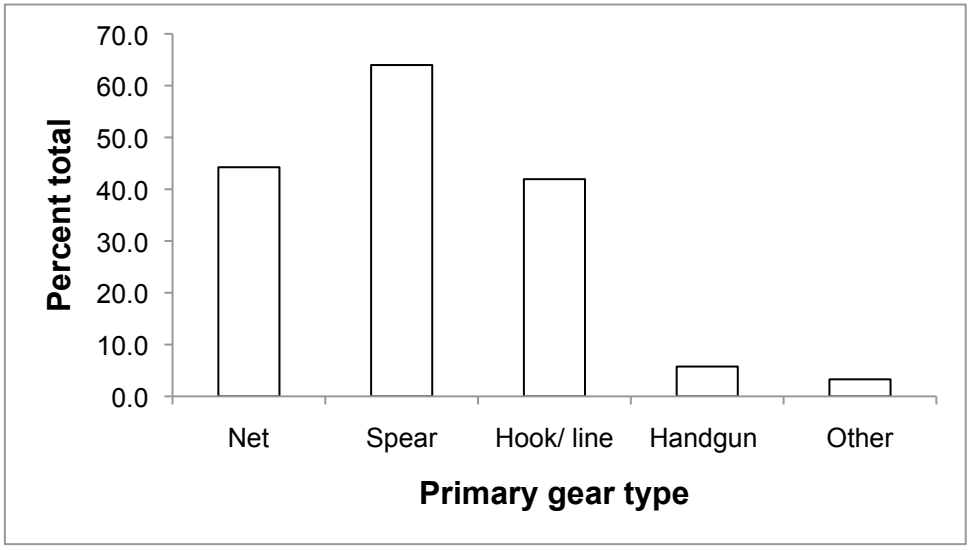


*Figure 14: Primary gear use by fishers interviewed (n=647). Fisher responses may include more than one gear type.*

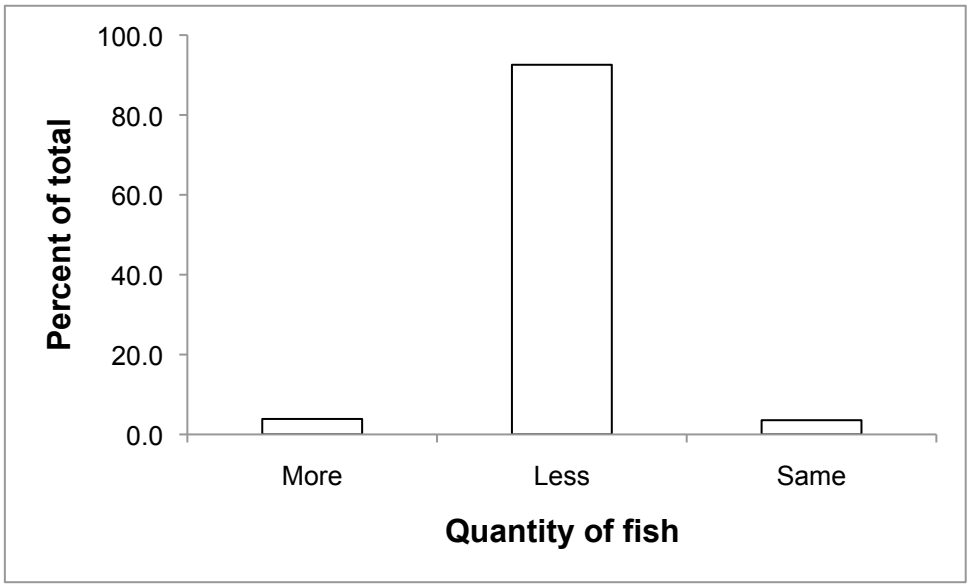


*Figure 15: The amount of fish relative to when fishers first started fishing (n=646). (Corresponds to Question #6 in Appendix B).*

relative to when they first started fishing, respondents overwhelmingly felt that reef resources had declined, with less fish (***Figure 15***), smaller fish (***Figure 16***), and worse reef quality (***Figure 17***). Repondents pointed to a number a causes creating the decline in reef resources ***(Figure 18***), led by pollution (43%), population increase (16%) and the

change to a cash economy (12%). Although not specifically listed in the survey, oil pollution eminating from foreign commercial fishing vessels was frequently stated as the primary source of pollution.

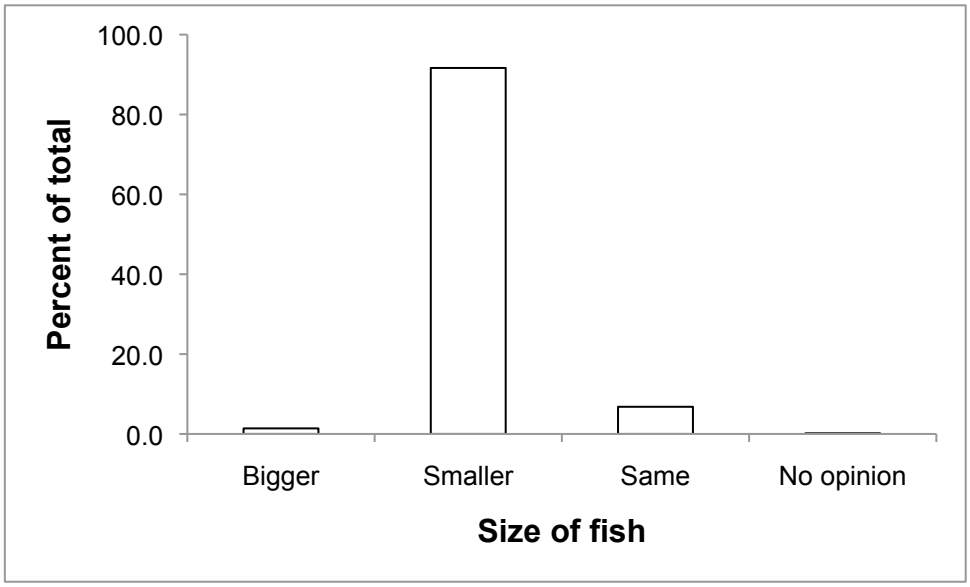


*Figure 16: The size of fish relative to when fishers first started fishing (n=647). (Corresponds to Question #7 in Appendix B).*

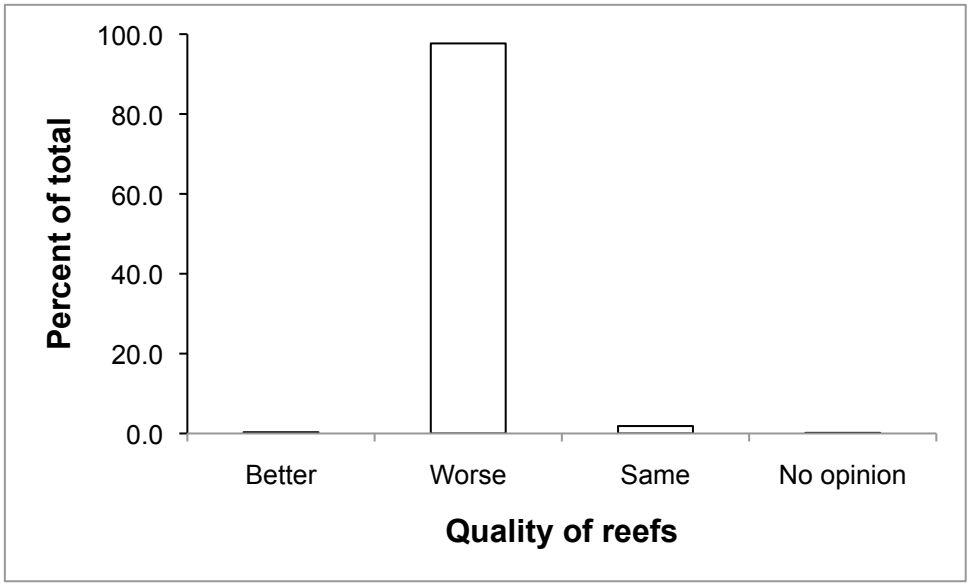


*Figure 17: The quality of reefs relative to when fishers first started fishing (n=646). (Corresponds to Question #8 in Appendix B).*

Dredging was often listed as a primary cause of reef degradation in areas where it is concentrated, such as Nett Municipality. Nearly all fishers felt there are more people fishing now than in previous years (***Figure 18***). Among the increase in the number of

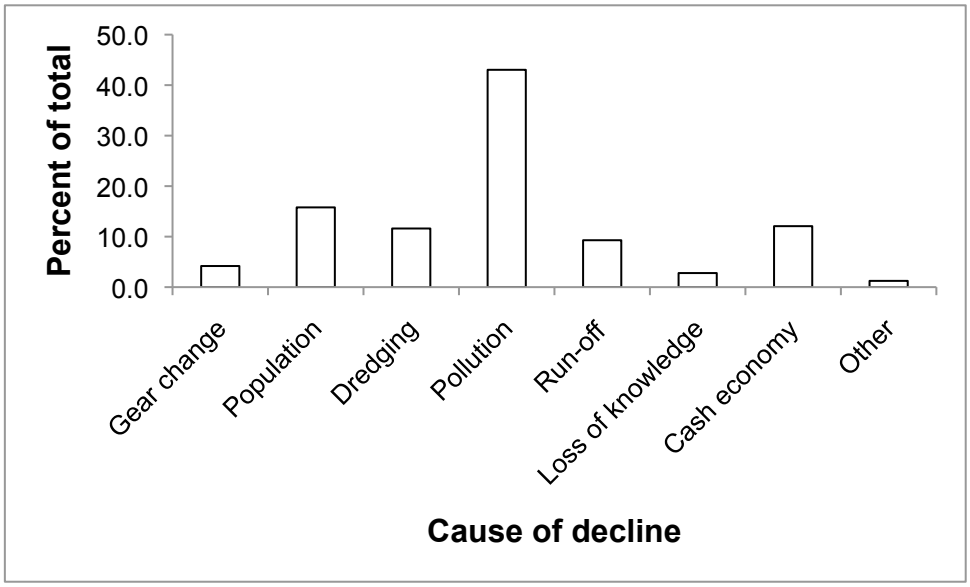


*Figure 18: The main cause of decline in reef quality stated by fishers (n=646). (Corresponds to Question #9 in Appendix B).*

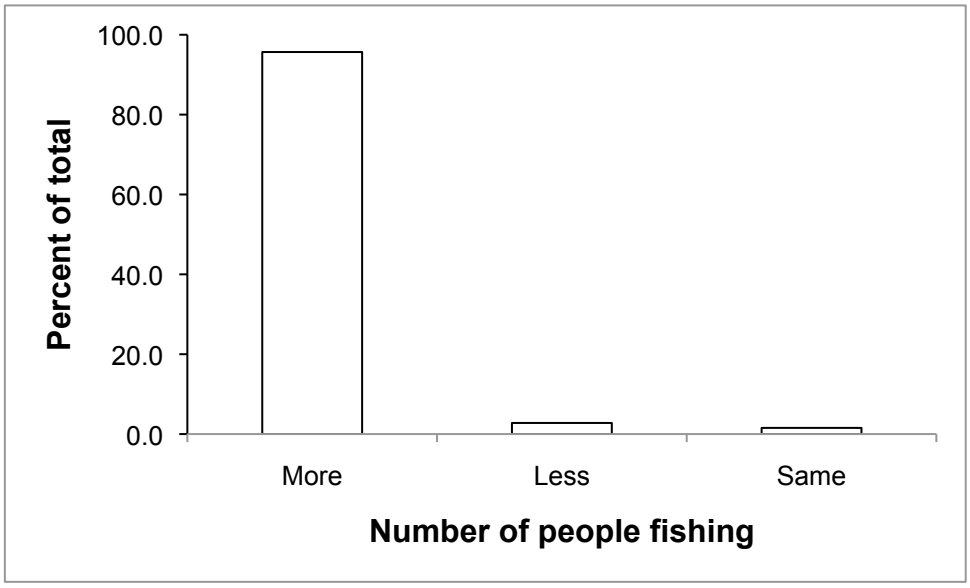


*Figure 18: The number of people now fishing relative to when fishers first started fishing (n=647). (Corresponds to Question #10 in Appendix B).*

fishers, there was an obvious age-associated difference in the manner in which fishers target fish. *Question #10 (**Appendix B**)* specifically asked patriarch fishers (fishers over 40 yrs old) whether younger generation fishers were better or worse at resource utilization. Over 90% of patriarchfishers felt the younger generation was poorer at protecting and utilizing reef resources (***Figure 19***). Fishers were allowed to provide open-ended responses on why they thought younger fishers took worse care of the reef. Among the responses given, older fishers felt that fishing across all sizes and no limits on fishing (or sales) volumes were the main cause (72% of total responses) (***Figure 20***). Other reasons listed included a disregard for the future generation and a focus on money, without regard for the consequences to reefs or the next generation of fishers or consumers. When asked about management, fishers overwhelmingly believed management was important to maintaining reef resources (98.3% of respondents). Based on responses, co-management is strongly supported, with municipal governments taking greater responsibility in monitoring and enforcement. Interestingly, fisher felt they were best at managing resources (***Figure 21***), even though resource declines are obvious and state involvement in management has been sparse. ***Nonetheless, fishers were largely supportive of a variety of state-imposed management options, with nearly all respondents supporting marine protected areas (MPAs), size limits, species bans and limits on foreign fishing***. The least support was given to limits to nighttime spearfishing, limits on the volume of fish sold and the number of fish caught (***Figure 22***), suggesting additional education and awareness is required for these management strategies. When fishers were asked whether they would work harder to support and monitor reef resources if given opportunities to develop management, the response was overwhelmingly positive. Fishers also widely supported boat registration and licensing, provided licensing and registration costs are absorbed or reduced by the state (***Figure 23***). In addition to support for management, fishers were strongly supportive of participating in management decision-making, and enforcement and monitoring. When asked whether they would work harder to protect resources if involved in fisheries management decision-making, 87% responded positively, with 12% stated they would not change their behavior.

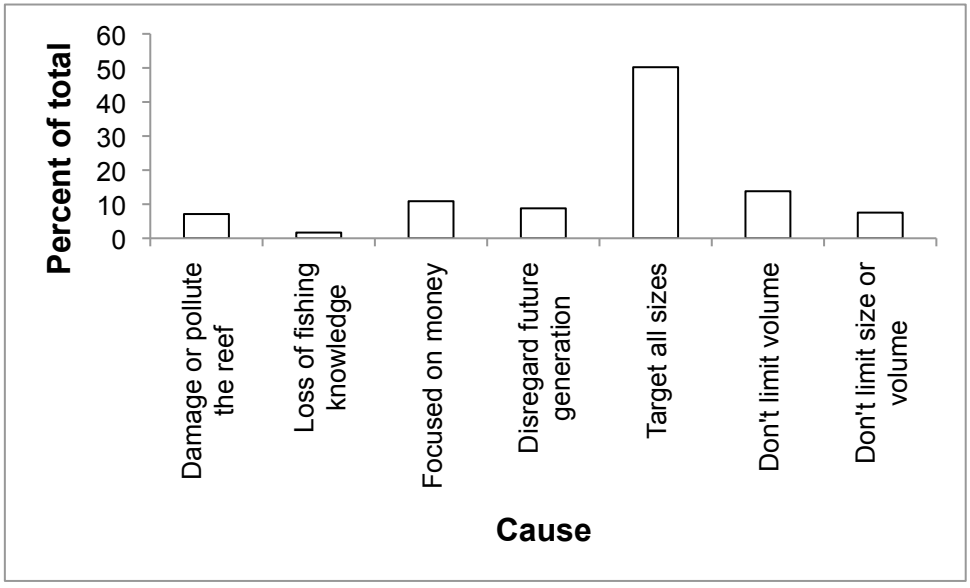


*Figure 19: Causes listed among patriarch fishers for why younger fishers are worse stewards of the reef. (Corresponds to Question #11 in Appendix B). (n=239)*

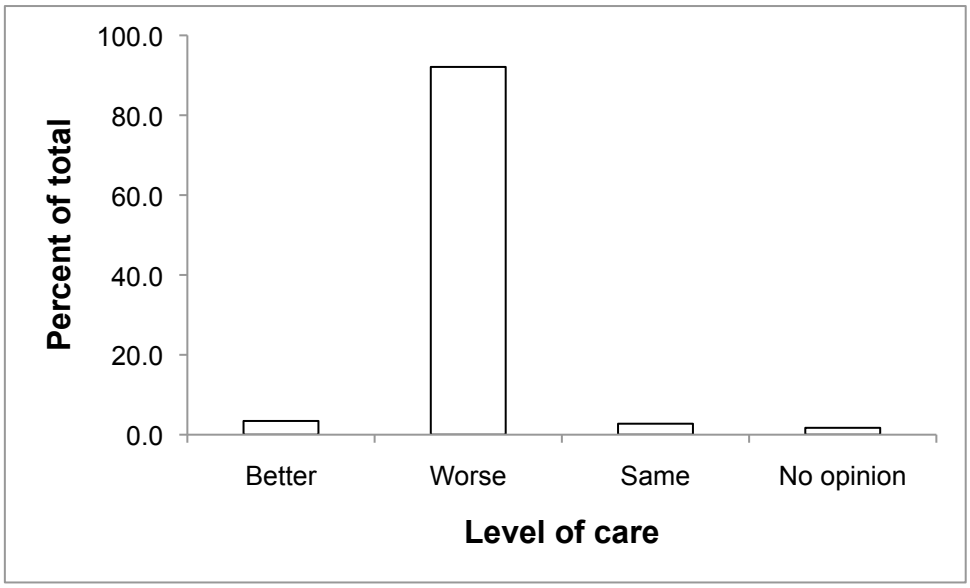


*Figure 20: The level of care given to reef resources by younger generation fishers, as stated by patriarch fishers (n=291). (Corresponds to Question #11 in Appendix B).*

In Pohnpei, fishers appear to recognize the need to protect two very vulnerable and culturally important species—bumphead parrotfish (*Bolbometopon muricatum*) and humphead wrasse (*Cheilinus undulatus*). The two species, known as ***kemeik*** (also *mwioakoahk*) and ***merrer*** (also *poros, painipokon)*. Fishers voiced strong support for a

sales and export ban for these two species outright (***Figure 24***). Less support was provided for a catch ban (*ca.* 60%). However, when asked whether they would support for these species knowing that they were going extinct locally and in Micronesia (as shown from recent scientific and anecdotal evidence), support for a sales, catch and export ban improved to nearly 100% (***Figure 25***).

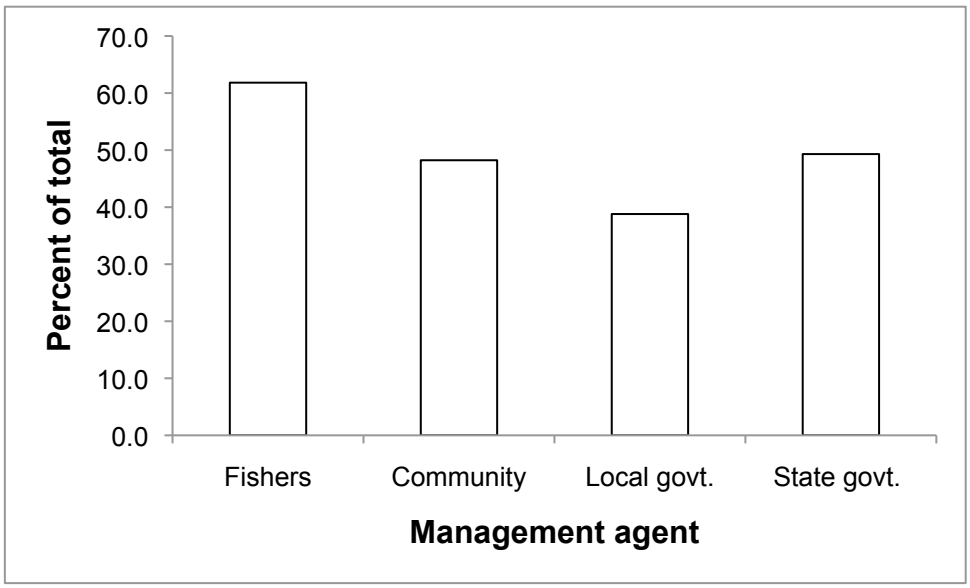


*Figure 21: The percentage of total respondents listing who they think is best at managing marine resources. (Corresponds to Question #13 in Appendix B).*

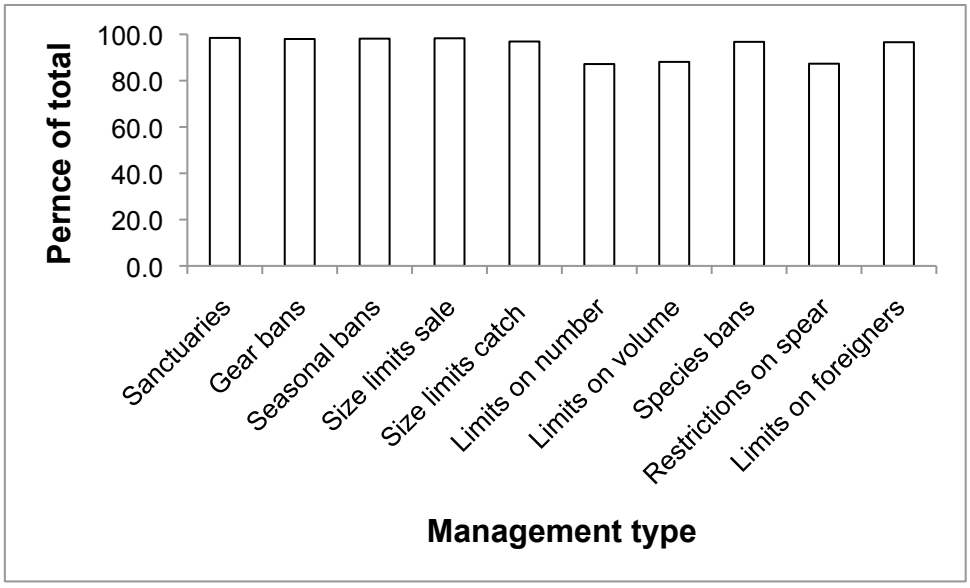


*Figure 22: Percentage of support for various management types among all respondents. (Corresponds to Question #18 in Appendix B).*

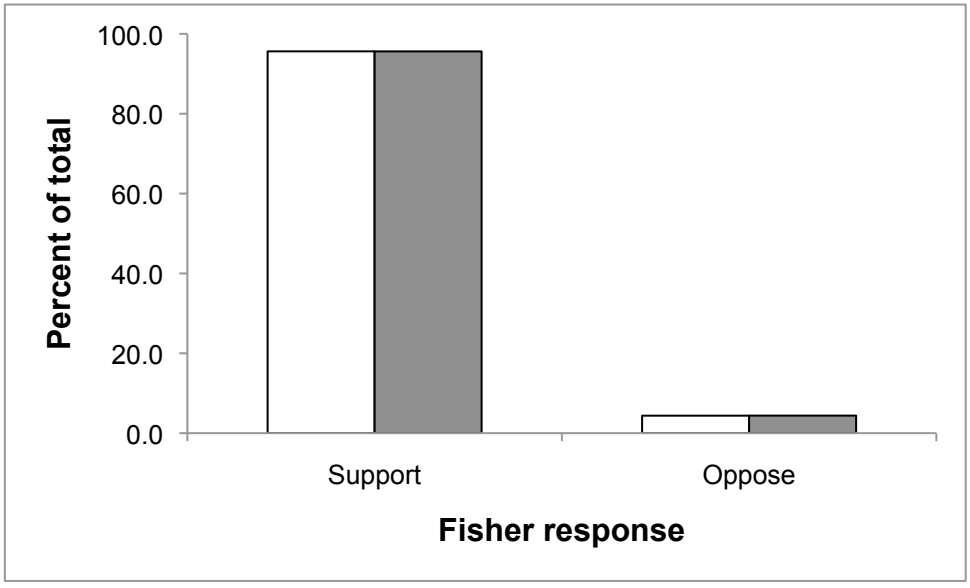


*Figure 23: Degree of support for licensing of fishers (grey) and boat registration (white).*

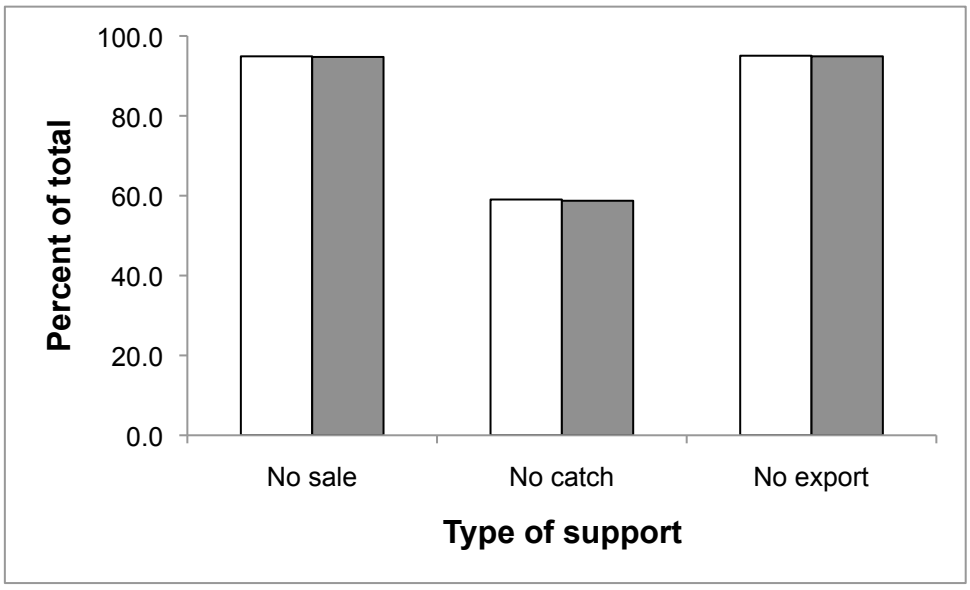


*Figure 24: Level of support among fishers for prohibitions on sale, catch and export of bumphead parrotfish and humphead wrasse. (n=614 fishers). (Corresponds to Question #29 in Appendix B).*

In response to fishing violations, fishers appeared strongly supportive of some form of punishment. Although most fishers felt the state government should be responsible for levying punishment, substantial support was given for shared responsibilities between state and local governments for monitoring and enforcement

(***Figure 26***). Among the types of punishment supported, fishers showed the greatest support for fines, followed by jail time for repeat offenders. A number of respondents also supported community service, which is more appropriate to minor offenses (***Figure 27***). Few respondents thought violators should receive no punishment.

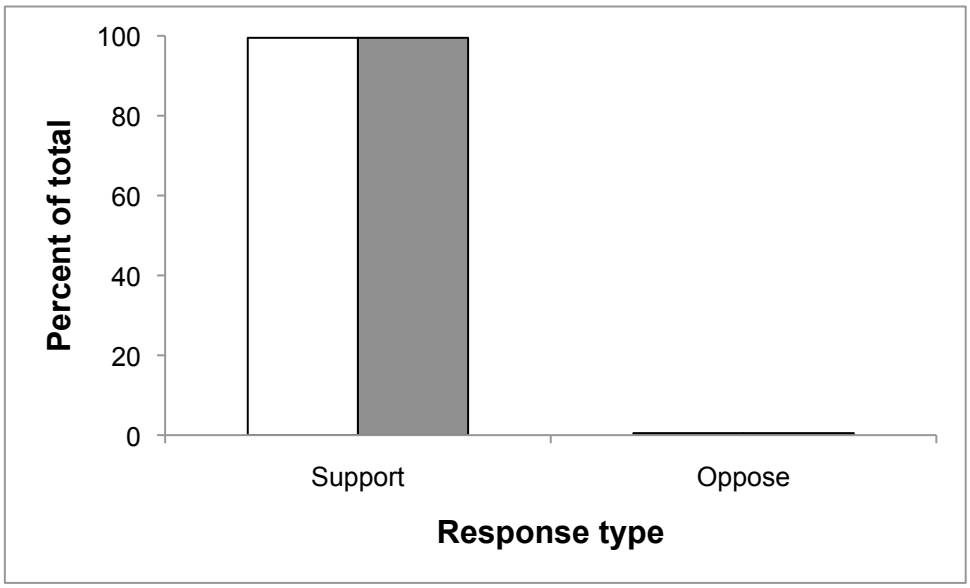


*Figure 25: Responses to a catch ban when fishers perceive extinction risk for bumphead parrotfish and humphead wrasse. (Corresponds to Questions #30-32 in Appendix B). (n=600 fishers)*

Among respondents, most supported a return to marine tenureship whereby fishers could only fish in their own municipalities (***Figure 28***). This form of management is widely practiced in Melanesia and in some parts of Micronesia (e.g., Yap) and provides fishers created sense of ownership of resources and a greater ability to control fishing activity.

When asked about legislative action and timeframes needed for passage of legislation, fishers were highly opinionated. Greater than 80% of respondents felt that legislative action on marine resource management was too slow (***Figure 29***). When asked what response time they would prefer following reception of legislation (bill for an act),

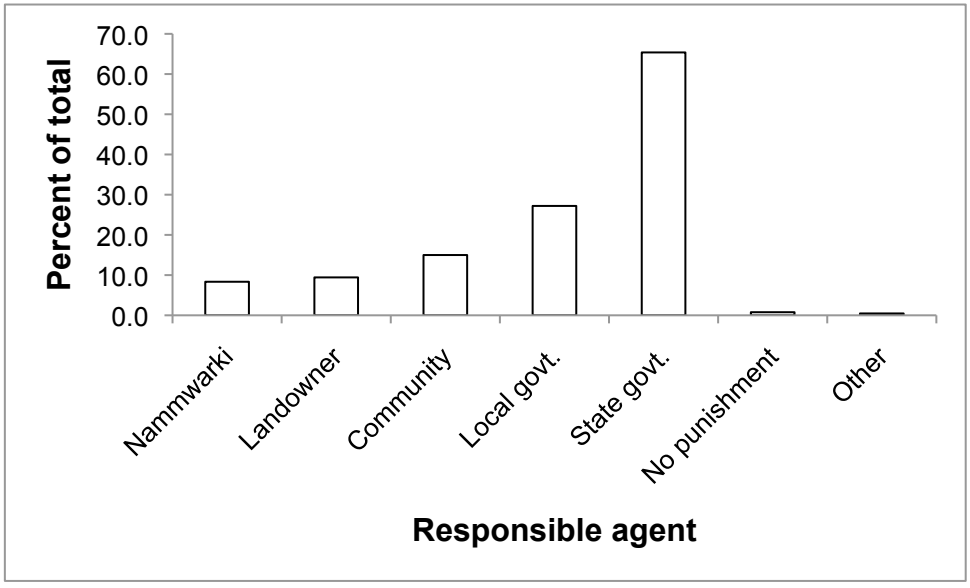


*Figure 26: Responses by fishers on who should levy punishment for fishing violations. (Corresponds to Question #24 in Appendix B). Represents 819 responses by 647 fishers.*

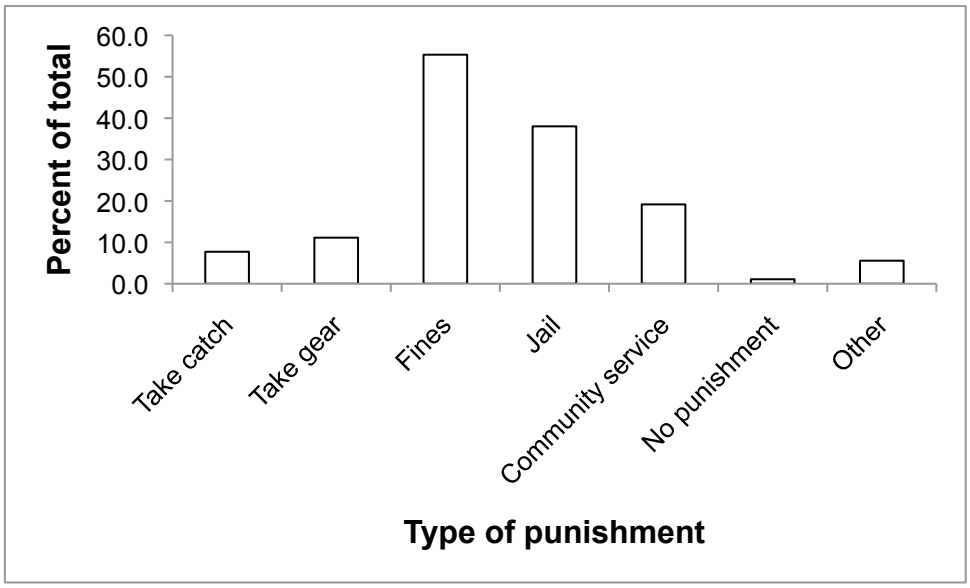


*Figure 27: Percent support for various types of punishment for fishing violations. (Corresponds to Question #25 in Appendix B). Represents 893 responses by 647 fishers.*

fishers overwhelmingly (>90% of respondents) preferred a 1 year timeframe or less for consideration and enactment (or decline) of a bill being received (***Figure 30***).

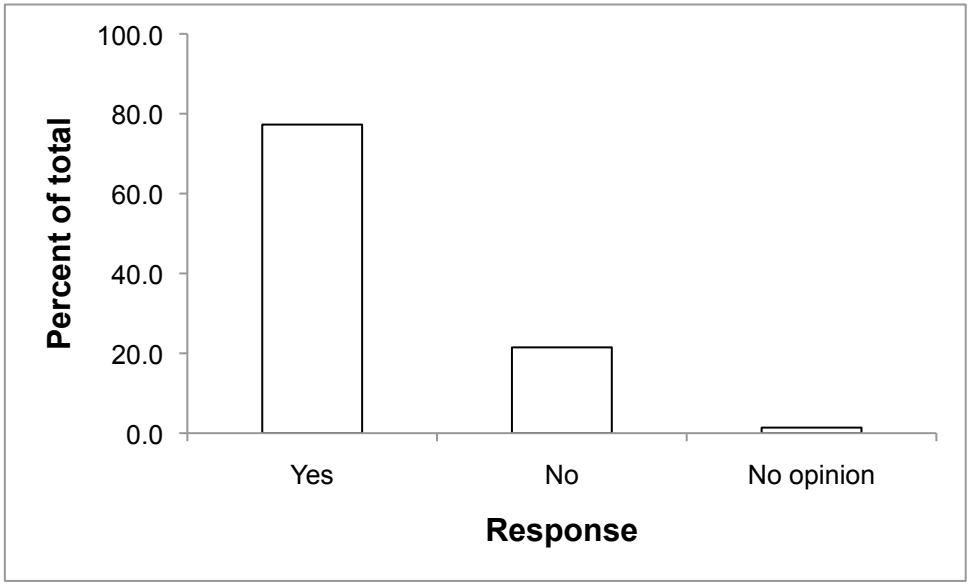


*Figure 28: Percent of respondents supporting municipal marine tenureship of marine resources (Corresponds to Question #27 in Appendix B).*

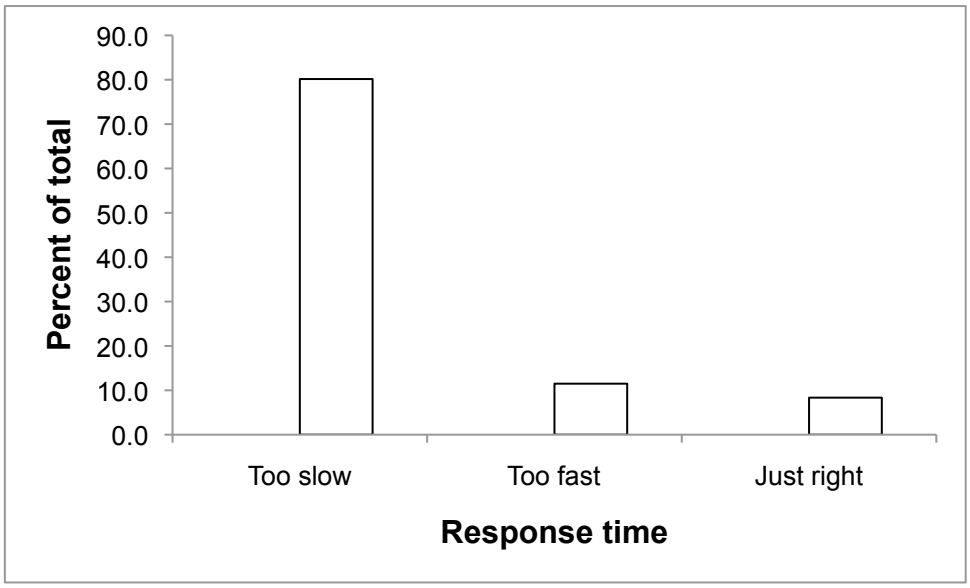


*Figure 29: Legislative response to management needs, based on 635 fisher responses across all municipalities. (Corresponds to Question #35 in Appendix B).*


*Figure 30: Timeframe for legislative consideration of management reconnemdations following reception, based on 635 fisher responses across all municipalities (Corresponds to Question #36 in Appendix B).*

## Business surveys

In 2009, a total of 21 surveys were conducted to capture the input of reef fish into schools, restaurants and businesses. These represent 9 restaurants, 7 take-out stalls, 4 academic institutions, and the state hospital. Based on surveys, 86% of these institutions derive their fish directly from markets, with only two buying from fishers directly. In those instances, only a small portion was purchased directly from fishers (≤ 25%). One-third purchased fish daily, while an equal proportion purchased weekly or split purchases over 2-3 days per week. Combined, these institutions purchase *ca.* 740 kg of reef fish weekly, equivalent to *ca.* 38.5 mt of reef fish annually. This represents about 7% of the total volume of reef fish flowing through markets.

## Airport surveys

Airport surveys were conducted over 21 days by trained survey personnel. In total, 72 passengers exporting reef fish were interviewed, or 3.4 persons $d^{-1}$. During surveys, none of the passengers stated that they were exporting for commercial purposes, with 94% exporting fish was for personal use. Personal use primarily includes personal

consumption. Gifts to friends and relatives contributed 3% of the total. On average, surveyed passengers export reef fish 1.2 days $yr^{-1}$. The average weight of fish exported was 17.3±1.6 kg $person^{-1}$. The two most common destinations for reef fish export were Hawaii (30.6%) and Guam (19.4%), with 38.8% to the US Mainland (***Figure 31***). The remaining 11.2% of exports were divided between the Northern Mariana Islands, other Micronesian islands and Japan.

Exported fish composition by family was relatively similar to that from both catch and household consumption (***Figure 31***). However, unlike commercial catch, rabbitfish were the second most common fish in exports (***Figure 32***). This family also appeared to be very popular in household consumption, but does not contribute substantially to comercial catch, likely because of its small weight contribution.

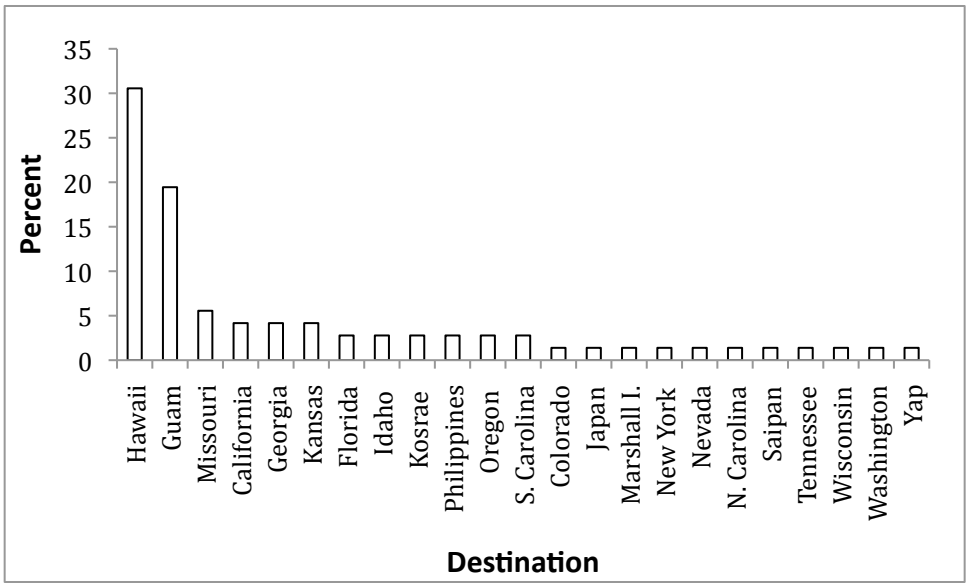


*Fig. 31. Destinations of coral reef fish exported from Pohnpei during surveys.*

## Subsistence fishing surveys

Subsistence field surveys proved to be the most difficult of the five survey components. A variety of reasons contributed to this, including a general lack of purely subsistence fishers in the state, the difficulty in encountering new fishers not previously interviewed

and poor weather or tides during interview times. Nonetheless, 57 interviews were conducted in 3 of 5 municipalities to provide information on gear usage, catch composition and effort, as catch-per-unit-effort (CPUE).

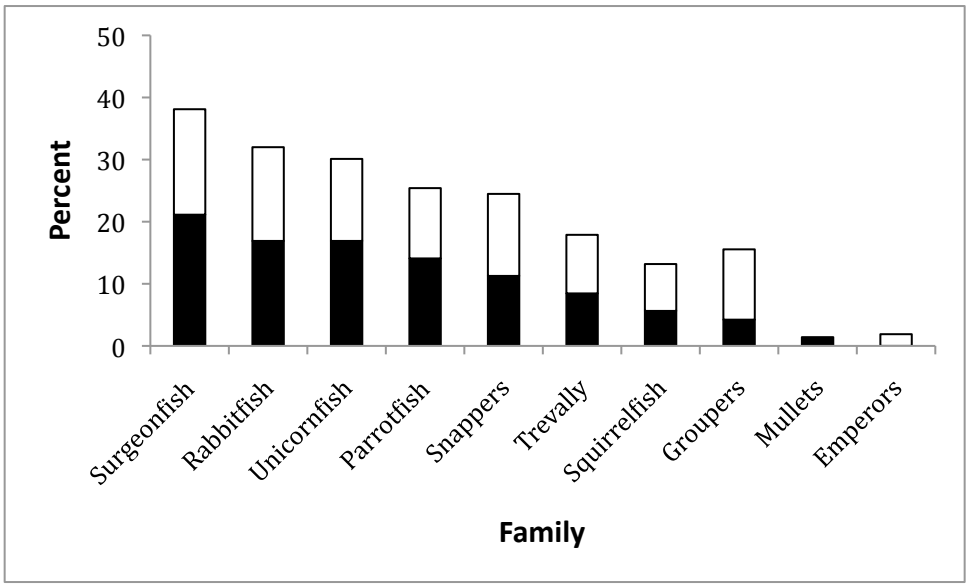


*Fig. 32. Primary (black) and secondary (white) reef fish families represented in exports.*

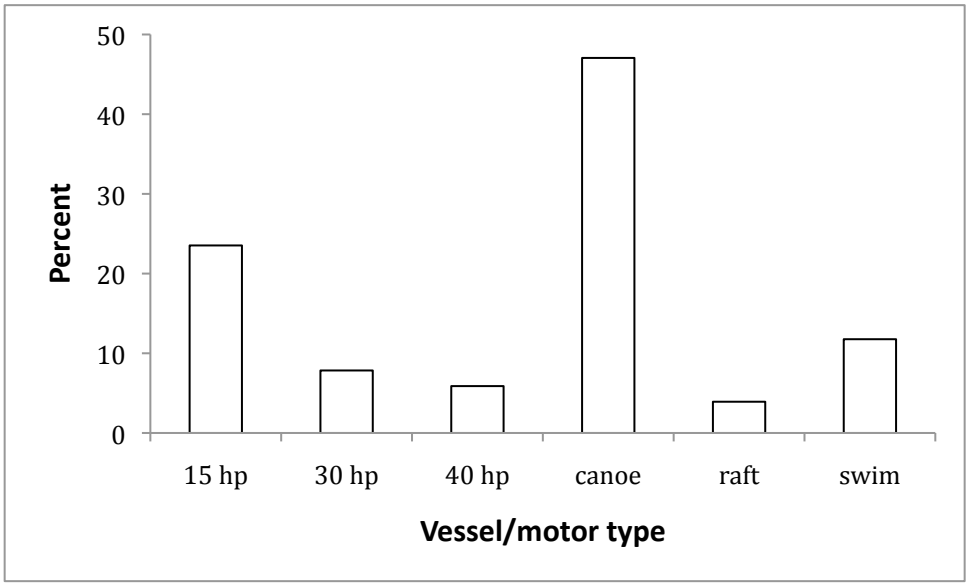


*Fig. 33. Vessel or motor type used by subsistence fishers participating in interviews.*

On average, subsistence fishers fished 2.8±0.4 days week$^{-1}$, spending 3.6±0.3 hrs per trip. CPUE was 3.2±0.5 kg of fish per hour, which compares favorably with the 3.4±0.1 kg hr$^{-}$

[1] established for the commercial fishery in 2006 (Rhodes et al. 2008). In contrast to commercial fishers, subsistence fishers relied on non-motorized means of getting out to the reef more than 50% of the time and few used fuel-consuming 40hp motors, which dominated commercial vessel type (***Figure 33***). Similarly, gear type varied between subsistence and commercial fishers, with net dominating among gear types and spear being used in only around 20% of catches. (***Figure 34***). Commercial fishers rely heavily on spear (70%) as the primary method of fishing. Also in contrast to the commercial fishery was the choice of fish. Unicornfish, which contribute to *ca.* 30% of commercial catch, represented only 6% of subsistence catch (***Figure 35***). Emperors and rabbitfish were common in subsistence catch (*ca*. 18% each), but were minor components of commercial catch. Interestingly, rabbitfish are one of the more preferred fish eaten by households. In terms of volume, parrotfish (19.7%) and emperors (16.0%) were the largest contributors, followed by trevally (12.0%) and groupers (8.3%).

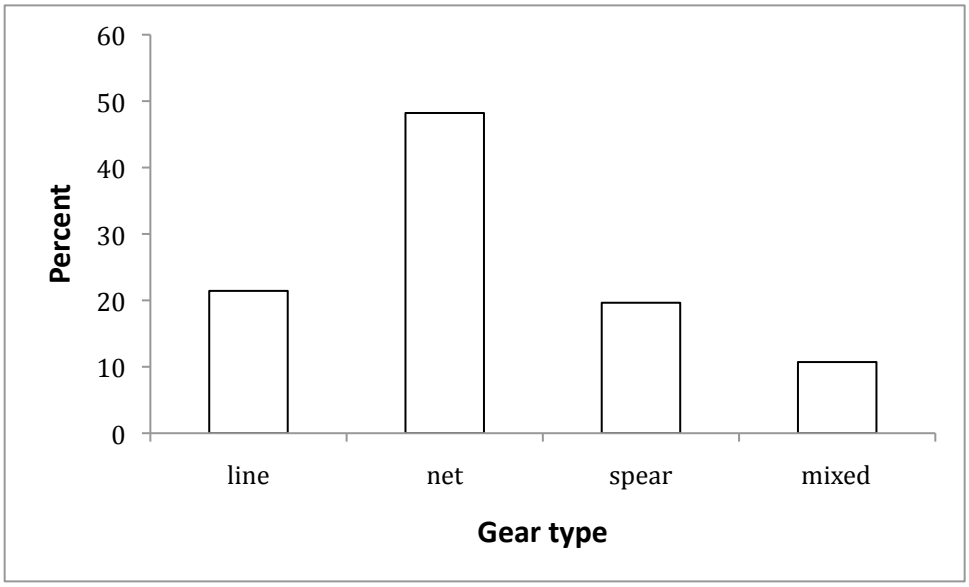


*Fig. 34. Gear type of fishers surveyed for subsistence fishing.*

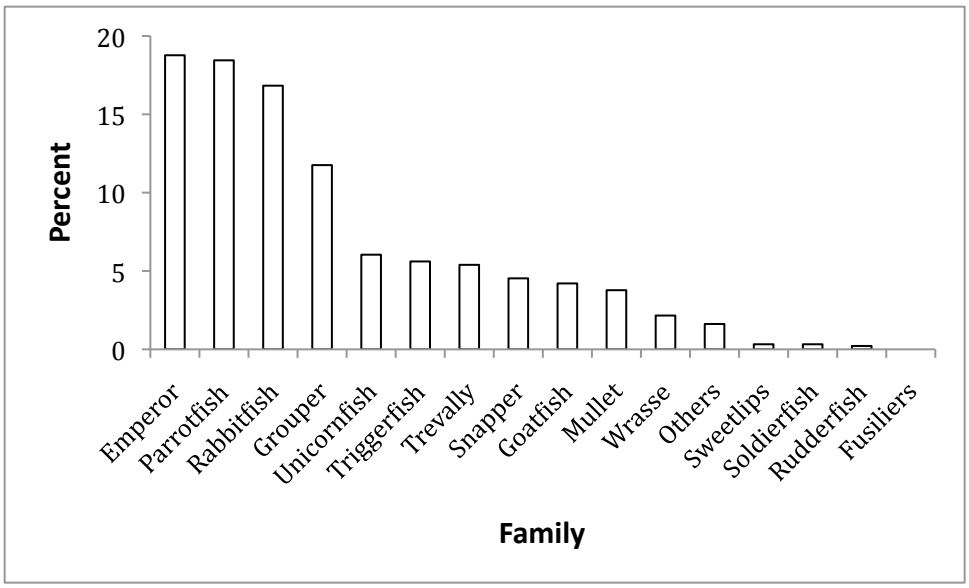


*Fig. 35. Contribution by family to subsistence catch. Percentages are based on the number of individuals in all catches combined.*

## Outreach, stakeholder participation and management activities

During the survey, outreach avtivities were conducted at the community, academic, and state and national government levels. At the academic level, PI Rhodes made his annual Earth Day presentation to students and faculty at the College of Micronesia (COM) in 2009 and 2010. Both presentations were based on survey findings and centered on issues of sustainability and student participation in management and conservation. Approximately 100 students and several faculty attended in each session. Three former and three current COM students, as well as OFA staff, partiipated in survey activities and were trained in interview and survey techniques, data collection and data entry. Following the NOAA survey, one student surveyor went on to work for the Pohnpei State Department of Economic Affairs, Division of Statistics to conduct the 2010 state census.

At the municipal level, PI Rhodes met in 2009 with the mayor and administrative staff of Kitti Municipality, municipal representatives of Sokehs Municipality, and the full representative body of Madelonimw Municipality. These meetings were held to discuss the NOAA-funded achievements, the current project purpose and to examine and discuss

objectives and techniques to improve state and municipal management and enforcement. Additional discussions were held on the development and implementation of a municipal marine protected area (MPA) for Sokehs and full MPA coverage for Ant Atoll. The Ant Atoll marine sanctuary was enacted through executive order in 2010 and follows a design presented by PI Rhodes to the state government and local landowners in 1999. The Sokehs sanctuary presentation was facilitated by the Conservation Society of Pohnpei and attendance included both Sokehs municipal and state representatives. The Sokehs MPA, when enacted, will represent the largest MPA on the main island and the first to incorporate include a range of essential fish habitat, including mangroves, seagrass, lagoon and barrier reef.

At the state level, PI Rhodes met with Governor David Ehsa on several occasions in 2009 and 2010 to update him on survey progress, outcomes and management needs. A Powerpoint presentation of key findings was presented to Governor Ehsa in May 2010, followed by a presentation to the full Pohnpei State Marine Resource Committee. The latter presentation was meant to leverage support for bills developed through the Pohnpei Environmental Working Group (*see bleow*). At the national level in 2010, PI Rhodes met and discussed key findings with Valentin Martin, director of the FSM Department of Marine Resources. Director Martin was presented with the full list of reports and recommendations provided by PI Rhodes to Pohnpei State since 1998. The governor, Director Martin and all members of the Pohnpei State Marine Resources Committee were provided with a copy of the final report for the current project, entitled "Pohnpei Fisher Perceptions and Management Survey: A Report to the Pohnpei State Government for Marine Resource Management Improvement".

In addition to presentations to students and government, a working group of state, non-governmental, private individuals formed in 2010 as the Pohnpei Environmental Working Goup. The Group met during several occasions to discuss management needs and formulate legislation to be submitted to the Pohnpei State Legislature (PSL). The submissions were based directly on current and past study findings and recommendations submitted to the state by PI Rhodes (1998-2010). These findings and recommendations were derived primarily from NOAA-funded research, as well as past research by Rhodes supported through the University of Hong Kong. The Group includes the Pohnpei State

attorney general, PSL legal council, Micronesia Conservation Trust director, head of the Pohnpei State Office of Fisheries and Aquaculture, Conservation Society of Pohnpei director, a TNC (The Nature Conservancy) representative, and PI Rhodes. The working group identified recommendations from current and past surveys by PI Rhodes that could be drafted into the existing Pohnpei State Fisheries Act (Title 29 and Conservation and Resources Act (Title 26) and sent to the Pohnpei State Legislature for the 2010 session. The working grouper also identified recommendations for drafting and submission to the PSL in 2011. Immediate management legislation included (1) bans on exports of reef fish, (2) bans on the catch, sale and possesssion of humphead wrasse, *Cheilinus undulatus*, bumphead parrtofish, *Bolbometopon muricatum*, and giant clam, *Tridacna* spp., (3) harvest of gravid lobster for sale or harvest of lobster by any means other than by hand, and (4) inclusion of February into the existing March-April grouper sales ban. Legislation slated for 2011 includes minimum size restrictions on the sale of several species or species groups (e.g. medium-bodied grouper). The size restriction recommendations were based on the outcomes of the NOAA-funded 2006 market survey. PI Rhodes, together with the CSP Marine Team and director and the director of OFA identified 10 species and species groups to be slated for size restrictions.

Ongoing outreach activities at the community level include a series of National Fish and Wildlife Foundation (NFWF)-funded workshops that will begin in January 2011. The participatory workshops will provide stakeholders with survey findings and identify ways forward for co-management of marine resources throughout the 3-month workshop series. The workshops represent a product of the subsistence surveys and a necessary next step toward building bottom-up consensus among government and stakeholders for workable management solutions.

## Discussion and Conclusions

The current study achieved its main objective of determining subsistence catch volumes of coral reef fish in Pohnpei to allow ecological footprint analyses to proceed. The ecological footprint analysis is being conducted to provide legislators with a broader and more detailed idea of the current state of Pohnpei's coral reef resources. The footprint

analysis has already found that Pohnpei is currently extracting nearly 725 mt annually from reefs, with *ca.* 500 mt of coral reef fish from commercial and 227 mt of coral reef fish for subsistence use. Based on preliminary estimates of sustainable use, this represents a value 149% over sustainable yield. Thus, there is an urgent need to accurately characterize the fishery and identify the sources of demand. Past NOAA-funded projects identified several factors contributing to unsustainable yield and limiting spawning stock biomass: (1) nighttime spearfishing, (2) overharvesting of juveniles, (3) targeting of spawning aggregations, and (4) the commercialization of reef resources without parallel management. The current study provided the volume estimates needed to conduct in-depth sustainability estimates and also highlighted a desire among individuals in the fishing community to participate in management decision-making and to pressure legislators into passing much-needed legislation.

Combined survey results highlight the need for an overall volume reduction in the coral reef fish fishery. Productivity needs to be increased and demand needs to be decreased if Pohnpei is to achieve sustainability. There are a variety of options to achieve this, including limits on nighttime spearfishing, additional restrictions on targeting spawning aggregations and species using them, size limits on heavily impacted species, guidelines for the use of net, including mesh size and length, and changes to market practices that are currently causing increased pressure on resources, among others. Pohnpei State has not passed any significant marine resource protection legislation in more than 15 years, aside form the establishment of poorly monitored and enforced marine sanctuaries. Additional efforts are clearly needed. Recent indications are that the state is not likely to meet these needs in the timeframe needed to reduce current trends. Instead, needed reforms are likely to best be achieved through co-management, with greater input by local communities. Some success in co-management has been made, such as the Enipein Marine Sanctuary. Additional success will likely come from more empowerment of local communities, with improved educational awareness and capacity building in resource management to local communities. Based on fisher perception surveys, communities are ripe for inclusion and wanting for management improvement. There is clear evidence that fishers recognize declines in reef resources and have a keen

interest in designing management. There are current plans to engage fishing communities in management decision-making, such as the planned NFWF workshops.

The current study has identified management needs. To further aid management decision-making, future research should continue to focus on establishing and tracking marketing and fishing trends, including gathering additional life history information for regionally important species. Spawning aggregations should continue to be a key focus of research, since the dynamics are still poorly understood. Specifically, additional efforts are needed to establish individual aggregation and spawning population abundance for trend analysis and spawning stock biomass assessment. Within the region, practically no baseline information exists on coral reef fisheries, specifically catch composition, gear use and effort. Thus, there is a significant information gap for management decision-making at the most basic level. Far greater efforts should be made by funding agencies and researchers to fill these gaps and follow-up assessments are needed where information currently exists. Without such information, it is unlikely that management can be successful.

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# Appendix A: Household survey instrument

**Pohnpei 2009 Household Survey**

***Per Capita Consumption and Subsistence Fishery for Coral Reef Fish***

Household Code: _____ Municipality: _____

Village: _____

Interviewer: _____ Date: _____

This survey is being conducted to provide information on subsistence fishing for nearshore, CORAL REEF FISH ONLY and per capita consumption of CORAL REEF FISH ONLY. This survey is not designed to answer questions about pelagic fish, such as tuna. Although the survey is NOT designed to determine levels of commercial fishing, answers about commercial fishing can be input into the survey and designated as such.

*The following questions are being asked to provide general information about your household:*

1. Name: _____ (Male/Female)
   If not the fisherman, relation to the fisher (e.g., wife): _____

2. How many people are in your household? Male adults_____ Female Adults _____
   Male children _____ Female children _____ Total _____

3. Number of adults (16+ yrs) employed in the household: _____

4. Number of fishers in the household (**if none, skip to consumption survey**):
   Male:_____ Female:_____

5. Number of fishers by age:
   10-20: ___ 21-30: ___ 31-40: ___ 41-50: ___ 51-60: ___ >60: ___

6. Number of fishers by education level:
   No school___ Elementary ___ H.S. ___ H.S. degree or above ___

7. On average, how many days of the week do you fish for **reef fish**? _____

8. On average, **how many pounds of reef fish** do you catch each week? _____

9. On average, how may days in the week do the fishers fish strictly for food (**no sale**)?
   Number of days: _____

10. Do any of the fishers in the household sell **reef fish**? (Y/N)_____
    Number of fishers selling **reef fish** _____

11. On average, how many days of the week do you sell **reef fish**?
    Number of days: _____

12. About what percentage of the total catch of **reef fish** is
    a) Sold: %____
    b) Kept: % ____
    c) Given away: %____
    d) Traded: % ____

13. How much of the household's total income comes from the sale of **reef fish**:
    None: ____ 1/4: ____ 1/2: ____ 3/4:_____ All_____ %_____

14. What type of boat is used for fishing?
    a. canoe ___ b. 15 hp ___ c. 30 hp ___ d. 40 hp ___ e. Other ____

15. List the **three** most important gear types the fisher uses (**order of importance**):
    a. spear___ b. hook and line___ c. net____ d. surround net___
    e. gillnet ___ f. trap_____ g. root extract (i.e., *Derris* root)___
    h. shore____ i. other_____

16. When is the primary fishing time (night or day?) _____

17. Which municipality do fishers in your household usually fish in?
_____

18. Do you mainly fish inside or outside the reef? _____

19. List the **top 5 fish** fishers most prefer **to catch**?

    1. _____
    2. _____
    3. _____
    4. _____
    5. _____

**NOTES:**

## Household Reef Fish Consumption Survey

20. How does the household get its reef fish?
Caught: ____ Bought: ____ Given to them: ____ Traded:_____

21. Do you ever buy reef fish outside the market? Yes/No

22. Since this time yesterday, how many meals/times did your **household** eat *reef fish*: _____

23. In the last 7 days, how many days did your **household** eat *reef fish*: _____

In the last 24 hours, what type (local or common name), origin (bought, caught, given, traded) and quantity of ***reef fish*** did your **household** eat:

***Meal # 1:*** ***# People in Household Eating the Meal:***

| | **Fish 1** | **Fish 2** | **Fish 3** | **Fish 4** | **Fish 5** |
|---|---|---|---|---|---|
| **Fish type** | | | | | |
| **Fish origin** | | | | | |
| **Quantity # pcs, length, weigth** | | | | | |

***Meal # 2:*** ***# People in Household Eating the Meal:***

| | **Fish 1** | **Fish 2** | **Fish 3** | **Fish 4** | **Fish 5** |
|---|---|---|---|---|---|
| **Fish type** | | | | | |
| **Fish origin** | | | | | |
| **Quantity # pcs, length, weight** | | | | | |

***Meal # 3:*** ***# People in Household Eating the Meal:***

| | **Fish 1** | **Fish 2** | **Fish 3** | **Fish 4** | **Fish 5** |
|---|---|---|---|---|---|
| **Fish type** | | | | | |
| **Fish origin** | | | | | |
| **Quantity # pcs, length, weight** | | | | | |

***Meal # 4:*** ***# People in Household Eating the Meal:***

| | **Fish 1** | **Fish 2** | **Fish 3** | **Fish 4** | **Fish 5** |
|---|---|---|---|---|---|
| **Fish type** | | | | | |
| **Fish origin** | | | | | |
| **Quantity # pcs, length, weight** | | | | | |

24. What are the top 5 ***reef fish*** your household likes to **eat**?

1. _____
2. _____
3. _____
4. _____
5. _____

25. Has the price increase for reef fish changed how much reef fish your household buys? (Y/N) _____

Much less: ____ Somewhat less: ____ Same:_____

26. How (buy less fish, buy smaller fish, buy pelagics, etc.)?

# Appendix B: Fisher Perception Survey

**Pohnpei 2009 Household Survey**

Household Code: _____ Municipality: _____

Village: _____

Interviewer: _____ Date: _____

This phase of the interview is designed to gather people's perceptions of CORAL REEF FISHERIES resources and management strategies, past and present. A number of questions will be asked about how CORAL REEF FISH resources have changed over the years and how people feel about the quality of the reef. The interview is also designed to determine whether fisher are using similar or different methods to fish than in the past. The survey is designed for answers by up to four fisher per household.

1. List the age of the fisher participating in this survey: _____
2. List the education level of fisher participating in this survey:
   *None____Elementary ____ H.S. ____ H.S. diploma __College____*
3. At what age did you start fishing? _____
4. Do you fish for: a. *Sale*____ b. *Food*____ c. *Both*_____
5. What is your primary fishing method (gear type)?_____
6. From the time you first started fishing, do you feel that there are:
   *a. More fish? ____Less fish? _____ Same number ____No opinion____*
7. Since you first started fishing is the size of fish now:
   *Bigger ____ Smaller ____ Same ____ No opinion ____*
8. Since you first started fishing, is the quality of the reef (corals, water clarity, etc.) now:
   *Better ____ Worse ____ The same ____ No opinion ____*

9. If resources are worse, what is the main cause?
   a. *Changes in type of gear* _____
   b. *Population increase* _____
   c. *Dredging* _____
   d. *Pollution* _____
   e. *Run-off from land clearing* _____
   f. *Loss of Fishing knowledge* _____
   g. *Change to a cash economy* _____
   h. *Other:*_____

10. From when you first started fishing, do you think there are:
    *More people fishing* ____ *Less* ____ *About the same* ____

11. *For fishers over 40*: Do you feel that the younger generation of fisher takes better care of the resources (fish) than the older generation, worse care, or about the same?
    *Better care* ____ *Worse care* ____ *About the same* ____ *No opinion* ____
    *Why?*_____
    _____
    _____

12. In your opinion, do people need to help manage fish, or do you feel that fish can take care of themselves?
    *Should manage* ____ *Fish will take care of themselves* _____

13. Who is better at managing the fish resources?
    *Fisher*____ *Community*____ *Local govt.*____*State*____

14. If you sell your fish, do you think you are getting the right price at the market, not enough, or too much? (*If subsistence, go to Q18*)
    *Right price* _____ *Not enough* _____ *Too much* _____

*15.* If you got paid more for your fish, would you fish less, fish more, or fish about the same amount?
    *Fish more* _____ *Fish less* _____ *Same amount* _____

16. If you sell your fish, do you think prices should follow fuel prices, i.e., if fuel prices go up, the price of fish should also go up (like other materials)?
    *Should go up* _____ *Should stay the same* _____

17. Who should control the price of fish, market owners, fisher, or government?
    *Markets* _____ *Fisher* _____ *Government* _____

18. Do you or would you support or oppose the following types of management?

| | *Support* | *Oppose* |
|---|---|---|

| | | | |
|---|---|---|---|
| *a.* | *Sanctuaries, such as Kehpara* | _____ | _____ |
| *b.* | *Bans on gear, such as a ban on gillnets* | _____ | _____ |
| *c.* | *Seasonal bans, such as the grouper sales ban* | _____ | _____ |
| *d.* | *Size limits for sale of fish* | _____ | _____ |
| *e.* | *Size limits for catch* | _____ | _____ |
| *f.* | *Limits on the number of fish caught* | _____ | _____ |
| *g.* | *Limits on the volume of fish sold* | _____ | _____ |
| *h.* | *Ban on catching or selling certain species* | _____ | _____ |
| *i.* | *Restrictions on nighttime spearishing* | _____ | _____ |
| *j.* | *Limits on foreigners fishing in Pohnpei* | _____ | _____ |
| *k.* | *Other:* _____ | | |

19. Would you support a requirement that fisher be licensed in Pohnpei to help monitoring and enforcement efforts?
    *Yes*_____ *No*_____

*20.* Would you support a requirement to register boats in Pohnpei as a way to help monitoring and enforcement efforts?
    *Yes*_____ *No*_____

21. How important is it for fisherman to participate in developing management plans?
    *Very important* _____ *Somewhat important* _____ *Not important*_____

22. Would you be willing to participate and share you views to develop a management plan for Pohnpei?
    *Willing* _____ *Not willing* _____

23. If you or your community helped develop a management plan, would you be more willing or less willing to support it?
    *More willing*_____ *Less willing*_____ *No change*_____

24. If a fisherman breaks a fishing law, such as fishing in a sanctuary, who should be responsible for handing out the punishment?

| | |
|---|---|
| *a. Nanmwarki* | _____ |
| *b. Landowner* | _____ |
| *c. Community* | _____ |
| *d. Local government* | _____ |
| *e. State government* | _____ |
| *f. No punishment* | _____ |

    *Other*_____

25. If fisher break fishing laws, what is an acceptable punishment?

| | | |
|---|---|---|
| *a.* | *Taking their catch* | _____ |
| *b.* | *Taking their gear* | _____ |
| *c.* | *Fines (Money or local products)* | _____ |
| *d.* | *Jail* | _____ |
| *e.* | *Community service* | _____ |
| *f.* | *No punishment* | _____ |
| *g.* | *Other*_____ | |

26. If you or your community helped develop a management plan, would you be more willing to be involved in *enforcement* (reporting of violations), not willing or no change from now?

    *More willing* _____ *Less willing* _____ *No change* _____

27. Should Pohnpei go back to a style of management where, for example, only Uh fisher can fish in Uh?

    *Yes* _____ *No* _____ *No opinion* _____

28. If you were only allowed to fish within your municipality, would you work harder to protect the fish/resources, work less hard or no change?

    *Work harder* _____ *Work less* _____ *No change* _____

29. For the two following species, would you support the following rules?

| | *No sale* | *No catch* | *No export* |
|---|---|---|---|
| *Kemeik* | _____ | _____ | _____ |
| *Merrer* | _____ | _____ | _____ |

30. If you knew that *merrer* were endangered in Micronesia with the possibility of becoming extinct, would you support a catch ban

    *Support*_____ *Oppose* _____

32. If you knew that *merrer* were endangered of becoming extinct in Pohnpei, would you support a catch ban?

    *Support*_____ *Oppose* _____

32. If you knew that *kemeik* were endangered of becoming extinct in Pohnpei, would you support a catch ban?

    *Support*_____ *Oppose* _____

33. Where do you get information about fishing laws in Pohnpei?

| *Posters* | *Radio* | *Newspaper* | *Other fishers* | *Other* |
|---|---|---|---|---|
| _____ | _____ | _____ | _____ | _____ |

34. Has a marine resource conservation or enforcement officer ever approached you while fishing or while selling catch?

    *Yes* _____ *No* _____

35. Is the legislature acting too fast, too slow or the right speed in enacting fisheries management legislation?

    *Too slow*_____ *Too fast* _____ *Right speed* _____

36. From the time the legislature receives recommendations for management, how long should they take to consider (pass or reject) a measure?

    *< 1 year* _____ *1 year* _____ *2 years* _____ *3 years* _____ *Longer* _____

# Appendix C: Business Survey Instrument

**Pohnpei 2009 Business Survey**

***Component IV: Business Purchasing and Volume***

**Business Code: _____ Municipality: _____**
**Village: _____**
**Interviewer: _____ Date: _____**
**Follow-up (Y/N): _____**

This phase of the interview is designed to gather information on business (restaurant, hotel, school) purchases of CORAL REEF FISHES. A number of questions will be asked that will be used to determine the relative frequency, source and amount of CORAL REEF FISHES purchased by business. The survey is designed for answers by a single business entity.

Business name: _____
Purchasing agent: _____
Business Address: _____
Contact phone (if available): _____

1. Does your business purchase reef fish? (If no, conclude survey.)
   a. YES _____ b. NO _____
2. Where do you or your business purchased reef fish from?
   a. Directly from a fisherman: ____
   b. Market: _____
   c. Both: _____
   d. Other: _____
3. If fish comes from multiple sources, approximately, how much (% per day or week) is purchased from the market? _____
4. Is reef fish purchased (or acquired) daily, weekly or some other time period?
   a. Daily: _____
   b. Some days, but not all (approx. # days per week): _____
   c. Weekly: _____
   d. Other: _____
5. How many pounds of reef fish are usually purchased daily (weekly, etc., depending on how often fish is purchased)? _____
6. How many pounds of reef fish did you purchase the last time you bought reef fish? _____

NOTES/COMMENTS:

# Appendix D: Airport Export Survey Instrument

**Pohnpei 2009 Airport Export Survey**

| |
|---|
| Flight Code: _____ Destination: _____ |
| Interviewer: _____ Date: _____ |

**This survey component is designed to gather information on the volume, origin and content of ALL Reef-Derived Marine PRODUCTS, but primarily EXPORTED CORAL REEF FISHES. Although the subsistence survey is focused on CORAL REEF FISH, surveys will capture individual weights for all Reef-Derived Marine products, by category.**

**1. Name of individual: _____**

**2. Does this person represent an:**

**(a) Individual: _____ (b) Business:_____**

**3. Destination of products: _____**

**4. Approximate number of times per year the exporter ships products: _____**

**5. Purpose of export:**

**Resale: ____ Gift: ____ Other: _____**

**6. Total *reef fish* weight: _____**

**7. $1^{o}$ reef fish (family): _____ $2^{o}$ reef fish (family): _____**

**8. Origin of reef fish:**

**(a) Caught: ____ (b) Bought: _____ (c) Mixed: ____**

**Comments:**

# Appendix E: Subsistence (Field) Survey Instrument

**Date:_____**

**Fishing location:_____**

**Boat/engine type:_____**

**Time fishing: _____**

**Gear type: _____**

**No. of fishers: _____**

**Fisher location: _____**

**Avg. # days fishing per week: _____**

**Avg. time fishing (hrs):_____**

| Family | Pieces | Weight |
|---|---|---|
| **Groupers** | | |
| **Snappers** | | |
| **Unicornfish/Surgeonfish** | | |
| **Rabbitfish** | | |
| **Goatfish** | | |
| **Parrotfish** | | |
| **Rudderfish** | | |
| **Wrasse** | | |
| **Emperors** | | |
| **Sweetlips** | | |
| **Soldierfish/Squirrelfish** | | |
| **Trevally** | | |
| **Triggerfish** | | |
| **Mullet** | | |
| **Fusiliers** | | |
| **Other** | | |

# Appendix F: Consent form (Household survey, as example)

**Agreement to Participate in**

**Household Study of Fish Consumption, Fishing and Management**

Household Code: _____ Municipality: _____

Village: _____

Interviewer: _____ Date: _____

**Kevin Rhodes, Primary Co-Investigator**

This research project is being conducted to help determine the amount and type of reef fish being taken from Pohnpei's reef and lagoon. The purpose of the project is to learn how much fish people eat and catch in Pohnpei, in addition to thoughts and feelings about local participation in fish and resource management in the state. We are asking all households and municipalities in Pohnpei to participate. The research is a joint project between the University of Hawaii at Hilo, College of Micronesia and Conservation Society of Pohnpei.

Participation in the project will consist of answering questions from an interviewer about people in your household by a local interviewer. Interview questions will focus on how much fish is eaten by the household, where it comes from (e.g. purchased of caught) and what methods are used to get it (e.g. speared, netted). The interviewer will also ask about the type of management in Pohnpei now, and whether and how it can be improved with community participation. No personal identifying information will be included with the research results. Completion of the form containing background data should take no more than 5 minutes. Each interview may last from 30 minutes to 1 hour. Approximately 600 households will participate in the interviews, along with a larger number of individuals. Interviews may be recorded on audiotape for the purpose of accuracy and recall.

The investigator believes there is no risk to participating in this research project. The information is being used only by the researcher and not by Pohnpei Government.

Participating in this research may be of no direct benefit to you. It is believed, however, the results from this project will benefit the fishing community by identifying better ways to manage fish resources in Pohnpei through local participation and answers will form the basis of a workshop planned to distribute survey results and participation on improving management for fish resources.

The information collected here today will be confidential. Agencies with research oversight, such as the UH Committee on Human Studies, have the authority to review research data. All research records and audiotapes will be stored in the primary investigators office for the duration of the research project. These records and audiotapes will be stored by the PI for

documentation of oral history and for future comparison, if there should be a follow-up or future study.

Participation in this research project is completely voluntary. You are free to withdraw from answering any or all questions at any time during the duration of the project with no penalty, or loss of benefit to which you would otherwise be entitled.

If you have any questions regarding this research project, please contact the researcher, Kevin Rhodes (691) 922-2056 or Patterson Shed (CSP) at (691) 320-5409.

If you have any questions regarding your rights as a research participant, please contact the UH Committee on Human Studies at (808) 956-5007 (Hawaii) or by email: uhirb@hawaii.edu.

**Participant:**
I have read and understand the above information, and agree to participate in this research project or have agreed verbally.

_____ If verbal agreement: _____
Name (printed)

_____ _____
Signature Date