H. T. HARVEY & ASSOCIATES

Ecological Consultants

Identifying Fish Stocks Requiring Federal Conservation and Management in Hawaii

Project #3836-01

Prepared for:

National Marine Fisheries Service, Pacific Islands Regional Office

1845 Wasp Blvd., Bldg. 176
Honolulu HI 96818

And

Pacific States Marine Fisheries Commission

205 SW Spokane, Suite 100
Portland OR 97202

Prepared by:

H. T. Harvey & Associates

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983 University Avenue, Building D • Los Gatos, CA 95032 • Ph: 408.458.3200 • F: 408.458.3210

Executive Summary

The Western Pacific Fishery Management Council (Council) and National Marine Fisheries Service (NMFS) seek to prioritize management efforts for fisheries active in federal waters surrounding the Hawaiian Islands. The Magnuson-Stevens Fishery Conservation and Management Act (MSA) National Standards (NS) 1, 3, and 7 provide a framework for managing commercial fisheries. Collectively, these standards are intended to prevent overfishing while achieving optimal yield, minimize cost and avoid duplication, and require that stocks be managed as a unit. This document reports the results from a review of 115 MUS from the Hawaii Fisheries Ecosystem Plan (FEP). Following these three MSA standards, we applied multiple measures to identify fisheries that may benefit from increased management attention, ecosystem components to monitor but which do not require management action, and stocks that can be removed from the Hawaii FEP.

The proportion of landings reported over an 11-year time series (2004-2014) from federal (vs. state) waters, NMFS guidelines for following NS 1, economic data on fishery landings, and the results of a survey returned by 5 fisheries scientists were incorporated into a multivariate analysis ('Rapfish') that evaluated the ecology, fishery characteristics, local sociological importance, and institutional management of each MUS. The results are presented graphically and in tabular form; landings data, summed scores, and expert judgment were used to sort the MUS into four groups: 1) the majority, eighty-nine MUS, fisheries with <20% of their landings from federal waters that should be removed from the Hawaii FEP, 2) six MUS with a greater proportion (≥20%) of landings from federal waters but whose characteristics support removal from the FEP (i.e., vulnerability, importance, etc. suggest the lowest management priority), 3) fourteen MUS that do not appear to require management or conservation but should be retained in the FEP for monitoring or ecosystem-based management considerations, and 4) six fisheries recommended for management and conservation.

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Section 1. Introduction

1.1 Background

The National Marine Fisheries Service (NMFS) and Western Pacific Fishery Management Council (WPFMC or Council) manage fishing in Federal waters (generally 3-200 nautical miles or nm from shore) around the Hawaii Islands through regulations implementing the Fishery Ecosystem Plan for the Hawaii Archipelago (Hawaii FEP) as authorized by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act or MSA). Pursuant to the Magnuson-Stevens Act, the WPFMC is responsible for developing fishery management plans for fisheries under its jurisdiction that are in need of conservation and management. To identify candidate fisheries with significant landings from federal waters that may require conservation and management, we applied NMFS advisory guidelines for implementing National Standards (NS) 1, 3, and 7 of the Magnuson-Stevens Act. Specifically, National Standard 1 requires that conservation and management measures achieve optimum yield (OY) while preventing overfishing. National Standard 3 requires that stocks be managed as a unit to the extent practicable. And National Standard 7 requires that conservation and management measures minimize cost and avoid unnecessary duplication, where practicable. See Section 2.1, below, for more information.

Hawaiian fisheries are an integral part of the modern cultural, social and economic fabric of the Hawaiian Islands (Gulko et al. 2002, Hamnett et al. 2004, Tissot 2005), but present a substantial challenge to management agencies because of the diversity of fishing activities and target species, and the difficulty of obtaining quantitative information on these activities. Hawaiian fisheries are conducted from the high tide line out into open water, spanning multiple habitats that include both State (shoreline to 3 nautical miles) and federal (3 to 200 nautical miles) jurisdictions. Some of these fisheries are small, accounting for only a few hundred pounds landed yearly, but others land multiple tons. Their economic value too ranges widely. Some fisheries are the provenance of subsistence or recreational fishermen only; others are largely the focus of commercial operations.

In Hawaii, commercial fisheries primarily target coastal pelagic species such as bigeye scad or akule and mackerel scad or opelu (Zeller et al. 2014, Nadon 2017), but also land numerous other reef-associated species belonging to families including, but not limited to goatfishes, surgeonfishes, snappers, parrotfishes, and jacks (Nadon 2017). Recreational and subsistence fisheries are thought to substantially exceed commercial landings (Friedlander & Parrish 1997, see also Zeller et al. 2008).

1.2 Project Objective

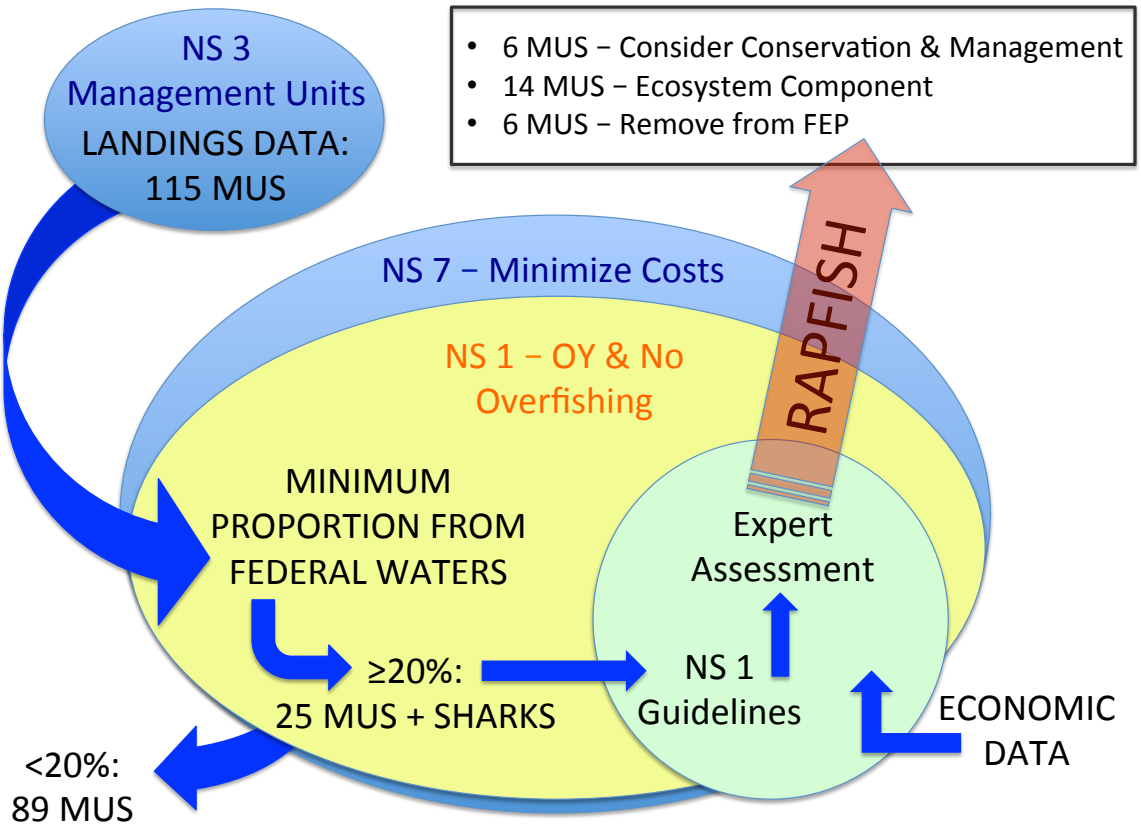
The goal of this project is to prioritize NMFS-identified management unit species (MUS) from the Hawaii FEP for the most appropriate level of conservation and management. Based on the application of National Standards 1, 3, and 7 and the consolidated criteria proposed on January 20, 2015 (80 FR 2786), and finalized on October 18, 2016 (81 FR 71858), each MUS is to be placed in one of the following categories:

1. MUS that require conservation and management
2. MUS that are not now, but should be considered for conservation and management and the justification
3. MUS that do not require conservation and management, but should remain in the FEP as ecosystem component species, for data collection purposes or ecosystem-based management considerations and any management measures would be limited
4. MUS that do not require conservation and management, and should be removed from the FEP and the justification

1.3 Approach

Our evaluation of these Hawaiian fisheries was based on application of the three National Standards (NS 1, 3, and 7) referenced above and described in detail below. These standards allow for a range of options for applying them to fisheries, and we sought a combination of approaches that were both consistent with the requirements of MSA and with the unique characteristics of the fisheries. We relied on a combination of quantitative data (landings, economic value), published literature, expert opinion (survey), and professional judgment (Figure 1).

Figure 1. The process for developing management recommendations for selected management unit species (MUS).



Section 2. Methods

NMFS Pacific Islands Fisheries Science Center (PIFSC), via the Pacific States Marine Fisheries Commission (PSMFC), provided non-confidential Hawaii FEP MUS landings data from the years 2004 through 2014 (inclusive) for 115 management unit species (MUS). Details of the areas, species groups, gear types, and number of fishermen landing these MUS are provided in Appendix 1. (Fisherman count information was provided to show that each datum represented the summed values from at least three fishermen.) Economic value data were obtained for the same time period for 90 of these MUS. In addition, we requested expert assessments for 26 of these MUS from five scientists familiar with Hawaii FEP fisheries.

2.1 Magnuson Stevens Act: National Standards 1, 3, and 7

To apply NS 1, we followed the guidelines published by NMFS (Table 1). As explained below (Section 2.5), these were applied using a multivariate, non-parametric analytical tool (Rapfish; Pitcher 1999).

Table 1. NMFS guidelines for following NS 1.

NS 1 Guidelines	
1.	The stock is an important component of the marine environment.
2.	The stock is caught by the fishery.
3.	Whether an FMP can improve or maintain the condition of the stocks.
4.	The stock is a target of a fishery.
5.	The stock is important to commercial, recreational, or subsistence users
6.	The fishery is important to the Nation and to the regional economy.
7.	The need to resolve competing interests and conflicts among user groups and whether an FMP can further that resolution.
8.	The economic condition of a fishery and whether an FMP can produce more efficient utilization.
9.	The needs of a developing fishery, and whether an FMP can foster orderly growth.
10.	The extent to which the fishery could be or is already adequately managed by states, by state/Federal programs, by Federal regulations pursuant to other FMPs or international commissions, or by industry self-regulation, consistent with the policies and standards of the Magnuson-Stevens Act.

Based on the structure of the landings data received, conversations with fisheries scientists and on our own review of the data, we considered the 115 MUS to be evidence that NS 3 was satisfied: each was an individual stock of fish or interrelated stocks that could be "…managed as a unit or in close coordination". NS 7, which requires that the economic costs of management be conservative, was applied in part through our assessment of the landings and economic data—fisheries with appreciable local significance were prioritized for management action while those with minimal significance required additional justification for high-level management attention.

2.2 Landings

Section 302(h)(1) of the Magnuson-Stevens Act requires the Council to prepare an FMP for each fishery under its authority (e.g. from Federal waters) that is in need of conservation and management. The NS 1 guidelines make clear that any stock of fish that is predominantly caught in Federal waters and is overfished or subject to overfishing, or is likely to become overfished or subject to overfishing requires conservation and management. Beyond that, Councils have broad latitude in determine whether a stock requires conservation and management based on the 10 factors listed above (Table 1) and other considerations the Council determines relevant.

NMFS' Sustainable Fisheries Division (SFD), via the PSMFC, provided a list of each individual Hawaii bottomfish, crustacean, precious coral, and coral reef ecosystem MUS for which data are required, drawing, from the 2009 Hawaii FEP, and the data supplied by the State of Hawaii Division of Aquatic Resources for the years 2004-2014. These data included the approximate location of capture (Appendix 1, Section 8.1.3). Landings data from all 115 MUS were evaluated to determine the proportion of total landings from 2004-2014 reported from federal versus state waters. Based on consultations with NMFS and Council staff and following a report to the Council[1], we prioritized further analyses only on those fisheries with landings from Federal waters equal to greater than 20%. This is because NMFS and the Council have limited ability to implement effective Federal conservation and management measures for fisheries where greater than 80% of landings are taken from within State waters (shoreline to 3 nautical miles). We included sharks in our subsequent analyses (federal landings ratio: 19.7%) because of the potential ecological importance of this high trophic level MUS. The total number of MUS meeting the criterion of this proportion of landings from Federal waters was 25; with the addition of the shark MUS, 26 MUS were examined further.

Fishermen report catch data using the State Commercial Fisheries Statistical Charts (Appendix 1, Section 8.1.3, see F, G, and H) which includes nearshore reporting grids extending from the shoreline out 2 nautical miles (nm) and offshore reporting grids extending seaward from the inshore

[1] Nelson, P. 2016. Update on the Analysis of Hawaii FEP Fish Stocks for Possible Ecosystem Component Classification. Presented by Jarad Makaiau at the 168th meeting of the Western Pacific

grids. State waters legally extend from 0 to 3 nm from the shore, so Federal catches (i.e., those reported from grids seaward of the nearshore grids) are likely to be slightly biased, depending on the MUS. We note that the bias stemming from the configuration of the Statistical Charts mentioned above results in a more conservative approach because more MUS are likely to be prioritized for further analyses.

To provide a comprehensive perspective on each MUS over the entire 11-year period, we calculated the annual proportion of the catch from federal waters and graphed these time series, overlaid with the annual landings from State and Federal waters, to review trends in annual landings. These figures for the 26 MUS are included in Appendix 4, and the calculated ratios for all 115 MUS are provided in Appendix 3.

2.3 Economics

Four of the NS 1 guidelines directly or indirectly rely on economic valuations of a fishery, and NS 7 requires that conservation and management keep costs to a minimum and avoid duplication. The economic value of a fishery was, therefore, used to aid in establishing priorities for additional management and conservation measures.

The available data were limited to Hawaii DAR (Division of Aquatic Resources) Fishery Statistics[2] from reported landings and held by the Western Pacific Fisheries Information Network (WPacFIN). We downloaded data for the 90 MUS included in the WPacFIN database with landings from federal waters equal to or in excess of 20% in this database for the same time period (2004-2014) (see Results, Section 3.2, Table 5). These data were used to determine the maximum price per pound over the 11-year period, and to calculate the total, mean, and standard deviation of the annual value of the landings from 2004-2014.

2.4 Expert Assessment

Five scientists, selected by NMFS and WPFMC scientists, responded to our request for assistance. Each fisheries expert received an electronic document (see Appendix 5) referencing the MUS with landings from federal waters in excess of 20% plus sharks (summed over all years, 2004-2014, n=26). For each MUS, they were asked to respond to four statements, prefaced by the following instructions:

> *Please answer the following questions by choosing from the alternative answers provided. We expect that these will be "judgment calls"—that you answer these questions based on your familiarity with the stock or fishery*

[2] https://pifsc-www.irc.noaa.gov/wpacfin/hi/dar/Pages/hi_data_3.php

in question and your familiarity with Hawaii's nearshore environment, and not based on some quantitative assessment. The accuracy of your answers is less important than how your responses compare from one fishery to the next. Please respond to these [four] statements:

1. *A Fishery Management Plan (FMP) would improve the condition of the stock. If, in your estimation, the stock is currently at or near its unfished biomass, a FMP would maintain the condition of the stock.*
2. *This stock is a target of a fishery.*
3. *This stock is important to the regional economy (i.e. at least at the county or island level). Even if the fish is not sold commercially, a substantial sport or subsistence fishery for the stock may contribute to the local economy.*
4. *This stock is adequately managed under current State and Federal regulations. Consider the possibility that catch levels could be so low that no active form of management is required.*

Responses were limited to: True, Possibly, Unlikely, or False. Last, they were asked: "Is there a stock of fish that is caught in Federal waters in proportions lower than 20 percent that you believe is in need of conservation and management under the Hawaii FEP? If so, explain why."

We scored each assessment individually, awarding a score of '4' for each 'True', '3' for each 'Possibly', '2' for 'Unlikely', and '1' for 'False.' After normalizing the scores (0-10), the average of the scores was used for the Rapfish analyses discussed below. To assess the degree of concordance among the respondents, we generated a heatmap from the standard deviations calculated from the respondents' scores for each question and each MUS.

2.5 Rapfish

Rapfish is an analytical tool, based on a non-parametric ordination technique (non-metric multi-dimensional scaling or NMDS), developed for comparing the sustainability of fisheries (Pitcher et al. 1998). As the name suggests, the method provides a rapid assessment tool for evaluating diverse fisheries, even when quantitative information is limited (Pitcher et al. 1998, 2013).Each fishery is scored for multiple attributes including characteristics of the fishery, social and economic traits, and ecological and institutional features. This allows managers and scientists to evaluate multiple fisheries across a spectrum ranging from the ideal ("good") to the worst-case ("bad"). Below, we identify, define, and score critical attributes of the 26 MUS, and present graphics that illustrate how these fisheries compare to each other along a best-to-worst case spectrum. Notably, we distinguish among attributes relevant to multiple disciplines: ecology, socio-economics, fishery science and governance. Rapfish provides a graphical comparison of project scenarios based on a scoring structure in the form of kite diagrams that illustrate the strengths and weaknesses of scenarios relative to a "perfect" scenario and relative to each other MUS. The statistical under-pinnings of Rapfish, as well as its

applications to the fields of fisheries science and conservation, are detailed in (Pitcher & Preikshot 2001, Pitcher et al. 2013). We used R code (R Development Core Team 2016) downloaded on May 8, 2017 from www.rapfish.org to run these analyses.

Rapfish is applied to attributes, each of which can be scored relative to best-case and worst-case hypothetical fisheries. We selected and defined multiple fisheries attributes based on the National Standards, and grouped them into 4 categories:

1. Ecology—attributes based on the ecological characteristics of the species
2. Institutional—attributes based on the prevailing status of fishery management
3. Social—attributes based on the economic value and the societal importance of the fishery
4. Fishery—attributes based on characteristics of the fishery targeting that MUS

While Rapfish was developed for the purpose of evaluating the sustainability (primarily) of fisheries (Pitcher & Preikshot 2001, Pitcher et al. 2009), we applied the technique—and defined the criteria—to evaluate the potential need of a fishery for greater management or conservation measures. The criteria, therefore, were based directly on the guidelines developed for NS 1, and designed so that "…extreme values of attribute scores could be assigned unequivocally as either 'good' or 'bad' in terms of their relationship to…" this potential need for a higher level of management (Pitcher et al. 1998). Table 2 lists these attributes, their relationship to NS 1 guidelines, and the type of data used divided into four disciplines: Ecology, economic, institutional, and fishery. We used quantitative data (where available), the results from a survey of fisheries experts, literature reviews, and professional judgment to evaluate and score these attributes.

To incorporate the time series from the landings data into the Rapfish analysis, we used linear regression to plot a line based on the annual total landings (i.e., catches from State and federal waters combined. We calculated the R^2 value for each fishery, and the R^2 was used to determine the score for column D: If $R^2 > 0.33$, we used the slope of the line. If $R^2 < 0.33$, the fishery was assigned a score of 2 (flat or irregular) or 3 (episodic: when the number of years with reported landings was <10; a single missing year was not grounds for scoring the fishery as 'episodic'). For example, *Carangoides orthogrammus* was scored as a '2', despite the positive slope of the regression line because $R^2 = 0.32$. *Alectis ciliaris* was scored as a '2' despite n=10 years of landings (not 11).

Table 2. Rapfish analyses: Metrics for fishery disciplines and attributes.

Discipline	Attributes	NS 1 Guidelines	Data Type	Relevance
Ecology	trophic category	1a. Stock is important component of marine environment	categorical: herbivore/planktivore/ carnivore/piscivore (literature)	ecological importance
	trophic level (quantitative)	1b. Stock is important component of marine environment	FishBase§ score for trophic level (literature)	ecological importance
Economic	value	6. Fishery is important to nation & regional economy; 8. Economic condition of the fishery*	landed value (PacFIN)	economic importance; economic condition*
	importance	5. Stock is important to comm/rec/sub users	categorical: tr-pos-unl-fa (expert opinion)	economic importance
Institutional	FMP	3. FMP would improve/maintain condition of stock	categorical: tr-pos-unl-fa (expert opinion)	adequacy of current management
	current	10a. Fishery is already adequately managed	categorical: tr-pos-unl-fa (expert opinion)	adequacy of current management
	State	10b. Fishery is already adequately managed (see Note, below)	proportion of the landings from State waters (see Note, below)	adequacy of current management
Fishery	yrs_land	2b. MUS is caught by fishery	n/11: proportion of years with landings (quantitative)	measure of MUS significance
	trend	2c. MUS is caught by fishery	categorical: graph: incr-flat/irreg-episo-decr (categorical)	measure of MUS significance
	target	4. MUS is a target of a fishery	categorical: tr-pos-unl-fa (expert opinion)	measure of MUS significance

'tr-pos-unl-fa' = true—possible—unlikely—false

'incr-flat/irreg-episo-decr' = increasing—flat or irregular—episodic—decreasing'

§ FishBase (Froese & Pauly 2017), <www.fishbase.org>, accessed May, 2017.

*Annual landed values and the fluctuations in price and landed values provide applicable albeit indirect information on the economic condition of a fishery.

Note: Under NS Guideline 10a and 10b, the terminology refers to the adequacy of existing management. NMFS' ability to provide effective management support is partially limited by the proportion of any fishery pursued in federal waters. For expediency, we assumed that effective federal management was probably limited to those fisheries where ≥20% of landings were reported from federal waters; critically, this is not an indication that effective management by other agencies is guaranteed when federal landings are <20% of total landings.

Score ranges reflected the ordinal nature of some attributes (e.g., 0 to 2 or 0 to 4) as well as the continuous values possible for other attributes (e.g., landings in pounds). In order to accommodate requirements of the Rapfish statistical analysis, these scores were standardized. These standardized scores are shown in Table 3. Results of the Rapfish analysis are given in section 3.4.

Table 3. Standardized scores for 26 MUS.

	Yrs. Landed	Trend	Target	FMP	Current	State	Trophic Category	Trophic Level	Value	Importance	Sum of Scores
Randall's Snapper	1.8	5.0	3.5	5.5	9.0	0.0	10.0	8.9	-	4.5	48.2
No-Bite, whitefin trevally	0.9	5.0	5.5	5.5	8.5	0.0	10.0	8.9	-	4.5	48.8
Alfonsin (flashlight fish)	1.8	5.0	3.0	5.0	7.5	0.0	7.5	9.1	-	3.0	41.9
Black Coral	0.9	5.0	10.0	9.5	8.0	0.0	5.0	-	-	9.5	47.9
Deepwater Shrimp	2.7	5.0	9.0	8.0	7.0	0.7	5.0	-	0.3	7.5	45.2
Silverjaw Jobfish (Lehi)	10.0	7.5	9.5	9.5	8.0	2.6	10.0	9.1	0.5	9.0	75.8
Pink Snapper (Opakapaka)	10.0	10.0	10.0	9.5	8.0	2.8	7.5	9.3	10.0	10.0	87.2
Red Snapper (Onaga)	10.0	2.5	10.0	10.0	8.0	3.2	10.0	9.8	8.2	10.0	81.7
Pink Snapper (Kalekale)	10.0	10.0	10.0	9.5	8.5	3.3	7.5	8.2	-	9.5	76.5
Gray Jobfish (Uku)	10.0	10.0	10.0	10.0	7.0	3.4	7.5	9.6	6.7	10.0	84.2
Largeheaded scorpionfish (Hogo)	10.0	7.5	5.5	6.5	5.5	3.9	7.5	8.0	0.2	5.5	60.0
Goldspot jack (Papa)	10.0	7.5	8.5	8.5	6.5	4.0	7.5	10.0	0.3	6.5	69.3
Red Snapper (Ehu)	10.0	7.5	10.0	10.0	8.0	4.2	7.5	10.0	1.8	10.0	78.9
Golden Kali	10.0	7.5	4.0	5.5	7.5	4.2	5.0	7.6	-	4.0	55.3
Sea Bass (Hapuupuu)	10.0	7.5	10.0	10.0	7.0	5.1	7.5	8.9	1.5	9.5	77.0
Flower Snapper (Gindai)	10.0	10.0	9.5	9.5	8.5	5.2	7.5	8.9	0.2	9.5	78.8

	Yrs. Landed	Trend	Target	FMP	Current	State	Trophic Category	Trophic Level	Value	Importance	Sum of Scores
Greater Amberjack (Kahala)	10.0	10.0	7.0	8.0	7.5	5.3	10.0	10.0	-	5.5	73.3
Kona Crab	10.0	7.5	10.0	10.0	6.5	5.5	7.5	-	-	9.5	66.5
Pig Lipped Trevally (Butaguchi)*	9.1	7.5	10.0	8.0	6.0	5.6	7.5	8.0	0.2	10.0	72.0
Rainbow runner (Kamanu)	10.0	7.5	5.0	5.0	7.5	6.8	7.5	9.6	0.1	5.5	64.5
Ulua kihikihi (Kagami)	9.1	7.5	6.0	6.0	7.0	7.6	7.5	8.9	-	5.0	64.6
Giant Trevally (White Ulua)	10.0	7.5	10.0	8.5	6.0	7.6	10.0	9.3	0.4	10.0	79.3
Mackerel scad (Opelu)	10.0	7.5	10.0	8.0	6.5	7.7	5.0	8.9	7.2	10.0	80.8
Papio, Ulua (jack family)	6.4	5.0	10.0	8.0	6.0	7.8	7.5	8.4	-	10.0	69.1
Peacock wrasse (Laenihi)	10.0	7.5	8.5	7.0	6.0	7.8	7.5	7.8	-	7.0	69.1
Shark (misc.)	10.0	10.0	4.5	7.0	7.0	8.0	10.0	9.8	2.0	4.5	72.8

*Likely refers to *Thick* lipped Trevally (Butaguchi), *Pseudocaranx dentex*. A '-' indicates no available data.

Section 3. Results

3.1 Landings

Of the 115 MUS from the Hawaii FEP, 4 reported landings from offshore, federal waters only, 49 had landings exclusively from inshore waters, and the remainder, 62, reported landings from both inshore and offshore waters. A table of all of these species is provided in Appendix 3. Twenty-five of the MUS reported total landings from federal waters equal to or in excess of 20% (Table 4); we included sharks, despite reporting 19.7% of landing from federal waters because 1) the score is close to the criterion and 2) this MUS includes fishes with a suite of biological and fishery characteristics that make most component species particularly vulnerable to over-fishing. The first 4 MUS are notable for having no landings from State waters (i.e., federal waters only) and Table 4 presents them in rank order from those with highest proportion of catches from federal waters to the MUS with the lowest proportion ≥20%. Time series for all MUS were reviewed graphically, and the 26 referred to above are shown in Appendix 4; a list of all MUS reported from inshore waters (i.e., State) only is provided in Appendix 5.

Table 4. MUS with federal landings ratios ≥20% + sharks.

Ratio	Common	Scientific	Pacific Islands Name
1.000	Black Coral	*Antipathes* spp.	Black coral
1.000	Alfonsin	*Beryx decadactylus*	Alfonsin, Lantern-eye, Flashlight fish
1.000	No-Bite	*Carangoides equula*	Whitefin trevally, No-bite ulua
1.000	Randall's Snapper	*Randallichthys filamentosus*	Randall's snapper; Bake-akamutsu
0.932	Deepwater Shrimp	*Heterocarpus laevigatus*	Deepwater shrimp, Nylon shrimp
0.736	Silverjaw Jobfish	*Aphareus rutilans*	Lehi, Deep/Silvermouth
0.716	Pink Snapper	*Pristipomoides filamentosus*	Opakapaka, Pink snapper, Crimson jobfish
0.681	Red Snapper	*Etelis coruscans*	Onaga, Ulaula, Ulu, Buninas, Taighulupegh, Longtail snapper
0.669	Pink Snapper	*Pristipomoides sieboldii*	Kalekale, Kalikali, Lavender jobfish
0.657	Gray Jobfish	*Aprion virescens*	Uku, Gogunafon, Aiwe, Hi-Way
0.614	Hogo	*Pontinus macrocephalus*	Hogo, Nohu, Largeheaded scorpionfish, Red seabass
0.595	Papa	*Carangoides orthogrammus*	Island/Yellow spotted/Goldspot jack/trevally
0.583	Red Snapper	*Etelis carbunculus*	Ehu, Buninas agaga, Falaghal moroobw
0.575	Golden Kali	*Erythrocles schlegelii, E. scintillans*	Golden kale, Schlegel's boga fish, Yanaginomai
0.493	Sea Bass	*Hyporthodus quernus*	Hapu'upu'u, Shapon, Sapon
0.478	Flower Snapper	*Pristipomoides zonatus*	Gindai, Buninas, Flower snapper, Tai, Kindai, Kentai, Shimac
0.474	Greater Amberjack	*Seriola dumerili*	Kahala, Greater amberjack, Boogaman
0.447	Kona Crab	*Ranina ranina*	Kona crab
0.436	Pig Lipped Trevally	*Caranx* spp. (juvenile)	I'e, Papio
0.319	Kamanu	*Elagatis bipinnulata*	Hawaiian Salmon, Rainbow Runner, Kamano
0.238	Kagami	*Alectis ciliaris*	Ulua kihikihi, Kagami ulua, Uluaki
0.235	Giant Trevally	*Caranx ignobilis*	White ulua, Mamulan, Tarakiton, Etam
0.230	Opelu	*Decapterus macarellus*	Opelu, Mackerel scad, Muroaji
0.222	Papio, Ulua	Carangidae (family)	Ulua/papio (Misc.)
0.219	Laenihi	*Iniistius pavo*	Laenihi, Nabeta, Peacock/blue wrasse
0.197	Shark	*Squalus, Carcharhinus* spp.	Sharks

3.2 Economics

Fifteen of the 26 MUS selected for review were included in the WPacFIN database. The total landed values summed over the 11-year time series ranged from $59,602 (rainbow runner) to $7,100,133 (Opakapaka), and the maximum price per MUS pound over this time period ranged from $1.08 (misc. sharks) to $9.00 (deepwater shrimp) (Table 5). The value of annual landings was least variable for Uku and most variable the high-value deepwater shrimp (Table 5).

Table 5. WPacFIN economic data (2004-2014) for priority MUS.

MUS	Price/Lb. (max)	Coef Var	Value mean	Value total (sum)
Randall's Snapper	-	-	-	-
No-Bite, whitefin trevally	-	-	-	-
Alfonsin (flashlight fish)	-	-	-	-
Black Coral	-	-	-	-
Deepwater Shrimp	$9.00	1.8424	$19,691	$216,600
Silverjaw Jobfish (Lehi)	$4.66	0.3327	$34,327	$377,596
Pink Snapper (Opakapaka)	$6.79	0.2355	$645,467	$7,100,133
Red Snapper (Onaga)	$8.12	0.2674	$529,188	$5,821,073
Pink Snapper (Kalekale)	-	-	-	-
Gray Jobfish (Uku)	$4.53	0.0976	$431,628	$4,747,905
Largeheaded scorpionfish (Hogo)	$6.68	0.3039	$10,338	$113,723
Goldspot jack (Papa)	$4.72	0.7074	$18,916	$208,077
Red Snapper (Ehu)	$6.21	0.2292	$114,146	$1,255,611
Golden Kali	-	-	-	-
Sea Bass (Hapuupuu)	$5.64	0.6311	$96,049	$1,056,541
Flower Snapper (Gindai)	$4.92	0.3381	$12,778	$140,560
Greater Amberjack (Kahala)	-	-	-	-
Kona Crab	-	-	-	-
Pig Lipped Trevally (Butaguchi)*	$4.56	1.1525	$15,365	$169,012
Rainbow runner (Kamanu)	$2.63	0.3600	$5,418	$59,602
Ulua kihikihi (Kagami)	-	-	-	-
Giant Trevally (White Ulua)	$2.89	0.2157	$23,162	$254,784
Mackerel scad (Opelu)	$2.89	0.1432	$463,668	$5,100,346

MUS	Price/Lb. (max)	Coef Var	Value mean	Value total (sum)
Papio, Ulua (jack family)	-	-	-	-
Peacock wrasse (Laenihi)	-	-	-	-
Shark (misc.)	$1.08	0.2500	$126,268	$1,388,947

*Likely refers to *Thick* lipped Trevally (Butaguchi), *Pseudocaranx dentex*. A '-' indicates no data available.

3.3 Expert Assessment

Expert assessments for four key attributes can be summarized as providing answers (limited to "true", "possibly", "unlikely [to be true]", "false") to the following questions:

- Is the stock the target of a fishery?
- Is the fishery economically important to Hawaiian fishermen?
- Would the fishery benefit substantially from a formal FMP?
- Is fishery already managed sustainably?

These assessments were used in the Rapfish analysis (below), but it is important to note that these assessments were not always consistent. Table 6 shows the standard deviation for each fishery x attribute combination, ordered from the fishery where the average concordance was the greatest (blue; mean SD=0.2092 for red snapper or *ehu*) to the least (red; mean SD=0.9980 for no-bite or whitefin trevally). The experts agreed more closely about whether the MUS was the target of a fishery, and least about the efficacy of the current management approach.

Table 6. Agreement (blue, lower scores) and disagreement (red, higher scores) among expert assessments and average congruence.

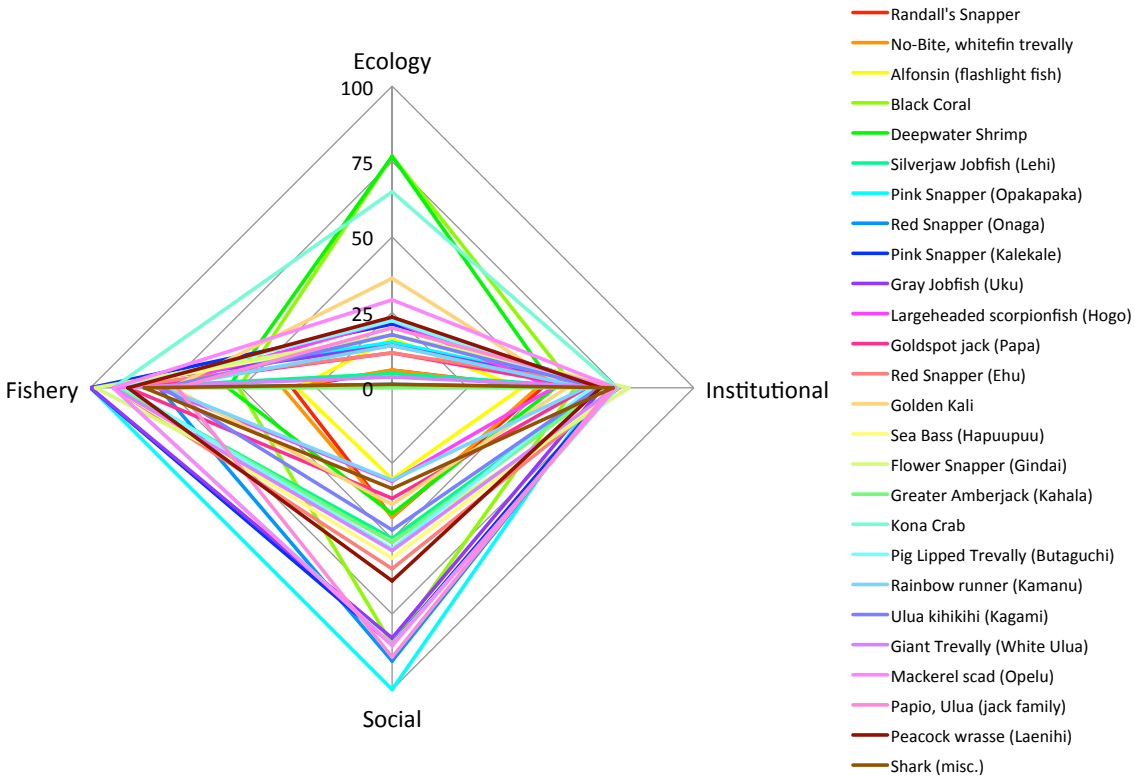
	Targeted	Econ. Imp.	FMP	Management	Mean
Red Snapper (Onaga)	0.0000	0.0000	0.0000	0.8367	0.2092
Red Snapper (Ehu)	0.0000	0.0000	0.0000	0.8367	0.2092
Gray Jobfish (Uku)	0.0000	0.0000	0.0000	1.0954	0.2739
Pink Snapper (Opakapaka)	0.0000	0.0000	0.4472	0.8367	0.3210
Sea Bass (Hapuupuu)	0.0000	0.4472	0.0000	0.8367	0.3210
Papio, Ulua (jack family)	0.0000	0.0000	0.8367	0.5477	0.3461
Pink Snapper (Kalekale)	0.0000	0.4472	0.4472	0.5477	0.3605
Giant Trevally (White Ulua)	0.0000	0.0000	0.8944	0.5477	0.3605
Kona Crab	0.0000	0.4472	0.0000	1.1402	0.3968
Black Coral	0.0000	0.4472	0.4472	0.8367	0.4328
Mackerel scad (Opelu)	0.0000	0.0000	0.8367	0.8944	0.4328
Flower Snapper (Gindai)	0.4472	0.4472	0.4472	0.5477	0.4723
Pig Lipped Trevally (Butaguchi)*	0.0000	0.0000	0.8367	1.1402	0.4942
Silverjaw Jobfish (Lehi)	0.4472	0.5477	0.4472	0.8367	0.5697
Rainbow runner (Kamanu)	0.7071	0.4472	0.7071	0.7071	0.6421
Peacock wrasse (Laenihi)	0.5477	0.8367	0.4472	0.8944	0.6815
Golden Kali	0.5477	0.5477	0.4472	1.2247	0.6919
Alfonsin (flashlight fish)	0.4472	0.4472	0.7071	1.2247	0.7066
Ulua kihikihi (Kagami)	0.5477	0.7071	0.8944	0.8367	0.7465
Largeheaded scorpionfish (Hogo)	0.8367	0.8367	0.5477	0.8367	0.7644
Greater Amberjack (Kahala)	1.0954	0.8367	0.4472	0.7071	0.7716
Deepwater Shrimp	0.8944	1.2247	0.8367	0.4472	0.8508
Goldspot jack (Papa)	0.8944	1.1402	0.5477	0.8944	0.8692
Randall's Snapper	0.8944	1.3038	0.8367	0.5477	0.8957
Shark (misc.)	0.8367	1.0954	0.8367	0.8367	0.9014
No-Bite, whitefin trevally	1.3038	1.3038	0.8367	0.5477	0.9980

*Likely refers to *Thick* lipped Trevally (Butaguchi), *Pseudocaranx dentex*.

3.4 Rapfish

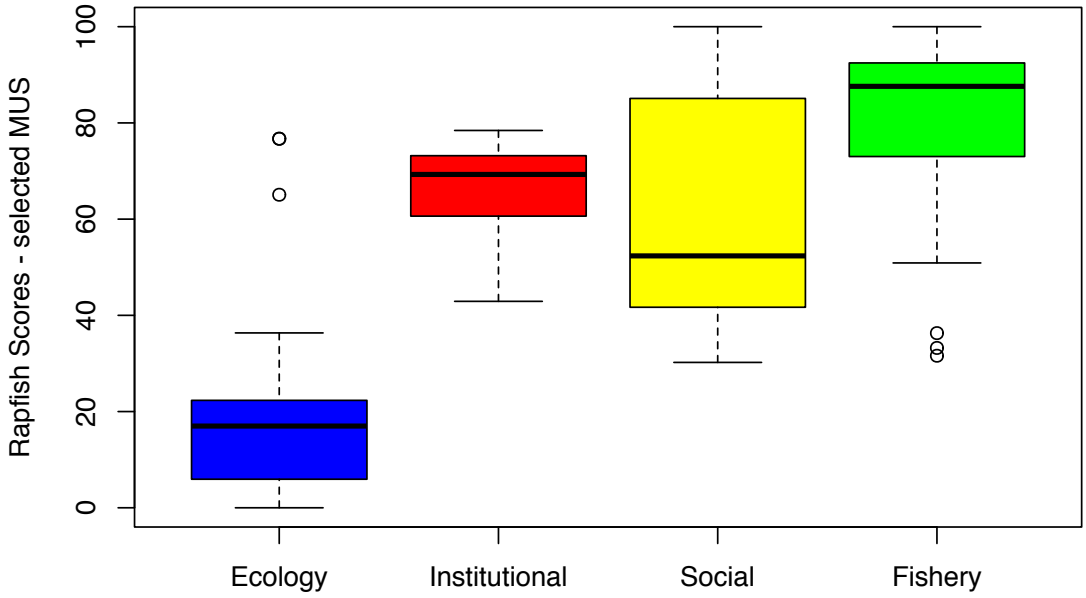
Ordination of the MUS attributes positioned the fisheries along a spectrum between a theoretical worst-case fishery, one presumably most urgently in need of management attention, and an equally theoretical best-case fishery, one for which additional management would be least necessary. Because only the score on the first axis is relevant, we present the results in a kite diagram (Figure 2), rather than providing two-dimensional ordinations. Note that a fishery can be simultaneously well managed and, targeting an apex predator, ecologically vulnerable, these attributes were evaluated separately for each discipline (ecology, socio-economics, institution, fishery).

Figure 2. Kite diagram of Rapfish results for all 26 MUS.



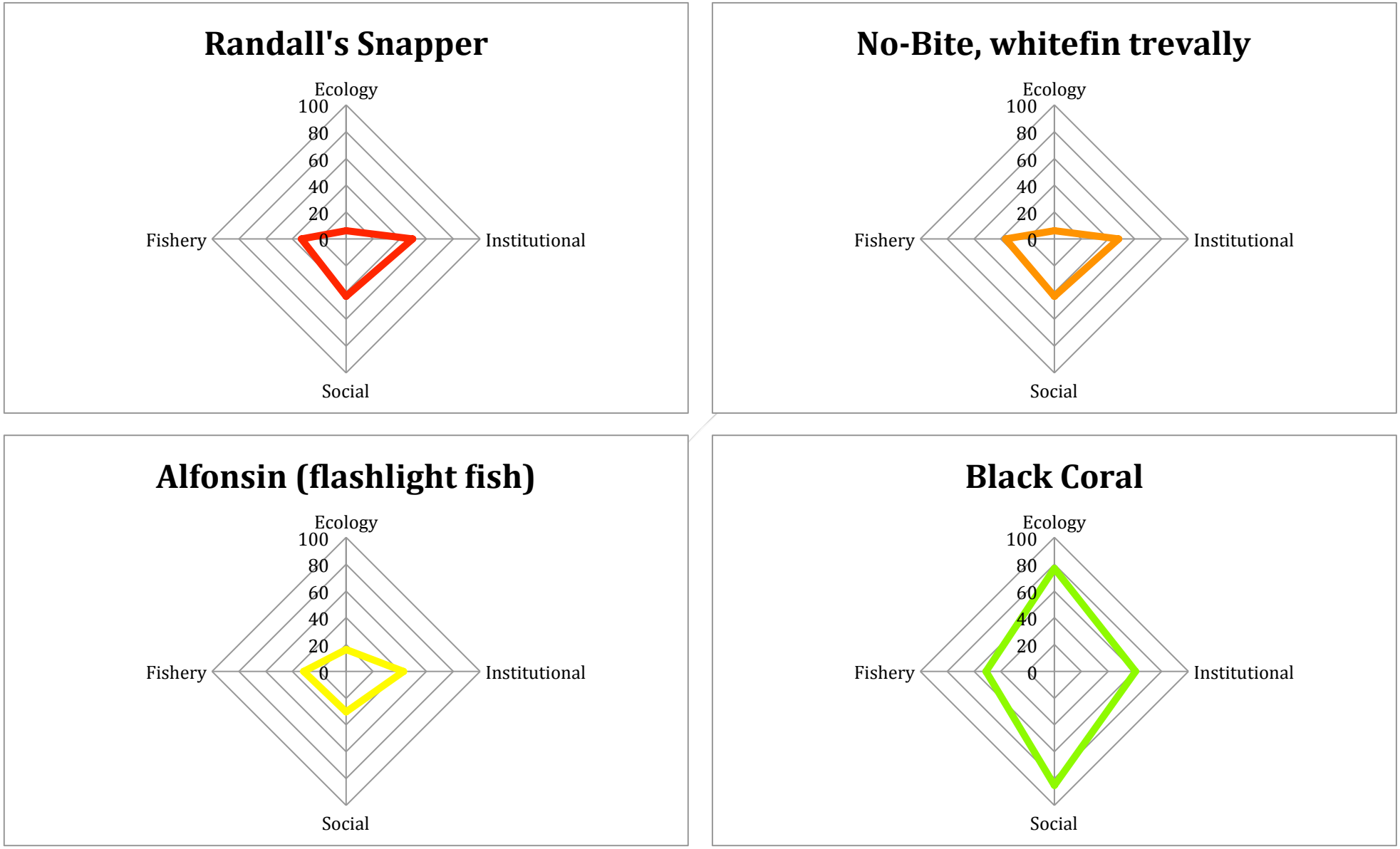
The variance in the fisheries' scores by discipline (Figure 3) shows the scope for management action.

Figure 3. Boxplot of Rapfish scores by discipline.

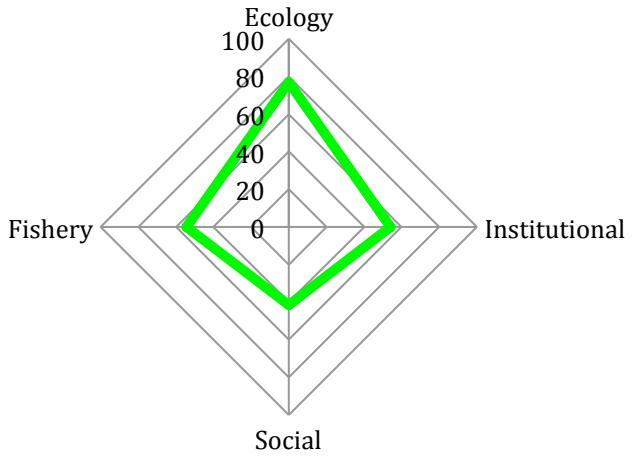


To aid in the review of individual fisheries, Figure 4 (a-z) shows Rapfish scores for individual fisheries.

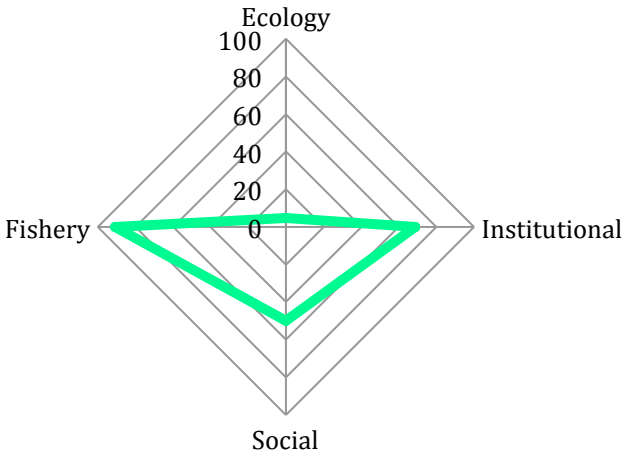
Figure 4. Kite diagrams for 26 MUS with ≥20% of landings from Federal waters + sharks.



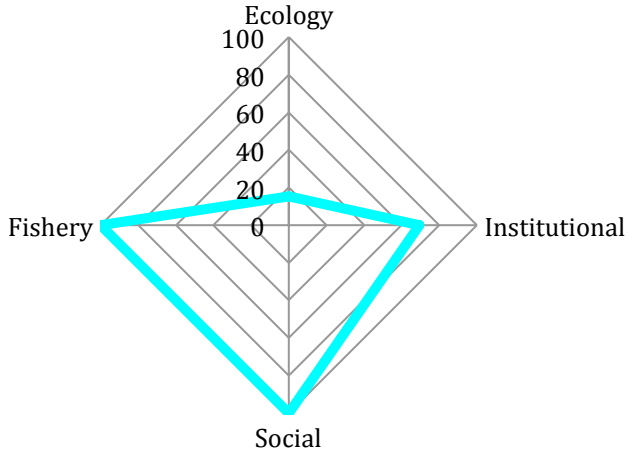
Deepwater Shrimp



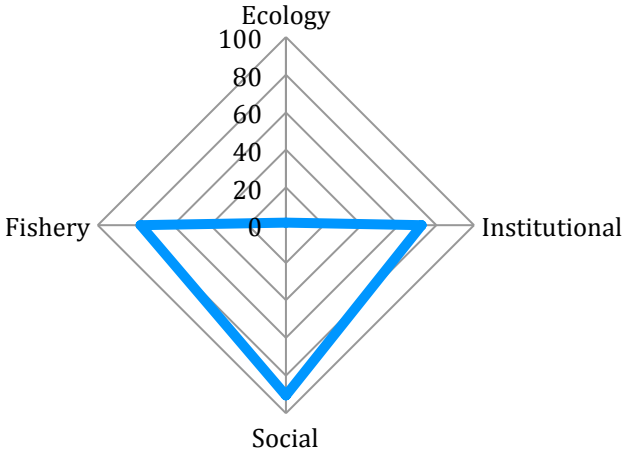
Silverjaw Jobfish (Lehi)



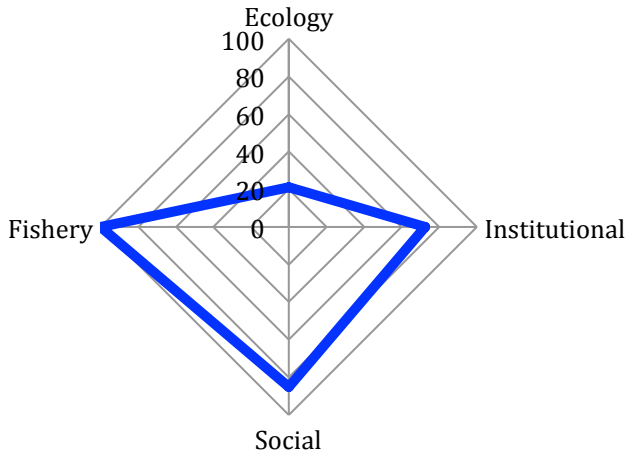
Pink Snapper (Opakapaka)



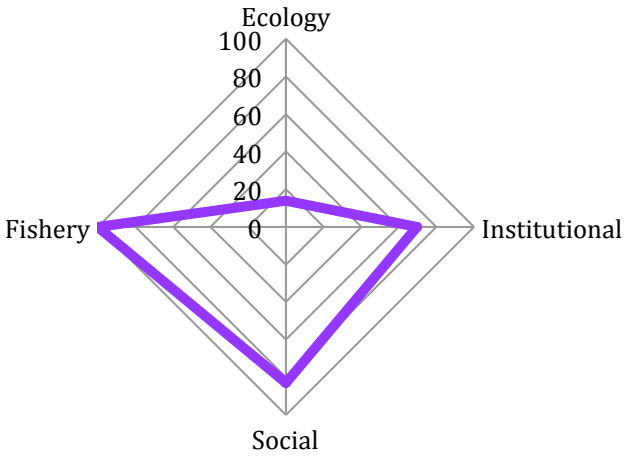
Red Snapper (Onaga)



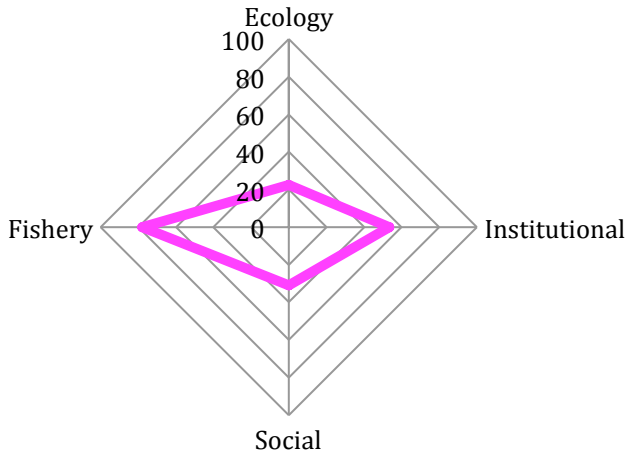
Pink Snapper (Kalekale)



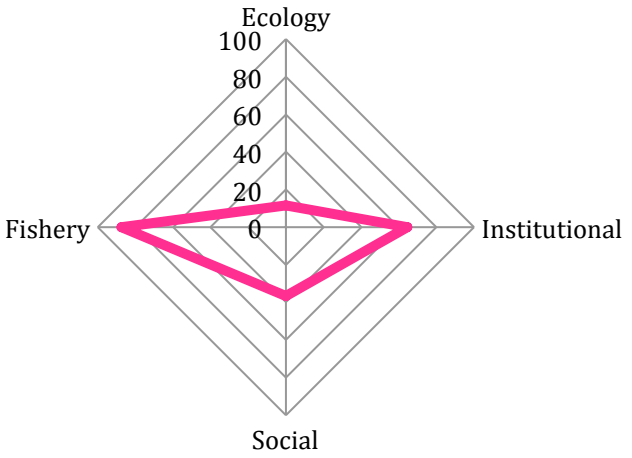
Gray Jobfish (Uku)



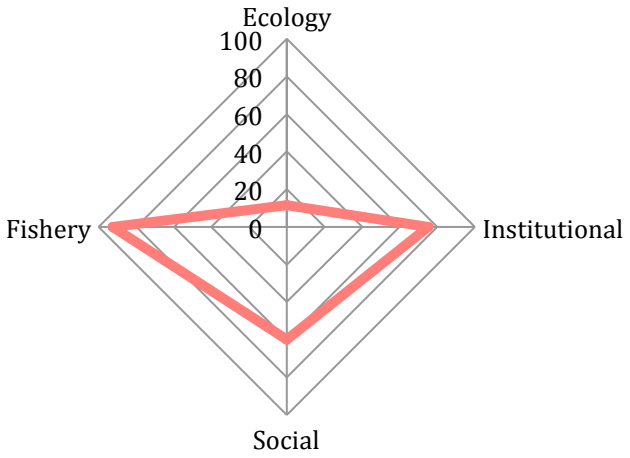
Largeheaded scorpionfish (Hogo)



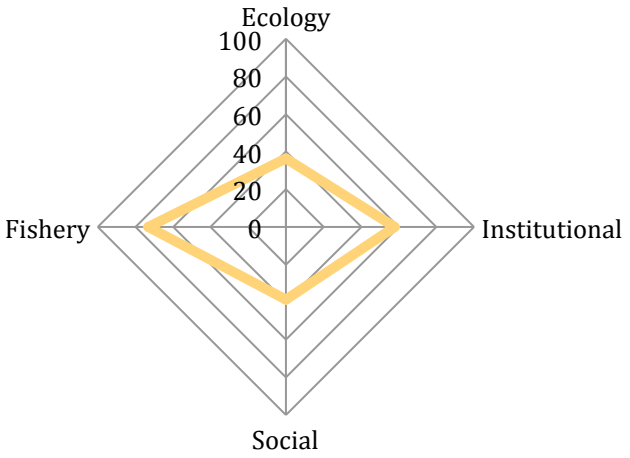
Goldspot jack (Papa)



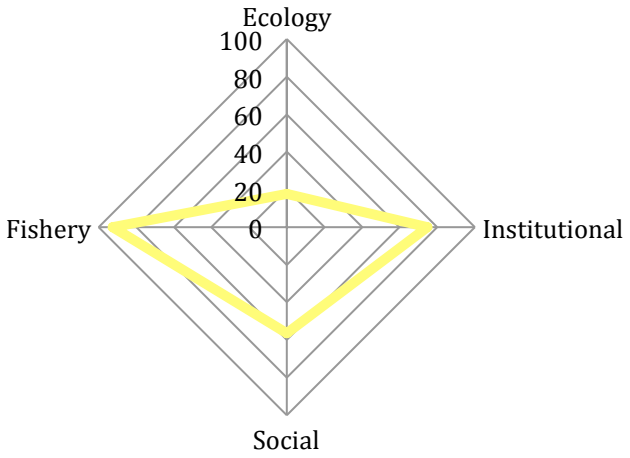
Red Snapper (Ehu)



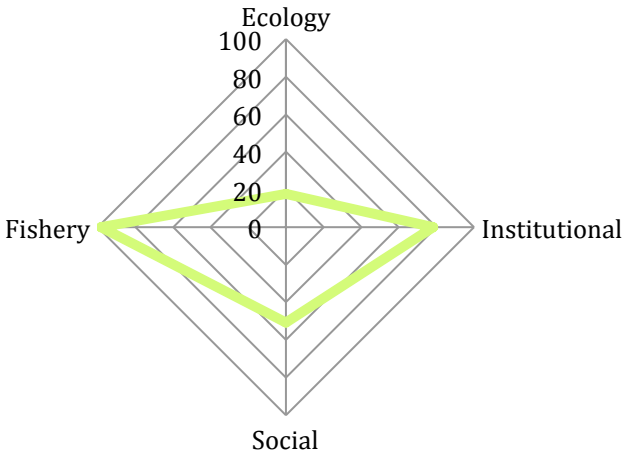
Golden Kali



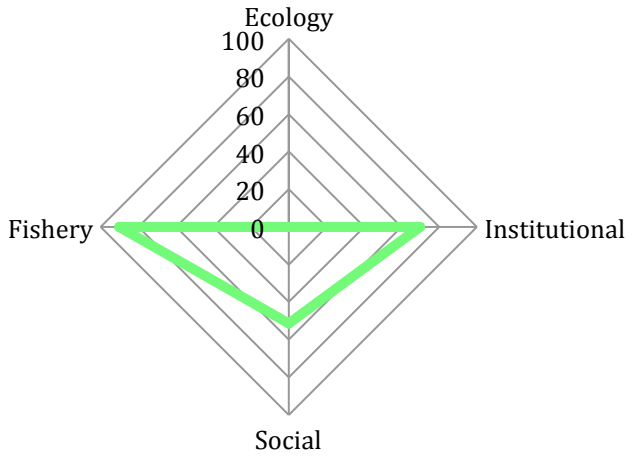
Sea Bass (Hapuupuu)



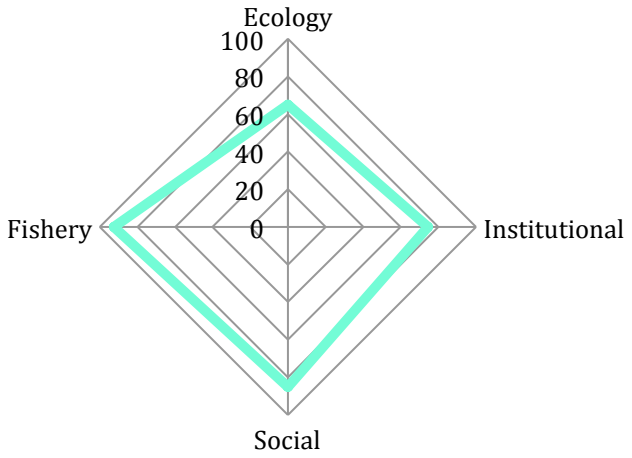
Flower Snapper (Gindai)



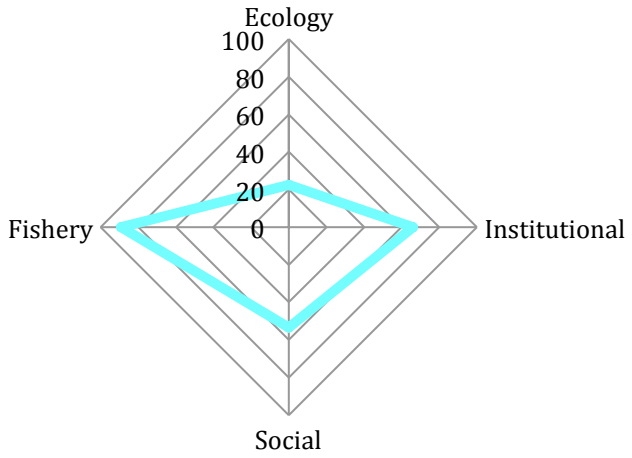
Greater Amberjack (Kahala)



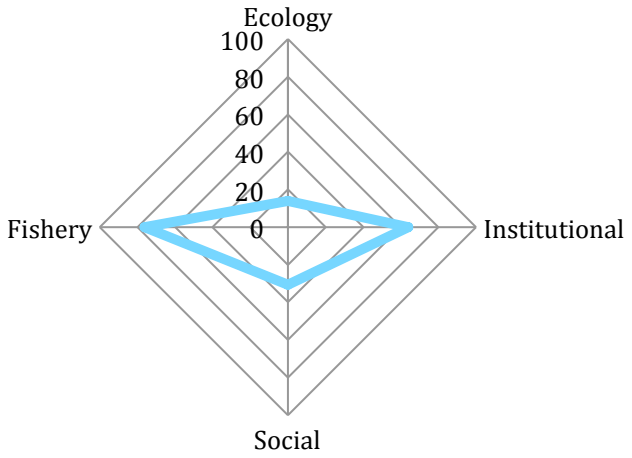
Kona Crab



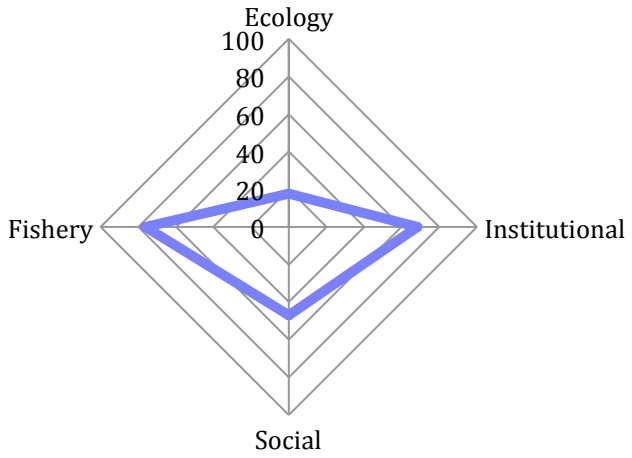
Pig Lipped Trevally (Butaguchi)



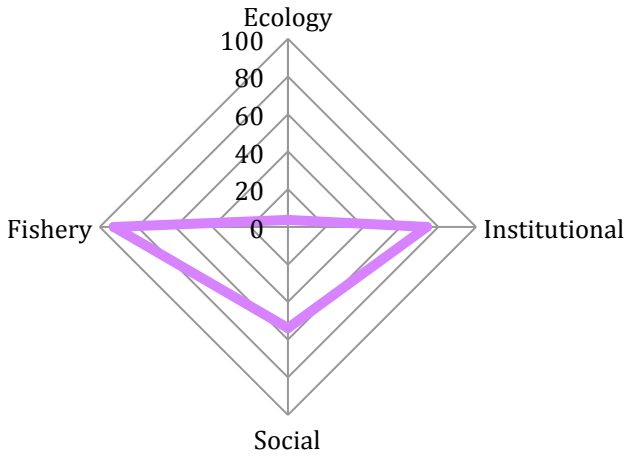
Rainbow runner (Kamanu)



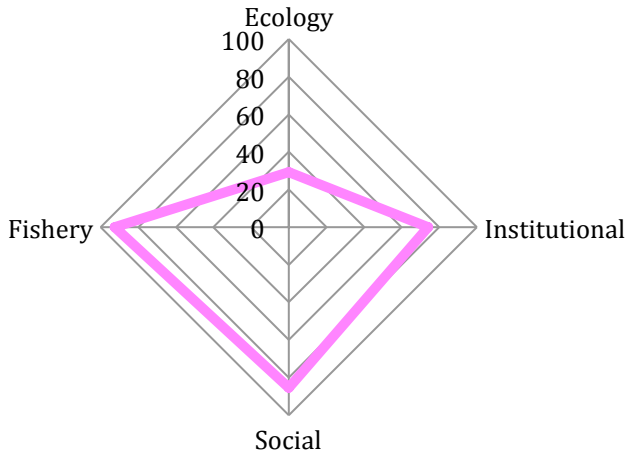
Ulua kihikihi (Kagami)



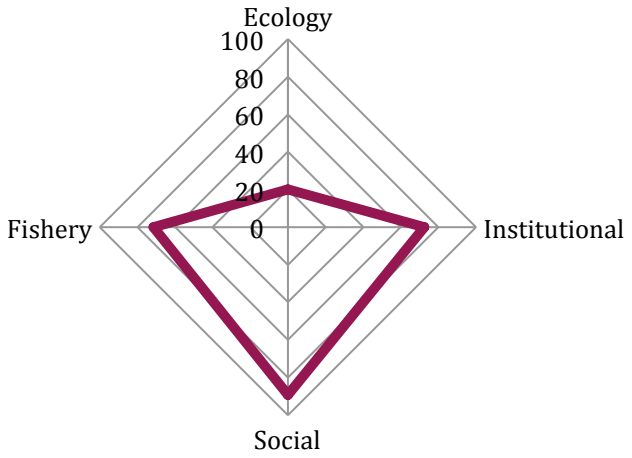
Giant Trevally (White Ulua)

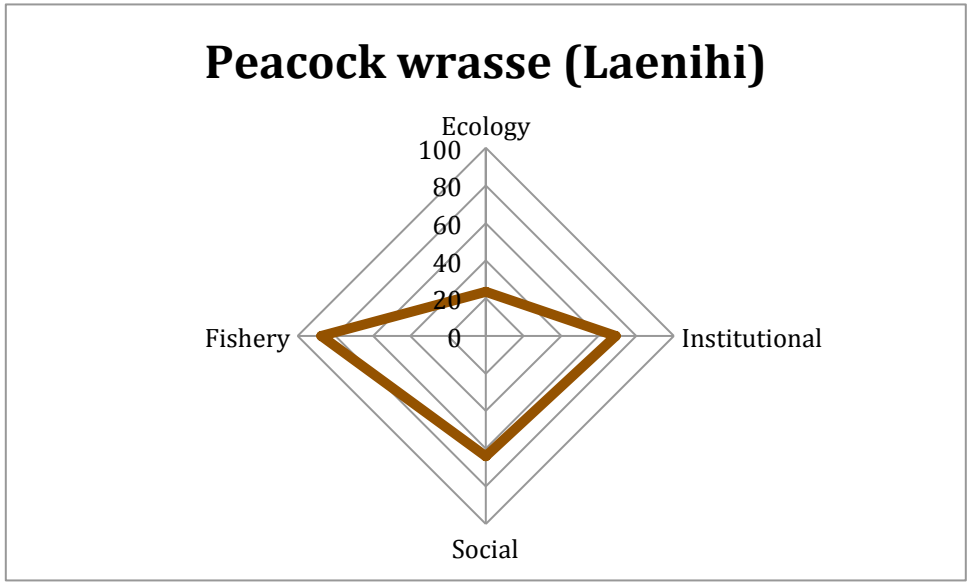


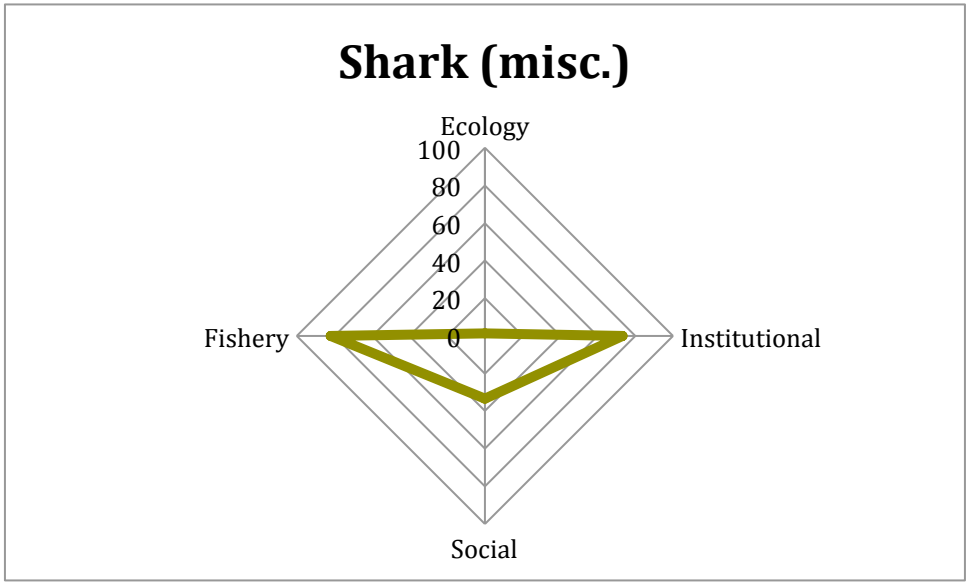
Mackerel scad (Opelu)



Papio, Ulua (jack family)




Peacock wrasse (Laenihi)
Ecology
100
80
60
40
20
0
Fishery
Institutional
Social


Shark (misc.)
Ecology
100
80
60
40
20
0
Fishery
Institutional
Social

Section 4. Conclusions

All MUS with less than 20%[3] of their combined landings (2004-20014) from federal waters should be removed from the Hawaii FEP. The species that make up these MUS are not without ecological importance; however, from a management perspective, even a complete closure of all federal waters to their capture would have a minimal and probably undetectable impact on population dynamics. At present, these species appear either to have only a minor presence in Hawaiian fisheries or (more often) to be so strongly associated with State waters, that their management is more properly the domain of the State of Hawaii.

The MUS with landings from federal waters equal to or greater than 20%, however, have the potential to benefit from a federal component to their conservation and management. Table 7 shows the Rapfish scores for the 26 MUS with a significant presence in federal waters fisheries, and the quartiles based on the summed scores. High (yellow) scores suggest a more vulnerable fishery with greater management and conservation needs; low (green) scores suggest a reduced need for close management attention.

Application of National Standards 1, 3 and 7 using the Rapfish analysis on these MUS and their rank, coupled with the observations of fishery experts in Hawaiian fisheries and our own observations, suggest the following (see also Table 8): Six MUS should be removed from the Hawaii FEP—Goldspot Jack (*Papa*), Rainbow Runner (*Kamanu*), Largeheaded Scorpionfish (*Hogo*), No-Bite (Whitefin Trevally), Randall's Snapper, and Alfonsin (Flashlight Fish). These MUS all fell into the first (lowest) quartile of the summed Rapfish scores (Table 8). One other MUS in the first quartile, Shark (misc.), we recommend be categorized as an Ecosystem Component; this MUS is something of a catch-all for a comparatively diverse group of species, known for their low rate of reproduction and susceptibility to overfishing. In addition, sharks are high trophic level species with a potential to affect ecosystem function disproportionate to their numbers; their removal may have substantial, deleterious effects. At the other end of the spectrum where fisheries are important or uniquely vulnerable, Kona Crab, Pink Snapper (*Opakapaka*), Mackerel scad (*Opelu*), Pink Snapper (*Kalekale*), Black Coral, and Gray Jobfish (*Uku*) and should be carefully considered for conservation and management. Members of this group of MUS vary quite widely in their biological and fishery characteristics, but all warrant close attention. Most of the remaining MUS we recommend be considered as 'ecosystem components', where management may be warranted given increased fishing

[3] These MUS all had <15% of their combine landings from federal waters; there was an abrupt decrease in this percentage when all MUS were compared across this boundary.

mortality, changing environmental conditions, or additional data, but highlight three that merit closer attention than the others: Peacock wrasse (*Laenihi*), Red Snapper (*Onaga*), and Sea Bass (*Hapuupuu*). Although the results of the analyses placed them comfortably in the third quartile, notes from the expert assessments and our own perspective suggest that these also deserve notice. We recommend that they remain in the 'Ecosystem Component' classification for the present, but additional data or changes to these fisheries could easily warrant dedicated conservation and management measures.

Table 7. Rapfish scores for MUS with ≥20% of landings from federal waters + sharks and the quartiles (Q) for the summed scores.

MUS	Ecology	Institutional	Social	Fishery	Total	Q	scientific name(s)
Kona Crab	65.1	74.5	85.1	92.5	317	4	*Ranina ranina*
Pink Snapper (Opakapaka)	15.2	69.4	100.0	100.0	285	4	*Pristipomoides filamentosus*
Mackerel scad (Opelu)	29.2	74.1	85.4	92.5	281	4	*Decapterus macarellus*
Pink Snapper (Kalekale)	21.1	72.5	85.1	100.0	279	4	*Pristipomoides sieboldii*
Black Coral	76.7	60.6	85.1	50.9	273	4	*Antipathes* spp.
Gray Jobfish (Uku)	14.0	69.7	82.9	100.0	267	4	*Aprion virescens*
Papio, Ulua (jack family)	20.0	72.6	89.3	71.3	253	4	Carangidae (family)
Flower Snapper (Gindai)	17.6	78.4	50.9	98.4	245	3	*Pristipomoides zonatus*
Peacock wrasse (Laenihi)	23.5	69.2	64.0	87.6	244	3	*Iniistius pavo*
Red Snapper (Onaga)	1.2	72.3	90.6	77.4	241	3	*Etelis coruscans*
Sea Bass (Hapuupuu)	17.6	74.7	56.4	92.5	241	3	*Hyporthodus quernus*
Red Snapper (Ehu)	11.6	75.3	60.0	92.5	239	3	*Etelis carbunculus*
Pig Lipped Trevally (Butaguchi)*	22.3	66.0	53.4	89.1	231	2	*Caranx* spp. (juvenile)
Deepwater Shrimp	76.7	54.0	41.7	54.5	227	2	*Heterocarpus laevigatus*
Giant Trevally (White Ulua)	3.6	74.0	53.9	92.5	224	2	*Caranx ignobilis*
Silverjaw Jobfish (Lehi)	4.7	68.8	49.9	90.8	214	2	*Aphareus rutilans*
Greater Amberjack (Kahala)	0.0	69.8	51.3	90.3	211	2	*Seriola dumerili*
Ulua kihikihi (Kagami)	17.6	68.4	47.1	76.1	209	2	*Alectis ciliaris*
Golden Kali	36.3	57.8	38.7	73.0	206	2	*Erythrocles schlegelii, E. scintillans*
Goldspot jack (Papa)	11.6	64.5	36.6	87.6	200	1	*Carangoides orthogrammus*
Shark (misc.)	1.2	73.2	33.4	82.2	190	1	*Carcharhinus, Squalus* spp.
Rainbow runner (Kamanu)	14.0	64.0	30.6	76.3	185	1	*Elagatis bipinnulata*
Largeheaded scorpionfish (Hogo)	22.3	53.5	30.9	77.9	185	1	*Pontinus macrocephalus*
No-Bite, whitefin trevally	5.9	48.0	42.9	36.3	133	1	*Carangoides equula*
Randall's Snapper	5.9	49.7	42.9	33.2	132	1	*Randallichthys filamentosus*
Alfonsin (flashlight fish)	16.4	42.9	30.2	31.6	121	1	*Beryx decadactylus*

*Likely refers to Thick lipped Trevally (Butaguchi), *Pseudocaranx dentex*.

Table 8. Ranked scores and expert assessment were combined to recommend management actions.

	Conservation & Management	Ecosystem Component	Remove from FEP	Scientific Name(s)
Kona Crab	X			*Ranina ranina*
Pink Snapper (Opakapaka)	X			*Pristipomoides filamentosus*
Mackerel scad (Opelu)	X			*Decapterus macarellus*
Pink Snapper (Kalekale)	X			*Pristipomoides sieboldii*
Black Coral	X			*Antipathes* spp.
Gray Jobfish (Uku)	X			*Aprion virescens*
Papio, Ulua (jack family)		X		Carangidae (family)
Flower Snapper (Gindai)		X		*Pristipomoides zonatus*
Peacock wrasse (Laenihi)	?	X		*Iniistius pavo*
Red Snapper (Onaga)	?	X		*Etelis coruscans*
Sea Bass (Hapuupuu)	?	X		*Hyporthodus quernus*
Red Snapper (Ehu)		X		*Etelis carbunculus*
Pig Lipped Trevally (Butaguchi)*		X		*Caranx* spp. (juvenile)
Deepwater Shrimp		X		*Heterocarpus laevigatus*
Giant Trevally (White Ulua)		X		*Caranx ignobilis*
Silverjaw Jobfish (Lehi)		X		*Aphareus rutilans*
Greater Amberjack (Kahala)		X		*Seriola dumerili*
Ulua kihikihi (Kagami)		X		*Alectis ciliaris*
Golden Kali		X		*Erythrocles schlegelii, E. scintillans*
Goldspot jack (Papa)			X	*Carangoides orthogrammus*
Shark (misc.)		X		*Carcharhinus, Squalus* spp.
Rainbow runner (Kamanu)			X	*Elagatis bipinnulata*
Largeheaded scorpionfish (Hogo)			X	*Pontinus macrocephalus*
No-Bite, whitefin trevally			X	*Carangoides equula*
Randall's Snapper			X	*Randallichthys filamentosus*
Alfonsin (flashlight fish)			X	*Beryx decadactylus*

*Likely refers to Thick lipped Trevally (Butaguchi), *Pseudocaranx dentex*.

Section 5. Acknowledgements

Mahalo nui loa to Jarad Makaiau (NMFS) and Marlowe Sabater (WPRFMC) for their patient, knowledgeable and insightful assistance in all phases of this work. We are also grateful to the fishery scientists who took the time to complete our expert assessment surveys; their care, knowledge and assistance were tremendously helpful.

Section 6. References

Friedlander AM, Parrish JD (1997) Fisheries harvest and standing stock in a Hawaiian Bay. Fish Res 32:33–50

Froese R, Pauly D (2017) FishBase, www.fishbase.org

Gulko D, Maragos JE, Friedlander AM, Brainard R (2002) Status of coral reefs in the Hawaiian Archipelago. Silver Spring, Maryland

Hamnett MP, Liu M, Johnson DB (2004) Fishing, ocean recreation, and threats to Hawaii's coral reefs. Honolulu, Hawaii

Nadon MO (2017) Stock Assessment of the Coral Reef Fishes of Hawaii, 2016. US Dept Commer NoAA Tech Memo NOAA-TM-NM:217

Pitcher TJ (1999) Rapfish, a rapid appraisal technique for fisheries, and its application to the code of conduct for responsible fisheries. Food and Agricultural Organization of the United Nations, Rome

Pitcher T, Bundy A, Preikshot D, Hutton T, Pauly D (1998) Measuring the unmeasurable: a multivariate and interdisciplinary method for rapid appraisal of the health of fisheries. In: Pitcher T, Hart PJB, Pauly D (eds) Reinventing Fisheries Management. Kluwer Academic Publishers, London, p 31–54

Pitcher TJ, Kalikoski D, Short K, Varkey D, Pramod G (2009) An evaluation of progress in implementing ecosystem-based management of fisheries in 33 countries. Mar Policy 33:223–232

Pitcher TJ, Lam ME, Ainsworth C, Martindale A, Nakamura K, Perry RI, Ward T (2013) Improvements to Rapfish: a rapid evaluation technique for fisheries integrating ecological and human dimensions. J Fish Biol 83:865–889

Pitcher TJ, Preikshot D (2001) RAPFISH: A rapid appraisal technique to evaluate the sustainability status of fisheries. Fish Res 49:255–270

R Development Core Team (2016) R: A language and environment for statistical computing.

Tissot BN (2005) Integral marine ecology: community-based fishery management in Hawaii. World Futures 61:79–95

Zeller D, Darcy M, Booth S, Lowe MK, Martell S (2008) What about recreational catch? Fish Res 91:88–97

Zeller D, Harper S, Zylich K, Pauly D (2014) Synthesis of underreported small-scale fisheries catch in Pacific island waters. Coral Reefs 34:25–39

Section 7. List of Preparers

Peter Nelson, Ph.D.

Sharon Kramer, Ph.D.

Section 8. Appendices

8.1 Appendix 1—Hawaii FEP MUS Landings

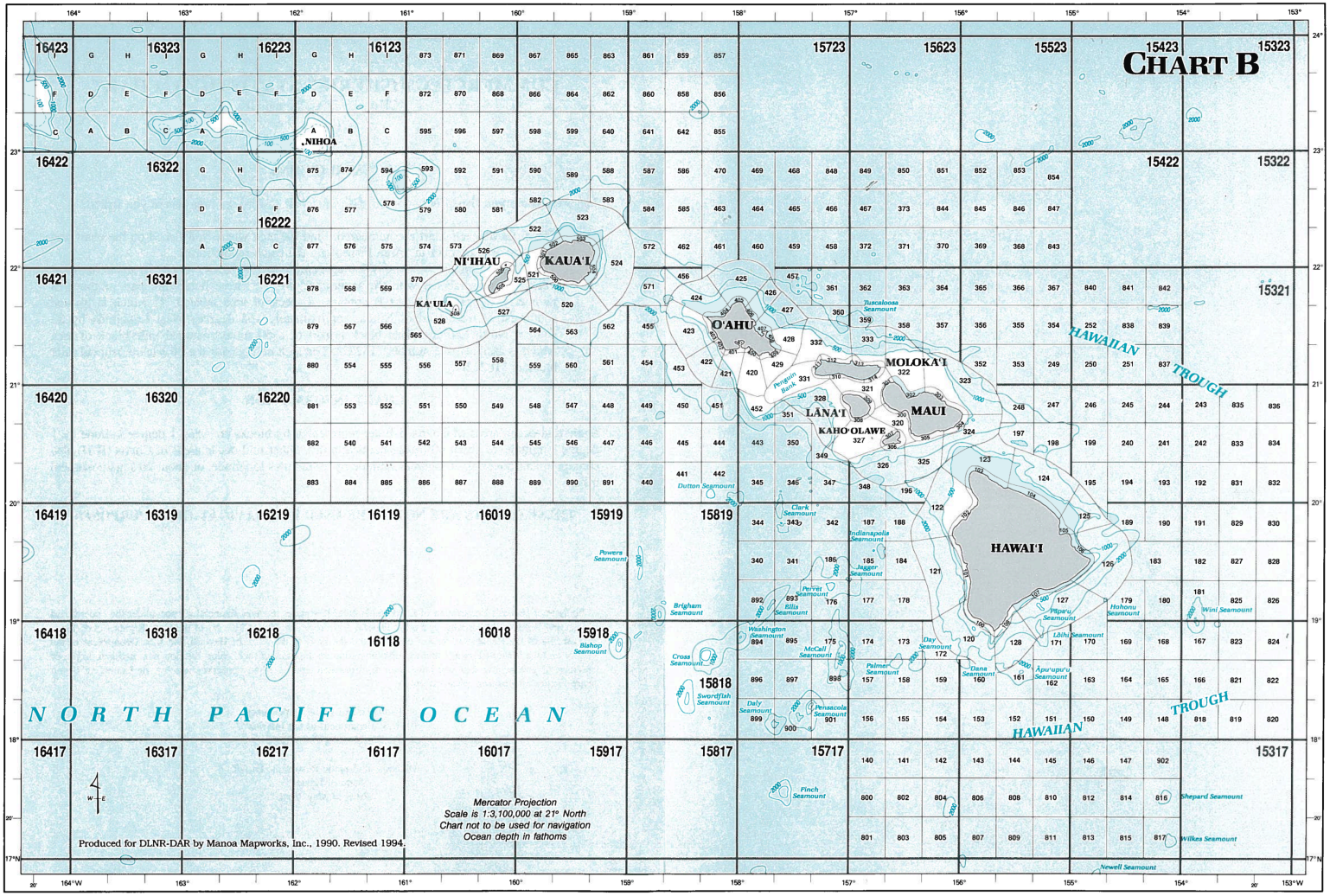
8.1.1 Data Fields

Field	Description
Year	Year of date fished
Area_Name	Name of area groupings provided in the request (See Table X: Area Grouping)
Area_Type	Either inshore or offshore depending on the area code (See Table X: Area Grouping)
Group_Code	Unique species group code identifier (Used specifically for joining data.)
Group_Name	Name of species groupings provided in the request (See Table X: Species Grouping)
Species_Code	State of Hawaii DAR species code
Common_Name	Species common name
Scientific_Name	Species scientific name
Subgroup	Subgroup (if available) for species in group 28: "Coral Reef Ecosystem – Other Coral Reef Ecosystem MUS"
Lbs_Kept	Sum of lbs kept by year, area grouping, and species
Num_fisher	Number of unique CML counted by year, area grouping, and species

8.1.2 Notes

- Fisherman (CML) count is provided to show that some of the summary records are confidential and will need to be grouped further.
- Common names are what were provided in the NMFS request.
- Groupings were all provided in original request.
- NMFS request established which gear to include/exclude; a list of included gear and excluded gear is included below.
- Data are included for years 2004 – 2014.

8.1.3 Chart of Fishing Areas



8.1.4 Code Tables

8.1.4.1 Area Grouping shows included area/subareas (reference map 8.1.3, above, for area/subarea locations).

ISLAND	AREA_TYPE	AREA_FK
HAWAII	INSHORE	100
HAWAII	INSHORE	100A
HAWAII	INSHORE	100B
HAWAII	INSHORE	101
HAWAII	INSHORE	101A
HAWAII	INSHORE	101B
HAWAII	INSHORE	101C
HAWAII	INSHORE	102
HAWAII	INSHORE	102A
HAWAII	INSHORE	102B
HAWAII	INSHORE	103
HAWAII	INSHORE	103A
HAWAII	INSHORE	103B
HAWAII	INSHORE	104
HAWAII	INSHORE	105
HAWAII	INSHORE	106
HAWAII	INSHORE	107
HAWAII	INSHORE	108
HAWAII	OFFSHORE	120
HAWAII	OFFSHORE	120*
HAWAII	OFFSHORE	121
HAWAII	OFFSHORE	121*
HAWAII	OFFSHORE	122
HAWAII	OFFSHORE	123
HAWAII	OFFSHORE	124
HAWAII	OFFSHORE	125
HAWAII	OFFSHORE	126

ISLAND	AREA_TYPE	AREA_FK
HAWAII	OFFSHORE	127
HAWAII	OFFSHORE	128
MAUI	INSHORE	300
MAUI	INSHORE	301
MAUI	INSHORE	302
MAUI	INSHORE	303
MAUI	INSHORE	304
MAUI	INSHORE	305
MAUI	OFFSHORE	321
MAUI	OFFSHORE	322
MAUI	OFFSHORE	323
MAUI	OFFSHORE	324
MAUI	OFFSHORE	325
KAHOOLAWE	INSHORE	306
KAHOOLAWE	INSHORE	307
KAHOOLAWE	OFFSHORE	327
LANAI	INSHORE	308
LANAI	INSHORE	309
LANAI	OFFSHORE	328
LANAI	OFFSHORE	328*
MOLOKAI	INSHORE	310
MOLOKAI	INSHORE	311
MOLOKAI	INSHORE	312
MOLOKAI	INSHORE	313
MOLOKAI	INSHORE	314
MOLOKAI	OFFSHORE	332
MOLOKAI	OFFSHORE	333
AUAU CHANNEL	OFFSHORE	320
PENGUIN BANK	OFFSHORE	331
OAHU	INSHORE	400
OAHU	INSHORE	401
OAHU	INSHORE	402

ISLAND	AREA_TYPE	AREA_FK
OAHU	INSHORE	403
OAHU	INSHORE	404
OAHU	INSHORE	405
OAHU	INSHORE	406
OAHU	INSHORE	407
OAHU	INSHORE	408
OAHU	INSHORE	409
OAHU	OFFSHORE	420
OAHU	OFFSHORE	421
OAHU	OFFSHORE	422
OAHU	OFFSHORE	423
OAHU	OFFSHORE	424
OAHU	OFFSHORE	425
OAHU	OFFSHORE	426
OAHU	OFFSHORE	427
OAHU	OFFSHORE	428
OAHU	OFFSHORE	429
KAUAI	INSHORE	500
KAUAI	INSHORE	501
KAUAI	INSHORE	502
KAUAI	INSHORE	503
KAUAI	INSHORE	504
KAUAI	OFFSHORE	520
KAUAI	OFFSHORE	521
KAUAI	OFFSHORE	522
KAUAI	OFFSHORE	523
KAUAI	OFFSHORE	524
NIIHAU	INSHORE	505
NIIHAU	INSHORE	506
NIIHAU	OFFSHORE	526
NIIHAU	OFFSHORE	527

8.1.4.2 Gear included in the NMFS data request; records with specific gear types were included/excluded at the discretion of WPacFIN as provided in the request from NMFS.

GEAR_PK	GEAR_NAME
0	*
3	DEEP-SEA HANDLINE, BOTTOM HANDLINE
4	INSHORE HANDLINE, COWRIE SHELL (TAKO)
7	*
10	CASTING, LIGHT TACKLE, SPINNER, WHIPPING
11	TRAP (MISC.)
12	*
13	SPEARFISHING, DIVE, SQUIDING (TAKO)
14	DIVING, DIVE FOR LOBSTER OR NAMAKO, ETC.
15	BLACK CORAL DIVE
19	*
20	NET (MISC.)
21	LIFT NET, OPELU
22	GILL NET, FENCE NET, LAY NET, CROSS NET
23	SEINE NET
24	BULLPEN TRAP
25	LOBSTER NET
26	CRAB NET
27	THROW NET
28	*
29	*
30	BAIT NET
31	*
32	SHRIMP TRAWL NET
35	*
37	*
40	KONA CRAB NET, LOOPS
49	*
51	CRAB TRAP (CAN BE DEEP SEA)

GEAR_PK	GEAR_NAME
52	FISH TRAP
53	LOBSTER TRAP, LOBSTER POT
54	SHRIMP TRAP
60	HANDPICKED (LIMU, OPIHI, WANA, AAMA CRAB, NAMAKO, INA)
72	*
77	*
98	SUBMERSIBLE, PRECIOUS CORAL
99	OTHER

* Denotes Unknown Gear (These gear codes may be from historical data out of the scope of this request.)

8.1.4.3 Gear excluded in the NMFS data request.

GEAR_PK	GEAR_NAME
1	AKUBOAT, POLE & LINE
2	LONGLINE, AHI BOAT, FLAGLINE
5	KAKA LINE, SET LINE
6	TROLLING (MISC.)
8	IKA-SHIBI
9	PALU AHI, DROP STONE, MAKE DOG
33	PURSE SEINE NET (PELAGIC)
41	SCOOP NET
45	AQUARIUM COLLECTING NET
61	TROLLING - LURES
62	TROLLING - BAIT
63	TROLLING - STICK
70	ALBACORE TROLLING
90	FISH POND
91	FLOATLINE
92	SHORTLINE
93	VERTICAL LONGLINE
97	HYBRID

8.2 Appendix 2—Summary: MSA National Standards 1, 3 & 7

NS	name	essence	notes
1	Optimum Yield	Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the U.S. fishing industry.	NMFS' guidelines for applying NS1 are listed in Table 1
3	Management Units	To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.	Assumed that the fisheries data provided were assigned as properly designated Management Unit Species (MUS)
7	Costs and benefits	Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.	Prioritizing MUS for conservation measures will minimize costs and avoid duplication

8.3 Appendix 3—Ratio of Landings from Federal Waters

The ratio of the landings for all MUS (weight summed over all years) from federal waters to all waters (federal + state).

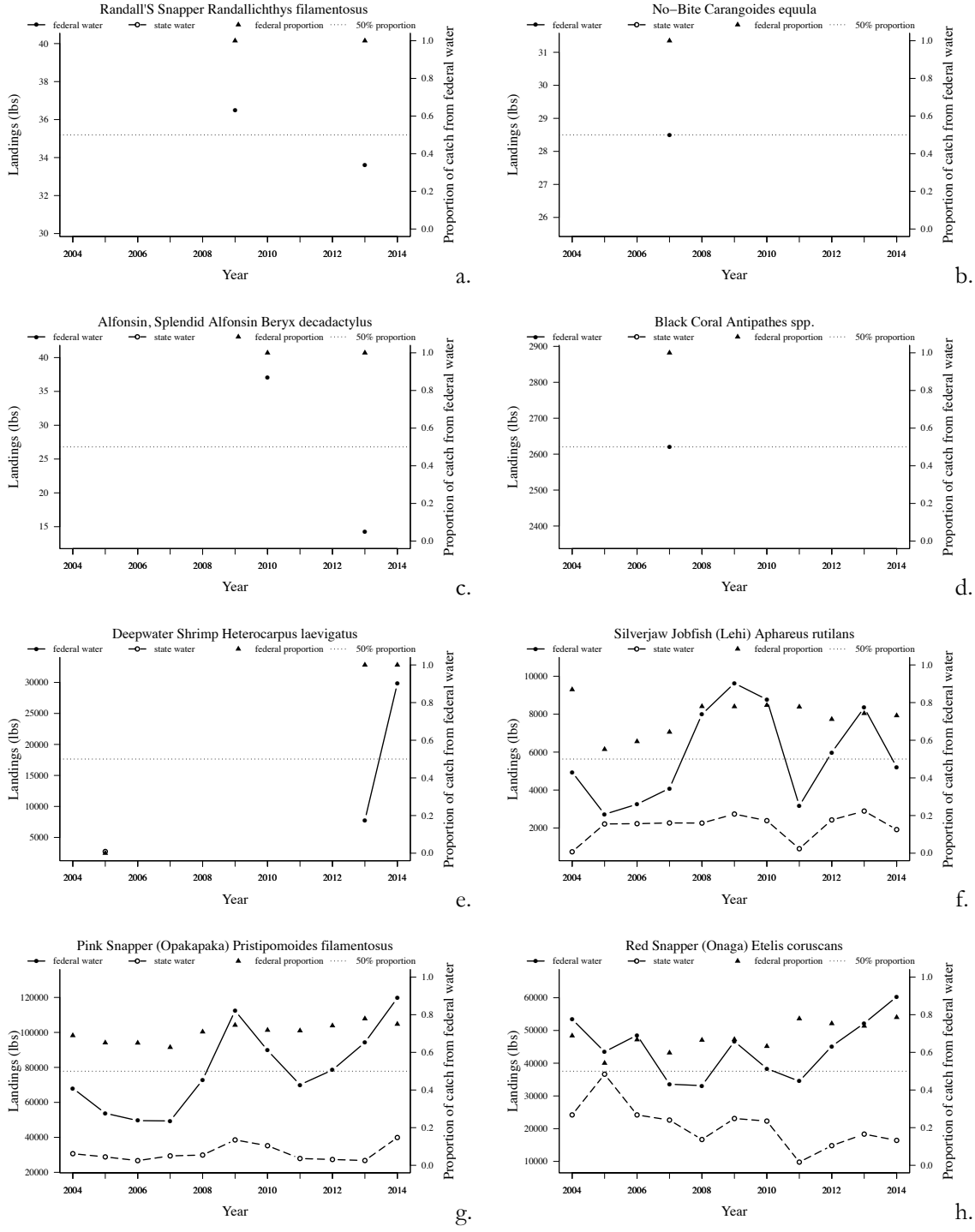
Alphabetical		Rank Order	
scientific name	**fed ratio**	**scientific name**	**fed ratio**
Acanthurus dussumieri	0.0034	*Antipathes* spp.	1.0000
Acanthurus triostegus	0.0014	*Beryx decadactylus*	1.0000
Alectis ciliaris	0.2378	*Carangoides equula*	1.0000
Antipathes spp.	1.0000	*Randallichthys filamentosus*	1.0000
Aphareus furca	0.0271	*Heterocarpus laevigatus*	0.9323
Aphareus rutilans	0.7363	*Aphareus rutilans*	0.7363
Aprion virescens	0.6566	*Pristipomoides filamentosus*	0.7156
Balistidae (family)	0.0264	*Etelis coruscans*	0.6811
Belonidae (family)	0.0151	*Pristipomoides sieboldii*	0.6691
Beryx decadactylus	1.0000	*Aprion virescens*	0.6566
Bodianus bilunulatus	0.0421	*Pontinus macrocephalus*	0.6142
Carangidae (family)	0.2215	*Carangoides orthogrammus*	0.5954
Carangoides equula	1.0000	*Etelis carbunculus*	0.5832
Carangoides orthogrammus	0.5954	*Erythrocles schlegelii, E. scintillans*	0.5752
Caranx ignobilis	0.2354	*Hyporthodus quernus*	0.4925
Caranx melampygus	0.1380	*Pristipomoides zonatus*	0.4779
Caranx sexfasciatus	0.0953	*Seriola dumerili*	0.4745
Caranx spp. (juvenile)	0.4359	*Ranina ranina*	0.4473
Cephalopholis argus	0.0065	Caranx spp. (juvenile)	0.4359
Chlorurus sordidus	0.0057	*Elagatis bipinnulata*	0.3187
Ctenochaetus strigosus	0.0061	*Alectis ciliaris*	0.2378
Decapterus macarellus	0.2300	*Caranx ignobilis*	0.2354
Elagatis bipinnulata	0.3187	*Decapterus macarellus*	0.2300
Erythrocles schlegelii, E. scintillans	0.5752	Carangidae (family)	0.2215
Etelis carbunculus	0.5832	*Iniistius pavo*	0.2189
Etelis coruscans	0.6811	*Squalus, Carcharhinus* spp.	0.1970
Heterocarpus laevigatus	0.9323	*Naso hexacanthus*	0.1407
Heteropriacanthus cruentatus	0.0912	*Caranx melampygus*	0.1380
Hyporthodus quernus	0.4925	*Sphyraena barracuda*	0.1199
Iniistius pavo	0.2189	Labridae (family)	0.1184
Kuhlia spp.	0.0098	*Mulloidichthys pfluegeri*	0.1113
Kyphosus spp.	0.0008	*Sphyraena helleri*	0.1023
Labridae (family)	0.1184	*Myripristis murdjan*	0.0986
Lutjanus fulvus	0.0138	*Caranx sexfasciatus*	0.0953
Lutjanus kasmira	0.0607	*Heteropriacanthus cruentatus*	0.0912
Mulloidichthys flavolineatus	0.0015	*Uraspis helvola*	0.0900
Mulloidichthys pfluegeri	0.1113	NULL*	0.0833
Mulloidichthys vanicolensis	0.0053	*Lutjanus kasmira*	0.0607

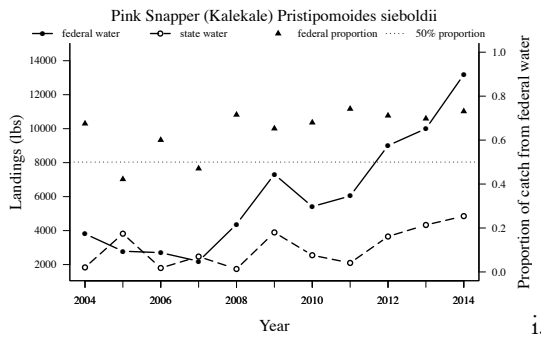
Alphabetical		Rank Order	
scientific name	**fed ratio**	**scientific name**	**fed ratio**
Myripristis murdjan	0.0986	*Selar crumenophthalmus*	0.0593
Naso hexacanthus	0.1407	*Bodianus bilunulatus*	0.0421
Naso spp.	0.0004	*Parupeneus multifasciatus*	0.0318
NULL*	0.0833	*Octopus* spp.	0.0299
Octopus cyanea	0.0047	*Parupeneus cyclostomus*	0.0282
Octopus spp.	0.0299	*Aphareus furca*	0.0271
Panulirus marginatus	0.0178	Balistidae (family)	0.0264
Parupeneus cyclostomus	0.0282	*Sargocentron spiniferum*	0.0262
Parupeneus insularis	0.0017	*Sargocentron xantherythrum*	0.0207
Parupeneus multifasciatus	0.0318	*Pontinus* spp.	0.0191
Parupeneus porphyreus	0.0095	*Panulirus marginatus*	0.0178
Polydactylus sexfilis	0.0040	Belonidae (family)	0.0151
Pontinus macrocephalus	0.6142	*Lutjanus fulvus*	0.0138
Pontinus spp.	0.0191	*Kuhlia* spp.	0.0098
Pristipomoides filamentosus	0.7156	*Parupeneus porphyreus*	0.0095
Pristipomoides sieboldii	0.6691	*Cephalopholis argus*	0.0065
Pristipomoides zonatus	0.4779	*Ctenochaetus strigosus*	0.0061
Randallichthys filamentosus	1.0000	*Chlorurus sordidus*	0.0057
Ranina ranina	0.4473	*Mulloidichthys vanicolensis*	0.0053
Sargocentron spiniferum	0.0262	*Octopus cyanea*	0.0047
Sargocentron xantherythrum	0.0207	*Polydactylus sexfilis*	0.0040
Scomberoides lysan	0.0014	*Acanthurus dussumieri*	0.0034
Selar crumenophthalmus	0.0593	*Parupeneus insularis*	0.0017
Seriola dumerili	0.4745	*Mulloidichthys flavolineatus*	0.0015
Sphyraena barracuda	0.1199	*Acanthurus triostegus*	0.0014
Sphyraena helleri	0.1023	*Scomberoides lysan*	0.0014
Squalus, Carcharhinus spp.	0.1970	*Kyphosus* spp.	0.0008
Uraspis helvola	0.0900	*Naso* spp.	0.0004

*NULL determined subsequently to be *Aphareus furca*.

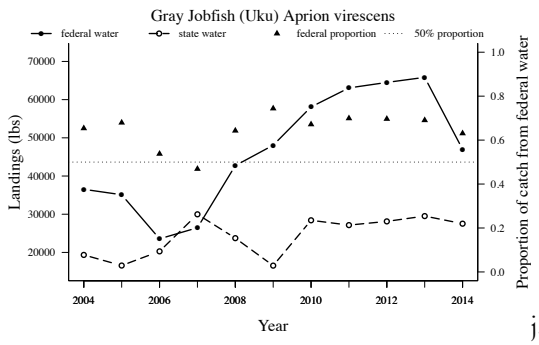
These MUS make up the 26 with ≥20% of landings from federal waters, plus sharks.

8.4 Appendix 4—Time Series for 26 MUS with ≥20% of landings from federal waters + sharks

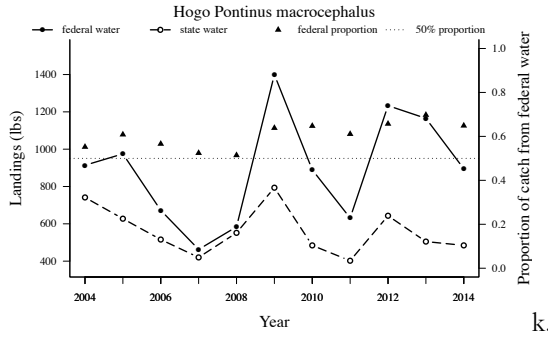



Pink Snapper (Kalekale) Pristipomoides sieboldii
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

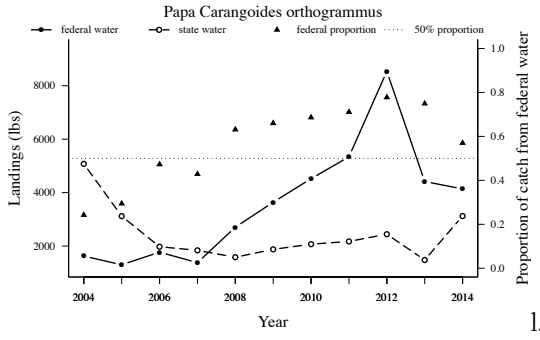
i.


Gray Jobfish (Uku) Aprion virescens
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

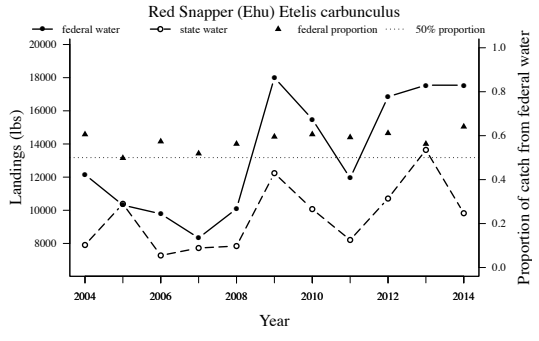
j.


Hogo Pontinus macrocephalus
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

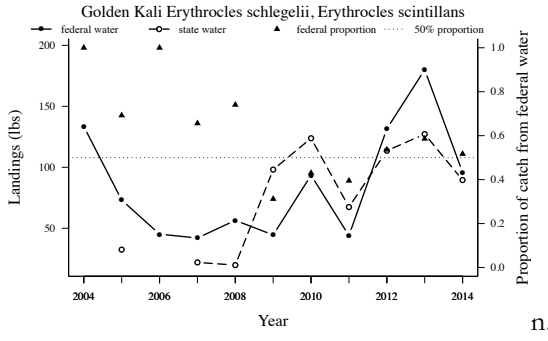
k.


Papa Carangoides orthogrammus
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

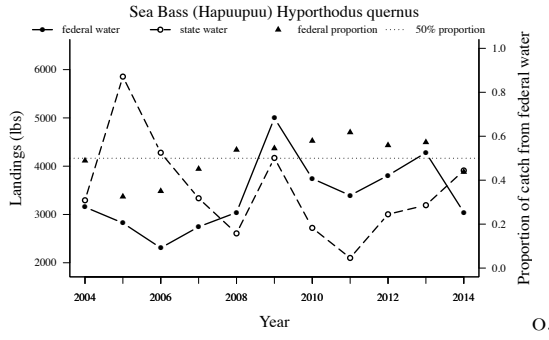
l.


Red Snapper (Ehu) Etelis carbunculus
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

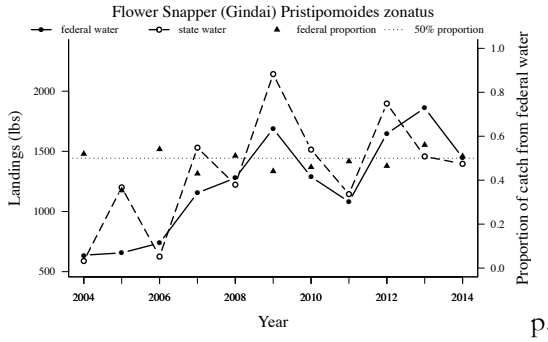
m.


Golden Kali Erythrocles schlegelii, Erythrocles scintillans
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

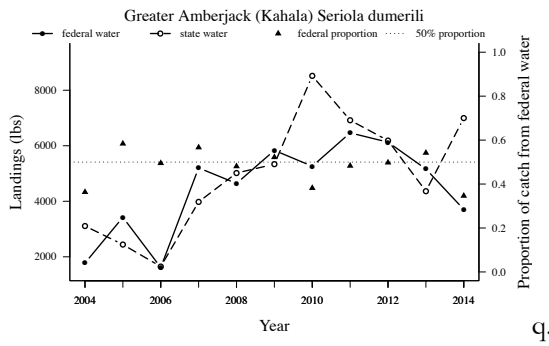
n.


Sea Bass (Hapuupuu) Hyporthodus quernus
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

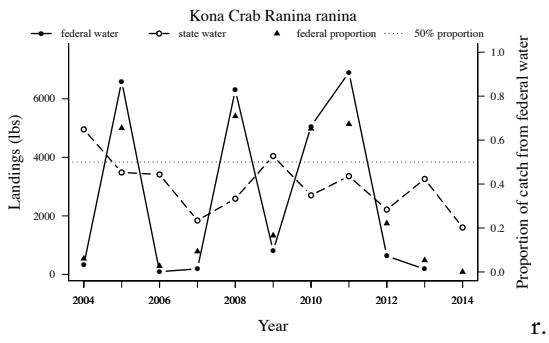
o.


Flower Snapper (Gindai) Pristipomoides zonatus
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

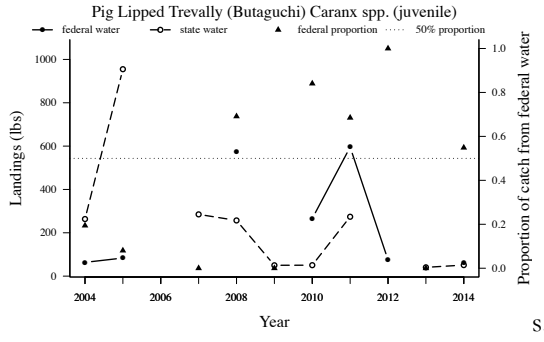
p.


Greater Amberjack (Kahala) Seriola dumerili
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

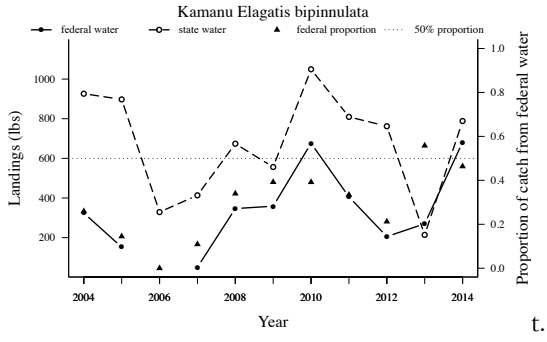
q.


Kona Crab Ranina ranina
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

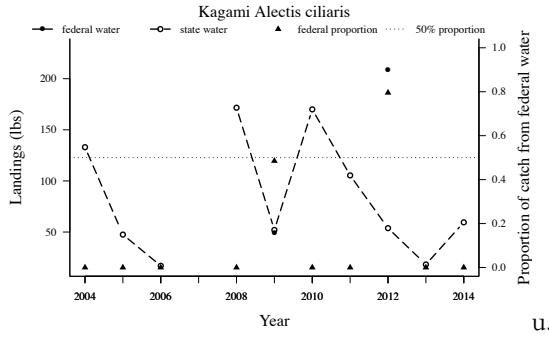
r.


Pig Lipped Trevally (Butaguchi) Caranx spp. (juvenile)
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

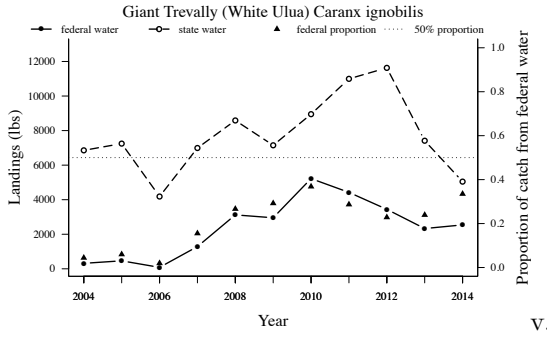
s.


Kamanu Elagatis bipinnulata
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

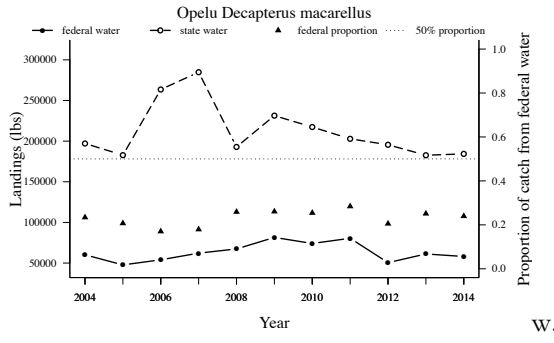
t.


Kagami Alectis ciliaris
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

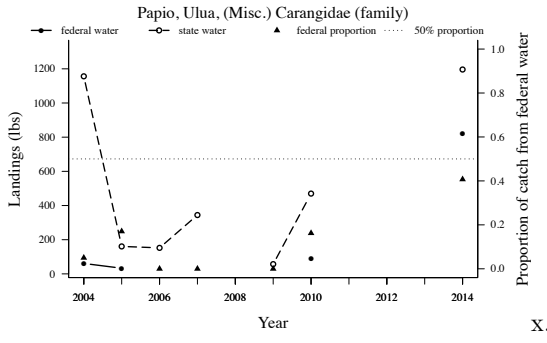
u.


Giant Trevally (White Ulua) Caranx ignobilis
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

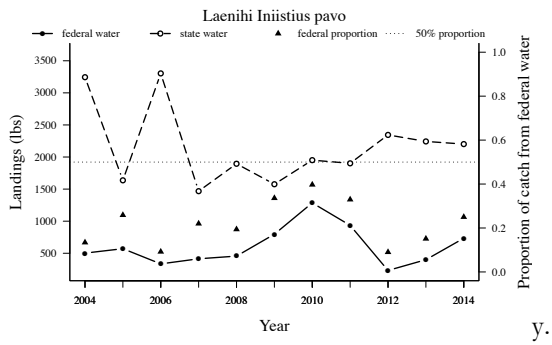
v.


Opelu Decapterus macarellus
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

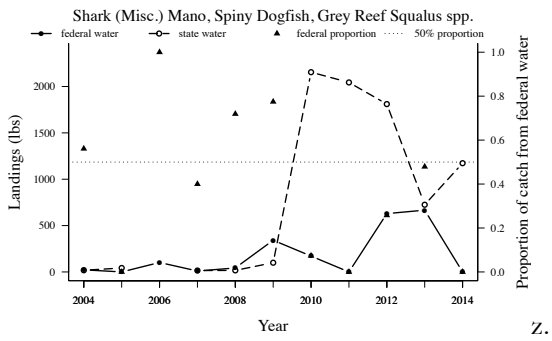
w.


Papio, Ulua, (Misc.) Carangidae (family)
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year

x.


Laenihi Iniistius pavo
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year
2004
2006
2008
2010
2012
2014

y.


Shark (Misc.) Mano, Spiny Dogfish, Grey Reef Squalus spp.
federal water
state water
federal proportion
50% proportion
Landings (lbs)
Proportion of catch from federal water
Year
2004
2006
2008
2010
2012
2014

z.

8.5 Appendix 5—MUS reported from inshore waters only

scientific name	common name	Pacific islands name
Abudefduf abdominalis	Ma'O Ma'O	Sergeant major, Hawaiian sergeant, Mamo
Abudefduf sordidus	Kupipi	Kupipi
Acanthurus achilles	Pakuikui	Achilles tang, Pakuikui, Kolama
Acanthurus blochii	Pualu	Pualu, Puhal, Ualu
Acanthurus guttatus	Api	Api
Acanthurus nigrofuscus	Maiii	Maiii, Alii bang bang, Alibangbang
Acanthurus nigroris	Maiko	Maiko
Acanthurus olivaceus	Naenae	Na'ena'e, Nuinui, Naenae
Albula spp.	Oio	Oio, Bonefish, Ola (unspecified)
Aluterus monoceros	Loulu	Filefish, Oili lepa, Hage
Asparagopsis taxiformis	Limu Kohu	Limu kohu, Lemu
Atule mate	Omaka	Omaka, Yellowtail scad
Aulostomus spp.	Nunu	Nunu, Billie Hu, Cornetfish
Bothidae (family)	Pakii	Pakii, Flounder, Flat fish
Calotomus carolinus	Panuhunuhu	Star eye parrotfish, Sleeping Uhu, Panunu
Carangoides ferdau	Barred Jack	Barred jack/ulua, Blue trevally
Caranx lugubris	Black Trevally (Black Ulua)	Black jack, Black trevally, Gunkan, Tarakiton Attelong
Carpilius maculatus	Crab (Misc.)	7-11 crab, Stone crab
Chanos chanos	Awa	Awa, Safole, Milkfish, Bangos
Cheilinus unifasciatus	Poou	Poou, Ringtail wrasse
Cheilio inermis	Kupoupou	Kupoupou, Mongoose fish, Cigar wrasse
Cirrhitus pinnulatus	Poo Paa	Po'opa'a, Pa'au, Pau'au, Popa'a, Popa, Ulutui, Rock cod
Codium spp.	Wawaeiole	Limu wawaeiole, Pokpoklo, Rat feet limu, Lemu
Conger cinereus	Puhi (White)	White conger/garden eel, Puhi, Pusi
Diodontidae (family)	Oopu Hue	Spiny pufferfish, balloon fish, Fugu
Elops hawaiensis	Awaawa	Awaawa, Awa'aua, Hawaiian ladyfish, Ten pounder
Gnathanodon speciosus	Paopao	Paopao, Yellow ulua, Stripe ulua, Golden/Tiger trevally

Gracilaria spp.	Ogo	Limu, Ogo, Lipoa
Gymnothorax spp.	Puhi (Black/Brown)	Black & brown eel, Puhi, Pusi
Hemiramphus spp.	Iheihe	Halfbeak, Iheihe, Sayori, Ballyhoo
Monotaxis grandoculis	Mu	Bigeye emperor, Mu, Humpnose bream
Mugil cephalus	Amaama	Amaama, Anae, Striped mullet
Mulloidichthys spp.	Weke (Misc.)	Iasina, Ti'ao, Yellow goatfishes (unknwn/juv)
Muraenidae (family)	Puhi (Misc.)	Puhi, Pusi, Eel
Naso lituratus	Kalalei	Hangon, Umaumalei, Orangespine unicornfish
Neomyxus leuciscus	Uouoa (Juvenile)	Uouoa, False mullet, Woowoo, Acute-jawed mullet
Oreochromis macrochir	Tilapia	Tilapia
Panulirus penicillatus	Green Spiny Lobster	Ula hiwa, Green/Pronghorn/Tuffed spiny lobster
Parupeneus pleurostigma	Malu	Malu, Maru, Sidespot goatfish
Plantae (kingdom)	Limu (Misc.)	Lemu, Limu, Seaweed
Portunus sanguinolentus hawaiiensis	Kuahonu Crab	Kuahonu/White/Koha/Swimming crab
Pristipomoides auricilla	Yellowtail Snapper (Kalekale)	Yellowtail kalikali/kalekale, Purple opakapaka
Scarus psittacus	Panunu	Pale nose/Common parrotfish, Uhu, Panunu
Scylla serrata	Samoan Crab	Samoan/Mangrove crab
Scyllarides haanii	Ridgeback Slipper Lobster	Humpbacked/Ridge back slipper lobster, Ulapapapa
Scyllarides squammosus	Scaly Slipper Lobster	Ulapapapa, Scaly slipper lobster
Synaptidae (family)	Namako	Sea cucumber, Loli/Lole, Namako
Thalassoma spp.	Hinalea	Wrasse (unspecified), Hinalea
Upeneus taeniopterus	Weke Pueo	Bandtail/Striped goatfish, Weke pueo, Nightmare weke, Obake

8.6 Appendix 6—Expert Assessment form

[See following pages.]

Dear [Insert Name of Expert Reviewer]

The National Marine Fisheries Service (NMFS) and the Western Pacific Fishery Management Council (Council) are requesting your help in qualitatively evaluating social, economic, and biological factors for a number of fish stocks caught around Hawaii. Your evaluation will help us identify stocks that may require continued conservation and management under the Fishery Ecosystem Plan for the Hawaii Archipelago (Hawaii FEP). Stocks that do not require conservation and management under the Hawaii FEP may be identified as ecosystem component species and continue to be included in the plan for data collection purposes, or to achieve ecosystem management objectives.

Section 302(h)(1) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires the Council to prepare a fishery management plan for each fishery under its authority (i.e. Federal waters 3-200 nautical miles offshore) that is in need of conservation and management. Federal regulations at 50 CFR 600.305(c) provide guidance to assist the Council in identifying fisheries under its authority that require conservation and management (81 FR 71858, October 18, 2016). Specifically, the Council must include in the Hawaii FEP any stock of fish that is predominantly caught in Federal waters, and is overfished or subject to overfishing. Beyond such stocks, the Council may decide whether additional stocks require conservation and management based on, but not limited to, the 10 factors below:

1. The stock is an important component of the marine environment.
2. The stock is caught by the fishery.
3. Whether a Federal fishery management plan can improve or maintain the condition of the stock.
4. The stock is a target of a fishery.
5. The stock is important to commercial, recreational, or subsistence users.
6. The fishery is important to the Nation or to the regional economy.
7. The need to resolve competing interests and conflicts among user groups and whether a Federal fishery management plan can further that resolution.
8. The economic condition of a fishery and whether a Federal fishery management plan can produce more efficient utilization.
9. The needs of a developing fishery and whether a Federal fishery management plan can foster orderly growth.
10. The extent to which the fishery is already adequately managed by states, by state/Federal programs, or by Federal regulations pursuant to other Federal fishery management plans or international commissions, or by industry self-regulation, consistent with the requirements of the Magnuson-Stevens Act and other applicable laws.

Currently, the Hawaii FEP includes hundreds of individual stocks, caught in association with Hawaii coral reef, crustacean, precious coral and bottomfish fisheries. The attached table provides a list of all stocks reported in the State of Hawaii's commercial marine license (CML) reporting system between 2004 and 2014, and the proportion of catch from Federal waters under the jurisdiction of NMFS and the Council. During this period, Hawaii commercial fishermen reported catching 115 different stocks, of which, 65 were caught in Federal waters.

For each of the 115 stocks, NMFS and the Council have begun evaluating the 10 factors and available information to help identify stocks that may require continued conservation and management under the Hawaii FEP. However, we are seeking your help in evaluating Factors 3, 4, 6 and 10 for those stocks that the Federal catch proportion is 20 percent and greater. That is, sharks (*Squalus* spp, *Carcharhinus* spp.) to Randall's snapper (*Randallichthys filamentosus*).

To assist you in this review, we have provided a review sheet for each stock of fish with landings >20% from federal waters (Table 1) to complete your answers. Additionally, if there a stock of fish caught in Federal waters in proportions lower than 20 percent (Table 2) that you believe is in need of conservation and management under the Hawaii FEP, please identify the fish and explain why.

Please email your completed worksheets to pnelson@harveyecology.com by April 14, 2017. If you have any questions about this evaluation, please contact Peter at pnelson@harveyecology.com, 408-458-3266 (office) or 707-267-5896 (cell).

Mahalo for your time and your expertise!

TABLE 1. Stocks with >20% of landings from federal waters

	SCIENTIFIC_NAME	FEDERAL_PROPORTION	PIR_COMMON_NAME
1	*Randallichthys filamentosus*	1.00	Randall's snapper; Bake-akamutsu
2	*Carangoides equula*	1.00	Whitefin trevally, No-bite ulua
3	*Beryx decadactylus*	1.00	Alfonsin, Lantern-eye, Flashlight fish
4	*Antipathes* spp.	1.00	Black coral
5	*Heterocarpus laevigatus*	0.93	Deepwater shrimp, Nylon shrimp
6	*Aphareus rutilans*	0.74	Lehi, Deep/Silvermouth
7	*Pristipomoides filamentosus*	0.72	Opakapaka, Pink snapper, Crimson jobfish
8	*Etelis coruscans*	0.68	Onaga, Ulaula, Ulu, Buninas, Taighulupegh, Longtail snapper
9	*Pristipomoides sieboldii*	0.67	Kalekale, Kalikali, Lavender jobfish
10	*Aprion virescens*	0.66	Uku, Gogunafon, Aiwe, "Hi-Way"
11	*Pontinus macrocephalus*	0.61	Hogo, Nohu, Largeheaded scorpionfish, Red seabass
12	*Carangoides orthogrammus*	0.60	Island/Yellow spotted/Goldspot jack/trevally
13	*Etelis carbunculus*	0.58	Ehu, Buninas agaga, Falaghal moroobw, Squirrelfish snapper
14	*Erythrocles schlegelii, Erythrocles scintillans*	0.58	Golden kale, Schlegel's boga fish, Yanaginomai
15	*Hyporthodus quernus*	0.49	Hapu'upu'u, Shapon, Sapon
16	*Pristipomoides zonatus*	0.48	Gindai, Buninas, Flower snapper, Tai, Kindai, Kentai, Shimac
17	*Seriola dumerili*	0.47	Kahala, Greater amberjack, Boogaman
18	*Ranina ranina*	0.45	Kona crab
19	*Caranx* spp. (juvenile)	0.44	I'e, Papio
20	*Elagatis bipinnulata*	0.32	Hawaiian Salmon, Rainbow Runner, Kamano
21	*Alectis ciliaris*	0.24	Ulua kihikihi, Kagami ulua, Uluaki
22	*Caranx ignobilis*	0.24	White ulua, Mamulan, Tarakiton, Etam
23	*Decapterus macarellus*	0.23	Opelu, Mackerel scad, Muroaji
24	Carangidae (family)	0.22	Ulua/papio (Misc.)
25	*Iniistius pavo*	0.22	Laenihi, Nabeta, Peacock/blue wrasse
26	*Squalus* spp., *Carcharhinus* spp.	0.20	Sharks (misc.), Spiny dogfish, Green-eye shark

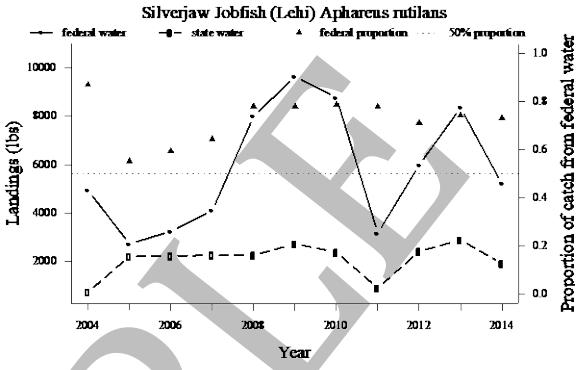
TABLE 2. Stocks with <20% of landings from federal waters

SCIENTIFIC_NAME	FEDERAL PROPORTION	PIR_COMMON_NAME
Naso hexacanthus	0.14	Opelu kala, Sleek unicornfish, Tataga (Black tongue)
Caranx melampygus	0.14	Omilu, Bluefin trevally, Hoshi Ulua, Star ulua, Nukumomi
Sphyraena barracuda	0.12	Kaku, Sapat?, Opelu mama, Butternose
Labridae (family)	0.12	Wrasse, Ea (unspecified)
Mulloidichthys pfluegeri	0.11	Moelua, Moilua, Weke nono, Moana ula
Sphyraena helleri	0.10	Kawelea, Kamasu, Japanese barracuda, Kalalea
Myripristis murdjan	0.10	Uu, Mempachi, Bigscale/Blotcheye soldierfish
Caranx sexfasciatus	0.10	Sasa ulua, Pake (Chinese) ulua
Heteropriacanthus cruentatus	0.09	Glasseye, Bigeye, Aweoweo, Matapula
Uraspis helvola	0.09	Dobe ulua, Whitemouth jack
Lutjanidae (family)	0.08	Wahanui
Lutjanus kasmira	0.06	Ta'ape, Saas, Funai, Blue-line snapper, Yosuji-fuedai
Selar crumenophthalmus	0.06	Atulai, Akule, Lengo, Rengo
Bodianus bilunulatus	0.04	A'awa,Hawaiian hogfish, Table boss, Bodai, Aia, Aeea
Parupeneus multifasciatus	0.03	Manybar/Multibarred goat fish, Moana maru, Moano
Octopus spp.	0.03	Tako, Octopus, He'e, Fe'e
Parupeneus cyclostomus	0.03	Moana kali, Moana kea, Kuchihige
Aphareus furca	0.03	Reef silvermouth, Crazy paka, Joey Brown, Goro, Gurutsuki
Balistidae (family)	0.03	Triggerfishes (family), Hage, Joe Lewis
Sargocentron spiniferum	0.03	Alaihe mama, Saber squirrelfish, Uukanipo
Sargocentron xantherythrum	0.02	Alaihe, Hawaiian squirrelfish, Uukanipo, Indian fish
Pontinus spp.	0.02	Nohu, Okoze, Scorpionfish, Rockfish
Panulirus marginatus	0.02	Ula, Hawaiian red spiny lobster
Belonidae (family)	0.02	Ahaaha, Dasu, Needlefish, Bluebone, Garfish
Lutjanus fulvus	0.01	Toau, Blacktail/Flametail snapper, Golden perch
Kuhlia spp.	0.01	Aholehole, Flagtails
Parupeneus porphyreus	0.01	Kumu, Whitesaddle goatfish
Cephalopholis argus	0.01	Peacock grouper, Roi, Royal seabass
Ctenochaetus strigosus	0.01	Black/Hawaiian/Goldring/Yellow-eyed surgeonfish
Chlorurus sordidus	0.01	Bullethead Parrotfish
Mulloidichthys vanicolensis	0.01	Weke-ula, Yellowfin goatfish, Pink/Red weke
Octopus cyanea	<0.01	Tako, Day octopus, He'e mauli, Fe'e
Polydactylus sexfilis	<0.01	Sixfinger/Sixfeeler threadfin, Moi

Acanthurus dussumieri	<0.01	Palani, Pone
Parupeneus insularis	<0.01	Munu, Joe Louis, Double bar goatfish, Black kumu
Mulloidichthys flavolineatus	<0.01	Weke a'a, White weke, yellow stripe(d) goatfish
Acanthurus triostegus	<0.01	Manini, Kichu'
Scomberoides lysan	<0.01	Lae, Leatherneck, Leatherback, Sagoshi
Kyphosus spp.	<0.01	Rudderfish, Guilli, Nenue
Naso spp.	<0.01	Unicornfishes, Naso tangs, Kala, Tataga
Upeneus taeniopterus	NA	Bandtail/Striped goatfish, Weke pueo, Nightmare weke, Obake
Thalassoma spp.	NA	Wrasse (unspecified), Hinalea
Synaptidae (family)	NA	Sea cucumber, Loli/Lole, Namako
Scyllarides squammosus	NA	Ulapapapa, Scaly slipper lobster
Scyllarides haanii	NA	Humpbacked/Ridge back slipper lobster, Ulapapapa
Scylla serrata	NA	Samoan/Mangrove crab
Scarus psittacus	NA	Pale nose/Common parrotfish, Uhu, Panunu
Pristipomoides auricilla	NA	Yellowtail kalikali/kalekale, Purple opakapaka
Portunus sanguinolentus hawaiiensis	NA	Kuahonu/White/Koha/Swimming crab
Plantae (kingdom)	NA	Lemu, Limu, Seaweed
Parupeneus pleurostigma	NA	Malu, Maru, Sidespot goatfish
Panulirus penicillatus	NA	Ula hiwa, Green/Pronghorn/Tuffed spiny lobster
Oreochromis macrochir	NA	Tilapia
Neomyxus leuciscus	NA	Uouoa, False mullet, Woowoo, Acute-jawed mullet
Naso lituratus	NA	Hangon, Umaumalei, Orangespine unicornfish
Muraenidae (family)	NA	Puhi, Pusi, Eel
Mulloidichthys spp.	NA	Iasina, Ti'ao, Yellow goatfishes (unknwn/juv)
Mugil cephalus	NA	Amaama, Anae, Striped mullet
Monotaxis grandoculis	NA	Bigeye emperor, Mu, Humpnose bream
Hemiramphus spp.	NA	Halfbeak, Iheihe, Sayori, Ballyhoo
Gymnothorax spp.	NA	Black & brown eel, Puhi, Pusi
Gracilaria spp.	NA	Limu, Ogo, Lipoa
Gnathanodon speciosus	NA	Paopao, Yellow ulua, Stripe ulua, Golden/Tiger trevally
Elops hawaiensis	NA	Awaawa, Awa'aua, Hawaiian ladyfish, Ten pounder
Diodontidae (family)	NA	Spiny pufferfish, balloon fish, Fugu
Conger cinereus	NA	White conger/garden eel, Puhi, Pusi
Codium spp.	NA	Limu wawaeiole, Pokpoklo, Rat feet limu, Lemu
Cirrhitus pinnulatus	NA	Po'opa'a, Pa'au, Pau'au, Popa'a, Popa, Ulutui, Rock cod
Cheilio inermis	NA	Kupoupou, Mongoose fish, Cigar wrasse
Cheilinus unifasciatus	NA	Poou, Ringtail wrasse

Chanos chanos	NA	Awa, Safole, Milkfish, Bangos
Carpilius maculatus	NA	7-11 crab, Stone crab
Caranx lugubris	NA	Black jack, Black trevally, Gunkan, Tarakiton Attelong
Carangoides ferdau	NA	Barred jack/ulua, Blue trevally
Calotomus carolinus	NA	Star eye parrotfish, Sleeping Uhu, Panunu
Bothidae (family)	NA	Pakii, Flounder, Flat fish
Aulostomus spp.	NA	Nunu, Billie Hu, Cornetfish
Atule mate	NA	Omaka, Yellowtail scad
Asparagopsis taxiformis	NA	Limu kohu, Lemu
Aluterus monoceros	NA	Filefish, Oili lepa, Hage
Albula spp.	NA	Oio, Bonefish, Ola (unspecified)
Acanthurus olivaceus	NA	Na'ena'e, Nuinui, Naenae
Acanthurus nigroris	NA	Maiko
Acanthurus nigrofuscus	NA	Maiii, Alii bang bang, Alibangbang
Acanthurus guttatus	NA	Api
Acanthurus blochii	NA	Pualu, Puhal, Ualu
Acanthurus achilles	NA	Achilles tang, Pakuikui, Kolama
Abudefduf sordidus	NA	Kupipi
Abudefduf abdominalis	NA	Sergeant major, Hawaiian sergeant, Mamo

Scientific Name: *Aphareus rutilans*



Common Name: Lehi, Deep/Silvermouth, silverjaw jobfish

Please answer the following questions by choosing from the alternative answers provided. We expect that these will be "judgment calls"—that you answer these questions based on your familiarity with the stock or fishery in question and your familiarity with Hawai'i's nearshore environment, and not based on some quantitative assessment. The accuracy of your answers is less important than how your responses compare from one fishery to the next. Please respond to these statements:

A Fishery Management Plan (FMP) would improve the condition of the stock. If, in your estimation, the stock is currently at or near its unfished biomass, a FMP would maintain the condition of the stock.

a. True
b. Possibly
c. Unlikely
d. False

This stock is a target of a fishery.

a. True
b. Possibly
c. Unlikely
d. False

This stock is important to the regional economy (i.e. at least at the county or island level). Even if the fish is not sold commercially, a substantial sport or subsistence fishery for the stock may contribute to the local economy.

a. True
b. Possibly
c. Unlikely
d. False

This stock is adequately managed under current State and Federal regulations. Consider the possibility that catch levels could be so low that no active form of management is required.

a. True
b. Possibly
c. Unlikely
d. False

Is there a stock of fish that is caught in Federal waters in proportions lower than 20 percent that you believe is in need of conservation and management under the Hawaii FEP? If so, explain why.

8.7 Appendix 7—Abbreviations

FEP	Fishery Ecosystem Plan for the Hawaii Archipelago
FMP	Fishery Management Plan
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MUS	management unit species
NMFS	National Marine Fisheries Service
PacFIN	Pacific Fisheries Information Network
PIRO	Pacific Islands Regional Office, NMFS
PSMFC	Pacific States Marine Fisheries Commission
SFD	Sustainable Fisheries Division
WPacFIN	Western Pacific Fisheries Information Network
WPFMC	Western Pacific Fishery Management Council, 'Council'