Monterey Bay Aquarium
Seafood Watch®

Gray Snapper (Uku)

Aprion virescens

Hawaii

Handline, Troll and Pole

January 23, 2014

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Disclaimer

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Final Seafood Recommendation

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
Hawaiian gray snapper (uku) Hawaii Central Pacific - Handline	Red (2.16)	Yellow (2.71)	Green (3.46)	Green (3.67)	**Good Alternative (2.937)**
Hawaiian gray snapper (uku) Hawaii Central Pacific - Troll/Pole	Red (2.16)	Yellow (2.71)	Green (3.46)	Green (3.87)	**Good Alternative (2.976)**

Scoring note – Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact. Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

▲ **Best Choice** = Final Score between 3.2 and 5, **and** no Red Criteria, **and** no Critical scores

▲ **Good Alternative** = Final score between 2.2 and 3.199, **and** Management is not Red, **and** no more than one Red Criterion other than Management, **and** no Critical scores

▲ **Avoid** = Final Score between 0 and 2.199, **or** Management is Red, **or** two or more Red Criteria, **or** one or more Critical scores.

Executive Summary

This report evaluates the ecological sustainability of uku (*Aprion virescens*), one of the fish species in the Main Hawaiian Islands (MHI) “non-Deep 7” bottomfish complex using the Seafood Watch (SFW) Criteria. As of March 2012, this complex is managed as one stock under an Annual Catch Limit (ACL), whereas previously there were no quotas in place for this subset of bottomfish. Prior to the separation of the bottomfish stocks into deep and shallow species, all bottomfish were managed together. The Deep 7 species complex has been a higher priority management concern because of its higher commercial value and biomass than the shallower "non-Deep 7" complex.

In terms of biomass caught, in 2011 uku ranked as 18th of the 87 species/categories commercially fished in Hawaii, and had the highest catch of any single demersal fish species. While the Deep 7 bottomfish species fetch a higher market price, fisherman have increasingly targeted uku over the last decade resulting in annual uku catches that exceed the majority of the Deep 7 species catches (by biomass), in several years even surpassing opakapaka catch (which has the highest catch of the Deep 7 species). In general, fisherman preferentially target uku when poor weather conditions prohibit fishing Deep 7 species and because uku aggregate during their breeding season, they can provide a consistent catch once a fisherman finds a school. Between 2007 and 2011, when the Deep 7 fishery reached its TAC and closed, fisherman switched to harvesting non-Deep species, particularly uku.

Uku is caught by handline both offshore and inshore as well as by trolling. Offshore handlining accounts for the largest percentage of annual landings. Both handline and troll capture methods rank as red for SFW Criterion 1, Impacts of the Fishery on the Stock, due to uku's high inherent vulnerability and because its stock status is of high concern. Its stock status scores as high concern because it is unknown whether the non-Deep 7 stock is overfished and uku's Catch per Unit Effort (CPUE) is decreasing. Fishing mortality is of moderate concern due to increased management of the non-Deep 7 stock. Handline caught and troll/pole caught uku rank as yellow for SFW Criterion 2, Impacts of the Fishery on Bycatch and Other Retained Species. These yellow rankings are driven by the not overfished/not experiencing overfishing status of the Deep 7 species that are caught while fishing uku by this method, namely the endemic hapu'u or Hawaiian seabass, as well as opakapaka and onaga. Discards are low by all methods, so do not negatively impact the Criterion 2 score. SFW Criterion 3, Effectiveness of Fishery Management, is based on the harvest strategy because bycatch is low. Harvest subcriteria score as moderate to highly effective due to management measures, namely the new fishing quota (ACL). SFW Criterion 4, Impacts on Habitat and Ecosystem, scores as green due to the minimal effects of fishing methods on benthic habitats. Due to these rankings, Seafood Watch categorizes uku as a good alternative.

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Introduction

Scope of the analysis and ensuing recommendation

Uku (Aprion virescens), also known as grey snapper, is the primary fishery assessed in this analysis. Fishing methods assessed for uku capture are handline (offshore and inshore) and trolling. Additional species analyzed here (with the reason in brackets) are: opakapaka (*Pristipomoides filamentosus*) [constitutes > 5% of the total catch when uku is at least 5% of the overall catch], onaga (*Etelis coruscans*) [constitutes > 5% of the total catch when uku is at least 5% of the overall catch], hapu'u or hapu'upu'u (Hyporthodus quernus, formerly known as Epinephelus quernus) [rarely caught, but >20% of overall fishing mortality for this species occurs when also fishing for uku], yellowfin tuna (*Thunnus albacares*) [caught by trolling, constitutes > 5% of the total catch when uku is at least 5% of the overall catch]. The region considered in this assessment is the Main Hawaiian Islands in the Central Pacific Ocean.

Overview of the species and management bodies

Uku (*Aprion virescens*), a quasi-pelagic top-predator, is a large bodied snapper species (size up to 112 cm total length and 15.4 kg) found in the tropics and subtropics {Randall 1996} between 0 and 180 meters depth in open waters of deep lagoons, channels, or seaward reefs {Lieske and Myers 1994}. Uku in Hawaii reach sexual maturity at 4-5 years of age {Everson et al. 1989}. The maximum age of uku in the Central Pacific is unknown, but individuals up to 16 years old have been observed in Australia {Huepel et al. 2009}. Occurring in the Indo-Pacific region from East Africa to Hawaii and from southern Japan to Australia {Allen 1985}, uku support commercial and subsistence fisheries across its range. Exhibiting daily and seasonal movement patterns {Meyer et al. 2007}, uku catches (in Hawaii) are generally larger during the summer {PIFSC 2012a} when they form spawning aggregations {Meyer et al. 2007}. Uku appears to have episodic recruitment leading to pulses of large year class cohorts that persist in the fishery for some time (pers comm. D. Kobayashi).

In Hawaii, uku are caught offshore and inshore using baited and weighted handlines that sit over the benthos, and by trolling with lures in surface waters, as they occur near the bottom and in the water column. Based on logbook data from 2003 to 2011, the majority of the uku catch is captured offshore with handlines (69% +/- 6%). Starting around 2008, an increasing amount of uku was caught inshore with handlines and a decreasing amount was caught via trolling {HDAR 2013}. Based on effort data from the same time period, trolling is the most efficient method to capture uku, yielding the greatest weight per hour fished.

As of 2012, the Western Pacific Fisheries Management Council (WPFMC) manages uku catch along with six other species under a combined "non-Deep 7 bottomfish" Annual Catch Limit (from January 1 to December 31st), which applies to both commercial and recreational fisheries. The other species in the management unit are: white ulua (*Caranx ignobilis*), black ulua (*Caranx lugubris*), butaguchi (*Pseudocaranx dentex*), taape (*Lutjanus kasmira*), yellow tail kalekale (*Pristipomoides auricilla*) and

kahala (*Seriola dumerili*) {Federal Register 2013}. Prior to 2012 there were no catch limits set for these species, although the more commercially valuable "Deep 7 bottomfish" species (onaga, ehu, gindai, kalekale, opakapaka, lehi, and hapuupuu) have been managed under an ACL since the 2011-2012 fishing season, and prior to that were managed with a total allowable catch (TAC) from 2007-2011; their fishing year runs from September 1st to August 31st. Uku must be at least one pound to be landed. Prior to 2011, uku was caught in the MHI as well as the NWHI, but it is now only caught in the MHI due to the establishment of the Papahanaumokuakea Marine National Monument.

The state of Hawaii closed areas within state waters by creating bottomfish restricted fishing areas in 1998 across the MHI, which were redesigned and re-designated in 2007 to increase their effectiveness by including more essential fish habitat for bottomfish species (specifically for Deep 7 bottomfish species, though their habitat overlaps partially with uku's habitat). There are no closed areas in federal waters off the MHI. The NWHI were closed to all fishing (including bottomfishing) upon establishment of the Papahanaumokuakea Marine National Monument. Given recent research findings that marine larval dispersal generally occurs from the MHI to the NWHI following prevailing currents, the Monument may not serve to replenish diminished MHI fish stocks {Toonen et al. 2011}.

Production Statistics

Although uku is caught across the Indo-Pacific it is difficult to determine its global production based on available data. The FAO global capture production database only contains production statistics on uku for the US, derived from Hawaiian catch data {FAO 2013}. Between 1992 and 2011 uku was the second highest producing Hawaiian bottomfish species after opakapaka, comprising approximately 21 percent of bottomfish sold in that time period. Uku is also caught in the bottomfish fisheries of American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI) and Guam, but these fisheries are much smaller than the MHI fishery, such that in 2010 the total bottomfish catch from all three was half of Hawaii's total 2010 uku catch {Brodziak et al. 2012}.

Importance to the US/North American market

The majority of the uku landed in Hawaii are sold and consumed in Hawaii (sold either at auction, to dealers/wholesalers, markets, restaurants or to friends/neighbors) with some fish shipped to the mainland US. While uku is a desirable fish in high demand in Hawaii, the deeper water snappers (namely opakapaka, ehu and onaga) are considered to be of superior quality, are in higher demand, and sell for higher prices (see Figure 1) .

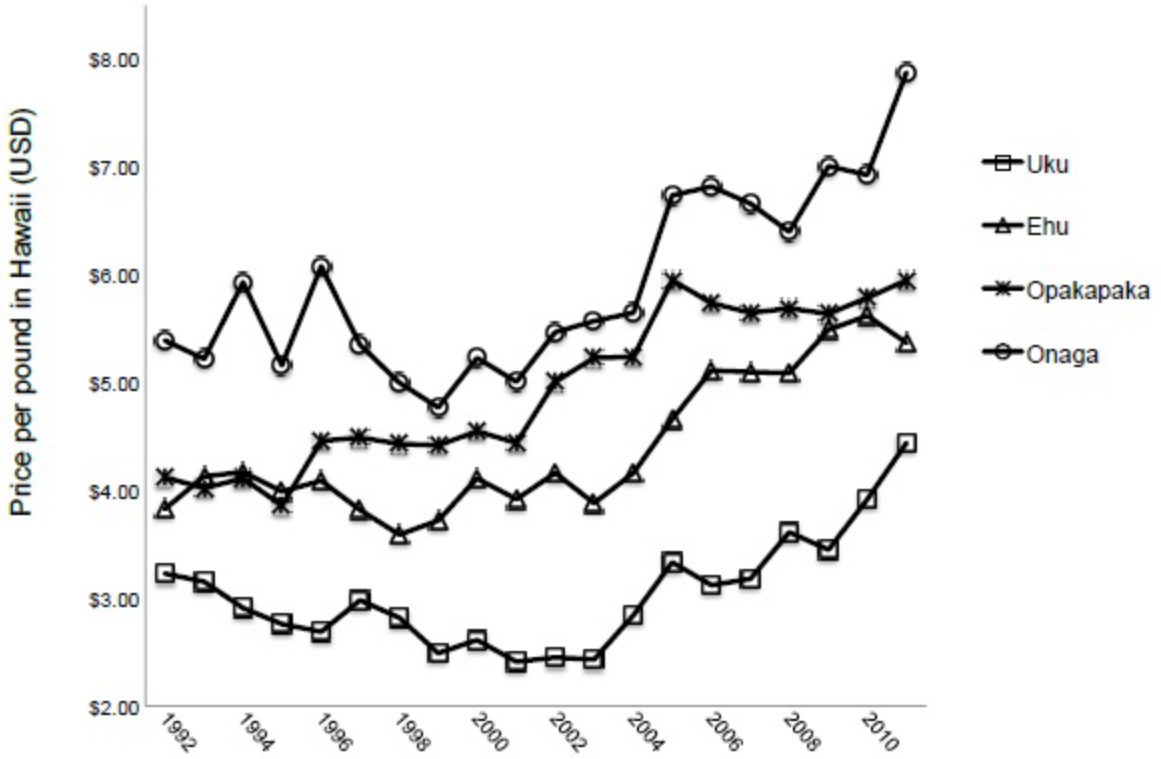

Figure 1: Mean price per pound for uku and three deeper water snapper species (onaga, opakapaka and ehu) for 1992 through 2011. DLNR data obtained from PIFSC website.

In addition to Hawaiian caught fish, demand for snapper in Hawaii is met by imported fish. The National Marine Fisheries Service, Fisheries Statistics and Economics Division track snapper imports, but do not collect information at the species level so we cannot determine the amount of uku imported specifically. The top 5 countries that import snapper (though not specifically uku) to Honolulu, in order of decreasing magnitude are Tonga, New Zealand, Australia, Indonesia and Fiji (see Figure 2) . Tonga alone accounted for between 36% and 70% of imports to Honolulu between 1996 through 2012. In the mid-90's the Solomon Islands was an additional major exporter to Hawaii, but has not accounted for any imports since 1998.

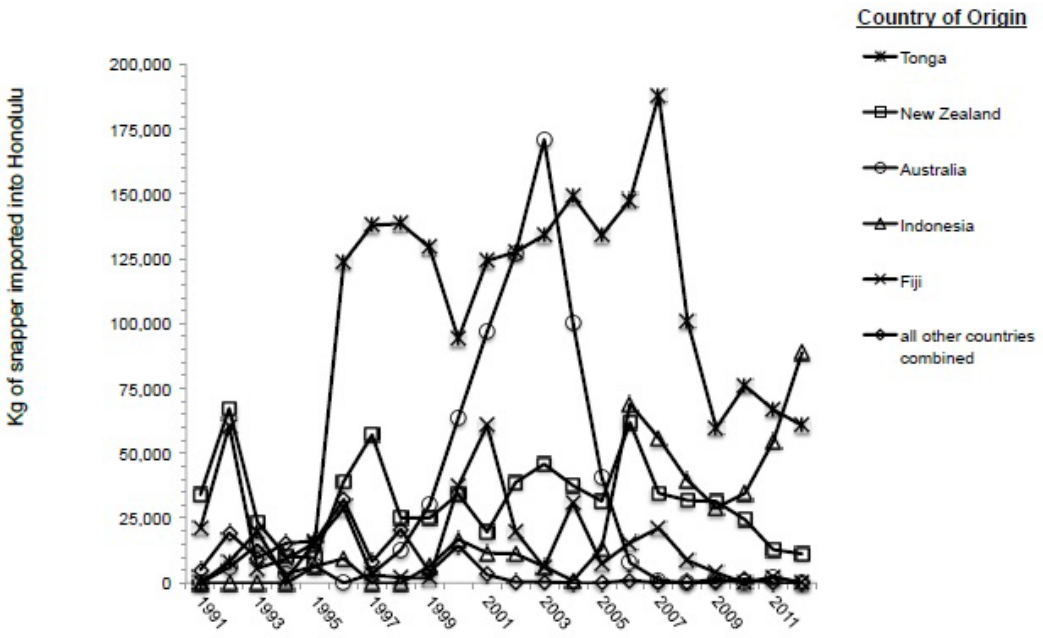

Figure 2: Annual total kilograms of snapper (which includes all fish species from the family Lutjanidae) imported to Hawaii from 1991 to 2012. The top 5 countries of origin are displayed, as well as the annual total imported from all other countries combined. The majority of imports are fresh (fillets or whole fish). Information obtained from the National Marine Fisheries Service, Fisheries Statistics and Economics Division

Common and market names

Acceptable market name:jobfish, Common name: Green jobfish {FDA 2012}, grey snapper, blue-green snapper
Hawaiian name: Uku

Primary product forms

Whole (fresh), filet (fresh){Hawaii Seafood Council NA}

Analysis

Scoring Guide

- All scores result in a zero to five final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of five indicates high performance.
- The full Seafood Watch Fisheries Criteria that the following scores relate to are available on our website at http://www.seafoodwatch.org

Criterion 1: Stock for which you want a recommendation

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown. The final Criterion 1 Score is determined by taking the geometric mean of the abundance and fishing mortality scores.

HAWAIIAN GRAY SNAPPER (UKU)				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Hawaii Central Pacific Handline	1.00:High	2.00:High Concern	2.33:Moderate Concern	**Red (2.159)**
Hawaii Central Pacific Troll/Pole	1.00:High	2.00:High Concern	2.33:Moderate Concern	**Red (2.159)**

Justification of Ranking

Factor 1.1 - Inherent Vulnerability to Fishing

- Low = FishBase vulnerability score for species 0-35 OR species exhibits life history characteristics that make it resilient to fishing, e.g., early maturing (<5 years), short lived (< 10 years), small maximum size, and low on food chain.
- Medium = FishBase vulnerability score for species 36-55 OR life history characteristics that make it neither particularly vulnerable or resilient to fishing, e.g. moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain.
- High = FishBase vulnerability score for species 56-100 OR life history characteristics that make is particularly vulnerable to fishing, e.g. long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator.

  Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g. schooling,

aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Factor 1.2 - Abundance

- 5 (Very Low Concern) = Strong evidence that population is above target abundance level (e.g. biomass at maximum sustainable yield, BMSY) or near virgin biomass
- 4 (Low Concern) = Population may be below target abundance level, but it is considered not overfished.
- 3 (Moderate Concern) = Abundance level is unknown and species has a low or medium inherent vulnerability to fishing
- 2 (High Concern) = Population is overfished, depleted, or a species of concern OR Abundance is unknown and species has a high inherent vulnerability to fishing.
- 1 (Very High Concern) = Population is listed as threatened or endangered.

Factor 1.3 - Fishing Mortality

- 5 (Very Low Concern) = Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY) OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality)
- 3.67 (Low Concern) = Probable (>50% chance) that fishing mortality is at or below a sustainable level, but some uncertainty OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught)
- 2.33 (Moderate Concern) = Fishing mortality is fluctuating around sustainable levels OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery, and if species is depleted, reasonable management is in place.
- 1 (High Concern) = Overfishing is occurring, but management is in place to curtail overfishing OR fishing mortality is unknown, species is depleted and no management is in place
- 0 (Critical) = Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.

HAWAIIAN GRAY SNAPPER (UKU)

1.1 - Inherent Vulnerability

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

1.00 **High**

Inherent Vulnerability Score = 61 {Froese and Pauly 2000}{Cheung et. al. 2005}

1.2 - Stock Status

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **High Concern**

NMFS lists the 'overfished' status of the Main Hawaiian Islands Non-Deep 7 Bottomfish Multi-species Complex (uku is a member of this complex) as 'unknown' and whether it is 'approaching [the] overfished condition' as 'unknown' {NMFS 2012}. It is unclear whether uku was ever overfished because its stock has never been assessed individually. In June 2013 the WPRFMC's Scientific and Statistical Committee (SSC) recommended that NMFS carry out a species specific stock assessment for uku {WPRFMC 2013}.

Uku is scored here as 'high concern' because of the unknown overfished status of the non-Deep 7 complex and because its inherent vulnerability is high {Cheung et. al. 2005}{Froese and Pauly 2000}. The entire bottomfish complex (including Deep 7 and Non-Deep 7 species) was listed as overfished in 2007 with a B_{MSY} value of 0.62 {Brodziak et al. 2009}. According to the 2011 Deep-7 stock assessment (which did not include uku), this subset of species is no longer overfished {Brodziak et al. 2011}.

We also examine a basic catch per unit of effort (CPUE) metric, the biomass landed divided by the total hours fished (all gears), as a way to obtain information on the stock status (see Figure 3). Based on 2003-2012 commercial logbook data for all trips where uku constituted 5 percent or more of the overall catch by weight (including all methods of fishing), CPUE for uku alone decreased by 47% and CPUE for total landings decreased by 43% {HDAR 2013}.

Rationale:
In the MHI, overall bottomfish biomass declined from high values in the 1960s-1970s to relatively low values in the mid-1990s, continuing into the 2000s with biomass values fluctuating around 60% of B_{MSY}, reaching 0.62 in 2007 {Brodziak et al. 2009}.

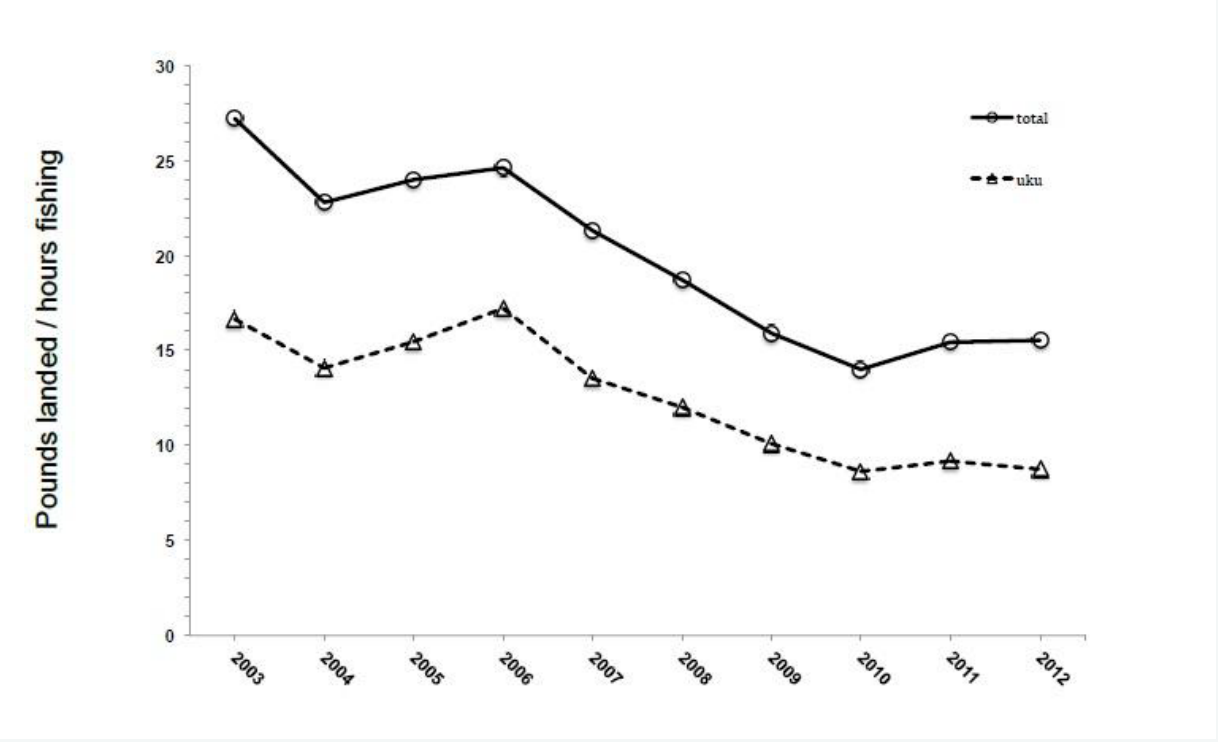

Figure 3: Pounds of catch per hour of fishing for 1) uku and for 2) total landings when uku was at least 5% of the total catch. Calculated based on commercial logbook data, using annual totals (2003-2012) from fishing trips where uku constituted at least 5% of the total catch. (DLNR data)

1.3 - Fishing Mortality

Hawaii Central Pacific, Troll/Pole

2.33 **Moderate Concern**

NMFS lists the 'overfishing' status of the Main Hawaiian Islands Non-Deep 7 Bottomfish Multi-species Complex (uku is a member of this complex) as 'unknown' {NMFS 2012}. The most recent Hawaiian bottomfish stock assessment that included uku was based on catch data up to 2004, then updated to include data up to 2007, found that the MHI complex was experiencing overfishing as recently as 2007 {Moffitt et al. 2006}{Brodziak et al. 2009}. The subsequent bottomfish stock assessment focused on the deep 7 species {Brodziak et al. 2011}. While the overfishing status of uku is currently unknown, effective management is in place for this and other non-deep 7 bottomfish species. These management measures include protected areas, a fishing quota (as of the 2012-2013 season), and reporting requirements. The NWHI is closed to bottomfishing and there are currently 12 Bottomfish Restricted Fishing Areas (BFRAs) in state waters of the MHI where bottomfishing is prohibited. Nineteen BRFAs had been designated in 1998, were found to be ineffective in 2005, then were redesigned in 2007 based on seafloor habitat mapping to include more Essential Fish Habitat (EFH) (specifically they were designed to include 20% of

the EFH for ehu/*Etelis carbunculus* and ehu/*Etelis* coruscans, whose habitats overlap with uku's in deeper areas) {Moore et al. 2013}, resulting in the current set of 12 {Sackett et al 2012}. The state is mandated to monitor the effectiveness of the BRFAs {Sackett et al 2012}, and research has shown some increases in size frequencies inside BRFAs {Moore et al. 2013}. While these BRFAs target conserving the deeper depths at which uku is found, they do not In addition to the closed areas, the Western Pacific Fisheries Management Council (WPFMC) (as of April 12th, 2013) manages uku catch along with six other species under a combined "non-Deep 7 bottomfish" Annual Catch Limit {Federal Register 2013}. While the WPRFMC council recommended a 2013 ACL of 140,000 lbs. for the non-deep 7 fishery, corresponding to less than a 26% chance of overfishing {WPRFMC 2012a}, the NMFS set the 2013 ACL at 145,000 lbs. (65,909 kgs.) {Federal Register 2013}.In 2011 the uku catch of 109,497 lbs. (49,771 kgs.) represented 59% of all non-deep 7 bottomfish species caught (the percentage was also 59 in 2010), a decrease from earlier years (2009 = 62%, 2008 = 66%, 2007 = 65%, 2006 = 73%, 2005 = 64%, 2004% = 61%, 2003 = 60%, 2002 = 51%, 2001 = 49%) {PIFSC 2012b}.

Troll capture of uku represents a decreasing percentage of overall annual uku landings, although it is the most efficient method for capture based on CPUE (using lbs caught / hours spent fishing) {HDAR 2013}. Between 2003 and 2006, trolling accounted for approximately 20% of uku landed, increasing to a high of 36% in 2007 (corresponding to the closure of the Deep 7 bottomfish fishery which uses exclusively deep water handlines), then declining with some fluctuation from 2009 to the 2012 figure of 9% {HDAR 2013}.

Rationale:

In general, bottomfish harvest rates were low in the 1960s to mid-1970s, increased to peak in 1989 (at approximately 200% of H_{MSY}), and have declined gradually since {Brodziak et al. 2009}. The 2006 stock assessment (based on data up to 2004) for the entire bottomfish complex (including both deep 7 and non-deep 7 species) found that over the entire Hawaiian archipelago (including the NWHI and the MHI) bottomfish stocks were experiencing overfishing. The 2008 update assessment (completed in 2009) demonstrates that this was largely due to depletion in the MHI stock, which in 2007 had an H/H_{MSY} (in the report relative harvest, H, is used instead of F) of 1.11, constituting overfishing. It is not clear whether this overfishing determination was based largely on high catches of Deep 7 species or if overfishing was occuring throughout the bottomfish complex. In contrast to the 2008 update assessment, the model used in the 2010 stock assessment (Deep 7 species only), found that the MHI bottomfish stock was not overfished from 1988-2007, had experienced overfishing in 1989 and was not experiencing overfishing in 2010 {Brodziak et al. 2011}.

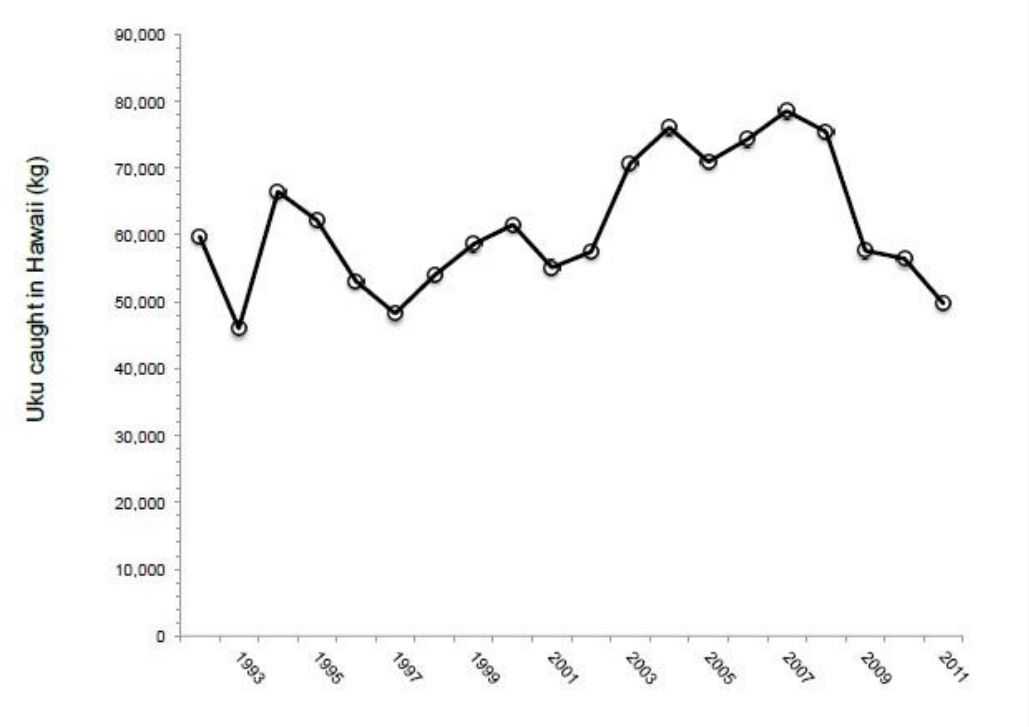

Figure 4: Kilograms of uku caught annually in Hawaii from 1992 through 2011. DLNR data obtained from PIFSC website.

Hawaii Central Pacific, Handline

2.33 **Moderate Concern**

NMFS lists the 'overfishing' status of the Main Hawaiian Islands Non-Deep 7 Bottomfish Multi-species Complex (uku is a member of this complex) as 'unknown' {NMFS 2012}. The most recent Hawaiian bottomfish stock assessment that included uku was based on catch data up to 2004, then updated to include data up to 2007, found that the MHI complex was experiencing overfishing as recently as 2007 {Moffitt et al. 2006}{Brodziak et al. 2009}. The subsequent bottomfish stock assessment focused on the deep 7 species {Brodziak et al. 2011}. While the overfishing status of uku is currently unknown, effective management is in place for this and other non-deep 7 bottomfish species. These management measures include protected areas, a fishing quota (as of the 2012-2013 season), and reporting requirements. The NWHI is closed to bottomfishing and there are currently 12 Bottomfish Restricted Fishing Areas (BFRAs) in state waters of the MHI where bottomfishing is prohibited. Nineteen BRFAs had been designated in 1998, were found to be ineffective in 2005, then were redesigned in 2007 based on seafloor habitat mapping to include more Essential Fish Habitat (EFH) (specifically they were designed to include 20% of the EFH for ehu/*Etelis carbunculus* and ehu/*Etelis coruscans*, whose habitats overlap with uku's in deeper areas) {Moore et al. 2013}, resulting in the current set of 12 {Sackett et al 2012}. The

state is mandated to monitor the effectiveness of the BRFAs {Sackett et al 2012}, and research has shown some increases in size frequencies inside BRFAs {Moore et al. 2013}. In addition to the closed areas, the Western Pacific Fisheries Management Council (WPFMC) (as of April 12th, 2013) manages uku catch along with six other species under a combined "non-Deep 7 bottomfish" Annual Catch Limit {Federal Register 2013}. The WPRFMC's SSC recommended a 2013 ACL of 140,000 lbs for the non-deep 7 fishery, corresponding to less than a 26% chance of overfishing {WPRFMC 2012a}, which NMFS set as the ACL {Federal Register 2013}. We note here that in June 2013 the WPRFMC recommended that uku be removed from the non-deep 7 bottomfish category and be assessed as a single species with its own ACL due to its dominance in the catch {WPRFMC 2013}.

In 2011 the uku catch of 109,497 lbs. (49,771 kgs.) represented 59% of all non-deep 7 bottomfish species caught (the percentage was also 59 in 2010), a decrease from earlier years (2009 = 62%, 2008 = 66%, 2007 = 65%, 2006 = 73%, 2005 = 64%, 2004% = 61%, 2003 = 60%, 2002 = 51%, 2001 = 49%) (for annual landings from 2002-2011 see Figure 4) {PIFSC 2012b}.

Deep-sea/offshore handline capture is the largest source of uku landings of all methods used, whereas inshore handlining represents a much smaller (but increasing) percentage of the uku catch. Between 2003 and 2012, deep sea handline methods accounted for 65%-75% of all uku landings (exclusive of 2007, corresponding to the closure of the Deep 7 bottomfish fishery which exclusively uses deep water handlines). Between 2003 and 2012, inshore handline methods accounted for a maximum of 9% of all annual uku landing totals {HDAR 2013}.

Rationale:

In general, bottomfish harvest rates were low in the 1960s to mid-1970s, increased to peak in 1989 (at approximately 200% of H_{MSY}), and have declined gradually since {Brodziak et al. 2009}. The 2006 stock assessment (based on data up to 2004) for the entire bottomfish complex (including both deep 7 and non-deep 7 species) found that over the entire Hawaiian archipelago (including the NWHI and the MHI) bottomfish stocks were experiencing overfishing. The 2008 update assessment (completed in 2009) demonstrates that this was largely due to depletion in the MHI stock, which in 2007 had an H/H_{MSY} (in the report relative harvest, H, is used instead of F) of 1.11, constituting overfishing. It is not clear whether this overfishing determination was based largely on high catches of Deep 7 species or if overfishing was occuring throughout the bottomfish complex. In contrast to the 2008 update assessment, the model used in the Deep 7 stock assessment (which did not include uku), found that the MHI bottomfish stock was not overfished from 1988-2007, had experienced overfishing in 1989 and was not experiencing overfishing in 2010 {Brodziak et al. 2011}.

Criterion 2: Impacts on other retained and bycatch stocks

All retained and primary bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch.

Hawaiian gray snapper (uku): Hawaii Central Pacific, Handline

Subscore:: **2.709** **Discard Rate:** **1.00** **C2 Rate:** **2.709**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
HAWAIIAN GRAY SNAPPER (UKU)	1.00: High	2.00: High Concern	2.33: Moderate Concern	**2.159**
HAWAIIAN GROUPER (HAPU'U)	1.00: High	2.00: High Concern	3.67: Low Concern	**2.709**
SHARKS	1.00: High	2.00: High Concern	3.67: Low Concern	**2.709**
GREATER AMBERJACK	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
HAWAIIAN PINK SNAPPER (OPAKAPAKA)	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
HAWAIIAN RUBY SNAPPER (ONAGA)	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

Hawaiian gray snapper (uku): Hawaii Central Pacific, Troll/Pole

Subscore:: **2.709** **Discard Rate:** **1.00** **C2 Rate:** **2.709**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
HAWAIIAN GRAY SNAPPER (UKU)	1.00: High	2.00: High Concern	2.33: Moderate Concern	**2.159**
SHARKS	1.00: High	2.00: High Concern	3.67: Low Concern	**2.709**
GREATER AMBERJACK	2.00: Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**

YELLOWFIN TUNA	2.00: Medium	5.00: Very Low Concern	5.00: Very Low Concern	**5.000**

Both handline and longline fisheries for uku produce a Criteria 2 score of "yellow" due to low but significant bycatch of species with high inherent vulnerabilities and high concern stock statuses. We note here that we did not include the ESA listed endangered Hawaiian monk seal in our assessment. There have been observed interactions with monk seals that take or damage bottom-caught fish, and there have been 7 instances of monk seals getting hooked since 1982 that have been attributed to the bottomfish fishery. These were attributed to the bottomfish fishery because the monk seals were observed (alive) with hooks caught in their mouths {WPRFMC 2009}, and the bottomfish fishery is the most prominent demersal hook and line fishery. The fishery is listed as a Category III fishery under the requirements of the Marine Mammal Protection Act, meaning the fishery is responsible for <1% of the species' PBR (Potential Biological Removal—the maximum number of animals that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population) {NMFS 2012b}. Under section 7 of the Endangered Species Act, NMFS has determined that the bottomfish fishery does not adversely impact ESA- listed species or their habitat {WPRFMC 2009}.

The species assessed under Criteria 2 were selected based on their occurance in logbook data for fishing trips in which uku comprised at least 5% of the landings. SFW obtained this logbook data from Reginald Kokubun at the Hawaii Department of Aquatic Resources (HDAR).

Justification of Ranking

Only species that scored 'red' are included here. All other species evaluations are in Appendix 1. See criterion 1 for scoring definitions.

GREATER AMBERJACK

2.1 - Inherent Vulnerability

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **Medium**

Inherent Vulnerability Score = 54 {Cheung et. al. 2005}{Froese and Pauly 2000}

2.2 - Stock Status

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

3.00 **Moderate Concern**

NMFS lists the 'overfished' status of the Main Hawaiian Islands Non-Deep 7 Bottomfish Multi-species Complex (kahala or *Seriola dumerili* is a member of this complex) as 'unknown' and whether it is 'approaching [the] overfished condition' as 'unknown' {NMFS 2012}. Kahala is scored here as 'moderate concern' because of the unknown overfished status of the complex and because its inherent vulnerability is moderate {Cheung et. al. 2005}{Froese and Pauly 2000}.

According to a 2006 DSEIS (Draft Supplemental Environmental Impact Statement) on the bottomfish fishery, jointly authored by NMFS and the WPRFMC, the Hawaiian kahala stock is "healthy" due to low commercial catch and because kahala discarded in the fishery are likely to survive {WPRFMC 2006}. Demand for wild caught kahala has been low since 1983 when Hawaii's primary fish auction (the United Fishing Agency) stopped selling it due to increased incidences of ciguatera poisoning.

2.3 - Fishing Mortality

Hawaii Central Pacific, Handline

3.67 **Low Concern**

Wild captured kahala is rarely fished commercially in Hawaii (see image with catch data from 1992-2011) due to its potential for carrying the ciguatera toxin {Lewis 1986}, which it obtains from feeding on deep coral reefs. Kahala is farmed commercially in Hawaii, as it is free from ciguatera {Greenberg 2010}. Kahala is the most commonly discarded fish in both the deepwater handline and troll fisheries, with 2688 individuals discarded in the deep handline fishery between 2003 and 2012 when uku comprised at least 5% of the total catch {HDAR 2013}. However, because kahala is generally released live (pers comm. S. Pooley, PIFSC) and because bycatch and discards in these fisheries are low {HDAR 2013}, mortality by these methods are deemed low. Overall fishing mortality for kahala is low (see landings from 1992-2011 in Figure 5), the rank for this criterion is "low concern".

Rationale:

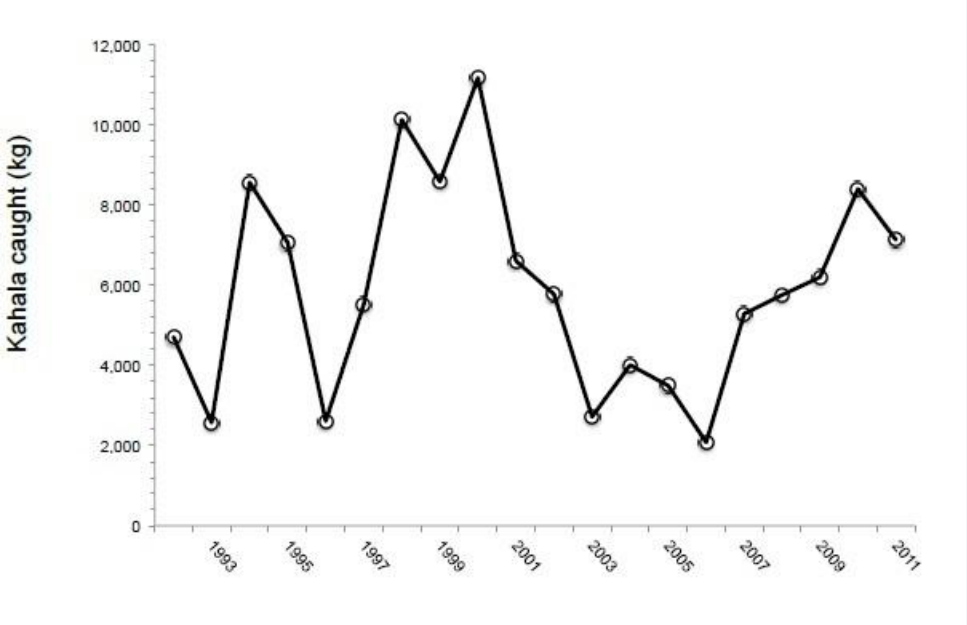

Figure 5: Kilograms of kahala caught annually in Hawaii from 1992 through 2011. DLNR data obtained from PIFSC website.

Hawaii Central Pacific, Troll/Pole

3.67 **Low Concern**

Wild captured kahala is rarely fished commercially in Hawaii (see image with catch data from 1992-2011) due to its potential for carrying the ciguatera toxin {Lewis 1986}, which it obtains from feeding on deep coral reefs. Kahala is farmed commercially in Hawaii, as it is free from ciguatera {Greenberg 2010}. Kahala is the most commonly discarded fish in both the deepwater handline and troll fisheries, with 216 individuals discarded in the troll fishery between 2003 and 2012 when uku comprised at least 5% of the total catch {HDAR 2013}. However, because kahala is generally released live (pers comm. S. Pooley, PIFSC) and because bycatch and discards in these fisheries are low {HDAR 2013}, mortality by these methods are deemed low. Overall fishing mortality for kahala is low, the rank for this criterion is "low concern".

2.4 - Discard Rate

Hawaii Central Pacific, Handline

1.00 **< 20%**

The discard rate/landings for handline capture in the bottomfish fishery is low. Using data from 2003 to 2012, the mean number of discards of any species in deepsea handline fishery (when uku is > or = to 5%

of the total catch) was 594 fishes, and in the inshore handline fishery (when uku is > or = to 5% of the catch) it was 127 fishes. Although the number of total fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 136,906 lbs. (62,230 kgs.) for deepsea handline and 34,911 lbs. (15,869 kgs.) for inshore handline. These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}. We note that that logbook data is believed to underreport catches and discards compared to observer data {NMFS 2011b}, however, it still is likely that discard rate is <20% .

Hawaii Central Pacific, Troll/Pole

1.00 **< 20%**

The discard rate/landings for troll capture in the bottomfish fishery is low. Using trolling data from 2003 to 2012, the mean number of discards of any species when uku is > or = to 5% of the total catch was 94 fishes. Although the corresponding total number of fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 15,931 lbs. (7,242 kgs). These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}.

HAWAIIAN GROUPER (HAPU'U)

2.1 - Inherent Vulnerability

Hawaii Central Pacific, Handline

1.00 **High**

Inherent Vulnerability = 70 {Cheung et. al. 2005}{Froese and Pauly 2000}. IUCN classifies hapu'u as "Near Threatened" on its Red List of Threatened Species {Cornish 2004}.

2.2 - Stock Status

Hawaii Central Pacific, Handline

2.00 **High Concern**

Scoring hapu'u stock status is problematic. In 2004 IUCN listed hapu'u, a species endemic to Hawaii and Johnston Atoll, as "Near Threatened" {Cornish 2004}, which qualifies it scoring "2" (high concern) for this criterion. However, the Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex (of which hapu'u is a member) was classified as not overfished in the most recent stock assessment, with a B/B_{MSY}

of 0.92 for the overall compex {Brodziak et al. 2011}. Because the individual biomass of hapu'u (and the other six species) is unknown, we score this criterion as "2".

2.3 - Fishing Mortality

Hawaii Central Pacific, Handline

3.67 **Low Concern**

Hapu'u landings in the MHI are low and exhibit a declining trend (see landings from 1992 to 2011 in Figure 6) {PIFSC 2012b}. Between 2005 and 2008, hapu'u caught when uku biomass comprised > or = to 5% of the catch represented >20% of total hapu'u landings. Since then, hapu'u caught when uku biomass comprised > or = to 5% of the catch has represented a smaller percentage of total hapu'u landings, and was 9% in 2011 {HDAR 2013}{PIFSC 2012b}. This contribution to mortality may not be negligible, but is low enough that it may not adversely affect the hapu'u population.

The fishing mortality estimated in the Hawaiian Deep 7 bottomfish multi-species complex stock assessment (H/H_{MSY}, used instead of F/F_{MSY} = 0.58), indicates that the complex as a whole is not undergoing overfishing by a large margin {Brodziak et al. 2011}. The annual catch of hapu'u, while fluctuating, has decreased significantly over the last two decades (see image below). Hapu'u currently represents only a small portion of the overall Deep 7 catch, which has decreased over time to the current value of 4% {PIFSC 2012b}.

Effective management is in place for hapu'u as part of the Deep 7 Bottomfish Fishery, suggesting that it is probable that overfishing of hapu'u is not occurring, in lieu of having a species specific H/H_{MSY}. Management measures for the Deep 7 Fishery include reporting requirements, catch quotas, non-commercial bag limits and protected areas. The complex was managed under a Total Allowable Catch (TAC) limit from 2007 through the 2010-2011 fishing season, and as of the 2011-2012 season the complex is managed under an Annual Catch Limit (ACL) {Federal Register 2011}. The ACL is used to determine the Annual Catch Target (ACT), which is the seasonal quota for the fishery. In the MHI there are 12 Bottomfish Restricted Fishing Areas (BRFAs) where bottomfish fishing is prohibited. These areas protect 20% of two Deep 7 species Essential Fish Habitat (EFH), whose habitat overlaps highly with that of hapu'u {Moore et al. 2013}.

Rationale:

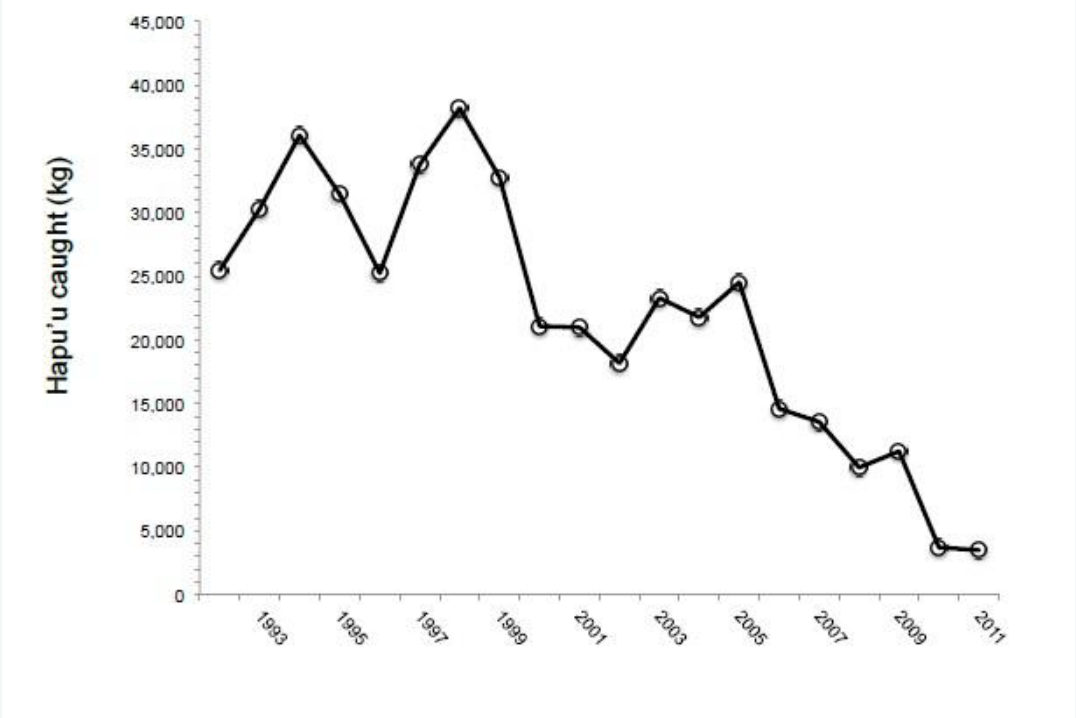

Figure 6: Kilograms of hapu'u caught annually in Hawaii from 1992 through 2011. DLNR data obtained from PIFSC website.

2.4 - Discard Rate

Hawaii Central Pacific, Handline

1.00 **< 20%**

The discard rate/landings for handline capture in the bottomfish fishery is low. Using data from 2003 to 2012, the mean number of discards of any species in deepsea handline fishery (when uku is > or = to 5% of the total catch) was 594 fishes, and in the inshore handline fishery (when uku is > or = to 5% of the catch) it was 127 fishes. Although the number of total fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 136,906 lbs. (62,230 kgs.) for deepsea handline and 34,911 lbs. (15,869 kgs.) for inshore handline. These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}. We note that that logbook data is believed to underreport catches and discards compared to observer data {NMFS 2011b}, however, it still is likely that discard rate is <20% .

HAWAIIAN PINK SNAPPER (OPAKAPAKA)

2.1 - Inherent Vulnerability

Hawaii Central Pacific, Handline

2.00 **Medium**

Inherent Vulnerability = 43 {Cheung et. al. 2005}{Froese and Pauly 2000}. We note that the fishbase inherent vulnerability score pre-dates recent research findings on opakapaka life history characteristics. Until recently, this species was thought to live to a maximum age of approximately 18 years {Ralston and Miyamoto 1983}, but a recent aging study using radiocarbon and lead isotope dating techniques found that maximum age may exceed 45 years old {Andrews et al. 2011}. This could indicate that opakapaka has a slower population turnover rate than previously thought, which could suggest a higher inherent vulnerability. This revised age estimation was factored into the most recent Deep 7 Bottomfish stock assessment {Brodziak et al. 2011}.

2.2 - Stock Status

Hawaii Central Pacific, Handline

3.00 **Moderate Concern**

Opakapaka is a member of the Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex, and is the most abundant and has the highest catch of all 7 included species. This complex, which is considered as one combined stock, is not overfished according to the most recent stock assessment {Brodziak et al. 2011} and current B/B_{MSY} for the complex is 0.95 {NMFS 2012}. This stock assessment was based on reported catch data and estimates of unreported catch through 2010, as well as life history parameters, and did not include fishery independent data. Although the complex is considered not overfished, this criterion scores as "moderate concern" rather than "low concern" because of the lack of a species specific stock assessment for opakapaka.

2.3 - Fishing Mortality

Hawaii Central Pacific, Handline

3.67 **Low Concern**

The most recent available harvest rate for the Deep 7 Bottomfish Multi-species Complex is below F_{MSY} by a large margin. H/H_{MSY} (the equivalent of F/F_{MSY}) for 2010 was 0.58. The combined stock is not currently experiencing overfishing {Brodziak et al. 2011}. There is no species specific estimate for opakapaka.

Opakapaka constitutes approximately half of the total Deep 7 catch (see Figure 7 for opakapaka landings from 1992 to 2011) {PIFSC 2012b}. The shallower depths of opakapaka habitat (found from 30-360m) coincide with the deeper edge of uku habitat (found 0-180m), so both fish are often landed together when fished on handline. Between 2003 and 2012, using all trips where uku was at least 5% of the total catch, opakapaka constituted 9%+/- 2% of the catch. This is a fairly low percentage, and may likely not negatively affect the opakapaka population. Opakapaka caught with uku on these trips represented 17% +/- 3% of total annual opakapaka catch {HDAR 2013}.

Effective management is in place for opakapaka as part of the Deep 7 Bottomfish Fishery. Management measures for the Deep 7 Fishery include reporting requirements, catch quotas, non-commercial bag limits and protected areas. The complex was managed under a Total Allowable Catch (TAC) limit from 2007 through the 2010-2011 fishing season, and as of the 2011-2012 season the complex is managed under an Annual Catch Limit (ACL) {Federal Register 2011}. The ACL is used to determine the Annual Catch Target (ACT), which is the seasonal quota for the fishery. In the MHI there are 12 Bottomfish Restricted Fishing Areas (BRFAs) where bottomfish fishing is prohibited. These areas protect 20% of 2 Deep 7 species Essential Fish Habitat (EFH), whose habitat overlaps highly with that of opakapaka {Moore et al. 2013}.

Rationale:

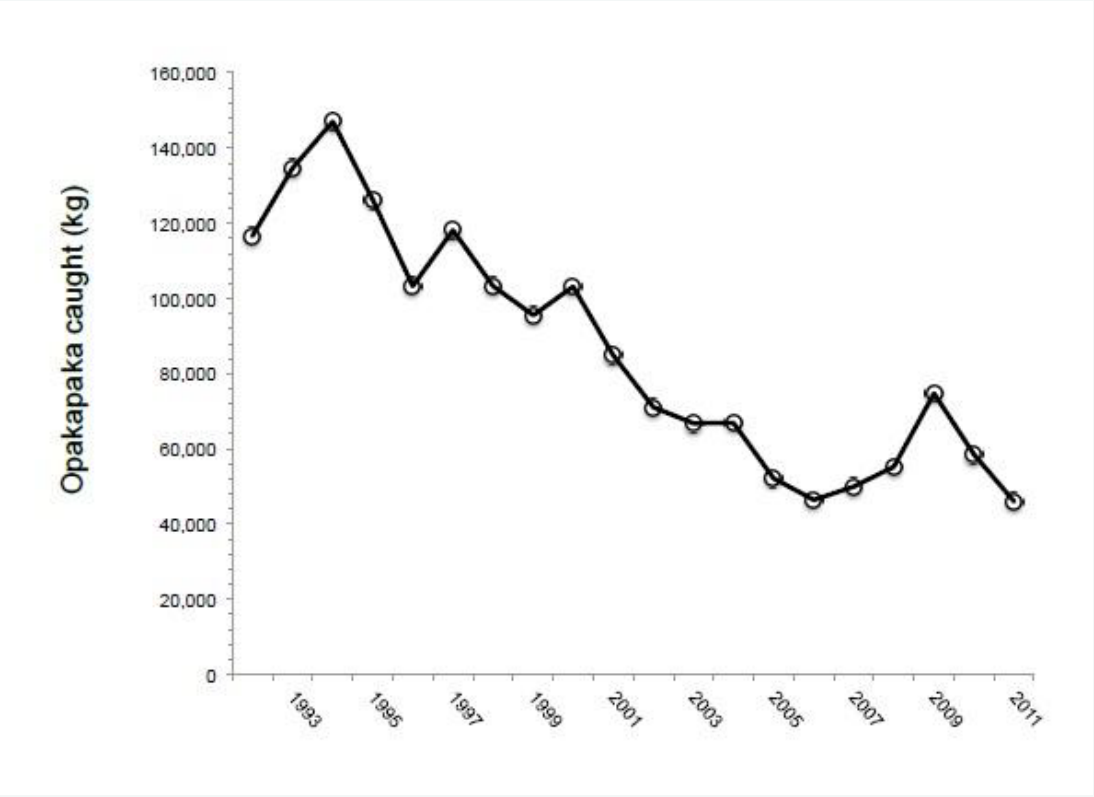

Figure 7: Kilograms of opakapaka caught annually in Hawaii from 1992 through 2011. DLNR data obtained from PIFSC website.

2.4 - Discard Rate

Hawaii Central Pacific, Handline

1.00 **< 20%**

The discard rate/landings for handline capture in the bottomfish fishery is low. Using data from 2003 to 2012, the mean number of discards of any species in deepsea handline fishery (when uku is > or = to 5% of the total catch) was 594 fishes, and in the inshore handline fishery (when uku is > or = to 5% of the catch) it was 127 fishes. Although the number of total fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 136,906 lbs. (62,230 kgs.) for deepsea handline and 34,911 lbs. (15,869 kgs.) for inshore handline. These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}. We note that that logbook data is believed to underreport catches and discards compared to observer data {NMFS 2011b}, however, it still is likely that discard rate is <20% .

HAWAIIAN RUBY SNAPPER (ONAGA)

2.1 - Inherent Vulnerability

Hawaii Central Pacific, Handline

2.00 **Medium**

Inherent Vulnerability = 45 {Cheung et. al. 2005}{Froese and Pauly 2000}

2.2 - Stock Status

Hawaii Central Pacific, Handline

3.00 **Moderate Concern**

Onaga is a member of the Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex, and has the second highest catch of all 7 included species. This complex, which is considered as one combined stock, is not overfished according to the most recent stock assessment {Brodziak et al. 2011} and current B/B_{MSY} for the complex is 0.95 {NMFS 2012}. This stock assessment was based on reported catch data and estimates of unreported catch through 2010, as well as life history parameters, and did not include fishery independent data. Although the complex is considered not overfished, this criterion scores as "moderate concern" rather than "low concern" because of the lack of a species specific stock assessment for onaga.

2.3 - Fishing Mortality

Hawaii Central Pacific, Handline

3.67 **Low Concern**

The most recent available harvest rate for the Deep 7 Bottomfish Multi-species Complex is below F_{MSY} by a large margin. H/H_{MSY} (the equivalent of F/F_{MSY}) for 2010 was 0.58. The combined stock is not currently experiencing overfishing {Brodziak et al. 2011}. There is no species specific estimate for onaga.

The most commercially valuable of the deep 7 species, onaga's catch has steadily declined from 2004 (168,527 lbs./76,603 kgs.) through to the present (2011 catch: 46,921 lbs./ 21,328 kgs.) (see Figure 8) {PIFSC 2012b}. (see image below) Onaga's depth range (100-450m) coincides with uku's (0-180m) over 80 m, so the two are caught together, but have been at a decreasing rate from 2003 to 2012 (excluding 2007, the year the deep 7 fishery closed). On trips where uku constitutes at least 5% of the catch, onaga was 6% in 2003, down to 2% in 2012, representing 10% and 5% of onaga's annual catch respectively {HDAR 2013}.

Effective management is in place for onaga as part of the Deep 7 Bottomfish Fishery. Management measures for the Deep 7 Fishery include reporting requirements, catch quotas, non-commercial bag limits and protected areas. The complex was managed under a Total Allowable Catch (TAC) limit from 2007 through the 2010-2011 fishing season, and as of the 2011-2012 season the complex is managed under an Annual Catch Limit (ACL) {Federal Register 2011}. The ACL is used to determine the Annual Catch Target (ACT), which is the seasonal quota for the fishery. In the MHI there are 12 Bottomfish Restricted Fishing Areas (BRFAs) where bottomfish fishing is prohibited. These areas protect 20% of 2 Deep 7 species Essential Fish Habitat (EFH), one of which is onaga {Moore et al. 2013}.

Rationale:

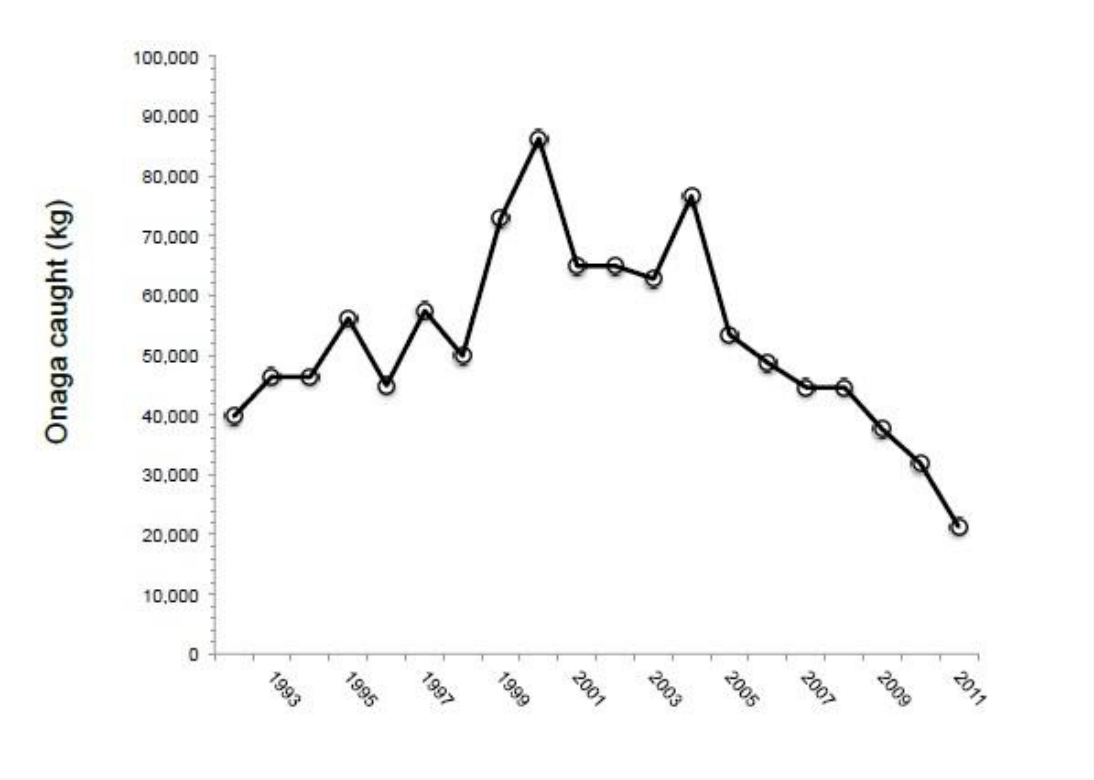

Figure 8: Kilograms of onaga caught annually in Hawaii from 1992 through 2011. DLNR data obtained from PIFSC website.

2.4 - Discard Rate

Hawaii Central Pacific, Handline

1.00 **< 20%**

The discard rate/landings for handline capture in the bottomfish fishery is low. Using data from 2003 to 2012, the mean number of discards of any species in deepsea handline fishery (when uku is > or = to 5% of the total catch) was 594 fishes, and in the inshore handline fishery (when uku is > or = to 5% of the catch) it was 127 fishes. Although the number of total fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 136,906 lbs. (62,230 kgs.) for deepsea handline and 34,911 lbs. (15,869 kgs.) for inshore handline. These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}. We note that that logbook data is believed to underreport catches and discards compared to observer data {NMFS 2011b}, however, it still is likely that discard rate is <20% .

SHARKS

2.1 - Inherent Vulnerability

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

1.00 **High**

According to SFW, inherent vulnerability is automatically ranked as high for unknown species of sharks assessed under Criterion 2. Globally,three-quarters of oceanic pelagic sharks and rays have an elevated risk of extinction due to overfishing {Dulvy et al. 2008}.

2.2 - Stock Status

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **High Concern**

According to SFW, stock status is automatically ranked as high for unknown species of sharks assessed under Criterion 2. Globally,three-quarters of oceanic pelagic sharks and rays have an elevated risk of extinction due to overfishing {Dulvy et al. 2008}.

2.3 - Fishing Mortality

Hawaii Central Pacific, Handline

3.67 **Low Concern**

Between 2003 and 2012, 410 sharks (classiified as "misc. sharks') were discarded in the deepwater bottomfish handline fishery when uku comprised at least 5% of the total catch {HDAR 2013}. According to the US National Bycatch Report, shark bycatch in the MHI bottomfish fishery is thought to be low and post-hooking survival rates for sharks are believed to be high (because sharks do not experience barotrauma) {NMFS 2011b}. Given this information, shark bycatch in the MHI bottomfish fishery is unlikely to adversely affect shark populations.

Hawaii Central Pacific, Troll/Pole

3.67 **Low Concern**

Between 2003 and 2012, 108 sharks (classiified as "misc. sharks') were discarded in the troll fishery when uku comprised at least 5% of the total catch {HDAR 2013}. According to the US National Bycatch Report, shark bycatch in the MHI bottomfish fishery is thought to be low and post-hooking survival rates for sharks are believed to be high (because sharks do not experience barotrauma) {NMFS 2011b}. Given this information, shark bycatch in the MHI bottomfish fishery is unlikely to adversely affect shark populations.

2.4 - Discard Rate

Hawaii Central Pacific, Handline

1.00 **< 20%**

The discard rate/landings for handline capture in the bottomfish fishery is low. Using data from 2003 to 2012, the mean number of discards of any species in deepsea handline fishery (when uku is > or = to 5% of the total catch) was 594 fishes, and in the inshore handline fishery (when uku is > or = to 5% of the catch) it was 127 fishes. Although the number of total fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 136,906 lbs. (62,230 kgs.) for deepsea handline and 34,911 lbs. (15,869 kgs.) for inshore handline. These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}. We note that that logbook data is believed to underreport catches and discards compared to observer data {NMFS 2011b}, however, it still is likely that discard rate is <20% .

Hawaii Central Pacific, Troll/Pole

1.00 **< 20%**

The discard rate/landings for troll capture in the bottomfish fishery is low. Using trolling data from 2003 to 2012, the mean number of discards of any species when uku is > or = to 5% of the total catch was 94 fishes. Although the corresponding total number of fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 15,931 lbs. (7,242 kgs). These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}.

SPOTTED JACK

2.1 - Inherent Vulnerability

Central Pacific, Handline

2.00 **Medium**

Inherent Vulnerability = 50 {Cheung et. al. 2005}{Froese and Pauly 2000}

2.2 - Stock Status

Central Pacific, Handline

3.00 **Moderate Concern**

It is likely that the Hawaiian omilu stock is healthy, as it not fished commercially in Hawaii due to incidences of ciguatera poisioning. It is fished recreationally by sport fisherman due to its aggressive/tenacious nature.

2.3 - Fishing Mortality

Central Pacific, Handline

5.00 **Very Low Concern**

Omilu is not fished commercially in Hawaii due to incidences of ciguatera poisoning, though it is fished recreationally due to its aggressive/tenacious nature. Omilu is a bycatch species in the deep handline bottomfish fishery, with 662 individuals caught/released between 2003 and 2012 when uku comprised at least 5% of the total catch, a very small number of fish {HDAR 2013}.

2.4 - Discard Rate

Central Pacific, Handline

1.00 **< 20%**

The discard rate/landings for handline capture in the bottomfish fishery is low. Using data from 2003 to 2012, the mean number of discards of any species in deepsea handline fishery (when uku is > or = to 5% of the total catch) was 594 fishes, and in the inshore handline fishery (when uku is > or = to 5% of the catch) it was 127 fishes. Although the number of total fish landed is not available, the number discarded

is small relative to the mean biomass of all fish species landed, which averaged 136,906 lbs. (62,230 kgs.) for deepsea handline and 34,911 lbs. (15,869 kgs.) for inshore handline. These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}. We note that that logbook data is believed to underreport catches and discards compared to observer data {NMFS 2011b}, however, it still is likely that discard rate is <20% .

YELLOWFIN TUNA

2.1 - Inherent Vulnerability

Hawaii Central Pacific, Troll/Pole

2.00 **Medium**

Inherent Vulnerability = 48 {Cheung et. al. 2005}{Froese and Pauly 2000}

2.2 - Stock Status

Hawaii Central Pacific, Troll/Pole

5.00 **Very Low Concern**

While yellowfin tuna is listed as "Near Threatened" on IUCN's Red List of Threatened Species, this is mainly due to concerns over overfishing in the Indian Ocean stock {Collette et al. 2011}. The NMFS lists the tropical Pacific yellowfin stock as "not overfished" with a B/B_{MSY} of 1.33 {NMFS 2012}. Because of the NMFS B/B_{MSY} estimate is region specific and more recent than the IUCN listing, yellowfin tuna's stock status is ranked as "very low concern" here.

2.3 - Fishing Mortality

Hawaii Central Pacific, Troll/Pole

5.00 **Very Low Concern**

In 2012, on trips where uku was at least 5% of the catch, yellowfin tuna comprised approximately 5% of the catch. In previous years (2003-2011) the yellowfin percentage was below 4%. The biomass of yellowfin tuna caught in the bottomfish fishery (usually by trolling) is negligible compared to the global yellowfin tuna biomass harvested in a year. In 2012, the yellowfin caught with uku (approximately 5K kg.) represented less than 0.0004% of its global capture {HDAR 2013}{FAO 2013}.

2.4 - Discard Rate

Hawaii Central Pacific, Troll/Pole

1.00 **< 20%**

The discard rate/landings for troll capture in the bottomfish fishery is low. Using trolling data from 2003 to 2012, the mean number of discards of any species when uku is > or = to 5% of the total catch was 94 fishes. Although the corresponding total number of fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 15,931 lbs. (7,242 kgs). These figures were calculated from Hawaii Division of Aquatic Resources commercial logbook data {HDAR 2013}.

Criterion 3: Management effectiveness

Management is separated into management of retained species and management of non-retained species/bycatch. The final score for this criterion is the geometric mean of the two scores.

Region / Method	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation
Hawaii Central Pacific Handline	3.000	4.000	Green(3.464)
Hawaii Central Pacific Troll/Pole	3.000	4.000	Green(3.464)

Factor 3.1: Management of fishing impacts on retained species							
Region / Method	**Strategy**	**Recovery**	**Research**	**Advice**	**Enforce**	**Track**	**Inclusion**
Hawaii Central Pacific Handline	Moderately Effective	N/A	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective
Hawaii Central Pacific Troll/Pole	Moderately Effective	N/A	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective

Justification of Ranking

Factor 3.1: Management of Fishing Impacts on Retained Species

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective', 'moderately effective', or 'highly effective'.

- 5 (Very Low Concern) = Rated as 'highly effective' for all seven subfactors considered
- 4 (Low Concern) = Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective'.
- 3 (Moderate Concern) = All subfactors rated at least 'moderately effective'.
- 2 (High Concern) = At minimum meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective'.
- 1 (Very High Concern) = Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective'
- 0 (Critical) = No management exists when a clear need for management exists (i.e., fishery catches threatened, endangered, or high concern species) OR there is a high level of Illegal, Unregulated, and Unreported Fishing occurring.

3.1.0 - Critical?

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

0.00 **No**

Uku is a managed fishery species. It is managed by the WPFMC as part of "non-Deep 7" bottomfish multi-species complex, which is described elsewhere in this report.

Subfactor 3.1.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place, are there appropriate management goals, and is there evidence that management goals are being met. To achieve a highly effective rating, there must be appropriate management goals and evidence that the measures in place have been successful at maintaining/rebuilding species.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **Moderately Effective**

As of 2011, the Main Hawaiian Islands Non-Deep 7 Bottomfish Multi-species Complex (uku is a member of this complex) is managed under one Annual Catch Limit (ACL), which corresponds to the calendar year (January 1 through December 31). The 2013 ACL is 140,000 lbs. {Federal Register 2013}. The

WPRFMC's SSC recommended an Acceptable Biological Catch (ABC) of 140,000 lbs (a 5000 lb increase over the 2012 ABC)., corresponding to less than 26 percent overfishing. This ABC recommendation was calculated using the mean catch for the complex for the last five years (2008-2012) and the 75th percentile of the entire catch time series {WPRFMC 2012a}. Also, with a quantitative stock assessment lacking (and stock status unknown), it is unclear whether an ABC (and corresponding ACL) based solely on catch data is adequate (though a large percentage of US fisheries ABCs are determined based solely on catch data). In June 2013, due to the high landings of uku relative to the other species managed under the non-deep 7 ACL, the WPRFMC recommended that NMFS manage uku under its own ACL {WPRFMC 2013}.

Subfactor 3.1.2 - Recovery of Species of Concern

Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/ endangered species or to limit fishery's impact on these species and what is their likelihood of success. To achieve a rating of highly effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

-1.00 **N/A**

The fishery is not a substantial contributor to mortality of overfished, depleted, endangered or threatened species.

Subfactor 3.1.3 - Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species. To receive a highly effective score, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **Moderately Effective**

The uku stock has never been assessed independently. The most recent stock assessment that included uku was a 2008 update for the combined bottomfish stock {Brodziak et al. 2009}. In June 20213 the WPRFMC's SSC recommended that NMFS assess uku's stock status independently of other species {WPRFMC 2013}.

Subfactor 3.1.4 - Management Record of Following Scientific Advice

Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels). A highly effective rating is given if managers nearly always follow scientific advice.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

3.00 **Highly Effective**

Given that quotas (ACLs) are a recent management measure for the non-Deep 7 bottomfish multi-species complex fishery, with the first in place for the 2012 fishing year, it is difficult to judge this criterion. For the 2013 fishing year, NMFS chose an ACL equal to the ABC (140,000 lbs.) recommended by the WPRFMC's SSC, corresponding to less than a 26% chance of overfishing {WPRFMC 2012b}{Federal Register 2013}. The SSC recently (June 2013) recommended that NMFS perform a stock assessment for uku independently of other bottomfish species {WPRFMC 2013} but NMFS does not yet have plans to carry out such an assessment. This ranking will be revisited to see if NMFS follows up on the SCC's advice within a reasonable time period.

Subfactor 3.1.5 - Enforcement of Management Regulations

Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations. To achieve a highly effective rating, there must be regular enforcement of regulations and verification of compliance.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **Moderately Effective**

The state of Hawaii Department of Land and Natural Resources, Division of Aquatic Resources requires all commercial fishermen who fish in state waters to submit monthly logbooks. If a fisherman holds a state license and also fishes in federal waters, he/she must include information about those catches in their state logbook data {NMFS 2011a}. Underreporting of commercial catch is likely to occur in these logbooks {Zeller et al. 2007}.

Commercial logbook data on Deep 7 bottomfish catch are monitored throughout the fishing season, ensuring that the Deep 7 fishery will close if the ACL is reached. Non-Deep 7 species' catch is not monitored in season, so there is no way to determine if the ACL is reached until after the fishing season ends and data comes in. In 2012, the first year that there was an ACL for the Non-Deep 7 fishery, the ACL was not exceeded.

Bottomfish Restricted Fishing Areas (BRFAs) are state level protected areas where bottomfishing is prohibited. BRFAs are enforced by the State of Hawaii Division of Conservation and Resources Enforcement (DOCARE). In some cases BRFAs extend into federal waters, but NMFS/the federal government has no authority to enforce them {NMFS 2011a}. State enforcement resources are limited and BRFAs near highly populated areas are challenging to enforce {Moore et al. 2013}. In a survey of 419 commercial bottomfish fisherman, 48% found the BRFAs ineffective, while 27% found them effective (14% were neutral and 11% didn't know) {Hospital and Beavers 2011}. The state has a mandate to monitor the effectiveness of the BRFAs, primarily in respect to Deep 7 bottomfish species (of which uku is not a member). This mandated monitoring is carried out by a research group at the University of Hawaii, primarily by using bottom camera bait stations (referred to as BotCams) to assess relative abundance and size distribution of fish species {Sackett et al. 2012}. Published monitoring results from 6 BRFAs show conflicting outcomes; at the most remote BRFA (in place since 1998) two Deep 7 fish species were larger inside compared to outside, and at a BRFA near a population center, two Deep 7 species were larger outside compared to inside {Moore et al. 2013}.

Subfactor 3.1.6 – Management Track Record

Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels. A highly effective rating will be given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **Moderately Effective**

Measures enacted by management, namely the ACL based management of the non-Deep 7 fishery (begun in 2012), have not been in place long enough to result in the long-term maintenance of stock abundance. Other management measures, such as the BRFAs, are monitored for their effectiveness at protecting-Deep 7 species, not non-Deep 7 species such as uku, so it is not possible to judge their effectiveness for this species.

Subfactor 3.1.7 - Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process. Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g. fishermen, conservation groups, etc.). A highly effective will be given if the management process is transparent and includes stakeholder input.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

3.00 **Highly Effective**

Before Federal management measures are enacted (which also affect fishing in state waters, such as ACLs), they are published in the Federal Register so the general public has time to comment. The public may also comment on any agenda items at a Western Pacific Regional Fisheries Management Council (WPRFMC) Meeting {WPRFMC 2011}. The WPRFMC provides oversight for inshore fisheries in Hawaii as well as across the larger region.

Factor 3.2: Management of fishing impacts on bycatch species				
Region / Method	**Strategy**	**Research**	**Advice**	**Enforce**
Hawaii Central Pacific Handline	No	Highly Effective	Moderately Effective	Highly Effective
Hawaii Central Pacific Troll/Pole	No	Highly Effective	Moderately Effective	Highly Effective

Justification of Ranking

Factor 3.2: Management of Fishing Impacts on Bycatch Species

Four subfactors are evaluated: Management Strategy, Scientific Research/Monitoring, Following of Scientific Advice, and Enforcement of Regulations. Each is rated as 'ineffective',

'moderately effective', or 'highly effective'. Unless reason exists to rank Scientific Research/Monitoring, Following of Scientific Advice, and Enforcement of Regulations differently, these ranks are the same as in 3.1.

- 5 (Very Low Concern) = Rated as 'highly effective' for all four subfactors considered
- 4 (Low Concern) = Management Strategy rated 'highly effective' and all other subfactors rated at least 'moderately effective'.
- 3 (Moderate Concern) = All subfactors rates at least 'moderately effective'.
- 2 (High Concern) = At minimum meets standards for 'moderately effective' for Management Strategy but some other factors rated 'ineffective'.
- 1 (Very High Concern) = Management exists, but Management Strategy rated 'ineffective'
- 0 (Critical) = No bycatch management even when overfished, depleted, endangered or threatened species are known to be regular components of bycatch and are substantially impacted by the fishery.

3.2.0 - All Species Retained?

Central Pacific, Handline

Hawaii Central Pacific, Handline

0.00 **No**

Bycatch levels from offshore and inshore handline bottomfish capture methods are low because these gear types and fishing strategies are highly selective for targeted species and sizes {WPRFMC 2006}. Based on 2004 MHI data, the bycatch rate in the bottomfish fishery (all gear types) was 8.5% {WPRFMC 2006}. Using data from 2003 to 2012 commercial logbook data obtained directly from HDAR, the mean number of discards of any species in deep sea handline fishery (when uku is > or = to 5% of the total catch) was 594 fishes, and in the inshore handline fishery (when uku is > or = to 5% of the catch) it was 127 fishes {HDAR 2013}. Although the number of total fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 136,906 lbs. (62,230 kgs.) for deep sea handline and 34,911 lbs. (15,869 kgs.) for inshore handline {HDAR 2013}.

Hawaii Central Pacific, Troll/Pole

0.00 **No**

Bycatch levels from trolling capture methods for bottomfish are low because this gear types and fishing strategy is highly selective for targeted species and sizes {WPRFMC 2006}. Based on 2004 MHI data, the bycatch rate in the bottomfish fishery (all gear types) was 8.5% {WPRFMC 2006}. Using data from 2003 to 2012 commercial logbook data obtained directly from HDAR, the mean number of discards of any

species by trolling capture when uku is greater than or equal to 5% of the total catch was 94 fishes {HDAR 2013}. Although the corresponding total number of fish landed is not available, the number discarded is small relative to the mean biomass of all fish species landed, which averaged 15,931 lbs. (7,242 kgs.) {HDAR 2013}.

3.2.0 - Critical?

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

0.00 **No**

Subfactor 3.2.1 - Management Strategy and Implementation

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and how successful are these management measures. To achieve a highly effective rating the primary bycatch species must be known and there must be clear goals and measures in place to minimize the impacts on bycatch species (e.g. catch limits, use of proven mitigation measures, etc.).

Hawaii Central Pacific, Handline

3.00 **Highly Effective**

As stated previously, bycatch levels from offshore and inshore handline bottomfish capture methods are low because these gear types and fishing strategies are highly selective for targeted species and sizes {WPRFMC 2006}. As a result the bycatch management strategy criterion is rated as highly effective.

Hawaii Central Pacific, Troll/Pole

3.00 **Highly Effective**

As stated previously, bycatch levels from trolling capture methods for bottomfish are low because this gear types and fishing strategy is highly selective for targeted species and sizes {WPRFMC 2006}. As a result the bycatch management strategy criterion is rated as highly effective.

Subfactor 3.2.2 - Scientific Research and Monitoring

Considerations: Is bycatch in the fishery recorded/documented and is there adequate monitoring of bycatch to measure fishery's impact on bycatch species. To achieve a highly effective rating, assessments must be conducted to determine the impact of the fishery on species of concern, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are being met.

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **Moderately Effective**

Observer programs are not in place for this fishery, but fishermen are required to fill out logbooks which record information on fishing effort, fishing participants, fishing locations, number and species of fish caught, whether fish were kept or released, the condition of any released fish, and interactions with protected species such as sea turtles, Hawaiian monk seals, other marine mammals, and seabirds{NMFS 2011a}. There is some concern that catches may be under-reported {Brodziak et al. 2011}.

Subfactor 3.2.3 - Management Record of Following Scientific Advice

Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels). A highly effective rating is given if managers nearly always follow scientific advice.

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

3.00 **Highly Effective**

See Harvest Strategy section for details.

Subfactor 3.2.4 - Enforcement of Management Regulations

Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's' compliance with regulations. To achieve a highly effective rating, there must be regular enforcement of regulations and verification of compliance.

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

2.00 **Moderately Effective**

See Harvest Strategy section for details.

Criterion 4: Impacts on the habitat and ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of Ecosystem Based Fisheries Management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the EBFM score.

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Overall Recomm.
Hawaii Central Pacific Handline	4.00:Very Low Concern	0.50:Moderate Mitigation	3.00:Moderate Concern	**Green (3.674)**
Hawaii Central Pacific Troll/Pole	5.00:None	0.00:Not Applicable	3.00:Moderate Concern	**Green (3.873)**

Justification of Ranking

Factor 4.1 – Impact of Fishing Gear on the Habitat/Substrate

- 5 (None) = Fishing gear does not contact the bottom
- 4 (Very Low) = Vertical Line Gear
- 3 (Low) = Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom *occasionally* (<25% of the time) or purse seine known to commonly contact bottom
- 2 (Moderate) = Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand;
- 1 (High) = Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g. cobble or boulder).
- 0 (Very High) = Dredge or trawl fished on biogenic habitat, e.g. deep-sea corals, eelgrass and maerl.

Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive plausible habitat type.

Central Pacific, Handline

Hawaii Central Pacific, Handline

4.00	**Very Low Concern**

The vertical handlines used in the Hawaiian bottomfish fishery are weighted and use baited circle hooks. Lines are deployed manually or with power reels to sit just above the benthos. This gear (specifically the terminal weight) does not routinely stay in contact with the substrate, depending on the individual fishing style. In addition to being highly selective for targeted species, this gear type is thought to have minimal impacts on the benthos because circle hooks are flat so are not as prone to snagging on rocky or other hard substrates unlike typical J shaped hooks {WPRFMC 2006}. When targeting Deep 7 bottomfish species (of which uku is not a member but uku are caught when fishing for these species) handlines are deployed over rocky reef areas, which may contain sensitive species such as black coral. It is unknown if bottomfish handlines interfere with such sensitive species.

Hawaii Central Pacific, Troll/Pole

5.00 **None**

This gear does not contact the substrate.

Factor 4.2 - Mitigation of Gear Impacts

- +1 (Strong Mitigation) = Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.
- +0.5 (Moderate Mitigation) = 20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.
- +0.25 (Low Mitigation) = A few measures in place, e.g., vulnerable habitats protected but other habitats not protected; some limits on fishing effort/intensity, but not actively being reduced.
- 0 (No Mitigation) = No effective measures are in place to limit gear impacts on habitats.

Central Pacific, Handline

Hawaii Central Pacific, Handline

0.50 **Moderate Mitigation**

The vertical handlines used in the bottomfish fishery are thought to have minimal impacts on the benthos {WPRFMC 2006}. Bottomfishing in the NWHI ended with the establishment of the Papahanaumokuakea Marine National Monument, with phase out beginning in 2009 and all fishing ending in 2011. In the Main Hawaiian Islands, there are 12 Bottomfish Restricted Fishing Areas (BRFAs)

in state waters {NOAA 2011} which protect less than 20% of suitable bottomfish habitat {Parke 2007}. These areas were set up to protect Deep-7 bottomfish species, whose habitat does not always overlap with uku's habitat (see detailed discussion in Criteria 4.3). Fishing intensity is also actively being controlled through annual catch limits. We consider this a moderate amount of mitigation because ongoing, effective measures are reducing fishing intensity, fishing effort, and the spatial footprint.

Hawaii Central Pacific, Troll/Pole

0.00 **Not Applicable**

Not applicable because this gear does not make contact with the substrate.

Hawaii Central Pacific, Troll/Pole

0.50 **Moderate Mitigation**

The vertical handlines used in the bottomfish fishery are thought to have minimal impacts on the benthos {WPRFMC 2006}. Bottomfishing in the NWHI ended with the establishment of the Papahanaumokuakea Marine National Monument, with phase out beginning in 2009 and all fishing ending in 2011. In the Main Hawaiian Islands, there are 12 Bottomfish Restricted Fishing Areas (BRFAs) in state waters {NOAA 2011} which protect less than 20% of suitable bottomfish habitat {Parke 2007}. These areas were set up to protect Deep-7 bottomfish species, whose habitat does not always overlap with uku's habitat (see detailed discussion in Criteria 4.3). Fishing intensity is also actively being controlled through annual catch limits. We consider this a moderate amount of mitigation because ongoing, effective measures are reducing fishing intensity, fishing effort, and the spatial footprint.

Factor 4.3 – Ecosystem-Based Fisheries Management

- 5 (Very Low Concern) = Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g. large proportion of fishery area protected with marine reserves, abundance is maintained at sufficient levels to provide food to predators).
- 4 (Low Concern) = Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. If hatchery supplementation or fish aggregating devices (FADs) are used, measures are in place to minimize potential negative ecological effects.

- 3 (Moderate Concern) = Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species. OR negative ecological effects from hatchery supplementation or FADs are possible and management is not place to mitigate these impacts.
- 2 (High Concern) = The fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.
- 1 (Very High Concern) = The use of hatchery supplementation or Fish Aggregating Devices (FADs) in the fishery is having serious negative ecological or genetic consequences. OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.

Central Pacific, Handline

Hawaii Central Pacific, Handline

Hawaii Central Pacific, Troll/Pole

3.00 **Moderate Concern**

Uku is a piscivore/top predator {Sandin and Williams 2010}, so is considered "an exceptional species" under this criterion. As stated previously, a species specific stock assessment is not available, and it is "undefined" whether the non-Deep 7 bottomfish fishery (of which uku is a one of 7 species) is currently overfished or undergoing overfishing and it is "unknown" if the overfishing condition is being approached {NMFS 2012}.

The Hawaiian bottomfish fishery, along with other fisheries managed by the Western Pacific Regional Fishery Management Council, have been managed under a Fishery Ecosystem Plan that aims to address fishery effects on other species, habitats and the ecosystem as a whole since 2010 {WPRFMC 2009}.

Bottomfishing in the NWHI ended with the establishment of the Papahanaumokuakea Marine National Monument, with phase out beginning in 2009 and all fishing ending in 2011. While the monument protects uku from exploitation in the NWHI, it is unlikely that this protection enhances uku stocks in the MHI, as evidence suggests that recruitment occurs in an east to west direction with prevailing currents {Toonen et al. 2011}. In addition to the NWHI closure to fishing, there are 12 bottomfish restricted fishing areas (BRFAs) in the MHI, which protect less than 20% of bottomfish habitat {Parke 2007}. It should be noted that the bottomfish EFH protected BRFAs corresponds to habitat required by adult Deep 7 bottomfish species (namely deep hard bottom areas), species which have different habitat requirements than uku {Parke 2007}.

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Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch and Seafood Reports, please contact the Seafood Watch program at Monterey Bay Aquarium by calling 1-877-229-9990.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that capture fisheries must possess to be considered sustainable by the Seafood Watch program:

- *Stocks are healthy and abundant.*
- *Fishing mortality does not threaten populations or impede the ecological role of any marine life.*
- *The fishery minimizes bycatch.*
- *The fishery is managed to sustain long-term productivity of all impacted species.*
- *The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.*
- *Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts, or reduction of genetic diversity.*

Based on these guiding principles, Seafood Watch has developed a set of four sustainability **criteria** to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Impacts on the species/stock for which you want a recommendation
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:

- Factors to evaluate and rank
- Evaluation guidelines to synthesize these factors and to produce a numerical score
- A resulting numerical score and **rank** for that criterion

Once a score and rank has been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

Best Choices/Green: Are well managed and caught or farmed in environmentally friendly ways.

Good Alternatives/Yellow: Buy, but be aware there are concerns with how they're caught or farmed.

Avoid/Red: Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment

1 "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.