

and



Monterey Bay Aquarium
Seafood Watch

Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex:
Hawaiian Grouper, Hawaiian pink snapper (opakapaka), Hawaiian red snapper (ehu), Hawaiian ruby snapper (onaga), Kalekale snapper, Oblique-banded snapper (gindai), and Rusty Jobfish (Iehi)

Epinephelus quernus, Pristipomoides filamentosus, Etelis carbunculus, Etelis coruscans, Pristipomoides sieboldii, Pristipomoides zonatus, Aphareus rustilans



Image ©HDAR/Les Hata

Hawaii
Handline

April 4, 2014
Blue Ocean Institute Seafood Analysts

About Blue Ocean Institute

Blue Ocean Institute creates an original blend of science, art and literature that inspires a deeper connection with nature, especially the sea. Our books, films and educational programs instill hope, enlighten personal choices and build a larger constituency for conservation. From Alaskan fishing villages to Zanzibar's shores, we witness firsthand how nature is changing, then explain what these changes mean for wildlife and for people. Blue Ocean translates science into language people can understand. Our goal is to be a unique voice of hope, guidance and inspired change. Our work is disseminated through major, mainstream outlets such as the PBS television network, *The New York Times*, Huffington Post, NationalGeographic.com and CNN.com plus other established print, television and online media.

Founded in 2003 by conservation pioneer and MacArthur "genius" award winner Dr. Carl Safina, Blue Ocean Institute builds on three decades of his field research, policy work, acclaimed books and other writing.

Blue Ocean's *From Sea to Table* Program

Blue Ocean's founders created the first seafood guide in 1998. Blue Ocean's online seafood guide now encompasses over 160-wild-caught species. Our peer-reviewed seafood reports are transparent, authoritative, easy to understand and use. All rankings and full reports are available on our website in the *Seafood Choices* section. *From Sea to Table* helps consumers, retailers, chefs and health professionals discover the connection between human health, a healthy ocean, fishing and sustainable seafood.

- Our online guide to sustainable seafood is based on our scientific rankings for more than 160 wild-caught seafood species and provides simple guidelines.
- We partner with Whole Foods Market (WFM) to help educate their seafood suppliers and staff, and provide our scientific seafood rankings for WFM stores in the US and UK.
- Through our partnership with Chefs Collaborative, we created *Green Chefs/Blue Ocean*, a free, interactive, online sustainable seafood course for chefs and culinary professionals.
- Our website features tutorials, videos, blogs, links and discussions of the key issues such as mercury in seafood, bycatch, overfishing, etc.

Check out our Fellows Program, Scientific Collaborations and Carl Safina's current work at www.blueocean.org.

Blue Ocean Institute is a 501 (c) (3) nonprofit organization based in the School of Marine & Atmospheric Sciences at Stony Brook University, Long Island, NY. www.blueocean.org admin@blueocean.org | 631.632.3763

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.

Disclaimer

Seafood Watch and Blue Ocean Institute strive to ensure that all our Seafood Reports and recommendations contained therein are accurate and reflect the most up-to-date evidence available at the time of publication. All our reports are peer-reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science or aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or of Blue Ocean Institute or their recommendations on the part of the reviewing scientists. Seafood Watch and Blue Ocean Institute are solely responsible for the conclusions reached in this report. We always welcome additional or updated data that can be used for the next revision. Seafood Watch and Seafood Reports are made possible through a grant from the David and Lucile Packard Foundation and other funders.

Guiding Principles

Blue Ocean Institute and Seafood Watch define sustainable seafood as originating from sources, whether fished¹ or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch and Blue Ocean Institute have developed four sustainability **criteria** for evaluating wild-catch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and **rating**

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide and Blue Ocean Institute's online guide:

Best Choice/Green: Are well managed and caught in ways that cause little harm to habitats or other wildlife.

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

Avoid/Red: Take a pass on these for now. These items are overfished or caught 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.

Summary

This report provides analysis and recommendations for the Hawaiian "Deep 7" bottomfish complex, which is made up six deep water snapper species and one deep water grouper species. These species are pink snapper (opakapaka) (*Pristipomoides filamentosus*), ruby snapper (onaga) (*Etelis coruscans*), red snapper (ehu) (*Etelis carbunculus*), rusty jobfish (lehi) (*Aphareus rustilans*), kalekale snapper (*Pristipomoides sieboldii*), oblique-banded snapper (gindai) (*Pristipomoides zonatus*), and Hawaiian grouper (Hapu'u) (*Epinephelus quernus*). These species are caught with handline gear around the Main Hawaiian Islands.

The Deep 7 bottomfish complex is assessed and managed as a singular unit. As a whole, the Deep 7 bottomfish complex is considered to be at a healthy abundance and fishing levels are sustainable. However, abundances and fishing mortality levels for individual species are not known. The abundance of Hawaiian grouper is a high concern because it has a high vulnerability to fishing and has been designated as near threatened. As with other handline fisheries, there is only a low amount of bycatch. Besides the Deep 7 species, the fishery may catch gray snapper and greater amberjack, but the fishery has only a moderate impact on these species.

The Deep 7 species are managed through annual catch limits and closed fishing areas by the Western Pacific Regional Fishery Management Council in federal waters and by the Department of Land and Natural Resources in Hawaii State waters. The handline gear used in the fishery has minimal impacts to bottom habitats, and there are some management efforts to protect the ecosystem as a whole.

All of the Deep 7 bottomfish species are rated "yellow" or a "good alternative".

Table of Conservation Concerns and Overall Recommendations

Species / Fishery	Impacts on the Species Under Assessment	Impacts on other Species	Management Effectiveness	Impacts on Habitat and Ecosystem	Overall Recommendation
Kalekale snapper: Hawaii Western Central Pacific - Handline	Yellow (2.64)	Red (2.16)	Green (3.46)	Green (3.67)	Yellow/Good Alternative (2.919)
Hawaiian grouper (hapu'u): Hawaii Western Central Pacific - Handline	Red (2.16)	Yellow (2.64)	Green (3.46)	Green (3.67)	Yellow/Good Alternative (2.919)
Hawaiian pink snapper (opakapaka): Hawaii Western Central Pacific - Handline	Yellow (2.64)	Red (2.16)	Green (3.46)	Green (3.67)	Yellow/Good Alternative (2.919)
Hawaiian ruby snapper (onaga): Hawaii Western Central Pacific - Handline	Yellow (2.64)	Red (2.16)	Green (3.46)	Green (3.67)	Yellow/Good Alternative (2.919)
Hawaiian red snapper (ehu): Hawaii Western Central Pacific - Handline	Yellow (2.64)	Red (2.16)	Green (3.46)	Green (3.67)	Yellow/Good Alternative (2.919)
Oblique-banded snapper (gindai): Hawaii Western Central Pacific - Handline	Yellow (2.64)	Red (2.16)	Green (3.46)	Green (3.67)	Yellow/Good Alternative (2.919)
Rusty Jobfish (lehi): Hawaii Western Central Pacific - Handline	Yellow (2.64)	Red (2.16)	Green (3.46)	Green (3.67)	Yellow/Good Alternative (2.919)

Scoring Guide

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/Green** = Final Score >3.2, **and** no Red Criteria, **and** no Critical scores
- **Good Alternative/Yellow** = Final score >2.2-3.2, **and** neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern², **and** no more than one Red Criterion, **and** no Critical scores
- **Avoid/Red** = Final Score ≤2.2, **or** either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern **Error! Bookmark not defined.**, **or** two or more Red Criteria, **or** one or more Critical scores.

² Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

Table of Contents

About Blue Ocean Institute.....	2
About Seafood Watch®	3
Guiding Principles	4
Summary	5
Introduction	8
Assessment	10
<i>Criterion 1: Impacts on the species under assessment</i>	10
<i>Criterion 2: Impacts on other species</i>	18
<i>Criterion 3: Management effectiveness</i>	24
<i>Criterion 4: Impacts on the habitat and ecosystem</i>	32
References	37
Appendix A: Review Schedule.....	41
Appendix B: List of All Species Assessed in the Fishery	42

Introduction

Scope of the analysis and ensuing recommendation

This report is for the Main Hawaiian Islands deepwater handline fishery that targets six deep water snappers and one deep water grouper, which together make up the "Deep 7" bottomfish complex. The Deep 7 complex includes: pink snapper (opakapaka) (*Pristipomoides filamentosus*), ruby snapper (onaga) (*Etelis coruscans*), red snapper (ehu) (*Etelis carbunculus*), rusty jobfish (lehi) (*Aphareus rustilans*), kalekale snapper (*Pristipomoides sieboldii*), oblique-banded snapper (gindai) (*Pristipomoides zonatus*), and Hawaiian grouper (Hapu'u) (*Epinephelus quernus*).

Overview of the species and management bodies

The six deep water snappers are found throughout the Indo-Pacific region, while the deep water Hawaiian grouper is endemic to the Hawaiian Islands and Johnston Atoll (Froese and Pauly 2013). These species typically occupy waters from 100-400 m in depth (Brodziak et al. 2011). These species are targeted in the Hawaiian deep water handline fishery. Historically the fishery occurred in waters surrounding both the Northwestern and Main Hawaiian Islands (MHI). However, the Northwestern Hawaiian Islands are now a protected Marine National Monument, so the current fishery is limited to the Main Hawaiian Islands. Within federal waters, the Western Pacific Regional Fishery Management Council manages the Deep 7 bottomfish species under the Hawaii Fishery Ecosystem Plan (WPRFMC 2006)(WPRFMC 2010). In Hawaii state waters, the Hawaii Department of Land and Natural Resources manages these species.

Production Statistics

Catches of the Deep 7 bottomfish species have varied over time. Peak catches occurred during the 1980's, with average annual catches of 439,000 lbs. Since then catches have decreased, averaging only 234,000 lbs since 2000. Pink snapper (opakapaka) makes up the majority of these catches, with average catches of 112,000 lbs during the 2000's, followed by Hawaiian ruby snapper (onaga), 57,500 lbs, and Hawaiian red snapper (ehu), 22,300 lbs (Brodziak et al. 2011)(PIFSC 2013). The remaining four species make up a much smaller percentage of the total catch.

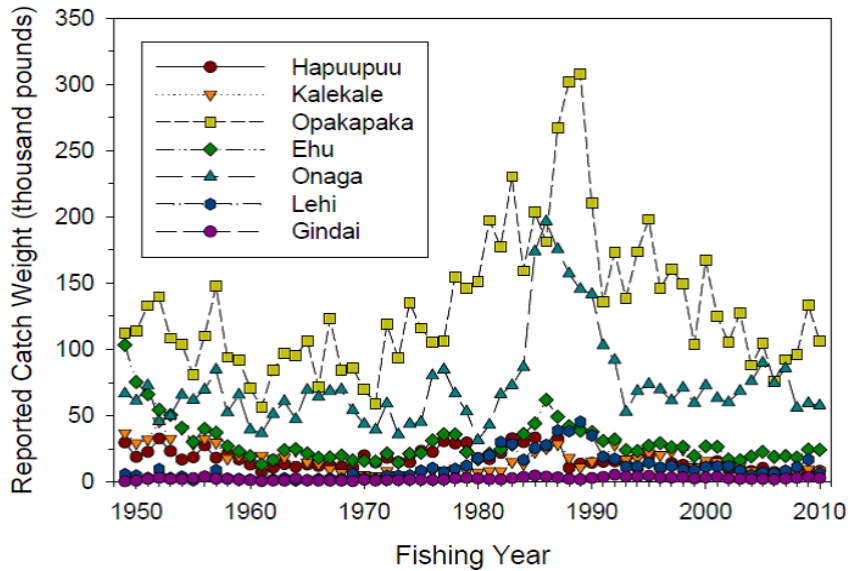


Figure 1: Hawaii Deep 7 catches by species (Brodziak et al. 2011)

Importance to the US/North American market

The majority of the Hawaii Deep 7 bottomfish species are consumed within the Hawaiian Islands. To meet market demand, snapper species are also imported into Hawaii from Indonesia (196,028 lbs), Tonga (134,078 lbs), New Zealand (22,467 lbs), and various other islands across the Pacific (NMFS 2013a). The origin of Deep 7 bottomfish are not always labeled at the point of sale.

Common and market names

Pink snapper (opakapaka) is also known as 'opaka', crimson jobfish or snapper. The Hawaiian ruby snapper (onaga) is also known as yellowstripe snapper, flame snapper or longtail snapper. The Hawaiian red snapper (ehu) is also known as squirrelfish snapper, deep water red snapper, ruby snapper, and ula'ula. Kalekale snapper is also known as 'kale', lavender jobfish or snapper, and Von Siebold's snapper. The oblique-banded snapper (gindai) is also known as ukikiki or snapper. Rusty jobfish (lehi) is also known as silver jaw jobfish. Hawaiian grouper (Hapu'u) is also known as Hawaiian sea bass.

Primary product forms

The Deep 7 species are primarily sold fresh and frozen, generally whole or as fillets.

Assessment

This section presents relevant information on the fishery and details how the fishery is scored relative to the Seafood Watch Fisheries Criteria, available at <http://www.seafoodwatch.org>. 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.

Criterion 1: Impacts on the species under assessment

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. Rating is based on the score as follows: >3.2=Green or Low Concern, >2.2 and <=3.2=Yellow or Moderate Concern, <=2.2=Red or High Concern. Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Criterion 1 Summary

Hawaiian grouper (hapu'u): Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex				
Region / Method	Inherent Vulnerability	Abundance	Fishing Mortality	Criterion 1 Score
Hawaii Western Central Pacific Handline	High Vulnerability	2.00:High Concern	2.33:Moderate Concern	Red (2.159)

Hawaiian pink snapper (opakapaka), Hawaiian red snapper (ehu), Hawaiian ruby snapper (onaga), Kalekale snapper, Oblique-banded snapper (gindai), and Rusty Jobfish (Iehi): Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex				
Region / Method	Inherent Vulnerability	Abundance	Fishing Mortality	Criterion 1 Score
Hawaii Western Central Pacific Handline	Medium Vulnerability	3.00:Moderate Concern	2.33:Moderate Concern	Yellow (2.644)

Criterion 1 Assessment

HAWAIIAN GROUPE (HAPU'U): MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX

Factor 1.1 - Inherent Vulnerability to Fishing

Scoring guidelines

- *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.

Hawaii Western Central Pacific, Handline

High

Fishbase has assigned a 'high' inherent vulnerability to fishing score of 70 out of 100 to Hawaiian grouper (Froese and Pauly 2013). The life history characteristics of Hawaiian grouper also suggest a high inherent vulnerability. They are born as females and then change sex to males later in life. They sexually mature as females around 58 cm (23 in) in length and 6-7 years of age (Nicholas and DeMartini 2008), but do not change sex from female to male until around 89.5 cm (35 in) in length and 20 years of age (DeMartini et al. 2011). Hawaiian grouper can grow to 1.2 m (3.9 ft.) in length (DLNR 2001) and have a maximum observed age of 34 years (Nicholas and DeMartini 2008). They are broadcast spawners and females are capable of producing a high number of eggs (Brodziak et al. 2011). Within the food chain, Hawaiian grouper are high level predators (Froese and Pauly 2013).

Factor 1.2 – Abundance

Scoring guidelines

- *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/depleted.*
- *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.*

Hawaii Western Central Pacific, Handline

2.00

High Concern

The six snappers and one grouper that make up the "Deep 7" bottomfish complex are all assessed together as a unit. The most recent population assessment for the Deep 7 species was conducted in 2011. According to this assessment, the abundance of the Deep 7 bottomfish was high during the 1960's and 1970's but declined to values lower than the abundance needed to produce the maximum sustainable catch or yield by the mid-1990's and has remained stable at this lower abundance level since. Currently, the abundance is estimated to be between 60-97% of the abundance/biomass needed to produce the maximum sustainable yield (BMSY). However, scenarios in which abundance was estimated to be low were considered unlikely, and it was determined that the abundance of the Deep 7 bottomfish was most likely more than 70% of BMSY, the overfished threshold level. It was therefore concluded that the Deep 7 bottomfish complex is not overfished/depleted (Brodziak et al. 2011). However, the Hawaiian grouper, which is endemic to the Hawaiian Islands, is listed as 'Near Threatened' by the International Union for Conservation of Nature (IUCN) (Cornish 2004). Because the individual abundance of Hawaiian grouper relative to abundance targets is not known, we have awarded a 'high concern' score based on the IUCN listing and the species' high vulnerability to fishing.

Factor 1.3 - Fishing Mortality

Scoring guidelines

- *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 ($\leq 5\%$ 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.*

Hawaii Western Central Pacific, Handline

2.33 Moderate Concern

According to the latest assessment, the majority of fishing mortality estimates for the Hawaiian "Deep 7" bottomfish complex were below sustainable levels or the fishing mortality rate resulting in maximum sustainable yield {Brodziak et al. 2011}. This suggests that it is highly likely overfishing is not occurring. In addition, since the last assessment was conducted, commercial catches have generally been below the set annual catch target (346,000 lbs.) {PIFSC 2013}.

While the Deep 7 species are assessed together, they do not make up equal proportions of the catch and catches have varied over the years. The average catches Hawaiian grouper between 2008 and 2010 were 7,500 lbs., which accounted for about 3.5% of the total Deep 7 bottomfish catch {Brodziak et al. 2011}. Recreational catches of the Hawaii Deep 7 species have generally not been reported, and were not available for this species. The recent Deep 7 bottomfish assessment included estimates of all unreported catches, which includes recreational catch. In this assessment they estimated that unreported/recreational catch of all Deep 7 species is mostly likely equal to the reported commercial catch {Brodziak et al. 2011}.

Although the most recent assessment indicated that fishing mortality on the Deep 7 species is below sustainable levels, fishing impacts on individual species are not known. Also, it should be noted that in previous assessments they found that overfishing was occurring on the Deep 7 species. Because current fishing impacts on the Hawaiian grouper are uncertain, we have awarded a 'moderate concern' score.

Rationale:

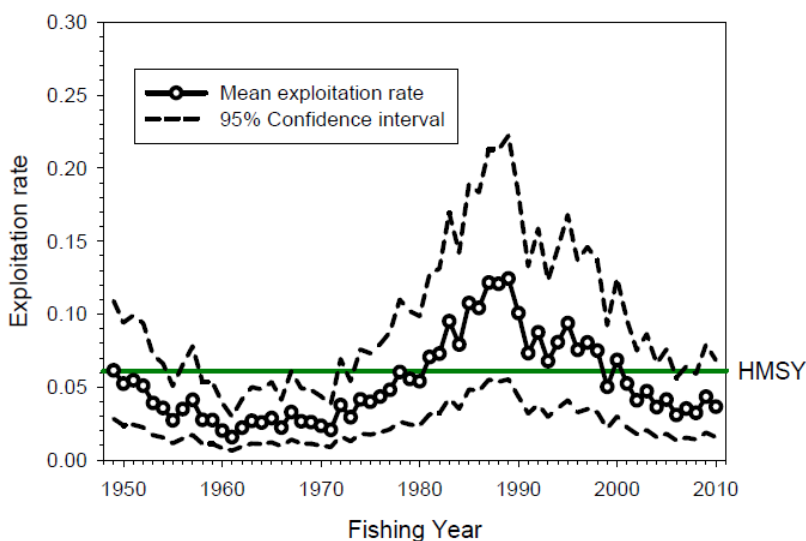


Figure 2: Fishing mortality rates on the Hawaii Deep 7 species from 1950-2010 in relation to the target fishing level/exploitation rate at maximum sustainable yield (HMSY)

HAWAIIAN PINK SNAPPER (OPAKAPAKA), HAWAIIAN RED SNAPPER (EHU), HAWAIIAN RUBY SNAPPER (ONAGA), KALEKALE SNAPPER, RUSTY JOBFISH, OBLIQUE-BANDED SNAPPER (GINDAI): MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX

Factor 1.1 - Inherent Vulnerability

Scoring guidelines

- *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 it 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.

Hawaii Western Central Pacific, Handline

Medium

Fishbase assigned medium vulnerability to fishing scores (36-45 out of 100) to all deep water snappers that are part of the "Deep 7" bottomfish complex, except for the rusty jobfish. Fishbase assigned a high vulnerability score (58) to rusty jobfish (Froese and Pauly 2013). Life history information for several species is incomplete but also indicates that these species have medium inherent vulnerabilities to fishing. Most species are moderately long lived (7-13 years), however, the pink snapper (Opakapaka) has been reported to live for over 40 years (Brodziak et al. 2011)(Andrews et al. 2012). Most species reach sexual maturity around 30-60 cm in length and reach a maximum size of 80-130 cm (DeMartini and Lau 1999)(Randall 2007)(Froese and Pauly 2013). Age at maturity is only known for pink snapper, which are reported to mature around 3 years of age (Everson 1984). These species are broadcast spawners and females are capable of producing a high number of eggs (Brodziak et al. 2011). Within the food chain, they are high level predators (Froese and Pauly 2013). Although rusty jobfish was given a high Fishbase vulnerability score, the life history attributes of rusty jobfish suggest it has biological traits that are similar to the other deep water snapper species and only has a medium vulnerability to fishing. We therefore rate the vulnerability for all these deep water snappers as 'medium'.

Rationale:

Table 1: Results from Seafood Watch fish vulnerability rubric (SFW criteria document, pg. 4). Attribute scores can range from 1-3 with higher scores signifying more resilient life history attributes.

Vulnerability attribute	Category	Score
Average age at maturity	Pink snapper: < 5 years; Other snappers: unknown	Pink snapper: 3; Other snappers: N/A
Average maximum age	Pink snapper: > 25 years; Other snappers: 10-25 years	Pink snapper: 1; Other snappers: 2
Fecundity	> 100 eggs	N/A
Average max size	100-300 cm	2
Average size at maturity	40-200 cm	2
Reproductive strategy	Broadcast spawner	3
Trophic level	> 3.25	1
Average Score	Medium Vulnerability	2.00

Species with average attribute scores between 1.80 and 2.43 are deemed to have a 'medium vulnerability'.

Factor 1.2 – Abundance

Scoring guidelines

- *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/depleted.*
- *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.*

Hawaii Western Central Pacific, Handline

3.00

Moderate Concern

The six snappers and one grouper that make up the "Deep 7" bottomfish complex are all assessed together as a unit. The most recent population assessment for the Deep 7 species was conducted in 2011. According to this assessment, the abundance of the Deep 7 bottomfish was high during the 1960's and 1970's but declined to values lower than the abundance needed to produce the maximum sustainable catch or yield by the mid-1990's and has remained stable at this lower abundance level since. Currently, the abundance is estimated to be between 60-97% of the abundance/biomass needed to produce the maximum sustainable yield (BMSY). However, scenarios in which abundance was estimated to be low were considered unlikely, and it was determined that the abundance of the Deep 7 bottomfish was most likely more than 70% of BMSY, the overfished threshold level. It was therefore concluded that the Deep 7 bottomfish complex is not overfished/depleted (Brodziak et al. 2011).

Normally, this would result in a score of 'low concern'. However, because these species are assessed as a unit and individual species' abundances are not known, we have rated this factor 'moderate concern' for all six deep water snapper species.

Factor 1.3 - Fishing Mortality

Scoring guidelines

- *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 ($\leq 5\%$ 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.*

Hawaii Western Central Pacific, Handline

2.33 Moderate Concern

According to the latest assessment, the majority of fishing mortality estimates for the Hawaiian "Deep 7" bottomfish complex were below sustainable levels or the fishing mortality rate resulting in maximum sustainable yield (Brodziak et al. 2011). This suggests that it is highly likely overfishing is not occurring. In addition, since the last assessment was conducted, commercial catches have generally been below the set annual catch target (346,000 lbs) (PIFSC 2013).

While the Deep 7 species are assessed together, they do not make up equal proportions of the catch and catches have varied over the years. Hawaiian pink snapper (opakapaka) has historically been the predominant species in this fishery, with total reported commercial catches ranging from a low of 76,000 lbs in 2006 to a high of 308,200 lbs in 1989. The average catches between 2008 and 2010 were 112,000 lbs. The second most commonly captured species has been Hawaiian ruby snapper (onaga), although catches are around half of those reported for pink snapper. The average catches for this

species between 2008 and 2010 were 57,500 lbs. The average catches of Hawaiian red snapper (ehu), the third most common captured species, were 22,300 lbs between 2008 and 2010. The average catches for rusty jobfish (lehi) (11,300 lbs, 2008-2010), kalekale snapper (7,800 lbs 2008-2010), and oblique-banded snapper (gindai) (3,100 lbs, 2008-2010) are much less than those reported for the top three species (Brodziak et al. 2011).

Recreational catches of the Hawaii Deep 7 species have generally not been reported. Estimates of recreational catches for Hawaiian pink snapper were 277,166 lbs in 2012 and 157,969 lbs (preliminary estimate) in 2013. Recreational catches for kalekale snapper were 11,452 lbs. and 10,753 lbs. in 2012 and 2013, respectively (NOAA 2014). Recreational catch estimates were not available for the other Deep 7 species. The recent Deep 7 bottomfish assessment included estimates of all unreported catches, which includes recreational catch. In this assessment they estimated that unreported/recreational catch of all Deep 7 species is mostly likely equal to the reported commercial catch.

Although the most recent assessment indicated that fishing mortality on the Deep 7 species is below sustainable levels, fishing impacts on individual species are not known. Also, it should be noted that in previous assessments they found that overfishing was occurring on the Deep 7 species. The 2004 assessment indicated that the two species of greatest concern were Hawaiian red snapper and Hawaiian ruby snapper (Moffit et al. 2006). Because current fishing mortality rates for individual species are not known we have awarded a 'moderate concern' score for all six deep water snapper species.

Rationale:

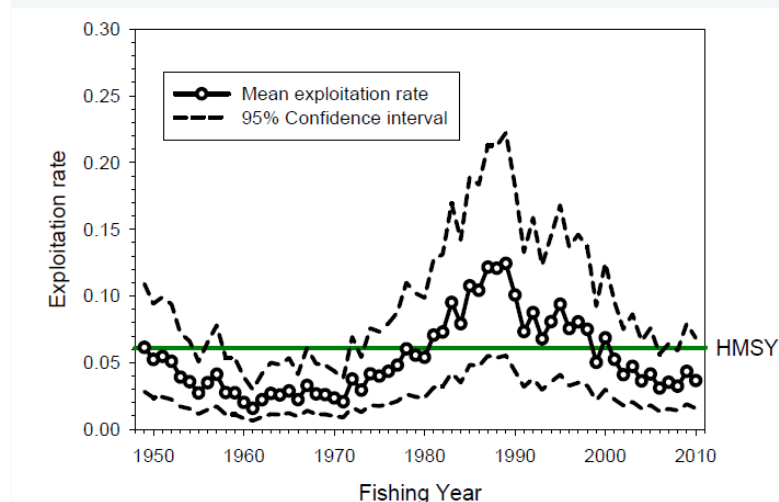


Figure 2: Fishing mortality rates on the Hawaii Deep 7 species from 1950-2010 in relation to the target fishing level/exploitation rate at maximum sustainable yield (HMSY)

Criterion 2: Impacts on other species

All main retained and 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. Rating is based on the score as follows: >3.2=Green or Low Concern, >2.2 and <=3.2=Yellow or Moderate Concern, <=2.2=Red or High Concern. Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical.

Criterion 2 Summary

Hawaiian grouper (hapu'u): Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex				
Region / Method	Lowest Scoring of Other Species	Lowest Species Subscore	Discard Rate Modifying Score ((Discards+Bait)/Retained Catch)	Criterion 2 Score
Hawaii Western Central Pacific, Handline	Greater amberjack, Hawaiian pink snapper, Hawaiian ruby snapper, Hawaiian red snapper, kalekale snapper, oblique-banded snapper, and rusty jobfish	2.644	1.00 (<20%)	Yellow (2.644)

Hawaiian pink snapper (opakapaka), Hawaiian red snapper (ehu), Hawaiian ruby snapper (onaga), Kalekale snapper, Oblique-banded snapper (gindai), and Rusty Jobfish (Iehi): Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex				
Region / Method	Lowest Scoring of Other Species	Lowest Species Subscore	Discard Rate Modifying Score ((Discards+Bait)/Retained Catch)	Criterion 2 Score
Hawaii Western Central Pacific, Handline	Hawaiian Grouper	2.159	1.00 (<20%)	Red (2.159)

Fishermen catch the Deep 7 bottomfish species with handline gear and can individually target these species. As a result, there is typically a low amount of bycatch and discards (fish thrown back to sea) in this fishery. However, some greater amberjack and Hawaiian gray snapper are caught as bycatch in this fishery and were assessed under this criterion {DLNR 2013b}{PIFSC 2013}. The impacts of the fishery on

these two species are of moderate concern. Other species reported to be caught incidentally in this fishery, but not assessed in this report because they are only caught in very low amounts, include giant trevally, blue striped snapper (taape), mackerel scad (opelu), butaguchi or thick-lipped ulua, large-headed scorpionfish, and squirrelfish {DLNR 2013b}. As well, it should be noted that the fishery could potentially catch endangered Hawaiian monk seals, but this is considered rare and no serious harm or injury to the monk seals is known to occur as a result of catches by this fishery {WPRFMC 2009}.

For the six deep snapper species, the Hawaiian grouper is the limiting species, due to high concern about the status of this species. For the Hawaiian grouper, the lowest scoring species are the six deep water snapper species and greater amberjack, all of which have unknown abundances and unknown fishing levels.

Criterion 2 Assessment

A full list of the main species assessed in this report can be found in Appendix B. See criterion 1 for assessments of Hawaiian grouper and the six deep snapper species.

GREATER AMBERJACK

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Hawaii Western Central Pacific, Handline

Medium

FishBase assigned a 'medium' inherent vulnerability to fishing score of 54 out of 100 to greater amberjack (kahala) (*Seriola dumerili*) (Froese and Pauly 2013). Greater amberjack reach sexual maturity between 80-127 cm in length and 3-5 years of age. They can grow up to 144 cm in length and live for a maximum reported age of 15 years. Greater amberjack are broadcast spawners. Within the food chain, they are a high level predator (Froese and Pauly 2013).

Factor 2.2 – Abundance

Scoring Guidelines (same as Factor 1.2 above)

Hawaii Western Central Pacific, Handline

3.00

Moderate Concern

Greater amberjack are part of the Hawaii Bottomfish Management Unit, which includes the Deep 7 species, as well as other shallow water species of groupers, snappers, and jacks. The entire Hawaii bottomfish complex was assessed as a unit in 2007, although the greater amberjack was not actually

included in the assessment. At that time, abundance of the bottomfish complex in the Main Hawaiian Islands was estimated to be at 62% of the target abundance level, the abundance/biomass needed to produce the maximum sustainable catch/yield (BMSY). Abundance was below the limit abundance reference point (70% of BMSY), so the bottomfish complex was considered overfished (Brodziak et al. 2009). However, an updated assessment of the Deep 7 bottomfish in 2011 indicated that the Deep 7 species were not overfished (Brodziak et al. 2011). The current status of the non-Deep 7 bottomfish species, including greater amberjack, remains unclear as no additional assessments have been conducted for the non-Deep 7 species (NMFS 2013b). Because the abundance of this species is unknown and they have a medium inherent vulnerability to fishing, we have awarded a 'moderate concern' score.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Hawaii Western Central Pacific, Handline

2.33

Moderate Concern

Fishing mortality rates for greater amberjack in Hawaiian waters are not known (NMFS 2013b). An assessment of the Hawaiian bottomfish unit in 2007 (although greater amberjack was not actually included) indicated that fishing mortality levels in the Main Hawaiian Islands were higher than the fishing mortality level at maximum sustainable yield (FMSY), indicating overfishing was occurring at the time (Brodziak et al. 2009). However, a more recent assessment of only the Deep 7 species in 2011 indicated that fishing levels were below sustainable levels (Brodziak et al. 2011). Current fishing levels on non-Deep 7 species are uncertain, because no additional assessments of the non-Deep 7 species have been conducted. Reported catches for the Main Hawaiian Islands Deep 7 Bottom Fishery from 2008-2012 indicate that amberjack make up about 3-4% of the retained catch in weight and about 2-4% of the total catch (retained and discarded) in numbers of fish (DLNR 2013b). Around 30-50% of the greater amberjack caught in the fishery are reported to be discarded back to sea. They are often discarded because of concerns of ciguatera poisoning. There is some concern that fishermen underreport catches and discards, so greater amberjack may make up a larger proportion of the catch than indicated by the catch data (WPRFMC 2009)(Brodziak et al. 2011)(WPRFMC 2009). In 2011, 15,800 lbs of greater amberjack were reported caught across all fisheries in Hawaii (PIFSC 2013) and 7,600 lbs were reported caught in the Deep 7 bottomfish fishery (DLNR 2013b). Therefore, the Deep 7 bottomfish fishery is a substantial contributor to fishing mortality on this species. Due to the limited information, fishing mortality is rated 'moderate concern'.

HAWAIIAN GRAY SNAPPER (UKU)

Factor 2.1 - Inherent Vulnerability

Hawaii Western Central Pacific, Handline

High

Fishbase has assigned a high vulnerability to fishing score of 61 out of 100 for Hawaiian gray snapper (Froese and Pauly 2013). Hawaiian gray snapper (*Aprion virescens*) reach sexual maturity between 42 and 50 cm in length and 4-5 years in age. They reach a maximum size of just over 100 cm. The maximum age of gray snapper in the Central Pacific is unknown, but individuals up to 16 years old have been observed in Australia (Heupel et al. 2009). They are broadcast spawners. Within the food chain, they are an important top-level predator species (Froese and Pauly 2013). Although these life history characteristics suggest Hawaiian gray snapper may only have a medium vulnerability to fishing, there are other indications that they may indeed be highly vulnerable to fishing, e.g., they form spawning aggregations and show site fidelity (Meyer et al. 2007). We have thus rated their vulnerability as 'high' based on the Fishbase score.

Factor 2.2 – Abundance

Hawaii Western Central Pacific, Handline

2.00

High Concern

Hawaiian gray snapper (uku) are part of the Hawaii Bottomfish Management Unit, which includes the Deep 7 species, as well as other shallow water species of groupers, snappers, and jacks. The entire Hawaii bottomfish complex was assessed as a unit in 2007. At that time abundance of the bottomfish complex in the Main Hawaiian Islands was estimated to be at 62% of the target abundance level, the biomass at maximum sustainable level (BMSY). Abundance was below the limit abundance reference point (70% of BMSY), so the bottomfish complex was considered overfished (Brodziak et al. 2009). However, an updated assessment of the Deep 7 bottomfish in 2011 indicated that the Deep 7 species were not overfished (Brodziak et al. 2011). The current status of the non-Deep 7 bottomfish species remains unclear as no additional assessment has been conducted for the non-Deep 7 species (NMFS 2013b). Because the current abundance level of gray snapper is unclear and this species has a high vulnerability to fishing, we have awarded a 'high concern' score.

Factor 2.3 - Fishing Mortality

Hawaii Western Central Pacific, Handline

3.67

Low Concern

Fishing mortality rates for Hawaiian gray snapper are not known (NMFS 2013b). An assessment of the Hawaiian bottomfish unit in 2007 indicated that fishing levels in the Main Hawaiian Islands were above sustainable levels at the time, meaning overfishing was occurring (Brodziak et al. 2009). However, a more recent assessment of only the Deep 7 species in 2011 indicated that fishing levels were below sustainable levels (Brodziak et al. 2011). Current fishing levels on non-Deep 7 species are uncertain, because no additional assessments of the non-Deep 7 species have been conducted. Gray snapper are the most common bycatch species in this fishery and the majority are retained. Reported catches for the Main Hawaiian Islands Deep 7 Bottom Fishery from 2008-2012 indicate that Hawaiian gray snapper have made up around 5% of the reported retained catch in weight (DLNR 2013b). In terms of total catches (retained and discarded) they make up about 2-3% of the catch in numbers of fish (there is no estimate of total catch in weight). There is concern that catches are underreported (WPRFMC 2009). However, it appears that a large portion of the gray snapper catches come from a targeted gray snapper fishery and not the Deep 7 fishery. In 2012, 116,400 lbs of gray snapper were caught across all Hawaii fisheries, while only 17,200 lbs of gray snapper were reported caught in the Deep 7 fishery (PIFSC 2013). As well, it has been noted that some of these catches may be incorrectly attributed to the Deep 7 fishery and actually caught in the targeted gray snapper fishery. Because the Deep 7 fishery is unlikely to have an adverse impact on gray snapper, we have rated this factor 'low concern'.

ALL SPECIES**Factor 2.4 – Discards and Bait Use***Scoring Guidelines*

The discard rate is the sum of all dead discards (i.e., non-retained catch) plus bait use, divided by the total retained catch.

<i>Ratio of bait + discards/landings</i>	<i>Factor 2.4 score</i>
<i>< 20%</i>	<i>1</i>
<i>20–40%</i>	<i>0.95</i>
<i>40–60%</i>	<i>0.9</i>
<i>60–80%</i>	<i>0.85</i>
<i>80–100%</i>	<i>0.8</i>
<i>>100%</i>	<i>0.75</i>

Hawaii Western Central Pacific, Handline

1.00

< 20%

Prior to the closure of the bottomfish fishery in the Northwestern Hawaiian Islands, bycatch was recorded through self-reported fishermen logbook data and on-board scientific observer data. Logbook data indicated a discard rate (discarded catch/retained catch) of around 14%, while the observer data indicated a higher discard rate of 34%. The higher discard rates from the observer program may indicate that fishermen do not report all discards in the logbooks (WPRFMC 2009). However, bycatch species and amounts may be different in the Main Hawaiian Islands bottomfish fishery. In the Main Hawaiian Islands fishery, more of the catch is thought to be retained and utilized. More recent data on fishermen reported catches and discards specific to the Deep 7 bottomfish fishery in the Main Hawaiian Islands indicates a total discard rate (discards/retained catches) of 1-4% from 2002-2012. The discard rate for target species ranged from less than 1% to 3% and for bycatch species from 6-20% (DLNR 2013b). The mostly commonly discarded species in this fishery is greater amberjack (*Seriola dumerili*) due to concerns of ciguatera poisoning (DLNR 2013b). Although catches and discards are thought to be underreported by fishermen, the discard rate is likely still <20%.

Criterion 3: Management effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. Rating is based on the score as follows: >3.2=Green or Low Concern, >2.2 and <=3.2 =Yellow or Moderate Concern, <=2.2 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern. Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) are Critical.

Criterion 3 Summary

Region / Method	Harvest Strategy	Bycatch Strategy	Criterion 3 Score
Hawaii Western Central Pacific Handline	3.00: Moderate	4.00: Well Managed	Green(3.464)

Criterion 3 Assessment

Factor 3.1: Harvest Strategy

Scoring Guidelines

Seven subfactors are evaluated: Management Strategy and Implementation, Recovery of Species of Concern, Scientific Research and Monitoring, Record of Following Scientific Advice, Enforcement of Regulations, Management Track Record, and Stakeholder Inclusion. 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.

Factor 3.1: Harvest Strategy Summary								
Region / Method	Management Strategy and Impl.	Recovery of Species of Concern	Scientific Research & Monitoring	Record of Following Scientific Advice	Enforcement of Regs.	Track Record	Stakeholder Inclusion	Factor 3.1 Score
Hawaii Western Central Pacific Handline	Moderately Effective	N/A	Moderately Effective	Highly Effective	Moderately Effective	Moderately Effective	Highly Effective	3.00: Moderate Concern

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.

Hawaii Western Central Pacific, Handline

Moderately Effective

In federal waters of the US Western Pacific, the Western Pacific Regional Fishery Management Council manages the Deep 7 bottomfish species. Previously these species were managed under the Bottomfish and Seamount Groundfish Fishery Management Plan, but since 2010 have been managed under the Hawaii Fishery Ecosystem Plan (WPRFMC 2009) (WPRFMC 2010). Historically there have been two large management sub-areas, the Main Hawaiian Islands and Northwestern Hawaiian Islands (WPRFMC 2006). However, the Northwestern Hawaiian Islands was declared a Marine National Monument and closed to fishing in 2010 (President Proclamation 8031: FR Doc E9-7860). Now all fishing occurs in the waters surrounding the Main Hawaiian Islands. Management measures under the federal plan include a ban on destructive fishing techniques, a prohibition on fishing at Hancock Seamount, size limits, limits on fishing effort, gear restrictions, a recreational bag limit, and catch reporting (WPRFMC 2006) (WPRFMC 2010). As well, a total allowable catch limit is set for the Deep 7 bottomfish species. For the 2012-13 and 2013-14 fishing years, the annual catch limit was set at 346,000 lbs. (FR 2012) (FR 2013). If the catch limits is project to be reached, the fishery for the Deep 7 bottomfish may be closed. If the catch limit is exceeded, the catch limit for the following season may be reduced by the amount of the overage. All of the incidentally captured fish species included in this report are included in the Hawaiian bottomfish management unit species (BMUS) complex and managed under the federal plan as well. The Hawaiian gray snapper, which is often retained in this fishery, is managed under an aggregate non-Deep 7 catch limit (FR 2013). Bottomfish species also occurs in Hawaii state waters. In state waters the Hawaii Division of Aquatic Resources (HDAR) part of the Department of Land and Natural Resources, is responsible for fisheries management (WPRFMC 2006). Management measures in state waters include annual vessel registration, catch reporting, gear restrictions, minimum sizes (Onaga and Opakapaka) and closed fishing areas (WPRFMC 2006))(DLNR 2013a). If the fishery for the Deep 7 is closed in federal waters because the

annual catch limit is reached, the State may close their waters to fishing for the Deep 7 species as well.

Management goals for abundance and fishing levels have been established for the Deep 7 complex as a whole but not for individual species (Brodziak et al. 2011). As a result, the impact of the fishery on individual species remains unclear. We have therefore awarded a moderately effective score.

Subfactor 3.1.2 - Recovery of Species of Concern

Considerations: When needed, are recovery strategies or management measures in place to rebuild overfished/threatened/endangered species or to limit fishery's impact on these species? What is their likelihood of success? To achieve a Highly Effective rating, 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.

Hawaii Western Central Pacific, Handline

N/A

The "Deep 7" bottomfish species are not considered depleted/overfished and therefore not in need of a recovery plan (Brodziak et al. 2011). However, it should be noted that Hawaiian grouper was assessed by the International Union for Conservation of Nature in 2004 and designated as 'Near Threatened'.

When it was previously deemed that overfishing was occurring on this complex, emergency management measures were put into place to stop overfishing (WPRFMC 2009).

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 achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.

Hawaii Western Central Pacific, Handline

Moderately Effective

Fishing effort data and catch rate data (amount of fish caught per unit of fishing effort) is collected, and used to provide an index of abundance for the Deep 7 bottomfish complex (Brodziak et al. 2011). Reporting of data occurs through the Hawaii Department of Aquatic Resources through the bottomfish trip reports. Since the Deep 7 bottomfish are assessed as a unit and not individually, the abundance of individual species cannot be determined. There are also concerns about under and un-reporting of Deep 7 species catches; in the latest assessment, they included estimates of these unreported catches (Brodziak et al. 2011). Population assessments are conducted on a fairly regular basis of about 2-3 years but the ability to conduct individual assessments has been hampered by a lack of species-specific

biological and fishery related data (Brodziak et al. 2011). In addition, it has been noted that the development of a fishery-independent scientific survey of the bottomfish species would help enhance the accuracy of assessments. It is reported that efforts to develop this survey are underway. We have awarded a moderately effective score for this factor.

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.

Hawaii Western Central Pacific, Handline

Highly Effective

The fisheries management council utilizes the scientific recommendations provided in the Deep 7 species assessment when developing catch limits for the fishery. The annual catch limit was set at 346,000 lbs for both 2012-2013 and 2013-2014 fishing years (FR 2012)(FR 2013). Given the current catch limit, the risk of overfishing is 40-45%. This is considered an acceptable risk level under the guidelines of the U.S. Magnuson-Stevens Fisheries Conservation Act (Brodziak et al. 2011). We have therefore awarded a highly effective score.

Subfactor 3.1.5 - Enforcement of Management Regulations

Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Hawaii Western Central Pacific, Handline

Moderately Effective

Catch data for the Hawaiian Deep 7 bottomfish fishery is recorded and monitored throughout the year. Fishers document catches on Hawaii state commercial bottomfish trip reports. Required submissions by dealers and auction records are used to check and validate fisher-submitted catch, and discrepancies are resolved. Catch data can also be cross-checked with data collected from the State Marine Product License holders. Federal logbooks are used in waters outside Hawaiian state limits. The catch data is monitored in relation to the annual total allowable catch limit, and when the catch limit is projected to be reached, the fishery is closed (FR 2012). Total commercial catches of the Deep 7 species during the 2012/2013 fishing season were around 250,000 lbs (DLNR 2013c)(PIFSC 2013), which was well below the annual catch limit of 346,000 lbs. (FR 2012). However, there is some uncertainty, as to whether all catches are reported. There is very limited reporting of recreational catches (Brodziak et al. 2011).

In Hawaii state waters, the Hawaii Division of Conservation and Resources Enforcement (DOCARE) is responsible for enforcing management regulations, like the Bottomfish Restricted Fishing Areas (BRFA) (NOAA 2011). In some cases Bottomfish Restricted Fishing Areas extend into federal waters, but the federal fisheries agency (National Marine Fisheries Service) has no authority to enforce them. State enforcement resources are limited and Bottomfish Restricted Fishing Areas near highly populated areas are challenging to enforce (Moore et al. 2013). We have therefore awarded a moderately effective score.

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 is given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.

Hawaii Western Central Pacific, Handline

Moderately Effective

The management measures for the Deep 7 bottomfish fishery appear to be maintaining fishing at a sustainable level, and the Deep 7 bottomfish are not considered depleted, though abundance is below the target level. However since the Deep 7 bottomfish are assessed as a unit, the status of individual species remains uncertain (Brodziak et al. 2011). Therefore we have awarded a moderately effective score.

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 rating is given if the management process is transparent and includes stakeholder input.

Hawaii Western Central Pacific, Handline

Highly Effective

There is stakeholder inclusion in the management process for the Deep 7 fishery. For example, the public is allowed to comment on proposed management measures for this fishery. Proposed federal regulations are published in the Federal Register before they are enacted so the public has time to comment. As well managers hold meetings that are open to the public and allow for public comments on any agenda items at these meetings (WPRFMC 2011).

Factor 3.2: Bycatch Management Strategy

Scoring Guidelines

Four subfactors are evaluated: Management Strategy and Implementation, Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.' Unless reason exists to rate Scientific Research and Monitoring, Record of Following Scientific Advice, and Enforcement of Regulations differently, these ratings 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.

Factor 3.2: Bycatch Management Strategy Summary					
Region / Method	Management Strategy and Impl.	Scientific Research and Monitoring	Record of Following Scientific Advice	Enforcement of Regs.	Factor 3.2 Score
Hawaii Western Central Pacific, Handline	Highly Effective	Moderately Effective	Highly Effective	Moderately Effective	4:00: Low Concern

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 Western Central Pacific, Handline

Highly Effective

Bycatch in this fishery is low and typically does not include any vulnerable species such as sea turtles, sea birds or marine mammals. Interactions with Hawaiian monk seals have been reported as possible because monk seals have been found with embedded hooks. However, it is not possible to determine what fishery these hooks came from and they may not be from the Deep 7 bottomfish fishery. Monk

seals are protected under the US Endangered Species Act, Marine Mammal Protection Act and under Hawaiian state law. In the bottomfish fishery, fishermen are encouraged to use barbless circle hooks and required to report any interactions with monk seals (NOAA 2013). Any potential interactions are thought to be very low, and there is no evidence of serious injury or harm to monk seals caused by this fishery. Other measures that have been implemented to reduce bycatch in this fishery include the prohibition of non-selective gears, like gillnets and bottom trawls, as well as outreach and training to fishermen on how to reduce bycatch and bycatch mortality (WPRFMC 2009). Because bycatch measures are in place and there are no significant bycatch concerns in this fishery, we have rated this factor 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 Western Central Pacific, Handline

Moderately Effective

On-board scientific observer programs are not in place to record bycatch and discards in this fishery. However, fishermen are required to fill out logbooks and 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 (NOAA 2011). There is some concern that catches and discards may be underreported (Brodziak et al. 2011). Population assessments of Hawaiian monk seals are conducted (NOAA 2013). We have rated this factor moderately effective.

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 Western Central Pacific, Handline

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? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Hawaii Western Central Pacific, Handline**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 Ecosystem Based Fishery Management score. Rating is based on the score as follows: >3.2=Green or Low Concern, >2.2 and <=3.2=Yellow or Moderate Concern, <=2.2=Red or High Concern. Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	Ecosystem Based Fisheries Management	Criterion 4 Score
Hawaii Western Central Pacific Handline	4.00:Very Low Concern	0.50:Moderate Mitigation	3.00:Moderate Concern	Green (3.674)

Criterion 4 Assessment

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

Scoring Guidelines

- 5 (None) = Fishing gear does not contact the bottom
- 4 (Very Low) = Vertical Line Gear
- 3 (Low) = Fishing gear contacts the bottom, but is not dragged along the bottom (e.g., bottom gillnet, bottom longline, trap) and fishing does not occur on sensitive habitats. Bottom seine gear fished on resilient mud/sand habitats. Midwater trawl gear that is known to contact bottom occasionally (<25% of the time) or purse seine gear 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 fished on habitats other than mud/sand
- 1 (High) = Dredge or bottom trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)
- 0 (Very High) = Dredge or bottom 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

Hawaii Western Central Pacific, Handline

4.00

Very Low Concern

Handline gear has a very low impact on bottom habitats (Morgan and Chuenpagdee 2003). The Hawaiian handline fishery gear typically has six to eight branching circle hooks off the main line. The line is lowered and raised with electric, hydraulic, or hand-powered reels (WPRFMC 2009). Fishermen fish along steep slopes of deep water banks and while the mainline may come in contact with the bottom, overall fishing effects on the habitat are considered minimal (WPRFMC 2010).

Factor 4.2 - Mitigation of Gear Impacts

Scoring Guidelines

- *+1 (Strong Mitigation) = Examples include large proportion of habitat protected from fishing gear (>50%), fishing intensity low/limited, gear is specifically modified to reduce damage to seafloor and modifications have been 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 gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.*
- *+0.25 (Low Mitigation) = Few measures are in place to limit gear impacts on habitats (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.*

Hawaii Western Central Pacific, Handline

0.50

Moderate Mitigation

The entire Northwest Hawaiian Islands (NWHI) was closed to fishing in 2010, so now all fishing occurs within the waters surrounding the Main Hawaiian Islands. A recent study that investigated population genetic structure of Hawaii fish species, including Hawaiian grouper, indicates there may be a genetic break between the protected Northwestern Hawaiian Islands and the Main Hawaiian Islands (Toonen et al. 2011), supporting the current Deep 7 bottomfish management structure of a distinct population in the Main Hawaiian Islands. In Hawaii State waters, there are 12 areas restricted to fishing within the Main Hawaiian Islands because they contain important bottomfish habitats (NOAA 2011). These areas protect less than 20% of suitable bottomfish habitat (Parke 2007), but 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

Scoring Guidelines

- *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 in 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 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.*

Hawaii Western Central Pacific, Handline

3.00

Moderate Concern

At least one of the Deep 7 species, the Hawaiian grouper, is considered an important top predator species and thus is considered a "species of exceptional ecological importance" in the Hawaii ecosystem (Friedlander and DeMartini 2002)(Dale et al. 2011). As well, the fishery catches gray snapper (a non-Deep 7 species) which is also considered a top predator and a "species of exceptional ecological importance" in the ecosystem (Dale et al. 2011). 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). The entire Northwestern Hawaiian Islands have been declared a Marine National Monument and fishing is no longer permitted there (NOAA 2011). However, a recent study indicates there may not be spill over from the protected Northwestern Hawaiian Islands to the Main Hawaiian Islands, supporting the current Deep 7 bottomfish management structure of a distinct population in the Main Hawaiian Islands (Toonen et al. 2011). Within state waters of the Main Hawaiian Islands, there are 12 areas restricted to fishing because they contain important bottomfish habitats (NOAA 2011), but these areas protect less than 20% of suitable bottomfish habitat (Parke 2007). While Hawaii is making great strides towards managing their fisheries using an ecosystem-based

approach, because this fishery catches some species of "exceptional importance" and there are not yet sufficient policies in place to ensure protection of their ecological role, we have awarded a moderate concern score.

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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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Appendix A: Review Schedule

A new population assessment of the Deep 7 bottomfish species is scheduled for 2014. Once the new assessment is released, this report may need updating.

Appendix B: List of All Species Assessed in the Fishery

Summary of all main species considered in the assessment

Main Hawaiian Islands Deep 7 Bottomfish Multi-species Complex: Hawaii Western Central Pacific, Handline				
Species	Inherent Vulnerability	Abundance	Fishing Mortality	Subscore
HAWAIIAN GROUPER (HAPU'U): MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX	High	2.00: High Concern	2.33: Moderate Concern	2.159
GREATER AMBERJACK	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
HAWAIIAN PINK SNAPPER (OPAKAPAKA): MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
HAWAIIAN RED SNAPPER (EHU): MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
HAWAIIAN RUBY SNAPPER (ONAGA): MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
KALEKALE SNAPPER: MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
OBLIQUE-BANDED SNAPPER - GINDAI: MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
RUSTY JOBFISH: MAIN HAWAIIAN ISLANDS DEEP 7 BOTTOMFISH MULTI-SPECIES COMPLEX	Medium	3.00: Moderate Concern	2.33: Moderate Concern	2.644
HAWAIIAN GRAY SNAPPER (UKU)	High	2.00: High Concern	3.67: Low Concern	2.709