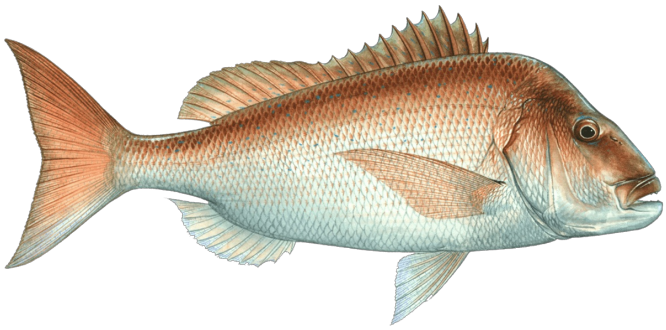
Squirefish (New Zealand tai snapper)

Pagrus auratus



New Zealand/Southwest Pacific

Bottom trawls, Set longlines, Danish seines

Seafood Watch Consulting Researcher

April 5, 2021

Seafood Watch Standard used in this assessment: Fisheries Standard v3

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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 Watch Assessment. Each assessment 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." This ethic is operationalized in the Seafood Watch standards, available on our website here. In producing the assessments, 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 assessments 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 Watch assessments in any way they find useful.

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 fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard. 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 online guide:

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

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

Avoid/Red: Take a pass on these for now; they're overfished, lack strong management or are 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

Summary

This report assesses squirefish (also known as Tai snapper; *Pagurus auratus*) taken by bottom trawl, Danish seine, and set longline gear in the New Zealand inshore fishery.

Snapper in New Zealand is caught using a range of gear types over a number of distinct stocks and management areas. There are four main management units (in order of estimated landings): SNA1 (north North Island), SNA8 (northwest North Island), SNA2 (northeast North Island), and SNA7 (west South Island). The SNA1 and SNA8 stocks are estimated to be below their respective target reference points. Snapper in SNA7 is estimated to be around the target reference point. And there is less information available on abundance and fishing mortality for the SNA2 snapper management area. Overfishing is likely to be occurring in SNA1.

Catch composition in the snapper target fishery is not well understood due to limited observer coverage and unavailability of landings data. Primary catch composition information comes from fishery-independent trawl surveys, and fishery-dependent data are quite limited (especially for Danish seine and longline gear). Bycatch rates are generally unknown for the various gear types, and fishing mortality in the snapper fishery for most C2 species is therefore unknown. Snapper longline and trawl gear is known to interact with Vulnerable and/or Threatened species, and actual or potential impacts to these species constrain the C2 score for these fisheries. There are very few data available for Danish seines, so trawl data have been used as a proxy for these fisheries.

The snapper catch in New Zealand is managed under the country's Quota Management System (QMS). The QMS system is not highly responsive to changes in snapper stock status, and snapper in SNA1 has been subject to the same Total Allowable Catch for 20 years. Although significant data are collected to inform stock assessments in most of the snapper management areas, limited fishery-dependent bycatch monitoring remains an issue. Fisheries laws and regulations are enforced by the New Zealand Ministry of Primary Industry, which conducts regular monitoring and verification activities, and the management system encourages the engagement of a wide range of stakeholders.

Snapper are found in a variety of demersal habitats, including mud and silt bottom, rocky areas, and reefs, although the extent to which gears are used in sensitive boulder/reef habitats is thought to be minimal. There are very few year-round protected areas within snapper habitat. All snapper fisheries in SNA 1 and SNA 2 assessed in this report receive an "Avoid" rating; the fisheries in SNA 7 and 8 receive a "Good Alternative" rating.

Final Seafood Recommendations

SPECIES | FISHERY	CRITERION 1 TARGET SPECIES	CRITERION 2 OTHER SPECIES	CRITERION 3 MANAGEMENT	CRITERION 4 HABITAT	OVERALL RECOMMENDATION
Squirefish | Southwest Pacific | Bottom trawls | New Zealand | SNA7	5.000	2.236	3.000	2.449	**Good Alternative (3.010)**
Squirefish | Southwest Pacific | Bottom trawls | New Zealand | SNA8	5.000	1.732	3.000	2.449	**Good Alternative (2.824)**
Squirefish | Southwest Pacific | Bottom trawls | New Zealand | SNA2	2.644	1.000	3.000	2.449	**Avoid (2.099)**
Squirefish | Southwest Pacific | Bottom trawls | New Zealand | SNA1	1.526	1.000	3.000	2.449	**Avoid (1.830)**
Squirefish | Southwest Pacific | Danish seines | New Zealand | SNA8	5.000	1.732	3.000	2.449	**Good Alternative (2.824)**
Squirefish | Southwest Pacific | Danish seines | New Zealand | SNA1	1.526	1.000	3.000	2.449	**Avoid (1.830)**
Squirefish | Southwest Pacific | Set longlines | New Zealand | SNA7	5.000	2.236	3.000	3.000	**Good Alternative (3.167)**
Squirefish | Southwest Pacific | Set longlines | New Zealand | SNA8	5.000	1.000	3.000	3.000	**Good Alternative (2.590)**
Squirefish | Southwest Pacific | Set longlines | New Zealand | SNA1	1.526	1.000	3.000	3.000	**Avoid (1.925)**

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 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).

Introduction

Scope of the analysis and ensuing recommendation

This report assesses the main sources of wild-caught Australasian snapper (*Pagurus auratus*) from the New Zealand Exclusive Economic Zone (EEZ), and covers the four management areas (referred to as SNA1, SNA2, SNA7 and SNA8), in which significant quantities of snapper are caught. This report covers all landings in these areas made by trawl, Danish seine, and bottom longline gear. Snapper are generally caught in association with a number of other target fisheries by area including tarakihi (*Nemadactylus macropterus*), red gurnard gurnard (*Chelidonichthys cuculus*), trevally (*Pseudocaranx dentex*) and john dory (*Zeus faber*).

Species Overview

Australasian snapper is a demersal fish distributed throughout the Indo-Pacific. It is described by {Pauly 1990} as golden pink to reddish in color, with a deep oblong body. Snapper is found at depths between 0-200m, though primarily 15-60m. The species occupies a wide range of habitats, including reefs, sandy and muddy bottoms. Snapper have been found to mature at around 3-4 years of age and 20-28 cm in length (Stewart et al 2010). The diet of snapper consists primarily of crustaceans, but also other invertebrates such as marine worms, starfish, sea urchins and shellfish, and occasionally vertebrates. Snapper are serial spawners, generally only spawning in waters less than 50m deep and at 18^{o}C {Froese & Pauly 2016}.

Management of the snapper fisheries reviewed in this assessment fall under the jurisdiction of New Zealand's Ministry for Primary Industries (MPI). The MPI performs a wide range of roles within the fishery management context, including research, stock assessment, regulatory development, monitoring control and enforcement activities. The primary legal instrument empowering the MPI is the Fisheries Act (1996)(Fisheries Act 1996), which aims "to provide for the utilization of fisheries resources while ensuring sustainability".

The snapper stocks around New Zealand support substantial commercial and recreational fisheries. The commercial fishery began in the late 19th Century, although landings did not peak until the 1970s with the widespread introduction of trawl and Danish seine gears. By the 1980s, with substantial longline removals for the Japanese market, several stocks showed signs of overfishing (MPI 2015). The Quota Management System (QMS) was introduced in 1986. This system applies a Total Allowable Commercial Catch (TACC) to the commercial fishery, within a management-area-wide TAC, which also includes recreational removals (FNZ 2019).

Snapper is managed in six geographical management areas, labelled SNA1, SNA2, SNA3, SNA7, SNA8 and SNA10 (Figure 1) (FNZ 2019). The majority of commercial landings originate from SNA1, with SNA8 also providing a substantial contribution (~20%). Smaller quantities are removed from SNA2 (~5%) and SNA 7 (<=3%)(FNZ 2019). Landings in SNA3 have never exceeded 2 t and there have been no recorded landings from SNA10, and they are not reviewed as part of this report, and they are not reviewed as part of this report. SNA1 is presumed to contain three biological stocks, although the level of mixing between these is unclear. SNA7 and SNA2 are presumed to contain two sub-stocks, while SNA8 is currently believed to contain one stock only (FNZ 2019).

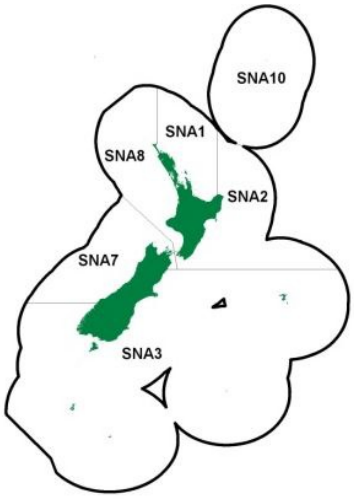

Figure 1: Snapper (P. auratus) management areas in New Zealand ({MPI 2017} (1)).

The availability of information on the relative importance of different gear types varies between management areas. In SNA1, the majority of snapper catches are taken by bottom longline and bottom trawl gear types, with some annual variation in gear types by region (Figure 2)(FNZ 2019). In SNA7 the majority of landings have historically been taken by bottom trawl (around 78% by weight) {MPI, 2015 (2)}. In most recent years, the majority of snapper taken in SNA 8 has been taken by bottom trawl fisheries primarily targeting other species (Walsh et al. 2017).

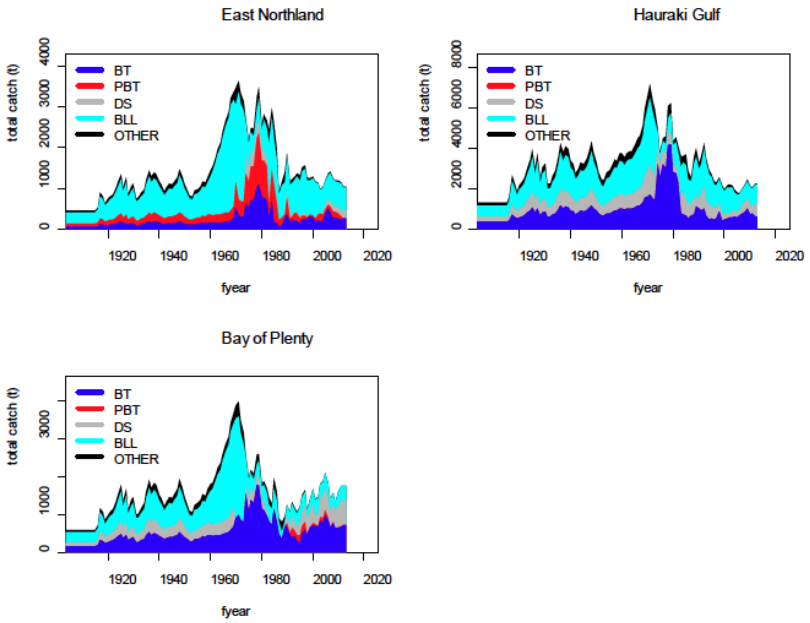

Figure 2: Commercial catch histories by method and area (adjusted for under-reporting) used as input to the 2013 SNA 1 assessment model (FNZ 2019).

Production Statistics

Total national snapper wild capture production in New Zealand peaked at 17,600t in 1978, but has remained steady around 6,000t since the early 1990s (Figure 1). The majority of snapper landings originate in SNA1. Landings in SNA1 and SNA2 peaked in the early 1970s (Figure 2), whereas landings in SNA7 and SNA8 peaked in the late 1970s (Figure 3).

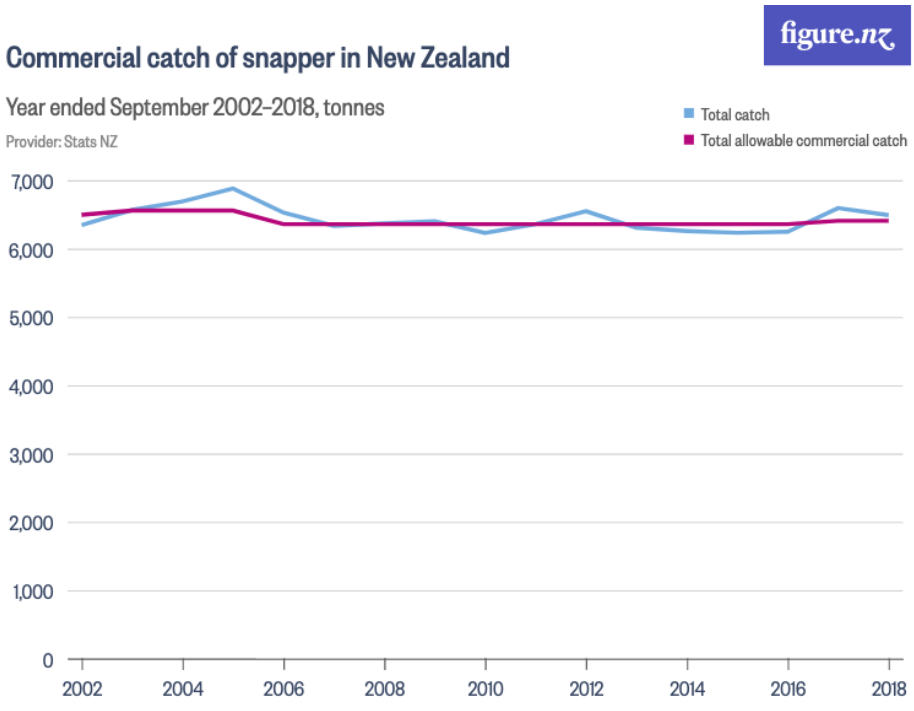

Figure 3: Commercial catch of snapper in New Zealand, 2002-2018 {Stats NZ 2020}.

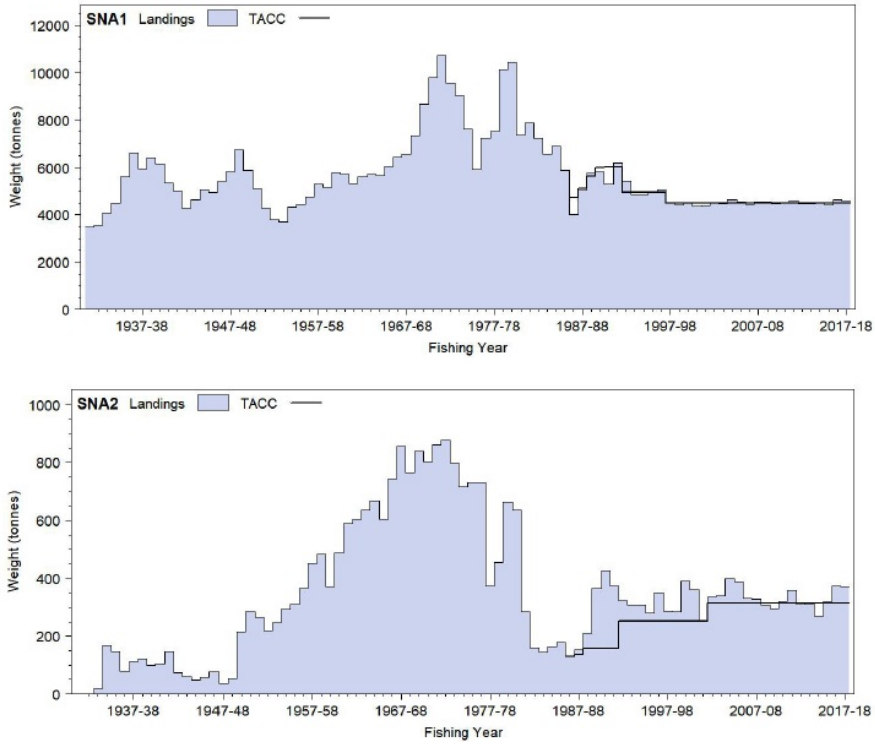

Figure 4: Total reported landings and TACCs for the four main SNA stocks. SNA 1 (Central East) and SNA 2 (Central East)(FNZ 2019).

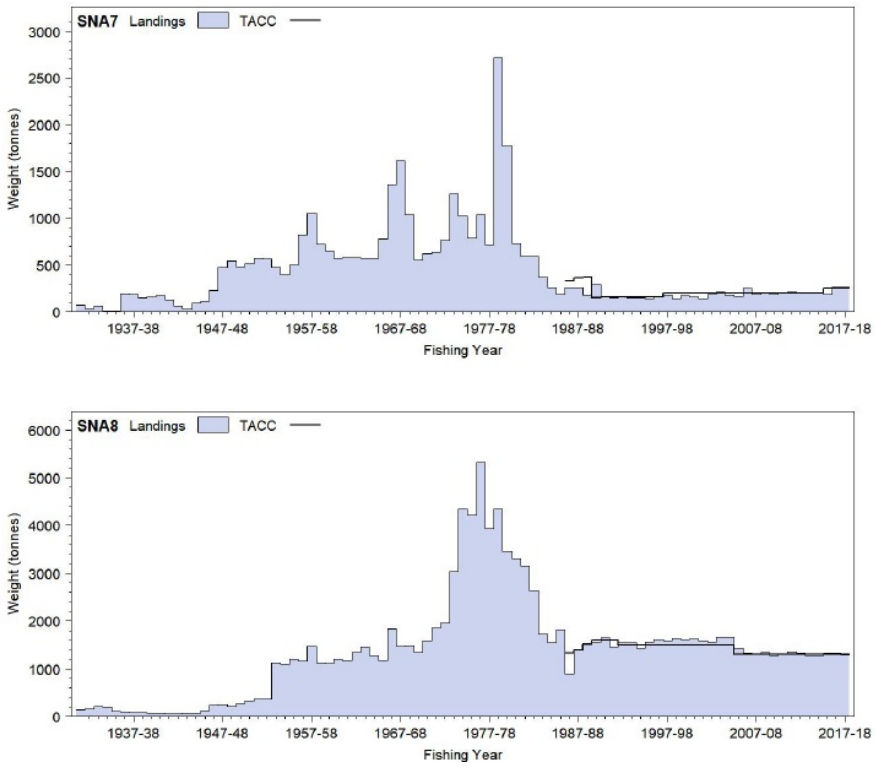

Figure 5: Total reported landings and TACCs for the four main SNA stocks. SNA 7 and SNA 8 (FNZ 2019).

Global annual capture production of snapper peaked in the 1960s at around 40,000t. In recent years, total landings have been declining, from around 34,000t in 2002 to 23,000t in 2014 (FAO (2)). Aquaculture snapper production was negligible until the mid-1970s, but saw rapid increases to a peak of around 88,000t in 2003 (FAO (1)) The majority of both aquaculture and wild capture snapper is produced by Japan, with the New Zealand fishery representing around 27% of global wild capture production and 7% of total global production including aquaculture in 2014 (Figure 5,6){FAO(1,2)}.

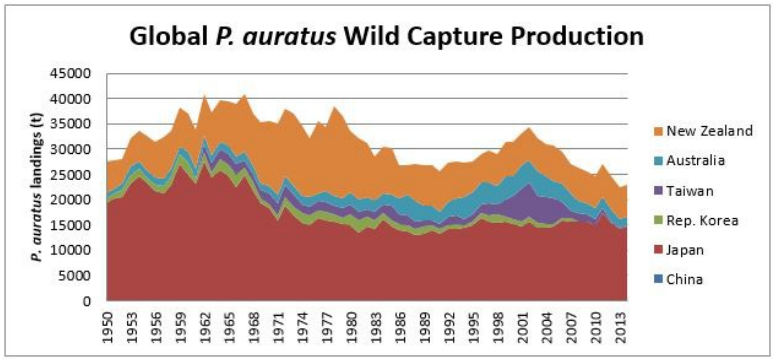

Figure 6: Global capture production of P. auratus. From the FAO statistical database (FAO (2)).

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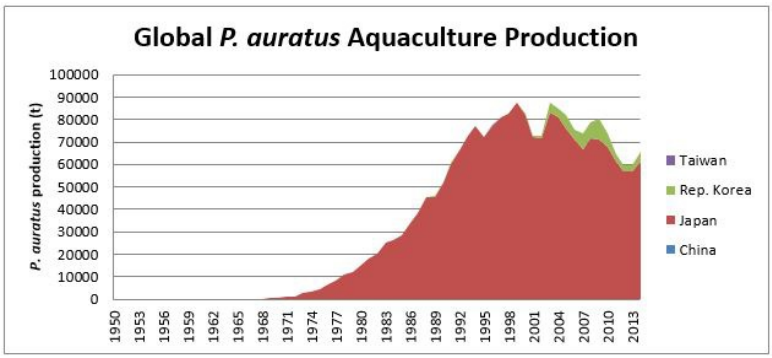


Figure 7: Global aquaculture production of P. auratus. From the FAO statistical database (FAO (1)).

New Zealand seafood exports to the end of December 2018 totaled NZ $1,817million, with more than 267,901 t exported (Seafood New Zealand 2019a). China, Australia and the United States are primary import partners foor New Zealand fisheries. In 2017 and 2018, New Zealand exported ~ 3,300 t of snapper products, worth approximately NZ $33 million (Seafood New Zealand 2019a). The primary export product forms were chilled whole and frozen whole snapper (Seafood New Zealand 2019b)

Importance to the US/North American market.

Total US seafood imports of snapper in 2018 were 19,481 t (worth US $131 million; total US snapper import statistics include all snapper species and are not limited to *P. auratus).* This represents approximately 4% of total US seafood imports in 2018 (NOAA 2019). More specific to New Zealand snapper, in 2019 the US imported 566 t worth approximately NZ $7.3 million (Seafood New Zealand 2019), and in 2018 the US imported 516 t of New Zealand snapper, worth approximately NZ $6.2 million (Seafood New Zealand 2018).

Common and market names.

Australasian snapper is also known as snapper, tai snapper, cockney bream, nobblers, pinkie, reddie, old man, ruggers, silver seabream, squirefish, bream, Western snapper, white snapper and it is called *tamure* in Maori {Froese & Pauly 2016}. This species is marketed in the US as porgy or squirefish (FDA 2016).

Primary product forms

The majority of snapper exported to the US is as chilled whole fish. Other product forms include fillets and headed and gutted (H&G) (Seafood New Zealand 2019).

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the species under assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Guiding Principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level*

Criterion 1 Summary

SQUIREFISH			
REGION / METHOD	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Southwest Pacific | Bottom trawls | New Zealand | SNA7	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Southwest Pacific | Bottom trawls | New Zealand | SNA8	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Southwest Pacific | Bottom trawls | New Zealand | SNA2	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Southwest Pacific | Bottom trawls | New Zealand | SNA1	2.330: Moderate Concern	1.000: High Concern	Red (1.526)
Southwest Pacific | Danish seines | New Zealand | SNA8	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Southwest Pacific | Danish seines | New Zealand | SNA1	2.330: Moderate Concern	1.000: High Concern	Red (1.526)
Southwest Pacific | Set longlines | New Zealand | SNA7	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Southwest Pacific | Set longlines | New Zealand | SNA8	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)
Southwest Pacific | Set longlines | New Zealand | SNA1	2.330: Moderate Concern	1.000: High Concern	Red (1.526)

Criterion 1 Assessments

SCORING GUIDELINES

Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*
- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

Squirefish

Factor 1.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1

Moderate Concern

Snapper in SNA1 are assessed as three biological stocks: East Northland (ENLD), Hauraki Gulf (HAGU), and Bay of Plenty (BOP). The results of the HAGU and BOP stock assessments are combined due to uncertainties about movement extents between the two areas. SNA1 snapper were most recently assessed in 2013. B_{2013}/B_0 (the estimated 2013 biomass / unfished biomass) was estimated to range from 0.19 - 0.24, suggesting that estimated biomass is not likely to be at the target reference points ($0.4B_0$). All three stocks population may be approaching or may be below the soft limit reference point (40-60% possibility below $0.2B_0$); however they are likely above the hard limit reference point (90% likelihood above $0.1B_0$)(FNZ 2020). SNA1 snapper therefore receive a moderate concern score because there are uncertainties about stock structure, older stock assessment data, and the fact that SNA1 stocks are likely below target reference points. They do not receive a high concern score because they are likely above hard limit reference points.

Justification:

All SNA1 snapper stocks exhibited a significant declining biomass trend since the 1960s, however, more recent trend data show moderate to variable increases (FNZ 2020){Figure A, B). Another biomass index, the longline CPUE indices were updated in 2016, extending the time series to include 2012/13–2014/15. The most recent indices were broadly comparable to the indices from 2007/08–2011/12, i.e. fluctuating without trend (FNZ 2020). There is recent information not yet published indicating that snapper in SNA1 may be increasing in abundance (Mace, FNZ, Pers. comm. 2020).

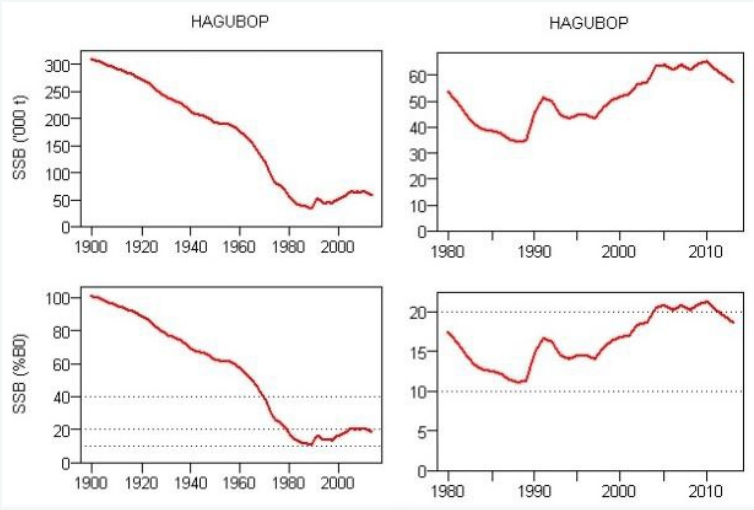


Figure 8: Estimated trajectories of Hauraki Gulf and Bay of Plenty combined SSB. Top left: SSB ('000t) since 1900; Top right: SSB ('000t) since 1980, expanded; Bottom left: SSB as a percentage of B0 since 1900, dotted lines represent target and limit reference points; Bottom right: SSB as a percentage of B0 since 1980, expanded, dotted lines represent hard and soft limit reference points. Adapted from the MPI fisheries plenary report (MPI 2017 (1)).

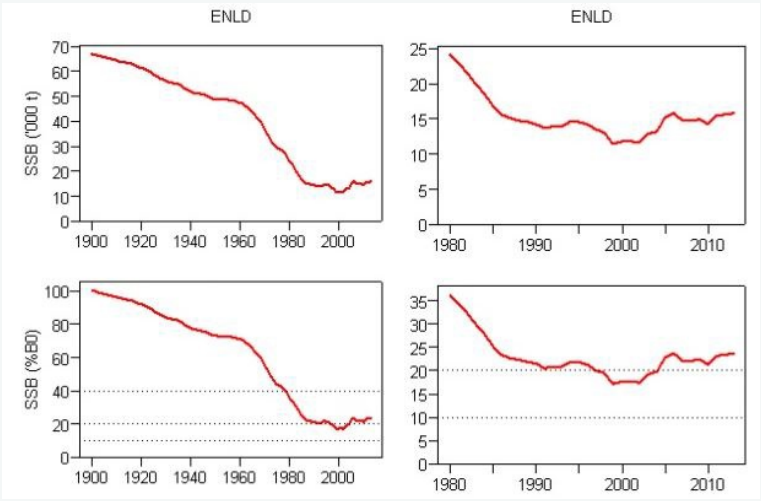


Figure 9: Estimated trajectories of ENLD stock SSB. Top left: SSB ('000t) since 1900; Top right: SSB ('000t) since 1980, expanded; Bottom left: SSB as a percentage of B0 since 1900, dotted lines represent target and limit reference points; Bottom right: SSB as a percentage of B0 since 1980, expanded, dotted lines represent hard and soft limit reference points. Adapted from the MPI fisheries plenary report (MPI 2017 (1)).

Southwest Pacific | Bottom trawls | New Zealand | SNA2

Moderate Concern

Catch-at-age sampling conducted in 2012 provided evidence that snapper in SNA2 consists of two sub-stocks. A stock assessment considering these sub-stocks separately was conducted for the first time in 2017/18. Due to a limited understanding of the relationship between the two sub-stocks and a truncated Catch Per Unit Effort (CPUE) analysis caused by concerns over data quality, the stock assessment was not able to reach any conclusions about the current stock status of either sub-stock in relation to target or limit reference points (Plenary 2018)(FNZ 2019)(FNZ 2020). New Zealand snapper are classified as IUCN Least Concern (Carpenter et al. 2014). There are no defined target reference points for either the northern or southern sub-stocks of SNA2 snapper; however, they are IUCN Least Concern and receive a moderate concern score.

Justification:

A full quantitative stock assessment was completed for SNA 2 in 2009, however the results from the assessment are no longer presented in the annual Plenary report because it assumed that SNA 2 comprised a single biological stock. Subsequent catch at age sampling found evidence for two sub-stocks within SNA 2: a northern stock located between Mahia Peninsula and Cape Runaway, and a southern stock occurring within Hawke Bay (FNZ 2019). In both the northern and southern sub-stocks CPUE indices were relatively stable between 2002 and 2006 then declined from 2006 to 2009 in the southern sub-stock and to 2010 in the northern sub-stock. Both sub stocks were relatively stable between 2010 and 2016, with the southern sub-stock showing more inter-annual variation. Abundance in both sub-stocks increased in 2017 (FNZ 2020).

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA7

Very Low Concern

SNA7 snapper biomass was at an historical low level in the early 2000s and has increased significantly since 2009 due to high recruitment in a few recent year classes. The 2020 stock assessment concluded that there is roughly a 40%-60% chance that estimated biomass of snapper in SNA7 is at or above the interim target reference point (0.4 $SB_{current}/SB_0$) and a <10% chance that biomass is below the $SB_{20\%}$ soft limit or hard limit $SB_{10\%}$(FNZ 2020). While the increase in estimated biomass and the proximity of the point estimate to the target are positive signs, the uncertainty of the point estimate precludes a score of very low concern. A score of low concern is therefore awarded.

Justification:

The most recent biomass estimate for SNA7 snapper was conducted in 2020, and estimated SSB/B_0 ratio = 0.41 . Estimated biomass has increased since 2009 (Figure A). The 2020 MPI report states while biomass was at an historical low level in the early 2000s, it has increased rapidly since 2009 due to the recent recruitment of one or two large year classes . Additionally, the West Coast South Island trawl survey also shows an increase in snapper abundance from 2010-2019 (FNZ 2020).

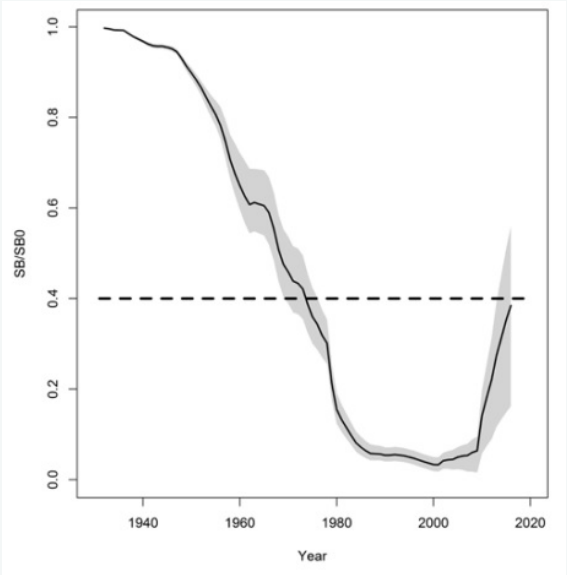


Figure 10: Trend in spawning biomass (SSB, relative to B0, y-axis) in the SNA7 snapper stock over time (x-axis). Solid line represents the median SSB estimate (with 90% confidence interval shaded), and the dashed line represents the 40% B0 interim target reference point. From the fisheries plenary (Plenary 2018).

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA8

Very Low Concern

Abundance data are limited for SNA8 snapper. The most recent stock assessment was conducted in 2020. The 2020 assessment estimates that $B_{2019\text{-}20}$ is roughly 49% of B_0 , and concluded that the probability the stock was above the target reference point ($0.4B_0$) was greater than 60%. There is a less than

1% chance the stock is below the hard limit reference point ($0.1B_0$)(FNZ 2020). A more recent study of CPUE indices for the stock was conducted in 2017, which estimated biomass to have substantially improved since the 2005 full stock assessment (2007/08 - 2015/16 CPUE index increased by a factor of 3.4 (FNZ 2019). Snapper in SNA8 scores very low concern because it is highly unlikely that stock status is below either the soft or hard management limits based on the 2020 assessment.

Justification:

Spawning biomass was estimated to have increased gradually during the 2000s followed by a more rapid increase in biomass from 2009 (in response to the recruitment of the strong 2006 year class) (FNZ 2020). As mentioned above, the 2017 CPUE index assessment suggests substantial increases in SNA8 abundance (Figure A). The recent increase in CPUE indices is consistent with the available age composition data from the SNA8 single trawl data. The time-series of age composition data indicate the recruitment of a strong year class in the fishery in 2008/09 followed by the recruitment of an even stronger year class in 2009/10. The latter year class persisted in the age composition of the catch over the subsequent years (to 2015/16) and the age structure was augmented by the recruitment of strong 2009 and 2010 year classes. Additionally, the trawl survey total biomass indices between 1989-99 - 2018-19 corroborates the recent increase in stock abundance. Abundance is likely to increase over the next two years at current levels of catch (2,356 t compared to a TAC of 1,785 t and a TACC of 1,300 t). The magnitude of the subsequent increase is uncertain (FNZ 2020).

MG-14291:SNA8 cpue index}

Factor 1.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1

High Concern

The most recent SNA1 assessment (2013) for snapper stocks concluded that SNA1 snapper catch at the current level is very likely (>60%) to cause overfishing to continue (FNZ 2020). Snapper landings have averaged slightly above the Total Allowable Commercial Catch (TACC; 4500 t) since the 1980s. Catches have been set in regulation at a hard cap of 4500 t since 2000 and are generally exceeded annually. While target reference points are limited for fishing mortality and somewhat outdated, current catch levels have a >60% chance of causing overfishing to continue in SNA1, and snapper fishing mortality receives a high concern score.

Justification:

The target exploitation rate is calculated as the level of fishing required to maintain the stock at the target reference point, or 40% of B_0 (expressed as $U_{40\%}B_0$). The fishing intensity for ENL stock rose sharply from the early 1960s, reached a peak in the early 1980s, and has since declined slightly. The fishing intensity for the Bay of Plenty and Hauraki Gulf stocks rose sharply from the early 1960s and reached a peak in the 1980s. It then declined by approximately 50% to 2007, but has since increased to 86% of the 1985 peak (FNZ 2019)(Figure A). The most recent MPI report concludes that there is a >60% chance that overfishing is occurring in East Northland and the Hauraki Gulf and Bay of Plenty stocks, and the current catch levels have a >90% chance of causing overfishing to continue in these areas (Figure B) (FNZ 2019). And despite some recent increases in biomass, fishing intensity is well above the intensity that would be required to maintain spawning biomass at the target level, $B_{40\%}$.

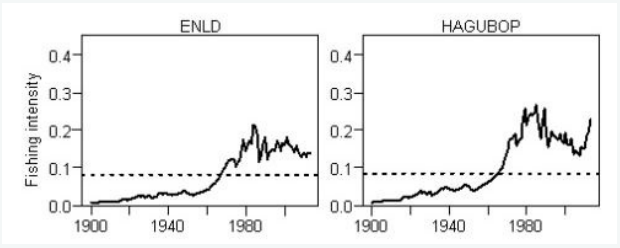


Figure 11: Estimated fishing intensity over time in SNA1 snapper stocks. Estimated fishing intensity since 1900 for the East Northland stock (left) and combined Hauraki Gulf and Bay of Plenty stocks (right). Dotted lines indicate target fishing intensity. From the MPI fisheries plenary report (MPI 2017 (1)).

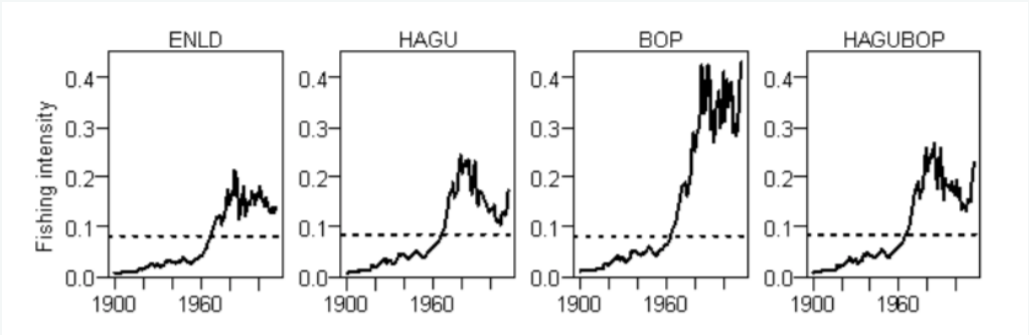


Figure 12: MPD estimates of fishing intensity by year and stock. Dotted lines show the intensity required to maintain the spawning biomass at 40%B0 (U40%B0) (FNZ 2019).

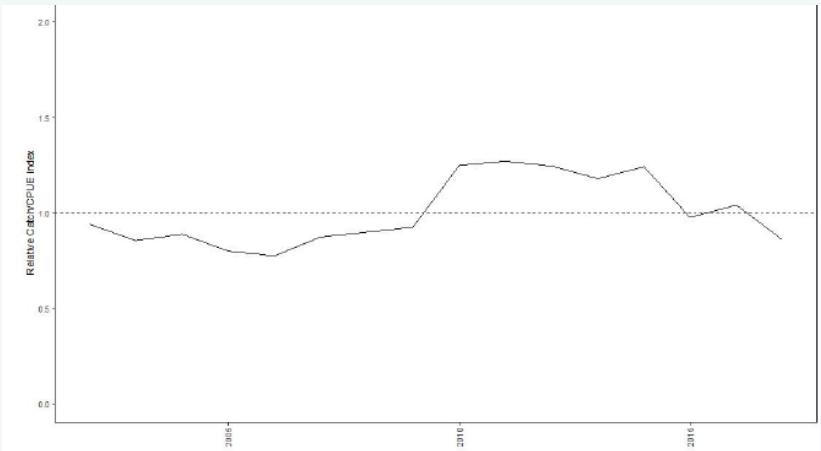
Southwest Pacific | Bottom trawls | New Zealand | SNA2

Moderate Concern

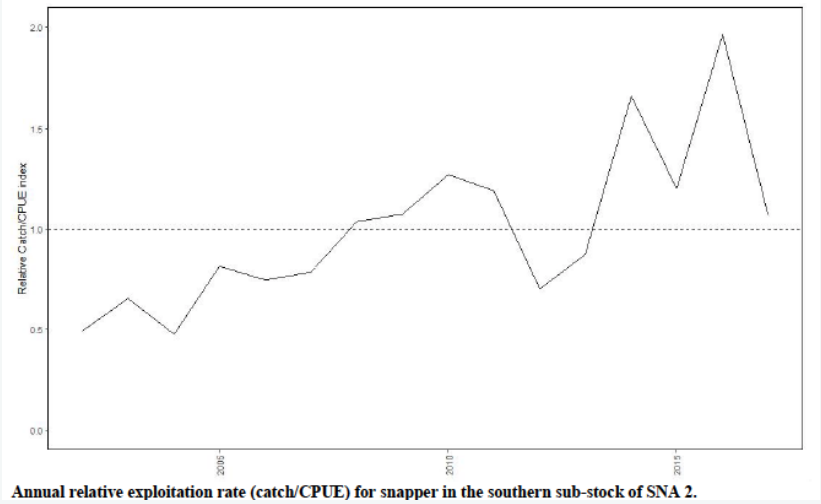
The most recent stock assessment (2018) concluded that the status of the two SNA2 sub-stocks in relation to the overfishing threshold F_{MSY} is unknown (FNZ 2019). The assessment also concluded that the probability of the current catch causing the stock to fall below the limit reference point or causing overfishing to continue/commence was "unknown." Due to the uncertainty of the current exploitation rate in relation to F_{MSY}, SNA2 snapper receive a moderate concern score for fishing mortality.

Justification:

There is no formal target reference point for exploitation rate established, although F_{MSY} is assumed. Exploitation rate is used as a proxy of fishing mortality for these stocks. In the northern stock, the 2017 exploitation rate remained around the series average, decreasing from above average to below average in the period from 2014 to 2017. In the southern stock the exploitation rate exhibited an upward trend from 2002 to 2016, but decreased to just above the series average in 2017 (FNZ 2019)(Figure A).



Annual relative exploitation rate (catch/CPUE) for snapper in the northern sub-stock of SNA 2.



Annual relative exploitation rate (catch/CPUE) for snapper in the southern sub-stock of SNA 2.

Figure 13: Annual exploitation rates of SNA2 snapper in the northern (top panel) and southern (bottom panel) portions of the stock (FNZ 2019).

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA7

Low Concern

Since 2013/14, roughly 80% of snapper landings has been taken as bycatch in other groundfish trawl fisheries. The most recent stock assessment (2020) concluded that fishing mortality is around 60% of the target level, and that overfishing is very unlikely (<10%) to be occurring. For all model runs, fishing mortality was well below the corresponding fishing mortality threshold ($F_{SB40\%}$). The assessment also concluded that the probability of the current catch causing biomass to decline below limit reference points or cause overfishing was less than 10% (FNZ 2020). SNA7 snapper fishing mortality is under target reference points, and therefore SNA7 snapper receive a low concern score for fishing mortality.

Justification:

Overfishing is considered to have occurred to from the mid-1960s to around 2010; however fishing mortality has declined consistently since 2006. The target fishing mortality is established as the level of mortality which would maintain the stock at 40% of unfished biomass, represented as $F_{SB40\%}$. Biomass is expected to continue to increase over at least the next 5 years (FNZ 2020)(Figure A).

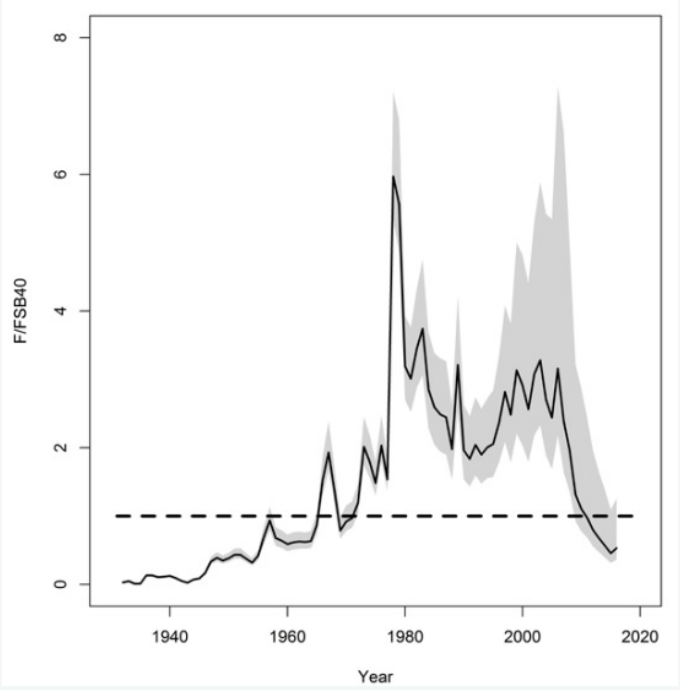


Figure 14: Trend in fishing mortality (y-axis, relative to target FSB40%) in the SNA7 snapper stock over time (x-axis). Solid line represents median estimated fishing mortality (with 90% confidence interval shaded) and dashed line represents interim target fishing mortality. From the fishery plenary report (Plenary 2018).

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA8

Low Concern

Fishing mortality estimates were updated in 2020 for SNA8 snapper. $F_{2019–20}$ was estimated to be 91% $F_{SB40\%}$, and it is unlikely (< 40%) to be above the overfishing threshold. F has declined significantly since 2000, and there is a less than 10% chance that current catch will cause overfishing to begin (FNZ 2020). Additional recent data based on the 2017 CPUE index assessment indicate that fishing mortality declined considerably from 2006/07 to 2010/11 and remained at the lower level through 2015/16 as evidenced by stable annual catches an increased CPUE (Figure A) (FNZ 2019). Fishing mortality has decreased markedly, and it is unlikely to be causing overfishing in SNA8; SNA8 snapper therefore receive a low concern score for fishing mortality.

Justification:

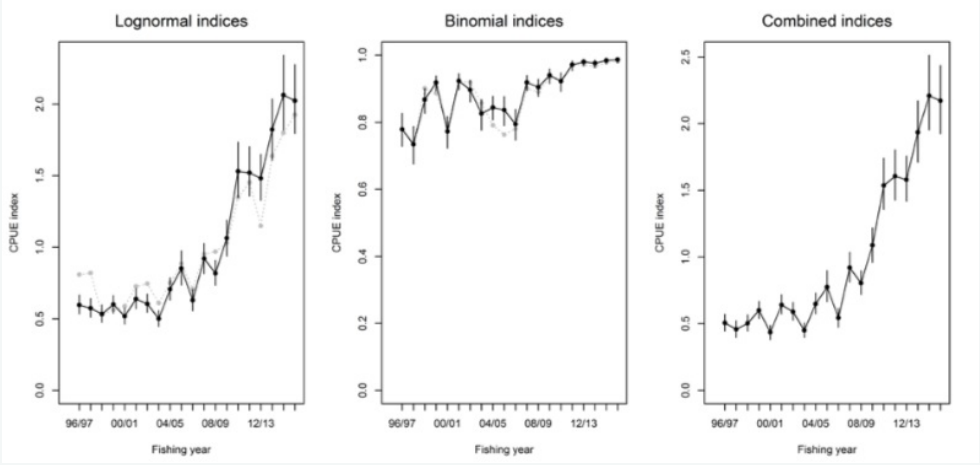


Figure 15: Standardised CPUE indices from the SNA 8 single trawl fishery, 1996/97-2015/16 (FNZ 2019).

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Factor 2.3 (Fishing Mortality) is Crtitical

Guiding Principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

SQUIREFISH			
REGION / METHOD	**SUB SCORE**	**DISCARD RATE/LANDINGS**	**SCORE**
Southwest Pacific | Bottom trawls | New Zealand | SNA7	2.236	1.000: < 100%	Yellow (2.236)
Southwest Pacific | Bottom trawls | New Zealand | SNA8	1.732	1.000: < 100%	Red (1.732)
Southwest Pacific | Bottom trawls | New Zealand | SNA2	1.000	1.000: < 100%	Red (1.000)
Southwest Pacific | Bottom trawls | New Zealand | SNA1	1.000	1.000: < 100%	Red (1.000)
Southwest Pacific | Danish seines | New Zealand | SNA8	1.732	1.000: < 100%	Red (1.732)
Southwest Pacific | Danish seines | New Zealand | SNA1	1.000	1.000: < 100%	Red (1.000)
Southwest Pacific | Set longlines | New Zealand | SNA7	2.236	1.000: < 100%	Yellow (2.236)
Southwest Pacific | Set longlines | New Zealand | SNA8	1.000	1.000: < 100%	Red (1.000)
Southwest Pacific | Set longlines | New Zealand | SNA1	1.000	1.000: < 100%	Red (1.000)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

SOUTHWEST PACIFIC | BOTTOM TRAWLS | NEW ZEALAND | SNA1			
SUB SCORE: 1.000	DISCARD RATE: 1.000	**SCORE: 1.000**	
SPECIES	**ABUNDANCE**	**FISHING MORTALITY**	**SCORE**
Parkinson's petrel	1.000: High Concern	1.000: High Concern	Red (1.000)
Tarakihi	1.000: High Concern	1.000: High Concern	Red (1.000)
Squirefish	2.330: Moderate Concern	1.000: High Concern	Red (1.526)
Smooth hammerhead	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Thorntail stingray	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Corals and other biogenic habitats	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Deep-water burrfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
John dory	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand rough skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

SOUTHWEST PACIFIC | BOTTOM TRAWLS | NEW ZEALAND | SNA1

SUB SCORE: 1.000 | DISCARD RATE: 1.000 | **SCORE: 1.000**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
New Zealand smooth skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
School shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White trevally	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand fur seal	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Jack mackerel	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)

SOUTHWEST PACIFIC | BOTTOM TRAWLS | NEW ZEALAND | SNA2

SUB SCORE: 1.000 | DISCARD RATE: 1.000 | **SCORE: 1.000**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Tarakihi	1.000: High Concern	1.000: High Concern	Red (1.000)
Thorntail stingray	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Corals and other biogenic habitats	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Deep-water burrfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
John dory	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand rough skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand smooth skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
School shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Squirefish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White trevally	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Jack mackerel	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)

SOUTHWEST PACIFIC | BOTTOM TRAWLS | NEW ZEALAND | SNA7

SUB SCORE: 2.236 | DISCARD RATE: 1.000 | **SCORE: 2.236**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Corals and other biogenic habitats	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Blue warehou	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red cod	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Tarakihi	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Squirefish	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

SOUTHWEST PACIFIC | BOTTOM TRAWLS | NEW ZEALAND | SNA8

SUB SCORE: 1.732 | DISCARD RATE: 1.000 | **SCORE: 1.732**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Maui dolphin	1.000: High Concern	3.000: Moderate Concern	Red (1.732)

SOUTHWEST PACIFIC | BOTTOM TRAWLS | NEW ZEALAND | SNA8

SUB SCORE: 1.732 | DISCARD RATE: 1.000 | **SCORE: 1.732**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Smooth hammerhead	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Thorntail stingray	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Corals and other biogenic habitats	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Deep-water burrfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
John dory	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand rough skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand smooth skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
School shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Tarakihi	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White trevally	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Jack mackerel	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Squirefish	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

SOUTHWEST PACIFIC | DANISH SEINES | NEW ZEALAND | SNA1

SUB SCORE: 1.000 | DISCARD RATE: 1.000 | **SCORE: 1.000**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Tarakihi	1.000: High Concern	1.000: High Concern	Red (1.000)
Squirefish	2.330: Moderate Concern	1.000: High Concern	Red (1.526)
Smooth hammerhead	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Thorntail stingray	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Corals and other biogenic habitats	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Deep-water burrfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
John dory	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand rough skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand smooth skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
School shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White trevally	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Jack mackerel	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)

SOUTHWEST PACIFIC | DANISH SEINES | NEW ZEALAND | SNA8

SUB SCORE: 1.732 | DISCARD RATE: 1.000 | **SCORE: 1.732**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Maui dolphin	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Smooth hammerhead	1.000: High Concern	3.000: Moderate Concern	Red (1.732)

SOUTHWEST PACIFIC | DANISH SEINES | NEW ZEALAND | SNA8

SUB SCORE: 1.732 | DISCARD RATE: 1.000 | **SCORE: 1.732**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Thorntail stingray	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Corals and other biogenic habitats	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Deep-water burrfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
John dory	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand rough skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
New Zealand smooth skate	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
School shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Tarakihi	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White trevally	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Jack mackerel	2.330: Moderate Concern	5.000: Low Concern	Green (3.413)
Squirefish	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

SOUTHWEST PACIFIC | SET LONGLINES | NEW ZEALAND | SNA1

SUB SCORE: 1.000 | DISCARD RATE: 1.000 | **SCORE: 1.000**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Parkinson's petrel	1.000: High Concern	1.000: High Concern	Red (1.000)
Squirefish	2.330: Moderate Concern	1.000: High Concern	Red (1.526)
Smooth hammerhead	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Flesh-footed shearwater	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Green sea turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Salvin's albatross	1.000: High Concern	5.000: Moderate Concern	Yellow (2.236)
Dogfish shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
School shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White trevally	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)

SOUTHWEST PACIFIC | SET LONGLINES | NEW ZEALAND | SNA7

SUB SCORE: 2.236 | DISCARD RATE: 1.000 | **SCORE: 2.236**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Salvin's albatross	1.000: High Concern	5.000: Moderate Concern	Yellow (2.236)
Red cod	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Tarakihi	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Squirefish	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

SOUTHWEST PACIFIC | SET LONGLINES | NEW ZEALAND | SNA8

SUB SCORE: 1.000 | DISCARD RATE: 1.000 | **SCORE: 1.000**

SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Parkinson's petrel	1.000: High Concern	1.000: High Concern	Red (1.000)
Smooth hammerhead	1.000: High Concern	3.000: Moderate Concern	Red (1.732)
Flesh-footed shearwater	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Green sea turtle	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Salvin's albatross	1.000: High Concern	5.000: Moderate Concern	Yellow (2.236)
Dogfish shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
School shark	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
White trevally	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Red gurnard	3.670: Low Concern	3.000: Moderate Concern	Green (3.318)
Squirefish	5.000: Very Low Concern	5.000: Low Concern	Green (5.000)

While significant data collection and analysis is conducted for offshore fisheries in New Zealand for species such as hake, hoki, ling, arrow squid and jack mackerel, there are fewer data and analyses available for the inshore fisheries (e.g. page 322 in (Fisheries New Zealand 2020)). According to the 2019 Fisheries Assessment Plenary Report (FNZ 2019), there are no summaries of observed fish and invertebrate bycatch in snapper target fisheries currently available, and the best available information is from research fishing surveys (p 1337). North Island catch composition data from the 2001 and 2010 trawl surveys reports identified species catch by weight and frequency for SNA1, SNA2 and SNA8 {Morrison & Parkinson 2001}(Jones et al 2010). Trawl survey catch composition data for these areas were extended to the Danish seine commercial fishery in these areas due to similarities in gear selectivity. Longline catch composition information from SNA1 (some observer coverage 1%-4% of hooks) (FNZ 2019) was extended to North Island fisheries in SNA2 and SNA8.

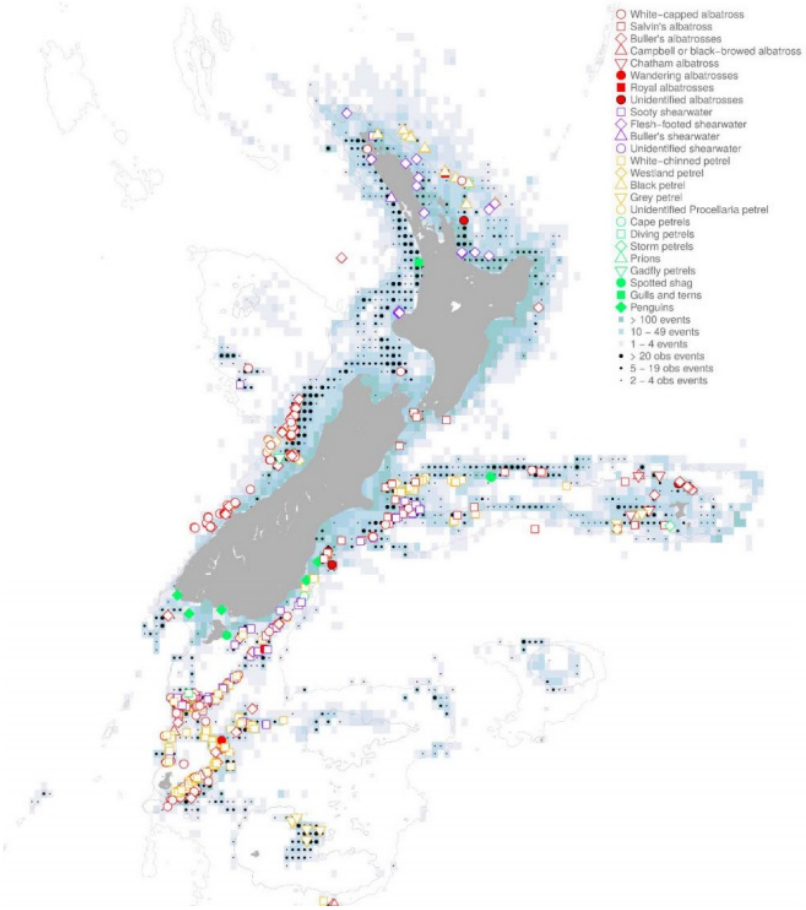
The population-level impacts of the fisheries targetting and otherwise retaining snapper on corals, sponges and other biogenic habitats are also assessed in this section (the impacts of fishing on the broader habitat and ecosystems is assessed under criterion 4).

Marine mammals (New Zealand fur seals and Maui dolphins) and green sea turtles with at least one observed mortality from 2000-current were included for the trawl and longline fisheries (pages 1337-1338 in (FNZ 2020)).

The main seabirds of concern identified are Parkinson's (black) petrel, Salvin's albatross, and Flesh-footed shearwater based on risk estimates presented in (Fisheries New Zealand 2020) (Table 3.2, page 28; image below) and the description of seabird interaction in snapper-targeted fisheries in (FNZ 2020) (page 1338). The map of observed captures below was also used to determine which SNAs each species is most likely to be caught in (Fisheries New Zealand 2020) (Figure 8.3, page 230; image below).

Species	PBR	Inshore trawl	Flatfish trawl	Bluenose BLL	Hapuka BLL	Minor BLL	Snapper BLL	Small ling BLL	Large ling BLL	Small STN SLL	Large STN SLL	Bigeye SLL	Swordfish SLL	Hoki trawl	Hake trawl	Ling trawl	SBW trawl	Scampi trawl	Squid trawl	Middle depth trawl	Deepwater trawl	Flatfish SN	Shark SN	Minor SN	TOTAL RISK RATIO
Black petrel	437	0.20	0	0.18	0.06	0.04	0.22	0	0	0	0	0.29	0.03	0.01	0	0	0	0.01	0	0.01	0	0	0	0	1.15
Salvin's albatross	3598	0.30	0.03	0	0	0.01	0	0.09	0	0	0	0	0	0.12	0	0.01	0.01	0.08	0	0.09	0.02	0	0	0	0.78
Flesh-footed shearwater	1451	0.29	0.01	0	0.04	0.04	0.19	0	0	0	0	0.02	0.01	0.01	0	0	0	0.03	0	0.01	0	0	0	0	0.67
Westland petrel	350	0.15	0.05	0	0.01	0.01	0	0.02	0	0.04	0	0.01	0	0.07	0.01	0	0	0	0	0.03	0	0.01	0.01	0	0.48
Southern Buller's albatross	1369	0.03	0.01	0	0	0	0	0.02	0	0.04	0.01	0	0	0.14	0.01	0.01	0	0.01	0.05	0.04	0	0	0	0	0.39
Chatham Island albatross	425	0.01	0	0	0.01	0.01	0	0.20	0.01	0	0	0	0	0.02	0	0	0	0	0	0.01	0.06	0	0	0	0.36
New Zealand white-capped albatross	10915	0.15	0.05	0	0	0	0	0	0	0.01	0	0.01	0	0.04	0	0.01	0	0.01	0.03	0.03	0	0	0	0	0.35
Gibson's albatross	496	0	0	0	0	0	0	0	0	0.07	0	0.04	0.19	0	0	0	0	0	0	0	0	0	0	0	0.34
Northern Buller's albatross	1628	0.01	0	0	0	0	0	0.02	0	0.03	0	0.07	0	0.03	0	0	0	0.03	0	0.02	0	0	0	0	0.25
Antipodean albatross	364	0	0	0	0	0	0	0	0	0.05	0	0.02	0.10	0	0	0	0	0	0	0	0	0	0	0	0.20
Otago shag	285	0.01	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14
Northern giant petrel	336	0	0	0	0.02	0.01	0.01	0	0	0	0	0	0	0.03	0	0	0	0.01	0	0.01	0.01	0	0	0	0.14
Spotted shag	3710	0.02	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09
Yellow-eyed penguin	287	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.04	0.01	0.08
Campbell black-browed albatross	1980	0	0	0	0	0	0	0	0	0.02	0	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	0.08
White-chinned petrel	25626	0	0	0	0	0	0	0.02	0.01	0	0	0	0	0.01	0	0	0	0.01	0.01	0	0	0	0	0	0.05
Northern royal albatross	716	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
Foveaux shag	207	0	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04
Grey petrel	5526	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0.04
Southern royal albatross	848	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02
Snares Cape petrel	1601	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01
Little black shag	338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01
Fishery group total -- all species		1.19	0.38	0.19	0.14	0.11	0.41	0.39	0.03	0.27	0.02	0.47	0.34	0.49	0.02	0.03	0.02	0.18	0.09	0.24	0.10	0.02	0.05	0.02	5.72

Figure 21: Mean species‖level risk estimates, disaggregated by target fisheries. Highlighted cells (increasing yellow‖red) identify fisheries that are responsible for an increasing proportion of species‖level risk. Target fisheries with zero risk to all species (rounded to two decimal places) are not shown; these include: albacore SLL, minor SLL, jack mackerel trawl, and grey mullet set net. Likewise, species for which mean total risk ratio rounds to zero are not shown. Table and caption taken verbatim from (Fisheries New Zealand 2020) (Table 3.2, page 28).



All observed seabird captures in trawl, surface longline, bottom longline, set net and purse seine fishing within New Zealand region, between October 2017 and September 2018. The colour within each 0.2 degree cell indicates the number of fishing events (tows and sets, darker colours indicate more fishing) and the black dots indicate the number of observed fishing events (larger dots indicate more observations). The coloured symbols indicate the location of observed seabird captures, randomly jittered by 0.2 degrees. The 500 m and 100 m depth contours are shown. http://data.dragonfly.co.nz/psc Data version v2019001. Table and caption taken verbatim from (Fisheries New Zealand 2020) (Figure 8.3, page 230).

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance
(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality
(same as Factor 1.2 above)

Factor 2.3 - Modifying Factor: Discards and Bait Use
Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

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.

Ratio of bait + discards/landings	Factor 2.3 score
<100%	1
>=100	0.75

Blue warehou

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA7

Moderate Concern

Blue warehou are a common bycatch species associated with the snapper fishery in SNA7. The seasonal pattern of landings suggest that there is a coastal migration of blue warehou, and there are limited data on stock structure. Biomass estimates are available from a number of trawl surveys from the 1980s and 1990s; however more current estimates of reference and current biomass are not available for this stock (FNZ 2020a). Blue warehou are not listed by IUCN but they are not highly vulnerable (Table 1), and they receive a moderate concern for abundance due to limited data.

Justification:

Table 1. Blue warehou, New Zealand Trawl and Danish Seine

Blue warehou, New Zealand Trawl and Danish Seine							
Productivity Attributes	**Value**	**Score (1 = low risk; 2 = medium risk; 6 = high risk)**	**Reference**	**Susceptibility Attribute**	**Information**	**Score (1 = low risk; 2 = medium risk; 6 = high risk)**	**Reference**
Average age at maturity (years)	4.5	1	FNA 2020a	**Areal overlap**		3	FNA 2020a
Average maximum age (years)	22	2	FNA 2020a	**Vertical overlap**		3	FNA 2020a
Fecundity (eggs/yr)	0			**Selectivity of fishery**		2	FNA 2020a
Average maximum size (cm) (not to be used when scoring invertebrate species)	75	1	FNA 2020a	**Post-capture mortality**		3	FNA 2020a
Average size at maturity (cm) (not to be used when scoring invertebrate species)	50	2		**Susceptibility Subscore**		2.325	
Reproductive strategy	Broadcast spawner	1	FNA 2020a				
Trophic level	3.7	3	fishbase.org	**Productivity-Susceptibility Score**	2.89		
Density dependence (invertebrates only)	NA			**Vulnerability Rating (high, medium or low)**	Medium		
Quality of Habitat	Moderately altered	2	FNA 2020a				
Productivity Subscore		**1.714285714**					

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA7

Moderate Concern

There are no recent estimates of fishing mortality for blue warehou, however catches have been well below TACCs in SNA7 since 2000 (FNZ 2020a). Fishing mortality of blue warehou relative to reference points is unknown, and they therefore for receive a moderate concern for fishing mortality in Danish seine and trawl fishing gear.

Corals and other biogenic habitats

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

High Concern
New Zealand has conducted numerous ecosystem assessments reviewing assessing the linkages between marine fisheries and biogenic habitats and corals in coastal waters (Morrison et al. 2014). For instance, a recent mapping study of the Hauraki Gulf seafloor found significant colonies of tubeworms (*Galeolaria hystrix*) up to 1.5 metres high covering hundreds of meters (Scoop News 2020). These areas may provide important habitats for some fish species (Morrison et al. 2014). Despite survey efforts, bycatch species is not typically identified, and abundance of corals and biogenic habitats is unknown. Unknown corals and other biogenic habitats receive a high concern score for abundance due to data deficiencies and their inherent vulnerability per the Seafood Watch Criteria.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

Low Concern
Corals and other biogenic habitats are occasionally taken incidentally in Danish seine and bottom trawl gear {Morrison & Parkinson 2001}. It is important to note the depth distribution of the most common deep sea corals typically does not overlap with the the more shallow operations of the snapper fleet (Baird et al. 2015)(Mace, FNZ, Pers. comm. 2020). However, there are biogenic species such as bryozoans, sponges, horse mussels and sea urchins that are more likely to come into contact with bottom fishing gear in the region {Morrison & Parkinson 2001}. A number of management measures are in place to protect corals and other biogenic habitats in New Zealand waters, such as marine reserves or areas where bottom impacting gear is prohibited. Trawls are prohibited from use in all harbors and estuaries and the inner Hauraki Gulf (Baird et al. 2015). Per the Unknown Bycatch Matrix, benthic invertebrates and corals and other biogenic habitats receive a high concern score for fishing mortality in bottom trawl fishing gear, however, due to differences in the vertical distribution of the fleet and hard deep sea corals and protection measures in place. Corals and other biogenic habitats receive a low concern score for fishing mortality in Danish seine and bottom trawl gear because there is minimal overlap with fishing efforts, and the probability of bycatch is low.

Deep-water burrfish

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern
Porcupine fish are categorized by the IUCN as Data Deficient (Matsuura et al. 2010). No stock assessment exists for porcupine fish (also known as deep-water burrfish), however they are commonly found off the North Island based on the 2010 survey from the Bay of Islands (Jones et al 2010). Porcupine fish are medium vulnerability per the Seafood Watch Productivity Sensitivity Analysis (PSA; Table 2), and they receive a medium concern for abundance per Seafood Watch standards.
Justification:

Table 2. Porcupine fish, New Zealand Trawl and Danish Seine

Porcupine fish, New Zealand Trawl and Danish Seine							
Productivity Attributes	**Value**	**Score (1 = low risk; 2 = medium risk; 7 = high risk)**	**Reference**	**Susceptibility Attribute**	**Information**	**Score (1 = low risk; 2 = medium risk; 7 = high risk)**	**Reference**
Average age at maturity (years)	NA			**Areal overlap**		3	
Average maximum age (years)	NA			**Vertical overlap**		3	
Fecundity (eggs/yr)	NA			**Selectivity of fishery**		2	
Average maximum size (cm) (not to be used when scoring invertebrate species)	50	1		**Post-capture mortality**		3	
Average size at maturity (cm) (not to be used when scoring invertebrate species)	NA			**Susceptibility Subscore**		2.325	
Reproductive strategy	Broadcast spawner	1	Meis 2007				
Trophic level	3.6	3	fishbase.org	**Productivity-Susceptibility Score**	2.91		
Density dependence (invertebrates only)	NA			**Vulnerability Rating (high, medium or low)**	Medium		
Quality of Habitat	Moderately altered	2					
Productivity Subscore		**1.75**					

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8

Moderate Concern
Fishing mortality of deep-water burrfish (porcupine fish) relative to reference points is unknown, and they therefore for receive a moderate concern for fishing mortality in Danish seine and trawl fishing gear.

Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern
Fishing mortality of cucumber fish and deep-water burrfish (porcupine fish) relative to reference points is unknown, and they therefore for receive a moderate concern for fishing mortality in Danish seine and trawl fishing gear.

Dogfish shark

Factor 2.1 - Abundance

Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

Moderate Concern
Data on spiny dogfish stock structure and abundance are limited, and there are no abundance or biomass estimates and no target reference points. Two independent data-limited sources, including survey data and commercial fishery CPUE (from the South Island) suggest that the spiny dogfish stock abundance is at or above the long-term mean (FNZ 2019). The New Zealand stock of spiny dogfish is IUCN Least Concern (Fordham et al. 2016), and some estimates from New Zealand suggest spiny dogfish abundance is steady to increasing; however data sources that inform abundance estimates are from the South Island only, which reflects a degree of uncertainty about stock status around the Northern Island. Spiny dogfish therefore receive a moderate concern for abundance in light of Least Concern IUCN status and limited reference points, especially for the North Island.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

Moderate Concern
There are no reference points with regards to fishing mortality for spiny dogfish in New Zealand. Landings of spiny dogfish have been well below TACCs for the Southern Island due to the limited market for this species (FNZ 2019). Data on bycatch in the snapper trawl and danish seine fleets around the Northern Island do not exist; however the IUCN states that it is not known if this level of fishing is sustainable, and that catch rate analyses and trawl survey biomass indices show no sign of significant declines (Fordham et al. 2016). Spiny dogfish receive a moderate concern for fishing mortality in the the snapper trawl and danish seine fleets due to data limitations and unknown fishing mortality parameters.

Flesh-footed shearwater

Factor 2.1 - Abundance

Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

High Concern
Flesh-footed shearwaters are IUCN Near Threatened, with an estimate of roughly 148,000 individuals or 74,000 breeding pairs, with a decreasing trend (Birdlife International 2019). Recent surveys in New Zealand have found fewer flesh-footed shearwater pairs than expected, and a survey of 8 major colonies found the total New Zealand population is less than 12,000 pairs. Declines are evident, and the species is now considered threatened in New Zealand (NZBirdsOnline 2019). Flesh-footed shearwaters receive a high concern score due to their IUCN listing and declining abundance trends.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

Low Concern
Flesh-footed shearwater are taken primarily in longline fisheries targeting snapper off northern New Zealand, and the estimated rate of capture is as much as 0.1 birds per 1000 hooks {Richardson et al. 2017}. From 2002-2017, over 72 flesh-footed shearwaters were captured by longline fisheries; however, these are considered minimum estimates because observer coverage rates are so low (FNZ 2019). The 2020 Aquatic Environment and Biodiversity Annual Review 2019–20 (Fisheries New Zealand 2020) provides an estimate of the risk of total fishing mortality exceeding a sustainable level ("PBR") for each seabird species, and a disaggregation of that risk by fishery (Table 3.2, reproduced verbatim in the summary to criterion 2 in this Seafood Watch report). Total estimated fishing mortality does not exceed PBR for flesh-footed shearwater, and the percentage of PBR taken in this fishery is less than 50% (29%). There is significant uncertainty in these values; however, the range of likely mortalities is still below the mean estimate for PBR (Figure 3.2 in (Fisheries New Zealand 2020); Figure reproduced in the Parkinson's petrel justification section)((Richard et al. 2017). A score of low concern is given (per Table 2.2.1 in the Seafood Watch Standard for Fisheries V3.2; applied here for seabirds).

Green sea turtle

Factor 2.1 - Abundance

Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

High Concern
The IUCN classifies green sea turtles globally as Endangered with a decreasing population trend. Based on the actual and extrapolated changes in subpopulation size at the 32 Index Sites, it is apparent that the mean annual number of nesting females has declined by 48% to 67% over the last three generations (Seminoff 2004). However, these declines are not consistent across all populations, and in the Western Pacific Ocean, Australia represents one of the key nesting grounds for many green sea turtles (and the the number of individuals has actually increased by up to 40% at some sites). IUCN also states that because many of the threats that have led to these declines are not reversible and have not yet ceased, it is evident that green turtles face a measurable risk of extinction, and green sea turtles therefore receive a high concern despite some regional population increases around Australia.
Justification:
Green sea turtles have been listed on the Convention on International Trade in Endangered Species (CITES) since 1975 and are currently listed on Appendix 1 because they are threatened with extinction and international trade is prohibited.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

Low Concern
The incidental capture in fisheries is considered a major threat to green sea turtles worldwide, and green sea turtles are bycatch in pelagic longline and purse seine fisheries in the Pacific Ocean (Seminoff 2004). Between 2002–03 and 2014–15 there was one observed capture of a green turtle in the snapper bottom longline fishery occurring in the Northland and Hauraki fishing area (FNZ 2020) . More recently, 2 turtles were taken in 2016-17 and 4 turtles were taken 2017-18 in surface longline fisheries off the Northern Island (FNZ PSC 2019). The total cumulative estimate of green sea turtle interactions across the Pacific was approximately 6,500 from 1989-2015; however these estimates are highly uncertain (NMFS 2019a). Fisheries data are limited (3-4% observer coverage), and there are no management reference points; green sea turtles therefore receive a low concern score for fishing mortality in the New Zealand snapper longline fishery because they are not a major contributor to overall green sea turtle mortality (<10%).

Jack mackerel

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern
Stock assessments are not available for jack mackerel species off New Zealand, and data collection is limited as the management system does not differentiate between the three species frequently caught (FNZ 2019a). Preliminary stock assessments for two of the three species were undertaken in 2007, primarily to determine the species splits for commercial landings off western New Zealand. These analyses were insufficient to estimate biomass of any one jack mackerel species. Stable catches and reported landings of jack mackerel species suggest that the stock may be stable (FNZ 2019a). The IUCN lists Jack Mackerel (*Trachurus declivis)* as Least Concern (Smith-Vaniz et al. 2018), and jack mackerel receive a moderate concern for abundance due to unknown stock status relative to reference points.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8

Low Concern
There are no reference points with regards to jack mackerel fishing mortality, although a preliminary 2011 assessment suggested that jack mackerel off the west coast of New Zealand were unlikely (<40%) to be experiencing overfishing (FNZ 2019a). Jack mackerel is subject to significant targeted trawl fisheries in New Zealand (around 40,000 tons annually), and it is likely that jack mackerel landings in the snapper trawl fisheries are relatively small in comparison (Mace, FNZ, Pers. comm. 2020)(FNZ 2019). Therefore, jack mackerel receive a low concern for fishing mortality because targeted snapper fisheries jack mackerel catch is relatively small in comparison to target jack mackerel fisheries, and the cumulative fishing mortality is likely within reference points.

John dory

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern

John dory in New Zealand waters are managed as five stocks. This review will address stock status trends for three stocks off the North Island relevant to snapper trawl and Danish seine fisheries. The 2019 assessment concluded that is not possible at this time to estimate current biomass for John Dory stocks, which are largely driven by major recruitment events. However, the stock assessment concluded that the stock is Unlikely (<40%) to be at or above the target reference point (the mean of the CPUE indices from 1995-2011) in light of recent declines. The report also concluded that there was a <40% to <10% chance the stocks are below the soft limit reference points (50% of target) and <10% that any stock is below the hard reference point (25% of target) (FNZ 2019a). John dory are not a Highly Vulnerable species (Table 3), and they receive a moderate concern in light of their vulnerability status, data deficiencies and moderate declines by some stocks off the North Island.

Justification:

John Dory in New Zealand are listed as IUCN Data Deficient with a stable population trend (Iwamoto 2015). In 2018, the CPUE indices for the three sub-areas (Hauraki Gulf and east Northland, Bay of Plenty, and west coast North Island) were updated to 2016–17. North and east of the North Island, the standardized CPUE indices fluctuated moderately during the 1990s and 2000s and then declined in the mid- to late- 2000s to 2012–13 and then increased relatively slowly from 2015-16 to 2016–17. Conversely, west of the North Island the standardized CPUE indices were at a high level in 2010–11 to 2012–13 and declined over the subsequent four years (to 2016–17) to below the series mean (FNZ 2019a).

Table 3. John Dory New Zealand Danish seine and trawl

John Dory, New Zealand Trawl and Danish Seine							
Productivity Attributes	**Value**	**Score (1 = low risk; 2 = medium risk; 9 = high risk)**	**Reference**	**Susceptibility Attribute**	**Information**	**Score (1 = low risk; 2 = medium risk; 9 = high risk)**	**Reference**
Average age at maturity (years)	4	1	fishbase.org	**Areal overlap**		3	FNZ 2019a
Average maximum age (years)	12	2	fishbase.org	**Vertical overlap**		3	FNZ 2019a
Fecundity (eggs/yr)				**Selectivity of fishery**		2	FNZ 2019a
Average maximum size (cm) (not to be used when scoring invertebrate species)	40	1	seafood.co.nz 2019	**Post-capture mortality**		3	
Average size at maturity (cm) (not to be used when scoring invertebrate species)	32	1	FNZ 2019a	**Susceptibility Subscore**		2.325	
Reproductive strategy	Broadcast spawner	1	FNZ 2019a				
Trophic level	4.5	3	fishbase.org	**Productivity-Susceptibility Score**	2.81		
Density dependence (invertebrates only)	NA			**Vulnerability Rating (high, medium or low)**	Medium		
Quality of Habitat	Moderately altered	2	FNZ 2019a				
Productivity Subscore		**1.571428571**					

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern
Snapper bottom trawl and danish seine gear account for the majority of cumulative fisheries mortality in the region. The absolute level of fishing mortality that corresponds to the target biomass levels for John Dory is unknown (FNZ 2019a). Fishing mortality proxies derived from total area catch divided by CPUE indices suggest that fishing mortality in 2 of the 3 stocks reviewed may be at or above reference levels (mean of series) in a number of recent years. John dory receive a moderate concern for fishing mortality because fishing mortality is unknown relative to reference points, and fishing mortality indices suggest the exploitation rate of this species may be above target management levels.

Maui dolphin

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8

High Concern
Ma¯ui dolphin are New Zealand's only endemic dolphin species and are currently restricted to a relatively small segment of coastline along the west coast of New Zealand's North Island in SNA8. They are ranked Nationally Critical under the New Zealand Threat Classification System (Baker et al. 2016) and are categorized by the IUCN as Critically Endangered (Reeves et al. 2013). For 2015–16 surveys, the census abundance of Ma¯ui dolphins was estimated to be 63 individuals of age 1 year or older (95% CL = 57, 75), using a two-sample, closed-population model, representing a significant decline from 2001-07 and 2010-11 surveys (Baker et al. 2016). Ma¯ui dolphins receive a high concern score for abundance due to their endangered status.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern
There are no documented cases of Maui dolphins appearing in snapper trawl or Danish seine gear in SNA8, however observer coverage is exceedingly limited (around 1.5%), so there is a high degree of uncertainty around this information. The International Whaling Commission reports that in years when separate statistics were provided, the number of reported Maui dolphin entanglements was 2, 3, 2 and 1 in 2000, 2001, 2002 and 2012 respectively, primarily in gillnet and trawl gear {Slooten & Dawson 2016}. Population viability analyses using current abundance estimates together with entanglement rates and historical and current fishing effort indicated a high risk of continued decline, and that gillnet entanglement had caused much of the decline since 1970 in the North Island population (Reeves et al. 2013). In summary, the cumulative fisheries mortality exceeds a sustainable level for this small, endemic population, however the proportion of takes attributable to the snapper trawl and Danish seine gear is unknown, and they receive a moderate concern for Maui dolphin fishing mortality.

New Zealand fur seal

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1

Low Concern
New Zealand fur seals have a widespread distribution from the New Zealand and Australian subantarctic islands through to temperate northern New Zealand and southern Australia (Chilvers 2018). New Zealand fur seals are classified as IUCN Least Concern with an increasing population trend {Chilvers & Goldsworhty 2015}. Overall, the total population of New Zealand Fur Seals across both New Zealand and Australia is estimated to be approximately 200,000 and is increasing at rates as high as 10% per year in some regions. New Zealand fur seals receive a low concern score for abundance because while their population is increasing, they have not yet expanded to what was thought to be their pre-sealing population levels or distribution (Chilvers 2018).

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1

Moderate Concern
There were two reported takes of New Zealand fur seals in snapper trawl fisheries in SNA1 from 2002-2017 (FNZ 2019), however negligible observer coverage results in unknown estimates of New Zealand actual fur seal fishing mortality for this fleet. In 2017-18, 80 New Zealand fur seals fleet were observed captured in trawl gear (primarily off the North Island), 12 were captured in surface longline, and 11 were captured in setnet gear. Trawl gear observed captures peaked at 159 in 2013-14 (FNZ PSC 2019). New Zealand does not have a hard cap on New Zealand fur seals takes, although historically they adopted a Potential Biological Removal limit of 63 sea lions, but this does not appear to be in effect currently {Childerhouse & Gales 1988}. Despite a recovering population trend, fishing mortality is still considered a primary threat to New Zealand fur seals via direct (mortality) and indirect (entanglement, resource competition) interactions (Chilvers 2018). In summary, cumulative and snapper fishery specific fishing mortality is unknown, and New Zealand fur seals receive a moderate concern score for fishing mortality in snapper trawl gear.

New Zealand rough skate

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

Moderate Concern
New Zealand rough skates are elasmobranchs and therefore are typically categorized as Vulnerable per Seafood Watch Standards. The IUCN lists rough skates as a species of Least Concern with a stable population trend {Finucci & Kyne 2018}, and therefore New Zealand rough skates receive a moderate concern score for abundance.
Justification:
The rough skate a medium-sized deepwater skate, endemic to New Zealand in the Southwest Pacific. It occurs on the continental shelf primarily at depths of 17-600 m, but has also been recorded to 1,500 m. The species is considered to have a relatively large population size, and biomass estimates have fluctuated without trend {Finucci & Kyne 2018}.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

Moderate Concern
Rough skates are fished commercially in New Zealand, in association with smooth skates. Skates were introduced to a Quota Management System beginning in 2003. Smooth and rough skate species are difficult to identify at the species level, so landings data are somewhat uncertain. Average landings of rough skates and smooth skates have ranged from 1500 t - 2100 t and 600 t - 800 t, respectively from 2010-2018 and have generally been within regional TACCs (FNZ 2019). Both skate species are also caught frequently in snapper trawl fisheries, although the impact of the snapper trawl fleet on rough skate and smooth skate fishing mortality is unknown. There are no reference points relative to smooth skate or rough skate fishing mortality, and the snapper trawl fisheries therefore receive a moderate concern.

New Zealand smooth skate

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

Moderate Concern
Smooth skates are distributed throughout most of New Zealand, and smooth skate stock structure and movement patterns are data limited. Biomass estimates of smooth skates are not available for the North Island, where snapper trawl fisheries are operating (FNZ 2019). The IUCN categorizes New Zealand smooth skates as Least Concern with a stable population trend {Finnuci & Kyne 2018}, and smooth skates receive a moderate concern in light of data deficiencies, IUCN status and vulnerable elasmobranch life history traits.
Justification:

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

Moderate Concern
Rough skates are fished commercially in New Zealand, in association with smooth skates. Skates were introduced to a Quota Management System beginning in 2003. Smooth and rough skate species are difficult to identify at the species level, so landings data are somewhat uncertain. Average landings of rough skates and smooth skates have ranged from 1500 t - 2100 t and 600 t - 800 t, respectively from 2010-2018 and have generally been within regional TACCs (FNZ 2019). Both skate species are also caught frequently in snapper trawl fisheries, although the impact of the snapper trawl fleet on rough skate and smooth skate fishing mortality is unknown. There are no reference points relative to smooth skate or rough skate fishing mortality, and the snapper trawl fisheries therefore receive a moderate concern.

Parkinson's petrel

Factor 2.1 - Abundance

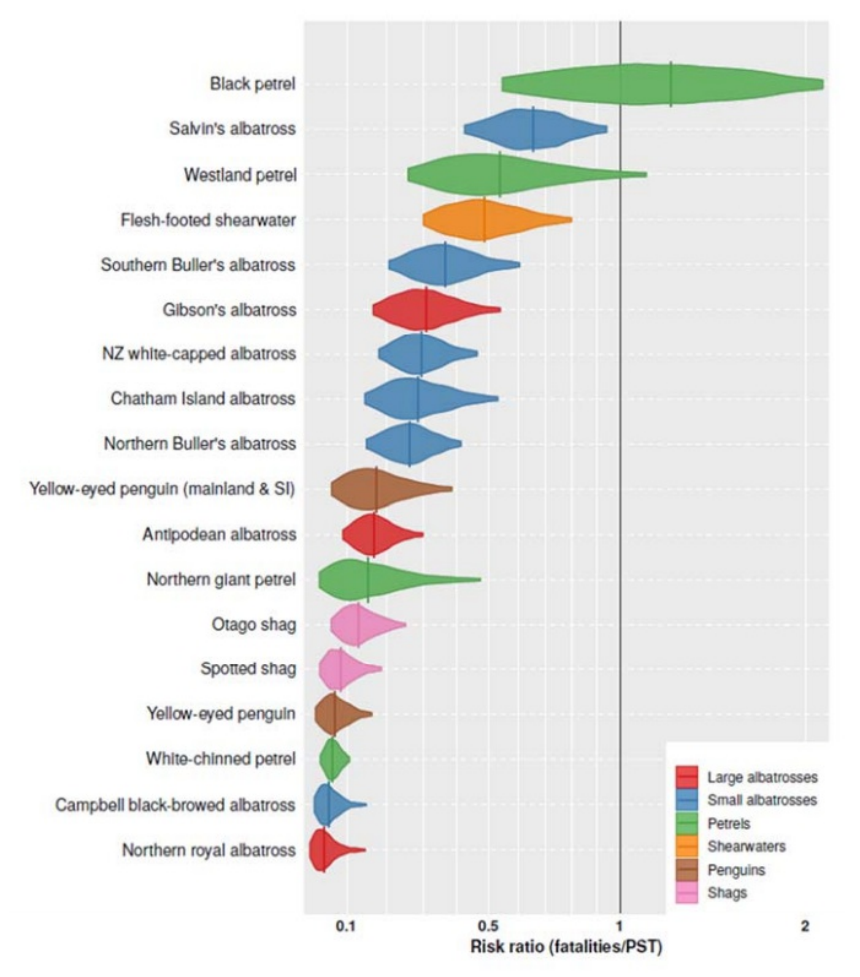
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

High Concern
Parkinson's petrel (black petrel) are IUCN Vulnerable with a stable population trend globally (BirdLife International 2018). Parkinson's petrel is a New Zealand endemic seabird species, with around 1200 pairs breeding annually around the North Island (Abraham et al. 2015). From counts within census grids at the Great Barrier Island colony, it appears that the number of breeding pairs of black petrel decreased between 2000–01 and 2011–12, followed by a slight increase from 2012–13. Demographic modeling of the population did not provide clear evidence for a population change over this period (Abraham et al. 2015). In New Zealand, Parkinson's petrels are listed as Threatened: Nationally Vulnerable (FNZ 2019), and in light of their IUCN and national listings, they receive a high concern score for abundance.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

High Concern
Parkinson's petrels (also known as black petrels) are taken primarily in longline fisheries (38 individuals from 2002-2017) and are listed as the seabird species at greatest risk of negative population impacts from commercial fishing (FNZ 2019). Estimates of snapper fishery and cumulative fishing mortality are considered minimums due to limited observer coverage in most fisheries regionally. The 2020 Aquatic Environment and Biodiversity Annual Review 2019–20 (Fisheries New Zealand 2020) provides an estimate of the risk of total fishing mortality exceeding a sustainable level ("PBR") for each seabird species, and disaggregation of that risk by fishery (Table 3.2, reproduced verbatim in the summary to criterion 2 in this Seafood Watch report). Total estimated fishing mortality does exceed PBR for Parkinson's petrel. The inshore trawl and snapper longline fisheries are two of the four substantial contributors to fishing mortality on this species (together accounting for 42% of the risk). There is significant uncertainty in these values; however, the majority of the range of likely mortalities is above the estimated sustainable level (Figure 3.2 in (Fisheries New Zealand 2020); Figure reproduced in the Justification section below)(Richard et al. 2017). A score of high concern is given (per Table 2.2.1 in the Seafood Watch Standard for Fisheries V3.2; applied here for seabirds).
Justification:



Standard species**l**level output of the New Zealand Seabird Risk Assessment. PST is slightly higher than PBR (447 vs 437). See Figure 3.2 in (Fisheries New Zealand 2020) for more information (most of the caption is missing in the document, and the original reference for the image is not present in the reference list for the chapter). .

Red cod

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderate Concern
There are no current abundance estimates available for New Zealand red cod (also known as Hoka), however analyses based on a 2017 west coast trawl survey suggested a moderate increase in the biomass of red cod from 2015 (which was the fourth lowest in the time series). Red cod are a fast-growing, short-lived species with few fish in the commercial fishery older than six years of age (FNZ 2019). Red cod exhibit moderate vulnerability (Table 5), and they receive a moderate concern for abundance.

Justification:

Table 5. Red cod, New Zealand trawl and Danish seine

Red cod, New Zealand Trawl and Danish Seine					
Productivity Attributes	**Value**	**Score (1 = low risk; 2 = medium risk; 10 = high risk)**	**Reference**	**Susceptibility Attribute**	**Information**
Average age at maturity (years)				**Areal overlap**	
Average maximum age (years)				**Vertical overlap**	
Fecundity (eggs/yr)	30,000,000	1	fishbase.org	**Selectivity of fishery**	
Average maximum size (cm) (not to be used when scoring invertebrate species)	90	1	FNZ 2019	**Post-capture mortality**	
Average size at maturity (cm) (not to be used when scoring invertebrate species)	52	2	FNZ 2019	**Susceptibility Subscore**	
Reproductive strategy	Broadcast spawner	1	FNZ 2019		
Trophic level	4.5	3	fishbase.org	**Productivity-Susceptibility Score**	2.86
Density dependence (invertebrates only)	NA			**Vulnerability Rating (high, medium or low)**	Medium
Quality of Habitat	Moderately altered	2	FNZ 2019		
Productivity Subscore		**1.666666667**			

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderate Concern
Red cod are primarily taken in conjunction with the following commercial fisheries: stargazer, red gurnard,tarakihi and various other species in the West Coast South Island target bottom trawl fisheries (FNZ 2019). Fishing mortality reference points are unavailable for this stock, and red cod receive a moderate concern score for fishing mortality in the snapper trawl fishery.

Red gurnard

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Low Concern
Stock structure data for red gurnard are not available, however they are managed as discrete stocks around the east and west sides of the North and Sound Islands. Because they are no data to differentiate these stocks, they will be reviewed here as one stock based on general trends and extant data. Biomass estimates for this stock are derived from CPUE indices or trawl survey results depending on the availability of fishery dependent and independent data regionally. Standardized CPUE indices off the northwest Island and western south Island suggest that red gurnard biomass is increasing and is likely to above reference points and is well above the long-term mean. Off the northeast Island, standardized CPUE indices have been at or near the series mean (FNZ 2019). Additionally, recent trawl survey data from the east and west coasts of the South Island suggest the red gurnard stock as near or at the series high (FNZ 2019). A number of data limited sources indicate red gurnards around New Zealand are stable to increasing in most areas, and they receive a low concerns score for abundance.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderate Concern
Red gurnard are taken in targeted trawl fisheries and as bycatch in inshore snapper, tarakihi, and travally fisheries. Fishing mortality reference points are not defined for red gurnard in all subareas. Fishing intensity proxies or exploitation rate analyses suggest that in most areas, fishing intensity has been stable (since the mid-1990s to current) with no trend, with the exception of the eastern South Island subarea, where the fishing intensity proxy increased in 2010 and remains above the long-term average (FNZ 2019). Red gurnard are managed via a Quota system, and regional TACCs have been exceeded intermittently in most management areas (except west of the North Island) since the mid-1990s (FNZ 2019). The effects of the snapper bottom trawl fisheries on red gurnard fishing mortality are unknown, and they receive a moderate concern score.

Salvin's albatross

Factor 2.1 - Abundance

Southwest Pacific | Set longlines | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

High Concern
Salvin's albatross are listed as IUCN Vulnerable, and despite data limitations, it is generally understood that this species may have undergone a rapid decline in the last 50 years. Different census methods make a comparison of the available data potentially misleading, however, breeding is largely restricted to one small island group, where it is susceptible to stochastic events (Birdlife International 2018a). It was estimated in 2014 that there were roughly 39,995 breeding pairs on the Bounty Islands, which represents 99% of the global population; this is equivalent to 79,990 mature individuals, or approximately 110,000 total individuals (Birdlife International 2018a). The 2014 estimate is roughly half of the 1978 estimate. Data limitations and the IUCN Vulnerable listing yield a high concern score for Salvin's albatross in New Zealand.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Set longlines | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

Moderate Concern
The 2020 Aquatic Environment and Biodiversity Annual Review 2019–20 (Fisheries New Zealand 2020) provides an estimate of the risk of total fishing mortality exceeding a sustainable level ("PBR") for each seabird species, and a disaggregation of that risk by fishery (Table 3.2, reproduced verbatim in the summary to criterion 2 in this Seafood Watch report). Total estimated fishing mortality does not exceed PBR for Salvin's albatross, and the percentage of PBR taken in this fishery is less than 50% (30%). There is significant uncertainty in these values; however, the range of likely mortalities is still below the mean estimate for PBR (Figure 3.2 in (Fisheries New Zealand 2020); Figure reproduced in the Parkinson's petrel justification section)((Richard et al. 2017). A score of low concern is given (per Table 2.2.1 in the Seafood Watch Standard for Fisheries V3.2; applied here for seabirds).

School shark

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

Moderate Concern
Tagging evidence suggests there is a single stock of school shark in the New Zealand EEZ. Differences in length and CPUE trends in the catch form different areas of the EEZ have led managers to assess at a number of stock management units within the EEZ rather than as a single stock. Assessments of all areas were last conducted in 2018. The stock status of each is summarized below, but in short, the evidence suggests stock abundance relative to a sustainable level is unknown or better, with no clear indication of any being below the soft limit reference point or above the target reference point. A score of moderate concern is applied in this situation.

Stock Status summary

- N1E: About as Likely as Not (40-60%) to be at or above Bmsy, and Unlikely (<40%) to be below the soft limit.
- 2 / 3N: Unknown whether soft limit has been reached, and Unlikley (<40%) that the hard limit has been reached.
- 3S/5: Unlikley (<40%) to be below the target or below the soft limit
- SCH 4: Unknown, no reference points established
- 7 /8 /1W: About as Likely as Not (40-60%) to be at or above Bmsy, and Unlikley (<40%) to be below the soft limit.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8

Moderate Concern
School sharks are targeted and are common source of bycatch in snapper trawl and longline fisheries off the North Island. The main area where school sharks and snapper are caught together appears to be the SNA1 area (the N1E school shark area), where they are both caught with trawls, gillnets and longlines (see Fishery Interactions box under N1E in (FNZ 2019)). School sharks in New Zealand were assessed in 2018, with differing findings by region (see summary and map below for reference). Most areas were 'About as Likely as Not (40-60%)' to be overfished, including N1E, or Unknown. One area does appear to be undergoing overfishing, but there are no significant snapper fisheries in this area (Mace, FNZ, Pers. comm. 2020). A score of moderate concern is awarded.

Overfishing is (FNZ 2019):

- N1E: About as Likely as Not (40-60%) to be occurring
- 2 / 3N: Unknown
- 3S/5: Likely (>60%) to be occurring
- SCH 4: Unknown, no reference points established
- 7 /8 /1W: About as Likely as Not (40-60%) to be occurring

Smooth hammerhead

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

High Concern
Smooth hammerheads are categorized by the IUCN as Vulnerable with a decreasing population trend and appears in Appendix II of the CITES Convention. Significant population declines (30-49%) have occurred for this population globally (Rigby et al. 2019). There are no target reference points for smooth hammerhead abundance in New Zealand waters and they receive a high concern score for abundance.
Justification:
The smooth hammerhead shark is primarily a coastal species using inshore and continental shelf waters and some large estuaries. Smooth hammerhead distribution is primarily along the northern portions of the North Island (Robertson 2014).

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

Moderate Concern
Smooth hammerhead are listed as one of the top three elasmobranch bycatch species in SNA1 on the northeast North Island (FNZ 2019), and smooth hammerheads were also reported in trawl survey tows in the inner Bay of Islands (Jones et al 2010). Directed fishing for smooth hammerheads is not allowed due to their Vulnerable status, however quota systems are not in place to manage this species in New Zealand and exports of bycatch up to 15 t per year are allowed (Robertson 2014). There are no management reference points for this species, landings data are unavailable for most fisheries, and fishing is listed as one of the primary threats to this species (Rigby et al. 2019). Smooth hammerheads are generally more impacted by surface longline fishing gear (Mace, FNZ, Pers. comm. 2020); however incidental takes do occur with benthic trawl gear (FNZ 2020). Smooth hammerhead receive a moderate concern for fishing mortality due to their Vulnerable status and unknown fishing mortality relative to reference points.
Justification:
Hammerheads are particularly vulnerable to capture in nets because of their unique head shape; they can become entangled in much smaller meshed nets than sharks or other fish of similar total body length. No catch statistics have been published by the Ministry of Fisheries or Ministry for Primary Industries since 2010, but reported landings of smooth hammerheads in New Zealand before then were relatively steady at about 10 tonnes per year, and consistently less than 15 tonnes per year (Robertson 2014). In 2008 New Zealand developed its own National Plan of Action for the Conservation and Management of Sharks to ensure that management strategies for sharks are implemented in New Zealand in order to meet the international goals. The NPOA was reviewed and revised in 2013 and in October 2014, shark-finning was banned for non Quota Management System shark species (Robertson 2014). Based on a New Zealand report "Non-detriment finding for smooth hammerhead shark," management determined is likely "reasonable to allow exports of smooth hammerhead products that were legally obtained within the New Zealand Exclusive Economic Zone as long as the reported capture remains at less than 15 tonnes per annum and that captures remain entirely from accidental bycatch, and that no targeted hammerhead fishery is developed (Robertson 2014)."

Tarakihi

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA1

High Concern
Snapper area SNA 1 overlaps with tarakihi area TAR 1E (compare the map of tarakihi management areas in Justification below to the map of snapper management areas in the introduction to this report). TAR 1E is considered to be part of the eastern stock of tarakihi, along with TAR 2, TAR 3, and part of TAR 7. This stock was most recently assessed in 2018. SB2016-2017 was estimated to be 17.3% of SB0, and very likely to be below the soft limit (20% of B0) (FNZ 2019). The stock, therefore, receives an abundance score of high concern.
Justification:

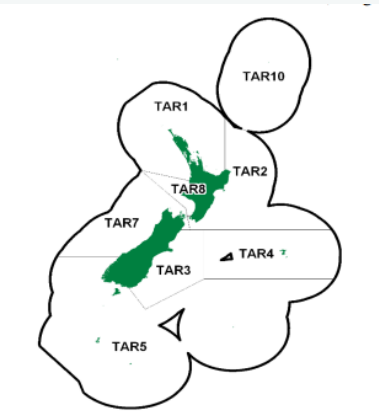


Figure 16: Tarakihi management areas in New Zealand {MPI 2017}

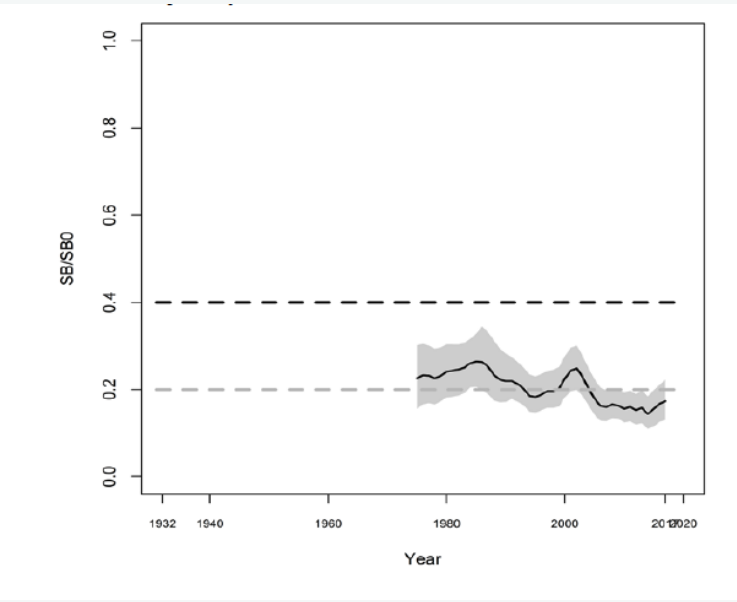


Figure 17: Annual trend in spawning biomass relative to the 40% SB0 interim target biomass level and 20% SB0 soft limit for the updated base model for TAR 1E, TAR 2, TAR 3, TAR 7 (Eastern Cook Strait). The line represents the median and the shaded area represents the 95% confidence interval (FNZ 2019).

Southwest Pacific | Bottom trawls | New Zealand | SNA2

High Concern
Snapper area SNA 2 overlaps with tarakihi area TAR 2 (compare the map of tarakihi management areas in the SNA Justification field to the map of snapper management areas in the introduction to this report). TAR 2 is considered to be part of the eastern stock of tarakihi, along with TAR 1E, TAR 3, and part of TAR 7. See scoring and justification for SNA 1 above for further details.

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA7

Low Concern

Snapper area SNA 7 overlaps with tarakihi area TAR 7 (compare the map of tarakihi management areas in Justification below to the map of snapper management areas in the introduction to this report). For the purposes of stock assessment, "the west coast South Island and Tasman Bay areas of TAR 7 are assumed to be a discrete stock. The eastern Cook Strait area of TAR 7 is considered to be part of the eastern stock of tarakihi" (FNZ 2019). The latter is reviewed in SNA 1 above, which has a far greater overlap with that stock. The part of TAR 7 mainly overlapping with SNA 7 was last assessed in 2018. That assessment used updated survey data, but the model from the earlier (2007) assessment. The authors of the 2007 assessment concluded biomass was likely (>60%) at or above the target of Bmsy/B40%. The updated survey data found a higher recruited biomass index than in 2007, indicating the stock is still 'Likely' (>60%) above the target. While these findings are positive, a more comprehensive updated stock assessment would provide more confidence in the results. This, plus uncertainty in stock structure, precludes a score of very low concern, but allows for a score of low concern.

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern

Snapper area SNA 8 overlaps with the western half of tarakihi area TAR 1 (TAR 1W) and with TAR 8 (compare the map of tarakihi management areas in the SNA 1 Justification field to the map of snapper management areas in the introduction to this report). The stock in TAR 1W was last assessed in 2017. Reference points were not determined because, "based on the east coast TAR stock assessment, biomass may have declined substantially before the start of the series" (FNZ 2019). TAR 8 has not been assessed, and "[I}nsufficient information is available to determine the status of TAR 8" (FNZ 2019). Abundance relative to sustainable levels is therefore considered unknown, and scores moderate here.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA1

High Concern

The most recent stock assessment (in 2018) found the eastern stock of tarakihi (TAR 1E, TAR 2, TAR 3 and part of TAR 7) to be undergoing overfishing with >99% probability (FNZ 2019). Fishing mortality on this stock of tarakihi, therefore, receives a high concern score. Whether the snapper fishery in SNA1 receives this score depends on whether the fishery is a substantial contributor to that mortality (SFW Wild Capture Fisheries Standard 3.2). The main QMS species (species managed under the Quota Management System) caught as bycatch in the SNA 1 fishery are trevally, red gurnard, John dory and tarakihi (see Fishery Interactions table for SNA1 in (FNZ 2019)). However, tarakihi are caught in both target and non-target fisheries, and the commercial fishery depth distribution of tarakihi tends to be deeper than target snapper fisheries (Mace, FNZ, Pers. comm. 2020). If this latter could be quantified further, a score of moderate concern could be justified here. For now, the SNA1 fishery receives a high concern score for its impacts on tarakihi because tarakihi is a common bycatch species and cumulative fishing mortality for that stock is at above a sustainable level.

Justification:

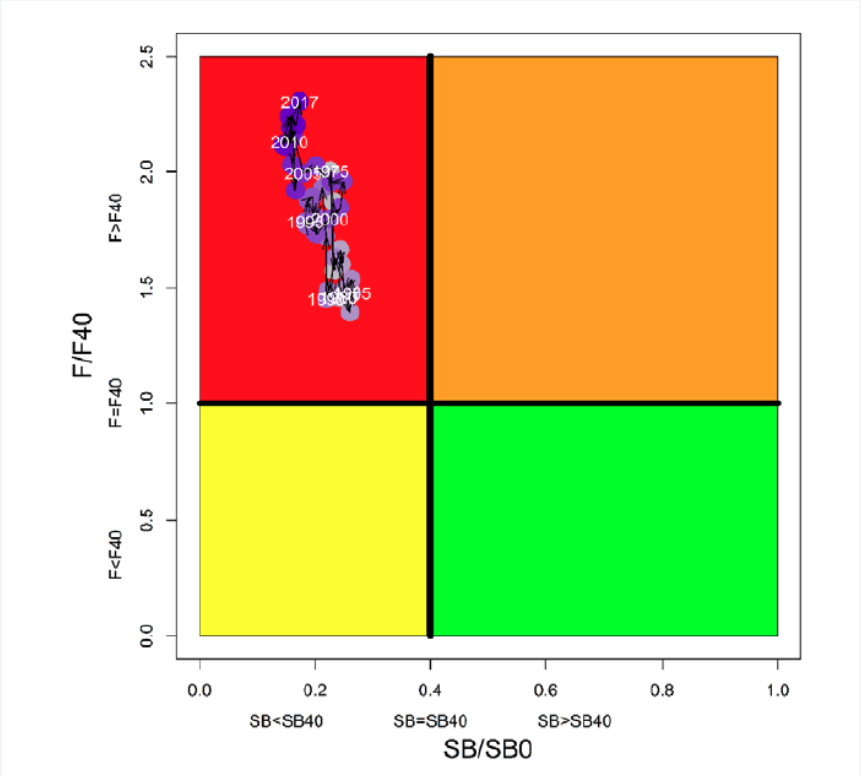


Figure 18: Annual spawning biomass and fishing mortality compared to the SB40% interim target biomass level and corresponding fishing mortality reference for the updated base model (median values from MCMCs) for TAR 1E, TAR 2, TAR 3, TAR 7 (Eastern Cook Strait) (FNZ 2019).

Southwest Pacific | Bottom trawls | New Zealand | SNA2

High Concern
The most recent stock assessment (in 2018) found the eastern stock of tarakihi (TAR 1E, TAR 2, TAR 3 and part of TAR 7) to be undergoing overfishing with >99% probability (FNZ 2019). Fishing mortality on this stock of tarakihi, therefore, receives a high concern score. This score is applied here pending further information on whether the SNA 2 is a substantial contributor to the overfishing of this stock of tarakihi (see discussion in SNA 1 for further details).

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderate Concern
The overfishing status of tarahiki in the west coast South Island and Tasman Bay areas of TAR 7 is 'Unknown' (FNZ 2019). Thus a moderate concern score is appropriate.

Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8

Moderate Concern
As noted above, TAR 1W was last assessed in 2017, and TAR 8 has not been assessed at all. Fishing mortality reference points have not been defined for either area (FNZ 2019). As fishing mortality relative to a sustainable level is unknown, this factor is considered a moderate concern.

Thorntail stingray

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

High Concern
Thorntail (also known as longtail) stingrays elasmobranchs and are Vulnerable per Seafood Watch standards based on life history characteristics. This species is found off southern Africa, Australia, and New Zealand from the intertidal zone to a depth of 440 meters. Thorntail stingrays are not listed under IUCN, and they receive a high concern score due to limited data and vulnerable life history traits.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

Moderate Concern
Thorntail stringrays are a benthic species caught incidentally in bottom trawl fisheries such as snapper. Thorntail stringrays were the most commonly caught (by weight) elasmobranch on the North Island trawl survey (Jones et al 2010). There are no data on fishing mortality of thorntail stingrays relative to reference points, and they receive a moderate concern for fishing mortality in the snapper trawl and Danish seine fisheries off the North Island.

White trevally

Factor 2.1 - Abundance

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

Moderate Concern
There is some uncertainty regarding stock structure around the North Island for trevally, and stock assessments were rejected for two of three proposed stocks due to differing index trends. However, relative abundance indices for trevally off the north and northeast North Island indicate increasing trends. Off the western North Island, spawning biomass has remained relatively stable since the mid–1990s (FNZ 2019). Abundance data are unavailable due to conflicting data in a significant portion of the trevally habitat off the North Island, however two data-limited indices indicate the stock is likely not experiencing a decline, and they receive a moderate concern score for abundance.

Southwest Pacific | Bottom trawls | New Zealand | SNA2

Moderate Concern
There is a lack of available information on abundance for trevally in TRE2, but it is categorized by the IUCN as a species of Least Concern. Therefore its abundance is deemed of 'Moderate' concern. The MPI notes that in future the stock will be assessed in conjunction with TRE1, as the two are now thought to potentially represent a single biological stock.

Factor 2.2 - Fishing Mortality

Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

Moderate Concern
Trevally is caught around the North Island and the north of the South Island, with the main catches from the northern coasts of the North Island. Trevally is taken in the northern coastal mixed trawl fishery, mostly in conjunction with snapper. Recent landings from the norther North Island management area have been higher than any landings of the previous decade. Off the northeast North Island, catches have exceeded the TACC in some recent fishing years (FNZ 2019). For the western North Island, estimated fishing mortality has increased moderately since the early 1990s but is likely below the $F_{SB40\%}$ level. Fishing mortality reference points are unknown for much of trevally caught off the North Island, and fishing mortality associated with the snapper trawl fishery is also unknown. Therefore, white trevally receive a moderate concern score for fishing mortality.

Factor 2.3 - Discard Rate/Landings

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA7
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA1

< 100%
Data are limited on discards in the snapper fishery due to negligible observer coverage in the longline, Danish seine and trawl fleets. The snapper stock assessment suggests that around 6-10% of snapper caught on longlines off the North Island are undersized (<25 cm), and these fish must be discarded (FNZ 2019). An FAO investigation into marine discard rates {Kelleher 2005} concluded that discard rates in demersal finfish trawl fisheries averaged 9.6%; and in demersal longline fisheries 7.5% (although the range of discard rates was large, 0.5-83% and 0.5-57% respectively). There are no data on bait use in the snapper longline fishery. When combined with the limited discard rate information from the various snapper fleets, it is highly likely that the discards (+ bait for longline) ratio to snapper landings is <100%.

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- *5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.*
- *4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.*
- *3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.*
- *2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'*
- *1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'*
- *0 (Critical) — Management Strategy and Implementation is 'critical'.*

The Criterion 3 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

Rating is Critical if Management Strategy and Implementation is Critical.

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species.

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective', 'moderately effective', 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	RESEARCH AND MONITORING	ENFORCEMENT	INCLUSION	SCORE
Southwest Pacific | Bottom trawls | New Zealand | SNA1	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Bottom trawls | New Zealand | SNA2	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Bottom trawls | New Zealand | SNA7	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Bottom trawls | New Zealand | SNA8	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Danish seines | New Zealand | SNA1	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Danish seines | New Zealand | SNA8	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Set longlines | New Zealand | SNA1	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Set longlines | New Zealand | SNA7	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**
Southwest Pacific | Set longlines | New Zealand | SNA8	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Highly effective	**Yellow (3.000)**

Criterion 3 Assessment

SCORING GUIDELINES

Factor 3.1 - 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? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Factor 3.2 - Bycatch Strategy
Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

Factor 3.3 - Scientific Research and Monitoring
Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

Factor 3.4 - Enforcement of Management Regulations
Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Factor 3.5 - 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, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

Factor 3.1 - Management Strategy And Implementation

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderately Effective
The snapper fisheries in New Zealand are managed under the Quota Management System (QMS), with total fishery removals limited to a level determined according to the Harvest Strategy Standard - see Justification below for more information {MPI 2008}. The total annual catch limit for each stock is the Total Allowable Catch (TAC), which is subdivided between the Total Allowable Commercial Catch (TACC), an allowance for recreational use, customary use, and other fishing-related mortality (OECD 2015)(Mace et al 2013)(FNZ 2019). While snapper is targeted in SNA1 and SNA8, much of snapper in New Zealand is actually caught as part of multi-species fisheries. Associated target fisheries include red gurnard, tarakihi, john dory and trevally, and all of these species are managed via the QMS systems with allocated TACCs.

Of the main retained stocks/substocks in the fisheries assessed in this Seafood Watch report, around 70% have biomass reference points (see table in Justification below) (FNZ 2020). For those where status is known, all are above the hard limit, and most are above the soft limit (roughly 73%) and the target (roughly 68%). In regards to overfishing, roughly 60% have an overfishing reference point and just under half (54%) of those are not subject to overfishing (see table in Justification below). If managers are able to determine reference points for stocks that currently do not have them (especially for risk of overfishing), and reduce fishing mortality such that the number of stocks subject to overfishing decreases significantly, then this factor could be scored Highly Effective. As it is, a score of Moderately Effective is appropriate.
Justification:
The Harvest Strategy Standard defines the basic outline by which reference points and annual TACs should be determined. The strategy is based on the establishment of three reference points for a fishery: a target, around which the stock should fluctuate; a soft limit, which triggers a rebuilding plan; and a hard limit, below which fishery closure should be considered. The target reference point is generally based around an MSY proxy based on a CPUE index (SNA 2) or a proxy ($B_{40\%}$; SNA1, SNA7, SNA8). B_0 is the estimated unexploited biomass (defined as the estimated biomass in 1931), and forms the basis for the hard and soft limit reference points for all four stocks: 10% B_0 and 20% B_0, respectively. A further key aspect of the Harvest Strategy is the calculation of an estimated probability that potential management approaches will exceed the limit reference points; as a rule, the management approach used should have a 50%+ chance of achieving the target reference point or better; <10% chance of breaching the soft limit; and <2% chance of breaching the hard limit (MPI 2015).

Stock assessments do not follow a specific schedule, and TAC changes are infrequent. For instance, the TACCs in SNA1 and SNA7 had remained at 4,500t and 200t, respectively since 1997/8 until 2016/17 (SNA7 increased to 250 t)(FNZ 2019). Although a harvest regime utilizing biomass-based reference points is in place for each of the four management areas, there seems to be some variation in effectiveness. Snapper in SNA1 has been subject to the same TAC for 20 years despite having biomass considerably below the target reference point the entire time, and they are likely (>60%) currently subject to overfishing (FNZ 2019). However, snapper in SNA 7 is considered unlikely to fall below limit reference points and has seen a substantial rise in biomass over the past decade.

Moderate TAC overages do sometimes occur (FNZ 2019). There is however a system to reduce over-catch of quotas via 'deemed values' such that penalties per kilogram are incurred when quotas are exceeded, balancing over-harvest with the need for accurate reporting and at-sea discards (Mace, FNZ, Pers. comm. 2020).

Stock status summary table for the main retained species in fisheries catching snapper. Based upon https://www.mpi.govt.nz/dmsdocument/17653-Stock-status-table-for-fish-stocks

Species	Stock/substock	Last assessment date	At or above target?	Below the soft limit?	Below the hard limit?	Overfishing?

Snapper	SNA 1 - East Northland	2013	N	Y	N	Y
Snapper	SNA 1 - Hauraki Gulf/BoF	2013	N	Y	N	Y
Snapper	SNA 2	2018				
Snapper	SNA 7	2018	Y	N	N	N
Snapper	SNA 8	2017		N	N	
Trevally	TRE 1					
Trevally	TRE 7	2015	Y	N	N	N
Red gurnard	GUR 1W	2017	Y	N	N	N
Red gurnard	GUR 1E, GUR 1BoP	2017	Y	N	N	N
Red gurnard	GUR 2	2019	Y	N	N	Y
Red gurnard	GUR 7	2018	Y	N	N	N
Red gurnard	GUR 8					
John dory	JDO 1 (HG & EN)	2018	N	N	N	N
John dory	JDO 1 (BP)	2018	N	N	N	Y
John dory	JDO 1 (WCNI)	2018	N	N	N	Y
John dory	JDO 2	2013	N	Y	N	
John dory	JDO 7	2018	Y	N	N	N
Tarakihi	TAR 1E, TAR 3, TAR 2&7 (EAST CS)	2018	N	Y	N	Y
Tarakihi	TAR 1W	2017				
Tarakihi	TAR 4					
Tarakihi	TAR 5, TAR 8					
Tarakihi	TAR 7	2018	Y	N	N	
Favorable status			8	12	16	7
Unfavorable status			7	4	0	6
Unknown status			7	6	6	9
Ref points %			68.2	72.7	72.7	59.1
favorable status as a % of known status			53.3	75	100	53.8

Factor 3.2 - Bycatch Strategy

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderately Effective
This factor assesses the effectiveness of management in preventing the catch of unwanted species, especially those of conservation concern. Species that are generally retained are considered in C3.1, even if they are considered 'bycatch' by managers.

Examination of bycatch of both protected and non-protected species is a major component of the annual Aquatic Environment and Biodiversity Review (AEBR) conducted by the MPI (Fisheries New Zealand 2020). However, the main focus of the report is offshore fisheries; non-target catch and discards in inshore fisheries is currently not well monitored and assessed (page 321 in (Fisheries New Zealand 2020)). And while there is an objective in the draft National Inshore Finfish Fisheries Plan (Fisheries New Zealand 2020b) to manage inshore fisheries to avoid or mitigate adverse effects on incidentally-caught fish species (pp22), analyses to inform this objective have yet to be conducted (p322 in (Fisheries New Zealand 2020)).

There is also an objective in the draft management plan to manage inshore fisheries to avoid, remedy or mitigate the adverse effects of fishing on endangered, threatened and protected species (p22). To this end, there are National Plans of Action for seabirds (Fisheries New Zealand 2020c) and sharks (Fisheries New Zealand 2013), a Threat Management Plan for Hector's and Maui Dolphin (Fisheries New Zealand 2020d), and Te Kaweka Takohaka mō te Hoiho (strategy to protect the yellow-eyed penguin) (Hoiho Governance Group 2019).

The combination of the fishery plan and these taxon-specific plans lays out the broader strategy to mitigate the most harmful incidental impacts from the fisheries targeting snapper. This framework, complete with specific, targeted measures in some cases, suggests a highly effective strategy for ETP species. However, there remain significant impacts on a number of these species, including Parkinson's petrel, Maui dolphin, and a number of vulnerable shark and ray species (see Criterion 2 for more detail). This, combined with a lack of deeper monitoring and analysis of the non-ETP species bycatch in the snapper fisheries (and a strategy based upon those findings), leads to a score of moderately effective.
Justification:

There are management measures in place to address bycatch:

In 2008 New Zealand developed its own National Plan of Action (NPOA) for the Conservation and Management of Sharks (Ministry of Fisheries 2008) to ensure that management strategies for sharks are implemented in New Zealand in order to meet the international goals. Probably the most significant objective in the revised 2013 NPOA plan was to eliminate all shark-finning. Most non-QMS shark species, including smooth hammerhead, now have to be landed with their fins naturally attached. As a signatory to the WCPFC, New Zealand has obligations for recording, reporting and undertaking research on species listed as 'key shark species', and for ensuring that the management measures applied within New Zealand fisheries waters are compatible with or better than those of the WCPFC (Robertson 2014)

In 2008, the West Coast North Island Marine Mammal Sanctuary was established under the Marine Mammal Protection Act. Within the sanctuary, the Fisheries Act 1996 has been used to restrict commercial and recreational trawling out to 2-4 nm offshore in the 400 km of coastline between Maunganui Bluff (Northland) and Pariokariwa Point (North Taranaki), as well as restrictions on commercial and recreational set-netting out to 7 nm offshore over the same coastline, and to 2 nm offshore over the 150 km of coast from Pariokariwa Point to Hawera. In 2013, the Marine Mammals Protection Act 1978 was used to provide a complete ban on commercial and recreational set-netting 2 to 7 nm offshore along a 40 km section of the coast north of New Plymouth (Department of Conservation 2019).

As mentioned above, there is also a NPOA for seabirds that aims to reduce the number of seabird deaths from fishing. This document was updated in May of 2020 and included a public consultation period. The seabird NPOA reflects collaboration and consultation between the Ministry for Primary Industries, the Department of Conservation, the fishing industry, tangata whenua and environmental groups (Ministry for Primary Industries 2013).

Factor 3.3 - Scientific Research And Monitoring

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderately Effective
This factor assesses the effectiveness of any research and monitoring efforts in ensuring fishing impacts are not unsustainable on any species caught in the fishery, whether retained or discarded. For the main retained species/stocks, most have a relatively recent stock assessment (see table in Cirterion 3.1). Fishery-dependent and independent data are used to inform these stock assessments and CPUE index analyses. CPUE data are collected via landings annually, while fishery-independent survey data are included as available. In order to fill in data gap needs, a new survey conducted along the west coast of the North Island will occur the next three fall seasons (data not yet available). Trawl surveys off the South Island are typically run annually. These surveys are used to identify community composition and produce biomass estimates when possible (FNZ 2019).

The main concern is the absence of any regular monitoring or assessment activities of species that are typically discarded in any of the snapper fisheries. As noted in the summary section in Criterion 2, there are no summaries of observed fish and invertebrate bycatch in snapper target fisheries currently available, so most inforamtion is from research fishing surveys (p1337 in (FNZ 2019). These include trawl surveys {Kendrick & Francis 2002} (Jones et al 2010) but also, in the case of SNA1, longlining surveys (unpublished data). There is some limited observer coverage in the snapper fishery, which enables the estimation of rates of seabird, mammal and turtle incidental catch; however, observer rates were reportedly low (consistently below 5%)(FNZ 2020).

Thus, although significant amounts of data are collected to inform stock assessments in most of the snapper management areas, the limited availability of publicly accessible fishery dependant bycatch data renders a score of moderately effective for all snapper fisheries in New Zealand.
Justification:
Although not precisely comparable due to gear differences, research trawls conducted in the same management areas as the snapper fisheries reported high rates of non-snapper catch {Kendrick & Francis 2002}(Jones et al 2010). Trawl surveys in SNA8 found snapper made up only 18.7% of total catch by weight {Morrison & Parkinson 2001}. Although many of the most frequently-occurring species in these surveys are also managed under the QMS system (and therefore their removals are monitored as part of their respective fishery), non-target species are not subjected to the same level of assessment and oversight {FNZ 2019; FNZ 2019a}.

When the sustainability and management of the SNA 1 fishery were reviewed in 2013, wastage within the snapper commercial fleet was identified by stakeholders as an area of concern. Of particular concern was the lack of information relating to how much snapper below the minimum legal size (MLS) was being returned to the sea. In response, the MPI began assessing the feasibility of electronic monitoring in SNA 1 (Pria et al. 2016), and the MPI is targeting 100% electronic monitoring in the SNA 1 trawl fleet in the future. As at October 2017, there are cameras on 16 trawl vessels in SNA 1(around the Bay of Plenty, Hauraki Gulf and the east coast of Northland)(FNZ 2020d).

Illegal catch rates are estimated at the precautionary rate of 10%, and included in stock assessments. Customary non-commercial fishing is one source of mortality of unknown scale that does not appear to be factored into stock assessments. The frequency of stock assessments varies; the most recent full stock assessment for each management area was conducted in 2013 (SNA1), 2018 (SNA2, SNA7, SNA8)(FNZ 2020). Data on ghost fishing and derelict gear are not available.

Factor 3.4 - Enforcement Of Management Regulations

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Highly effective
Monitoring and enforcement in New Zealand fisheries are the responsibility of the MPI. The MPI reports that it invests in encouraging and enforcing compliance with fishery laws and regulations, using satellite technology, aircraft, patrol boats, and a limited number of at-sea observers (Ministry for Primary Industries 2019). An independent study of compliance in New Zealand fisheries concluded that the QMS was generally supported by fishery participants, and fishers reported being inspected by fishery officers an average of three times per year (Kazmierow el al 2010). Permits and regulations are in place, and there is sufficient capacity to ensure compliance appropriate to the scale of the fishery; however TACCs are exceeded in some years in a number of fisheries, including snapper, and minimal observer coverage renders it challenging to ensure TACC compliance. These TACC overages are relatively small in relation to overall catches due to penalties associated with deemed values and overharvesting. Additionally, fishers in SNA 1 have been collaborating with MPI to establish an electronic monitoring program in SNA 1 trawl fisheries (FNZ 2020d). Therefore, all New Zealand snapper fisheries receive a highly effective for enforcement.
Justification:
Reported commercial landings rarely exceed TACCs for SNA 1, SNA 7 and SNA 8 (overages generally limited to 10-15%); however there is evidence that landings were double the TACC in SNA 2 in the 1990s. The Fisheries Act provides for sanctions against transgressions, which include significant fines and imprisonment for up to five years (Fisheries Act 1996). Fishery officers inspect commercial fishing vessels and commercial premises that buy and sell fish, to ensure that the fish have been reported and recorded correctly. Fishery officers conduct sea patrols that target commercial vessels. When they board, they inspect catches and ensure that catch reports are correct (Ministry for Primary Industries 2019).

Factor 3.5 - Stakeholder Inclusion

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Highly effective
New Zealand's fishery management system encourages the engagement of a wide range of stakeholders, both for the management of individual stocks and the development of the management system itself. For all snapper fisheries, the level of stakeholder inclusion is considered highly effective with a transparent process that involves all major user groups, addresses user conflicts and encourages participation from the public and stakeholders.
Justification:
Stakeholder engagement is a component of New Zealand fisheries legislation and practiced widely throughout the decision-making process (OECD 2015). The Fisheries Act 1996 mandates the engagement of commercial, recreational, environmental and customary Maori ('Tangata whenua') stakeholders (Fisheries Act 1996). Stakeholder engagement is encouraged during the development and implementation of management decisions for individual stocks, but is also a critical component in the development of the over-arching management regime. This is exemplified in the recent Fisheries Management System Review initiated in 2015 by the MPI, the first stage of which included seeking feedback from anyone with an interest in New Zealand fisheries via online questionnaires, drop-in information sessions, and stakeholder meetings (MPI 2016 (1)).

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 (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- ***Score >3.2=Green or Low Concern***
- ***Score >2.2 and ≤3.2=Yellow or Moderate Concern***
- ***Score ≤2.2 = Red or High Concern***

GUIDING PRINCIPLES

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	SCORE
Southwest Pacific | Bottom trawls | New Zealand | SNA1	2	0	Moderate Concern	**Yellow (2.449)**
Southwest Pacific | Bottom trawls | New Zealand | SNA2	2	0	Moderate Concern	**Yellow (2.449)**
Southwest Pacific | Bottom trawls | New Zealand | SNA7	2	0	Moderate Concern	**Yellow (2.449)**
Southwest Pacific | Bottom trawls | New Zealand | SNA8	2	0	Moderate Concern	**Yellow (2.449)**
Southwest Pacific | Danish seines | New Zealand | SNA1	2	0	Moderate Concern	**Yellow (2.449)**
Southwest Pacific | Danish seines | New Zealand | SNA8	2	0	Moderate Concern	**Yellow (2.449)**
Southwest Pacific | Set longlines | New Zealand | SNA1	3	0	Moderate Concern	**Yellow (3.000)**
Southwest Pacific | Set longlines | New Zealand | SNA7	3	0	Moderate Concern	**Yellow (3.000)**
Southwest Pacific | Set longlines | New Zealand | SNA8	3	0	Moderate Concern	**Yellow (3.000)**

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate
Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - 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. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 - 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.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts
Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management
Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

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

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1

2
Snapper is found in a variety of demersal habitats, including mud and silt bottom, rocky areas, and reefs (FNZ 2019).Trawling for snapper is reported to primarily occur over sand, mud, and gravel (Baird et al. 2015). Bottom trawls and Danish seine gear targeting snapper receive a 2.
Justification:
It's important to note that significant research in New Zealand indicates that muddy and sandy coastal habitats that may be disturbed by trawl or danish seine gear are home to important epifaunal organisms, such as horse mussels and less well-known taxa, and this disturbance may in fact have major consequences on marine ecosystem functioning. For instance, the mixing and displacement of sediment (bioturbation) by benthic macrofauna heart urchins of the genus Echinoderm has significant biogeochemical and ecosoystem-level implications via organic matter degradation and carbon burial implications (Lohrer et al. 2005). Additionally, research also suggests that sublittoral muddy habitats are often the most impacted by bottom trawling due to intense fishing pressure and presenc of long-lived species (Rijnsdorp et al. 2016). New Zealand is also vulnerable in that gravel habitats, which would elsewhere be expected to recover quickly, are home to slow-growing taxa such as habitat-forming bryozoans (Wood et al. 2013), which are recognised as very likely to form habitat for fish including snapper (Morrison et al. 2014).

Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

3
Snapper is found in a variety of demersal habitats, including mud and silt bottom, rocky areas, and reefs (FNZ 2019).Trawling for snapper is reported to primarily occur over sand, mud, and gravel, and it is likely that longliners targeting adult snapper similarly avoid setting their gear over biogenic habitats to avoid getting hung up (Mace, Personal Communication, 2018)(Baird et al. 2015). Longline gear fished over mixed sand, mud and gravel receive a 3.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8

Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

0

The 2020 Aquatic Environment and Biodiversity Annual Review (Fisheries New Zealand 2020) summarizes the significant efforts fishery managers have undertaken to date to understand and minimize negative impacts from fishing on seafloor habitats. This work includes mapping benthic habitats and fishing effort, and working with stakeholders to implement closed areas and other protection. Outside of New Zealand territorial waters (0-12nm), a substantial proportion (30.2% - page 389 in (Fisheries New Zealand 2020)) of representative habitats are protected from bottom fishing gear, there are some protections in place for vulnerable habitats such as seamounts and hydrothermal vents, and the expansion of the trawl fishery footprint is not expected (FNZ 2019) (Baird et al. 2015). However, the percentage of seafloor protected within territorial waters is far less (19.6%) (e.g. page 389 in (Fisheries New Zealand 2020). According to the May 2020 Fishery Assessment Plenary Volume 3 document [FNZ 2020}, some proportion comes from so-called 'Benthic Optimised Marine Environment Classification' classes A, C (northern shelf) and H (shelf break and upper slope) (p1431). These classes (habitat types) cover the majority of the nearshore habitat around the North Island, where most snapper fishing occurs (see map in Justification below), though most of H is in deeper waters than those fished by the inshore fleet (see table in Justification below). The estimated area open to inshore trawling within each of these classes is 82%, 58% and 5%, respectively (see table in Justification below). However, at least 90% of the snapper trawls occur in waters less than 100m depth (p1431 in (FNZ 2020)), and the proportion of the area closed at these depths around the North Island is far smaller. Very little is closed to all fishing (total area of marine reserves and 'Type 2' MPAs around the North Island as of Jan 2020 was 1823 km2 (based on table at https://www.doc.govt.nz/about-us/science-publications/conservation-publications/marine-and-coastal/marine-protected-areas/marine-protected-areas-tier-1-statistic/marine-protected-areas-tier-1-statistic-2019/; Also, see map of marine reserves and Type 2 MPAs in Justification below). There are also restrictions on certain types of trawling and certain seasons (see map of seasonal and gear restrictions on trawling in Justification below), but these do not prevent all trawling all year round. In short then, it is unlikely that a substantial portion of representative habitat in nearshore waters is protected, and a score of +0.0 is appropriate here.

Justification:

Estimated area of each BOMEC class (in depths of under 3000 m), the seafloor area of waters open to bottom trawling within each BOMEC class (in depths of under 1600m), the trawl footprint from TCER, TCEPR, and ERS deepwater and inshore fishstocks over the fishing years 2007–08 to 2017–18 (Baird & Mules 2020a, 2020b, in review), and the percentage overlap by the deepwater and inshore footprints. Note: previous versions have taken a longer prior time window (from 1989–90) for deepwater fisheries. Note there will be some overlap between the inshore and deepwater footprints in some inshore BOMEC classes. Table and caption taken verbatim from (Fisheries New Zealand 2020) with the exception that the final column is calculated and the yellow highlights were added for clarity (see text in Explanation above).

BOMEC class	Total area (km2)	Area open to bottoml fishing (km²)	Deepwater footprint area (km2)	Deepwater footprint area (% of total)	Deepwater footprint area (% area open to bottom fishing)	Inshore footprint area (km2)	Inshore footprint area (% of total)	Inshore footprint area (% area open to bottom fishing)	% of total area that is open to fishing
A	27557	19764	493	2	3	16109	57	**82**	72
B	12420	11984	3359	27	28	10814	89	**90**	96
C	89710	87914	22419	25	26	51256	58	**58**	98
D	27268	25786	1983	7	8	20443	74	**79**	95
E	60990	60211	12656	21	21	14037	23	**23**	99
F	38608	30931	3607	9	12	0			80
G	6342	6033	2475	39	41	4067	69	**67**	95
H	138550	129323	38856	28	30	19218	14	**15**	93
I	52224	51910	26946	52	52	676	1	**1**	99
J	311361	277138	32234	10	12	4756	2	**2**	89
K	1290	1290	0			36	3	**3**	100
L	198577	175509	23950	12	14	6	0	**0**	88
M	233825	183402	5099	2	3	264	0	**0**	78
N	493034	388647	3003	1	1	1047	0	**0**	79
O	935315	598607	184	0	0	13	0	**0**	64
Total	2627073	2048448	176954	7	9	142744	6	**7**	78

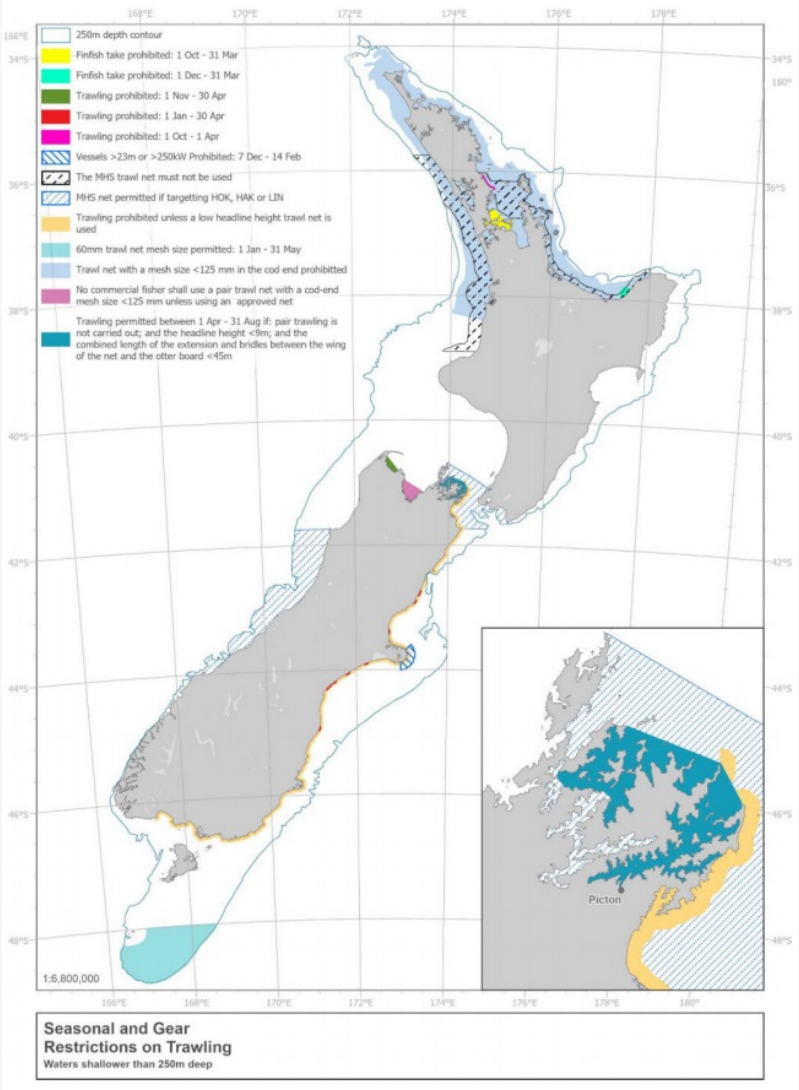


Figure 19:

Areas where gear and seasonal restrictions apply to the use of trawl gear, in waters shallower than 250 m depth. Map represents restrictions as at March 2020. Text and image taken verbatim from (Fisheries New Zealand 2020).

New Zealand Marine Protected Areas

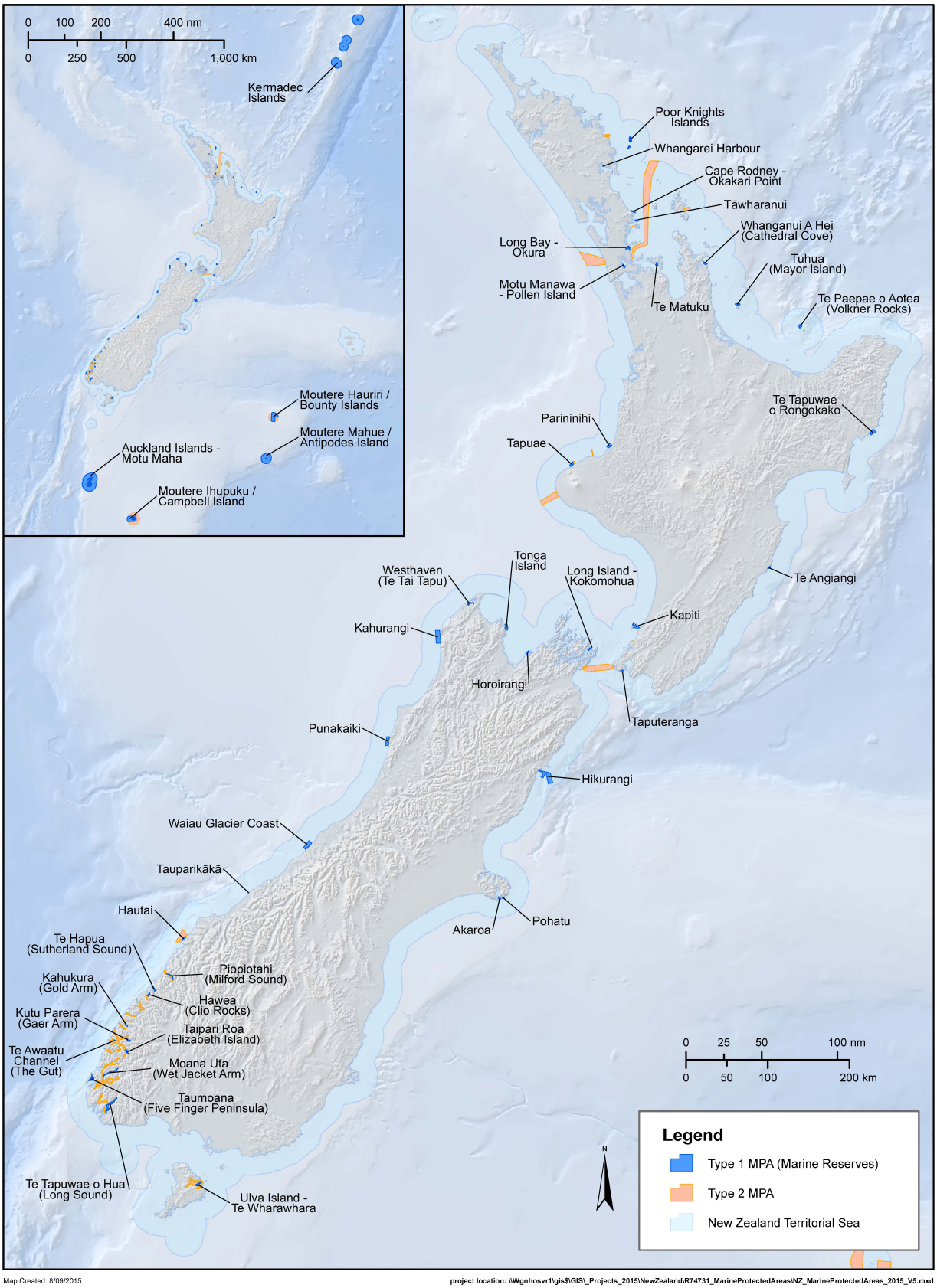


Figure 20: New Zealand Inside Waters Marine Protected Areas

Factor 4.3 - Ecosystem-based Fisheries Management

Southwest Pacific | Bottom trawls | New Zealand | SNA7
Southwest Pacific | Bottom trawls | New Zealand | SNA2
Southwest Pacific | Bottom trawls | New Zealand | SNA1
Southwest Pacific | Bottom trawls | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA8
Southwest Pacific | Danish seines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA1
Southwest Pacific | Set longlines | New Zealand | SNA8
Southwest Pacific | Set longlines | New Zealand | SNA7

Moderate Concern
This factor assesses whether all stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. To score a low concern in this factor, a fishery must, in part:

- have policies in place to protect ecosystem functioning and account for capture species' ecological role (even if they have not yet been proven effective)
- have spatial management in place to protect ecosystem functioning.

According to Fisheries New Zealand, the Draft National Inshore Finfish Fisheries Plan is "aimed at progressing New Zealand towards ecosystem-based fisheries management (EBFM)." (Fisheries New Zealand 2020b) The authors identify four focal areas of the Plan that contribute to EBFM. Of these, two are ecological in nature (the other two are social):

- "Shifting fisheries management to an integrated management approach of the multiple individual stocks that are caught within a fishery;" and
- "Improving environmental performance with a focus on protecting habitats of significance for fisheries management from the impacts of fishing and land-based effects, and ensuring the long-term viability of protected species."

The draft Plan also lays out specific objectives for these focal areas. Broadly, then, the draft Plan and related documents like the National Plans of Action for seabirds and sharks, and the Threat Management Plan for Hector's and Maui Dolphins (Fisheries New Zealand 2013) (Fisheries New Zealand 2020c) (Fisheries New Zealand 2020d) provides a framework to develop and implement EBFM policies, but this has not yet happened. Indeed, as the most recent Aquatic Environment and Biodiversity Annual Review notes, "Multi-species fishing at close to BMSY using predominantly bottom-trawling is likely to make New Zealand's marine ecosystems less resilient (compared to fishing more conservatively compared to BMSY and not using predominantly bottom-trawling) to other anthropogenic disturbance and to environmental variability, including climate change, through trophic and ecosystem-level effects." (Fisheries New Zealand 2020) This is very much the current approach for the inshore fisheries. To the second bullet above, the review of closed areas in Factor 4.2 above suggests there is some spatial management in place to protect spawning areas and some small areas fully protected through marine reserves and to a lesser extent, Type 2 MPAs. In addition, the focus on the draft Plan to protect habitats of particular significance for fisheries management may lead to additional spatial protections. However, at this time no such habitats have been defined or applied (though candidates have been proposed) (Fisheries New Zealand 2020). So while the direction as laid out in the draft Plan is positive, it is too early to see what may come out of it, and a moderate score is given here.

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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

Appendix A

Yellow- and Green-Scoring Criterion 2 Species :