



**Fisheries New Zealand**

Tini a Tangaroa

# Medium term research plan for deepwater fisheries

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# Introduction

This medium-term research plan (**MTRP**) sets out the research needs to inform management of New Zealand's deepwater fisheries.

It is a living document that will be updated regularly to (i) reflect changes in management priorities where these occur, and (ii) identify new information requirements. Budget constraints are also a consideration resulting in trade-offs not just between deepwater research projects, but across all of the fisheries research that is conducted. Annual research plans will continue to be consulted with stakeholders through the Deepwater Fisheries Plan Advisory Group (FPAG) and reported in Annual Operational Plans and Annual Review Reports for deepwater fisheries.

The MTRP should be read alongside the National Fisheries Plan for Deepwater and Middle-depth fisheries ([National Deepwater Plan](#)). Deepwater and middle-depth fisheries are those generally between 12 nautical miles and 200 nautical miles offshore. Fisheries are categorised into three tiers:

- Tier 1 – high volume, high value quota management system stocks that commercial fishers usually target;
- Tier 2 – quota management system stocks that are smaller or less valuable bycatch fisheries, or are only targeted at certain times of the year; and
- Tier 3 – bycatch species that are not managed through the quota management system.

# Surveys

Surveys provide important fishery-independent information for monitoring a number of deepwater fish stocks. All tables in this document reflect the financial year (1 July – 30 June) in which contracts will be initiated, which may be the year before the actual delivery of the work. Where available, project codes are provided.

## TRAWL SURVEYS

### Wide-area, multi-species trawl surveys

Wide-area trawl surveys collect biological information and provide abundance indices for a range of species. There are three deepwater and middle-depth wide-area trawl surveys which cover the three main deepwater fishing grounds: Chatham Rise, Sub-Antarctic, and the West Coast of the South Island (WCSI). The surveys are optimised to provide information on relevant Tier 1 middle-depth fish stocks, but also provide valuable information on a range of Tier 2 and non-QMS species, including data that informs risk assessments for sharks, and important ecosystem data (e.g., sea temperature, stomach content analysis) in these key fishery areas.

**Table 1: Wide-area trawl survey schedule by financial year (incl. month of delivery)**

	2023/24	2024/25	2025/26	2026/27	2027/28
Chatham Rise	Jan 2024 (MID2021-02)		Jan 2026 (MID2021-02)		Jan 2028
Sub-Antarctic		Dec 2024 (MID2021-02)		Dec 2026	
WCSI		June/July 2024 (MID2021-02)		June/July 2027	

#### *Chatham Rise wide-area trawl survey*

The Chatham Rise trawl survey was completed annually from 1992–2014 at which point the frequency was decreased to every other year because of the high cost and other priorities in the Fisheries New Zealand research budget. Information collected during all Chatham Rise trawl surveys was compiled in 2012.<sup>1</sup> The survey series provides biomass trend and distribution information on 142 species which are included as data inputs to stock assessments for a number of species, including hoki, hake and ling.

The Chatham Rise trawl survey will continue to be carried out in January every other year.

#### *Sub-Antarctic wide-area trawl survey*

The Sub-Antarctic trawl survey was completed annually between 1992–1994 and 2001–2010. The survey frequency was then changed to be biennial because of the high cost and other priorities in the Fisheries New Zealand research budget, although surveys were completed in sequential years in 2012 and 2013 to address additional information needs. The Sub-Antarctic trawl survey provides information on 134 species and data inputs to stock assessments for a number of Tier 1 species, including hoki, hake and ling.

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<sup>1</sup> O'Driscoll, R L et. al. (2011). [A review of hoki and middle-depth trawl surveys of the Chatham Rise, January 1992-2010. New Zealand Fisheries Assessment Report 2011/47. 72p.](#)

The Sub-Antarctic trawl survey will continue to be carried out in December every other year in the alternate financial year to the Chatham Rise trawl survey.

#### *West Coast South Island (WCSI) wide-area trawl survey*

The WCSI trawl survey was initially developed and designed as an acoustic survey focused on indexing spawning hoki abundance on the WCSI each winter. The survey was completed annually from 1988 to 1993, and again in 1997. In 2000, a trawl survey component was added to the survey to provide information on other middle depth species, which was repeated in 2012, 2013, and 2016. The survey methodology was amended in 2016 to focus on hake and ling rather than hoki following a review of the hoki model. The importance of the trawl survey to other species, including hake and ling, is the key reason the survey has continued.

The last WCSI trawl survey was completed in 2021, it is scheduled for completion in June/July every third year thereafter, so the next survey is scheduled for 2024. The 2018 survey included an acoustic survey of spawning hoki, but the 2021 survey did not. The DWWG recommended reinstating the acoustic component of this survey and it is included in the 2024 WCSI voyage plan.

### **Scampi surveys**

Scampi is fished in five key areas using light bottom trawl gear. Export statistics for scampi were estimated at \$81 M in the 2023 calendar year.

The key scampi stocks, where most fishing occurs, are currently monitored using trawl/photographic surveys completed every third year. A characterisation of SCI 4A was completed in 2019 (FNZ FAR 2020/04) and the first SCI 4A survey was completed in September 2023 alongside the SCI 3 survey. It is proposed that future SCI 4A surveys will also be conducted alongside the SCI 3 survey.

**Table 2: Scampi survey schedule**

	2023/24	2024/25	2025/26	2026/27	2027/28
<b>SCI 1</b>		March 2025			
<b>SCI 2</b>			March 2026		
<b>SCI 3</b>	Sep 2023				Sep 2027
<b>SCI 4A</b>	Sep 2023				Sep 2027
<b>SCI 6A</b>				Feb/March 2027	

### **ACOUSTIC SURVEYS**

Acoustic surveys are often used to monitor and estimate abundance of fish stocks that aggregate for either spawning or feeding. Acoustic surveys rely on the reflection of sound waves to estimate the abundance of fish as the acoustic system passes above the aggregation or fishing grounds.

Acoustic technology has improved significantly in recent years, with the development of multi-frequency and acoustic-optical systems that have allowed the technology to be used to monitor species where the lack of air-filled swim bladders or mixture of fish species in schools had previously made acoustics unfeasible.

For some species/stocks, to successfully measure abundance, any acoustic survey must deploy either a towed acoustic system (a tow body or trawl net-mounted system), a multi-frequency acoustic system, or an acoustic optical system. For clarity, this requirement is specified in the description of each planned acoustic survey below.

Acoustic surveys at regular cycles are employed to monitor hoki in the Cook Strait, West Coast South Island and Pegasus Canyon; orange roughy, and southern blue whiting; all during their respective spawning periods. Survey outputs are used as key inputs to stock assessments. Specific details for these are provided below.

### *Hoki (HOK)*

Cook Strait is the main area for spawning of the eastern hoki stock. Because hoki aggregate and aggregations are often in mid-water during spawning, acoustic surveys are considered more effective than trawl surveys for this stock. In 2019, the survey of the eastern spawning stock was expanded to include the Pegasus Canyon and Conway Trough spawning areas on the east coast of the South Island. This extension to the survey was continued in 2021 and 2023 and will remain as an objective in the survey contract.

The survey may be completed using a hull-mounted echosounder and has been carried out from industry vessel platforms during commercial fishing trips as well as from research vessels. From 2019-2023, surveys have been completed aboard the *RV Kaharoa*. It is anticipated the 2025 survey will be completed by the *RV Kaharoa II*.

The Cook Strait and Pegasus Canyon hoki acoustic survey is scheduled to be completed every two years. Note that from 2020/21, this project has been contracted in the financial year prior to the completion of the survey as it occurs at the beginning of a financial year. This is reflected in the table below.

**Table 3: Cook Strait and Pegasus Canyon/Conway Trough hoki survey schedule**

	2023/24	2024/25	2025/26	2026/27	2027/28
<b>Cook Strait / Pegasus Canyon/ Conway Trough</b>		July/Aug 2025		July/Aug 2027	

The main spawning area for the western hoki stock is off the west coast of the South Island. This acoustic survey has been completed irregularly in the past. The work to revise the hoki stock assessment model and discussions of the Deepwater Fisheries Assessment Working Group have indicated the importance of the acoustic component of the survey and it will be included in the 2024 WCSI wide-area trawl survey (Table 1).

### *Orange roughy (ORH)*

Orange roughy is a long-lived, deepwater species that occurs throughout the New Zealand EEZ. The largest fisheries occur on the Chatham Rise, Challenger Plateau, and around the north of the North Island. In the 2023 calendar year, exports of orange roughy were worth an estimated \$43 M.

In 2014, a Management Strategy Evaluation indicated that surveys and assessments of orange roughy could be completed every four years. This would provide for utilisation while ensuring that stocks are not overfished and would allow fisheries managers to respond appropriately to any changes in abundance.

There are currently no surveys planned for ORH 1 or ORH 3B-Sub-Antarctic. In ORH 1, there remain uncertainties around stock structure. For ORH 3B Sub-Antarctic, there is a low level of fishing and little information on stock structure.

The fishing industry has progressed orange roughy acoustic surveys, both within and outside of Fisheries New Zealand contracting processes for ORH 3B Northwest Chatham Rise, East & South Chatham Rise, Puysegur, in ORH MEC (2A, 2B, and 3A), ORH 7A, and in ORH 7B.

Acoustic surveys for orange roughy take place in winter, which can complicate contracting given the government financial year of July–June. Therefore, the surveys below are reflected in the year they will be contracted with dates of completion shown in the table.

**Table 4: Orange roughy survey schedule\***

	Year of Contracting				
	2023/24	2024/25	2025/26	2026/27	2027/28
ORH 1					
ORH 2A North					
ORH MEC					
ORH 3B – NW Rise				July 2026	
ORH 3B – ES Rise		<b>July 2024</b>		July 2026	
ORH 3B – Puysegur					
ORH 7A	July 2023		<b>July 2025</b>		July 2027
ORH 7B					

\*Dates in bold reflect planned industry-led survey initiatives

#### *Southern blue whiting (SBW)*

Southern blue whiting mainly occurs in the Sub-Antarctic waters of New Zealand, with the largest stock found around Campbell Island Rise (SBW 6I). Smaller stocks are also found around the Auckland Islands (SBW 6A), Bounty Platform (SBW 6B), and on the Pukaki Rise (SBW 6R). In the 2023 calendar year, exports of southern blue whiting were worth an estimated \$23 M.

Southern blue whiting exhibit highly variable year class strength and are characterised by episodic recruitment events. Stocks are therefore surveyed and assessed regularly, both to allow for utilisation of significant recruitment events, but also to respond when large year classes leave the fishery or fish abundance declines.

Since the 2013/14 fishing year there has been very little fishing in SBW 1, SBW 6A, and SBW 6R (excluding 2019/20 in SBW 6R), so no dedicated acoustic surveys are planned for these stocks. If landings from any of these stocks exceed 500 tonnes for two years in a row or a TACC is fully caught, consideration will be given to additional monitoring/assessment.

The survey for SBW 6B is planned to be completed annually. This hull-mounted acoustic survey is currently completed using a commercial fishing vessel. The survey was most recently completed successfully in 2023.

The survey for SBW 6I is scheduled to be completed every third year using the *RV Tangaroa*.

**Table 5: Southern blue whiting survey schedule**

	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
<b>SBW 6B</b>	Aug 2024	Aug 2025	Aug 2026	Aug 2027	Aug 2028	Aug 2029
<b>SBW 6I</b>	Sep 2025			Sep 2028		



# Stock assessments & monitoring

## TIER 1 SPECIES

### Hoki

Hoki is New Zealand’s largest fishery with a TACC of 110 000 tonnes in 2023/24. The TACC is set for the whole area; however, hoki is assessed and managed through a non-regulatory catch limit agreement as two biological stocks; western and eastern. Juveniles from both stocks are assumed to mix on the Chatham Rise and to recruit to their respective stocks as they approach sexual maturity.

Hoki first achieved Marine Stewardship Council (MSC) certification in 2001 and has been re-certified three times; most recently in 2018, when it was certified as a fisheries complex with hake and ling trawl fisheries. The hoki, hake and ling trawl fisheries are due for an MSC assessment for re-certification in 2024/25.

Significant work to review and amend the hoki stock assessment model to more reliably reflect the fishery was undertaken in the 2020/21 financial year.

Stock assessments for hoki are completed annually.

### Hake

Hake fisheries have changed significantly in recent years, mainly as the result of changes in the fleet following new requirements that took effect in 2016. In the 2023 calendar year, hake exports were worth an estimated \$10 M. New Zealand’s three hake fisheries achieved MSC Certification in 2013 and were recertified in 2018 as part of the hoki, hake, ling trawl fishery complex. HAK 7 was subsequently withdrawn in 2019 in response to stock assessment information.

Hake stocks are currently assessed on three-year cycles (Table 6). Due to the current low level of targeted effort in HAK 4 and the 2020 stock assessment estimating the current biomass (55% B<sub>0</sub>) to be well above the management target (40% B<sub>0</sub>), future stock assessments will only be conducted in HAK 4 when the catch reaches certain threshold values. These thresholds will be two consecutive fishing years with a catch greater than 360 tonnes or a single fishing year with a catch greater than of 720 tonnes.

**Table 6: Hake assessment schedule**

	2023/24	2024/25	2025/26	2026/27	2027/28
HAK 1		Assessment			Assessment
HAK 4					
HAK 7	<b>Assessment</b>			<b>Assessment</b>	

*\*Assessments in bold reflect industry funded work*

### Ling

Ling is fished by a variety of fishing methods and fleets. Just over half of targeted ling catch is from bottom longline. A significant amount of ling is also taken as bycatch in the hoki trawl fishery. The ling biological stocks do not align with the Quota Management Areas. Assessments are completed based on assumed biological stock structure, although this remains uncertain, especially for the Cook Strait and North Island areas.

In the 2023 calendar year, ling exports were worth \$62 M. Five of New Zealand’s ling stocks (ten fisheries) were certified by the MSC in 2013 and recertified in 2018, with the five trawl ling fisheries included in the hoki/hake/ling trawl fishery complex. Key ling stocks are currently assessed on three-year cycles.

No assessments are currently planned for LIN 2 or LIN CS (Cook Strait) primarily because of uncertainty in stock structure. The 2024 LIN 5&6 assessment included characterisation of LIN 6B, which has now been included as part of the assessment for LIN 5&6 (Table 7).

**Table 7: Ling assessment schedule**

	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
<b>LIN 3/4</b>		Assessment			Assessment	
<b>LIN 5/6 and LIN 6B</b>	Assessment			Assessment		
<b>LIN 7</b>			Assessment			Assessment

### Southern blue whiting

Assessments of the SBW 6I stock are conducted every third year, aligned with the triennial survey (Table 8).

Southern blue whiting at Bounty Island (SBW 6B) is currently managed using a harvest control rule (HCR) that provides guidance on an appropriate level of fishing mortality to be applied based on biomass estimates from the annual acoustic survey which is conducted on an industry vessel.

**Table 8: Southern blue whiting assessment schedule**

	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
<b>SBW 6B</b>	HCR	HCR	HCR	HCR	HCR	HCR
<b>SBW 6I</b>			Assessment			Assessment

### Orange roughy

In 2014, a Management Strategy Evaluation indicated that surveys and assessments of orange roughy every four years would provide for utilisation while ensuring that stocks are not overfished. This would allow TACC adjustments to respond to changes in abundance.

Orange roughy stock assessments are scheduled to align with the relevant acoustic surveys. There are no assessments planned for ORH 1 or ORH 3B sub-Antarctic. For ORH 1, this is because of uncertainties in stock structure and no agreed biomass indices. For ORH 3B-Sub-Antarctic, this is due to the limited fishing effort and lack of available data from the fishery.

The ORH 7A stock assessment was deferred to 2023/24 because the original survey in 2022 was disrupted by COVID and subsequently completed in July 2023. Should a successful industry-led survey take place in 2025 as planned, the stock assessment will be updated for the 2026 plenary.

Surveys and assessments for ORH 3B Puysegur, ORH 7B, and ORH 2A North are currently industry-led initiatives.

Table 9: Orange roughly assessment schedule\*

	2023/24	2024/25	2025/26	2026/27	2028/29
ORH 2A North					
ORH MEC					
ORH 3B – NW Rise		Assessment			
ORH 3B – ES Rise		<b>Assessment</b>			
ORH 3B – Puysegur					
ORH 7A	Assessment				Assessment
ORH 7B					

\*Assessments in bold reflect where data used will be from planned industry-led survey initiatives

## Scampi

Scampi stocks are scheduled for assessments to occur the year after the relevant survey, which are scheduled for completion every fourth year. The first SCI 4A assessment will be conducted in 2024/25 based on the completion of a SCI 4A survey in 2023/24.

Table 10: Scampi assessment schedule

	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
SCI 1			Assessment			
SCI 2				Assessment		
SCI 3		Assessment				Assessment
SCI 4A		Assessment				Assessment
SCI 6A	Assessment				Assessment	

## Jack mackerel

There are three species of jack mackerel in New Zealand (*Trachyurus novaezealandiae*, *T. declivis*, and *T. murphyi*) that occur in varying proportions in different areas. Two species are considered native to New Zealand (*T. declivis* and *T. novaezealandiae*). *Trachyurus murphyi*, or 'Chilean jack mackerel,' is understood to be in New Zealand waters as the result of a range expansion from the wider south Pacific stock, in the 1980s and 1990s, and is unlikely to spawn or reproduce in significant quantities in New Zealand waters. Exports of jack mackerel were worth an estimated \$84 m in the 2023 calendar year.<sup>2</sup>

<sup>2</sup> This includes fish taken in the JMA1 purse seine fishery

Two of the three main jack mackerel quota management areas (JMA 3 and JMA 7) are managed by the Deepwater Fisheries Management team and are therefore covered by this research plan.

Historically, no estimates of stock status were available for any of the three jack mackerel species. An assessment for the JMA 7 stock began in 2020, which identified some issues with species identification and sampling at-sea.

The issues were subsequently resolved and a partial quantitative stock assessment using an event resolution CPUE index from observer data was accepted by the Plenary in 2023. The assessment included the two native species only. The approach is planned to be extended to JMA 3 in 2024/25.

Based on the life history characteristics of jack mackerel species (including maximum age of approximately 30 years), it is proposed to conduct assessments every third year.

**Table 11: Jack mackerel assessment schedule**

	2023/24	2024/25	2025/26	2026/27	2027/28
JMA 3		Assessment			
JMA 7			Assessment		

## Arrow squid

New Zealand’s squid fishery comprises two species, *Nototodarus sloanii* and *N. gouldi*. Squid exports were worth an estimated \$71 M in the 2023 calendar year.

Squid have a different life cycle from fish, which does not fit with standard fish population modelling approaches. Most squid live for around one year, spawn, and then die. The result of this is a new stock each year, the size of which tends to be driven by environmental factors. As a result, there may be high variability in abundance from year to year with recruitment varying between years by a factor of up to ten.

## Oreos

There are four species of oreo in New Zealand that are managed as a species complex: black (*Allocyttus niger*), smooth (*Pseudocyttus maculatus*), spiky (*Neocyttus rhomboidalis*), and warty (*Allocyttus verucosus*). The vast majority of effort and catch is for black oreo and smooth oreo and the species mix in the catch varies from area to area. Oreo exports were worth an estimated \$11 M in the 2023 calendar year.

Assessing and surveying oreo stocks has proved to be difficult. In the early years of the fishery, trawl surveys were used to estimate abundance; however, the aggregated nature of the fish led to very uncertain abundance estimates. From 1997, acoustic surveys were employed to survey oreo, but there are issues with species composition in acoustic marks, and no surveys have been completed since 2016.

Some assessments have been accepted in the past. However, most stocks have not had an accepted assessment for 10 years or more. One of the key issues is determining an abundance index, with acoustic surveys problematic and no accepted CPUE indices. Doonan et al. (2024) looked into this issue and new approaches for future oreo assessment work are being considered.<sup>3</sup>

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<sup>3</sup> Doonan, I.J.; Ladroit, Y.; Holmes, S.J.; Datta, S. (2024). Investigating monitoring and assessment approaches for oreo species. *New Zealand Fisheries Assessment Report 2024/20*. 42 p.

## TIER 2 STOCKS AND SPECIES

Tier 2 species and stocks are typically less valuable bycatch fisheries or are only target fisheries at certain times of the year. Because of the nature of these fisheries, Tier 2 stocks are often data limited making full stock assessments problematic. The abundance of Tier 2 stocks may be monitored using approaches including stock assessment, CPUE indices, age and/or size structure, and trawl survey indices.

In 2016, a workshop was held at which New Zealand fisheries experts considered each Tier 2 deepwater species and stock to characterise available information and potential monitoring approaches for each stock.

Reviews of stock status for Tier 2 stocks are primarily undertaken based either on significant changes in catch volume (e.g., decrease in bycatch in another target fishery suggesting a potential sustainability issue or an increase suggesting an increase in abundance), or when specific concerns are raised by stakeholders.

In addition, trends in the bycatch of Tier 2 (and non-QMS) species and stocks will continue to be monitored through bycatch reports prepared through the Aquatic Environment research stream, and the three wide area multi-species trawl surveys.

Fisheries New Zealand will identify priority Tier 2 stocks annually based on the catch balancing prioritisation process and monitoring of trends in catch or survey indices.

**Table 12: Tier 2 stock research**

Species / stocks <sup>4</sup>	Export value (2023)	How assessed / monitored	Upcoming research
Alfonsino (all)	\$8 M	Industry funded characterisation of BYX2/3 presented in 2023. CPUE likely not useful as an overall stock index.	None planned for 2024/25
Barracouta (BAR4/5/7)	\$30 M	BAR4 – CPUE indices updated in 2021 BAR5 – CPUE indices updated in 2021 BAR7 – CPUE indices updated in 2020	BAR4/5 – assessment planned for 2025/26  BAR7 – none planned
Black cardinalfish (all)	\$0.4 M	CDL2-4 assessed in 2009 and CPUE updated in 2014	None planned for 2024/25
Deepwater crabs (CHC/GSC/KIC)	Not available	Catch	None planned for 2024/25
Blue (English) mackerel (EMA3 & EMA7)	\$16 M	Partial quantitative stock assessment for EMA7 developed in 2023	Next assessment for EMA7 planned for 2026.  None planned for EMA3.
Frostfish (FRO3-9)	Not available	FRO7 monitored by West Coast South Island inshore <i>Kaharoa</i> survey. Reviewed in 2022.	None planned for 2024/25
Gemfish (SKI3 & SKI7)	\$5 M	Well-developed CPUE and trawl survey indices covering both stocks. Last updated in 2021.	Assessment planned for 2024/25

<sup>4</sup> All stocks managed under the Deepwater and Middle-depth Fisheries Plan unless otherwise indicated

Species / stocks <sup>5</sup>	Export value (2023)	How assessed / monitored	Upcoming research
Ghost shark (dark) GSH 4-6	\$0.4 M for both ghost shark species	GSH3 & 4 monitored by Chatham Rise and east coast South Island inshore trawl surveys.	None planned for 2024/25
Ghost shark (pale) (all)		GSP1 and GSP5 monitored by Chatham Rise and sub-Antarctic trawl surveys respectively. Reviewed in 2022. WCSI Tangaroa trawl survey not thought to monitor GSP7.	None planned for 2024/25
Lookdown dory (all)	Not available	LDO1 monitored by WCSI Tangaroa trawl. LDO3 monitored by Chatham Rise and sub-Antarctic trawl surveys. Reviewed in 2022.	None planned for 2024/25
Patagonian toothfish (all)	\$16 M <sup>6</sup>	Catch	None planned for 2024/25
Prawn killer (all)	Not available	Catch	None planned for 2024/25
Redbait (all)	Not available	Characterisation and CPUE indices developed during 2022-23. Observer indices considered promising for RBT7 and Southland (part of RBT3).	None planned for 2024/25
Ribaldo (RIB3-RIB8)	Not available	RIB3/4 monitored by Chatham Rise trawl survey. RIB5/6 monitored by Sub-Antarctic trawl survey. RIB7 monitored by WCSI Tangaroa trawl survey. Reviewed in 2022.	None planned for 2024/25
Rubyfish (all)	Not available	Catch	None planned for 2024/25
Sea perch (SPE3-SPE7) <sup>7</sup>	\$1.1 M	Inshore trawl surveys on east and west coasts of the South Island, and the Chatham Rise trawl survey may monitor the different species in the areas covered by the surveys. This was reviewed in 2022. Until very recently, however, no distinction was made between the two species during surveys.	None planned for 2024/25
Silver warehou (all)	\$22 M	Qualitative evaluation of the SWA3 and SWA4 stocks was undertaken in 2023.	None planned for 2024/25
Spiny dogfish (SPD4 & SPD5)	\$0.1 M	The Chatham Rise trawl survey may monitor abundance in SPD4 but does not cover the entire depth range. Reviewed in 2022.	None planned for 2024/25
White warehou (all)	\$2.1M <sup>8</sup>	The Chatham Rise trawl survey is thought to monitor abundance in WWA4.	None planned for 2024/25

<sup>5</sup> All stocks managed under the Deepwater and Middle-depth Fisheries Plan unless otherwise indicated

<sup>6</sup> Likely that most of this was fish caught in other jurisdictions

<sup>7</sup> There are two species of sea perch that are managed as a species complex; *Helicolenus percooides* and *H. barathri*. They have relatively distinct depth ranges with little overlap between the two species.

<sup>8</sup> The figure assumes that 'warehou, other' export information refers to white warehou

# Data collection

Information and data that underpins the management of New Zealand's fish stocks are wider than the surveys and stock assessments detailed in the previous sections.

This section of the research plan covers data collection (land-based sampling and observer coverage planning), ageing of observer samples, management strategy evaluations, and methods development work (e.g., survey design).

## Land-based catch sampling

Results from the sampling of commercial catch is a key input to a number of stock assessments. For these stocks, sufficient, representative samples of the length and/or age of the commercial catch must be available for the stock assessments to accurately estimate stock status.

For most deepwater fisheries, observers provide adequate sampling to support stock assessments. However, for some fisheries, getting sufficient observer coverage to collect representative samples can be challenging. Where fish are not fully processed at sea, research providers can be contracted to visit the landing sites and collect the required samples at that point.

This mechanism is currently in place for the hoki fishery to collect samples from the Cook Strait and the West Coast South Island within 25NM of the coast and is being considered for Pegasus Canyon. This project is scheduled to be completed annually.

## Observer coverage

Fisheries New Zealand plans at-sea observer coverage based on biological sampling targets for stock monitoring (e.g. length frequencies (**LF**) and otolith samples) and percentage coverage targets for the estimation of protected species interactions. Observer coverage is planned and delivered based on the number of 'observer days' required for each fishery on a financial year basis.

The number of observer days necessary to achieve biological sampling requirements is calculated using the following information from the most recent fishing year:

- The total number of target tows in each area
- The number of observed target tows in each area
- The number of samples collected by observers for each species/area combination
- The number of sea days delivered for each area

Because of the variability in fishing effort over the range of fisheries each year, it is challenging to plan required observer coverage in advance, and delivery can be affected by fishing activities during a year (e.g., if there is no fishing in a particular fishery, it will appear that coverage did not meet the target).

The table below provides indicative estimates of the required coverage in each of the main deepwater fisheries, and the main objectives that drive the setting of coverage requirements.

## Industry based sampling

Table 13: Objectives and rationale for deepwater observer coverage

Fishery complex & stocks covered	Main objective(s)	Rationale and comment
<b>Deepwater trawl fisheries</b>		
North Island Deepwater ORH 1, 2A, 2B, 3A BYX 2, CDL 2	Biological sampling of ORH	18 ORH LFs per area (ORH 1 A, B, C, D, ORH 2A North, Mid-East Coast) (total 110 LFs) Estimated 1 LF per day <sup>9</sup>
Chatham Rise Deepwater, ORH 3, OEO 3A, 4, BYX 3	Biological sampling of ORH to support stock assessment for ESCR, NWCR	60 LFs (300 otoliths) per ORH sub-stock (600 total). Estimated 2 LFs per day
Sub-Antarctic Deepwater ORH 3B OEO 1, 6	Biological sampling of ORH	100 LFs for Puysegur (300 otoliths), no target for Sub-Antarctic ORH stock. Estimated 1 LF per day
West Coast Deepwater ORH 7A, 7B	Biological sampling of ORH 30% effort coverage target for MSC (ORH7A only)	60 LFs for ORH 7A (300 otoliths), same to apply for ORH 7B if re-surveyed or re-opened Estimated 1 LF per day
<b>Hoki &amp; Middle depth trawl fisheries</b>		
West Coast North Island JMA 7, EMA 7, BAR 7	Biological sampling of JMA and other QMS species to support stock assessments Protected species capture monitoring	175 LFs (800 otoliths) for the two native JMA species and ad hoc sampling of JMM. Estimated 2 LFs per day. 20-30% effort coverage to allow estimation of protected species interactions
West Coast SI (FMA7) HOK 1 HAK 7, LIN 7 SWA 1	Biological sampling of HOK, HAK, LIN 30% effort coverage target for MSC stocks Protected species capture monitoring	400 LFs (1600 otoliths) for HOK, 200 LFs (1,000 otoliths) for HAK, 200 LFs (1,100 otoliths) for LIN. Estimated 2 LFs per day, species are generally not sampled at the same time as one another
WCSI HOK (Inside the line) HOK 1	Biological sampling of HOK Protected species capture monitoring	120 LFs (1200 otoliths) for HOK (note observer sampling is supplemented by shore-based sampling). Estimated 1 LF per day. 20-30% effort coverage to allow estimation of protected species interactions
Cook Strait HOK HOK 1	Biological sampling of HOK Protected species capture monitoring	120 LFs (1200 otoliths) for HOK (note observer sampling is supplemented by shore-based sampling). Estimated 1 LF day. 20-30% effort coverage to allow estimation of protected species interactions
ECSI HOK	Biological sampling of HOK Protected species capture monitoring	120 LFs (1200 otoliths) for HOK (note observer sampling is intended to be supplemented by shore-based sampling). Estimated 1 LF per day 20-30% effort coverage to allow estimation of protected species interactions

<sup>9</sup> Estimated LF per day was calculated by dividing the total number of LF collected for all the fishstocks in the complex for the fishing year by the total number of observer days achieved for this fishery complex during the fishing year. JMA LFs were split evenly between the Chatham Rise and Sub-Antarctic middle depth fisheries for the purposes of this calculation. This number was averaged across 2017/18, 2018/19 and 2019/2020 fishing years



Fishery complex & stocks covered	Main objective(s)	Rationale and comment
Chatham Rise Middle depths (FMA3 /FMA4) HOK 1, HAK 1, 4 LIN 3, 4, SWA 3, 4, JMA 3, BAR 1, BAR 4	Biological sampling of HOK, HAK, LIN 30% effort coverage target for MSC stocks Protected species capture monitoring	400 LFs (1600 otoliths) for HOK, 100 LFs (1000 otoliths) per area for HAK, 100 LFs (1100 otoliths) for LIN. Estimated 1 LF per day, species are generally not sampled at the same time as one another
Sub-Antarctic Middle depths (ex SQU/SBW) HOK 1, HAK 1, LIN 5, 6 SWA 4, WWA 5B, BAR 5, JMA 3	Biological sampling of HOK, HAK, LIN to support stock assessments. 30% effort coverage target for MSC stocks. Protected species capture monitoring	400 LFs (1600 otoliths) for HOK, 100 LFs (1000 otoliths) for HAK, 100 LFs (1100 otoliths) for LIN. Estimated 2 LFs per day, species are generally not sampled at the same time as one another
Southern blue whiting SBW (All)	Protected species capture monitoring Biological sampling of SBW	70% coverage required for monitoring of interactions with New Zealand sea lions in SBW 6I. 50 LFs (1500 otoliths) for SBW 6I, 100 LFs (1000 otoliths) for SBW 6B Estimated 1 LF per day
Squid SQU 1T, 6T	Protected species capture monitoring	70% coverage required for monitoring of interactions with New Zealand sea lions in SQU 6T
<b>Bottom longline fishery</b>		
Bottom longline >34m vessels LIN 3-6	Biological sampling of LIN 20% effort coverage target for MSC stocks	15-20% effort coverage target to monitor protected species interactions, VMP adherence, biological sampling particularly for LIN 5&6/6B Estimated 1 LF per day
Bottom longline <34m vessels Mainly LIN 7WC	Biological sampling of LIN, protected species capture monitoring. 20% effort coverage target for MSC stocks	10-15% effort coverage target to monitor protected species interactions, VMP adherence, biological sampling particularly for LIN 7 WC Estimated 1 LF per day
Potting LIN 3-7	Biological sampling of LIN, catch composition, protected species monitoring	10-15% effort coverage target to undertake biological sampling, monitor protected species interactions, and catch composition Estimated 1 LF per day
<b>Scampi trawl fishery</b>		
Scampi All other stocks	Protected species capture monitoring Catch composition Biological sampling of SCI	20-30% effort coverage target to monitor protected species interactions. 50 LFs per area (SCI 1, 2, 3, 4A). Estimated 1 LF per day
Scampi SCI 6A	Protected species capture monitoring Catch composition Biological sampling of SCI	20-30% effort coverage target to monitor protected species interactions. 50 LFs Estimated 1 LF per day

## **Ageing of deepwater fish species**

Information on the age structure of catches from commercial fisheries and resource surveys are key inputs to stock assessments of middle depth and deepwater species. Two main protocols are used to provide catch-at-age from fisheries. Where the fishery is discrete in time (e.g., spawning fisheries) this may take the form of an age-length key (ALK) which is used with length frequency samples to determine the age distribution of the catch. The second is direct ageing which is the ageing of otoliths collected throughout the year to represent the age distribution of the catch, which requires a larger number of otoliths to obtain a representative age distribution.

Key Tier 1 species are aged each year, even if assessments are on longer cycles. This provides a basic monitoring tool and could potentially identify significant changes in age structure that occur in years between assessments. Other fisheries are aged specifically to inform planned projects. There are also some species where the ageing data is either not used in the stock assessment, or it is not yet possible to accurately age the fish. For some of these species, otoliths are still collected, but are not aged on a regular basis.

**Table 14: Details of ageing for Tier 1 and Tier 2 species, including planned frequency**

Fishery	Area	Source	Method	# to be read	Planned freq.
<b>Hoki</b>					
HOK 1	WCSI spawning	Obs.	ALK	750	Annual
		Research	ALK		Annual
	Cook Strait spawning	Obs.	ALK	750	Annual
		Research	ALK		Annual
	ECSI spawning	Obs.	ALK	750	Annual
		Research	ALK		Annual
	Chatham Rise	Obs.	Direct	1200	Annual
		Research	ALK	750	Biennial
	Sub-Antarctic	Obs.	Direct	1200	Annual
		Research	ALK	750	Biennial
<b>Hake</b>					
HAK 1	Sub-Antarctic	Obs.	ALK	500	Annual
		Research	ALK	400	Biennial
HAK 4	Chatham Rise	Obs.	ALK	0	Annual
		Research	ALK	300	Biennial
HAK 7	WCSI	Obs.	ALK	600	Annual
		Research	ALK	600	Triennial
<b>Ling</b>					
LIN 3&4	Chatham Rise (trawl)	Obs.	ALK	500	Annual
		Research	ALK	600	Biennial
	Chatham Rise (BLL)	Obs.	ALK	TBC	Annual
LIN 5&6	Sub-Antarctic (trawl)	Obs.	ALK	500	Annual
		Research	ALK	600	Biennial
	Sub-Antarctic spawning (BLL)	Obs.	ALK	TBC	Annual
	Sub-Antarctic non-spawning (BLL)	Obs.	ALK	TBC	Annual
LIN 7	WCSI	Obs.	ALK	500	Annual
		Research	ALK	600	Triennial
<b>Southern blue whiting</b>					
SBW 6B	Bounty Platform	Obs.	ALK	600	Annual

Fishery	Area	Source	Method	# to be read	Planned freq.
SBW 6I	Campbell Island	Obs.	ALK	600	Annual
		Research	ALK	600	Triennial
SBW 6R	Pukaki Rise	Obs.	ALK	(600)	Not currently planned
Orange roughy					
ORH MEC		Obs.	Direct		Every 4 years
		Research	Direct	900	Following surveys
ORH 3B	Northwest Rise	Obs.	Direct		Every 4 years
		Research	Direct	900	Following surveys
	East & South Rise	Obs.	Direct		Every 4 years
		Research	Direct	900	Following surveys
	Puysegur	Obs.	Direct		Following surveys
		Research	Direct	500	Not planned
Sub-Antarctic	Obs.	Direct		Not planned	
ORH 7A	WCSI	Obs.	Direct		Every 4 years
		Research	Direct	900	Following surveys
ORH 7B	Southern WCSI	Research	Direct	500	Following surveys
ORH ET					As required for assessments
Oreo					
OEO 3A	Black oreo	To be confirmed following confirmation of monitoring approach			
	Smooth oreo				
OEO 4	Smooth oreo				
OEO 1 & 6	Pukaki smooth				
	Pukaki black				
	Southland smooth				
	Bounty smooth				
Jack mackerel					
JMA 3	<i>T. murphyi</i>	Obs.	ALK	600	Triennial
	<i>T. novaezealandiae</i>	Obs.	ALK	600	Annual
	<i>T. declivis</i>	Obs.	ALK	600	Annual
JMA 7	<i>T. novaezealandiae</i>	Obs.	ALK	600	Annual
	<i>T. declivis</i>	Obs.	ALK	600	Annual

Tier 2 species					
Barracouta					
BAR 4&5	Chatham Rise and Southland	Obs and Research	ALK	900	Annual
Gemfish					
SKI 3&7	Southeast coast and Challenger	Obs	ALK	600	Annual
Silver Warehou					
SWA 3&4	Chatham Rise and Southland	Obs and research	ALK	600	Annual

With the exception of barracouta and gemfish since 2021 and SWA from 2024, the ageing of Tier 2 species is done on an as-needed basis to support assessments, characterisations, or other analyses to estimate stock status. The scheduling of this work will be based on the scheduling of other work, and therefore cannot be detailed in full here.

As needs for ageing of additional species are often not identified until after the beginning of the financial year, Fisheries New Zealand will generally provide flexibility within the ageing project to age a significant number of additional otoliths as needed over the course of the fishing year (e.g., 2400 otoliths were aged in addition to those explicitly detailed in 2019/20).

# Management Strategy Evaluations and Harvest Control Rules

Management Strategy Evaluation (MSE) describes the use of simulations to compare the effectiveness of management strategies (data collection, harvest strategies/rules, analysis methods) to achieve specified management objectives.

MSEs can take a wide range of forms, and the objectives against which management strategies are being assessed can range from developing a harvest control rule (HCR), or informing research frequency, to working through voluntary measures and operational parameters to maximise economic yield from a fishery.

Under the National Deepwater Plan 2019, Fisheries New Zealand will run MSEs for Tier 1 stocks wherever possible to inform species-specific management approaches. The first MSE of a deepwater stock was completed for hoki in 2011 and defined a management target range to manage the fishery for economic yields and desired fish size.

MSEs should be updated at regular intervals (or if there is substantial change in the fishery) to ensure the outcomes remain consistent with management objectives for the relevant fishery and to incorporate any updated information on biology, stock status, or other factors.

The Marine Stewardship Council (MSC) has implemented a requirement for MSEs to be in place in order to achieve MSC certification so all stocks currently certified will have MSEs developed if they are not already in place. There are MSEs in progress for hake in HAK 7 (industry funded) and other hake and all ling stocks will then follow once the strategy has been established using HAK 7.

## Methodology and Development

Methodology and development work will be required on an ongoing basis to ensure that there is continuous improvement in methodologies and models used to inform the management of deepwater fisheries. This kind of work can be difficult to plan in advance and is not planned in a structured way as many other categories of research are.

At present, this section serves to identify areas where there is likely methodology and/or development work that is required or may be required in future to be prioritised as resources allow. For a more comprehensive list of potential future methodology and/or development work for each species see the Fisheries Assessment Plenary.

In addition, recent discussions with stakeholders have highlighted an objective of continuous improvement in the availability of information to inform management including new approaches to be more cost effective or efficient, and regular external reviews of stock assessments to prompt innovation and progress. An example of work in progress is the investigation of technology to automate otolith ageing.

### *Hoki*

Potential future research for hoki includes further investigations into natural, fishing, and cryptic mortality, and exploring alternative spatial stock hypotheses and model structures including adding the ECSI spawning fishery as a separate fishery.



### *Hake*

Potential future research for hake includes a review of historical ageing to address uncertainty seen in the 1990s, a review of the age-length data for the sub-Antarctic, investigating the spatial-temporal structure of sub-Antarctic hake and the potential exclusion of the RV *Tangaroa* sub-Antarctic trawl survey biomass estimate for 2017 from future stock assessments of HAK 1. Linkages between HAK 7 and HAK 1, particularly in Puysegur should be explored as well as addressing concerns regarding WCSI survey coverage particularly south of the survey area where most of the fishery takes place. Climate impacts on spatial and temporal population dynamics and recruitment should also be considered.

### *Ling*

Potential future research for ling includes revisiting maturity ogives and biological parameters, a further investigation into longline CPUE standardisation, and additional work on the most appropriate value of natural mortality. Potting fisheries for ling have been increasing and observer data is required to better understand these fisheries.

### *Southern blue whiting*

The main potential piece of future research for southern blue whiting is determining how to best represent mean weights at age for Campbell Island Rise southern blue whiting given the negative relationship between year class strength and growth in the model.

### *Orange roughy*

Potential future research for orange roughy includes examining any contamination by swim bladder species when estimating orange roughy acoustic biomass, re-examining the natural mortality and steepness assumptions for each orange roughy assessment, reviewing the assumption of a 5% overrun, representing fish loss from trawl gear damage and ripped nets, for current and recent years, re-evaluating stock structure assumptions and the relationship between maturity and spawning with the potential for age-dependent skipped spawning.

### *Scampi*

Potential future research for scampi includes examining the spatial and temporal patterns in grade length and sex composition, conducting additional tagging to improve growth estimates, and exploring evidence for the effects of recent fishing activity on catch rate. Another potential piece of future research includes examining recruitment patterns by obtaining better information on size composition. The first photo survey of scampi in SCI 4A occurred in 2023. Work is underway to resolve issues raised regarding the photo survey in SCI 1 and SCI 2. Outcomes will inform future surveys in all areas.

### *Oreos*

Potential future research for oreos includes re-establishing acoustic surveys and further work to identify species composition in large marks, particularly for SSO 4. For BOE the models need to include variable growth with depth and analysis of length composition data to get acceptable LFs or move toward using age composition data.

### *Jack mackerels*

Work was completed in 2022 to speciate jack mackerels using otolith shape analysis and resolve sampling representativeness. A stock assessment of JMA 3 is planned.

### *Barracouta*

Potential future research for barracouta would be to develop age-based stock assessments for BAR 5 and BAR 7 as well as further spatio-temporal analysis to further develop the CPUE time series and stock assessment. Ageing of otoliths has occurred for the past 3 years in support of a future assessment.

### *Gemfish*

Potential future research for gemfish includes, evaluating potential environmental influences on gemfish distribution and recruitment and assessing records of *Rexea spp.* other than *Rexea solandri* in NZ waters. An age-based assessment model is planned in 2024-25 and ageing of otoliths has been occurring as recommended.

### *Silver warehou*

The stock structure of silver warehou is poorly known so a holistic approach to understanding biological stocks is recommended. For SWA 3 & 4 the Chatham Rise trawl survey indices should be reevaluated and a spatial-temporal approach considered. Ageing is also recommended as is further exploration of alternative CPUE models including spatial approaches.