



SIOFA Fisheries Summary: orange roughy (*Hoplostethus atlanticus*) 2025

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Prepared by the SIOFA Secretariat

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Contents

1.	Purpose of this document.....	4
2.	Data sources and analysis code	5
2.1	Data availability	5
2.2	Missing/incomplete/problematic data for the purposes of this report.....	5
2.3	Data used in this report.....	6
2.4	Analysis code	6
3.	Species Summary	7
4.	Biological Summary.....	8
5.	Description of the fishery.....	8
5.1	Fleet and gear	8
5.2	Fishing areas	9
5.3	Assessment Areas	9
5.4	Catch and effort.....	10
5.5	Catch limits	12
5.6	Illegal Unreported and Unregulated (IUU) catch.....	12
5.7	Other sources of fishing mortality.....	12
6.	Stock assessment and status	12
6.1	Harvest strategy and reference points.....	15
7.	Data collection	15
7.1	Biological data summaries.....	16
7.2	Tag data	16
8.	Summaries of abundance indices and other observational data	17
8.1	Scaled length frequencies.....	17
8.2	Scaled age frequencies	17
8.3	CPUE indices	17
8.4	Acoustic biomass indices	17
8.5	Trawl survey indices.....	18
8.6	Tag-based abundance estimates	18
9.	Biological parameters	18
9.1	Natural mortality	19
9.2	Growth parameters	19
9.3	Length/weight relationship	20
9.4	Maturity and spawning.....	21
9.5	Stock recruitment relationship.....	21
9.6	Tag parameters.....	22

10. Target catch/bycatch and ecosystem impacts.....	22
10.1 Orange roughy target catch and bycatch	22
10.2 Target catch/bycatch by SIOFA Subarea.....	25
10.3 Discards.....	25
10.4 Catch/bycatch in orange roughy Assessment Areas.....	27
10.5 Incidental catch of VME taxa and other invertebrates.....	27
11. Interactions with seabirds, mammals, turtles, sharks and other species of concern	28
11.1 Seabirds interactions	30
11.1.1 Captures	30
11.1.2 Observations	30
11.2 Marine mammals interactions.....	32
11.2.1 Captures	32
11.2.2 Observations	32
11.3 Turtles interactions.....	32
11.4 Shark captures of species considered to be at high risk and/or of concern.....	32
12. Effects of the fishery on the ecosystem.....	32
13. References	33
14. Appendix A – Supplementary tables and figures.....	36

Summary of updates in this version:

- Figures have been updated to be color-blind friendly, where possible, using the Okabe-Ito color scale (Okabe & Ito 2008, “Color Universal Design (CUD): How to Make Figures and Presentations That Are Friendly to Colorblind People.” <http://jfly.iam.u-tokyo.ac.jp/color/>).
- Data is presented for the last 10 years in the data series (2014–2023), previous data (2013) will remain available in older reports but is not showcased here.
- Flextables used to create auto-updating nested tables
- Added an analysis of discards in the fishery (see Section 10.3)

1. Purpose of this document

The SIOFA Fisheries Summaries describe specific SIOFA fisheries in the SIOFA Area (Figure 1) and summarize the available information for each species, and their biology and ecology. This document is targeted at the general public and institutions and countries wanting to better understand SIOFA fisheries. It also describes SIOFA data available on SIOFA individual fisheries that could be used by scientists and consultants for scientific research.

The [SIOFA Ecosystem Summary](#) provides more detailed information on effects of SIOFA fisheries on ecosystems and species in the SIOFA Area. The [SIOFA Fisheries Overview](#) integrates these documents and describes general trends for the main fisheries in the SIOFA Area.

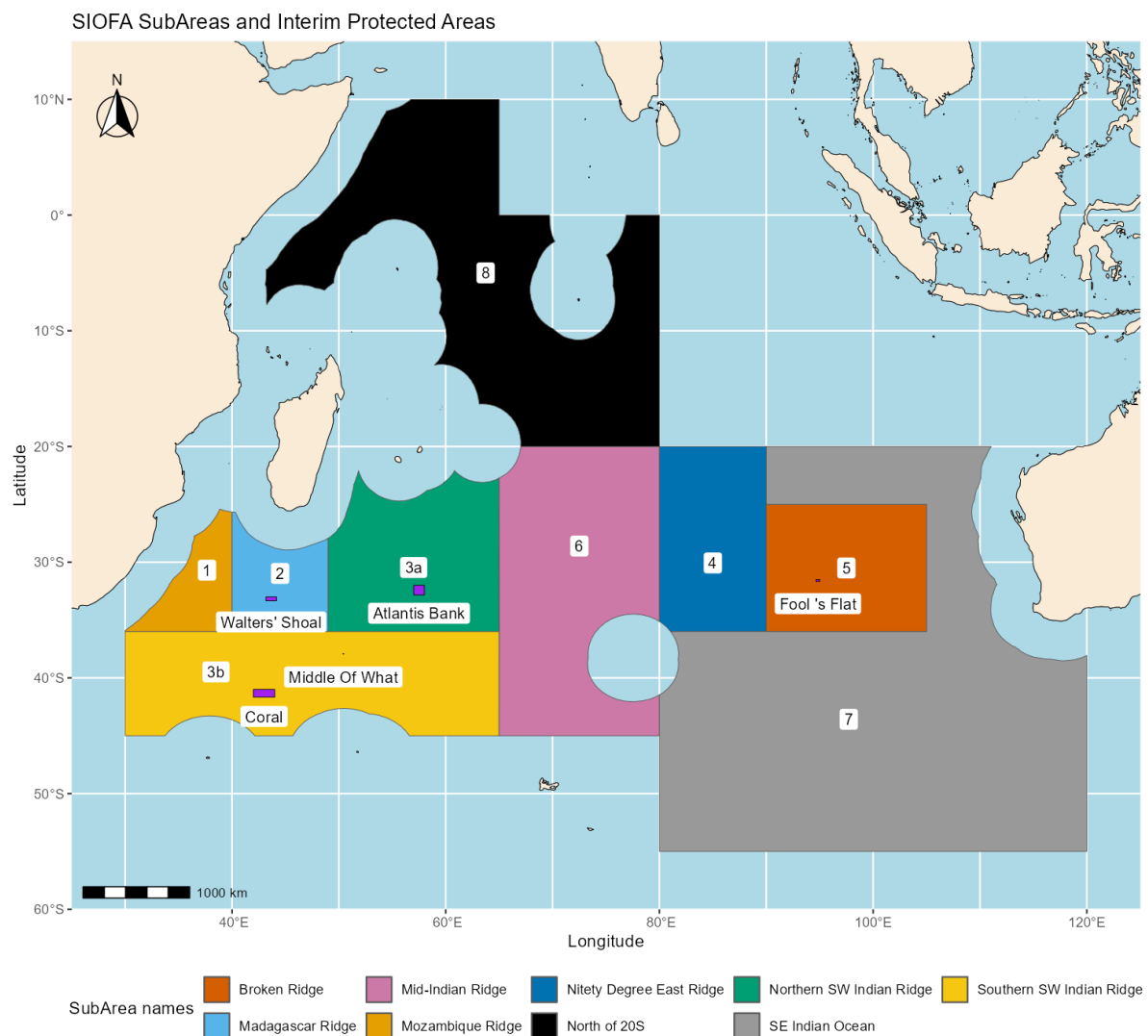


Figure 1 – The SIOFA Area and Subareas (source: SIOFA Spatial database). The Subarea numbers and colour codes are used consistently throughout this summary to identify Subareas. The map highlights SIOFA Interim Protection Areas (in magenta) as defined in [CMM 01\(2024\)](#) (Annex 3). All the interim protection areas have been labelled by name for easier recognition.

2. Data sources and analysis code

2.1 Data availability

There are thirteen CCPs that are members of SIOFA. The SIOFA Secretariat receives data from CCPs pertaining to their fishing activities, biological sampling, and Scientific Observer reports as per [CMM 02\(2023\)](#) (Data Standards). The SIOFA Secretariat acts as custodian for these data on behalf of its members. Request to release or publish these data (e.g., for scientific purposes) are regulated under [CMM 03\(2016\)](#) (Data Confidentiality). Data requests can be made through the SIOFA Secretariat (secretariat@siofa.org).

The main SIOFA databases are:

- AggregatedCatchEffort, which contains catch (and sometimes effort) aggregated at different spatial resolutions, varying from the whole SIOFA Area to 20' squares, from 2000 to 2019.
- HBHCatchEffort, which contains haul-by-haul catch and effort at a spatial accuracy varying from degrees to seconds, from 1998 to 2022.
- Observer, which contains Scientific Observer collected biological sampling, observer reported catches, and observed operations data, from 2012 to 2022.

The SIOFA databases are supported by other data assets such as:

- Spatial layers, which contains all the GIS spatial layers available to the Secretariat (e.g., boundaries of SIOFA Subareas, Assessment Areas). These have been collected at https://github.com/SIOFASecretariat/SIOFA_SC_Spatial_layers
- Codes, including gear and species codes etc. Some of these have been collected at <https://github.com/SIOFASecretariat/FAO-unified-codes>

The main SIOFA databases have been described in the outputs of project SEC2021-05 (see [SC-07-08](#), restricted access), where it was noted that the data was repeated (i.e., overlaps) across the first two databases. A suggestion has been made to further develop the three databases as three 'subject areas' that form part of a single SIOFA Fisheries Database in the future.

Further data (e.g., on active vessels) is available from Annual National Reports (2015–2025) that SIOFA CCPs submit to the Scientific Committee every year, which are made publicly available on the SIOFA website (<https://siofa.org/meetings/groups/Scientific%20Committee%20Meeting>).

2.2 Missing/incomplete/problematic data for the purposes of this report

2024 Catch, Effort and Scientific Observer data are scheduled to be submitted to the Secretariat at the end of May in 2025. Any data more recent than 2023 should be thus considered as draft, potentially incomplete and subject to further revisions, and has therefore been excluded from this report.

Inconsistencies between tows times and positions have been detected in the 2021 and 2022 data from the orange roughy fishery. Similarly, catch weights in the 2023 data from the orange roughy fishery likely contained some errors. Furthermore, small inconsistencies have been identified in the reported trap effort from 2021.

These data were included in this report, but caution should be exercised when interpreting positional data at a fine scale or catches for the most recent year.

While these reports are based on best available data, there might be other data issues that have not been detected and caution is advised when interpreting the results presented.

2.3 Data used in this report

A SIOFA database extract was delivered on 17 September 2024 and used in this report.

The information presented in this report was extracted from different sources, depending on the type of data required. To minimize the confusion that can arise from having to interpret multiple data sources, explicit references to data sources have been made in each table/figure caption in the report.

The report is intended to cover the last five years of available data (at a minimum) but note that the data used covers the 2014–2023 period (10 years of data), and that the period covered varies across the different sections as detailed below.

- i. Active fleet composition (2014–2023): SIOFA HBHCatchEffort and SIOFA AggregatedCatchEffort databases
- ii. Main fisheries (2000–2023): Annex 1 of [CMM 17\(2024\)](#).
- iii. Total catches per CCP (2014–2023): SIOFA AggregatedCatchEffort database, combined with SIOFA HBHCatchEffort database.
- iv. Catch, Effort (including per Subarea) and discards (2014–2023): SIOFA HBHCatchEffort database, SIOFA AggregatedCatchEffort database and spatial layers (this does not include non-fish catch, see Section 10 for definitions of target catch).
- v. VMEs (2004–2023): SIOFA Observer and HBHCatchEffort databases.
- vi. Fishing in Interim Protected Areas (2014–2023): SIOFA HBHCatchEffort and Spatial databases
- vii. Biological sampling (2014-2023): SIOFA Observer database.
- viii. Observer-reported catches (2014-2023): SIOFA Observer database.
- ix. Observer coverage (2014-2023): SIOFA Observer database.

2.4 Analysis code

The code that produces all analyses presented in this report is publicly available at https://github.com/SIOFASecretariat/SIOFA_SC_Reports_code

3. Species Summary

Common name	Orange roughy
Scientific name	<i>Hoplostethus atlanticus</i> Collet 1889
Scientific synonyms	<i>Hoplostethus gilchristi</i> , <i>Hoplostethus islandicus</i>
FAO species code	ORY
Year of this report	2025
Assessment Areas/ Management Units	One assessment area, Walter's Shoal Ridge, within FAO area 51
Assessment method	Integrated stock assessment (using CASAL)
Most recent assessment	2024/25
Year of next assessment	2028
Harvest strategy	Not yet defined
Summary of current stock status	For the Walter's Shoal Ridge, there is a 76% probability that the stock was not overfished and no overfishing was taking place in 2020 (para 92, SC7 report 2022) No other assessments are available in other areas

This report describes the orange roughy fishery in the SIOFA Area and available biological parameters for orange roughy.

Fisheries for orange roughy in the SIOFA Area are managed under [CMM 01\(2024\)](#) (Interim Management of Bottom Fishing) and [CMM 15\(2024\)](#) (Management of Demersal Stocks).

Management advice for this species is given in the Report of the Scientific Committee of SIOFA and management decisions are summarised in the Report of the Meeting of Parties of SIOFA.

The SIOFA Scientific Committee has provided interim advice, endorsed by the SIOFA MoP, to put in place an interim catch limit for orange roughy corresponding to the average annual catch in the last 6 years (see paragraph 79, [MoP10 Report](#)). However, no further management advice has been agreed for orange roughy in the SIOFA area.

A comprehensive harvest strategy for the orange roughy stocks has not yet been developed (Brandao et al. 2022), but the MoP adopted management objectives and performance indicators for toothfish (MoP11 report, Annex N), as well as some sensitivity choices for the Management Strategy Evaluation.

Orange roughy was assessed through an integrated stock assessment, using the CASAL software package (Bull et al. 2012). The latest assessment by Mormede and Hoyle (2025) evaluated three potential stocks (Walters Shoal Ridge, Long Walters Shoal Ridge and the South-West Indian Ocean Ridge).

4. Biological Summary

Orange roughy is globally widespread in deeper waters. In the south-central Indian Ocean, it has been found in association with bottom features to a depth of 180–1800 m. For orange roughy, there is evidence for ontogeny changes with increasing depth (Dunn et al. 2009; Dunn & Forman 2011). Orange roughy are benthic pelagic and are usually found near the bottom, but sometimes up to 50–200 m above the seabed to forage, or in spawning plumes in areas of high-water mass movement and mixing (Lorance *et al.*, 2002). Parasite and trace element analyses indicate orange roughy is a relatively sedentary species with little movement between fishery management areas (Edmonds et al. 1991).

Aggregations of orange roughy form in cold waters (3–9 °C) at depths between 700 and 1600 m on steep continental slopes, over canyons, ridges and other underwater topographical features such as seamounts, especially to spawn and feed (Clark *et al.* 2000, Uiblein et al. 2003, Clark et al. 2016), with individuals migrating up to 100 km to reach a spawning ground (Coburn & Doonan 1994, Francis & Clark 1998). Spawning occurs in specific areas, generally at depths of 700–1000 m near pinnacles and canyons from May to August (in the southern hemisphere), with differences in the onset of spawning between areas which seems to be consistent from year to year (Pankhurst 1988, Bell et al. 1992, Young et al. 2004). Not all mature fish spawn every year (see e.g., Doonan 2013), and the range of age-at-spawning is 32–41 years of age (Cordue 2014). Fecundity is variable, between about 16 000 and 115 000 eggs per kg in the Pacific (Pankhurst 1988, Clark *et al.* 1994, Koslow *et al.* 1995, Young *et al.* 2004), with differences between large regions.

Orange roughy are opportunistic predators feeding on prawns, squid, and small fishes (Rosecchi et al. 1988, Labbé & Arana 2001, Koslow & Bulman 2002), but also amphipods, mysids and decapod crustaceans (Rosecchi et al. 1988, Bulman & Koslow 1992).

Females are generally larger than males. Catches include both sexes, but individual trawl tows can be dominated by either sex, indicating potential sex substructure in aggregations, particularly during spawning (Anderson 2011).

The maximum age in orange roughy can exceed 200 years (Tracey & Horn 1999, Gili et al. 2002, Horn et al. 2016, Horn & Maolagáin 2019). Orange roughy have low productivity due to a combination of the late onset of maturity, and low annual growth rate in relation to size (Cordue 2014). Estimates of productivity parameters for orange roughy for the SIOFA Area are given in Saunders (2022).

5. Description of the fishery

5.1 Fleet and gear

Orange roughy are targeted in the SIOFA Area using bottom trawls but have been reported as being caught also in midwater trawls in the alfonsino fishery (2014–2023). The orange roughy fishery is a mixed fishery in itself, with different species being caught opportunistically and fishing gears being swapped accordingly. Some data have been aggregated to a daily level such that gear type can't be specified beyond 'trawl' but are most likely to be bottom trawls (2014–2023). The orange roughy fishery is thought to have been extensive in the early 2000s, with vessels flagged to different countries, but the fleet engaging in the orange roughy fishery was only 3 or fewer vessels since 2004. As a consequence of the low number of vessels participating in the fishery, the total tonnage of target catch taken tends to fluctuate from year to year. The CCPs that have participated in the alfonsino fishery are summarised in Table 1 within Section 7 of this Summary.

In the 2019–2023 period, participation in the orange roughy fishery has involved on average 2 vessels per year.

5.2 Fishing areas

Orange roughy fisheries in the southwestern part Indian Ocean (SWIO) (Figure 2) occur mainly on or around underwater topographic features. The spatial distribution of catches has not changed significantly over time.

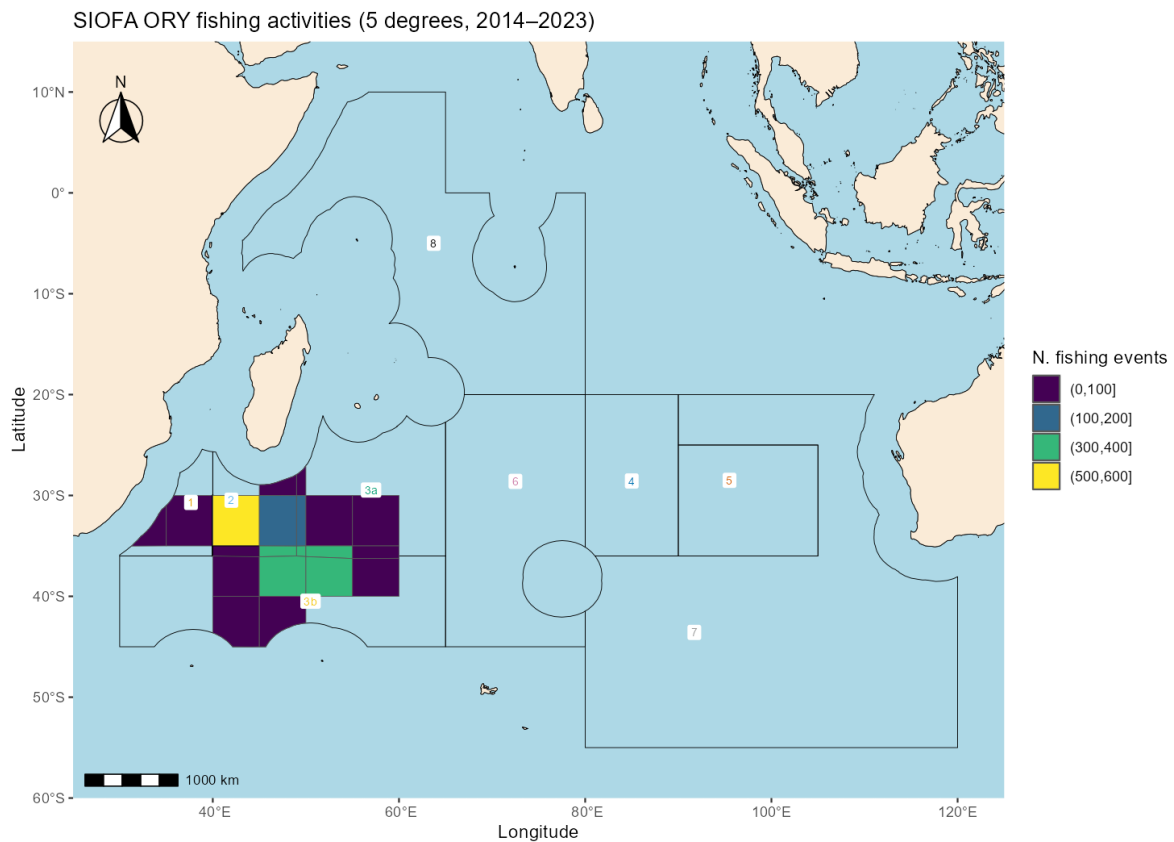


Figure 2 – Spatial distribution of fishing events that caught orange roughy in the SIOFA Area, derived from haul-by-haul level fishing data, aggregated at a 5x5 degrees resolution (source: SIOFA HBHCatchEffort databases 2014–2023). This map represents all fishing events that reported a catch of ORY, irrespective of declared target species.

5.3 Assessment Areas

Eight assessment areas were defined by Cordue (2018a and b, Figure 3) and used by Roa-Ureta et al. (2022). The assessment areas North Walter's, Walter's Shoal Ridge, West Walter's, Seamounts and Meeting were grouped in a spatial unit called the "Long Walter's Shoal Ridge" (LWSR) while the assessment areas North Ridge, Middle Ridge and South Ridge were grouped as the "South-west Indian Ocean Ridge" (SWIOR).

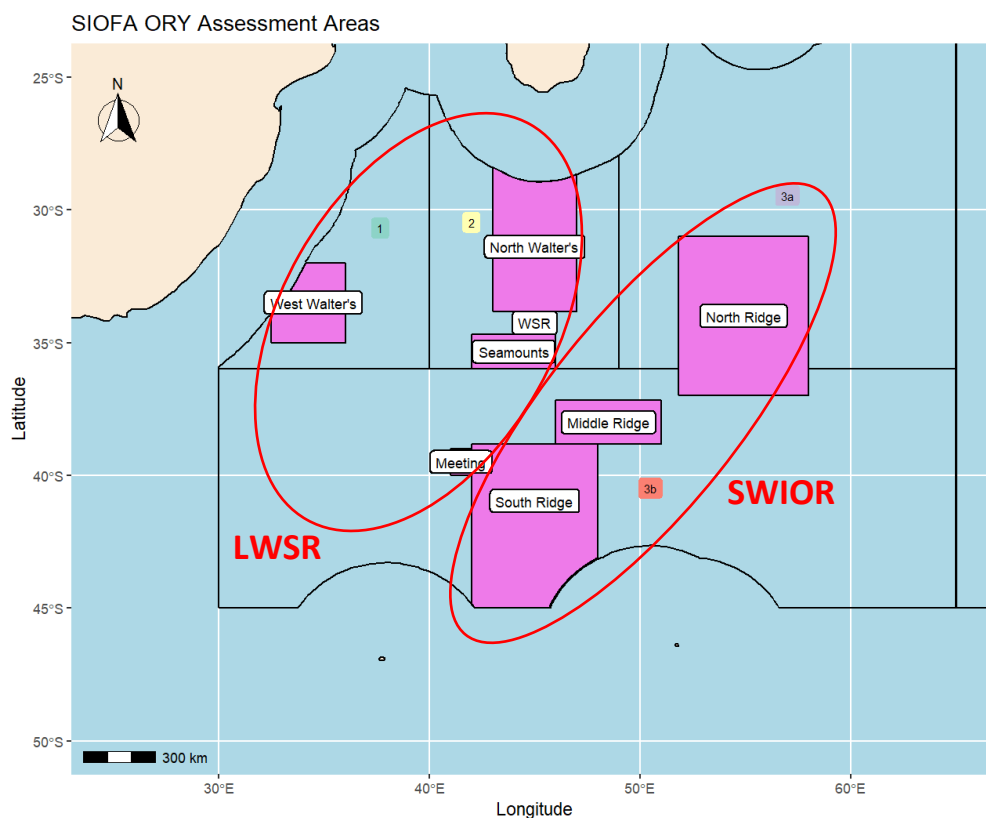


Figure 3 – Map of SIOFA Areas used for assessments (in magenta) for orange roughy as defined by Cordue (2018a, 2018b) and used by Roa-Ureta et al. (2022) (source: SIOFA Spatial layers). Labels indicate names of single assessment areas. Red ovals denote the grouping of single assessment areas into two larger management units for purposes of stock assessment by Roa-Ureta et al (2022). These management units are labelled Long Walter's Shoal Ridge (LWSR) and South-west Indian Ocean Ridge (SWIOR).

5.4 Catch and effort

Note that fishing effort and catches reported in this section represent the total catch of orange roughy, irrespective of whether each particular fishing event had been targeting orange roughy or not. Consequently, CPUE represents the CPUE of all fishing events that caught orange roughy (even as bycatch), and hence if the proportion of operations actively targeting orange roughy increases then CPUE will likely increase as well. In this context CPUE cannot be considered a reliable index of abundance.

Catches of orange roughy have been increasing over the last years but are overall within the historical average (Figure 4a). The average annual catch of orange roughy during the recent (2018–2022) period was 1075.7 t. In recent years fishing is prosecuted by only one or two vessels in the SIOFA orange roughy season, so variability in fleet deployment can cause large fluctuations in both catch and effort. Vessel maintenance periods, breakdowns, bad weather or market preference can significantly affect the total annual catch. Due to the seasonal nature of the fishery, vessel interruptions will also have a disproportionate effect on measures of effort.

Effort levels have decreased in recent years, from the higher values in 2015–2018 (Figure 4b). Orange roughy is mostly caught in the western SIOFA Area, mainly Subareas 2 and 3a (Figure 4b).

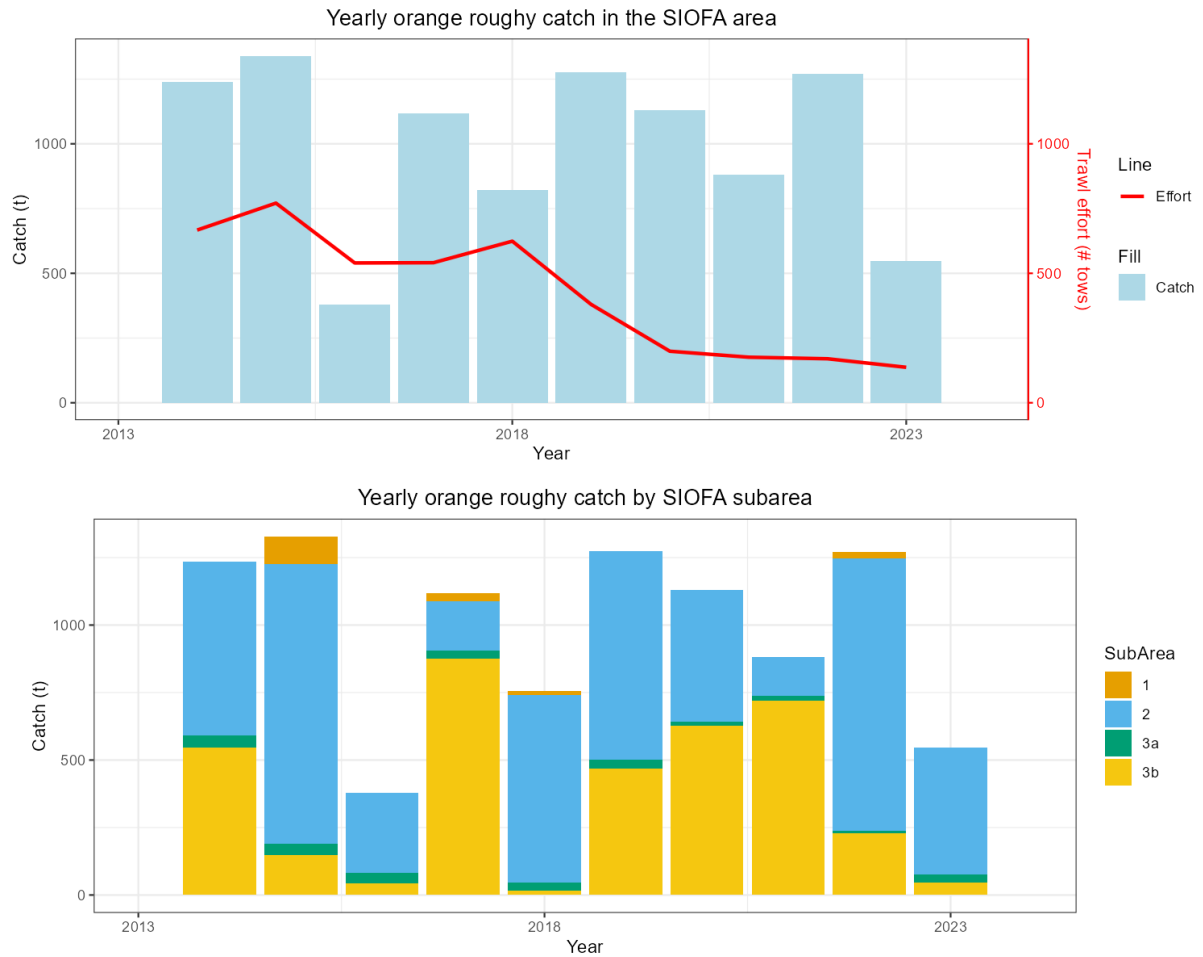


Figure 4a and b – Yearly catch of orange roughy (t) and effort (number of tows) in the SIOFA Area (upper panel, a) and in different SIOFA Subareas (lower panel, b) (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Values in these figures are provided in Table A.1 (Appendix A).

Recent years have seen lower levels of effort with higher catches (Figure 4), so unstandardised catch per units of effort (CPUEs) have been rising correspondingly (Figure 5). Standardised CPUE indices have not yet been developed for orange roughy, however it is likely that standardised CPUEs would have little information as an index of abundance for orange roughy aggregations on seamounts, especially when effort includes fishing events in which ORY was only caught as bycatch.

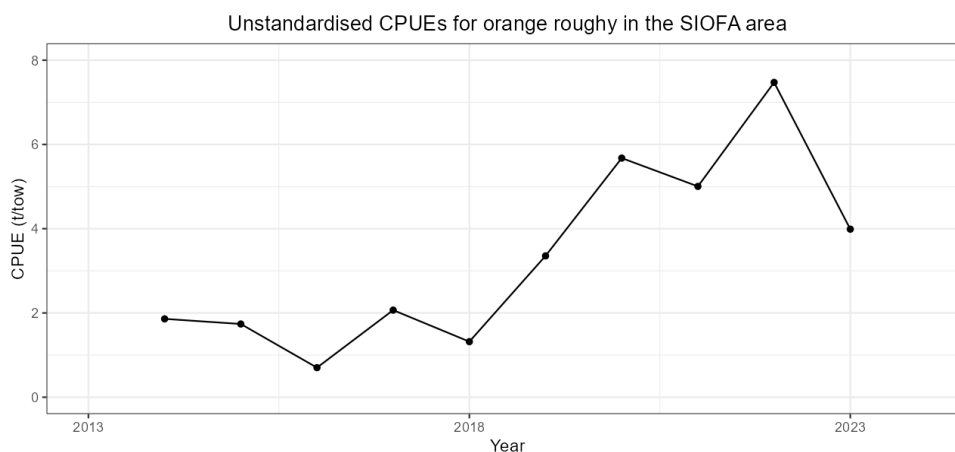


Figure 5 – Unstandardised catch per unit effort (CPUEs) of orange roughy in the SIOFA Area (t/tow) (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023).

Orange roughy catch and bycatch are further investigated in Section 10.

5.5 Catch limits

There are currently no catch limits for orange roughy in the SIOFA area.

5.6 Illegal Unreported and Unregulated (IUU) catch

No claims of Illegal Unreported and Unregulated (IUU) catches of orange roughy have been reported to SIOFA.

5.7 Other sources of fishing mortality

Some mortality associated with escapement from trawl nets is likely to occur, mostly of small fish that escape through the trawl mesh. The level of mortality associated with escapement is unknown.

6. Stock assessment and status

Integrated stock assessments were performed in 2014 (Cordue 2014), 2018 (Cordue 2018a and b), 2022 (Roa-Ureta *et al.* 2022), and 2025 (Mormede and Hoyle 2025).

Mormede and Hoyle (2025) evaluated three potential stocks (Walters Shoal Ridge, Long Walters Shoal Ridge and the South-West Indian Ocean Ridge). The assessment integrates updated fisheries data, biological parameters, and acoustic biomass estimates to evaluate stock status. Bayesian age- and sex-based models were applied to estimate population dynamics, incorporating new age-frequency distributions and standardized catch per unit effort (CPUE) data.

The assessment results for Walters Shoal showed that biomass in 2023 (the terminal year of the assessment) was estimated at 59.3% B_0 (52.4-66.1) and there was 100% probability that $B_{2023} > B_{40\%}$. While the exploitation rates in the past have exceeded $F_{40\%}$, they have declined and current (2023) exploitation rates are below $F_{40\%}$ (Figure 6)

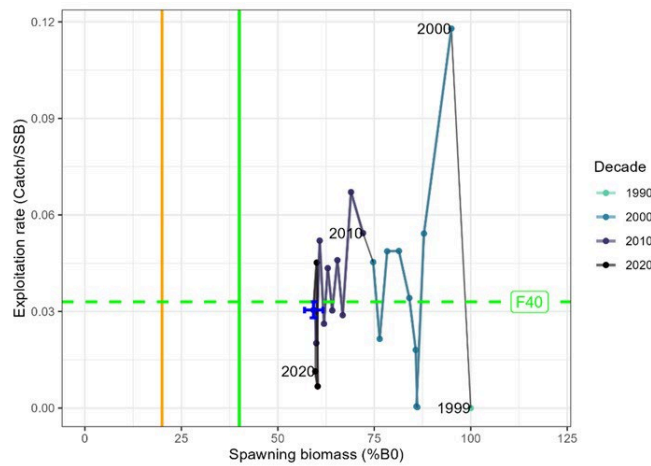


Figure 6 - Kobe plot for the Walters Shoal Ridge stock trajectory showing exploitation rate (catch/SSB) and spawning biomass (% B_0). The red vertical line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and green lines are the % B_0 target (40% B_0) and the corresponding exploitation rate (catch divided by $SSB_{F_{40}} = 0.176$ under average recruitment assumptions). Biomass and exploitation rate estimates are medians from posterior distributions for the base model. The blue cross represents the limits of the 95% credible intervals of the estimated ratio of the SSB to B_0 and exploitation rate in 2023.

The assessment results for Long Walters Shoal showed that biomass in 2023 was estimated at 58.8% B_0 (53.2-64.5) and there was 100% probability that $B_{2023} > B_{40\%}$. While the exploitation rates in the past have exceeded $F_{40\%}$, current (2023) and most recent (2010-2023) exploitation rates are below $F_{40\%}$ (Figure 7).

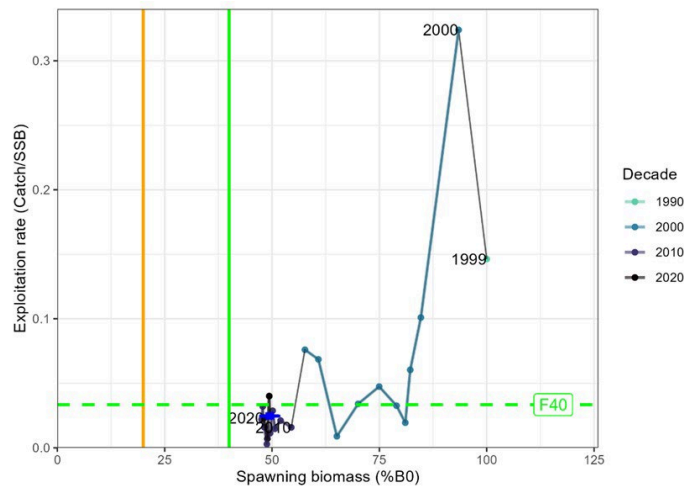


Figure 7 - Kobe plot for the Long Walters Shoal Ridge stock trajectory showing exploitation rate (catch/SSB) and spawning biomass (% B_0). The red vertical line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and green lines are the % B_0 target (40% B_0) and the corresponding exploitation rate (catch divided by $SSB_{F_{40}} = 0.176$ under average recruitment assumptions). Biomass and exploitation rate estimates are medians from posterior distributions for the base model. The blue cross represents the limits of the 95% credible intervals of the estimated ratio of the SSB to B_0 and exploitation rate in 2023.

The assessment results for South-West Indian Ocean Ridge, showed that biomass in 2023 was estimated at 80.3% B_0 (56.7 - 95.7) and there was 100% probability that $B_{2023} > B_{40\%}$. The exploitation rates have never exceeded $F_{40\%}$ (Figure 8).

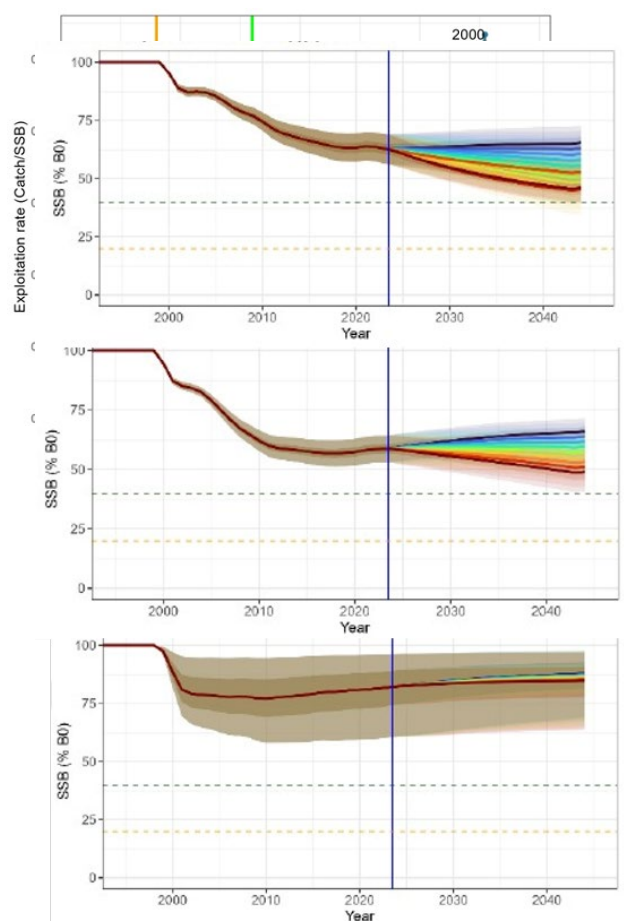


Figure 8 - Kobe plot for the South-West Indian Ocean Ridge stock trajectory showing exploitation rate (catch/SSB) and spawning biomass (% B_0). The red vertical line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and green lines are the % B_0 target (40% B_0) and the corresponding exploitation rate (catch divided by $SSB_{F_{40}} = 0.176$ under average recruitment assumptions). Biomass and exploitation rate estimates are medians from posterior distributions for the base model. The blue cross represents the limits of the 95% credible intervals of the estimated ratio of the SSB to B_0 and exploitation rate in 2023.

The assessment produced biomass projections from 2023-2043 (Figure 9). The projections use a range of catch scenarios, but SC used the average catch from 2015-2020 (the level agreed by MoP for MSE testing) to describe the estimated future stock status.

For Walters Shoal Ridge, all base case runs with catch maintained at the 2015-2020 average, indicated that biomass is estimated to remain above 40% B_0 throughout the projection period. For the projected exploitation rate, for half of the model runs, exploitation rates remained below $F_{40\%}$ through to 2028, but only 25% of model runs remained below $F_{40\%}$ through to 2040.

For Long Walters Shoal Ridge, all base case runs indicated that biomass is estimated to remain above 40% B_0 throughout the projection period. For the projected exploitation rate, all model runs in the base case with catch maintained at the 2015-2020 average, exploitation rates remained below $F_{40\%}$ through to 2028, but only 25% of model runs remained above $F_{40\%}$ through to 2040.

For South-West Indian Ocean Ridge, all model runs and future constant-catch scenarios satisfied the interim target (50% probability of being above 40% B_0). The interim target fishing pressure ($F_{40\%}$) was never exceeded.

Figure 9 - The projections of spawning stock biomass for each assessment area Walters Shoal Ridge (top), Long Walters Shoal Ridge (middle) and South-West Indian Ocean Ridge (bottom). The blue vertical line represents the start of the projection period (2023).

Overall, for all stock structure assumptions tested, the current stock status is well above the target $40\%B_0$ level, and the exploitation rates are currently below $F_{40\%}$. The biomass is not predicted to drop below $40\%B_0$ under projection of continuing current catch. For some potential scenarios, however, the exploitation rates could increase in future for some stocks.

6.1 Harvest strategy and reference points

Harvest strategies for orange roughy in the SIOFA Area have not yet been agreed upon.

The SIOFA Scientific Committee has provided interim advice, endorsed by the SIOFA MoP, to put in place Harvest Control Rules for interim management, notably to maintain catches at present levels (unless there is evidence of a marked downward trend in the resource) until sufficient further informative data becomes available for meaningful improvements to the existing assessments. Where not previously defined for specific stocks, the SC recommended the present level be defined as the average (mean) of the 5 year period 2015–2020 for orange roughy (see paragraph 79, [MoP10 Report](#)). However, no further management advice has been agreed for orange roughy in the SIOFA area.

Interim reference points for orange roughy were adopted by the Scientific Committee and the MoP in 2023, were a target reference point of BMSY using a proxy of $= 0.4*B_0$, and a limit reference point of $0.2*B_0$.

7. Data collection

Catch and effort fishery data are collected under [CMM 02\(2023\)](#) and were submitted by the CCPs listed in Table 1.

Table 1 – Orange roughy catch and effort data submitted by different SIOFA CCPs, by year (source: SIOFA AggregatedCatchEffort and HBHCatchEffort database 2014–2023). HBH= haul-by-haul level data; AGG= aggregated data at different levels.

Orange roughy catch and effort data submitted by different SIOFA CCPs		
Year	Country	Database
2014	AUS	HBH
2014	COK	AGG
2015	COK	AGG
2015	JPN	AGG
2016	COK	AGG
2017	COK	AGG
2018	COK	AGG
2019	COK	AGG
2019	COK	HBH
2020	COK	HBH
2021	AUS	HBH
2021	COK	HBH
2022	COK	HBH
2023	COK	HBH

Biological data (i.e., measures and biological samples of orange roughy) are collected by Scientific Observers as a requirement of [CMM 02\(2023\)](#), and were submitted by the CCPs listed in Table 2.

Table 2 – Orange roughy Scientific Observer biological data collected by different SIOFA CCPs, by year (source: SIOFA Observer database 2014–2023).

Orange roughy observer data submitted by different SIOFA CCPs	
Year	Country
2004	AUS
2009	AUS
2010	AUS
2011	AUS
2012	AUS
2013	AUS
2014	AUS
2018	COK
2019	COK
2020	COK
2021	AUS
2022	COK
2023	COK

7.1 Biological data summaries

A summary of biological data collected by Scientific Observers and counts of records by year for selected data fields, are shown in Table 3.

Table 3 – Orange roughy biological data collection by Scientific Observers, by year. Numbers of records per year are summarised for the following: length, weight, otoliths collected, sex determination, and gonad maturity stage, gonad weight, and stomachs sampled (source: SIOFA Observer database 2014–2023).

Orange roughy observer data measurements							
Year	Length (n)	Weight (n)	Otoliths collected (n)	Sex (n)	Maturity (n)	Gonad weight (n)	Stomachs sampled (n)
2014	283	283	283	283	283	0	283
2018	9 727	9 724	9 727	9 727	7 414	9 512	0
2019	9 605	0	3 192	9 605	9 078	0	9 745
2020	6 799	6 799	680	6 780	6 291	0	0
2021	42	42	42	42	42	0	42
2022	4 312	4 312	4 220	4 312	4 191	0	4 312
2023	1 300	1 300	134	1 300	1 300	0	1 300
Total	32 068	22 460	18 278	32 049	28 599	9 512	15 682

7.2 Tag data

SIOFA does not require or conduct any tagging of orange roughy, and any such tagging program is unlikely to be successful.

8. Summaries of abundance indices and other observational data

8.1 Scaled length frequencies

Length frequencies were estimated by Cordue (2018) but were not published.

8.2 Scaled age frequencies

Fish from one feature (a seamount called Sleeping Beauty) were sampled for otoliths in 2017 so that an age frequency could be constructed and growth parameters established. These data were used in conjunction with a stock hypothesis, a catch history, and acoustic biomass estimates to perform a Bayesian stock assessment as described in Cordue (2018a). The same parameters were later used in the updated stock assessment described in Roa-Ureta (2022). The scaled age frequencies are shown in Figure 10.

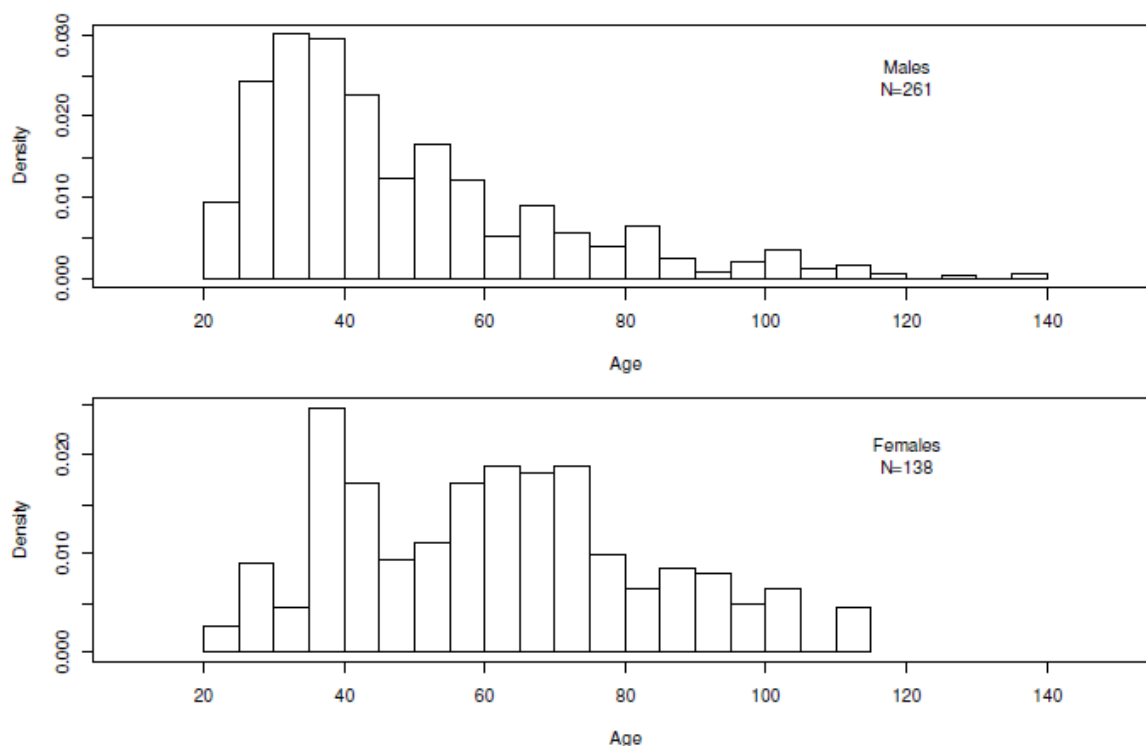


Figure 10 – Scaled age frequencies by sex used as used in the stock assessment described in Cordue (2018a).

8.3 CPUE indices

Recent years have seen lower levels of effort (hauls) with higher catches (Figure 4a), so unstandardised catch per unit of effort (CPUE) have been rising correspondingly (Figure 5). Standardised CPUE indices have not been developed, however it is likely that standardised CPUE would have little information as an index of abundance for orange roughy aggregations on seamounts.

8.4 Acoustic biomass indices

Macaulay (2022) calculated acoustic biomass indices (Table 4) that was presented at SC7 in paper SC-07-23.

Table 4 – Biomass, sampling coefficient of variation (CV), fish areal density, and metadata for surveys that had identified orange roughy backscatter (Source: paper SC-07-23).

Area	Feature	Survey start date	Transect type	Mean fish density [fish/m ²]	Biomass [t]	Sampling CV [%]	Number of transects	Survey area [km ²]	
North Ridge	Fruitsalad	2018-07-25	parallel	0.31	1800	43	6	2.1	
		2018-08-30	star	0.11	400	36	11	1.2	
North Walter's	Angelo's	2019-06-07	parallel	0.16	500	15	3	1.1	
	Da Vinci's	2018-06-20	parallel	0.07	300	104	5	1.6	
South Ridge	Crayfish	2018-08-28	parallel	1.21	6900	23	14	2.1	
		Boulder	2018-07-03	parallel	0.51	4100	29	6	2.9
			2018-07-03	parallel	0.44	2000	41	6	1.7
WSR	Grover	2018-07-05	parallel	0.66	3000	20	5	1.7	
		Porky's	2018-07-01	parallel	0.40	1000	14	4	0.9
			2018-07-01	parallel	0.19	700	18	8	1.4
Wrongford's	Sleeping Beauty	2018-07-09	parallel	0.01	200	68	7	5.0	
		2018-07-01	parallel	0.35	2500	25	6	2.6	
		2018-07-02	parallel	0.11	1400	33	6	4.7	
		2018-07-04	parallel	0.27	1800	29	4	2.5	
		2018-07-12	parallel	0.04	800	53	6	7.9	
		2018-06-22	parallel	0.08	1700	49	7	7.6	
		2018-06-24	parallel	0.16	1100	28	4	2.5	
		2018-06-27	parallel	0.04	1000	104	8	10.3	
		2018-06-28	parallel	0.01	300	98	7	12.8	
		2018-07-05	parallel	0.44	11 000	40	7	9.1	
Wrongford's	Sleeping Beauty	2018-07-05	parallel	1.36	50 400	89	7	13.5	
		2018-07-19	parallel	0.35	6900	23	7	7.0	
		2019-06-22	parallel	0.27	2500	21	5	3.5	
		2019-06-23	parallel	0.25	400	21	4	0.6	
		2019-06-23	parallel	0.23	1300	17	5	2.1	
		2020-07-13	star	0.57	6400	66	18	4.1	

8.5 Trawl survey indices

No trawl surveys have been undertaken for orange roughy in the SIOFA Area.

8.6 Tag-based abundance estimates

SIOFA does not require or conduct tagging of orange roughy and no orange roughy tagging experiments in the SIOFA Area have been reported to SIOFA, hence no tag-based abundance indices of abundance are not available.

9. Biological parameters

Biological parameters for orange roughy used in the most recent stock assessment were collected in a single table (Table 5).

Table 5 – Biological parameters for orange roughy used in the most recent stock assessment by Roa-Ureta et al. (2022)

Relationship	Parameter (units)	Area	Value			References
			Both	Male	Female	
Natural mortality	M (y^{-1})		0.042 (0.032-0.054)			Roa-Ureta et al. (2022)
Von Bertalanffy growth coefficient	t_0 (y)			-0.5	-0.5	Cordue (2018a)
	k (y^{-1})		0.069	0.073	0.065	Cordue (2018a)
	L_∞ (cm) c.v.		46.75	45.2	48.3	Cordue (2018a)
Length-weight	a ($t.cm^{-1}$)			0.000316	0.000215	Cordue (2018a)
	b			2.38	2.50	Cordue (2018a)
Maturity	a_{50} ($\pm a_{to95}$)		37 (± 12)			Cordue (2018a)
Stock recruitment relationship			Beverton-Holt			
Stock recruitment steepness	h		0.57			Roa-Ureta et al. (2022)
Recruitment variability	σ_R	stable				
Ageing error type	Normal					
Ageing parameters	c.v.			0.1		Cordue (2018a)

9.1 Natural mortality

Natural mortality was estimated by Roa-Ureta et al. (2022) within the age-structured stock assessment and was estimated to be $0.042 y^{-1}$ (0.032-0.054).

9.2 Growth parameters

Growth parameters were estimated by Brouwer *et al.* (2022, SERAWG-04-09) and are given in Table 6. Note that these are not the same growth parameters that were used in the most recent stock assessment by Roa-Ureta et al. (2022) as given in Table 6.

Brouwer et al. (2022) noted that otolith and associated biological data collection has been inconsistent in SIOFA orange roughy fisheries, and recommended that in future a stratified sampling selection should be employed for otolith collection to ensure more representative samples are collected across the size range of fish and between areas to estimate growth. However, it was noted that age-length keys may be an imprecise method for calculate age-frequencies and that random age sampling may be better for determining age frequencies for orange roughy (R. Saunders, NIWA, pers. Comm.).

Table 6 – Growth parameters for orange roughy in different assessment units and the overall SIOFA Agreement area (source: Brouwer et al. 2022, SERAWG-04-09).

Parameters	Combined	Male	Female
Walters Shoal			
L_{∞}	46.6 (45.98 , 47.22)	45.09 (44.5 , 45.68)	48.61 (47.78 , 49.44)
k	0.07 (0.07 , 0.08)	0.08 (0.07 , 0.09)	0.07 (0.06 , 0.07)
t_0	3.49 (2.49 , 4.49)	4.1 (3.07 , 5.13)	3.31 (4.48 , 2.14)
CV	0.08	0.06	
South			
L_{∞}	54.99 (52.88 , 57.1)	53.38 (51.18 , 55.59)	57.13 (53.77 , 60.48)
k	0.05 (0.03 , 0.07)	0.13 (0.02 , 0.23)	0.04 (0.02 , 0.06)
t_0	7.65 (-1.77 , 17.07)	18.35 (10.85 , 25.85)	4.44 (18.94 , 10.05)
CV	0.08	0.07	
West			
L_{∞}	50.7 (49.34 , 52.06)	50.53 (48.5 , 52.55)	51.51 (49.8 , 53.23)
k	0.04 (0.03 , 0.06)	0.03 (0.02 , 0.04)	0.06 (0.04 , 0.08)
t_0	-7.91 (-16.46 , 0.64)	-29.93 (-47.01 , -12.86)	4.18 (10.39 , 2.03)
CV	0.08	0.08	
SIOFA			
L_{∞}	48.78 (48.23 , 49.32)	47.03 (46.32 , 47.75)	50.83 (49.95 , 51.71)
k	0.06 (0.06 , 0.07)	0.07 (0.06 , 0.08)	0.06 (0.05 , 0.06)
t_0	2.6 (1.49 , 3.71)	2.17 (0.14 , 4.2)	2.66 (1.23 , 4.08)
CV	0.08	0.08	

9.3 Length/weight relationship

The length-weight relationship used in the most recent stock assessment by Roa-Ureta et al. (2022) was carried forward from Cordue (2018a) and is shown below in Figure 11.

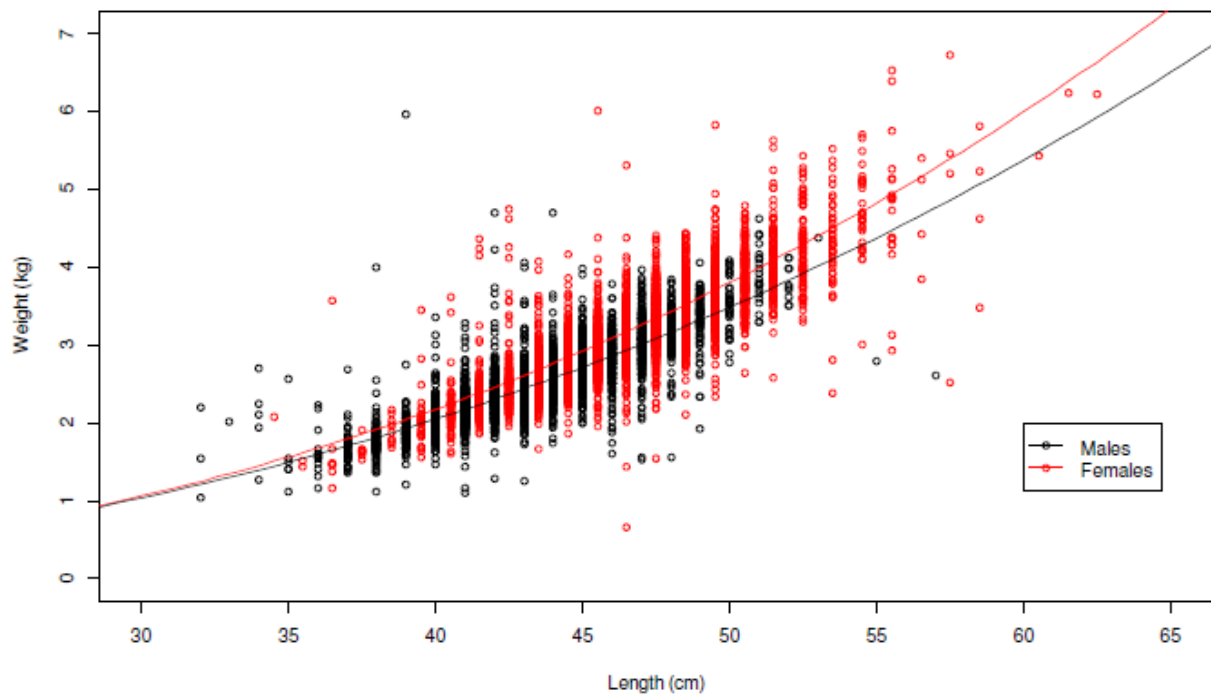


Figure 11 – Length-weight data from Beauty Seamount used in the stock assessment described in Cordue (2018a) and carried forward also in the stock assessment described in Roa-Ureta et al. (2022). Fitted curves are shown separately for males and females; female lengths are offset by 0.5 cm for display purposes.

9.4 Maturity and spawning

Maturity parameters representing the median age at which male and female fish become sexually mature are shown below in Table 7. These were derived from gonad staging data from samples collected in the SIOFA Area as described in Brouwer et al. (2022). These authors note that biological sampling has been inconsistent in time and space in the SIOFA orange roughy fishery, recommend revision of the sampling protocols to prioritise biological data collection in tows made on the Southern Rise, Western Rise and areas to the East within the SIOFA Area.

Table 7 – Orange roughy length-at-50% maturity for each sex, by region area (source: Brouwer et al. 2022, SERAWG-04-09).

Area	Female length (cm)	Male length (cm)
South Ridge	35.3	40.45
Walters Shoal	39.15	39.55
Western Rise	34.97	38.08
SIOFA Area	33.08	36.85

9.5 Stock recruitment relationship

The stock-recruitment relationship for orange roughy has not yet been investigated in the SIOFA Agreement area. The stock assessment described in Roa-Ureta (2022) assumed a Beverton-Holt stock recruitment relationship with a steepness value (h) of 0.57, based on a ratio between length at 50% maturity and asymptotic length, as proposed in a meta-analysis by Wiff et al. (2018). This is lower than the steepness value of 0.75 used in the assessment by Cordue (2018a).

9.6 Tag parameters

SIOFA does not require or conduct any tagging for orange roughy.

10. Target catch/bycatch and ecosystem impacts

Bycatch commonly refers to the capture of all fish species that were not intended as a target in a given fishing event.

Bycatch was defined by the SIOFA SC as “*Fishery resources that are not target nor targeted typically in the taxonomic classes Chondrichthyes and Actinopterygii and infraphylum Agnatha and class Cephalopoda and Crustacea, that are part of the catch which is not the target*” (paragraph 207c of the [SC8 report](#)).

The ratio of target catch/bycatch in the orange roughy fisheries suffers from a lack of reported target species for fishing events that caught orange roughy before 2019, hence it was not possible to determine catch/bycatch ratios before 2019.

As a practical mean of estimating the catch/bycatch ratio for that period, the Workshop on the development of ecosystem and fisheries summaries ([WS2022-SUM1](#)) suggested using a catch threshold whereby hauls in which at least 50% of the catch was orange roughy are designated as orange roughy target hauls and hauls that caught less than 50% orange roughy considered as orange roughy bycatch. This criterion identified as targeted to orange roughy hauls that contributed 90–95% of the total annual catch of orange roughy.

10.1 Orange roughy target catch and bycatch

Target catch/bycatch is depicted in Figure 12. Note that the 50% catch threshold rule to define orange roughy target hauls was applied only to fishing effort before 2019, and the pre-2019 ratios are not strictly comparable to the data from 2019 onwards in this figure. Future work should consider harmonizing this time series.

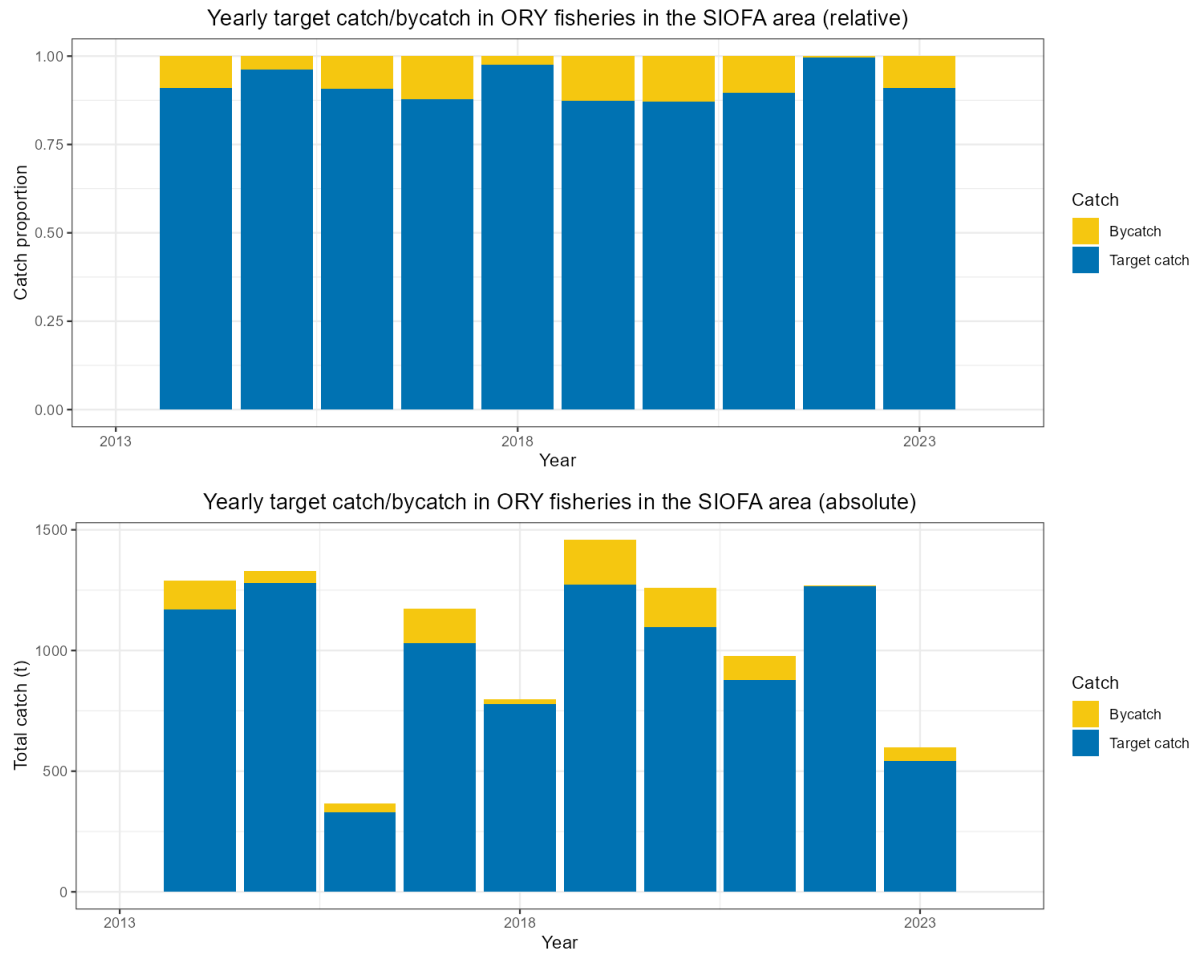


Figure 12a and b – Catch of orange roughy and other species in SIOFA fisheries that targeted orange roughy, shown as relative values (upper panel, a) and absolute values (lower panel, b) (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Catches reported without location information are not included. Note that catch data for years prior to 2019 did not record orange roughy as a target species, so data in these years reflect an assumption that orange roughy target hauls are those that caught greater than 50% orange roughy by weight.

Figure 13 illustrates the species that compose the majority of bycatch in fisheries targeting orange roughy.

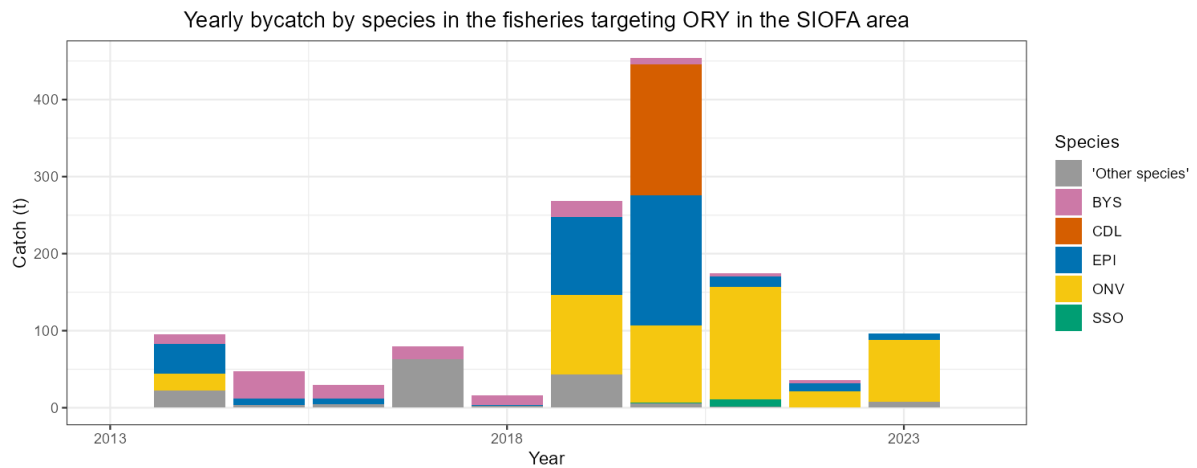


Figure 13 – Yearly bycatch in fisheries targeting orange roughy in the SIOFA Area, by species (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Species are identified by their 3-letter FAO code.

Sharks is used in this report as a broad term to include all Chondrichthyans (see Appendix B of the Overview of SIOFA Fisheries for a full list of taxa), unless otherwise specified.

Bycatch of shark species is shown in Figure 14. However, shark catches (comprising only little sleeper shark, SOR) were only reported in the CatchEffort database in a single year (2017). See also Section 9.4 for sharks catches that were reported in the Observer database.

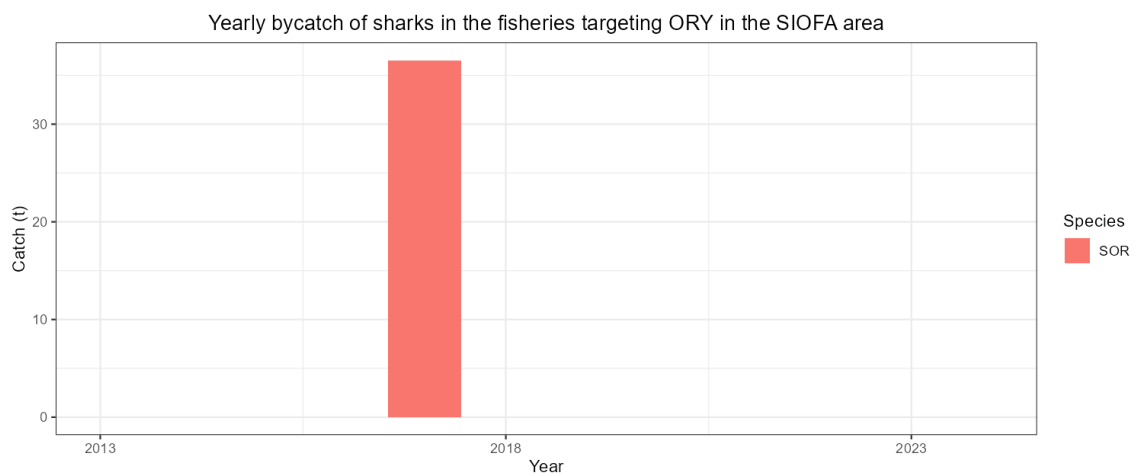


Figure 14 – Reported bycatch of shark species in fisheries targeting orange roughy (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2004–2023).

10.2 Target catch/bycatch in fisheries targeting orange roughy by SIOFA Subarea

Target catches and bycatches in fisheries targeting orange roughy in the SIOFA Area were largely concentrated in Subareas 2 and 3b (Figure 15).

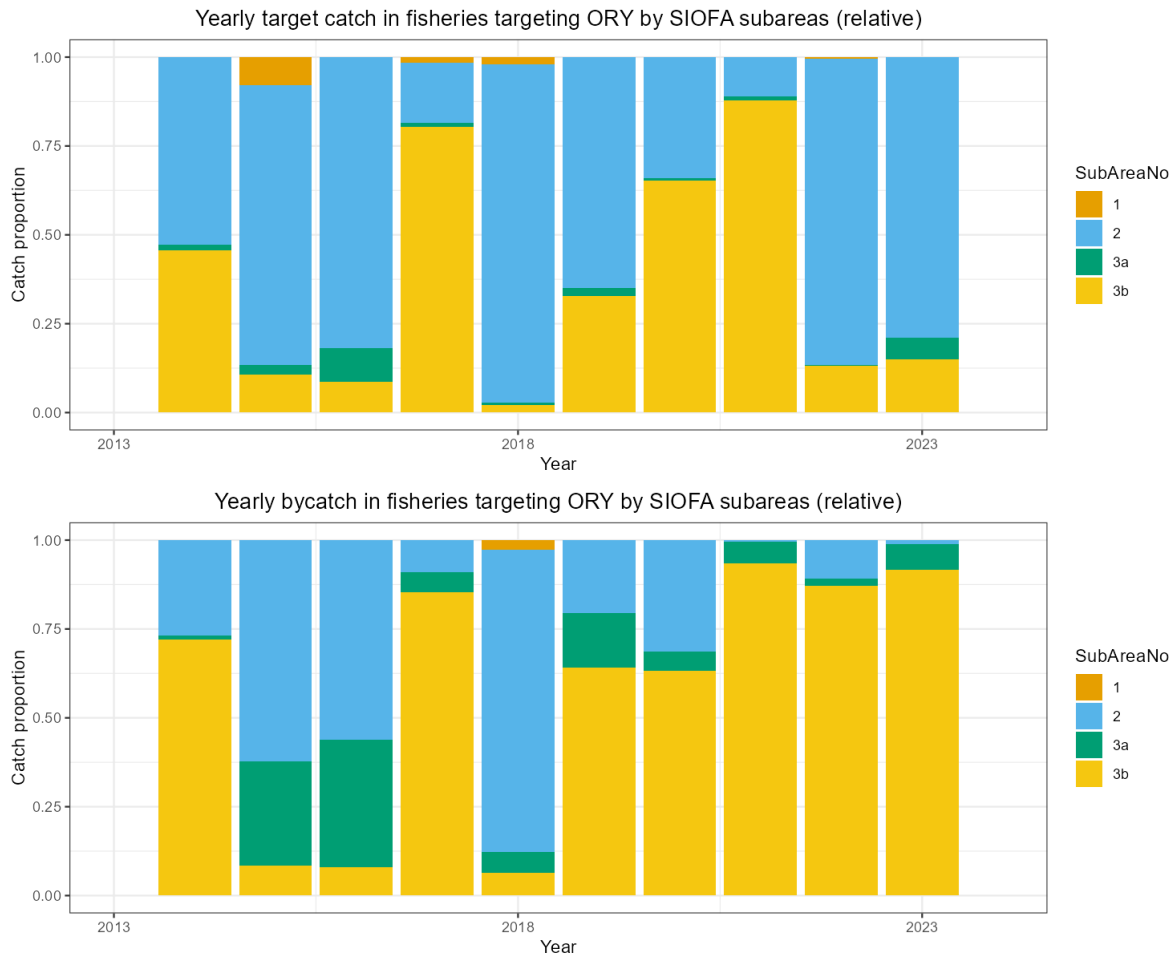


Figure 15a and b – Distribution of target catch and bycatch in fisheries targeting orange roughy in different SIOFA Subareas (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Catches reported without location information are not included. Values of the figure panels are provided in Table A.2 (Appendix A).

10.3 Discards

A specific field is included in SIOFA CatchEffort databases to indicate the fate of the catch, including retained, discarded and “other” categories.

Discard rates of fisheries targeting orange roughy in the SIOFA Area are presented in Figure 16.

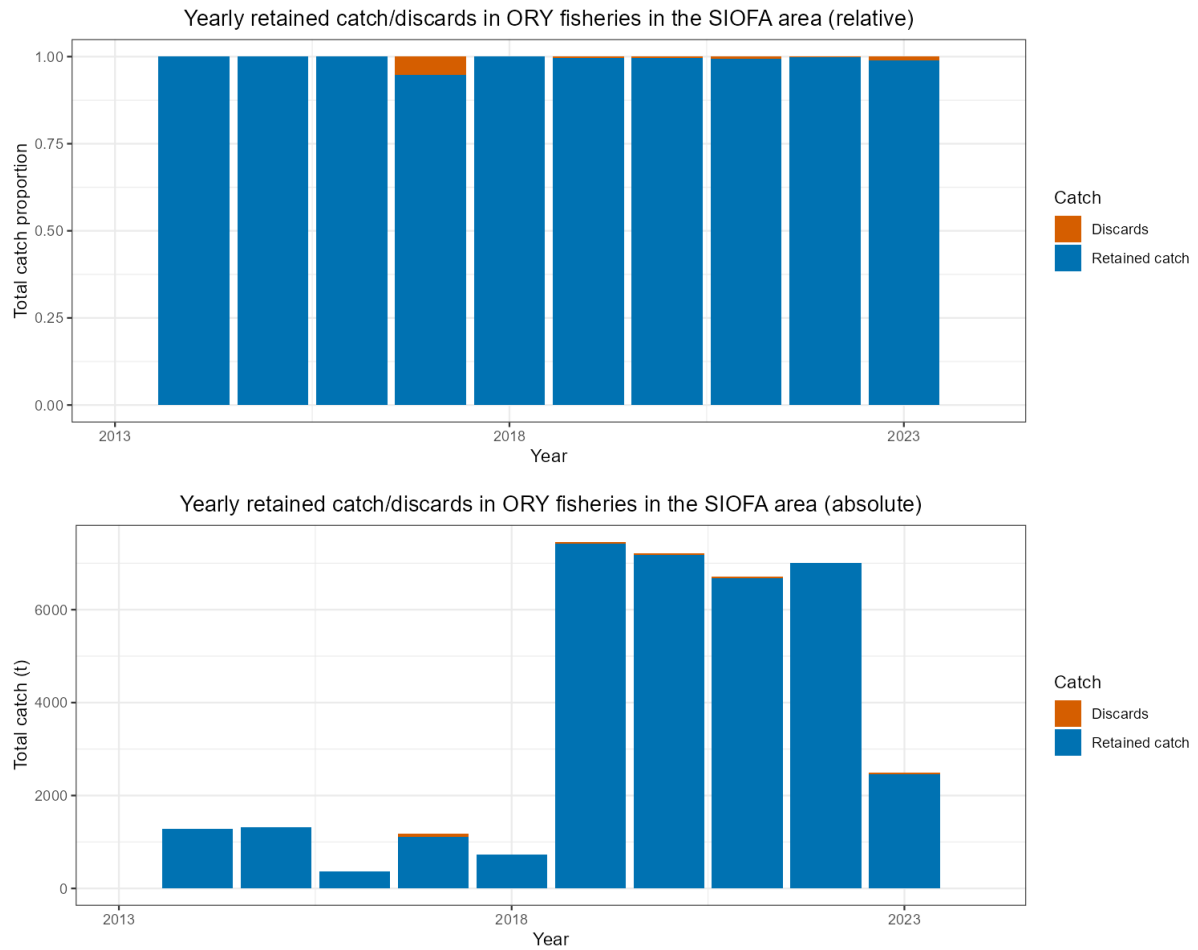


Figure 16a and b – Total retained and discarded catch in SIOFA fisheries that targeted orange roughy, shown as relative values (upper panel, a) and absolute values (lower panel, b) (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Catches reported without location information are not included.

Discards composition by species in fisheries targeting orange roughy in the SIOFA Area is presented in Figure 17. Some of the most represented species in discards are orange roughy itself, the spiky oreo (*Neocyttus rhomboidalis*, ONV) and the smooth oreo dory (*Pseudocyttus maculatus*, SSO), but note that reporting of discards prior to 2019 is fragmentary and that contains erroneous codes (e.g. the ruffe, ACC, which is a freshwater fish).

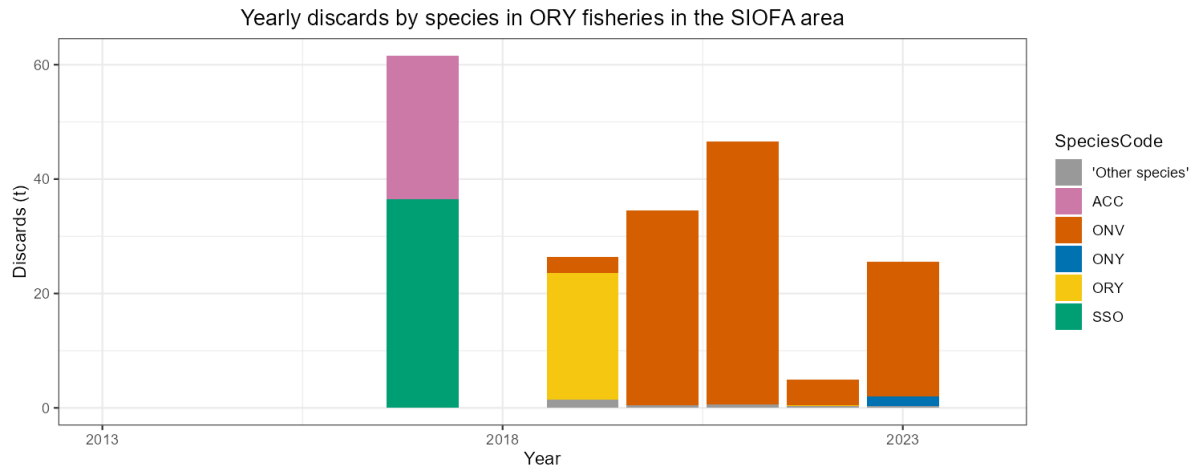


Figure 17 – Reported discards of fish species in fisheries targeting orange roughy (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Only the top five species (by weight) are fully represented, while the other species have been grouped in a single category.

10.4 Catch/bycatch in orange roughy Assessment Areas

[this section is not included in the public version of the manuscript, due to confidentiality limitations set out in [CMM 2016/13](#)]

Table 8 shows the catch history of orange roughy catches in the different assessment areas from 2014–2022.

[this table is not included in the public version of the manuscript, due to confidentiality limitations set out in [CMM 2016/13](#)]

10.5 Incidental catch of VME taxa and other invertebrates

SIOFA Scientific Observers recorded the incidental captures of VME indicator taxa in fishing operations targeting orange roughy starting in 2003. While early years saw large (> 2 t) yearly incidental captures, these have been much more limited (< 500 kg) in recent years (Figure 19).

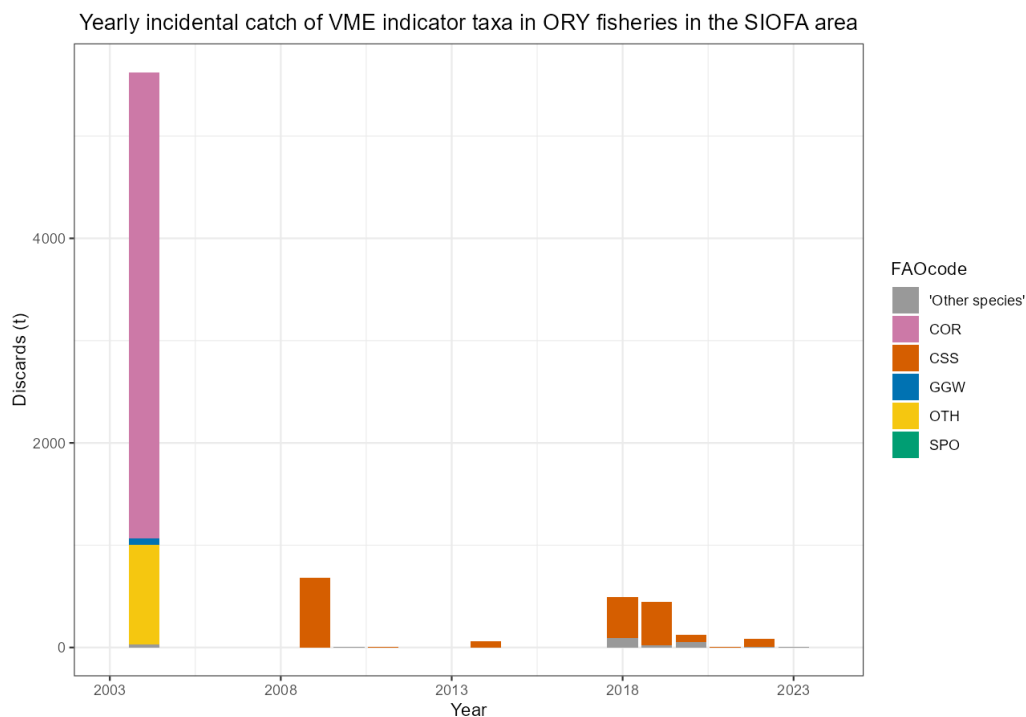


Figure 18 – Yearly incidental catch of VME indicator taxa in fisheries targeting orange roughy within the SIOFA Area, by taxa group (source: SIOFA Observer and HBHCatchEffort databases 2004–2023). Only the top five species (by weight) are fully represented, while the other species have been grouped in a single category. Taxa are indicated by their 3-letter FAO code (see Appendix C of the SIOFA Ecosystem Summary for disambiguation). Figure A.1 in Appendix A presents a full list of taxa.

11. Interactions with seabirds, mammals, turtles, sharks and other species of concern

Only incidental captures of seabirds, marine mammals, turtles, and sharks considered to be at high risk and/or concern are reported in the SIOFA Scientific Observer database, and the following sections have drawn from this database to explore the number and locations of these interactions.

Incidental captures of other species (e.g., of sharks) are also recorded in the SIOFA CatchEffort database but are not reported here (see Section 10.1 instead).

Figure 20 shows the reported locations of incidental captures (Figure 20a) and observations (Figure 20b) of seabirds, mammals, and sharks considered to be at high risk and/or concern (i.e., included in SIOFA CMM 12) captured in fishing operations targeting orange roughy in the SIOFA Area, as recorded by Scientific Observers.

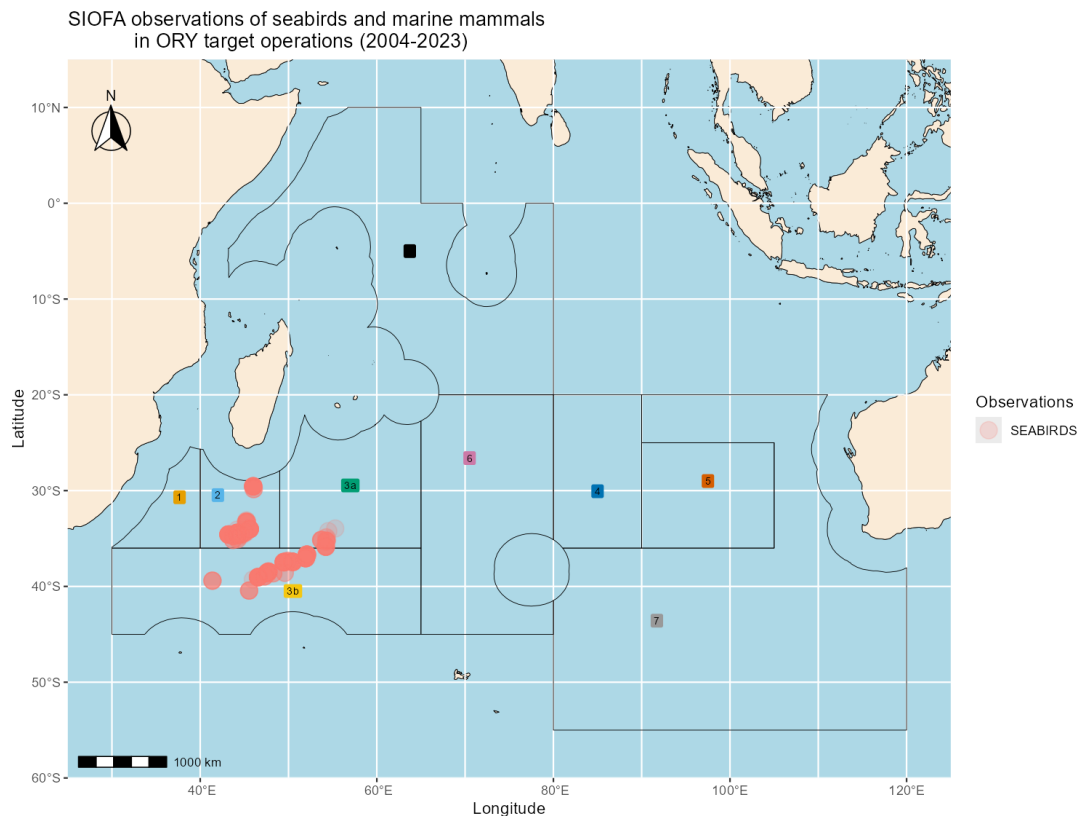
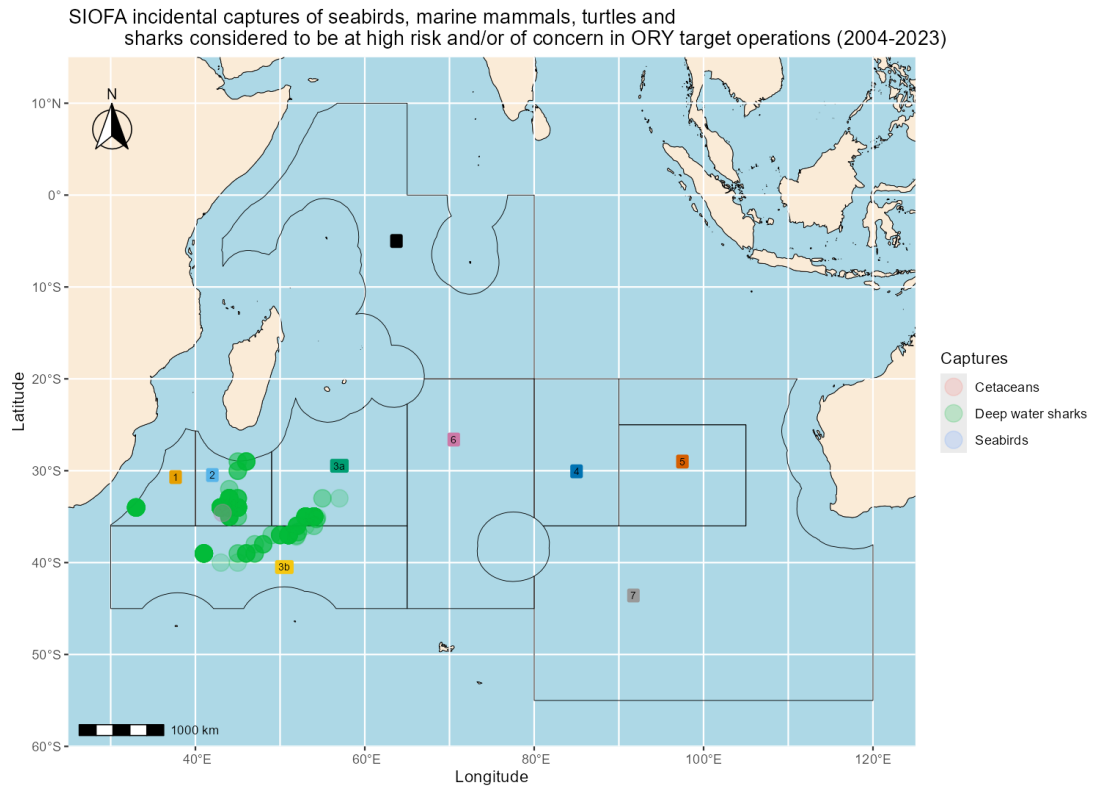


Figure 19a and b – Reported locations of incidental captures of seabirds (a, upper) and observations of seabirds around fishing operations (b, lower), cetaceans, and sharks considered to be “at high risk” and/or “of concern”, as defined in Annex 1 of [CMM 12\(2024\)](#), captured in fishing operations targeting orange roughy in the SIOFA Area, as recorded by SIOFA Scientific Observers (source: SIOFA Observer database 2004–2023).

11.1 Seabirds interactions

Provisions for the mitigation of accidental capture of seabirds in orange roughy fisheries are in [CMM 13\(2022\)](#) (Conservation and Management Measure on mitigation of seabirds bycatch in demersal longlines and other demersal fishing gears fisheries(Mitigation of Seabirds Bycatch)).

11.1.1 Captures

Incidental captures of seabirds in orange roughy fisheries consist of a single fatal capture of Hall's giant petrel (*Macronectes halli*) in 2012 by a vessel operating a bottom trawl.

11.1.2 Observations

The presence of several different seabirds was recorded by SIOFA Scientific Observers around fishing operations that targeted orange roughy in the SIOFA Area (Table 9).

Table 8 – Number of seabirds observed around fishing operations that targeted orange roughy between 2010 and 2022 (source: SIOFA Observer database 2010–2022).

Year	Common name	Scientific name	Fishing gear	Abundance
2010	Albatrosses nei	<i>Diomedeidae</i>	Single boat bottom otter trawls	36
2010	Atlant. yellow-nosed albatross	<i>Thalassarche chlororhynchos</i>	Single boat bottom otter trawls	6
2010	Petrels nei	<i>Procellaria spp</i>	Single boat bottom otter trawls	1100
2010	Wandering albatross	<i>Diomedea exulans</i>	Single boat bottom otter trawls	19
2011	Antarctic giant petrel	<i>Macronectes giganteus</i>	Single boat bottom otter trawls	12
2011	Atlant. yellow-nosed albatross	<i>Thalassarche chlororhynchos</i>	Single boat bottom otter trawls	11
2011	Cape petrel	<i>Daption capense</i>	Single boat bottom otter trawls	118
2011	Giant petrels nei	<i>Macronectes spp</i>	Single boat bottom otter trawls	29
2011	Shy albatross	<i>Thalassarche cauta</i>	Single boat bottom otter trawls	32
2011	Wandering albatross	<i>Diomedea exulans</i>	Single boat bottom otter trawls	100
2011	White-chinned petrel	<i>Procellaria aequinoctialis</i>	Single boat bottom otter trawls	49
2020	Seabirds nei		Trawls (nei)	2655
2021	Albatrosses nei	<i>Diomedeidae</i>	Single boat bottom otter trawls	13
2021	Atlant. yellow-nosed albatross	<i>Thalassarche chlororhynchos</i>	Single boat bottom otter trawls	37
2021	Black-browed albatross	<i>Thalassarche melanophris</i>	Single boat bottom otter trawls	26
2021	Wandering albatross	<i>Diomedea exulans</i>	Single boat bottom otter trawls	120
2021	White-chinned petrel	<i>Procellaria aequinoctialis</i>	Single boat bottom otter trawls	617
2022	Cape petrel	<i>Daption capense</i>	Trawls (nei)	8
2022	Great-winged petrel	<i>Pterodroma macroptera</i>	Trawls (nei)	11
2022	Grey petrel	<i>Procellaria cinerea</i>	Trawls (nei)	19
2022	Hall's giant petrel	<i>Macronectes halli</i>	Trawls (nei)	49
2022	Prions nei	<i>Pachyptila spp</i>	Trawls (nei)	11
2022	Seabirds nei		Trawls (nei)	1672
2022	Shy albatross	<i>Thalassarche cauta</i>	Trawls (nei)	36
2022	Wandering albatross	<i>Diomedea exulans</i>	Trawls (nei)	63
2023	Antarctic giant petrel	<i>Macronectes giganteus</i>	Bottom trawls (nei)	100
2023	Black-browed albatross	<i>Thalassarche melanophris</i>	Bottom trawls (nei)	15
2023	Black-browed albatross	<i>Thalassarche melanophris</i>	Midwater trawls (nei)	5
2023	Cape petrel	<i>Daption capense</i>	Bottom trawls (nei)	66
2023	Cape petrel	<i>Daption capense</i>	Midwater trawls (nei)	3
2023	Giant petrels nei	<i>Macronectes spp</i>	Bottom trawls (nei)	140
2023	Great-winged petrel	<i>Pterodroma macroptera</i>	Bottom trawls (nei)	255
2023	Grey petrel	<i>Procellaria cinerea</i>	Bottom trawls (nei)	9
2023	Indian yellow-nosed albatross	<i>Thalassarche carteri</i>	Bottom trawls (nei)	10
2023	Prions nei	<i>Pachyptila spp</i>	Bottom trawls (nei)	4
2023	Seabirds nei		Bottom trawls (nei)	30
2023	Shy albatross	<i>Thalassarche cauta</i>	Bottom trawls (nei)	121
2023	Wandering albatross	<i>Diomedea exulans</i>	Bottom trawls (nei)	59
2023	Wandering albatross	<i>Diomedea exulans</i>	Midwater trawls (nei)	3
2023	White-chinned petrel	<i>Procellaria aequinoctialis</i>	Bottom trawls (nei)	145
2023	White-chinned petrel	<i>Procellaria aequinoctialis</i>	Midwater trawls (nei)	11
2023	Wilson's storm petrel	<i>Oceanites oceanicus</i>	Bottom trawls (nei)	6

11.2 Marine mammals interactions

11.2.1 Captures

Incidental captures of mammals in orange roughy fisheries consist of a single non-fatal capture of a sperm whale (*Physeter macrocephalus*) in 2012 by a vessel operating a bottom trawl.

11.2.2 Observations

No observations of marine mammals were recorded by SIOFA Scientific Observers around fishing operations that targeted orange roughy.

11.3 Turtles interactions

No interactions with turtles have been reported by SIOFA Scientific Observers in fishing operations that targeted orange roughy.

11.4 Shark captures of species considered to be at high risk and/or of concern

Captures of deep-sea shark taxa considered to be at “high risk” and/or “of concern”, as listed in Annex 1 of SIOFA [CMM 12\(2024\)](#) (Conservation and Management Measure for Sharks (Sharks)) were reported in the SIOFA Observer database for fisheries that targeted orange roughy between 2018 and 2022 (Table 10).

Note That for Cook Islands vessels, who have landed all the orange roughy catch in the time period covered below all elasmobranchs are required to be released. As such all fish in this table should be considered releases and discards.

Table 9 – Number of sharks considered to be at “high risk” and/or “of concern”, as listed in Annex 1 of SIOFA [CMM 12\(2024\)](#) (Conservation and Management Measure for Sharks) captured in fisheries that targeted orange roughy between 2018 and 2022 (source: SIOFA Observer database 2012–2022).

Observed captures of sharks at “high risk” and/or “of concern” in SIOFA orange roughy fisheries				
Year	Common name	Scientific name	Fishing gear	Captures (n)
2018	Birdbeak dogfish	<i>Deania calceus</i>	Bottom trawls (nei)	275
2018	Frilled shark	<i>Chlamydoselachus anguineus</i>	Bottom trawls (nei)	1
2018	Goblin shark	<i>Mitsukurina owstoni</i>	Bottom trawls (nei)	2
2018	Gulper shark	<i>Centrophorus granulosus</i>	Bottom trawls (nei)	51
2018	Kitefin shark	<i>Dalatias licha</i>	Bottom trawls (nei)	91
2018	Largespine velvet dogfish	<i>Scymnodon macracanthus</i>	Bottom trawls (nei)	57
2018	Longnose velvet dogfish	<i>Centroselachus crepidater</i>	Bottom trawls (nei)	201
2018	Pacific longnose chimaera	<i>Harriotta raleighana</i>	Bottom trawls (nei)	26
2018	Portuguese dogfish	<i>Centroscymnus coelolepis</i>	Bottom trawls (nei)	32
2018	Southern lanternshark(Lucifer)	<i>Etmopterus granulosus</i>	Bottom trawls (nei)	4 635
2018	Velvet dogfish	<i>Zameus squamulosus</i>	Bottom trawls (nei)	9
2022	Birdbeak dogfish	<i>Deania calceus</i>	Trawls (nei)	2
2022	Longnose velvet dogfish	<i>Centroselachus crepidater</i>	Trawls (nei)	4
2022	Southern lanternshark(Lucifer)	<i>Etmopterus granulosus</i>	Trawls (nei)	332

12. Effects of the fishery on the ecosystem

The effects of this fishery on the ecosystems have not yet been investigated.

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14. Appendix A – Supplementary tables and figures

Table A.1 – Yearly orange roughy catch (t) and effort (number of trawls) in the SIOFA Area (upper panel, a) and in different SIOFA Subareas (lower panel, b) (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Total catch includes all orange roughy catches both as catch and bycatch.

Year	Total catch (t)	Effort (tows)
2014	1240.3	667
2015	1339.8	771
2016	378.8	540
2017	1118.4	541
2018	822.9	624
2019	1275	380
2020	1129.6	199
2021	880.8	176
2022	1270.4	170

Year	1	2	3a	3b
2014		644.8	43.2	547.2
2015	101.7	1035.3	42.2	148.6
2016		297.2	38.6	43
2017	29.1	183	29.2	877
2018	13.8	694.2	31.3	15.6
2019		773	34	467.9
2020		488.3	12.9	628.5
2021		143.4	18.5	718.9
2022	24	1009	7.9	229.5

Table A.2 – Catch vs bycatch (t) in orange roughy target fisheries per year by SIOFA Subareas (source: SIOFA AggregatedCatchEffort and HBHCatchEffort databases 2014–2023). Note that prior to 2019 target species was not reported.

Year	SubArea	Bycatch (t)	Catch (t)
2019	2	63.8	4629.9
2019	3a	48.1	170.1
2019	3b	200.6	2338.8
2020	2	143.6	2291.2
2020	3a	25.9	59
2020	3b	290.2	4399.2
2021	2	0.7	716.2
2021	3a	10.7	77.5
2021	3b	164.3	5748.9
2022	1		24
2022	2	3.9	6020
2022	3a	0.7	15.8
2022	3b	31.2	917.8

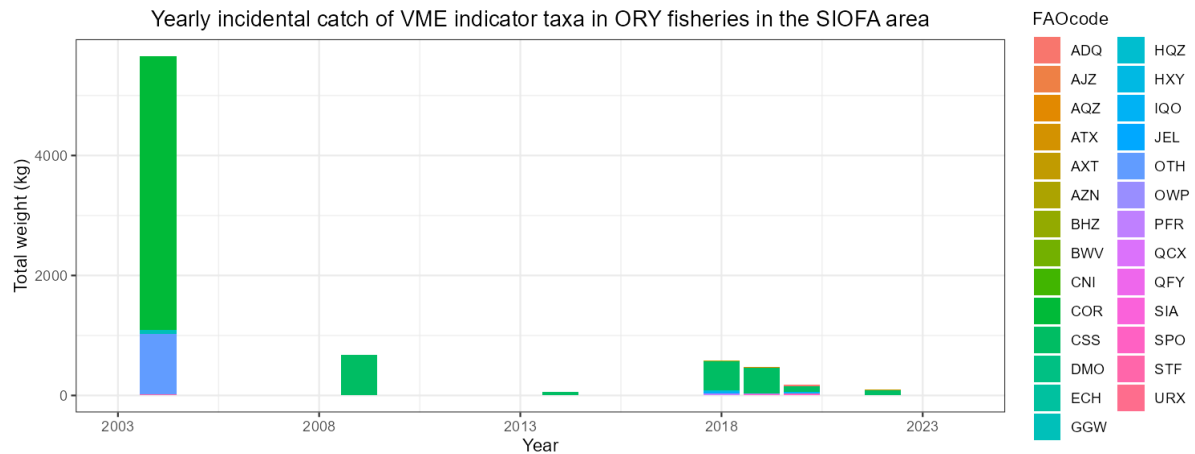


Figure A.1 – Yearly incidental catch of VME indicator taxa in fisheries targeting orange roughy within the SIOFA Area, by taxa group (source: SIOFA Observer and HBHCatchEffort databases 2004–2023). Taxa are indicated by their 3-letter FAO code (see Appendix C of the SIOFA Ecosystem Summary for disambiguation). Captures were recorded in 2021, but the total weight was negligible and thus difficult to visualise in this figure.