Chapter 28
High-seas fisheries for non–highly migratory species

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A small number of Australian fishing vessels target demersal fish species (those associated with the sea floor) in high-seas areas of the south Pacific and southern Indian oceans. The fisheries resources in these areas fall under the jurisdiction of 2 regional fisheries management treaties: the Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean (South Pacific Regional Fisheries Management Organisation [SPRFMO] Convention), and the Southern Indian Ocean Fisheries Agreement (SIOFA). The SPRFMO Convention entered into force on 24 August 2012 and the SIOFA on 21 June 2012. Annual meetings of the SPRFMO Commission and Scientific Committee have been held since 2013. Annual Meetings of the Parties, the SIOFA decision-making body, have been held since 2015; and annual meetings of the SIOFA Scientific Committee have been held since 2016.

Demersal fishing on the high seas by Australian vessels occurs under permits issued by the Australian Fisheries Management Authority (AFMA). High-seas permits allow Australian vessels to fish in high-seas areas outside the Australian Fishing Zone (AFZ), outside the Exclusive Economic Zones (EEZs) of other countries, and within the area of competence of either the SPRFMO or the SIOFA (Figures 28.1 and 28.6).

The Commonwealth Fisheries Harvest Strategy Policy (Department of Agriculture and Water Resources 2018) does not prescribe management arrangements for fisheries managed under the joint authority of the Australian Government and an international management body or arrangement. However, its principles guide Australia's negotiating positions in international fisheries management forums.

The South Tasman Rise (STR) is an undersea ridge that stretches beyond the AFZ and into the SPRFMO Convention area (Figure 28.4). The South Tasman Rise Trawl Fishery (STRTF) is included in this chapter because it has not operated within the AFZ since 2007. The STR orange roughy (*Hoplostethus atlanticus*) stock is the only high-seas stock that is assigned a status classification in this chapter.

Orange roughy stocks have recently been assessed in the SPRFMO Convention area (Cordue 2017, 2019; Edwards & Roux 2017; Roux et al. 2017) and the SIOFA area of competence (Cordue 2018a, b). These assessments are reported briefly in this chapter, but status has not been assigned for any stocks or regional 'management units'. Catch limits for orange roughy for the Louisville Ridge (1,140 t) and the Tasman Sea (346 t) were implemented on 28 April 2019 under SPRFMO Conservation and Management Measure (CMM) 03a-2019. Because of the way catch limits have been determined (that is, 1 'global' catch limit for multiple management units in the Louisville Ridge and Tasman Sea areas), and because spatially disaggregated catch data from New Zealand–flagged vessels are confidential, fishing mortality status for individual management units cannot be assessed reliably. Biomass status is also challenging to determine because assessments for a number of management units in both the SPRFMO and SIOFA areas provide an estimate of the theoretical maximum potential depletion and not a reliable point estimate of biomass in relation to defined limit and target reference points. Attempts are currently being made to assess alfonsino (*Beryx splendens*) stocks in the SIOFA area.

Catch of orange roughy and alfonsino taken by Australian vessels in the SPRFMO and SIOFA areas is currently low and sporadic. Assessment of status may be attempted in future editions of the *Fishery status reports* if the required catch data are available and assessments are deemed sufficiently robust for determining biomass status of individual stocks or management units, and/or catches from these stocks taken by Australian vessels are deemed to constitute a proportion of catches that may influence stock sustainability.

28.1 South Pacific Regional Fisheries Management Organisation Convention area

Description of the fishery

The SPRFMO Convention covers non–highly migratory fisheries resources; it excludes highly migratory species listed in the United Nations Convention on the Law of the Sea (1982). The SPRFMO Convention area has historically been fished by vessels from various nations using pelagic and demersal fishing gear. The main commercial fisheries resources managed by the SPRFMO are Chilean jack mackerel (*Trachurus murphyi*) and jumbo flying squid (*Dosidicus gigas*). The SPRFMO also manages fisheries for lower-volume demersal species such as orange roughy and alfonsino.

Demersal fisheries target species associated with seamounts, ridges and plateaus in the central, eastern and western areas of the south Pacific Ocean (Figure 28.1). Deep-sea structures tend to attract and support fish resources because their physical and biological properties enhance local productivity and retention. Some deepwater species form dense breeding aggregations over deep-sea structures, potentially allowing high catch rates and large catches (Norse et al. 2012). Some demersal species are slow growing and long lived, and aggregations can represent the accumulation of numerous age classes recruited over many decades. Initial catch rates typically made on these aggregations may not be sustainable, and can lead to rapid declines in abundance and availability (Norse et al. 2012). Long-term sustainable yields are usually only a small percentage of initial high catches.

Trawl fleets from the former Union of Soviet Socialist Republics (USSR) began fishing the high seas in the south Pacific for deep-sea species in the early 1970s. These vessels fished several areas, taking pencil (or bigeye) cardinal fish (*Epigonus denticulatus*), orange roughy, blue grenadier (*Macruronus novaezelandiae*) and oreodories (Oreosomatidae) (Clark et al. 2007). Australia's and New Zealand's fisheries expanded into the high seas, and fisheries targeting orange roughy were established on the Louisville Ridge in 1993 and on the STR in 1997. These fisheries were predominantly fished by Australian and New Zealand vessels, but other nations, including Belize, Japan, Norway, Panama, the Republic of Korea and Ukraine, also accessed these deep-sea resources, although taking lower catches (Gianni 2004).

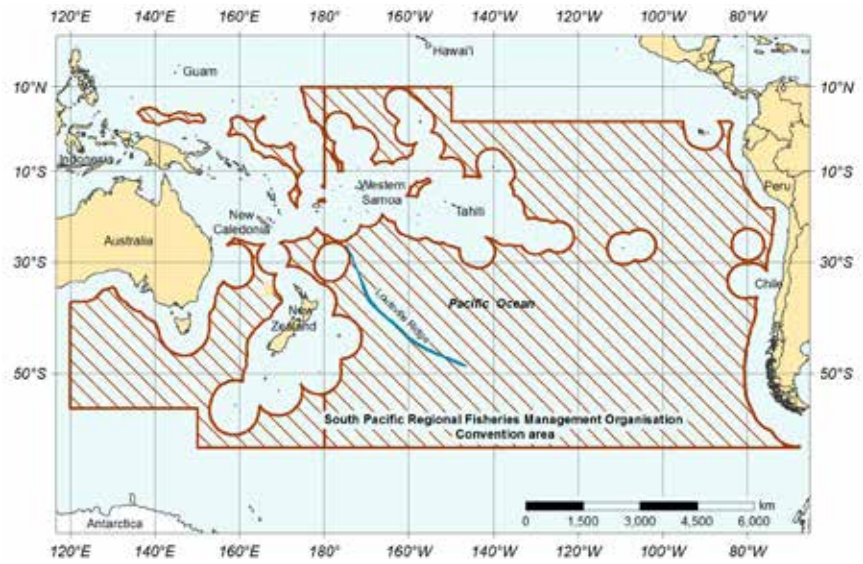
The species composition of catches from Australia's line and trawl fishing has varied over time. Historically, Australian high-seas fishing effort targeted orange roughy using demersal and midwater trawl gear. A low level of non-trawl activity, predominantly dropline and auto-longline methods targeting other species, such as jackass morwong (*Nemadactylus macropterus*), yellowtail kingfish (*Seriola lalandi*) and blue-eye trevalla (*Hyperoglyphe antarctica*), also occurred. Non-trawl catches now exceed those taken by trawl. An increase in catches of emperors (Lethrinidae), sweetlips (Haemulidae) and deepwater snappers (*Etelis* spp.) (as well as other more subtropical species) in the non-trawl fishery in recent years reflects a change in the main fishing grounds used by Australian non-trawl vessels. Deep-sea gillnets were prohibited in 2010 under an interim measure applicable to all fishing vessels within the SPRFMO Convention area, and this gillnet prohibition was adopted in an SPRFMO CMM in January 2013 (SPRFMO 2013).

From 2007 until 28 April 2019, and in accordance with SPRFMO CMM 03-2018, Australia restricted fishing to within its 2002 to 2006 bottom-fishing footprint. In 2019, a revised bottom-fishing CMM (03-2019) was implemented in the SPRFMO Convention area. The revised CMM adopts a spatial management approach that uses predictive habitat suitability models and other spatial analysis tools to define and close areas that are likely to contain vulnerable marine ecosystem (VME) habitats, while allow fishing to continue in key productive areas. In accordance with CMM 03a-2019, catch of species other than orange roughy is limited to the average annual level between 2002 and 2006.

Consistent with these and other SPRFMO CMMs, Australian high-seas fishing permits require the implementation of vessel monitoring systems, 100% observer coverage on all trawl vessels and for the first trip of the season (for all methods), and a minimum of 10% observer coverage annually on all non-trawl vessels.

In 2011, Australia completed a bottom fishery impact assessment in the SPRFMO Convention area to examine whether bottom-fishing activities by Australian vessels within the 2002 to 2006 footprint have significant adverse impacts on VMEs (Williams et al. 2011a). The study concluded that the overall risk of significant adverse impacts on VMEs by Australian bottom trawl and bottom longline operations was low, and the impact caused by midwater trawling and droplining was negligible (Williams et al. 2011a). In accordance with CMM 03-2020, Australia and New Zealand submitted a cumulative bottom fishery impact assessment on 4 August 2020, which is subject to review by the SPRFMO Scientific Committee in late 2020. The conclusions of this assessment were not finalised at the time of writing but will be included in next year's *Fishery status reports*.

FIGURE 28.1 South Pacific Regional Fisheries Management Organisation Convention area



Catch and effort

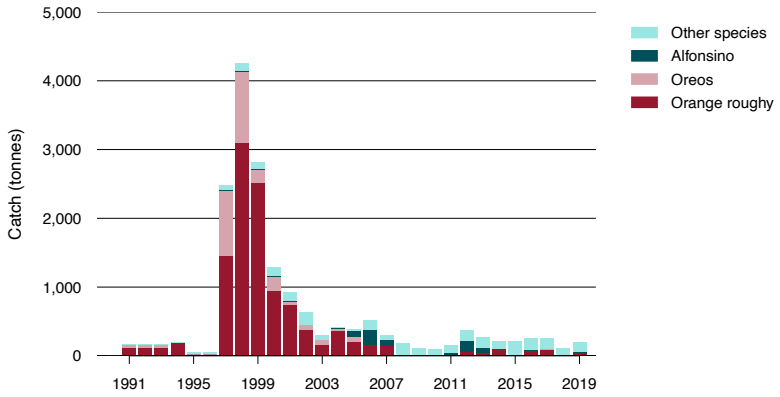
Two Australian longline vessels and 1 Australian trawl vessel were active in the SPRFMO Convention area in 2019. The total reported catch retained by these vessels was 123 t for the longline vessels and 62 t for the trawl vessel, totaling 186 t for both gears (Figure 28.2). Effort using line gears was 657,700 hooks. Effort using trawl gears could not be calculated due to errors in the logbooks, but attempts will be made to include this in the next *Fishery status reports*.

Spotcheek emperor (*Lethrinus rubrioperculatus*) accounted for 32% (39 t) of the longline catch; the remainder comprised yellowback bream (*Dentex spariformis*; 13%; 16 t), flame snapper (*Etelis coruscans*; 10%; 13 t), redthroat emperor (*L. miniatus*; 8%; 10 t) and other species (38%; 46 t). Logbook-reported discards in the longline fishery were 33 t, with most discards comprised of sharks.

Orange roughy accounted for 70% (44 t) of the trawl catch; the remainder comprised alfonsino (21%; 13 t) and other species (8%; 5 t). Logbook-reported discards in the trawl fishery were 48 t, with most discards comprised of sharks.

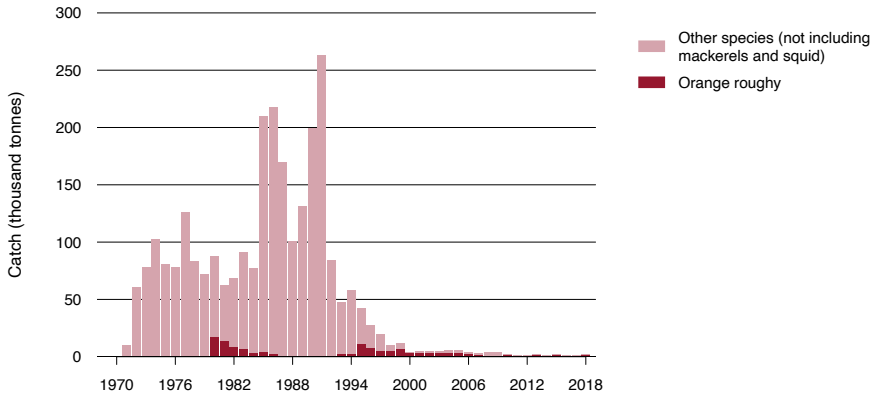
Total reported catch of demersal species by all fleets in the SPRFMO Convention area was 1,680 t in 2017 and 1,900 t in 2018 (Figure 28.3). Most of this catch was reported from the western SPRFMO Convention area, primarily by New Zealand vessels.

FIGURE 28.2 Australian trawl-and-line catch, by species, in the SPRFMO Convention area, 1990 to 2019



Source: AFMA

FIGURE 28.3 Total SPRFMO catch of demersal species, 1969 to 2018



Source: SPRFMO

Stock structure

The biological structure of stocks in the SPRFMO Convention area is uncertain. Research indicates that there is a greater level of genetic structure in global orange roughy populations than has previously been detected (Varela, Ritchie & Smith 2013). Analyses of biological data and various stock assessments have identified separate and geographically distinct fishing areas for orange roughy due to substantial distances or abyssal-depth waters. These fishing areas are STR, northern Lord Howe Rise, southern Lord Howe Rise, Challenger Plateau and West Norfolk Ridge.

In 2013, the first meeting of the SPRFMO Scientific Committee recommended that work be done to identify the existence and distribution boundaries of stocks of orange roughy and alfonsino that straddle EEZ boundaries and extend from EEZs into the SPRFMO Convention area. It is likely that alfonsino on northern Lord Howe Rise and orange roughy on Challenger Plateau, both within the SPRFMO Convention area, constitute such straddling stocks. Under the SPRFMO Convention, such stocks are subject to compatible management arrangements within EEZs and on the high seas.

Several regional management units of orange roughy have been assumed for assessment purposes in the SPRFMO Convention area. In addition to the STR stock (which straddles the AFZ and the SPRFMO Convention area), these units are Louisville North, Louisville Central, Louisville South, Lord Howe Rise, north-west Challenger Plateau and West Norfolk Ridge. Work is currently underway to improve the delineation of biological stocks of orange roughy in the SPRFMO Convention area.

SPRFMO orange roughy stock assessments

Several assessments have been attempted for orange roughy management units in the SPRFMO Convention area (Clark, Dunn & Anderson 2010; Cordue 2017, 2019; Edwards & Roux 2017; Roux et al. 2017; Wayte et al. 2003). The Cordue (2017) assessment is a catch history–based method that uses an age-structured population model with parameters borrowed from 5 stocks within New Zealand's EEZ. The method focuses on the minimum virgin biomass (B_{min}) that would allow the historical catches to have been taken, assuming a maximum exploitation rate of 67%. The assessment results indicated that in 2015, 5 of the 7 SPRFMO management units were very likely to have been above a limit reference point of 20% of unfished biomass ($0.2B_0$).[1] There was an indication that the north-west Challenger Plateau and Lord Howe Rise management units may be below this limit reference point, and that recent exploitation rates would not enable stock biomass to increase.

1 Reference points for orange roughy have not been adopted by the SPRFMO.

The Cordue (2017) assessment for the 3 Louisville Ridge management units was updated in 2019 (Cordue 2019). The 2019 assessment uses age and length composition data from the Louisville Central orange roughy stock and assumes a maximum exploitation rate of 67%. The biological parameters and year-class strengths for Louisville Central were then used to update catch-history based assessments for Louisville North and Louisville South. No biomass indices (for example, from acoustic surveys) were available, but the composition data were adequate to rule out very high exploitation rates for Louisville Central in 1995 (when there was a spike in catches), and eliminate low values of B_0 and current stock status. The estimates of unfished and current biomass for the Louisville stocks remain uncertain, but the new data have enabled more precise stock assessments (that is, there is likely to be less error in the models). The new estimate of natural mortality (M) of 0.03 indicates the potential for lower yields per unit of biomass for these stocks compared with New Zealand stocks (where M is ~0.045). Although stock status remains uncertain, the models suggest that Louisville Central is probably above $0.5B_0$ and that Louisville North is probably above $0.3B_0$. There is a small possibility that Louisville South is below $0.2B_0$, but it is likely well above this level. The updated assessment gave very similar results to the 2017 assessment for these stocks; consequently, the SPRFMO Commission agreed to roll over the catch limit for the 3 Louisville Ridge management units that was set using the 2017 assessment.

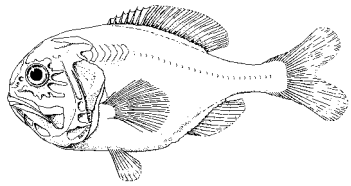
SPRFMO CMM 03a-2020 (first implemented in 2019 as CMM 03a-2019) sets catch limits for orange roughy for the management areas to the east and west of New Zealand. These catch limits are a combined 1,140 t for the 3 Louisville Ridge management units, and a combined 346 t for the 3 Tasman Sea management units.[2] For the Tasman Sea (which is where most of Australia's fishing has historically taken place), this catch limit has been established such that the limit could be safely taken from any of the 3 subunits without compromising the sustainability of any one subunit.

It should be noted that the results of the Cordue 2017 and 2019 assessments are conditional on the stock hypotheses being approximately correct, and have a high level of uncertainty for most management units. Nonetheless, catch limits derived from the assessment—particularly for the Tasman Sea—are likely to be highly precautionary. The SPRFMO has recommended that additional work be done to strengthen assessment outputs, including deriving age data from otoliths taken from fish in spawning aggregations and improving acoustic estimates of aggregation biomass. Work is currently underway to update the assessments for the Tasman Sea management units.[2]

2 The Tasman Sea management units include Lord Howe Rise, north-west Challenger Plateau and West Norfolk Ridge, and exclude Westpac Bank and South Tasman Rise.

28.2 South Tasman Rise Trawl Fishery

Orange roughy (*Hoplostethus altanticus*)



Line drawing: Rosalind Murray

TABLE 28.1 Status of the South Tasman Rise Trawl Fishery

Stock	Biological status				Comments
	2018		2019		
	Fishing mortality	Biomass	Fishing mortality	Biomass	
Orange roughy (*Hoplostethus atlanticus*)					Fishery has been closed under domestic arrangements since 2007 as a result of stock depletion.
Economic status					
Fishery closed.					

Fishing mortality	Not subject to overfishing	Subject to overfishing	Uncertain
Biomass	Not overfished	Overfished	Uncertain

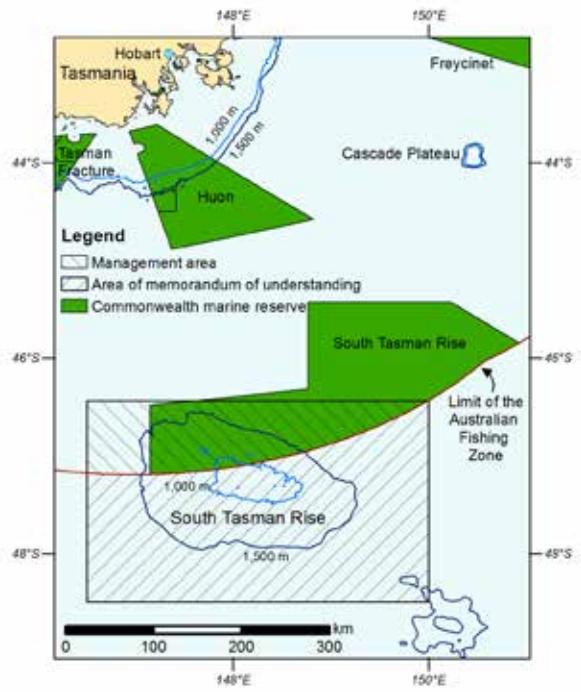
Description of the fishery

The STRTF includes areas inside both the AFZ and the high seas. The high-seas portion falls within the competence of the SPRFMO and is managed in accordance with SPRFMO CMMs.

Fishing began in the STRTF in 1997, using demersal trawl to target a recently discovered orange roughy stock. The fishery has not operated since 2007. Under the United Nations Fish Stocks Agreement,[3] other countries are entitled to access the high-seas portion of the stock, provided that a cooperative management regime with consistent measures for both portions of the stock (inside and outside the EEZ) is established.

3 The full title of the agreement is the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks; see un.org/depts/los/convention_agreements/convention_overview_fish_stocks.htm.

FIGURE 28.4 Area of the STRTF

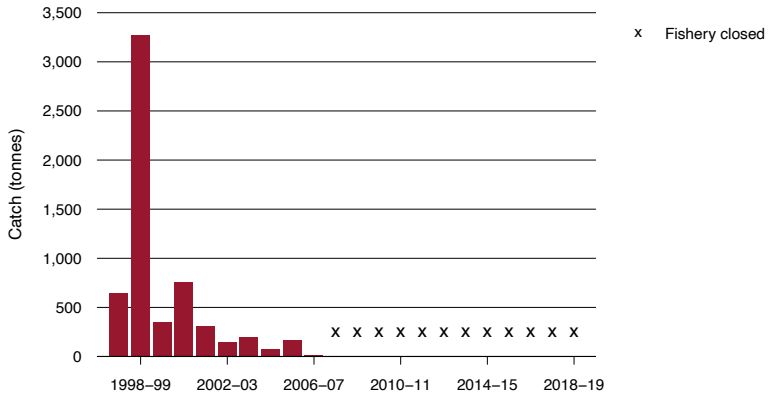


Catch history

Orange roughy catches by Australian vessels peaked at 3,270 t in 1998–99 and declined thereafter (Figure 28.5). From 2001 to 2006, when fishing was occurring, less than 10% of the total allowable catch was landed. Following indications of depletion of the orange roughy stock in the 2002 stock assessment and the limited fishing for several subsequent years, the STR was closed to Australian fishing vessels—both inside and outside the AFZ—in 2007.

In the later years of activity in the STRTF, catch was mostly smooth oreodory (*Pseudocyttus maculatus*) and spikey oreodory (*Neocyttus rhomboidalis*). No formal stock assessment of oreodories in the STRTF has been undertaken. However, before the fishery was closed, trends in catch and catch rates for these species indicated that stocks had been fished down. If fishing in the STRTF resumes, management arrangements for oreodories should be considered as part of the development of a revised harvest strategy, to ensure that these species are not overexploited.

FIGURE 28.5 Australian orange roughy catch in the STRTF, 1997–98 season to 2018–19 season



Stock structure

The orange roughy stock in the STR is managed independently, as a discrete population, as are the orange roughy stocks in the other fishing zones in the Southern and Eastern Scalefish and Shark Fishery (see Chapter 9).

Stock assessment

An assessment of the orange roughy stock in the STRTF by Wayte et al. (2003) used catches and catch rates in a standardised catch-per-tow analysis, as well as examining acoustic data collected during the 1998 to 2002 winter spawning seasons. Annual reported catches in the fishery declined after the first couple of years (Figure 28.5). Standardised catch-per-tow analysis (Wayte et al. 2003) indicated that catch rates declined by 92% between 1997–98 and 2002–03. Anecdotal information suggests that illegal catches in 1999 may have been substantially higher than documented. These reductions in catch and catch rate, when the cumulative total reported catch was 11,341 t, indicate that the initial stock biomass was not large compared with some other orange roughy populations and had been considerably reduced by 2002–03 (Wayte et al. 2003).

No recovery was evident after this, and estimated relative abundance in 2002–03 was only 8% of abundance in 1997–98 (Wayte et al. 2003). No significant acoustic marks, indicative of spawning aggregations, were apparent during industry surveys in 2000, 2001 or 2002. Although orange roughy may not form spawning aggregations in the same location every year, the absence of aggregations for several consecutive years is concerning. The assessment concluded that there was little doubt that the stock size, or the availability of fish to the fishery, had decreased dramatically after the first couple of years of the fishery and shown no signs of recovery. The fishery has not been surveyed since 2002.

Stock status determination

The assessment by Wayte et al. (2003) indicates that the stock biomass had been overfished. The life history characteristics of orange roughy may make the recovery of the stock a slow process—possibly in the order of decades—given the estimated level of depletion. Although the fishery has not been surveyed since 2002, in the absence of any new information, the stock remains classified as **overfished**.

However, given the time that has passed since this stock has been fished and the recovery that has been detected in the eastern zone orange roughy stock in the Commonwealth Trawl Sector (see Chapter 9), it is possible that similar rebuilding has occurred in the STR. This suggests increasing uncertainty around the biomass status of the stock. In the absence of additional information on stock status, it is possible that future biomass status may be classified as uncertain.

Since the fishery is closed, the stock is classified as **not subject to overfishing**.

28.3 Southern Indian Ocean Fisheries Agreement area of competence

Description of the fishery

Fisheries in the SIOFA area predominantly target demersal or benthopelagic species using demersal trawl, midwater trawl and demersal longline gears. Fishing in the SIOFA area occurs mostly on or near seamounts and ridges in the southern Indian Ocean and on the Saya de Malha bank in the north-western Indian Ocean (Figure 28.6). The former USSR began deep-sea trawling in what is now the SIOFA area in the 1960s. USSR vessels conducted periodic deep-sea trawl research cruises on a commercial scale from the mid 1970s until the dissolution of the USSR in 1991. During the 1990s, several Ukrainian-flagged deep-sea trawl vessels operated in the area (Bensch et al. 2009; Clark et al. 2007; Romanov 2003). No catch has been recorded by Ukraine since 2001.

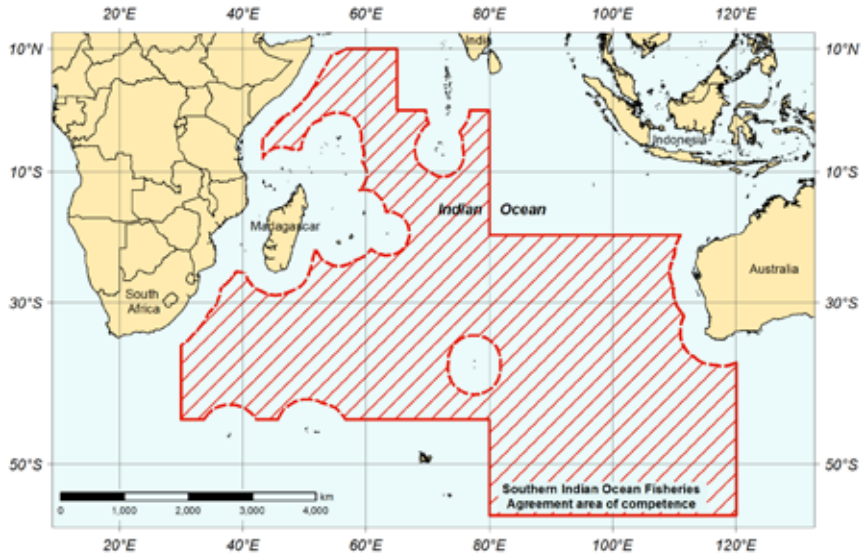
Deep-sea trawlers from Australia and New Zealand were reportedly fishing in the SIOFA area before 1999. In 1999, deep-sea trawling in the area increased substantially after orange roughy stocks were discovered (Japp & James 2005). In 2000, the combined catch of all deepwater species for all international vessels in the area was estimated at 40,000 t (Bensch et al. 2009), which was taken by up to 50 vessels from more than 12 nations. Accurate catch data are not available for many of these vessels because of the unregulated nature of the high-seas fishery at that time (Bensch et al. 2009). Although more vessels were thought to be fishing, only 8 reported participating in the fishery to the Food and Agriculture Organization of the United Nations (FAO) in 2001.

Australian vessels have reported catch from the SIOFA area since 1999. Fishing methods have been specified on Australian high-seas permits issued by AFMA since 2008; they include midwater trawl, demersal trawl, auto-longline, dropline and trap. Gillnetting was permitted up to 2008, but there are no records of gillnetting by Australian operators in the area after 1999 (Williams et al. 2011b), and AFMA has since prohibited the use of deepwater gillnets by Australian fishing vessels.

In 2011, Australia completed a bottom fishery impact assessment in the SIOFA area to examine whether individual bottom-fishing activities by Australian vessels have significant adverse impacts on VMEs (Williams et al. 2011b). The study concluded that the current overall risk of significant adverse impacts on VMEs by Australian bottom trawl and bottom longline operations is low, and the impact caused by midwater trawling and droplining is negligible (Williams et al. 2011b). In 2020, Australia updated its bottom fishery impact assessment to consider the impact of fishing using longline gears on Williams Ridge, near Australia's Heard Island and McDonald Islands toothfish fishery (see Chapter 25), as well as to consider the impacts of fishing using potting gears in Australia's historical fishing footprint within the SIOFA area (Welsford et al. 2020). This assessment concluded that the impact of fishing in both cases would be low for target stocks, associated species and VMEs.

SIOFA has adopted various CMMs, including CMMs relating to large-scale pelagic driftnets and deepwater gillnets; interim management measures for bottom fisheries; management measures for demersal stocks; an authorised vessel list; an illegal, unreported and unregulated vessel list; vessels without nationality; data standards and data confidentiality; and measures to regulate at-sea and in-port trans-shipment and vessel monitoring systems.

FIGURE 28.6 Southern Indian Ocean Fisheries Agreement area of competence



Recent catch and effort

Midwater and demersal trawl have contributed most of Australia's historical catch and effort from the SIOFA area, with orange roughy and alfonsino being the main species targeted using these gears. In 2016, 1 multipurpose vessel (trawl and demersal longline) was active in the fishery. No Australian vessels fished in the SIOFA area in 2017. One fishing trip was undertaken in late 2018, extending into 2019, using bottom line gears.

Catch-and-effort data for the SIOFA area can be disclosed in accordance with AFMA's data disclosure policy. Total retained catch taken by bottom line gears reported in logbooks in 2019 was 34 t, with discards of <1 t. Total effort was 54,200 hooks, comprised of 48,300 hooks for bottom longline and 5,900 hooks for dropline gears. The main species caught in 2019 using bottom line gears were *Polyprion* species (26 t), with small quantities of jackass morwong (*Nemadactylus macropterus*; 3 t), yellowtail kingfish (*Seriola lalandi*; 2 t) and other mixed species comprising the remainder of the catch.

Stock structure

The biological structure of stocks in the SIOFA area is uncertain; however, it is known that a number of stocks cross jurisdictional boundaries (for example, the Patagonian toothfish [*Dissostichus eleginoides*] stock that straddles Australia's Heard Island and McDonald Islands toothfish fishery within Australia's EEZ [see Chapter 5] and Williams Ridge in the SIOFA area). For orange roughy, 7 regional management units have been assumed for assessment purposes: Walters Shoal region, Meeting, North Walters, Seamounts, North Ridge, Middle Ridge and South Ridge.

SIOFA orange roughy stock assessments

Assessments have recently been attempted for 7 orange roughy management units in the SIOFA area (Cordue 2018a, b). The assessment for the Walters Shoal unit (Cordue 2018a) incorporates biological data in conjunction with a stock hypothesis, a catch history and acoustic estimates. The results indicate that the absolute scale of the stock is very uncertain because the true scale of the acoustic biomass estimates is poorly known. Virgin biomass is estimated to be in the range of 25,000–90,000 t. Given the stock hypothesis, it is highly likely that stock biomass is above $0.5B_0$.

For 6 management units, a catch history–based assessment was undertaken (Cordue 2018b). For 3 of these, Cordue also did a simple model-based assessment that incorporated acoustic biomass estimates and borrowed results from the Walters Shoal Region. Exploitation rates of 5% and 40% were used to bound stock size and estimates of biomass. Under the assumption of a maximum exploitation rate of 40%, the spawning biomass (SB) in 2017 was estimated to be $0.22SB_0$ for the Seamounts unit and $0.43SB_0$ for the South Ridge unit. All other stocks were estimated to be above $0.5SB_0$ under this assumption.

28.4 Economic status

The gross value of production is not available for the SPRFMO and SIOFA areas for confidentiality reasons. In 2019, 3 vessels were active in the SPRFMO area, and 1 vessel was active in the SIOFA area. Given limited catches in recent years, the value of the fisheries would be relatively low compared with other Australian fisheries.

One orange roughy stock is assessed in the STRTF, which is classified as overfished. As such, biomass is below the level associated with maximum economic yield. The fishery has been closed since 2007, so its economic status has not been assessed.

28.5 Environmental status

Deep-sea fisheries generally operate at depths of 200–1,600 m, on continental slopes or isolated oceanic structures such as ridges, seamounts and banks (FAO 2012). The depths and distances from the coast pose challenges to research, assessment and management of the effects of fishing on the environment and on target stocks (FAO 2012).

Impact assessment of bottom fishing

Under the United Nations General Assembly resolutions on sustainable fisheries (specifically, paragraph 83a of resolution 61/105, and paragraph 119(a) of resolution 64/72), states are called on to assess, based on the best available scientific information, whether individual bottom-fishing activities would have a significant adverse impact on VMEs, and to ensure that these activities are managed to prevent such impacts or are not authorised to proceed. This commitment was reflected in the SPRFMO interim measures (SPRFMO 2007), resulting in the development and adoption by the SPRFMO of a standard for impact assessment of bottom fisheries (SPRFMO 2012), compatible with the FAO deepwater guidelines (FAO 2009). The SPRFMO bottom-fishing impact assessment standard was updated in 2019 (SPRFMO 2019). SIOFA adopted a similar bottom-fishing impact assessment standard in 2017. Australia and New Zealand submitted a cumulative assessment of bottom-fishing impacts in accordance with the updated SPRFMO bottom-fishing impact assessment standard on 4 August 2020.

The South Tasman Rise Commonwealth Marine Reserve, which came into effect in 2007, overlaps with the STRTF (Figure 28.4). The reserve covers 27,704 km^2, including several seamounts. Commercial fishing is not permitted in the reserve. Several other marine reserves have been established near the STRTF.

Australia completed bottom-fishing impact assessments for demersal fishing activities in the south Pacific and southern Indian oceans in 2011 (Williams et al. 2011a, b) and an updated assessment for the SIOFA area in 2020 (Welsford et al. 2020). The Williams et al. (2011a, b) assessments for both areas concluded that the current overall risk of significant adverse impacts on VMEs by Australian vessels fishing with bottom trawls and bottom-set auto-longlines was low, primarily because of the low fishing effort and the small number of areas of high fishing intensity. The assessments also concluded that the current overall risk of significant adverse impacts on VMEs from midwater trawling and droplining by Australian vessels was negligible, based on the low level of fishing effort, the small number of areas of high fishing intensity and the effects of current management arrangements. The Welsford et al. (2020) assessment for the SIOFA area concluded that the impact of fishing using longline gears on Williams Ridge and using potting gears within Australia's historical fishing footprint in the SIOFA area would be low for target stocks, associated species and VMEs.

List of exempt native specimens

Under part 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Australian fisheries are assessed to ensure that they are managed in a manner that does not lead to overfishing, and that fishing operations are managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. In 2018, Australia's high-seas fisheries were reaccredited for 8 years under the EPBC Act.

In accordance with accreditation under the EPBC Act (see Chapter 1, 'Protected species interactions'), AFMA publishes and reports quarterly on interactions with protected species on behalf of Commonwealth fishing operators to the Department of Agriculture, Water and the Environment (DAWE). Since 2010, AFMA observers have recorded few interactions with protected species in the SPRFMO and SIOFA fisheries. One interaction with a basking shark (*Cetorhinus maximus*; dead) was reported in the SPRFMO trawl fishery in 2019.

These reported interactions with protected species form a part of the ongoing monitoring by DAWE of the performance of fisheries within their accreditation under the EPBC Act.

28.6 References

Bensch, A, Gianni, M, Greboval, D, Sanders, J & Hjort, A 2009, *Worldwide review of bottom fisheries in the high seas*, FAO Fisheries and Aquaculture Technical Paper 522, Food and Agriculture Organization of the United Nations, Rome.

Clark, MR, Dunn, MR & Anderson, OF 2010, *Development of estimates of biomass and sustainable catches for orange roughy fisheries in the New Zealand region outside the EEZ: CPUE analyses, and application of the 'seamount meta-analysis' approach*, New Zealand Fisheries Assessment Report 2010/19, Ministry of Fisheries, Wellington.

——, Vinnichenko, VI, Gordon, JDM, Beck-Bulat, GZ, Kukharev, NN & Kakora, AF 2007, 'Large-scale distant-water trawl fisheries on seamounts', in TJ Pitcher, T Morato, PJB Hart, MR Clark, N Haggan & RS Santos (eds), *Seamounts: ecology, fisheries and conservation*, Fish and Aquatic Resources Series 12, Blackwell, Oxford, United Kingdom.

Cordue, P 2017, 'Catch-history based stock assessments of seven SPRFMO orange roughy stocks', report prepared by Innovative Solutions Ltd for the fifth meeting of the SPRFMO Scientific Committee, Shanghai, China, 23 to 28 September 2017.

——2018a, 'Assessments of orange roughy stocks in SIOFA statistical areas 1, 2, 3a and 3b', report prepared by Innovative Solutions Ltd for the first meeting of the SIOFA Stock Assessment Working Group, Saint Denis, La Reunion, 15 to 18 March 2018.

——2018b, 'Stock assessment of orange roughy in the Walter's Shoal Region', report prepared by Innovative Solutions Ltd for the first meeting of the SIOFA Stock Assessment Working Group, Saint Denis, La Reunion, 15 to 18 March 2018.

——2019, 'A 2019 orange roughy stock assessment for Louisville Ridge', report prepared by Innovating Solutions Ltd for the seventh meeting of the SPRFMO Scientific Committee, La Havana, Cuba, 7 to 12 October 2019.

Department of Agriculture and Water Resources 2018, *Commonwealth Fisheries Harvest Strategy Policy*, Department of Agriculture and Water Resources, Canberra.

Edwards, C & Roux, M-J 2017, *A simple delay-difference model for assessment of data-poor orange roughy stocks*, final research report for project SEA201622, New Zealand Ministry for Primary Industries, Wellington.

FAO 2009, *International guidelines for the management of deep-sea fisheries in the high seas*, Food and Agriculture Organization of the United Nations, Rome.

——2012, *Deep-sea fisheries in the high seas: ensuring sustainable use of marine resources and the protection of vulnerable marine ecosystems*, Food and Agriculture Organization of the United Nations, Rome.

Gianni, M 2004, *High seas bottom trawl fisheries and their impacts on the biodiversity of vulnerable deep-sea ecosystems: options for international action*, International Union for Conservation of Nature, Gland, Switzerland.

Japp, DW & James, A 2005, 'Potential exploitable deepwater resources and exploratory fishing off the South African coast and the development of the deepwater fishery on the South Madagascar Ridge', in R Shotton (ed.), *Deep Sea 2003: conference on the governance and management of deep-sea fisheries*, part 1, *Conference papers*, FAO Fisheries Proceedings 3/1, pp. 162–8.

Norse, EA, Brooke, S, Cheung, WWL, Clark, MR, Ekeland, I, Froese, R, Gjerde, KM, Haedrich, RL, Hepell, SS, Morato, T, Morgan, LE, Pauly, D, Sumaila, R & Watson, R 2012, 'Sustainability of deep-sea fisheries', *Marine Policy*, vol. 36, pp. 307–20.

Romanov, EV (ed.) 2003, *Summary review of Soviet and Ukrainian scientific and commercial fishing operations on the deepwater ridges of the southern Indian Ocean*, FAO Fisheries Circular 991, Food and Agriculture Organization of the United Nations, Rome.

Roux, M-J, Doonan, I, Edwards, C & Clark, M 2017, *Low information stock assessment of orange roughy* Hoplostethus atlanticus *in the South Pacific Regional Fisheries Management Organisation Convention area*, New Zealand Fisheries Assessment Report 2017/01, New Zealand Ministry for Primary Industries, Wellington.

SPRFMO 2007, 'Interim measures adopted by participants in negotiations to establish South Pacific Regional Fisheries Management Organisation', third meeting of SPRFMO participants, Reñaca, Chile, 4 May 2007.

——2012, *Bottom fishery impact assessment standard*, third session of the Preparatory Conference, Santiago, Chile, February 2012.

——2013, *Report on the first meeting of the Commission of the South Pacific Regional Fisheries Management Organisation*, annex N, Auckland, New Zealand, 28 January to 1 February 2013.

——2019, 'Revision of the SPRFMO Bottom Fishery Impact Assessment Standard', paper SC7-19 to the 7th meeting of the SPRFMO Scientific Committee, La Havana, Cuba, 7 to 12 October 2019.

Varela, AI, Ritchie, PA & Smith, PJ 2013, 'Global genetic population structure in the commercially exploited deep-sea teleost orange roughy (*Hoplostethus atlanticus*) based on microsatellite DNA analysis', *Fisheries Research*, vol. 140, pp. 83–90.

Wayte, S, Bax, N, Clark, M & Tilzey, R 2003, 'Analysis of orange roughy catches on the South Tasman Rise 1997–2002', paper for the Orange Roughy Assessment Group, CSIRO, Hobart.

Welsford, D, Ziegler, P, Maschette, D & Sumner, M 2020, *Bottom fishing impact assessment (BFIA) for proposed fishing activities by Australia in the Southern Indian Ocean Fisheries Agreement (SIOFA) area—2020 update*, report prepared by the Australian Antarctic Division, Department of Agriculture, Water and the Environment for AFMA.

Williams, A, Franziska, A, Fuller, M, Klaer, N & Barker, B 2011a, *Bottom fishery impact assessment*, Australian report for the SPRFMO, CSIRO Marine and Atmospheric Research, Hobart.

——, Franziska, A, Fuller, M, Klaer, N & Barker, B 2011b, *Bottom fishery impact assessment*, Australian report for the SIOFA, CSIRO Marine and Atmospheric Research, Hobart.