Chapter 25
Heard Island and McDonald Islands Fishery

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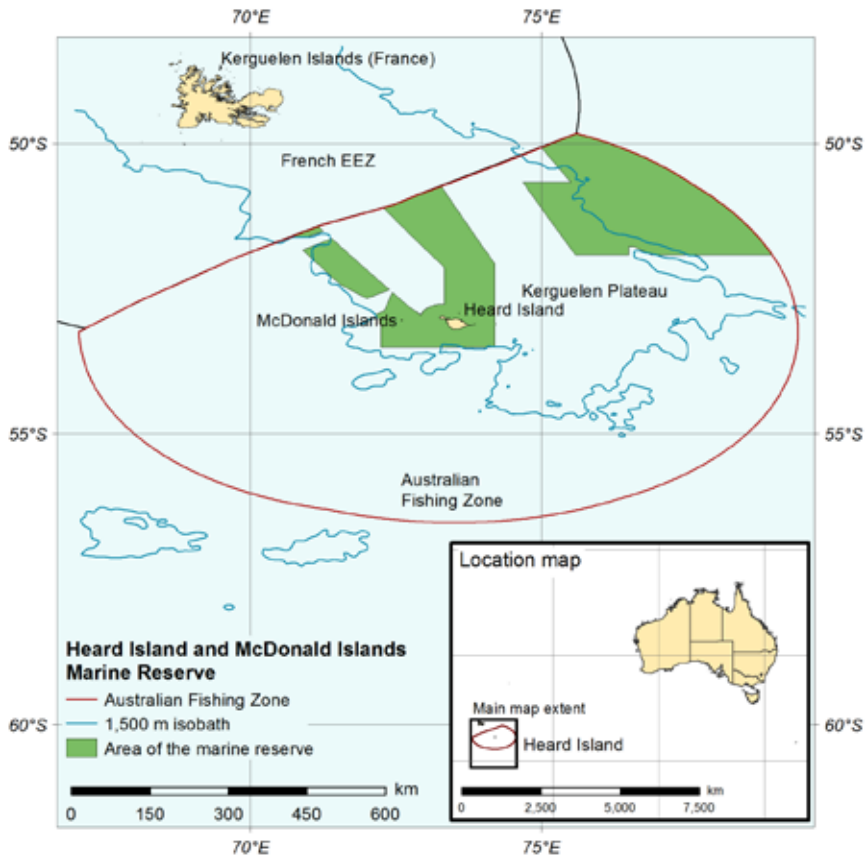
FIGURE 25.1 Area of the Heard Island and McDonald Islands Fishery, 2020



Note: **EEZ** Exclusive economic zone.

TABLE 25.1 Status of the Heard Island and McDonald Islands Fishery

Biological status					
Stock	2019		2020		Comments
	Fishing mortality	Biomass	Fishing mortality	Biomass	
Mackerel icefish (*Champsocephalus gunnari*)					TACs are set in accordance with a precautionary harvest strategy that maintains 75% of the estimated biomass.
Patagonian toothfish (*Dissostichus eleginoides*)					TACs are set in accordance with a precautionary harvest strategy. Most recent estimates of biomass are above the limit reference point.
Economic status					
Estimates of NER are not available. The primary target species, Patagonian toothfish, has historically low levels of latency and a high landing value, indicating positive NER for the fishery. A precautionary approach to the management of the stock, the setting of TACs under ITQs and target stocks at their target biomass levels should ensure that NER remain positive over the longer term.					

Notes: **ITQ** Individual transfer quota. **NER** Net economic returns. **TAC** Total allowable catch.

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

25.1 Description of the fishery

Area fished, fishing methods and key species

The Australian external territory of Heard Island and McDonald Islands (HIMI) is in the southern Indian Ocean (Figure 25.1), within the area covered by the Convention on the Conservation of Antarctic Marine Living Resources. The islands and their surrounding territorial waters (out to 12 nautical miles [nm]) are closed to fishing and regulated under the *Environment Protection and Management Ordinance 1987*, administered by the Australian Antarctic Division (AAD) of the Australian Government Department of Agriculture, Water and the Environment. A 1 nm buffer zone around the territorial waters of HIMI extends the area closed to fishing to 13 nm. The Heard Island and McDonald Islands Marine Reserve was declared in October 2002 and then expanded in March 2014 by proclamation after scientific assessment. The reserve now totals 71,200 km^2. Waters between 12 and 200 nm from HIMI are part of the Australian Fishing Zone (AFZ). The *Heard Island and McDonald Islands Marine Reserve management plan 2014–2024* (AAD 2014), made pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), provides the management regime for the reserve.

The key target species are Patagonian toothfish (*Dissostichus eleginoides*) and mackerel icefish (*Champsocephalus gunnari*). The fishery also has catch limits for bycatch species, such as deep-sea skates (Rajidae) and grey rockcod (*Lepidonotothen squamifrons*), based on assessments of long-term annual yield (Constable, Williams & de la Mare 1998). The catch limits for unicorn icefish (*Channichthys rhinoceratus*) and grenadiers (*Macrourus* spp.), another group of bycatch species, were updated in 2015 based on assessments undertaken by the AAD (Dell et al. 2015; Maschette & Dell 2015). The catch limits are regularly reviewed by the Australian Fisheries Management Authority's (AFMA's) Sub-Antarctic Resource Assessment Group, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Scientific Committee and the CCAMLR Commission, and are considered precautionary. Recent updates of the ecological risk assessments have lowered the risk of fishing to finfish bycatch species (see section 25.4). Demersal longline is the main method used in the fishery, with some catch taken by demersal trawl. Mackerel icefish is taken exclusively using demersal and midwater trawl.

Management methods

The AAD, in collaboration with AFMA observers and industry, regularly conducts fisheries-independent, random-stratified trawl surveys for target species (Patagonian toothfish and mackerel icefish) to collect relative abundance data, particularly of juvenile age classes. Harvest strategies for the target species are consistent with the precautionary approach implemented by the CCAMLR and have been used to set catch limits since the mid-1990s. The harvest strategies developed for the Heard Island and McDonald Islands Fishery (HIMIF) are consistent with the guidelines of the Commonwealth Fisheries Harvest Strategy Policy (Department of Agriculture and Water Resources 2018). For mackerel icefish, which is a short-lived species with highly variable recruitment, the target reference point dictates that the spawning stock biomass be maintained at 75% of the level that would occur in the absence of fishing at the end of a 2-year model projection and that the probability of the spawning biomass dropping below 20% of its pre-exploitation median level is less than 10% over the projection. For Patagonian toothfish, the target reference points dictate that median escapement of the spawning biomass at the end of a 35-year projection period is 50% of the median pre-exploitation level and that the probability of the spawning biomass dropping below 20% of its pre-exploitation median level is less than 10% over the projection.

The importance of the target species (especially mackerel icefish) as prey in the subantarctic ecosystem is taken into account, and catch limits must be sufficiently precautionary to ensure that the abundance of these species meets the ecological needs of dependent species (for example, seabirds and marine mammals). Mackerel icefish in the HIMIF was initially certified as sustainable by the Marine Stewardship Council (MSC) in March 2006 and was recertified in July 2016. Patagonian toothfish in the HIMIF, originally certified in 2012, was recertified as sustainable by the MSC in July 2017.

Fishing activity

Effort in the HIMIF has been fairly stable, with 2–5 vessels active at any one time since a total allowable catch (TAC) was first set in the mid-1990s, with the exception of the 2014–15 season when the toothfish TAC was substantially higher and 7 vessels fished.

Catches of mackerel icefish have been variable over time because it is a short-lived species, exhibiting periodic, large, dominant year-classes that contribute to high catches for a year or 2. When strong year-classes die out and subsequent cohorts are weaker, catches are reduced to account for the smaller biomass available to the fishery.

The TAC and catches of Patagonian toothfish have been stable at around 2,500 to 3,000 t for the past 20 years, with relatively little variation between the 2000–01 and 2013–14 fishing seasons. Catch in the 2014–15 fishing season increased in response to the increased TAC, but has since returned to just over 3,000 t.

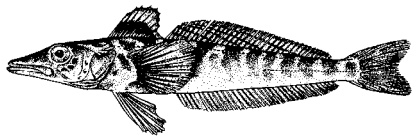
TABLE 25.2 Main features and statistics for the HIMIF

Fishery statistics a	2018–19 fishing season			2019–20 fishing season		
Stock	**TAC (t)**	**Catch (t)**	**GVP (2018–19)**	**TAC (t)**	**Catch (t)**	**GVP (2019–20)**
Mackerel icefish	443	443	Confidential	527	507	Confidential
Patagonian toothfish	3,525	3,390	Confidential	3,030	3,014	Confidential
Fishery-level statistics						
Effort	64 trawl-days 17,745,965 hooks 0 pots hauled			85 trawl-days 8,826,470 hooks 0 pots hauled		
Fishing permits	4 quota SFR holders			4 quota SFR holders		
Active vessels	5			5		
Observer coverage b	100% vessel coverage			100% vessel coverage		
Fishing methods	Demersal longline, demersal trawl, midwater trawl, pot (fish traps)					
Primary landing ports	Port Louis (Mauritius)					
Management methods	Input controls: limited entry, gear restrictions, temporal and spatial closures Output controls: TACs, ITQs Other: move-on provisions if bycatch thresholds are reached					
Primary markets	International: China, eastern Europe, Japan, United States – frozen					
Management plan	Heard Island and McDonald Islands Fishery Management Plan 2002 (amended 2011)					

a Fishery statistics are provided by fishing season, unless otherwise indicated. Season is 1 December to 30 November. Value statistics are by financial year. **b** All vessels are required to carry 2 observers on each trip, and 100% of hauls are observed. However, due to travel restrictions imposed by COVID, it was not possible to place 2 observers on all trips in the 2019–20 season.
Notes: **GVP** Gross value of production. **ITQ** Individual transferable quota. **SFR** Statutory fishing right. **TAC** Total allowable catch.

25.2 Biological status

Mackerel icefish (*Champsocephalus gunnari*)



Line drawing: FAO

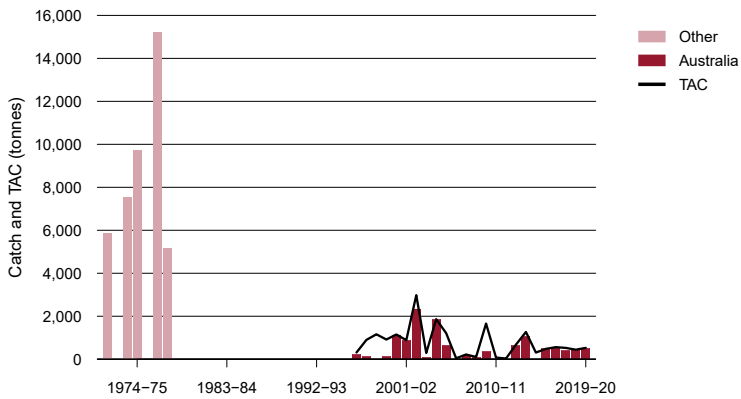
Stock structure

No genetic variation in mackerel icefish has been found among sites around HIMI, so there is considered to be a single stock in HIMI (Williams, Smolenski & White 1994). Genetic studies indicate that the population at HIMI is distinct from icefish populations in the southern Atlantic Ocean (Kuhn & Gaffney 2006). Mackerel icefish at HIMI and the Kerguelen Plateau in the French Exclusive Economic Zone (EEZ) are considered distinct stocks because of their different spawning seasons and growth rates (Williams et al. 2001).

Catch history

The catch history of icefish has been sporadic, with very high and unregulated catches taken by Soviet and Polish fleets across the Kerguelen Plateau in the 1970s, before the declaration of the EEZ around the Kerguelen Islands by France and the AFZ around HIMI. It is uncertain where these earlier catches were taken relative to the current maritime boundaries, although charts from this period indicate that the fishing fleet was aware of some of the banks where icefish currently form aggregations within the Australian EEZ. The initial TAC for icefish was set by the CCAMLR in 1995 following a demersal survey by the AAD. Since then, catches have generally followed the TAC, which takes into account the large natural fluctuations in abundance of the fish (Figure 25.2). Close to the full TAC was taken in 2019–20.

FIGURE 25.2 Catch and TAC of mackerel icefish in the HIMIF, 1971–72 season to 2019–20 season



Note: **TAC** Total allowable catch.
Source: AFMA

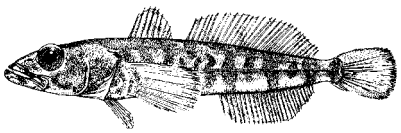
Stock assessment

A random stratified trawl survey in late March to mid-April 2020 provided information on the abundance and age structure of the mackerel icefish stock (Delegation of Australia 2020b). The 2+ age class was the largest and was estimated to account for 53% of the biomass (Delegation of Australia 2020a). The stock assessment estimated the current total biomass at 8,075 t. While the assessment, which used the generalised R yield model 'Grym' (Maschette et al. 2020), showed that catches could be increased to 1,272 t in the 2020–21 season, the CCAMLR Commission could not reach consensus to update any catch limits in the Convention area. Therefore, the 406 t TAC for the 2020–21 season, which was calculated from the previous assessment (Maschette, Nowara & Welsford 2019) and satisfies the CCAMLR harvest strategy requirement that the spawning stock biomass be maintained at 75% of the level that would occur in the absence of fishing at the end of a 2-year model projection, was retained (CCAMLR 2020).

Stock status determination

Based on the level of catch, the harvest rate relative to the stock biomass estimate (which, under the harvest strategy, allows for a high rate of escapement) and the robust nature of the assessment (which includes fisheries-independent data), the stock is determined to be **not overfished** and **not subject to overfishing**.

Patagonian toothfish (*Dissostichus eleginoides*)



Line drawing: FAO

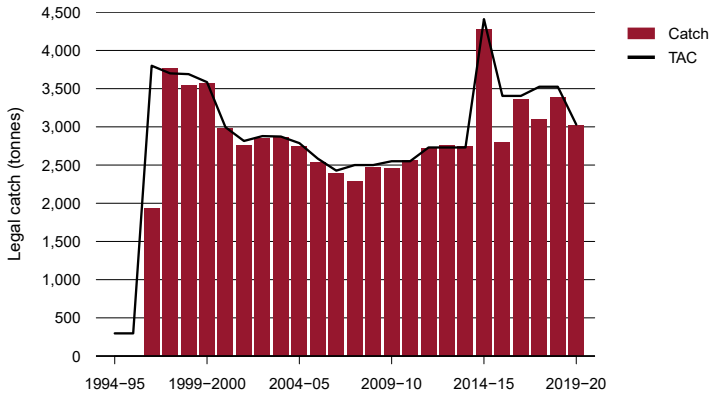
Stock structure

The Patagonian toothfish stock at HIMI is considered to comprise a population distinct from other regional toothfish populations in the south-west Pacific and Atlantic oceans (Appleyard, Ward & Williams 2002). However, limited genetic variation has been found among populations in the western Indian Ocean sector of the Southern Ocean – that is, HIMI, Crozet Islands, Kerguelen Islands, Marion Island and Prince Edward Islands (Appleyard, Williams & Ward 2004; Toomey et al. 2016). Data from tagging studies (for example, Welsford et al. 2011; Williams et al. 2002; Ziegler et al. 2021) indicate that, although adult toothfish at HIMI are relatively sedentary and usually recaptured within 15 nm of their point of release, in some cases they travel significant distances. For example, toothfish tagged at HIMI have been recaptured approximately 800 nm and 1,000 nm away on the Kerguelen and Crozet plateaus, respectively. Thus, toothfish in the Indian Ocean sector of the Southern Ocean may form a metapopulation, with some limited connectivity between the populations. The stock structure of toothfish on the Kerguelen Plateau has been further investigated in collaboration with French scientists to refine population models of toothfish in the area and improve management across the Kerguelen Plateau (Péron et al. 2016; Ziegler et al. 2021). The assessment takes the HIMI toothfish population as distinct, but accounts explicitly for population linkages on the Kerguelen Plateau (Ziegler et al. 2021).

Catch history

Catch of Patagonian toothfish in the HIMIF has declined slightly since the late 1990s, but was relatively stable from the early 2000s to 2013–14 and has mirrored the TAC (Figure 25.3). Because of the higher TAC, catches were greater in 2014–15. Catch in the 2019–2020 (3,014 t) seasons was close to the TAC.

FIGURE 25.3 Catch and TAC of Patagonian toothfish in the HIMIF, 1994–95 season to 2019–20 season



Note: **TAC** Total allowable catch.
Source: AFMA

Stock assessment

The most recent assessment for Patagonian toothfish (Ziegler 2019) was similar to the 2017 assessment, but included catch data to 2019; fishery observations, including tagging and ageing data to the 2017–18 season; estimated fishing mortality from gear loss; updated growth, length–weight and maturity-at-age parameters; and a simplification of the longline selectivity functions. The assessment was run using the agreed version of CASAL. This assessment also included catches from Williams Ridge, which is a small extension of the Kerguelen Plateau into the Southern Indian Ocean Fisheries Agreement area adjacent to the HIMI EEZ. As catches in this area are considered to be part of the same population fished in the HIMIF, they were accounted for in the stock assessment.

The 2019 estimated biomass was 51% of unfished levels ($SB_{2019}/SB_0 = 0.51$; 95% confidence interval 0.49–0.53). This decline from the 2017 estimate of 61% of unfished levels was due to the combination of 3 additional years of fishing, and updated observations and biological parameter estimates. The trajectory of the biomass is likely to decline below the target level of 50% of unfished levels during the projection period because of recent weak year-classes. However, if average recruitment is assumed, the stock will rebuild to 50% by the end of the 35-year projection period. Independent of the assumed recruitment, the stock is projected to be approximately 46% of unfished biomass by the time of the next assessment in 2021. An update of stock parameters requested by the Working Group on Fish Stock Assessment, including updated recruitment indices from the trawl survey, and updated age-frequency and tag–recapture data, found that the trajectory of the stock was consistent with that predicted in the 2019 stock assessment (Delegation of Australia 2020c).

A catch limit of 3,030 t satisfied the CCAMLR decision rules, and was the recommended TAC for the 2019–20 and 2020–21 fishing seasons (CCAMLR 2020).

Stock status determination

Given the high spawning biomass, the precautionary TAC that satisfies the CCAMLR decision rules, the robust nature of the stock assessment and the extensive CCAMLR review process, the stock is classified as **not overfished** and **not subject to overfishing**.

25.3 Economic status

Key economic trends

Survey estimates of net economic returns (NER) are not available for this fishery. The HIMF is characterised by persistently low levels of latency for the primary target species, Patagonian toothfish, since 1997–98. These low levels of latency for Patagonian toothfish, relatively high biomass and favourable prices are indicative of positive NER for the fishery.

Performance against economic objective

A harvest strategy, consistent with the principles of the CCAMLR, is in place for the fishery, and stock levels are around the target reference point. This, combined with the use of individual transferable quotas (ITQs), provides the best chance of maximising NER from the fishery, subject to the fishery's precautionary harvest strategy and strict operational constraints on vessels.

25.4 Environmental status

The HIMIF is exempt from export controls under the EPBC Act until 9 October 2026. No additional recommendations apply under this exemption, beyond standard recommendations pertaining to reporting.

In 2018, 3 ecological risk assessments were completed for the HIMIF using the 'ecological risk assessment for effects of fishing' method. The assessments covered the 3 gear types used in the fishery: demersal trawl, midwater trawl and demersal longline (Bulman et al. 2018; Sporcic et al. 2018a, b). All the assessments were completed to level 1 (Scale, Intensity, Consequence Analysis). The results for the 3 assessments were all improved from the previous assessments in 2009. The 2 trawl gears did not trigger the need for a level 2 analysis because there is limited trawl effort in the fishery. For the longline fishery, although the effort has increased since the previous assessment in 2009, improved research and mitigation resulted in only 1 component (community) requiring further assessment. This was due to a paucity of data on the broader consequences to the ecosystem of removing toothfish. In ecosystem models developed for the region, fishing was not found to be a driver of the food web dynamics (Subramaniam et al. 2020a, b).

In accordance with accreditation under the EPBC Act (see Chapter 1, 'Protected species interactions'), AFMA publishes and report quarterly on interactions with protected species on behalf of Commonwealth fishing operators to the Department of Agriculture, Water and the Environment (DAWE). These are summarised below.

In the HIMI longline fishery in 2020 (calendar year), 4 southern elephant seals (*Mirounga leonina*) died after being hooked on longline gear; 1 was released alive. Three white-chinned petrels (*Procellaria aequinoctialis*) and 1 southern giant petrel (*Macronectes giganteus*) were hooked and drowned while longline gear was being set. One white-chinned petrel was found dead in a trawl net.

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

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Patagonian toothfish
AFMA