

Southern Garfish (2023)

Hyporhamphus melanochir



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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Stock status	Indicators
Western Australia	Western Australia South Coast	Sustainable	Catch
Western Australia	Western Australia West Coast	Recovering	Catch, PSA, Catch-MSY,
Victoria	Victoria	Sustainable	Catch, effort, CPUE trends
Tasmania	Tasmania	Depleted	Catch, effort, CPUE trends, age composition
South Australia	Gulf St Vincent/Kangaroo Island	Recovering	Catch, effort, CPUE, harvest fraction, biomass, egg production
South Australia	South Australia West Coast	Sustainable	Catch, effort, CPUE trends
South Australia	South-East	Sustainable	Catch, effort, CPUE trends
South Australia	Spencer Gulf	Recovering	Catch, effort, CPUE, harvest fraction, biomass, egg production

STOCK STRUCTURE

Southern Garfish has a wide distribution in Australia, extending from Lancelin in Western Australia, along the southern coast of mainland Australia and up the east coast to Eden in southern New South Wales, as well as the surrounding waters of Tasmania [Gomon et al. 2008].

There has been no research into the stock structure of Western Australian populations of Southern Garfish. However, given the limited dispersal typically displayed by Southern Garfish, and the large spatial separation between the west and south coasts of Western Australia, it is highly likely that the west and south coast support separate biological stocks of this species [Ye et al. 2002; Steer et al. 2009].

In Victoria, there has been no research into the stock structure for populations of Southern Garfish and they are assumed to constitute a single jurisdictional stock.

In Tasmania, differences in size and age composition between the north coast and the east coast indicate that there may be multiple biological stocks; however, no firm evidence exists at present, and current stock assessments assume a single state-wide biological stock [Moore et al. 2018].

A multidisciplinary otolith-based study (otolith chemistry and morphometrics) identified at least five biological stocks in South Australia: West Coast, Northern Spencer Gulf, Southern Spencer Gulf, Northern Gulf St. Vincent and Southern Gulf St. Vincent [Steer et al. 2009]. Given the level of spatial separation of Southern Garfish observed between the gulfs, it was assumed that Southern Garfish from the south-east also comprised a separate biological stock. However, following a major reform of South Australia's Marine Scalefish Fishery in 2021 [Smart et al. 2022a], individual transferable quota arrangements and spatial scale of assessment for some key species (including Southern Garfish) were implemented at the spatial scale of four management zones: West Coast, Spencer Gulf, Gulf St Vincent/Kangaroo Island and South East.

Here, assessment of stock status is presented at the biological stock level for Western Australia (West Coast and South Coast), management unit level for South Australia (West Coast, Spencer Gulf, Gulf St Vincent/Kangaroo Island and South East) and at the jurisdictional level for Tasmania and Victoria.

STOCK STATUS

Gulf St Vincent/Kangaroo Island Southern Garfish is a primary species in South Australia's commercial multispecies, multi-gear and multi-sectoral Marine Scalefish Fishery. The most recent fishery assessment of Southern Garfish from the Gulf St Vincent/Kangaroo Island management unit was completed in 2023 and integrated catch and effort data from the commercial sector to the end of June 2022 [Smart et al. 2023], state-wide estimates of recreational catch data [Beckmann et al. 2023], and population demographic information (sex, age, and length composition) [Smart et al. 2023]. The Southern Garfish integrated stock assessment model was last run for the northern stock component of Gulf St Vincent/Kangaroo Island using data until December 2020 [Smart et al. 2022a]. As part of a major reform of the South Australian Marine Scalefish Fishery in 2021 [Smart et al. 2022b], four management zones were established, including consolidation of northern and southern components into the Gulf St Vincent/Kangaroo Island management unit.

The total catch of Southern Garfish from Gulf St Vincent/Kangaroo Island was 68 t in 2021–22, constituting 96% of the total allowable commercial catch. This level of catch was comparable to the previous two fishing seasons which had relatively stable catch and effort. The total effort in 2021–22, was 1,721 fisher-days which was an increase from 1,593 in 2020–21. The haul net sector accounted for 63 t of Southern Garfish catch (93% of the total catch) with the dab net sector catching 5 t in 2021–22. This dab net catch was the lowest on record, matching a record low total effort of 108 fisher days in 2021–22. This was likely driven by haul net licence holders holding most of the Gulf St

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Vincent/Kangaroo Island quota and a likely reduction in dab net fishing through the fleet rationalisation that occurred through the fishery reform [Smart et al. 2023]. The recreational catch in 2021–22 was 9 t [Beckmann et al. 2023].

Modelled estimates of the primary biological performance indicators for the northern stock component of the Gulf St Vincent/Kangaroo Island management unit are modelled estimates of fishable biomass, percentage virgin egg production, harvest fraction and recruitment [Smart et al. 2022a]. Adult biomass declined rapidly between 2001 and 2007 from a peak of 380 t to a low of 218 t. In subsequent years, adult biomass stabilised at an average of 256 t y⁻¹ until 2017. Modelled adult biomass has since increased to 304 t in 2019, indicating a stock recovery of 40% since the historically low adult biomass in 2007. The adult biomass has been within the upper and lower trigger reference points since 2013. The percentage of virgin egg production has averaged 14% since 1984, although this was higher in 2019 at 17%. Historically, the harvest fraction was > 70% from 1984 to 2003. However, from 2006 harvest fraction then followed a progressively declining trend and reached a low of approximately 30% in 2016. The harvest fraction in 2019 was 31%, which is within the operational target (< 35%). Despite these positive signs, recruitment remained impaired and there have been no further updates to the model outputs to warrant a change in stock status.

Adjustments to the management arrangements for the Gulf St Vincent/Kangaroo Island management unit over the past decade, such as changes to size limits, gear restrictions and the implementation of spatial closures, have reduced exploitation rates to target levels and enabled increases in adult biomass based on higher catch rates for hauling nets and dab nets.

The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. However, for the period 2007 to 2019 model outputs for biomass, egg production and harvest fraction suggest a recovering stock. Furthermore, the above evidence indicates that the current level of fishing mortality should allow the stock to recover from its recruitment impaired state.

On the basis of the evidence provided above, the Gulf St Vincent/Kangaroo Island management unit is classified as a **recovering stock**.

**South
Australia
West Coast**

The most recent fishery assessment of Southern Garfish from the West Coast management unit was completed in 2023 [Smart et al. 2023]. The primary measures for biomass and fishing mortality are catch, effort and catch rate. Small catches of Southern Garfish are landed by the commercial sector on the West Coast. Since 2005–06, total catch has averaged 3.4 t yr⁻¹, making up 1.4% of the annual state-wide catch of Southern Garfish. The implementation of commercial netting restrictions in this region has contributed to the continuous reduction in hauling net effort since the late 1950s [Smart et al. 2023]. Targeted catch rates by dab net fishers have remained at or above the historic average (approximately 35 kg fisher-day yr⁻¹) since 2016–17, reflecting a relatively high abundance of Southern Garfish in the region. The targeted dab net catch rate in 2021–22 was 38 kg fisher-day yr⁻¹.

The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. Furthermore, the above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the South Australia West Coast management unit is classified as a **sustainable stock**.

South-East Southern Garfish on the south coast are likely composed of multiple semi-discrete stocks [Smith et al. 2017]. The most recent fishery assessment of Southern Garfish from the South East management unit was completed in 2023 [Smart et al. 2023]. The primary measure for biomass and fishing mortality is catch and catch rates. Few Southern Garfish are landed by the commercial sector in the South East. Since catch and effort logbook information became available in 1983–84, total catch has averaged 1.1 t yr⁻¹, making up 0.3% of the annual state-wide catch of Southern Garfish. The total catch of Southern Garfish from the South East was 2.2 t for 2021–22 and taken entirely by dab net, while the target CPUE of 37 kg fisher-day⁻¹ was among the highest recorded. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. Furthermore, the above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the South East management unit is classified as a **sustainable stock**.

Spencer Gulf The most recent fishery assessment of Southern Garfish from the Spencer Gulf management unit was completed in 2023 and integrated catch and effort data from the commercial sector to the end of June 2022 [Smart et al. 2023], state-wide estimates of recreational catch data [Beckmann et al. 2023], and population demographic information (sex, age, and length composition) [Smart et al. 2023]. The Southern Garfish integrated stock assessment model was last run for the northern stock component of Spencer Gulf using data until December 2020 [Smart et al. 2022a]. As part of a major reform of the South Australian Marine Scalefish Fishery in 2021 [Smart et al. 2022b], four management zones were established, including consolidation of northern and southern components into the Spencer Gulf management unit.

The total catch of Southern Garfish from Spencer Gulf was 84 t in 2021–22, which is 16 t less than the total allowable commercial catch. This was the lowest catch on record for this management unit while total effort was the third lowest. The total effort in 2021–22 was 2,413 fisher-days, which was a small increase from 2,379 fisher-days in 2020–21, while targeted catch rates in 2021–22 of 84 kg per fisher-day using haul nets had increased by 37% since 2017–18 (61 kg per fisher-day). The haul net sector accounted for 78 t of Southern Garfish catch (94% of the total catch) with the dab net sector catching 5 t in 2021–22. The dab net catch was the lowest on record, matching a record low total effort of 130 fisher days in 2021–22. This was likely driven by haul net licence holders holding most of the Spencer Gulf quota and a likely reduction in dab net fishing through the fleet rationalisation that occurred through the fishery reform [Smart et al. 2023]. The recreational catch in 2021–22 was 12 t [Beckmann et al. 2023].

Modelled estimates of the primary biological performance indicators for the northern stock component of the Spencer Gulf management unit are modelled estimates of fishable biomass, percentage virgin egg production and harvest fraction [Smart et al. 2022a]. Adult biomass increased from a historical low of 281 t in 2003 to 417 t in 2011. Since then, adult biomass has been stable and ranged from 294 t to 373 t. The adult biomass was estimated as 346 t in 2019. The estimated adult biomass has been within the upper and lower trigger

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reference points in every year since 2005, except in 2010 and 2011 when it exceeded the upper trigger reference point. The percentage of virgin egg production has averaged 15% over the history of the fishery with no long-term trend of rise or fall. While harvest fractions have reduced considerably over the history of the fishery, particularly since 2005 when a net licence buyback scheme occurred, in recent years, such as in 2019 when it was 40%, they have not met the operational targets (< 35%). Despite positive signs for biomass and egg production, recruitment remained impaired and there have been no further updates to the model outputs to warrant a change in stock status.

Adjustments to the management arrangements for the Spencer Gulf management unit over the past decade, such as changes to size limits, gear restrictions and the implementation of spatial closures, have reduced exploitation rates to near target levels and enabled increases in adult biomass due to higher catch rates for hauling nets and dab nets.

The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. However, for the period 2003 to 2019 model outputs for biomass and egg production suggest a recovering stock. Furthermore, the above evidence indicates that the current level of fishing mortality should allow the stock to recover from its recruitment impaired state.

On the basis of the evidence provided above, the Spencer Gulf management unit is classified as a **recovering stock**.

Tasmania

Between 1995 and 2005 commercial catches of Southern Garfish in Tasmanian waters were relatively stable and ranged between 80–100 t per annum. A sharp decline to 31 t in 2007 coincided with a reduction in average size and truncation of older age classes in the catch, which may have resulted from heavy fishing pressure and/or a period of poor recruitment. As a result, seasonal closures were introduced in 2009 to protect spawning fish. By 2012, there was evidence of an increase in the size of Southern Garfish landed, a greater range of age classes present and increasing catch per unit effort, which collectively was interpreted to indicate stock recovery over that period. Catches fluctuated between 40 and 60 t up until 2013 after which they again trended downwards to 7.4 t in 2018–19, the lowest catch on record [Krueck et al. 2020]. Over the following three seasons, catches increased back to 16.5 t in 2021–22 [Cresswell et al. 2023]. However, consistent and steep declines in both catches and catch rates over several years up until 2018–19 give reason for continued caution that the stock could be depleted in some regions. The schooling behaviour and associated vulnerability of this species to overfishing suggests that even the current low levels of fishing pressure could be too high to allow the stock to recover in these regions. However, empirical data to support analyses of regional stock trends to identify regions of primary management concern are currently unavailable.

The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. The above evidence also indicates that current fishing mortality levels are expected to prevent the stock recovering from a recruitment impaired state.

On the basis of the evidence provided above, the Tasmania biological stock is classified as a **depleted stock**.

Victoria

Southern Garfish are predominantly caught as a byproduct using seine nets

whilst targeting King George Whiting (KGW) in Corner Inlet-Nooramunga (CI) [Bell et al. 2023]. Statewide landings have declined over time mostly due to the cessation of netting in all bays, inlets and estuaries except for CI [Bell et al. 2023].

Commercial catches among the main bays and inlets were used to gauge relative levels of fishing mortality. The inter-annual pattern in catch clearly shows progressive phasing out of commercial netting in Western Port (WP), Gippsland Lakes (GL), and Port Phillip Bay (PPB) in 2009, 2020 and 2022 respectively following licence buyouts to conserve stocks as a policy initiative for the benefit of recreational anglers [<https://vfa.vic.gov.au/commercial-fishing/commercial-fisheries/bays-and-inlet-fisheries> accessed on 29 Feb 2024]. In contrast, catch patterns in CI have remained mostly consistent, with low values in the mid-1990s and mid-2010s attributable to low availability of KGW as the main target species [Bell et al. 2023]. The recreational catch is unknown but likely to be relatively low as Southern Garfish are not a popular target species.

Stock biomass was evaluated using CPUE from CI for commercial seine harvests because time series relied upon in the past (WP, GL, and PPB) ceased at least several years ago. The CPUE trend, as a proxy for stock biomass, indicated that although there were two decades of decline from 27 kg/shot in 1978 to 18 kg/shot in 1998, thereafter CPUE remained stable at or slightly above the long-term average and well above the minimum of 3 kg/shot in 1996 when there was very little effort targeting KGW, so the catch was also at its lowest level [Bell et al. 2023].

There has been decreasing effort using seine nets unrelated to Southern Garfish abundance, and in conjunction with the relatively stable CPUE trend during the past two decades, this indicates that the stock is unlikely to have been recruitment impaired. Indeed, recent spikes in CPUE in 2017 and 2022 were almost the same as the initial value in 1978 at the start of the series.

The above evidence indicates that the stock is unlikely to be depleted and that recruitment is unlikely to be impaired. Furthermore, the above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, Southern Garfish in Victoria is classified as a **sustainable stock**.

**Western
Australia
South Coast**

Throughout the south coast of WA, annual catches have fluctuated between 5 to 35 t, with the highest catch recorded for the early 1990's and lowest catches recorded around 2000 and consistently since 2017. Overall, there has been a slight downward trend in catch in recent decades. Results from periodic surveys of boat-based recreational fishing on the South Coast of WA indicate low catch levels by these fishers. There is limited available information on shore-based catches of Southern Garfish for this region.

A study by Jones et al. [2021] provided estimates of biological parameters and total mortality for Southern Garfish, based on catch curve analysis applied to age composition data collected in 1998–99 at multiple sites along the south coast (Oyster Harbour, Princess Royal Harbour, Wilson Inlet and Peaceful Bay). That analysis yielded a total mortality estimate of 0.90 y^{-1} , which was the lowest value for this species across all sampling regions in South Australia, Victoria and Western Australia. The maximum age for this species was assumed to be 10 years, as this was the oldest age recorded by Jones et al. [2002] for garfish

across all regions and it occurred on the south coast of WA. This translates to a value of $0.42 y^{-1}$ for natural mortality (M) using the approach of Dureuil & Froese [2021], with 1.5% survival of fish to the maximum age (10 y) in an unfished population. This associated estimate of fishing mortality ($F = 0.48 y^{-1}$) is just above M, which is indicative of a moderate level of exploitation for the population at the time of sampling in that study.

Applying the above mortality values and biological parameters estimated by Jones et al. [2002] for Southern Garfish on the South Coast of WA in a traditional per recruit analysis yields an estimate for spawning potential ratio (SPR) of 0.36, which is between the threshold (0.3) and target (0.4) levels. Using an extended form of per recruit analysis, incorporating a stock-recruitment function to allow for potential effects of fishing on recruitment, yields an estimate of relative female spawning biomass of 0.3, which is at the threshold level. The above results from per recruit analyses indicate that in the late 1990s, after the peak of commercial fishing, this species was not over-exploited. Given that since this time commercial catch levels have been low relative to their peak in the early 1990s, and that recreational catches are likely much lower than commercial catches, the current population is likely to be sustainable.

Southern Garfish is a relatively short-lived species and attains maturity at a relatively young age (i.e., the population is expected to be relatively productive). Further, almost all the Southern Garfish catch in Western Australia consists of mature fish [Jones et al. 2002; Smith et al. 2017]. Commercial effort directed towards species within Wilson Inlet, where most of the commercial catch of this species is taken, fluctuates considerably from year-to-year, being impacted by the availability of more valuable marine species, which, in turn is impacted by bar opening timing, duration and frequency. The nature of this fishery, therefore, offers a level of protection to garfish through periods of reduced targeting.

The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. Furthermore, the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, Western Australia South Coast stock is classified as a **sustainable stock**.

**Western
Australia
West Coast**

Until the closure of Perth metropolitan waters (i.e. between 31-33° south) to commercial and recreational fishing for southern garfish in 2017, the majority of the catch of this species in the West Coast Bioregion was taken from Cockburn Sound. The most recent assessment of the adult spawning stock in Cockburn Sound was completed in 2017 [Smith et al 2017], following the Western Australian Department of Primary Industries and Regional Development's risk-based Weight of Evidence approach. Using this approach, the assessment considered the vulnerability of this species to fishing given its biological characteristics, catch and catch per unit effort (CPUE) trends, age and length composition data, catch curve estimates of fishing mortality, and yield-per-recruit (YPR) and spawning potential ratio (SPR) estimates, with the latter calculated based on spawning biomass per recruit and also eggs per recruit. The assessment assigned Southern Garfish in Cockburn Sound a high risk to sustainability at the catch and effort levels experienced by the stock post-2005 [Smith et al 2017]. The decline in stock status was attributed to both environmental drivers (e.g., marine heatwave events) and overfishing. Concerns over the risk to sustainability resulted in the above-mentioned prohibition on

catching garfish in Perth Metropolitan waters from 2017.

Anecdotally, there are increasing reports, from commercial and recreational fishers catching other species, of garfish occurring in abundance within the area of the closure. Based on a Productivity Susceptibility Analysis (PSA), the southern garfish stock in Cockburn Sound is considered a low relative risk due to fish maturing at approximately 1 year and immature fish being rarely caught by recreational or commercial fishers. There has been no reported catch by commercial fishers, and only a small amount of catch is recorded as being taken by recreational fishers (despite the closure). Therefore, the closure is likely to have reduced fishing mortality to near zero since 2017, and a substantial increase in abundance since 2017 is plausible.

Predicted values for MSY derived from a data-limited Catch-MSY analysis were between 18 and 20 t, depending on the prior ranges specified for final depletion. If assuming zero catch since 2017, this Catch-MSY analysis predicts a substantial increase in stock biomass since that year. It is acknowledged, however, that together with several strong model input assumptions, this Catch-MSY method assumes a constant carrying capacity which may not be plausible for Cockburn Sound due to the known substantial environmental changes that have occurred in this embayment, including multi-decadal declines in seagrass abundance. Furthermore, declines in environmental productivity (combined with historical fishing pressure) in Cockburn Sound have been linked to the decline and subsequent closure of a blue swimmer crab fishery in Cockburn Sound (Marks et al. 2021).

The above evidence indicates that prior to 2017 the stock was depleted. However, as Perth metropolitan waters have been formally closed to fishing for Southern Garfish since 2017, with negligible catches taken during this extended period, the very low or negligible fishing mortality resulting from this closure is expected to have allowed stock recovery.

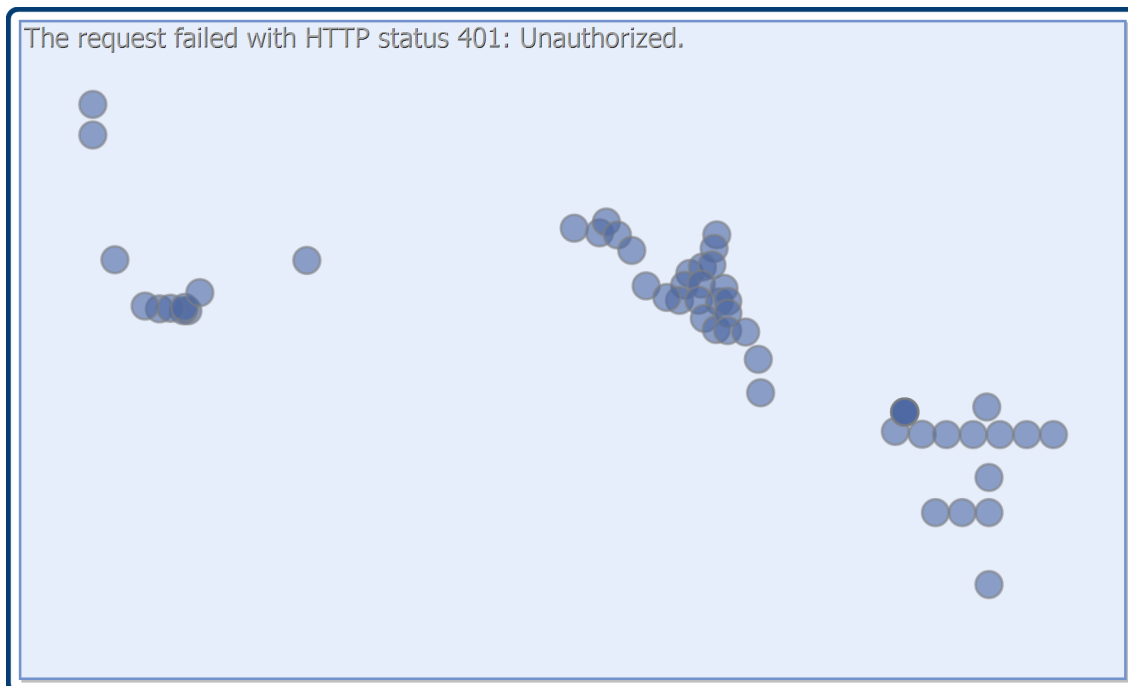
On the basis of the evidence provided above, the Western Australia West Coast biological stock is classified as a **recovering stock**.

BIOLOGY

Southern Garfish biology [Ye et al. 2002; Smith et al. 2017]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Southern Garfish	South Australia: 10 years, 380 mm TL Tasmania: 9.5 years, 460 mm TL Western Australia: 12 years, 430 mm TL	Western Australia: 12 months, 230 mm TL South Australia: 18 months, 190 mm TL Victoria: 19 months, 210 mm TL Tasmania: 22 months, 200 mm TL

DISTRIBUTION



Distribution of reported commercial catch of Southern Garfish

TABLES

Fishing methods	South Australia	Tasmania	Victoria	Western Australia
Charter				
Rod and reel				✓
Commercial				
Beach Seine				✓
Dab Net	✓			
Gillnet				✓
Haul Seine				✓
Hook and Line			✓	
Net			✓	✓
Seine Nets	✓			
Unspecified	✓	✓		
Recreational				
Beach Seine		✓		
Dab Net	✓	✓		
Hook and Line	✓	✓	✓	✓
Net			✓	

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Management Methods				
	South Australia	Tasmania	Victoria	Western Australia
Commercial				
Effort limits	✓		✓	
Gear restrictions	✓	✓	✓	✓
Licence			✓	
Limited entry	✓	✓	✓	✓
Size limit	✓	✓		
Spatial closures	✓	✓	✓	✓
Temporal closures	✓	✓		
Vessel restrictions				✓
Recreational				
Bag and possession limits				✓
Bag limits	✓	✓	✓	✓
Gear restrictions	✓		✓	
Licence		✓	✓	
Licence (boat-based sector)				✓
Size limit	✓	✓		
Spatial closures			✓	

Catch				
	South Australia	Tasmania	Victoria	Western Australia
Charter				Negligible
Commercial	157.08 t	16.495 t	62.7668 t	3.46675 t
Indigenous	Unknown	Unknown	Unknown (No catch under permit)	
Recreational	79 t (2013–14 survey) [Giri and Hall 2015]	0.3 t (in 2017–18 survey)	21 t (2006–07)	0.266 t (2020–21) Boat-based

Victoria – Indigenous (Management Methods). A person who identifies as Aboriginal or Torres Strait Islander is exempt from the need to obtain a Victorian recreational fishing licence, provided they comply with all other rules that apply to recreational fishers, including rules on equipment, catch limits, size limits and restricted areas. Traditional (non-commercial) fishing activities that are carried out by members of a traditional owner group entity under an agreement pursuant to Victoria’s *Traditional Owner Settlement Act 2010* are also exempt from the need to hold a recreational fishing licence, subject to any conditions outlined in the agreement. Native title holders are also exempt from the need to obtain a recreational fishing licence under the provisions of the Commonwealth’s *Native Title Act 1993*.

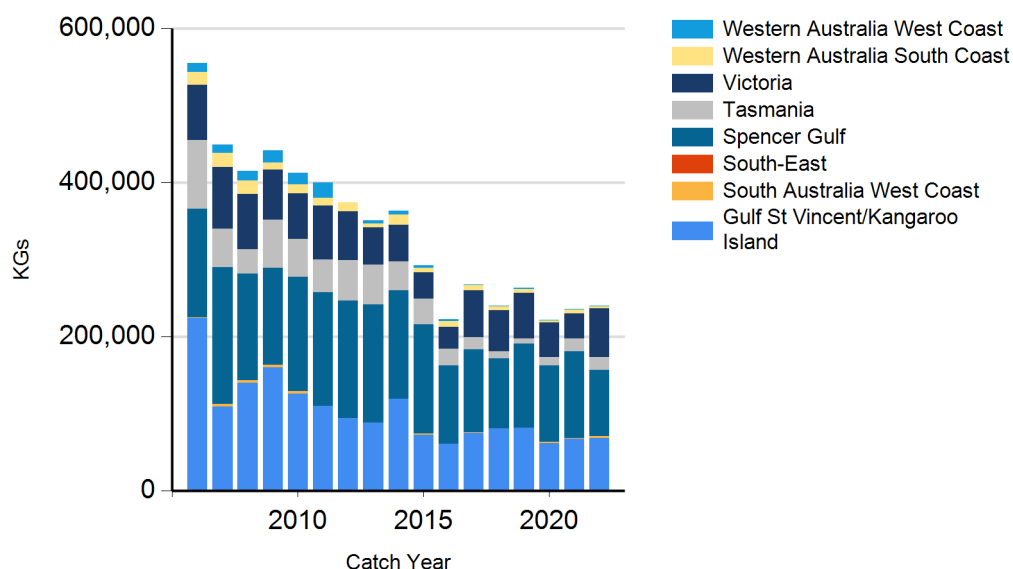
South Australia – Commercial (Catch). Data for the Northern Zone Rock Lobster Fishery (South Australia) and the Southern Zone Rock Lobster Fishery (South Australia) have been combined because of confidentiality requirements.

Tasmania – Recreational (Management Methods). In Tasmania, a recreational licence is required for fishers using dropline or longline gear, along with nets, such as gillnet or beach seine.

Tasmania – Indigenous (Management Methods). In Tasmania, Indigenous people engaged in fishing activities in marine waters are exempt from holding recreational fishing licences but must comply with all other fisheries rules as if they were licensed. Additionally, recreational bag and possession limits also apply. If using pots, rings, set lines or gillnets, aborigines must obtain a unique identifying code (UIC). The policy document Recognition of Aboriginal Fishing Activities for issuing a Unique Identifying Code (UIC) to a person for Aboriginal Fishing activity explains the steps to take in making an application for a UIC.

Western Australia – Recreational (catch). Current shore-based recreational catch and effort in Western Australia is unknown. State-wide surveys of boat-based fishing are conducted regularly, most recently in 2020–21 [Ryan et al. 2022].

CATCH CHART



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Commercial catch of Southern Garfish - note confidential catch not shown

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