Fisheries

Assessment of the South Australian Marine Scalefish Fishery in 2022-23

JD Dennis, MJ Drew, J Earl, D Matthews, J Davey, J Bussell, A Tsolos and CJ Noell

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October 2024

Report to PIRSA Fisheries and Aquaculture

Government of South Australia
Department of Primary Industries and Regions

SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

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LIST OF ABBREVIATIONS

List of standard and nonstandard abbreviations and acronyms used throughout the current report, the definition of the abbreviations and acronyms. Arranged in alphabetical order of abbreviation.

ABBREVIATION	DEFINITION
AFMA	Australian Fisheries Management Authority
B	Biological
BCF	Blue Crab Fishery
BPI	Biological Performance Indicator
cMSY	Catch Maximum Sustainable Yield
Conf.	Confidential
CPUE	Catch Per Unit Effort
CW	Carapace Width
DW	Disc Width
EPBC	Environmental Protection and Biodiversity Conservation
FRDC	Fisheries Research and Development Corporation
G	General
GSV	Gulf St Vincent
GSV/KI	Gulf St Vincent/Kangaroo Island
GSV/KIFZ	Gulf St Vincent/Kangaroo Island Fishing Zone
GSVPF	Gulf St Vincent Prawn Fishery
GVP	Gross Value of Production
ITQ	Individual Transferable Quota
L_{50}	Length at 50% maturity
LCF	Lakes and Coorong Fishery
LML	Legal Minimum Length
LTRP	Lower Trigger Reference Point
MFA	Marine Fishing Area
MSF	Marine Scalefish Fishery
MSFMAC	Marine Scalefish Fishery Management Advisory Committee
NGSV	Northern Gulf St Vincent
NSG	Northern Spencer Gulf
NSW	New South Wales
NZ	New Zealand
PI	Performance Indicator
PPB	Port Phillip Bay
Prop200kgtarHL	Proportion of targeted handline catches over 200 *kg*
Prop200kgtarLL	Proportion of targeted longline catches over 200 *kg*
QLD	Queensland
RBC	Recommended Biological Catch
S.E.	Standard Error
SA	South Australia
SAFS	Status of Australian Fish Stocks
SE	South East
SEFZ	South East Fishing Zone
SESSF	Southern and Eastern Scalefish and Shark Fishery
SG	Spencer Gulf
SGFZ	Spencer Gulf Fishing Zone
SG/WC	Spencer Gulf/West Coast
SGPF	Spencer Gulf Prawn Fishery
SGSV	Southern Gulf St Vincent
SSG	Southern Spencer Gulf
SZRLF	Southern Zone Rock Lobster Fishery
t	Tonnes
TAC	Total Allowable Catch
TACC	Total Allowable Commercial Catch
TARC	Total Allowable Recreational Catch
TAS	Tasmania
TL	Total Length
TMF	Tiered Management Framework
TRP	Trigger Reference Point
UTRP	Upper Trigger Reference Point
VIC	Victoria
VLSP	Voluntary Licence Surrender Program
WA	Western Australia
WC	West Coast
WCFZ	West Coast Fishing Zone
WCPF	West Coast Prawn Fishery
WV	Western Victoria
WVS	Western Victoria Stock

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EXECUTIVE SUMMARY

This report is the seventh in the annual reporting series for South Australia's Commercial Marine Scalefish Fishery (MSF). Data considered in this report extend for 40 years from 1 July 1983 to 30 June 2023. The report provides a description of the dynamics of the multi-species, multi-gear fleet and assigns stock status to 32 stocks of 20 species or taxa that are harvested in the fishery, using the National Fishery Status Reporting Framework (Piddocke et al. 2021). It builds on previous assessment reports by Steer et al. (2018a, 2018b, 2020), Drew et al. (2021) and Smart et al. (2022a, 2023), and includes a summary of the taxon-specific information relating to: (1) population biology; (2) fishing access; (3) management arrangements; (4) recreational catches from four surveys; (5) trends in commercial fishery statistics at the State-wide, biological stock or zone management unit scales; and (6) an assessment of fishery performance using performance indicators prescribed in the fishery's management plan (PIRSA 2013).

Over the last assessments (Drew et al. 2021, Smart et al. 2022a, 2023), the MSF has undergone a structural reform that included the formation of four management zones, implementation of total allowable commercial catches (TACCs) for eleven 'Tier 1' stocks, unitisation via Individual Transferable Quotas (ITQs) of every Tier 1 stock except King George Whiting (*Sillaginodes punctatus*) in the West Coast Fishing Zone (WCFZ), and a shift from calendar to financial year reporting. These updates have been applied throughout this assessment. Future stock summary reports will need to consider the new management plan and harvest strategy for the MSF to be introduced in July 2025, in particular, incorporating updates to the 'Performance Indicators' (PIs) and 'Trigger Reference Points' (TRPs) used to assign stock status.

Fleet Dynamics

Many of the changes in the operation of the MSF fleet over the past four decades have occurred in response to changes to fisheries management arrangements. These included reductions in fishing effort resulting from the rationalisation of the fleet through the licence amalgamation scheme implemented in 1994, reductions in the number of restricted marine scalefish ('B-class') licences, and two voluntary net buy-back initiatives in 2005 and 2014. In 2021, 100 MSF licences were surrendered through the MSF reform, with 211[1] licences remaining active in 2022/23. Many of the licences surrendered were either latent or belonged to fishers who owned multiple licences. No B-class licences remain following the MSF reform.

The multi-species, multi-gear nature of the MSF allows for a diverse fleet, with individual licence holders able to transfer effort from one species to another as circumstances change (i.e., management restrictions or changing stock abundance). One example of this diversification is that

[1] Includes Marine Scalefish Fishery, Rock Lobster Fisheries and Miscellaneous Fishery licences

catches of Southern Calamari (*Sepioteuthis australis*)—once taken primarily as bait—have increased such that this species is now the most economically valuable species in the commercial MSF, with a Gross Value of Production (GVP) ($6 million AUD) 50% greater than that of the next most valuable species (King George Whiting at $4 million AUD).

Many of the species considered in this report are caught by the haul net sector of the fishery, and some are incidentally caught when more valuable species are targeted. Of these, Yellowfin Whiting (*Sillago schomburgkii*), Australian Herring (*Arripis georgianus*), Snook (*Sphyraena novaehollandiae*), Leatherjackets (Monacanthidae spp.) and Yelloweye Mullet (*Aldrichetta forsteri*) are of medium wholesale value (~$10 per *kg*, whole fish). These species share similar commercial catch and effort trends, where effort and catch within the haul net sector has been sequentially reduced over recent decades, reflective of the downward trend in netting licenses within the fishery. Despite the long-term declining trend in effort across the fishery, Snook and Leatherjackets have been increasingly targeted by haul net fishers over recent years. There has also been an increase in catches of Ocean Jackets (*Nelusetta ayraudi*) using fish traps.

Ocean Jackets ('Tier 3'/'Negligible stock') surpassed Western Australian Salmon (*Arripis truttaceus*; 'Tier 2' stocks) in the 2022/23 fishing season as the largest commercial catch in the MSF at 522 *t* (cf. 362 *t* Western Australian Salmon). Meanwhile, catches of Tier 1 stocks (i.e., species with TACCs) increased from 2021/22 to 2022/23. This was anticipated following the fishery's reform, given some adjustment period is typically required with the implementation of new Management arrangements for the fishery (e.g., quota trading).

Stock Status

This report assessed the fishery performance of 20 species/taxonomic groups taken in the MSF based on data available until the end of the 2022/23 fishing season (Table E-1). Collectively, these taxa were considered across 32 management units, at a resolution that aligned at the State-wide, zonal or biological stock scale. Across the fishery, each of the management units is assigned a tier according to the Tiered Management Framework[2], of which 11 stocks are classified[3] as 'Tier 1', 11 as 'Tier 2', and 10 as 'Tier 3' (excluding rays and skates; Table E-1). Of the management units assessed, 24 (~75%) were classified as 'sustainable', two (~6%) were classified as 'depleted', one (~3%) was classified as 'recovering', two were classified as 'negligible' (~6%) and the remaining three (~9%) were classified as 'undefined' as there was insufficient information to assign a stock status. Gummy

[2] Species assessed at the State-wide and MSF management level are still assigned a tier for Individual Fishing Zones (i.e., WC, SG, GSV/KI, SE).
[3] Tiers are only assigned if average five-year annual commercial catches are greater than 5 *t* (Smart et al. 2022b).

(*Mustelus antarcticus*) and School Shark (*Galeorhinus galeus*) data are presented in this assessment, but no status was assigned in this report as they are part of Commonwealth-managed fisheries.

For Snapper (*Chrysophrys auratus*; 'Tier 1' in all stocks/zones), the Spencer Gulf/West Coast (SG/WC) stock and the Gulf St Vincent (GSV) stock were both classified as 'depleted' in the most recent stock assessment (Drew et al., 2022). This reflected a significant reduction in the spawning biomass, as well as declining catches and CPUE, and prolonged poor recruitment in both gulf stocks. The cross jurisdictional Western Victorian Stock (WVS) was classified as 'sustainable' (SAFS, 2023), which was consistent with the 'sustainable' classification for the South East Fishing Zone (SEFZ) in Drew et al. (2022).

All 'Tier 1' stocks of King George Whiting (WCFZ, Spencer Gulf, SGFZ, and Gulf St Vincent/Kangaroo Island Fishing Zone, GSV/KIFZ) were classified as 'sustainable'. While the lower Trigger Reference Point (TRP) for total catch and targeted handline effort were breached by all three Tier 1 stocks, handline Catch Per Unit Effort (CPUE) breaching the upper TRP suggests abundance is near the historic mean, and possibly increasing. The SEFZ ('negligible' tier) was classified as 'negligible'.

The recent stock assessment for Southern Garfish (*Hyporhamphus melanochir*) up to and inclusive of the 2022/23 fishing season maintained the SGFZ as a 'recovering' stock (Earl et al. 2024). This is because, while the management arrangements should facilitate the recovery of the SGFZ stock, harvest fraction has not yet reached the operational target of 30% described in the management plan and there has been no improvement in population age structure. The GSV/KIFZ was re-classified from 'recovering' to 'sustainable' (Earl et al. 2024). The remaining stocks (WCFZ and SEFZ; 'negligible' tier) were classified as 'sustainable' (Earl et al. 2024).

Whilst noting stakeholder concerns of localised depletion, all 'Tier 1' stocks of Southern Calamari (SGFZ and GSV/KIFZ) were classified as 'sustainable'. The WCFZ 'Tier 2' stock was classified as 'sustainable'. The SEFZ stock ('negligible' tier) was classified as 'negligible'.

<u>Future Directions</u>

The most important research needs for the fishery to support management include: (1) delivery of the $5M Snapper Science Program co-funded by the Government of South Australia and the Fisheries Research and Development Corporation (FRDC); (2) supporting development of a harvest strategy framework for the next management plan that is tailored to the tiered management of the fishery and provides the decision-making frameworks to support TACC setting; (3) transitioning stock assessments to support application of the new harvest strategy framework; (4) development of an innovative and cost-effective Southern Calamari stock assessment to enable provision of more reliable scientific advice that is commensurate with the value of that species; (5) evaluation of the spatial segregation of sexes for Southern Garfish to inform future assessments and management; and (6) obtaining more regular and reliable estimates of catch by the recreational sector.

Keywords: Marine Scalefish Fishery, fleet dynamics, stock status.

Table E-1. Status of South Australian Marine Scalefish Fishery (MSF) species (zone, biological, state-wide) for 2020, 2021/22 and 2022/23, fishery performance indicators, the scale of the stock or management unit, and the tier assigned by the Tiered Management Framework (Smart et al., 2022b). Tier 1-stock model outputs include fishable biomass, egg production and recruitment. State-wide assessments can include multiple stocks/zones with different tiers. Abbreviations: CPUE–catch per unit effort; NA–not assigned; Neg.–Negligible. Stock/zone abbreviations: West Coast (WC), Spencer Gulf (SG), Spencer Gulf/West Coast (SG/WC), Gulf St Vincent/Kangaroo Island (GSV/KI), South East (SE), Western Victoria (WV).

CATEGORY	SPECIES	SCALE	INDICATORS	STOCK	TIER*	STATUS		
						2020	2021/22	**2022/23**
PRIMARY	**Snapper**	Biological	Catch, effort, CPUE, age structure, model outputs	SG/WC	T1	Depleted	Depleted	Depleted
				GSV	T1	Depleted	Depleted	Depleted
				WV	T1	Sustainable	Sustainable	Sustainable
	King George Whiting	Zone	Catch, effort, CPUE, age structure, model outputs	WC	T1	Sustainable	Sustainable	Sustainable
				SG	T1	Sustainable	Sustainable	Sustainable
				GSV/KI	T1	Sustainable	Sustainable	Sustainable
				SE	Negligible	Negligible	Negligible	Negligible
	Southern Garfish	Zone	Catch, effort, CPUE, age structure, model outputs	WC	Negligible	Sustainable	Sustainable	Sustainable
				SG	T1	Recovering	Recovering	Recovering
				GSV/KI	T1	Recovering	Recovering	Sustainable
				SE	Negligible	Sustainable	Sustainable	Sustainable
	Southern Calamari	Zone	Catch & Effort	WC	T2	Sustainable	Sustainable	Sustainable
				SG	T1	Sustainable	Sustainable	Sustainable
				GSV/KI	T1	Sustainable	Sustainable	Sustainable
				SE	Negligible	NA	Negligible	Negligible
SECONDARY	**Yellowfin Whiting**	Zone	Catch & Effort	SG	T2	Sustainable	Sustainable	Sustainable
				GSV/KI	T2	Sustainable	Sustainable	Sustainable
	Blue Crab	WC Zone	Catch & Effort	WC	T2	Sustainable	Sustainable	Sustainable
	Western Aust. Salmon	State-wide	Catch & Effort	STATE	T2, Neg.	Sustainable	Sustainable	Sustainable
	Australian Herring	State-wide	Catch & Effort	STATE	T2, Neg.	Sustainable	Sustainable	Sustainable
	Whaler Sharks	State-wide	Limited data	STATE	T2, Neg.	Undefined	Undefined	Undefined
	Snook	State-wide	Catch & Effort	STATE	T3, Neg.	Sustainable	Sustainable	Sustainable
	Sand Crabs	State-wide	Catch & Effort	STATE	T3, Neg.	Sustainable	Sustainable	Sustainable
	Yelloweye Mullet	State-wide	Catch & Effort	MSF	T3, Neg.	Sustainable	Sustainable	Sustainable
	Mulloway	State-wide	Catch & Effort	MSF	Negligible	Sustainable	Sustainable	Sustainable
TERTIARY	**Ocean Jackets**	State-wide	Catch & Effort	STATE	T3, Neg.	Sustainable	Sustainable	Sustainable
	Blue-throat Wrasse	State-wide	Catch & Effort	STATE	T3, Neg.	Sustainable	Sustainable	Sustainable
	Silver Trevally	State-wide	Catch & Effort	STATE	Negligible	Sustainable	Sustainable	Sustainable
	Leatherjackets	State-wide	Limited data	STATE	T3, Neg.	Undefined	Undefined	Undefined
	Rays & Skates	State-wide	Limited data	STATE	NA	Undefined	Undefined	Undefined
	Cuttlefish	State-wide	Catch & Effort	STATE	Negligible	Sustainable	Sustainable	Sustainable
	Black Bream	State-wide	Total Catch	MSF	Negligible	Sustainable	Sustainable	Sustainable
	Gummy Shark	State-wide	-	STATE	NA	NA	NA	NA
	School Shark	State-wide	-	STATE	NA	NA	NA	NA

* Tiers are only assigned if the average five-year annual commercial catches are greater than 5 *t*, otherwise listed as 'Negligible' (Smart et al. 2022b).

1. INTRODUCTION

1.1. Overview

This is the seventh report in this series for the South Australian Marine Scalefish Fishery (MSF) that provides a summary of information on: 1) the Marine Scalefish Fishery; 2) management arrangements; 3) the spatial scale of assessments; 4) fishery performance indicators; 5) stock status classification system; 6) dynamics of the commercial fishing fleet; and 7) stock status of 32 stocks of 20 selected MSF species and species groups. Data included in this report were sourced from commercial logbook returns provided to SARDI by MSF licence holders over 40 years between the 1983/84 and 2022/23 fishing seasons. This assessment report is undertaken with fishing seasons as financial year (1 July to 30 June) rather than calendar years.

This report is partitioned into four sections. Section one provides an overall description of the MSF, its management arrangements, performance indicators, and details the indicators used to assess the status of the stocks within the fishery. Section two describes the dynamics of the commercial fleet, catch composition, and temporal trends in fishing effort. Section three provides a stock status update of MSF species, consisting of a series of species/taxon-based sub-sections for the 32 stocks of 20 selected species or species groups distributed across the ‘Primary’, ‘Secondary’, and ‘Tertiary’ species categories defined in the Management Plan (PIRSA 2013), with respective Fishing Zone summaries arranged in order from West to East. These are structured as ‘stand-alone’ updates for taxa caught in the fishery, that includes a summary of the relevant biological information, a description of the fishery, associated management regulations, State-wide and/or zonal fishery statistics, assessment of the fishery against the general performance indicators, and the classification of the stock status for 2022/23. These sub-sections have been reformatted in the current report, such that sub-sections for each taxa/species are presented as more concise summaries designed to allow readers to quickly access important facts and information.

The fourth and final section synthesises the overall performance of the fishery, details emerging trends within the fishing fleet, and identifies key research priorities that will enhance the assessment and management of South Australia’s MSF.

1.2. Description of the Marine Scalefish Fishery

The MSF is a multi-species, multi-gear fishery with > 200 active licence holders in 2022/23. Access to species within the fishery is available to other commercial fisheries, the recreational fishing sector, and Aboriginal traditional fishing. Due to the number of licences, gear types used, the species caught, fishers’ ability to switch target species and the geographical range, it is the most complex fishery in South Australian waters.

Commercial fishers in the MSF are permitted to take in excess of 60 marine species, including bony fishes, molluscs, crustaceans, sharks, rays and skates, and annelid worms. Fishery production by weight of catch in 2022/23 predominantly consisted of Ocean Jackets (*Nelusetta ayraudi*), Western Australian Salmon (*Arripis truttaceus*), Southern Calamari (*Sepioteuthis australis*), King George Whiting (*Sillaginodes punctatus*), and Southern Garfish (*Hyporhamphus melanochir*; descending order). Other species such as Yellowfin Whiting (*Sillago schomburgkii*), Australian Herring (*Arripis georgianus*), and Bronze Whaler Sharks (*Carcharhinus* spp.) also contribute significantly to the overall catch.

There are 30 types of fishing gear (or devices) permitted for use in the MSF. Their uses differ depending on the species being targeted and the location of fishing. With the exception of fishing rods and handlines, all devices must be registered on a licence before they can be used to take fish for trade or business. A proportion of MSF licence holders have specific net endorsements and are permitted to use haul nets and set/gill nets. In addition, licence holders from the Miscellaneous Fishery, the Northern Zone (NZRLF) and Southern Zone Rock Lobster (SZRLF) fisheries, the Lakes and Coorong Fishery (LCF), the West Coast (WCPF), Spencer Gulf (SGPF) and Gulf St Vincent Prawn (GSVPF) fisheries, and the Blue Crab Fishery (BCF) have all had varying levels of access to MSF species. For example, the three prawn trawl fisheries can only take certain MSF species as by-product.

The broad mixture of participants, gear types, licence conditions and regulations associated with the MSF make the task of assessing the status of the stocks challenging. This is further compounded by the highly dynamic nature of fisher behavioural responses to resource availability and seafood markets, as they can transfer their target between species and regions throughout State waters. This complexity means there is considerable capacity for the fishery to expand through the activation of latent effort.

The recreational fishing sector also has a level of access to many of the MSF species through sector allocations, some of which are close to 50% (PIRSA, 2013). Within the MSF, recreational fishers are constrained by regulation to specific fishing devices to target a variety of MSF species (Beckmann et al., 2023).

1.3. Management Arrangements

The MSF is managed by the South Australian State Government's Department of Primary Industries and Regions (PIRSA) Fisheries and Aquaculture Division in accordance with the legislative framework provided within the *Fisheries Management Act 2007*, and subordinate *Fisheries Management (General) Regulations 2017*, *Fisheries Management (Marine Scalefish Fisheries) Regulations 2017,* Ministerial determinations, licence conditions and Management Plan for the South Australian Commercial Marine Scalefish Fishery (PIRSA 2013).

The commercial MSF has undergone considerable management change over the years, including a settlement in 1992 with the Commonwealth Government Australian Fisheries Management Authority (AFMA) for offshore waters resources management (Offshore Constitutional Settlement), limitation through gear restrictions and configuration, licensing, and spatial and temporal closures related to resource sharing and protection of spawning areas, and size limits.

Prior to the reform of the MSF in 2021, there had been three notable management changes implemented to limit, and then reduce, the number of participants in the commercial MSF. The first occurred in 1977, when a freeze was imposed on the issue of new licences, which converted the commercial MSF into a limited-entry fishery. This also involved a 'show-cause provision' that prevented the re-issue of licences to fishers if a minimum level of commercial fishing had not been met. Non-transferable Restricted MSF licences were also created at this time to recognise part-time fishers. The second change was the licence amalgamation scheme which was introduced in 1994. This scheme is essentially a fractional licencing initiative which requires prospective fishers to purchase a certain number of points when buying a licence (Steer & Besley, 2016). The third change, implemented in 2005, was a voluntary buy-back of MSF licences and subsequent spatial closures to net fishing. A similar, smaller licence buy-back scheme was also implemented in 2014 in association with the establishment of the South Australian Marine Parks network.

With the exception of recreational Southern Rock Lobster pot licences, the recreational fishery is not licenced but subjected to a range of regulations, such as size, boat, bag and possession limits, restrictions on the types of gear that may be used, temporal and spatial closures, and the complete or partial protection of some species (e.g., Western Blue Groper).

1.3.1. Recent Commercial MSF Reform

In July 2021 the commercial MSF underwent a major fishery reform to improve the economic performance of the commercial MSF and increase stock sustainability (Smart et al. 2022b). Four regional zones of management were created that included Spencer Gulf (SG), Gulf St Vincent/ Kangaroo Island (GSV/KI), the West Coast (WC) and the South East (SE; Figure 1.3-1). The Tiered Management Framework (TMF) was designed as part of the MSF reform (Smart et al., 2022b) which assigned each species to a tier of management in each of the four Fishing Zones (i.e., stocks; Table 1.3-1; Appendix 6.1). 'Tier 1' stocks are managed via TACCs that may be further unitised into ITQs. 'Tier 2' and 3 stocks are managed without TACCs via input controls. Assessments for 'Tier 2' stocks are to be developed to provide a recommended biological catch (RBC) associated with sustainable fishing levels, while 'Tier 3' stocks are assessed using catch and effort statistics. Each stock was assigned to a tier based on six diverse indicators that include stock status, commercial importance, recreational importance, Aboriginal Traditional Fishing importance, level of targeting, and management need (Table 1.3-1; Appendix 6.1).

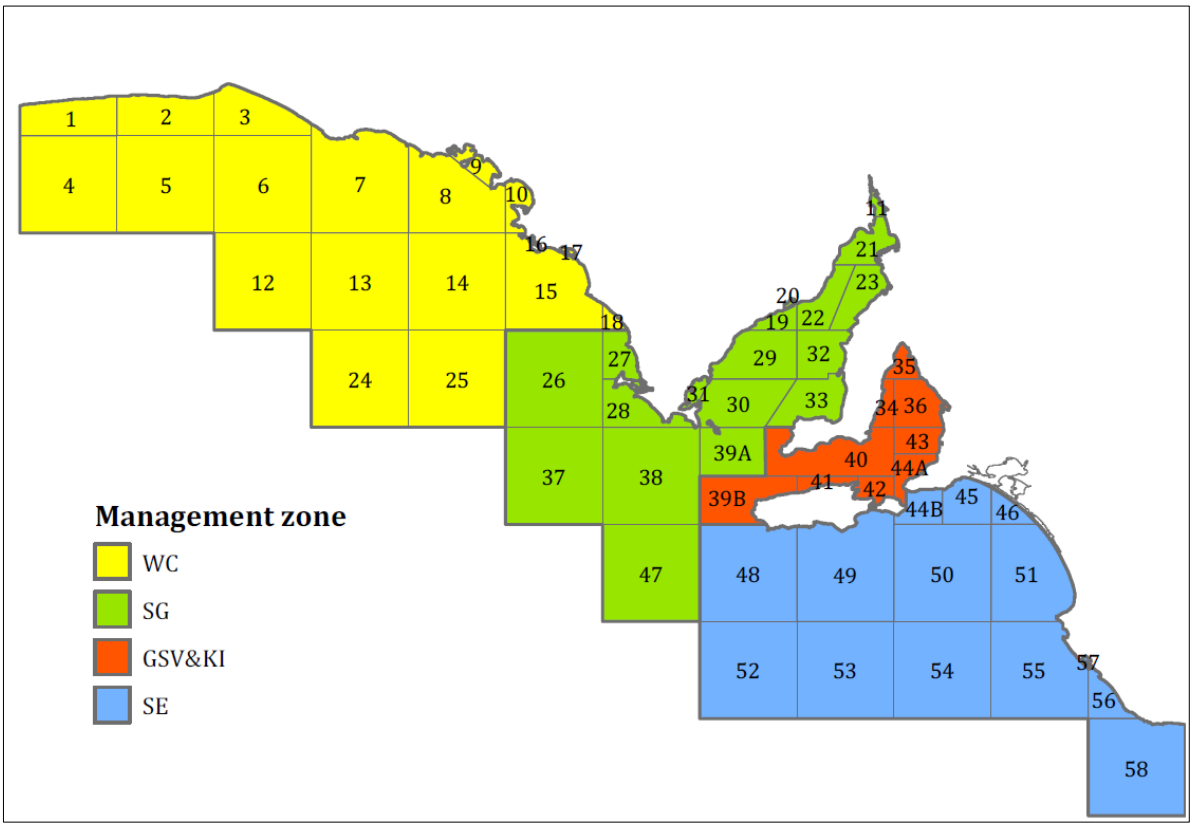


Figure 1.3-1. The four Fishing Zones implemented through the commercial MSF reform in July 2021. These are the Spencer Gulf fishing zone (SGFZ), Gulf St Vincent/Kangaroo Island fishing zone (GSV/KIFZ), West Coast Fishing Zone (WCFZ) and South East Fishing Zone (SEFZ). The boundaries of each zone are delineated by existing MFA blocks or sub-blocks.

Table 1.3-1. The relationship between MSF species as categorised in the Management Plan (PIRSA 2013) and the assignment of tiers to the species and their stocks under the Tiered Management Framework (TMF; Smart et al., 2022b). MSF Zone abbreviations are: Gulf St Vincent/Kangaroo Island (GSV/KI), Spencer Gulf (SG), West Coast (WC), South East (SE), Spencer Gulg/West Coast (SG/WC), Western Victoria (WV), Marine Scalefish Fishery (MSF).

MSF CATEGORY	SPECIES	MSF ZONE	TMF Tier*
PRIMARY	**Snapper**	All zones	T1
	King George Whiting	WC, SG, GSV/KI	T1
		SE	Negligible
	Southern Garfish	SG, GSV/KI	T1
		WC, SE	Negligible
	Southern Calamari	SG, GSV/KI	T1
		WC	T2
		SE	Negligible
SECONDARY	**Yellowfin Whiting**	SG, GSV/KI	T2
	Blue Crab	WC	T2
	Western Australian Salmon	SG, GSV/KI	T2
		WC, SE	Negligible
	Australian Herring	SG, GSV/KI	T2
		WC, SE	Negligible
	Whaler Sharks	WC, SG, GSV/KI	T2
		SE	Negligible
	Snook	SG, GSV/KI	T3
		WC, SE	Negligible
	Sand Crabs	SG	T3
		WC, GSV/KI , SE	Negligible
	Yelloweye Mullet	SG	T3
		WC, GSV/KI , SE	Negligible
	Mulloway	All zones	Negligible
TERTIARY	**Ocean Jackets**	SG	T3
		WC, GSV/KI , SE	Negligible
	Blue-throat Wrasse	SG	T3
		WC, GSV/KI, SE	Negligible
	Silver Trevally	All zones	Negligible
	Leatherjackets	SG, GSV/KI	T3
		WC, SE	Negligible
	Rays & Skates	All zones	Negligible
	Cuttlefish	All zones	Negligible
	Black Bream	All zones	Negligible
	Gummy Shark	All zones	Negligible
	School Shark	All zones	Negligible

* Tiers are only assigned if average five-year annual commercial catches are greater than 5 *t* (Smart et al. 2022b).

While the current Management Plan (PIRSA, 2013) refers to MSF species as primary, secondary or tertiary, the TMF has already been adopted by the Marine Scalefish Fishery Management Advisory Committee (MSFMAC) and will be formally implemented in the next management plan for the fishery, which will be introduced in July 2025. Therefore, the different stocks of species presented in this report have been assigned the classifications from the TMF (Smart et al. 2022b). Tiers are only assigned to a stock if the average five-year annual commercial catches are greater than 5 *t*, otherwise they are assigned as 'Negligible' (Smart et al. 2022b). From 1 July 2021 the fish stocks assigned a Tier 1 status include King George Whiting (GSV/KI, SG, WC), Southern Garfish (GSV/KI, SG), Southern Calamari (GSV/KI, SG) and Snapper (GSV/KI, SG, WC, SE). All these stocks are now managed via TACCs, and every stock has been unitised via ITQs, except King George Whiting in the West Coast Fishing Zone (WCFZ), which is managed under an 'Olympic' quota (i.e., the TACC is only capped for the zone, not for the individual licence holder).

Another outcome of the MSF reform was further rationalisation of the fleet, with the voluntary surrender of 100 licences (Smart et al., 2022b). Management efforts to fully realise the objectives of the MSF reform are ongoing and, where required, recommended by the MSFMAC. Further details of the reform and its implications for ongoing future assessments are available in Smart et al. (2022b).

1.3.2. Snapper Management Arrangements

Following the 2019 Snapper Stock Assessment (Fowler et al., 2020b) and a review of the management arrangements, fishing for Snapper was prohibited in all State waters from 1 November 2019 except for the region that now constitutes the South East Fishing Zone (SEFZ). This fishery closure was originally implemented to remain in effect until 1 February 2023. Following an updated assessment of Snapper (Drew et al., 2022), the closure has been extended to 30 June 2026. As such, no updated catch and effort information on Snapper are available for the SG, GSV/KI, and WCFZs in this assessment.

In 2020, the Snapper fishery in the SEFZ was managed using a total allowable catch (TAC) that was divided into a total allowable commercial catch (TACC) and a total allowable recreational catch (TARC). The TAC in 2020 was set at 75 *t* and divided among sectors according to their allocations in the Management Plan (PIRSA 2013).

The TACs in the SEFZ for the 2021, 2021/22, and 2022/23 fishing seasons were set based on the estimated fishable biomass in that region from the SnapEst model (Drew et al., 2022). For the 2021 fishing season, the TAC was set at 26.6 *t* (48 *t* pro-rata for five of the possible nine-month season) and divided among sectors following the State-wide allocations. For the 2021/22 and 2022/23 fishing seasons, the full TAC was set at 48 *t* and divided among sectors following the regional distribution of the State-wide sector allocations (Smart et al. 2023).

1.4. Spatial Scale of Assessments

The spatial assessment scale varies among species presented in this report and were determined by differing stock boundaries or management unit. Species such as King George Whiting, Southern Garfish, and Southern Calamari have assessments undertaken at the zonal level, but a State-wide level is also presented to provide a broader spatial scale for examining catch and effort statistics (Figure 1.3-1). Conversely, Snapper is assessed at the biological stock level which includes an amalgamation of the Spencer Gulf Fishing Zone (SGFZ) and WCFZ, as per the spatial boundaries of the SG/WC stock. Blue Crab (WC only) and Yellowfin Whiting are presented at the zonal scale, while all remaining stocks are assessed at the State-wide scale, as per previous reports. This tailored approach for each species/taxon allows scientific assessments to be conducted at the appropriate biological scale, while management advice can be provided at the zonal scale where required.

1.5. Fishery Performance Indicators

For each taxon, general performance indicators (PIs) are used to benchmark the performance of the fishery. These are derived from commercial catch, target effort and catch per unit effort CPUE, and vary amongst the taxa. Annual time-series of these PIs were derived from commercial fishery statistics from 1983/84 to 2022/23 (i.e., the reference period). Each performance indicator was benchmarked against the following trigger reference points:

1. the third highest and third lowest values of the reference period;
2. the greatest (%) inter-annual variation (+ and -) over the reference period;
3. the greatest rate of change (+ and -) over a five-year period; and
4. whether the PI has decreased over the most recent five consecutive years.

Biological performance indicators (BPIs) are also provided in the State-wide summaries for Snapper (3.3), King George Whiting (3.4), and Garfish (3.5) from their respective previous stock assessments.

Table 1.5-1. General (G) performance indictors used to benchmark the performance of the fishery. Gear group used for respective species to assess effort and CPUE against performance indicators is outlined in Table 2.2-1.

PERFORMANCE INDICATOR	TRIGGER REFERENCE POINT
TOTAL CATCH	3rd Lowest/3rd Highest
	Greatest % interannual change (+/-)
	Greatest five-year trend
	Decrease over five consecutive years
TARGET GEAR EFFORT	3rd Lowest/3rd Highest
	Greatest % interannual change (+/-)
	Greatest five-year trend
	Decrease over five consecutive years
TARGET GEAR CPUE	3rd Lowest/3rd Highest
	Greatest % interannual change (+/-)
	Greatest five-year trend
	Decrease over five consecutive years

1.6. Stock Status Classification

A national stock status classification system is used for the assessment of key Australian fish stocks (Piddocke et al., 2021). It considers whether the current level of fishing pressure is adequately controlled to ensure that the stock abundance is not reduced to a point where the production of juveniles and subsequent growth is significantly compromised (i.e., recruitment is impaired). The system combines information on both the current stock size and level of exploitation into a single classification for each stock against defined biological reference points. Each stock is then classified as: ‘sustainable’, ‘depleting’, ‘recovering’, ‘depleted’, ‘undefined’, or ‘negligible’ (Table 1.6-1). PIRSA has adopted this classification system to determine the status of all South Australian fish stocks.

Table 1.6-1. Classification scheme used to assign fishery stock status. The description of each stock status and its potential implications for fishery management are also shown (Piddocke et al., 2021).

	Stock status	Description	Potential implications for management of the stock
	Sustainable	Stock for which biomass (or biomass proxy) is at a level sufficient to ensure that, on average, future levels of recruitment are adequate (that is, not recruitment overfished) and for which fishing pressure is adequately controlled to avoid the stock becoming recruitment overfished.	Appropriate management is in place.
	Depleting	Biomass is not yet depleted, and recruitment is not yet impaired, but fishing pressure is too high (overfishing is occurring) and moving the stock in the direction of becoming recruitment impaired.	Management is needed to reduce fishing mortality and ensure that the biomass does not become depleted.
	Recovering	Biomass is depleted and recruitment is impaired, but management measures are in place to promote stock recovery, and there is evidence that recovery is occurring.	Appropriate management is in place, and there is evidence that the biomass is recovering.
	Depleted	Spawning stock biomass that has been reduced through catch and/or non-fishing effects, so that average recruitment levels are significantly reduced (recruitment is impaired). Current management is not adequate to recover the stock, or adequate management measures have been put in place but have not yet resulted in measurable improvements.	Management is needed to recover this stock; if adequate management measures are already in place, more time may be required for them to take effect.
	Undefined	Not enough information exists to determine stock status.	Data required to assess stock status are needed.
	Negligible	Stock for which catches have been historically low to negligible and the stock has generally not been subject to targeted fishing. The stock has not been overfished in the past and it is likely that the stock can sustain a higher catch than is currently taken. Fishing is unlikely to be having a negative impact on the stock. There is little information available, and a stock assessment is not justifiable.	Assessment will not be conducted unless catches and information increase.

2. COMMERCIAL FISHING FLEET DYNAMICS

2.1. Introduction

Fishing fleet dynamics reflect the decisions made by fishers that relate to when and where to fish, the most appropriate gear to use for the target species, and the economics of seafood production. These decisions are influenced by a range of factors, such as the seasonal availability, movement and migration of target stocks, seasonal changes in weather conditions, management arrangements, running costs, market access, wholesale price fluctuations and socioeconomics.

A comprehensive evaluation of the spatial and temporal characteristics of fishing activities is required before stock assessment models can be reliably developed to inform management decisions (Hilborn & Walters, 1992; Mahévas et al., 2008). In most cases, this includes a detailed breakdown of fishery catch patterns, fishing effort, CPUE, the spatial distribution of catches, fishing gear, and location for each species (Hilborn & Walters, 1992).

Whilst most of this report is devoted to the assessment of commercial fishery statistics for specific taxa taken in the MSF in order to determine stock status, this section provides a holistic view of the fishery by examining and comparing trends in commercial catches, fishing effort, gear use, and regions. This summary illustrates the dynamic nature of the MSF at different spatial and temporal scales, the changes in licence participation rates, and the relationships and trends between target species.

2.2. Methods

The MSF is divided into 58 Marine Fishing Areas (MFAs) for the purpose of statistical reporting and monitoring of commercial fishing activity (Figure 1.3-1). Licenced fishers are required to log their fishing activities by reporting specific details such as MFA fished, number of fishers on board, gear used, species targeted, species caught, weight of catch (whole weight of fish, and trunk/wing weight for shark and rays), catch in numbers of specific species, and method of capture. Prior to 2003, these details were recorded on a monthly basis but since then the fishers have been required to provide a daily log of fishing activity. These records are submitted monthly to PIRSA Fisheries and Aquaculture where they are entered into the Marine Scalefish Fisheries Information System. This database is routinely reviewed and cross-checked as per quality assurance protocols (Vainickis, 2010). The current database is a compilation of catch (whole fish weight) and effort data collected from 1 July 1983 to the present and provides the primary source of data used for the assessments of stock status presented in this report. As such, they are based on a 40-year time-series up to and including 2022/23. Gross value of production (GVP) figures presented in this report were sourced from EconSearch (2023) up to 2021/22, and provisional for 2022/23.

The complexity of the MSF database was reduced to a smaller, more manageable dataset that allowed analysis of the major trends in fleet dynamics. Two main approaches were adopted to achieve this. One approach involved aggregating the data into monthly categories. This level of temporal resolution was considered appropriate as monthly data were provided by many fishers prior to 2003. The other approach involved aggregating certain gear types into broader gear groups (Table 2.2-1). For example, haul nets, sinking and floating garfish nets, sinking mesh nets, and sinking mixed mesh nets were collectively categorised as haul nets, but were differentiated from large mesh nets (>15 *cm* mesh size) and set gillnets (5 *cm* mesh size) which were categorised as set nets (Table 2.2-1). Similarly, handlines, and fishing rods/poles in the line sector were categorised as handlines (Table 2.2-1). Longlines, drop lines and trot lines were grouped as longlines where appropriate (Table 2.2-1). Purse seine and salmon net have been grouped as salmon purse seine (S.A.) due to their exclusive use for Western Australian Salmon in the MSF (Table 2.2-1).

Table 2.2-1. Description and categorisation of gear types used (historically and current) in the Marine Scalefish Fishery.

GEAR CODE	GEAR DESCRIPTION	GEAR GROUP
BN	Bait net (5 *cm*)	Bait net (5 *cm*; BN)
A	Cockle rake	Cockle rake (CR)
CR	Cockle rake	
CN	Crab lift net (hoop/drop nets)	Crab net/pot (CN)
CP	Crab pot	
RA	Crab rake	Crab rake (RA)
DN	Dab net	Dab net (DN)
HA	Hand	Hand (HA)
HL	Handline	Handline (HL)
PO	Poles/rod and line	
HN	Hauling net	Hauling net (HN)
HNF	Hauling net (floating gar net)	
HNM	Hauling net (sinking mesh net)	
HNS	Hauling net (sinking mixed mesh)	
HNX	Hauling net (sinking and floating)	
DL	Drop line	Long line (LL)
LL	Long line	
TT	Trot line	
OT	Octopus pot	Octopus pot (OT)
PS	Purse seine	Salmon purse seine (S.A.)
S.A.	Salmon net	
GN	Set gill net	Set net (SN)
SH	Large mesh set net	
SF	Spade/fork	Spade/fork (SF)
SQ	Squid jig	Squid jig (SQ)
RT	Razor fish tongs	Tongs (RT)
FT	Fish trap (inc. Ocean jacket trap)	Trap (FT)
X	Other	Other (X)
XX	Other (incl. Diving)	

2.3. Trends in Commercial Catch

Commercial Fishing Fleet Dynamics

Commercial Catch

State-wide summary 2022/23

Fishing fleet statistics

Fishing Season	GVP* *$M AUD*	Total catch *t*	Stock catch *t*					Zonal catch *t*			
			Tier 1	Tier 2	Tier 3	Neg.	Other	WCFZ	SGFZ	GSV/KI FZ	SEFZ
2018/19	22	2,113	1,020	508	264	38	282	284	1,097	702	30
2019/20	21	2,137	850	519	461	60	245	270	1,293	509	64
2020/21	19	1,742	738	430	286	36	251	287	985	402	68
2021/22	21	1,934	623	688	353	34	235	273	1,213	399	48
2022/23	18**	2,242	642	680	624	24	271	266	1,494	427	55

**BDO EconSearch (2023), **Provisional value based on 20 species in this report only.*

GVP

- Southern Calamari had the highest commercial GVP in 2022/23 of $6 million AUD (Figure 2.3-1).
- King George Whiting ($4M) and Southern Garfish ($1.6M) remained the second and third most economically valuable MSF species, despite being the fourth and fifth ranked species by catch (Figure 2.3-1).
- Despite higher catches of 'Tier 2' stocks in 2022/23, they remain far less economically valuable than the traditional primary species of the fishery (Figure 2.3-1).

Commercial catch

Since 1983/84, there have been considerable shifts in the composition of the commercial MSF catches which have contributed to a long-term declining trend in fishery production (Figure 2.3-2; Figure 2.3-3). Catches of the Tier 1 stocks were relatively consistent until 2011/12, when gradual annual decreases started to occur (Figure 2.3-3a). Meanwhile, catches of Tier 2 and Tier 3 stocks, and other species have been declining since the 1980s. The 2022/23 annual catch in the MSF fishery was dominated by the Tier 2 stocks (~30%), followed by the Tier 1 stocks (~29%), Tier 3 stocks (~28%), and finally the other remaining permitted species (~12%) and Negligible stocks (~1%; Figure 2.3-3a). This is the second year in the history of the fishery where Tier 2 stocks constituted a greater percentage of the catch than Tier 1 stocks (Figure 2.3-3a). Appendices 6.1 and 6.2 provide summaries of non-confidential annual commercial catches between 1983/84 and 2022/23 of species presented in this report and all other permitted species reported in MSF logbooks.

In 2022/23, the species with the largest State-wide catch was Ocean Jackets at 522 *t* , followed by Australian Salmon at 362 *t* (Figure 2.3-1a). The remaining species with Tier 1 stocks, King George Whiting (192 *t*), Southern Garfish (138 *t*) and Snapper (29 *t*), where ranked as the fourth, fifth and twelfth highest catches in 2022/23, respectively (Figure 2.3-3a).

Tier 1 stocks

Total annual catches of the Tier 1 stocks declined from a peak of 2,004 *t* in 2000/01 to the second lowest catch on record of 642 *t* in 2022/23 (cf. 623 *t* 2021/22; Figure 2.3-3b). Prior to the 1999/00 fishing season, the composition of the Tier 1 stocks catch was relatively stable, where average annual King George Whiting catch accounted for around ~38%, followed by Southern Garfish (~25%), Snapper (~25%), and Southern Calamari (~12%). Since then, the relative proportions of the King George Whiting and Southern Garfish catches have declined to 30% and 21% in 2022/23, respectively, whereas annual catches of Southern Calamari (44%) have increased, particularly since 2009/10 (Figure 2.3-3b). The proportion of Snapper in the catches of Tier 1 species decreased considerably from

52% to 27% between 2010/11 and 2018/19, and then further to 5% in 2022/23 due to the ongoing fishery closure (Figure 2.3-3b).

Tier 2 stocks

The total annual catch of Tier 2 stocks averaged ~930 *t* between 1983/84–2000/01 with a historic peak since 1983/84 of 1,217 *t* in 1994/95 (Figure 2.3-3c). The total catch of Tier 2 stocks was stable at around 450–750 *t/year* during the late 2000s and 2010s, with a historic low of 430 *t* in 2007/08. Total catch of Tier 2 stocks has since increased to 680 *t* in 2022/23 (Figure 2.3-3c). Western Australian Salmon, Australian Herring, Bronze Whalers, and Yellowfin Whiting have consistently accounted for most (94% collectively in 2022/23) of the catch of Tier 2 stocks, while Blue Crabs accounted for most of the remaining catch during the 1990s prior to the formation of the Blue Crab Fishery (Figure 2.3-3c). The relative contributions of the other Tier 2 stocks to the total catch have remained stable since 2008/09, with the exception of Western Australian Salmon catches, which have fluctuated across years.

Tier 3 stocks

Annual catches of Tier 3 stocks peaked in 1988/89 at 1,189 *t*, when they were dominated by Ocean Jackets (~79%). Ocean Jackets continued to contribute most of the Tier 3 stocks catch up to 2005, before targeting of this species almost ceased during 2006/07–2015/16 (Figure 2.3-3d). Fishing for Ocean Jackets increased since 2016/17, with the highest catch since 1994/95 occurring in the 2022/23 fishing season (522 *t*; cf. 524 *t* 1994/95; Tier 3 and 'Negligible' stocks combined) (Figure 2.3-3d). In 2022/23, while Ocean Jackets dominated the Tier 3 stocks catch composition, Sand Crab (7.6%), and Snook (5.4%) constituted the majority of the remaining catch (Figure 2.3-3d).

Zone

- Since 1983/84, the SGFZ has dominated proportions of total catch, on average accounting for ~51% of the MSF total catch (Figure 2.3-2).
- Since the MSF reform in 2021, the proportion of the MSF total catch taken in the SGFZ has gradually increased, while the proportion of catches in the Gulf St Vincent/Kangaroo Island Fishing Zone (GSV/KIFZ) and WCFZ have decreased (Figure 2.3-2).
- In 2022/23, the highest catch occurred in the SGFZ (1,494 *t*), followed by the GSV/KIFZ (427 *t*) and WCFZ (266 *t*), with 55 *t* taken in the SEFZ (Figure 2.3-2).

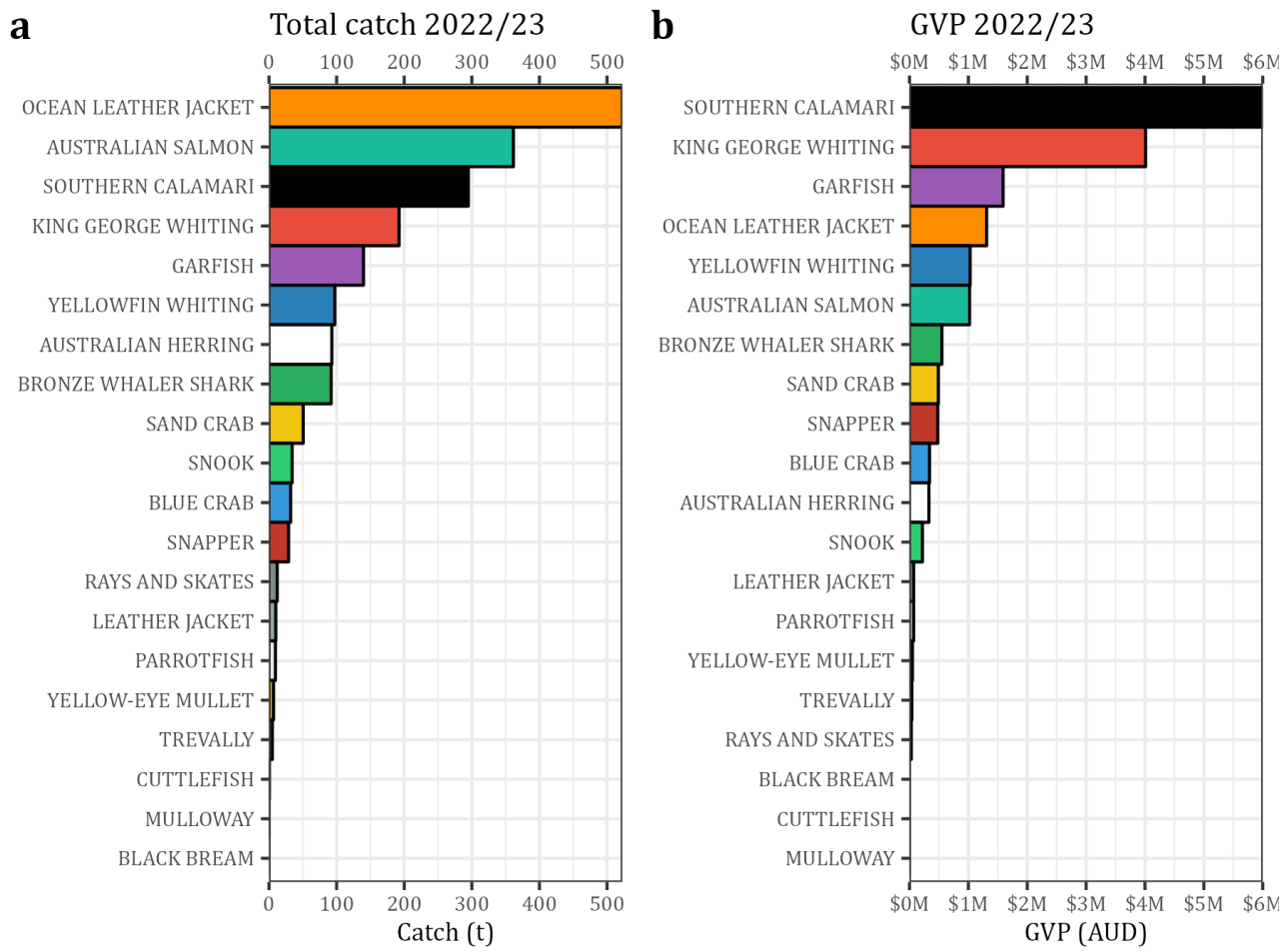


Figure 2.3-1. Species rankings in 2022/23 according to (a) total MSF catch and (b) gross value production (GVP; panel B). Only species assessed in this report are included.

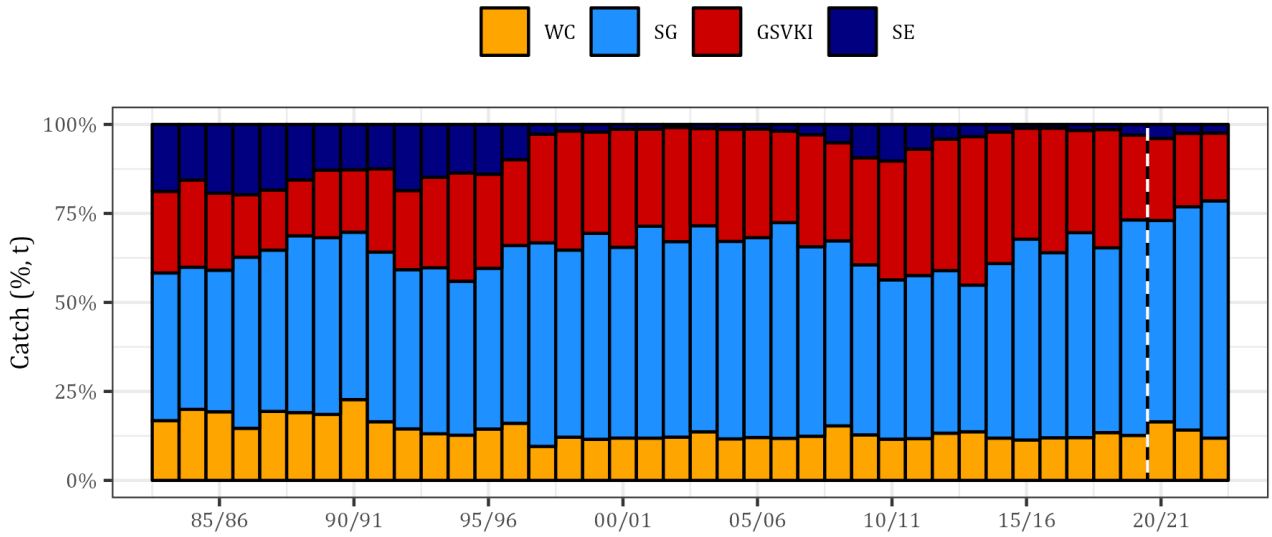


Figure 2.3-2. Catch distribution (% of total catch) across the four MSF Fishing Zones from 1983/84 – 2022/23. The dashed line indicates the reform of the MSF in July 2021. West Coast (WCFZ), Spencer Gulf (SGFZ), Gulf St Vincent/Kangaroo Island (GSV/KIFZ), and South East (SEFZ) Fishing Zone.

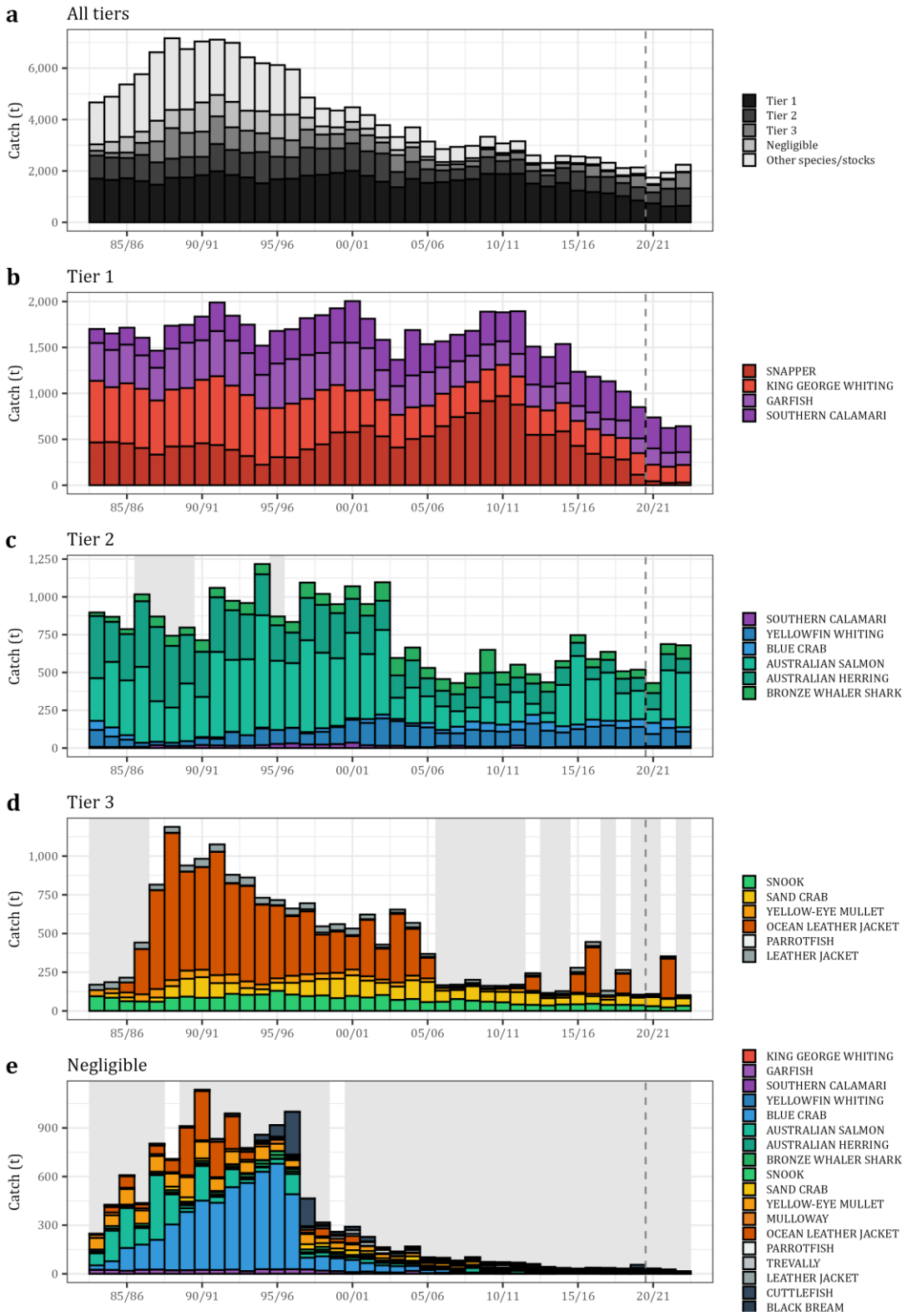


Figure 2.3-3. Long-term trends in (a) total catch (t) in the commercial Marine Scalefish Fishery for all tiers, (b) Tier 1, (c) Tier 2, (d) Tier 3 stocks between 1983/84 and 2022/23, (e) Negligible species with no tier asigned due to the average five-year annual commercial catches < 5 *t* (Smart et al. 2022b). The dashed line indicates the reform of the MSF in July 2021. Grey shading indicates years when data for one or more species are confidential.

2.4. Trends in Fishing Effort and Active Licences

Commercial Fishing Fleet Dynamics

Commercial Effort and Licences

State-wide summary 2022/23

Fishing fleet statistics

Fishing Season	Active Licences[4] *MSF incl.*	Total effort *Fisher-days*	Species/stock effort *Fisher-days*					Zonal effort *Fisher-days*			
			Tier 1	Tier 2	Tier 3	Neg.	Other	WCFZ	SGFZ	GSV/ KIFZ	SEFZ
2018/19	315	37,784	25,766	2,074	1,297	432	8,215	6,779	17,497	13,102	406
2019/20	304	35,143	23,708	2,156	1,378	563	7,338	6,927	15,990	11,545	681
2020/21	269	29,030	19,026	2,188	1,040	579	6,197	6,321	13,032	8,981	696
2021/22	217	26,202	16,567	2,291	973	490	5,881	6,328	11,526	7,916	432
2022/23	211	26,060	16,611	2,045	1,337	350	5,717	5,903	12,045	7,472	640

Active Licences

- There was a 75% (from 854 to 211) reduction in the number of licence holders actively operating in the MSF between 1983/84 and 2022/23 (Figure 2.4-1; Figure 2.4-2).
- Largest proportional reduction occurred for the Rock Lobster Fisheries, declining from 212 in 1987/88 to 15 in 2022/23 (93% reduction; Figure 2.4-2).
- Two buy-back schemes in 2005 and 2014 also contributed to removing active licences.
- 100 licences were voluntarily surrendered during the reform (51 latent due to no reported fishing activity)
- 211 licences were active in 2022/23 (191 MSF, 15 Rock Lobster Fisheries, 5 Miscellaneous Fishery; Figure 2.4-2).
- 3% reduction in licences from 2021/22 to 2022/23 (Figure 2.4-2).

Commercial effort

- Annual estimates of total fishing effort peaked at 136,281 *fisher-days* in 1991/92 (Figure 2.4-1a,b).
- This represented an 16% increase in annual effort since 1983/84 (Figure 2.4-1a,b).
- Reduction of 81% from 136,281 *fisher-days* in 1991/92 to 26,060 *fisher-days* in 2022/23.
- Since 1983/84, the majority (~80%) of the fishing effort reported in fishery logbooks in most years has been 'targeted effort' (i.e., fishers nominated a species/taxon as their target; Figure 2.4-1a).
- Remaining ~20% recorded as 'any target', decreasing to ~10% in 2022/23 (~90% targeted effort; Figure 2.4-1a).

Tier 1 stocks

Of the reported targeted effort, the four Tier 1 stocks have consistently accounted for the greatest proportion, of which King George Whiting has historically dominated (Figure 2.4-1b,c). In 2022/23, the Tier 1 stocks accounted for 63% of total targeted fishing effort (16,611 *fisher-days*; Figure 2.4-1b). Since 2011, there has been a subtle shift in targeted fishing activity, as fishers appear to have directed some targeted effort away from species such as Snapper and King George Whiting towards Southern Calamari (Figure 2.4-1c). The relative proportion of effort targeted towards Southern Calamari has increased from 27% in 2010/11 to 47% in 2022/23 (Figure 2.4-1c). Southern Calamari is now the most targeted species and has been since 2016/17 (Figure 2.4-1c). Over the same period, the relative proportion of effort targeted towards Snapper declined from 27% to < 3 % in 2022/23 (Figure 2.4-1c).

[4] Includes MSF, Rock Lobster Fisheries and Miscellaneous Fishery licences

Tier 2 stocks
In 2022/23, the Tier 2 stocks accounted for approximately 8% of the total targeted fishing effort (Figure 2.4-1b). A large decline in targeted effort for Tier 2 stocks occurred in 2003/04, with the number of *fisher-days* reducing by 33% between 2002/03 (4,783 *fisher-days*) and 2003/04 (3,203 *fisher-days*; Figure 2.4-1b). The distribution of targeted effort amongst the Tier 2 stocks has also changed considerably over the past 40 years (Figure 2.4-1d). Historically, Blue Crabs, Western Australian Salmon, Snook and Yelloweye Mullet attracted the most effort, accounting for > 95% of targeted effort directed at Tier 2 stocks in some years during the mid-1980s (Figure 2.4-1d). Since 2000/01, the relative proportions of effort targeted towards Yelloweye Mullet, Western Australian Salmon and Blue Crab have declined, while those for Yellowfin Whiting and Whaler Sharks have increased (Figure 2.4-1d).
Tier 3 stocks
In the 2022/23 fishing season, approximately 5% of total targeted fishing effort was for the Tier 3 stocks in this report (Figure 2.4-1b). There were a few periods of notable expansion for some 'niche' Tier 3 stocks, such as Leatherjackets and Ocean Jackets (Figure 2.4-1e). Targeted effort for each of these species doubled over short (<5 years) periods but did not persist. Targeted effort for Ocean Jackets has followed an increasing trend over the last five years, peaking in 2022/23, its highest since 2003/04 (Figure 2.4-1e). Increases in targeted effort for Ocean Jackets in 2022/23 has resulted in Ocean Jackets overtaking Western Australian Salmon (Tier 2 stocks) as the top ranked species by State-wide catch, increasing from third in 2021/22 (Figure 2.4-1e; Figure 2.3-1).
Gear
Haul nets and handlines have consistently been the dominant gear types used in the fishery, collectively accounting for > 60% of the total fishing effort in most years since 1983/84 (Figure 2.4-3). The proportional use of set nets has declined from 16% in 1987/88 to < 1% since 2019/20, with the greatest reduction occurring throughout the late 1990s and early 2000s in response to the State-wide netting review and associated restrictions (Figure 2.4-3). The use of squid jigs has steadily increased from 1993/94 as the Southern Calamari fishery evolved from a bait resource to a priority target species and has further increased from 2010/11 onwards (Figure 2.4-3). Squid jigs accounted for 26% of the total State-wide fishing effort in 2022/23 (Figure 2.4-3). The proportional use of longlines doubled from 2008/09 through to 2015/16 but has since declined and accounted for 9% of the total fishing effort in 2022/23 (Figure 2.4-3).
Zone
• The SEFZ has consistently been the most variable through time, peaking at 11% total MSF effort in 1986/87, but < 4% for the past ten fishing seasons (Figure 2.4-4). • GSV/KIFZ (~30% annual effort) and SGFZ (~45% annual effort) Fishing Zone have been the dominant zones regarding fishing effort (Figure 2.4-4). • The WCFZ accounts for ~19% annual effort, reaching 22% in the 2022/23 fishing season (Figure 2.4-4). • The SGFZ dominated effort in 2022/23, reaching 12,045 *fisher-days*, an increase of 5% from 2021/22 (Figure 2.4-4).

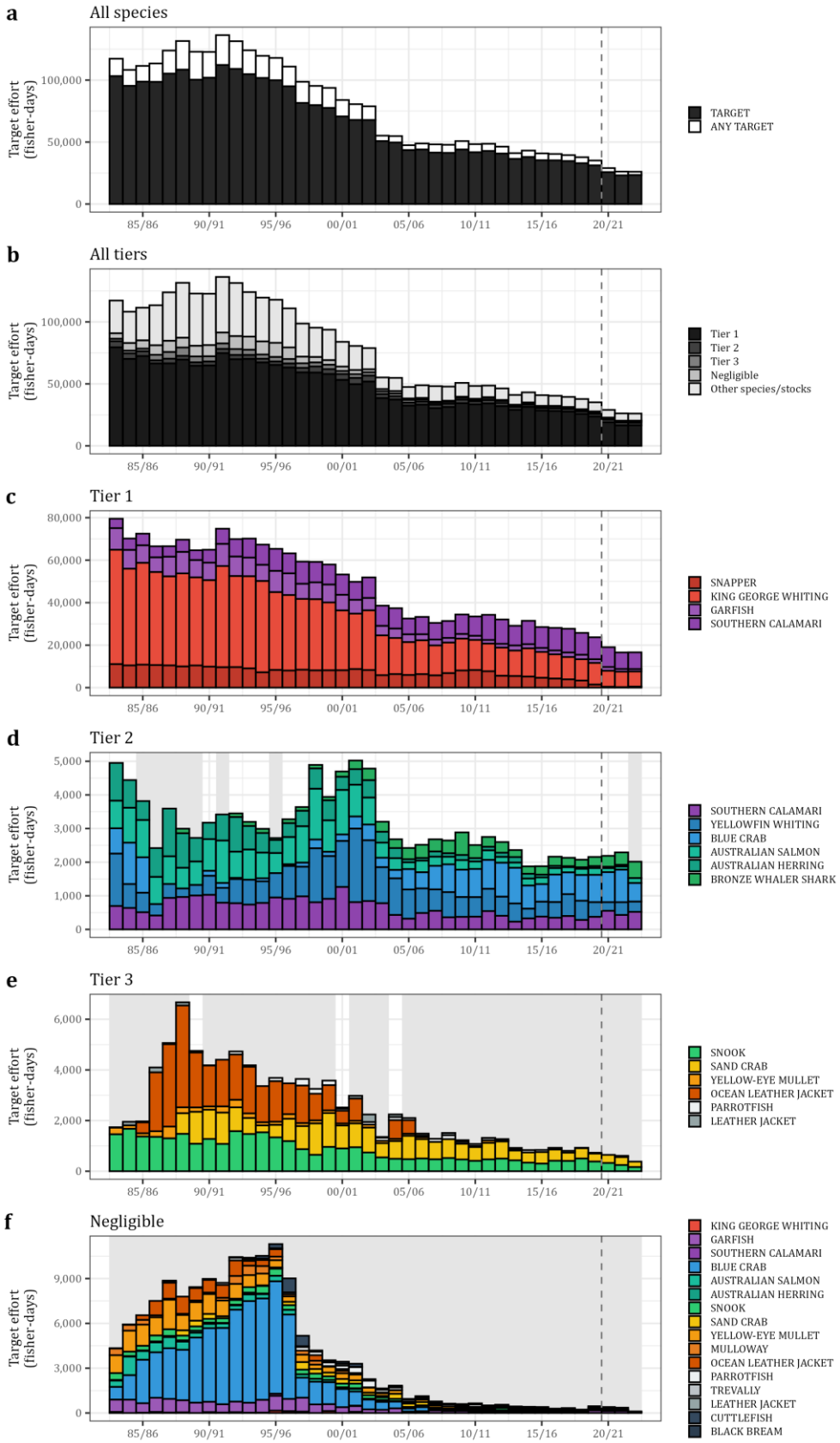


Figure 2.4-1. Total effort (fisher-days) in the commercial Marine Scalefish Fishery between 1983/84 – 2022/23, partitioned into targeting categories in each panel. This includes (a) targeted and non-targeted ('any target') effort, (b) species category (Tier 1, Tier 2, Tier 3, Negligible, and other), and tier- and species-specific targeted effort (c, Tier 1; d, Tier 2; e, Tier 3; f, Negligible species with no tier asigned due to the average five-year annual commercial catches < 5 *t,* Smart et al. 2022b). The dashed line indicates the reform of the MSF in July 2021. Grey shading indicates years when data for one or more species are confidential.

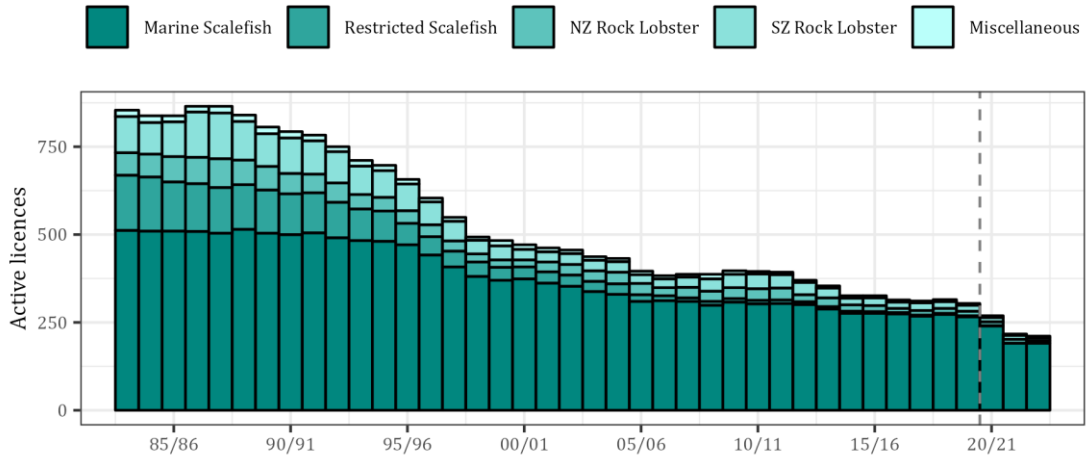


Figure 2.4-2. Long-term trend in the number of active licence holders that have access to the Marine Scalefish Fishery (MSF), including those from the Southern and Northern Zone Rock Lobster Fishery (SZRLF, NZRLF) and Miscellaneous Fisheries. The black dashed line indicates the reform of the MSF in July 2021.

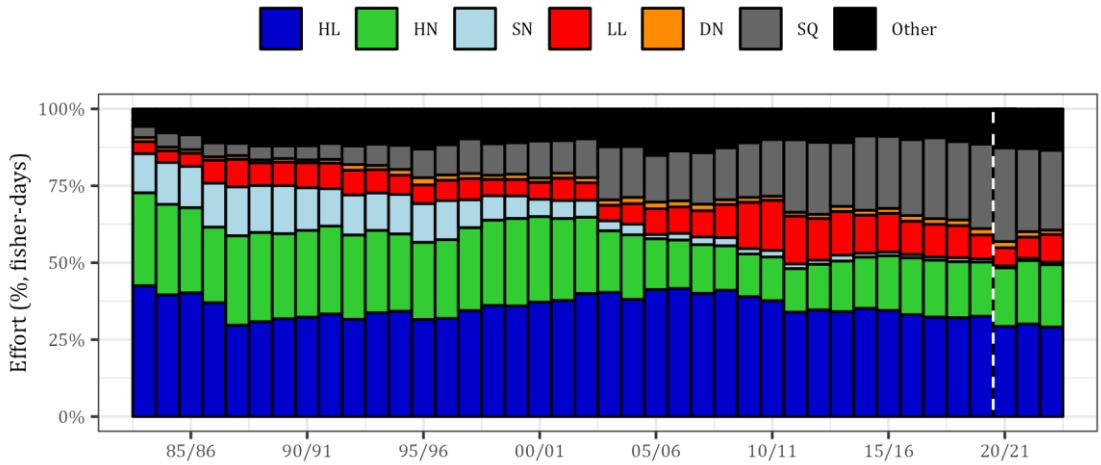


Figure 2.4-3. Gear usage (% of total fishing effort) within the Marine Scalefish Fishery between 1983/84 – 2022/23. The dashed line indicates the reform of the MSF in July 2021. Handline (HL), Haul net (HN), Set net (SN), Long line (LL), Dab net (DN), Squid Jig (SQ).

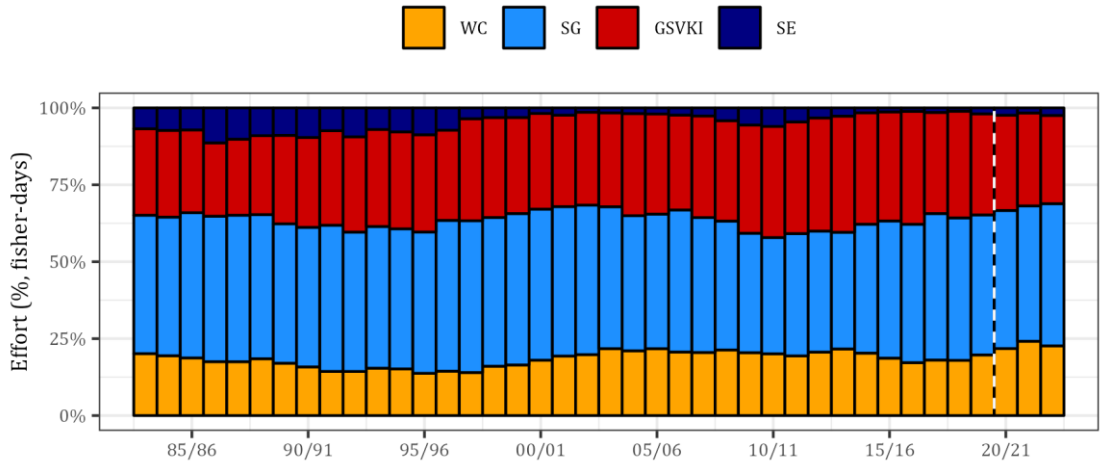


Figure 2.4-4. Effort distribution (% of total fishing effort) across the four MSF Fishing Zone from 1983/84 – 2022/23. The dashed line indicates the reform of the MSF in July 2021. West Coast (WCFZ), Spencer Gulf (SGFZ), Gulf St Vincent/Kangaroo Island (GSV/KIFZ), and South East (SEFZ) Fishing Zone.

2.5. Summary

The 2022/23 fishing season was the first occurrence where the catch of a Tier 3/Negligible stock was greater than that of any one Tier 1 stock. There are several reasons for this, with two clear observations being the increased Ocean Jacket catch and closure of the Snapper fishery across three out of four Fishing Zones. There have also been ephemeral periods of increased fishing activity for other Tier 2 and Tier 3 stocks, such as Western Australian Salmon, Snook and Ocean Jackets that highlights the dynamic capacity of the MSF fishing fleet. Given the declining fishing activity observed for some of the Tier 1 stocks, current fishers may have greater incentive to target an increased diversity of 'underutilised' or 'lesser-known' species and to synchronise their fishing activity to the species' patterns of seasonal abundance. However, much like the 2021/22 fishing season, 2022/23 also saw reduced catches of most Tier 1 stocks (i.e., the traditional primary species), which could be due to the changing management regime of the fishery and the need for fishers to adjust their fishing operations accordingly. Therefore, while the catch of Tier 2 and Tier 3 stocks was greater than or approaching the catch of Tier 1 stocks in 2021/22 and 2022/23, it remains to be seen whether this trend will continue.

In 2022/23, catches of King George Whiting and Southern Garfish were overtaken by Ocean Jackets and Western Australian Salmon, which are species with Tier 3 and Tier 2 stocks, respectively. Despite this, high beach prices maintained their rankings as the second and third most economically valuable species in the fishery according to GVP. This indicates that while catches of Tier 2 and Tier 3 stocks may increase and reduce the pressure on Tier 1 stocks to support the fishery, they are currently not as economically viable as the Tier 1 stocks. Southern Calamari remained the most valuable species in the fishery with a GVP of $6 million AUD. This was 50% higher than King George Whiting and further highlights the importance of Southern Calamari to the fishery. Not only does Southern Calamari have the highest GVP in the fishery, but also the highest gross margins, indicating that they are the most profitable species to fish for due to high beach prices and low fishing costs (Smart et al., 2022b).

The dynamics of the MSF fleet have shifted in recent years primarily due to changes in management arrangements. The most obvious changes have been the decline in fishing effort driven by the licence amalgamation scheme in 1994, two voluntary buy-back initiatives (2005 and 2014), and reduction in the number of B-class and Rock Lobster licences active in the fishery. Since their implementation, these significant management interventions have reduced the number of active licence holders by 70%, which has led to a 78% reduction in fishing effort. This has contributed to a gradual spatial contraction of effort across the State, with the fishery becoming almost exclusively confined to gulf waters, around the major regional centres of Port Lincoln and Ceduna, and a few protected bays on the west coast of the Eyre Peninsula. A further 100 licences were voluntarily surrendered from the

fishery through the MSF reform in 2021. As a result, no B-class licences remain in the fishery as of 2021/22. While this is the single greatest reduction in licences during the history of the fishery, the full effects on catch and effort will not be completely apparent for several more fishing seasons. This is due to the number of latent licences being surrendered during the reform (Smart et al. 2022b). As a result, the general trends in catch and effort (typically declining trends) continued in 2022/23. Most fishing effort within the MSF has been targeted, with fishers remaining activities being more general, or they were not specifically recording a target species in their catch returns.

Other key drivers of recent changes in fleet dynamics include the expansion and subsequent reduction in Snapper catches (particularly following the spatial closures from 1 November 2019), a steady reduction in King George Whiting and Southern Garfish catches, and the shift in effort towards targeting Southern Calamari. Collectively, the Tier 1 stocks of these four species have typically accounted for almost two-thirds of all targeted effort each year, of which King George Whiting has historically dominated. Since 2010/11, there have been substantial declines in targeted effort for Snapper, King George Whiting, and Southern Garfish as a consequence of a range of management arrangements (i.e., spatial closures, closed seasons, netting restrictions and catch limits). Simultaneously, targeted effort for Southern Calamari has steadily increased. This species has effectively become a year-round target for many fishers, possibly to offset the loss of access to the other Tier 1 stocks, while also driven by market demand (63% increase in GVP from 2012/13 to 2022/23). The increasing trend in the relative use of squid jigs also reflects this shift in behaviour in the fishing fleet.

3. STOCK STATUS OF MARINE SCALEFISH FISHERY SPECIES

3.1. Introduction

This section of the report uses a weight-of-evidence approach to determine the stock status of 20 MSF species or taxonomic groups that are distributed across the 'Tier 1', 'Tier 2', and 'Tier 3' stock categories, as defined in the Tiered Management Framework (TMF; Smart et al., 2022b; Table 1.3-1). Previous reports were based on the 'Primary', 'Secondary' and 'Tertiary' species categories, as defined in the Management Plan (PIRSA, 2013). The structure of this report has been adjusted to match the classifications from the TMF as these are being used to inform the management and science needs of the fishery and are expected to be incorporated into the replacement Management Plan in July 2025.

For each species or taxon, the relevant biological information is presented, along with a description of the fishery; associated management regulations; interrogation of the fishery statistics at either the biological stock, State-wide or zonal scale; assessment of the fishery against the general performance indicators; and a classification of stock status. Catch statistics and fishery information for Gummy Shark and School Shark are also presented. However, no statuses are assigned to these species as they are managed through Australian Fisheries Management Authority (AFMA) fisheries.

Whilst the category assignment of the species and stocks has changed using the TMF, the harvest strategy and performance indicators in the current Management Plan (PIRSA 2013) are applicable until the replacement management plan has been implemented.

3.2. Methods

3.2.1. Commercial Catch and Effort

Commercial catch and effort are the primary data considered in this section. The appropriate data for each taxon were extracted from the SARDI Aquatic Sciences' commercial Marine Scalefish Fisheries Information System which includes data from the Marine Scalefish, and Northern and Southern Zone Rock Lobster fisheries. These data span a 40-year time-series from 1983/84 to 2022/23 and were aggregated at either the biological stock, State-wide, or zonal scales to provide annual estimates of catch and effort for the main gear types (Table 3.2-1). Gear types were amalgamated into gear groups according to the descriptions given in section 2.2. Data on by-product of Southern Calamari by SA's three prawn trawl fisheries were also included. Previously, effort data was presented as total effort in State-wide summaries, however, this has now been presented as targeted effort unless stated otherwise under *Effort Type* in Table 3.2-1 and Table 3.2-2.

The presentation of data was limited by constraints of confidentiality, i.e., data could only be presented for years that relate to five or more fishers. The general (G) performance indicators for 2022/23 (Table

1.5-1) were benchmarked against the trigger reference points calculated from the historical data as per the Management Plan (Table 3.2-3; PIRSA, 2013). Total catch is presented as rounded values in all stock summaries, however unrounded values were benchmarked against the trigger reference points. The national stock status classification system developed for the Status of Australian Fish Stocks Report 2020 (Piddocke et al., 2021) was used to assign stock status (see Table 1.6-1, Table 3.2-1 & Table 3.2-2).

3.2.2. Recreational Catch and Effort

Recreational data are presented at the State-wide and zonal scale where applicable. State-wide estimates are available from each of the four recreational fishing surveys (Jones & Doonan, 2005; Jones, 2009; Giri & Hall, 2015; Beckmann et al., 2023). Regional average weights were used to estimate the 2021/22 State-wide recreational harvest, improving estimates where size differed regionally within each species (see Smart et al. 2022). Where data were available, recreational catches at the zone level were recalculated to match the spatial scale of the management zones as outlined in Smart et al. 2022. It should be noted, while recreational surveys were not conducted over the same 12-month period, they were labelled by the nearest financial year. Each estimate of recreational catch only includes South Australian residents. Due to lower sample size during the 2013/14 fishing survey compared to the other three surveys, estimates are more suited to demonstrating the broad-scale trends. In addition, the 2013/14 fishing survey does not provide patterns of regional size/weight variation due to a lack of comprehensive on-site surveys (Giri & Hall, 2015). As such, in this report, estimates of recreational catch from the 2013/14 fishing survey are only provided at the State-wide scale.

3.2.3. Catch MSY Method

A catch MSY (cMSY) assessment is a model-assisted analysis which uses a Schaefer production model to determine viable estimates of MSY based on prior specification for species' productivity and depletion levels at the beginning and end of the time series (Martell & Froese, 2013). These catch-only assessments can be very effective when changes in population size are evident in the catch history of a stock. However, they are less successful if changes in catches have been affected by management or changes in fishery dynamics. As the cMSY method relies strongly on catch data, it may not be suitable for stocks with large or variable recreational catches or that do not have recreational data regularly available. Therefore, while it is an assessment tool that can be applied to any stock, it ideally is used in conjunction with other lines of evidence, but if no information is available, it should be used judiciously and in a precautionary manner when used to assign stock status or management advice. In the current assessment, the cMSY method was applied to Yellowfin Whiting stocks and Blue Crab in the WCFZ to supplement the general PIs. This method was run using only commercial catch data under the assumption that changes in the stock size are evident in commercial

catch trends, particularly since recreational catch for these stocks is considerably less than commercial catches. The cMSY method was applied using the ‘datalowSA’ package in the R programming environment (Haddon, 2020; R core R-Core-Team, 2022).

Table 3.2-1. Marine Scalefish Fishery categories for primary species/taxa (King George Whiting, Snapper, Southern Garfish, Southern Calamari), and Yellowfin Whiting and Blue Crab considered in this report, the stock considered, performance indicators, main gear types (see Table 2.2-1), whether the assessment is based on targeted or total catch and effort data, the scale of their stock boundary, the tier assigned by the Tierd Management Framework (Smart et al., 2022b), and the stock status from 2020 to the present assesment (2022/23). Tier 1-stock model outputs include fishable biomass, egg production and recruitment. Abbreviations: CPUE–catch per unit effort; NA–not assigned; Neg.–Negligible. Stock/zone abbreviations: West Coast (WC), Spencer Gulf (SG), Spencer Gulf/West Coast (SG/WC), Gulf St Vincent/Kangaroo Island (GSV/KI), South East (SE), Western Victoria Stock (WVS).

CATEGORY	SPECIES	SCALE	INDICATORS	EFFORT TYPE	GEAR GROUP	STOCK	TIER[5]	STATUS		
								2020	2021/22	2022/23
PRIMARY	**Snapper**	Biological	Catch, effort, CPUE, age structure, model outputs	Targeted	Handline, Longline	SG/WC	T1	Depleted	Depleted	Depleted
						GSV	T1	Depleted	Depleted	Depleted
						SE (WVS)	T1	Sustainable	Sustainable	Sustainable
	King George Whiting	Zone	Catch, effort, CPUE, age structure, model outputs	Targeted	Handline, Haul Net, Set net	WC	T1	Sustainable	Sustainable	Sustainable
						SG	T1	Sustainable	Sustainable	Sustainable
						GSV/KI	T1	Sustainable	Sustainable	Sustainable
						SE	Negligible	Negligible	Negligible	Negligible
	Southern Garfish	Zone	Catch, effort, CPUE, age structure, model outputs	Targeted	Hauling Net, Dab Net	WC	Negligible	Sustainable	Sustainable	Sustainable
						SG	T1	Recovering	Recovering	Recovering
						GSV/KI	T1	Recovering	Recovering	Sustainable
						SE	Negligible	Sustainable	Sustainable	Sustainable
	Southern Calamari	Zone	Catch & Effort	Targeted	Squid Jig, Haul Net	WC	T2	Sustainable	Sustainable	Sustainable
						SG	T1	Sustainable	Sustainable	Sustainable
						GSV/KI	T1	Sustainable	Sustainable	Sustainable
						SE	Negligible	NA	Negligible	Negligible
SECONDARY	**Yellowfin Whiting**	Zone	Catch & Effort	Targeted	Haul Net, Set Net	GSV/KI	T2	Sustainable	Sustainable	Sustainable
						SG	T2	Sustainable	Sustainable	Sustainable
	Blue Crab	WC Zone	Catch & Effort	Targeted	Crab Net	WC	T2	Sustainable	Sustainable	Sustainable

[5] Tiers are only assigned if average five-year annual commercial catches are greater than 5 *t,* otherwise listed as 'Negligible' (Smart et al. 2022b).

Table 3.2-2. Marine Scalefish Fishery categories of secondary and tertiary species/taxa considered in this report, the stock considered, whether the assessment is based on targeted or total catch and effort data, the main gear types (see Table 2.2-1), the scale of their stock boundary, the tier assigned by the Tierd Management Framework (Smart et al., 2022b), and the stock status from 2020 to the present assesment. State-wide assessments can include multiple stocks/zones with different tiers. Abbreviations: CPUE–catch per unit effort; NA–not assigned; Neg.–Negligible. Stock/zone abbreviations: West Coast (WC), Spencer Gulf (SG), Spencer Gulf/West Coast (SG/WC), Gulf St Vincent/Kangaroo Island (GSV/KI), South East (SE).

CATEGORY	SPECIES	SCALE	INDICATORS	EFFORT TYPE	GEAR GROUP	STOCK	TIER[6]	STATUS		
								2020	2021/22	2022/23
SECONDARY	**Western Aust. Salmon**	State-wide	Catch & Effort	Targeted	Haul Net	STATE	T2/Neg.	Sustainable	Sustainable	Sustainable
	Australian Herring	State-wide	Catch & Effort	Targeted	Haul Net	STATE	T2/Neg.	Sustainable	Sustainable	Sustainable
	Whaler Sharks	State-wide	Limited data	Targeted	Longline	STATE	T2/Neg.	Undefined	Undefined	Undefined
	Snook	State-wide	Catch & Effort	Targeted	Haul Net	STATE	T3/Neg.	Sustainable	Sustainable	Sustainable
	Sand Crabs	State-wide	Catch & Effort	Targeted	Crab Net	STATE	T3/Neg.	Sustainable	Sustainable	Sustainable
	Yelloweye Mullet	State-wide	Catch & Effort	Total	Haul Net	MSF	T3/Neg.	Sustainable	Sustainable	Sustainable
	Mulloway	State-wide	Catch & Effort	Total	Handline, Set Net	MSF	Negligible	Sustainable	Sustainable	Sustainable
TERTIARY	**Ocean Jackets**	State-wide	Catch & Effort	Targeted	Fish Trap	STATE	T3/Neg.	Sustainable	Sustainable	Sustainable
	Blue-throat Wrasse	State-wide	Catch & Effort	Total	Handline	STATE	T3/Neg.	Sustainable	Sustainable	Sustainable
	Silver Trevally	State-wide	Catch & Effort	Total	Handline	STATE	Negligible	Sustainable	Sustainable	Sustainable
	Leatherjackets	State-wide	Limited data	Total	Haul Net	STATE	T3/Neg.	Undefined	Undefined	Undefined
	Rays & Skates	State-wide	Limited data	Total	Haul Net, Longline	STATE	NA	Undefined	Undefined	Undefined
	Cuttlefish	State-wide	Catch & Effort	Total	Squid Jig	STATE	Negligible	Sustainable	Sustainable	Sustainable
	Black Bream	State-wide	Total Catch	Total	Haul Net	MSF	Negligible	Sustainable	Sustainable	Sustainable
	Gummy Shark	State-wide	-	Targeted	Long line	STATE	NA	NA	NA	NA
	School Shark	State-wide	-	Total	Long line	STATE	NA	NA	NA	NA

[6] Tiers are only assigned if average five-year annual commercial catches are greater than 5 *t,* otherwise listed as 'Negligible' (Smart et al. 2022b).

Table 3.2-3. Results of the assessment of the general (G) fishery performance indicators against their trigger reference points at the State-wide spatial scales for Secondary and Tertiary species in 2022/23 (see Table 1.5-1). Lower trigger reference point (LTRP) breaches are indicated in light blue and upper trigger reference point (UTRP) breaches are indicated in blue. - indicates that no trigger has been breached. ● indicates that the trigger for five consecutive decreases has been triggered. *Conf.* identifies confidential data which prevents a PI from being assessed. *NA* indicates species not assessed. Assessment of Snapper, King George Whiting, Garfish, Southern Calarmari, Yellowfin Whiting, and Blue Crab outlined under respective State-wide summaries.

SPECIES	EFFORT TYPE	GEAR TYPE	TOTAL CATCH				GEAR EFFORT				GEAR CPUE			
			3rd lowest/3rd highest	Greatest % interannual change	Greatest 3-year trend	5-year consecutive decrease	3rd lowest/3rd highest	Greatest % interannual change	Greatest 3-year trend	5-year consecutive decrease	3rd lowest/3rd highest	Greatest % interannual change	Greatest 3-year trend	5-year consecutive decrease
Western Aust. Salmon	Target	HN	-	-	-	-	-	-	-	-	-	-	-	-
Australian Herring	Target	HN	-	-	-	-	-	-	-	-	-	-	-	-
Whaler Sharks	Target	LL	-	-	-	-	UTRP	-	-	-	-	-	-	-
Snook	Target	HN	LTRP	UTRP	-	-	-	-	-	-	UTRP	-	UTRP	-
Sand Crab	Target	CN	-	-	-	-	-	-	-	-	UTRP	-	-	-
Yelloweye Mullet	Total	HN	LTRP	-	-	●	LTRP	-	-	●	-	-	-	-
Mulloway	Total	HL/SN	LTRP	LTRP	-	-	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*
Ocean Jacket	Target	FT	-	-	-	-	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*	*Conf.*
Bluethroat Wrasse	Total	HL	-	-	-	-	-	-	-	-	-	-	-	-
Silver Trevally	Total	HL	-	-	-	-	-	-	LTRP	-	-	-	-	-
Leatherjackets	Total	HN	LTRP	-	-	-	LTRP	-	-	-	-	-	-	-
Rays and Skates	Total	LL/HN	-	-	-	-	LTRP (HN)	-	-	-	-	LTRP (LL)	-	-
Cuttlefish	Total	SQ	-	-	-	-	-	-	-	-	-	-	-	-
Black Bream	Total	ANY	LTRP	-	-	-	LTRP	-	-	-	-	-	-	-
Gummy Shark	Target	LL	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
School Shark	Total	LL	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

3.3. Snapper

Snapper

Chrysophrys auratus

State-wide summary 2022/23

Last stock assessment - Drew et al. 2022

Stock status (Tier 1)

Spencer Gulf/West Coast Stock*	Gulf St Vincent Stock*	South East Fishing Zone (Western Victoria Stock)*
Depleted – fishery closed	Depleted – fishery closed	Sustainable

Fishery statistics (State-wide)

Commercial			Recreational sector			
Fishing Season	**Total catch** *t*	**Targeted effort** *Fisher-days*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	281	3,380	**2000/01**	275 (65)	26	74
2019/20	115	1,474	**2007/08**	175 (27)	25	75
2020/21	43	414	**2013/14**	332 (128)	48	52
2021/22	25	259	**2021/22**	11 (8)	9	91
2022/23	29	490	** Drew et al. 2022*			

Biology

Snapper (*Chrysophrys auratus*) is a large-bodied, demersal, marine fish species in the family Sparidae, broadly distributed throughout temperate and sub-tropical waters of the Indo-Pacific region. This includes a continuous distribution around the southern coastline of mainland Australia and northern Tasmania (Kailola et al., 1993; Last et al., 2011). Throughout its distribution, Snapper occurs across a diversity of habitats extending from shallow, coastal bays and estuaries to the edge of the continental shelf, and across a depth range of 1–200 *m*. It is a long-lived species, estimated to live up to 36 years in South Australia (SA) and up to 40 years in other parts of Australia (McGlennon et al., 2000; Norriss & Crisafulli, 2010).

Snapper is a multiple batch spawning species with indeterminate fecundity and asynchronous oocyte development (McGlennon, 2003; Saunders, 2009). In SA, Snapper has a protracted spawning period that extends from November to February, peaking in December and January (McGlennon, 2003; Saunders et al., 2012). Mature fish form dense aggregations prior to and during the spawning period and can spawn repeatedly over consecutive days (Scott et al., 1993). Juveniles initially remain in the vicinity of their nursery areas for several months after settlement and then transition to more complex habitats as they develop, reaching sexual maturity at 3–4 years of age and 250–350 *mm* fork length (Pecl et al., 2014).

Snapper populations in SA are characterised by distinct strong and weak age classes that are consistent amongst years, relating to inter-annual variation in recruitment of age 0+ juveniles and the resulting variation in year-class strength (McGlennon et al., 2000; Fowler & Jennings, 2003). The occasional strong year class sustains the fishery through periods of time that are characterised by poor to average recruitment (McGlennon et al., 2000; Fowler et al., 2017b).

Stock structure

The stock structure for Snapper in Australian waters is complex, as there are considerable differences in the spatial scales over which populations are divisible into separate stocks (Fowler, 2016; Fowler et al., 2017a). A recent study indicated that there are three stocks that occur in South Australian coastal waters (Fowler, 2016; Fowler et al., 2017a). The Western Victorian Stock (WVS) is a cross-jurisdictional stock that extends westward from Wilsons Promontory, Victoria into the south eastern waters of South Australia (SA) as far west as Cape

Jervis. There are also two sole South Australian stocks, i.e., the Spencer Gulf/West Coast Stock (SG/WCS) and Gulf St. Vincent Stock (GSVS; Fowler 2016, Fowler et al. 2017).

The recent study on the stock structure of Snapper was also informative about the demographic processes responsible for the replenishment of the three stocks. It indicated that each stock depends on recruitment into a primary nursery area: Port Phillip Bay (PPB), Victoria for the WVS; Northern Spencer Gulf (NSG) for the SG/WCS; and Northern Gulf St. Vincent (NGSV) for the GSVS (Fowler 2016).

Here, assessment of stock status is presented at the biological stock level – SG/WC stock, GSV stock, and the SEFZ (WVS).

Fishery description

Snapper is an iconic fishery resource in each mainland State of Australia (Kailola et al. 1993). Throughout the mid-2000s, SA was the dominant State-based contributor to the national total catches of both the commercial and recreational sectors (Fowler, 2016). SA's Snapper fishery is geographically extensive and encompasses most of the State's coastal marine waters from the far west coast of Eyre Peninsula to the SE region, although the highest abundances have generally been in Spencer Gulf (SG) or Gulf St. Vincent (GSV), which have consequently produced the highest fishery catches (Fowler et al., 2020b).

Snapper is a primary target species of the commercial and recreational sectors of SA (PIRSA, 2013). Licence holders from four different commercial fisheries have access to the fishery, i.e., the Marine Scalefish Fishery (MSF), the Northern Zone and Southern Zone Rock Lobster Fisheries (NZRLF, SZRLF) and the Lakes and Coorong Fishery (LCF; PIRSA 2013). The main gear types used to target Snapper by commercial fishers are handlines and longlines, since using haul nets to take Snapper was prohibited in 1993. For local recreational fishers and others from inter-state, Snapper has been an important species in SA's waters because of their desire to catch the large trophy fish. Such recreational fishers target Snapper using rods and lines, primarily from boats, although jetty and land-based catches do occur.

Since 2019, due to depletion of stocks in SG/WC and GSV/KI, the Snapper fishery in these zones has been closed to all sectors.

Assessment program

- Application of a fully integrated assessment model ('SnapEst') and production of a stock assessment report every two or three years (previous assessment see Drew et al. 2022).
- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Fishery-dependent sampling of length and age structures during fishery closures.
- Length and age structures of SEFZ from market (SAFCOL, Adelaide) samples.
- Fishery independent estimates of biomass estimated using the DEPM.
- Recreational catch estimates obtained through mandatory reporting in the SEFZ via the SA Fishing App and from State-wide surveys approximately every five years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing.
- The current harvest strategy for Snapper (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach (Table 3.3-1).

Catch and effort trends

- Estimates of total State-wide commercial catch have fluctuated over varying time scales. Since 2003/04, State-wide catch increased to a record level of 970.9 *t* in 2010/11, before declining to 280.7 *t* in 2018/19 (pre-gulfs closures; Figure 3.3-1a).
- In 2021/22 and 2022/23, total commercial catch declined to record low levels (25 and 29 *t* respectively) with all landings coming from the SEFZ Region, due to the fishery closures for SG/WCS and GSVS (Figure 3.3-1a).
- The recreational catch in the 2021/22 survey was 3 *t* from the SEFZ (Figure 3.3-1a).
- The GVP of the commercial catch in 2022/23 was $0.47M, 87% below the mean GVP since these data became available in 2003/04 (Figure 3.3-1a).
- Between 1983/84 and 2008/09, the majority of catch has been taken from SG/WC (mean ~85%, range 69–93%), followed by GSV/KI (~12%, range 6–25%), and SEFZ (~2%, range 0.4–15%; Figure 3.3-1b). However, from 2009/10 catch taken from GSV/KI (~66%, range 37–81%) and SEFZ (~9%, range 1–25%) increased, while catches from SG/WC steeply declined (~24%, range 13–38%) until the closure of the SG/WC and GSV/KI fisheries in 2019 (Figure 3.3-1b).
- Targeted fishing effort declined from a historic high of 10,496 *fisher-days* in 1983/84, before peaking again at 9,158 *fisher-days* in 2010/11, in line with the state-wide record catch (Figure 3.4-1c). The State-wide targeted effort in 2022/23 was the second lowest on record due to the closure of SG/WC and GSV/KI fisheries (Figure 3.3-1c).

- Since 2018/19, highest catches occurred in MFA 51 (5-year average annual catch, ~24 *t*) and MFA 44A (~18 *t*), although this may be influenced by the fishery closures (Figure 3.3-2).

Current management regulations

- A summary of key historical management changes for the Snapper fishery is provided in the 2022 stock assessment report (Drew et al., 2022).
- Fishery Closure – WCFZ, SGFZ, and GSV/KIFZ are closed to Snapper fishing to all sectors until 30 June 2026.
- SEFZ managed via Total Allowable Catch (TAC) consisting of a Total Allowable Commercial Catch (TACC) with Individual Transferable Quotas (ITQs) and Total Allowable Recreational Catch (TARC)
- LML of 380 *mm* TL applies to all sectors in the SEFZ only.
- Daily recreational limits in the SEFZ only: 2 for individuals and 6 for boats when three or more are onboard.

Performance indicators

Catch, targeted effort, targeted CPUE trends, fishable biomass, harvest fraction, egg production, recruitment, age structure.

Research & development needs

- Investigate alternative assessment model outputs for Snapper stocks using Stock Synthesis (this is planned to be undertaken upon completion of the Snapper Science Program).
- Various research themes within the State Government and FRDC-funded Snapper Science Program – see 'Snapper Hub' at pir.sa.gov.au/snapper-recovery for details.
- 'Quantifying post-release survival and movement of Snapper (*Chrysophrys auratus*): Informing strategies to engage the fishing community in practices to enhance the sustainability of an important multi-sector fishery' (FRDC Project 2019/044).
- 'Cost-effective, non-destructive solutions to developing a pre-recruit index for Snapper' (FRDC project 2019/046).
- CPUE standardisation.
- Application of the harvest strategy framework when finalised under the next management plan.
- Ongoing improvements and refinements to the reporting of recreational catch.

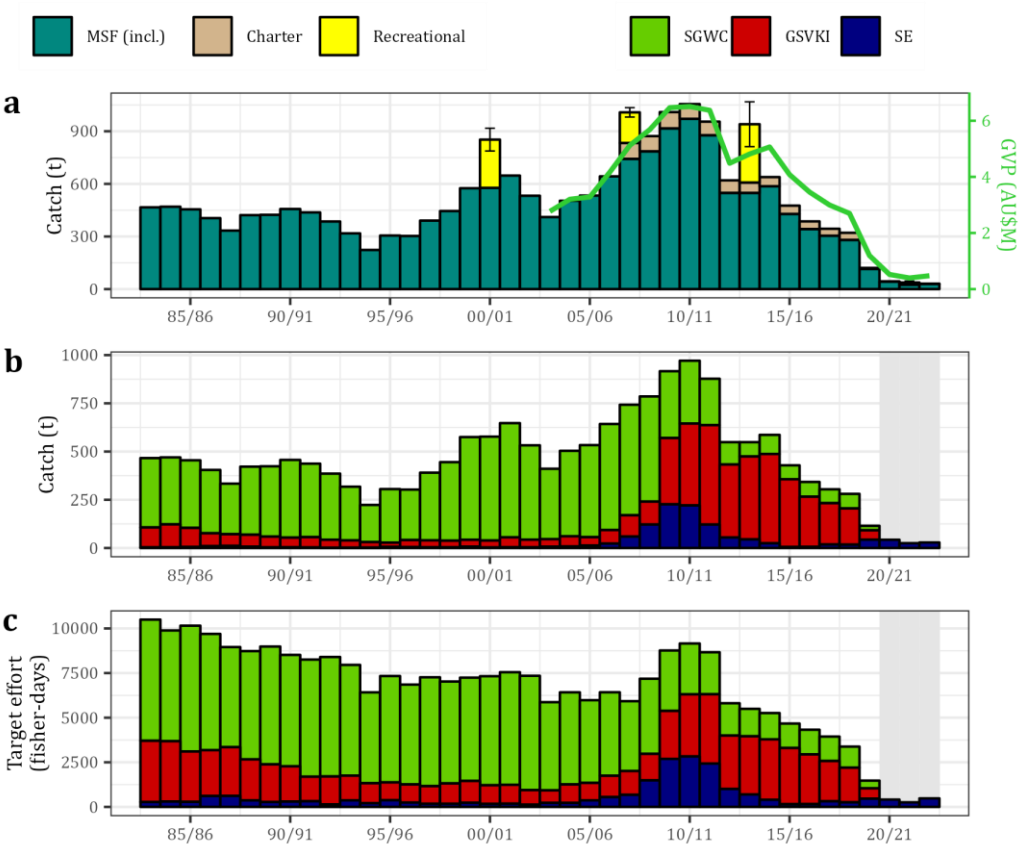


Figure 3.3-1. Fishery statistics for South Australia's Snapper Fishery. Long-term trends in annual estimates of: (a) total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP); (b) total commercial catch, by biological stock – Spencer Gulf/West Coast (SG/WC), Gulf St Vincent/Kangaroo Island (GSV/KI) and South East Fishing Zone (SEFZ); and (c) commercial effort targeting Snapper by Fishing Zone. Grey shading indicates years when data for one or more Fishing Zones are confidential.

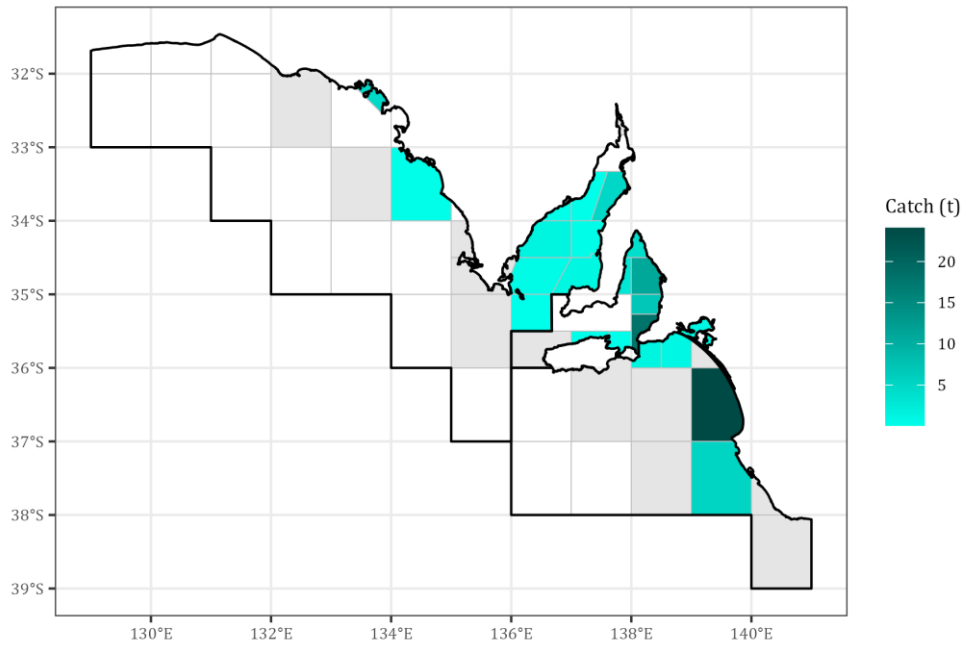


Figure 3.3-2. Spatial distribution of Snapper catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

Table 3.3-1. Results of the assessment of the general (G) fishery performance indicators against their trigger reference points at the regional spatial scales for Snapper in 2022/23 and assessment of the biological (B) fishery performance indicators from the previous stock assessment in 2022 (Drew et al., 2022)[7]. - indicates that no trigger has been breached. ● indicates that the trigger for five consecutive decreases has been triggered. - indicates trigger is not assessed. Stock/zone abbreviations: Spencer Gulf/West Coast (SG/WC), Gulf St Vincent (GSV), South East Fishing Zone (SEFZ).

PERFORMANCE INDICATOR	TYPE	TRIGGER REFERENCE POINT	SG/WC	GSV	SE
Total catch	G	3rd Lowest/3rd Highest	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-
	G	Greatest five-year trend	-	-	-
	G	Decrease over five consecutive years	-	-	-
Target handline effort	G	3rd Lowest/3rd Highest	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-
	G	Greatest five-year trend	-	-	-
	G	Decrease over five consecutive years	-	-	-
Target handline CPUE	G	3rd Lowest/3rd Highest	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-
	G	Greatest five-year trend	-	-	-
	G	Decrease over five consecutive years	-	-	-
Proportion of target HL catches exceeding 200 *kg* (prop200kgtarhl)	G	3rd Lowest/3rd Highest	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-
	G	Greatest five-year trend	-	-	-
	G	Decrease over five consecutive years	-	-	-
Target longline effort	G	3rd Lowest/3rd Highest	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-
	G	Greatest five-year trend	-	-	-
	G	Decrease over five consecutive years	-	-	-
Target longline CPUE	G	3rd Lowest/3rd Highest	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-
	G	Greatest five-year trend	-	-	-
	G	Decrease over five consecutive years	-	-	-
Proportion of target LL catches exceeding 200 *kg* (prop200kgtarll)	G	3rd Lowest/3rd Highest	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-
	G	Greatest five-year trend	-	-	-
	G	Decrease over five consecutive years	-	-	-
Fishable biomass	B	3-yr av. +/- 10% of previous 3-yr av.	-40%	-69%	27%
Harvest Fraction	B	above 32% (int. standard)	0%	0%	11%
Egg Production	B	< 20% of pristine population	2%	2%	6.5%
Recruitment	B	3-yr av. is +/- 10% of historical mean	-81%	-90%	-97%
	B	3-yr av. is +/- 10% of previous 6-yr av.	-28%	-78%	-98%
Age composition	B	Prop > 10 yrs < 20% of fished population	30%	35%	18.5%

[7] Stock assessment model ('SnapEst') outputs and figures available in Drew et al., (2022).

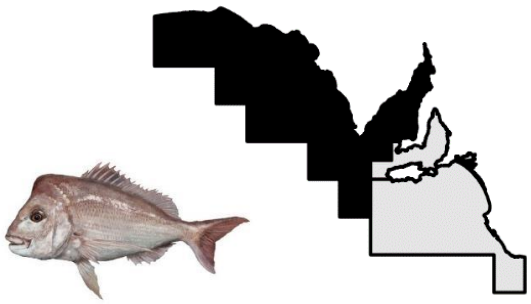
3.3.1. Spencer Gulf/West Coast Stock

Snapper

Chrysophrys auratus

Spencer Gulf/West Coast stock

2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Depleted – fishery closed	Depleted – fishery closed	Depleted – fishery closed

Commercial fishery statistics

Fishing season	Total catch *t*	HL			LL			TACC *t*
		Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/line-hour*	Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/hook*	
2018/19	76	571	59.7	9.4	609	50.7	0.1	-
2019/20	23	129	42.0	6.9	300	41.3	0.1	-
2020/21	**Depleted Stock – fishery closed**							
2021/22								
2022/23								

*HL–Handline, LL–Long line, CPUE-Catch per unit effort, TACC–Total allowable commercial catch. *Drew et al., 2022*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	257	68	-	0

Zonal catch, targeted effort and CPUE trends

Prior to the fishery closure in November 2019, annual catches from the SG/WCS varied cyclically (linked to strong recruitment events) for most of the period from 1983/84 to 2018/19, with peaks in 2001/02 (592 *t*) and 2007/08 (573 *t*; Figure 3.3-3a). From 2007/08 to 2013/14, annual catches decreased, and subsequently remained relatively stable at a low level. In 2017/18, the lowest catch (pre-closure) of 72 *t* was taken.

The highest targeted HL catch of 516 *t* was taken in 2001/02, which since decreased to the lowest on record in 2017/18 at 36 *t* (Figure 3.3-3a). Targeted HL effort increased from 1997/98 to 2002/03 when it was at its highest level of 5,227 *fisher-days* (Figure 3.3-3b). Since then, HL effort declined to the lowest level recorded at 571 *fisher-days* in 2018/19. Targeted HL CPUE has fluctuated, but showed a long-term increasing trend to 2011/12, with a peak at 132.6 *kg/fisher-day* in 2007/08, before declining to 59.8 *kg/fisher-day* in 2018/19 (Figure 3.3-3c). Handline CPUE by *kg/line-hour* reflects the trend of CPUE by *fisher-day*, peaking at 19.6 *kg/line-hour* in 2007/08 (Figure 3.3-3c).

From 1983/84 to 2003/04, targeted LL catch for the SG/WC stock was relatively stable before it increased and peaked at 178 *t* in 2005/06 (Figure 3.3-3a). Catch declined thereafter and, by 2018/19 had fallen to 33 *t*. Targeted LL effort peaked at 2,441 *fisher-days* in 1996/97, but then declined to 609 *fisher-days* in 2018/19 (Figure 3.3-3b). Highest targeted LL CPUE occurred between 2005/06 and 2008/09, peaking at 97.3 *kg/fisher-day* in 2005/06 (Figure 3.3-3d). After 2008/09, it decreased and then stabilised and was 50.7 *kg/fisher-day* in 2018/19. The LL CPUE by *kg/hook* reflected similar trends as *kg/fisher-day* from 2003/04 to 2011/12, subsequently increasing to its peak of 0.17 *kg/hook* in 2016/17 (Figure 3.3-3d).

The numbers of licence holders who targeted and caught Snapper using HL have declined slowly since 1983/84 until the closure of the fishery in November 2019 (Figure 3.3-3e). Those taking Snapper using HL fell from 220 in 1983/84 to 101 in 2018/19, while those targeting Snapper fell from 178 to 64 over the same period (Figure 3.3-3e). Since 1988/89, the number of licence holders taking Snapper with LL fell from 128 to 55 while those targeting Snapper fell from 111 to 45 (Figure 3.3-3e). Decline in monthly catch during November reflects the seasonal closure on Snapper (Figure 3.3-3f).

Between 2003/04 and 2011/12, the number of reported daily HL catches (between February and October) declined and from 2012/13 to 2018/19 were relatively stable but low (i.e., generally < 500 catches/year; Figure 3.3-3g). Estimates of the proportion of targeted handline catches over 200 *kg* (Prop200kgTarHL) ranged from 0.14 to 0.38 but showed no long-term trend (Figure 3.3-3g). The numbers of reported daily LL catches fell between 2008/09 and 2012/13 and have subsequently remained at the relatively low level of < 500 catches/year (Figure 3.3-3h). The annual estimates of the proportion of targeted longline catches over 200 *kg* (Prop200kgTarLL) peaked at 0.28 in 2007/08, prior to daily catches being constrained by trip limits (Figure 3.3-3h). They then declined to ~0.1 in 2010/11 and have since remained around this low level (Figure 3.3-3h).

Triggered performance Indicators

Biological (includes 'SnapEst' model outputs and age composition for 2021/22, presented in 2022 stock assessment report; Table 3.3-1, Drew et al., 2022).

- Fishable biomass – 3-year average ±10% of long-term average (-40% - stable).
- Egg production - < 20% of pristine population (2% - stable)
- Recruitment – 3-year average ±10% of long-term average (-81% - stable).
- Age composition – proportion of 10+ years of age < 20% of fished population (30%)
- Harvest fraction – above 32% (0% due to closure of the fishery)

General (includes total catch, target handline effort and CPUE, target long line effort and CPUE for 2022/23).

- No data available due to fishery closure.

Stock assessment summary

The latest stock assessment report (Drew et al., 2022) provides 'SnapEst' model outputs (estimates of fishable biomass, harvest fraction and recruitment) using information up to 2021/22 (inclusive; see biological performance indicators above). In that assessment the stock was classified as 'depleted'.

A closure was implemented for this stock in November 2019, and no evidence of improvements in biomass or recruitment were identified in the 2022 stock assessment. As a result, this stock retained its depleted status, and the closure was extended from February 2023 through to June 2026.

The above evidence indicates that the biomass of this stock is likely to be depleted and recruitment is likely impaired. The above evidence indicates that the current fishing mortality is constrained by management to a level that should allow the stock to recover from its recruitment impaired state; however, measurable improvements are yet to be detected. On this basis, the SG/WC Snapper stock is classified as a **depleted** stock.

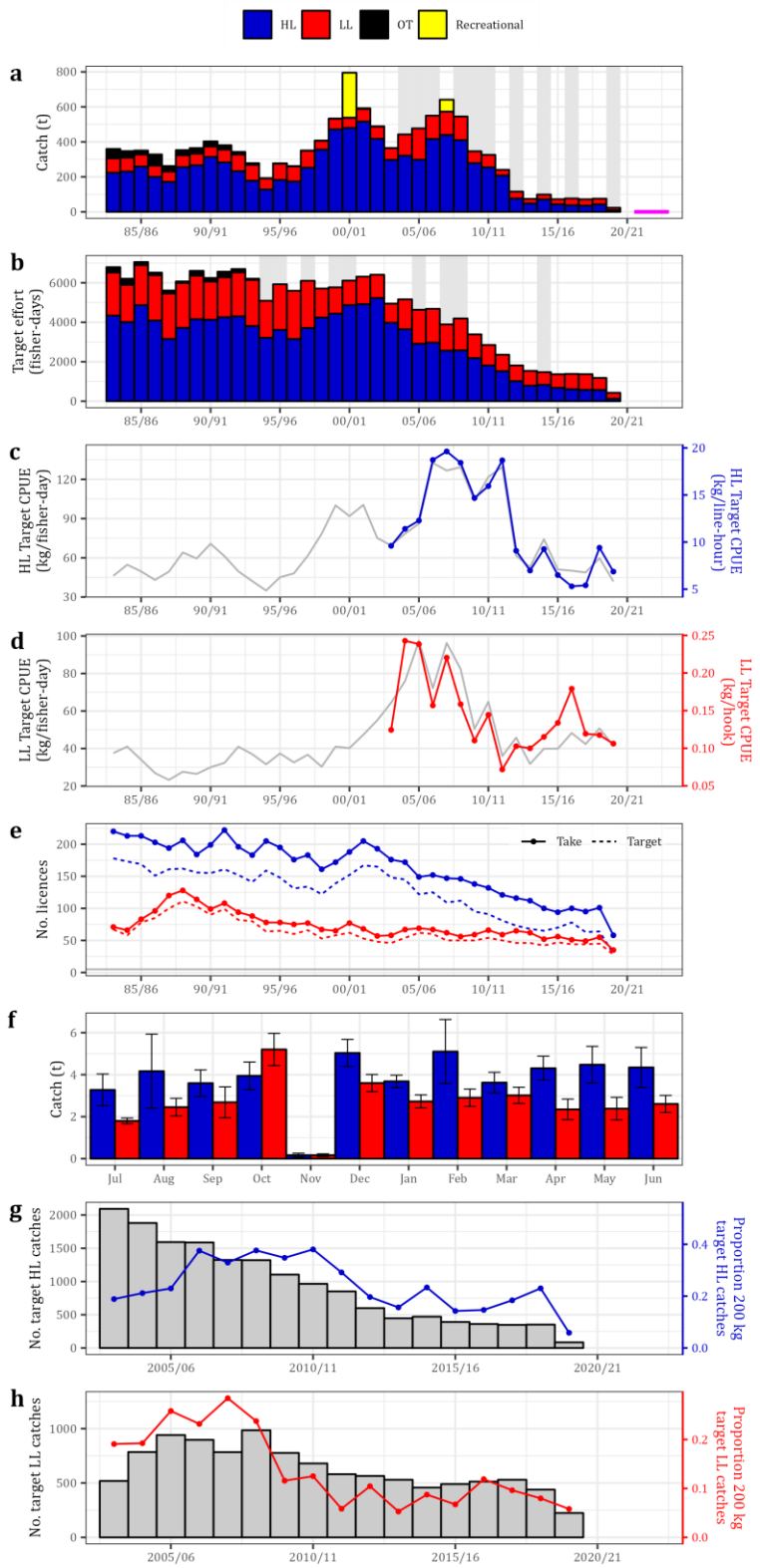


Figure 3.3-3. Key commercial fishery statistics for Snapper in the Spencer Gulf/West Coast biological stock, divisible into key gear categories – handline (HL), long line (LL) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HL catch per unit targeted effort; (d) LL catch per unit targeted effort; (e) number of licences that take and target Snapper; (f) average catch by month (error bars = Standard Error) for 2013/14–2022/23; (g) Number of daily HL catches and proportion of HL catches over 200 kg ; and (h) Number of daily LL catches and proportion of LL catches over 200 kg. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

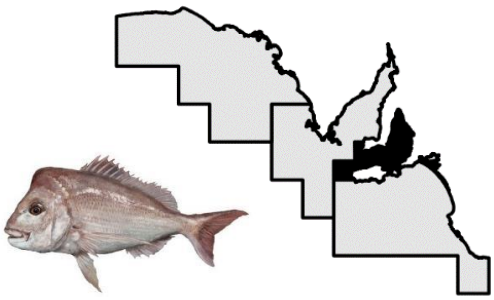
3.3.2. Gulf St Vincent Stock

Snapper

Chrysophrys auratus

Gulf St Vincent stock

2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Depleted – fishery closed	Depleted – fishery closed	Depleted – fishery closed

Commercial fishery statistics

Fishing season	Total catch *t*	HL			LL			TACC *t*
		Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/line-hour*	Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/hook*	
2018/19	188	452	41.4	6.5	1,491	104.7	0.4	-
2019/20	48	130	32.9	8.3	453	95.7	0.6	-
2020/21	**Depleted Stock – fishery closed**							
2021/22								
2022/23								

*HL – Handline, LL – Long line, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Drew et al., 2022*

Recreational catch**

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	22	66	-	0

Zonal catch, targeted effort and CPUE trends

As a result of the closure for this stock in November 2019, there are no fishing statistics available since the 2020/21 fishing season (Figure 3.3-4). Between 1983/84 and 2005/06, the GSV stock produced relatively low catches (Figure 3.3-4a). However, from 2006/07, total commercial catch increased exponentially, culminating in the record catch of 515 *t* in 2011/12. Total catch then decreased between 2011/12 and 2015/16, after which the rate of decline increased until the fishery closure (Figure 3.3-4a).

Targeted HL catch has generally been low for this stock despite the high effort levels during the early 1980s (Figure 3.3-4b). Targeted effort declined to a low level in 1994/95 and has since remained low but has varied cyclically. Estimates of annual targeted HL CPUE (*kg/fisher-day*) were low until 2001/02, before they increased to the highest levels between 2006/07 and 2013/14 (Figure 3.3-4c). Handline CPUE has subsequently decreased to a moderate level, with 32.9 *kg/fisher-day* recorded in 2019/20 while HL CPUE by *kg/line-hour* increased to 8.3 from 6.5 in 2018/19.

The LL fishery for the GSV stock largely accounted for the rapid increase in total catches from 2008/09 – 2010/11 (Figure 3.3-4a). Between 2008/09 and 2014/15, targeted LL catch increased from 80 *t* to 446 *t* (Figure 3.3-4a). This increase was associated with a 282% increase in targeted longline fishing effort from 792 to 3,027 *fisher-days* (Figure 3.3-4). Between 2007/08 and 2014/15, LL CPUE increased considerably, peaking at 145.2 *kg/fisher-day* (Figure 3.3-4d). From 2015/16, LL CPUE declined, reaching 104.7 *kg/fisher-day* in 2018/19. Catch per unit of effort of *kg/hook* varied annually since 2003/04 and diverged away from the period of highest recorded values of LL CPUE between 2010/11 and 2013/14 (Figure 3.3-4d).

The number of licences using handlines that reported taking Snapper declined from 93 in 1984/85 to 52 in 2018/19 (Figure 3.3-4e). Similarly, the number that targeted Snapper reduced from 87 to 45 (Figure 3.3-4e). The number of LL licences that took and targeted Snapper peaked in 2011/12 at 73 and 69, respectively, but since declined to 32 and 31 in 2018/19 (Figure 3.3-4e). The average monthly catch using HL and LL shows a minor increase during December and January for both gear types (Figure 3.3-4f), otherwise no seasonal trends in monthly catch are apparent.

The number of reported daily handline catches have generally been < 300/year since 2012/13 (Figure 3.3-4g). The estimates of the proportion of targeted handline catches over 200 *kg* (Prop200kgTarHL) peaked at 0.23 in 2007/08, but since 2014/15 have been low at < 0.1 (Figure 3.3-4g). The number of daily longline catches increased from 2008/09, peaked in 2011/12 at 1,953 catches and then declined between 2015/16 and 2018/19 to 830 catches (Figure 3.3-4h). The proportion of targeted longline catches over 200 *kg* (Prop200kgTarLL) was low from 2003/04 to 2007/08 (<0.2) but then increased up to 0.58 in 2014/15. Since then, there has been a general decline to 0.46 in 2018/19.

Triggered performance Indicators

Biological (includes 'SnapEst' model outputs and age composition for 2021/22, presented in 2022 stock assessment report; Table 3.3-1, Drew et al., 2022).

- Fishable biomass – 3-year average ±10% of long-term average (-69% - stable).
- Egg production - < 20% of pristine population (2% - stable)
- Recruitment – 3-year average ±10% of long-term average (-90% - stable).
- Age composition – proportion of 10+ years of age < 20% of fished population (35%)
- Harvest fraction – above 32% (0% due to closure of the fishery)

General (includes total catch, target handline effort and CPUE, target long line effort and CPUE for 2022/23).

- No data available due to fishery closure.

Stock assessment summary

The latest stock assessment report (Drew et al., 2022) provides 'SnapEst' model outputs (estimates of fishable biomass, harvest fraction, recruitment, and age composition) using information up to 2021/22 (inclusive; see biological performance indicators above). In that assessment the stock was classified as 'depleted'.

A closure was initially implemented for this stock from November 2019 through to February 2023. In 2020, the status of the GSVS was changed from 'depleting' to depleted (Fowler et al., 2020b). This reflected the declines in estimates of spawning biomass, model estimated fishable biomass, poor recruitment since 2009 and persistent high targeted catch and effort. No evidence of improvements in biomass or recruitment were identified in the 2022 stock assessment and as a result this stock retained its depleted status, and the total fishing closure was extended from February 2023 through to June 2026.

The above evidence indicates that the biomass of this stock is likely to be depleted and recruitment is likely impaired. The above evidence indicates that the current fishing mortality is constrained by management to a level that should allow the stock to recover from its recruitment impaired state; however, measurable improvements are yet to be detected. On this basis, the GSV/KI Snapper stock is classified as a **depleted** stock.

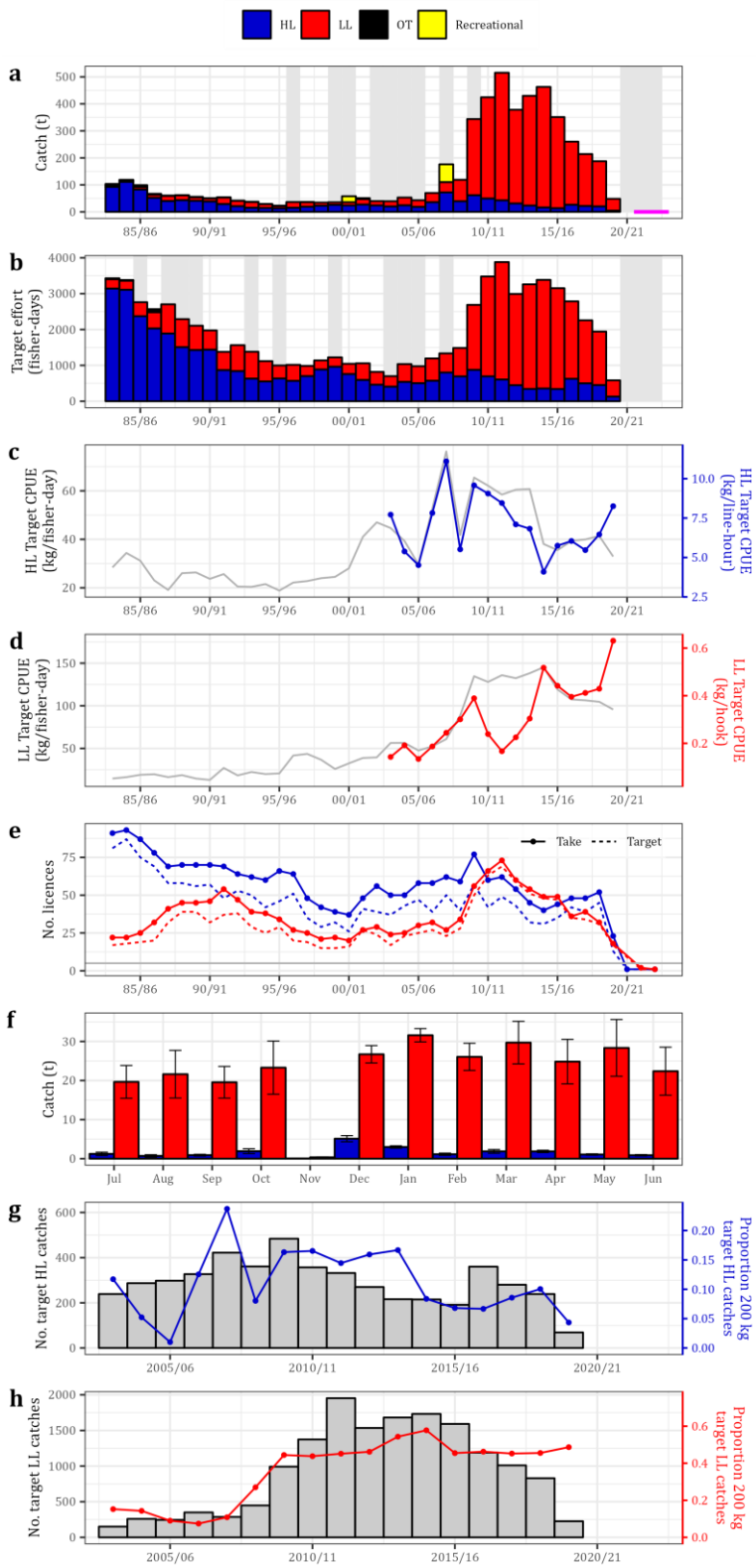


Figure 3.3-4. Key commercial fishery statistics for Snapper in the Gulf St Vincent stock, divisible into key gear categories – handline (HL), long line (LL) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HL catch per unit targeted effort; (d) LL catch per unit targeted effort; (e) number of licences that take and target Snapper; (f) average catch by month (error bars = Standard Error) for 2013/14–2022/23; (g) Number of daily HL catches and proportion of HL catches over 200 *kg* ; and (h) Number of daily LL catches and proportion of LL catches over 200 *kg*. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

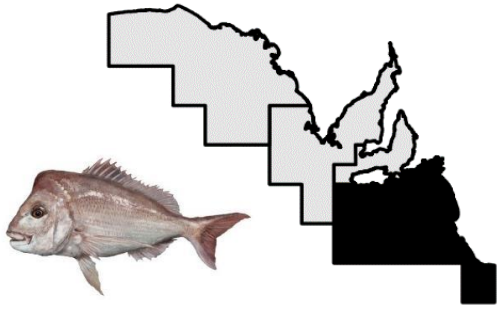
3.3.3. South East Fishing Zone (Western Victoria Stock)

Snapper

Chrysophrys auratus

South East Fishing Zone (WV stock)

2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	HL			LL			TACC / TARC *t*
		Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/line-hour*	Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/hook*	
2018/19	18	26	41.9	1.7	231	70.5	0.18	-
2019/20	43	4	4.8	2.4	458	87.6	0.17	-
2020/21	43	11	21.7	3.3	401	101.8	0.18	-
2021/22	25	11	14.8	1.9	247	100.9	0.19	36 / 12
2022/23	29	28	13.7	2.4	451	62.4	0.20	36 / 12

*HL – Handline, LL – Long line, CPUE - Catch per unit effort, TACC – Total allowable commercial catch, TARC – total allowable recreational catch. * Drew et al., 2022*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	18	19	-	8

Zonal catch, targeted effort and CPUE trends

The total catch of Snapper in the SEFZ was 29 *t* in 2022/23, constituting 80% of the TACC (Figure 3.3-5a). The SE Region has generally produced low catches of Snapper compared to the other stocks. However, from 2006/07 to 2010/11 there was an exponential increase in catch that peaked in 2009/10 at 226 *t* (Figure 3.3-5a). Catch then declined sharply to 5.2 *t* in 2015/16 before moderately increasing to 43.3 *t* in 2019/20.

Targeted HL catch in the SE Region has always been low, with a mean annual catch of ~3 *t* (Figure 3.3-5a). Catch increased between 2005/06 and 2009/10, peaking in 2007/08 at 14.03 *t* (Figure 3.3-5a). These catches reflect low but variable fishing effort, which peaked at 365 *fisher-days* in 2006/07 (Figure 3.3-5b). Until 2002/03, targeted HL CPUE was generally < 20 *kg/fisher-day* (Figure 3.3-5c). It increased to its highest levels from 2007/08 to 2008/09, peaking at 56.2 *kg/fisher-day* in 2007/08 (Figure 3.3-5c). Up to 2005/06, annual targeted LL catches were generally < 5 *t* (Figure 3.3-5a). There was then a rapid increase to the highest recorded catch of 218 *t* in 2009/10 (Figure 3.3-5a). Longline catches then declined to 6 *t* in 2016/17, but recently increased back up to 43 *t* in both 2019/20 and 2020/21. In 2022/23, catch was reduced back to 29 *t*, which was constrained by TACC.

There was a considerable increase in targeted LL effort from 64 *fisher-days* in 2002/03 to its peak at 2,676 *fisher-days* in 2010/11 (Figure 3.3-5). Effort subsequently declined to 121 *fisher-days* in 2015/16 but increased to 451 *fisher-days* in 2022/23 (Figure 3.3-5b). Targeted LL CPUE in *fisher-days* increased between 2005/06 and 2009/10, reaching 85.4 *kg/fisher-day* in 2009/10 (Figure 3.3-5d). Targeted LL CPUE of *kg/hook* peaked in 2004/05 at 0.29

kg/hook as effort was the lowest recorded (3,376 hooks set) since 2003/04 (Figure 3.3-5d). Since 2017/18, it has plateaued at ~0.17 *kg/hook*, and diverged from the CPUE values for *kg/fisher-day*.

The numbers of HL licences that took and targeted Snapper peaked in 1986/87, at 19 and 15, respectively (Figure 3.3-5e) before declining to < 5 fishers targeting Snapper from 2012/13 (except for 2018/19, n = 8). The numbers of LL fishers who took Snapper reached 41 in 2010/11 and the number of fishers that targeted Snapper peaked at 29 in 2009/10. Subsequently both have declined to 8 and 6, respectively, in 2022/23 as the commercial harvesting of Snapper is now controlled by ITQs (Figure 3.3-5e). Highest average monthly catch for LL gear type was between February and March before declining towards winter (Figure 3.3-5f).

The proportion of targeted handline catches over 200 *kg* (Prop200kgTarHL) was highest from 2005/06 to 2008/09, but in most years has either been close to or zero (Figure 3.3-5g). The proportion of targeted longline catches over 200 *kg* (Prop200kgTarLL) peaked in 2009/10 at 0.32 and then declined to 0.1 in 2016/17 (Figure 3.3-5h). From 2017, it increased reaching its highest level of 0.5 in 2019/20 and 2020/21, then declined to 0.26 in 2022/23.

Triggered performance Indicators

Biological (includes 'SnapEst' model outputs and age composition for 2021/22, presented in 2022 stock assessment report; Table 3.3-1, Drew et al., 2022).

- Fishable biomass – 3-year average ±10% of long-term average (+27% - stable).
- Egg production - < 20% of pristine population (6.5% - stable)
- Recruitment – 3-year average ±10% of long-term average (-97% - stable).
- Age composition – proportion of 10+ years of age < 20% of fished population (18.5%)
- Harvest fraction – Above 32% (11% - declining)

General (includes total catch, target handline effort and CPUE, target long line effort and CPUE for 2022/23; Table 3.3-1).

- None triggered.

Stock assessment summary

The latest stock assessment report (Drew et al., 2022) provides 'SnapEst' model outputs (estimates of fishable biomass, harvest fraction and recruitment) using information up to 2021/22 (inclusive; see biological performance indicators above). In that assessment the stock was classified as 'sustainable'.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above); however, stock status is determined by the Victorian Fisheries Authority since the SE regional population represents the western extremity of the cross-jurisdictional Western Victorian Stock (WVS). This population is primarily sustained through the emigration of fish from the main nursery area, which is located in Port Phillip Bay (PPB), Victoria (Fowler, 2016; Fowler et al., 2017a). In 2016 (Hamer & Conron, 2016), 2018 (Stewardson et al., 2018) and 2021 (Piddocke et al., 2021), the WVS was classified as 'sustainable'. The annual 0+ recruitment survey showed that over the 30 years to 2022, there had been eight years for which recruitment was above the long-term average. Furthermore, the 2018-year class was the largest yet recorded and the 2022-year class the third highest on record (Drew et al., 2022).

The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Snapper in the SEFZ is classified as a **sustainable** stock.

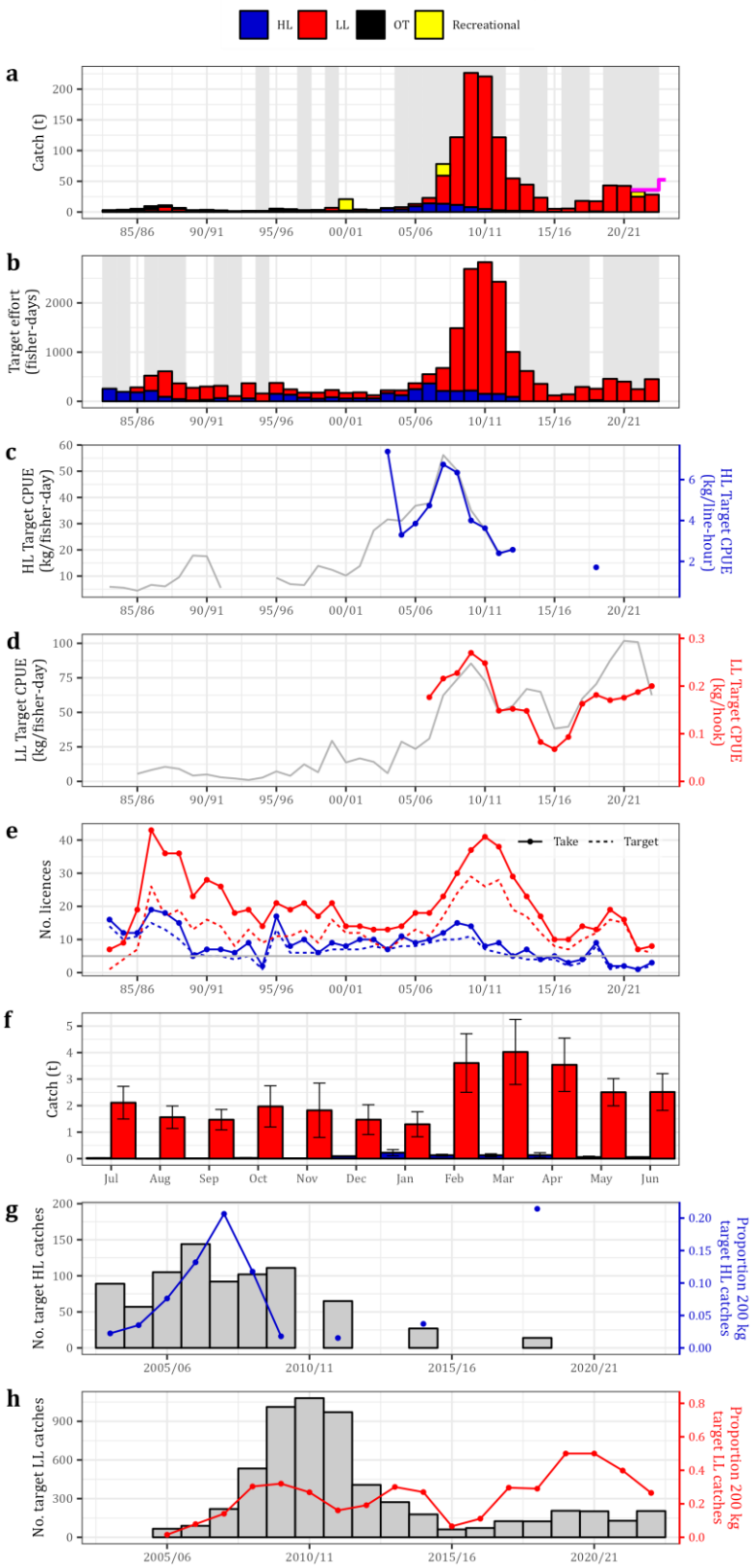


Figure 3.3-5. Key commercial fishery statistics for Snapper in the South East Fishing Zone, divisible into key gear categories – handline (HL), long line (LL) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HL catch per unit targeted effort; (d) LL catch per unit targeted effort; (e) number of licences that take and target Snapper; (f) average catch by month (error bars = standard error) for 2013/14–2022/23; (g) Number of daily HL catches and proportion of HL catches over 200 *kg* ; and (h) Number of daily LL catches and proportion of LL catches over 200 *kg*. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

3.4. King George Whiting

King George Whiting

Sillaginodes punctatus

State-wide summary 2022/23

Last stock assessment - Smart et al., 2023

Stock status (Tier 1)			Stock status (Negligible)
West Coast Fishing Zone*	**Spencer Gulf Fishing Zone***	**Gulf St Vincent/ Kangaroo Island Fishing Zone***	**South East Fishing Zone***
Sustainable	Sustainable	Sustainable	Negligible

Fishery statistics (State-wide)

Commercial			Recreational sector			
Fishing Season	**Total catch** *t*	**Targeted effort** *Fisher-days*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	234	10,162	**2000/01**	559 (73)	73	27
2019/20	234	10,337	**2007/08**	325 (34)	70	30
2020/21	181	7,691	**2013/14**	367 (63)	73	27
2021/22	176	7,379	**2021/22**	305 (37)	62	38
2022/23	192	7,294	** Smart et al., 2023*			

Biology

King George Whiting (*Sillaginodes punctatus*) is the largest species of the family Sillaginidae and occurs in coastal and shelf waters, distributed around the southern coastline from Sydney, NSW, to Perth, WA (Kailola et al., 1993). It has a complex life history that involves ontogenetic changes in habitats linked by movement at different life history stages (Fowler & Jones, 2008). In SA, spawning occurs during autumn and early winter on offshore reefs, shoals, and mounds in relatively deep water in exposed localities that experience medium/high wave energy (Fowler et al., 2000a; Fowler et al., 2000b; Fowler et al., 2002).

The eggs and larvae are advected throughout a prolonged pre-settlement duration to nursery areas in shallow, protected bays (Fowler & Short, 1996; Fowler et al., 2000b), while juvenile fish develop in the vicinity of these nursery areas. At ~3 years of age, those in the northern gulfs undertake significant movement southwards, whilst those in coastal bays move offshore, ultimately replenishing the populations of older fish on the spawning grounds (Fowler et al., 2000b; Fowler et al., 2002). This movement results in a significant ontogenetic shift from relatively protected shallow waters that support extensive meadows of seagrass to more exposed, deeper water and reef habitat. As a consequence, population size and age structures of King George Whiting vary geographically (Fowler et al., 2000a).

Stock structure

The stock structure for King George Whiting throughout its range in southern Australia remains unresolved due to uncertainty about the connectivity amongst regional populations and the lack of clear phylogeographic genetic structure (Haigh & Donnellan, 2000). A recent genetic study indicated that the SA and Victorian populations were genetically similar, but were distinct from those in Western Australia and also in Tasmania (Jenkins et al., 2016). This is consistent with the results from hydrodynamic modelling and otolith chemistry analyses which indicate that the Victorian populations may be replenished from SA, through the eastward advection of eggs and larvae (Jenkins et al., 2000; Jenkins et al., 2016; Drew et al., 2020; Rogers et al., 2020). There is therefore evidence of a single, panmictic stock existing where spawning from one region can contribute to the recruitment in another (Rogers et al., 2020).

For stock assessment and management purposes three stocks are recognised based largely on the locations of and connectivity between nursery areas and spawning grounds (Fowler et al., 2000b; Drew et al., 2021). Here, assessment of stock status is presented at the Fishing Zone stock level – WCFZ, SGFZ, GSV/KIFZ, and SEFZ.

Fishery description

King George Whiting is heavily targeted by both the commercial and recreational sectors (Drew et al., 2021). Several life history stages are targeted: young, immature adults in the northern gulfs; the immature fish as they travel southwards; and mature adults on the spawning grounds. As such, during their ontogenetic development, the fish run the gauntlet of fishing lines and nets that are used to target them in different habitats.

Based on historic access, three different commercial fisheries have a formal allocation to SA's King George Whiting stocks - the MSF, NZRLF and SZRLF (PIRSA 2013). Historically, this species was the most valuable for the commercial sector, but since 2007/08 its total value fell below that of Snapper and more recently below that of Southern Calamari. Nevertheless, King George Whiting often have the highest market price of any species, although this depends on supply and other market conditions. The main gear types used in the commercial fishery to target King George Whiting are handlines, haul nets and set nets. For the recreational sector, this is an iconic species that is heavily targeted with hook and line, principally from boats.

Assessment program

- Application of a fully integrated assessment model ('WhitEst') and production of a stock assessment report every two or three years (previous assessment see Smart et al., 2023).
- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Length and age structures from market (SAFCOL, Adelaide) and industry (regional) samples.
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for King George Whiting (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach (Table 3.4-1).

Catch and effort trends

- Total annual State-wide commercial catch peaked at 750 *t* in 1991/92 and has since progressively declined to a historic low of 176 *t* in 2021/22, increasing to 192 *t* in 2022/23 (Figure 3.4-1a).
- The 2022/23 fishing season is the third lowest total catch on record, and the eighth consecutive year below 300 *t* (Figure 3.4-1a). The recreational catch in the 2021/22 survey was 305 *t* (37 S.E.; Figure 3.4-1a).
- The GVP of the commercial catch in 2022/23 was $4M, 8.5% below the mean GVP since these data became available in 2003/04 (Figure 3.4-1a).
- Since 1983/84, the majority of catch has been taken from the SGFZ (~45%, range 36–57%), followed by the WCFZ (~36%, range 25–46%), and GSV/KIFZ (~19%, range 14–24%; Figure 3.4-1b).
- Targeted effort has steadily declined by 84% from 46,052 *fisher-days* in 1983/84 to 7,294 *fisher-days* in 2022/23 (Figure 3.4-1c). The State-wide targeted effort in 2022/23 is a historic low, and the third consecutive year below 10,000 *fisher-days*.
- Since 2018/19, highest catches occurred in MFA 42 for GSV/KI (5-year average annual catch, ~13 *t*), MFA 30 (~18 *t*) and 33 (~26 *t*) for SG, and MFA 9 for WC (~48 *t*; Figure 3.4-2).

Current management regulations

- A summary of key historical management changes for the King George Whiting fishery is provided in the 2023 stock assessment report (Smart et al., 2023).
- LML of 320 *mm* TL applies to all sectors East of longitude 136° E, 300 *mm* TL west of longitude 136° E.
- WC, SG and GSV/KI managed via Total Allowable Commercial Catches (TACCs) and Individual Transferable Quotas (ITQs) in SG and GSV/KI.
- Daily recreational limits: 10 for individuals and 30 for boats when 3 or more are onboard.

Tier 1 performance indicators	Negligible performance indicators
Catch, targeted effort, targeted CPUE trends, fishable biomass, harvest fraction, egg production, recruitment, age structure.	Catch, targeted effort, targeted CPUE trends.

Research & development needs
• Investigate alternative assessment model outputs for King George Whiting stocks using Stock Synthesis. • Supplement market sampling with industry-direct sampling in the regions to obtain more representative samples (commenced in 2023/24). • CPUE standardisation. • Application of the harvest strategy framework when finalised under the next management plan. • More regular and reliable estimates of recreational catch.

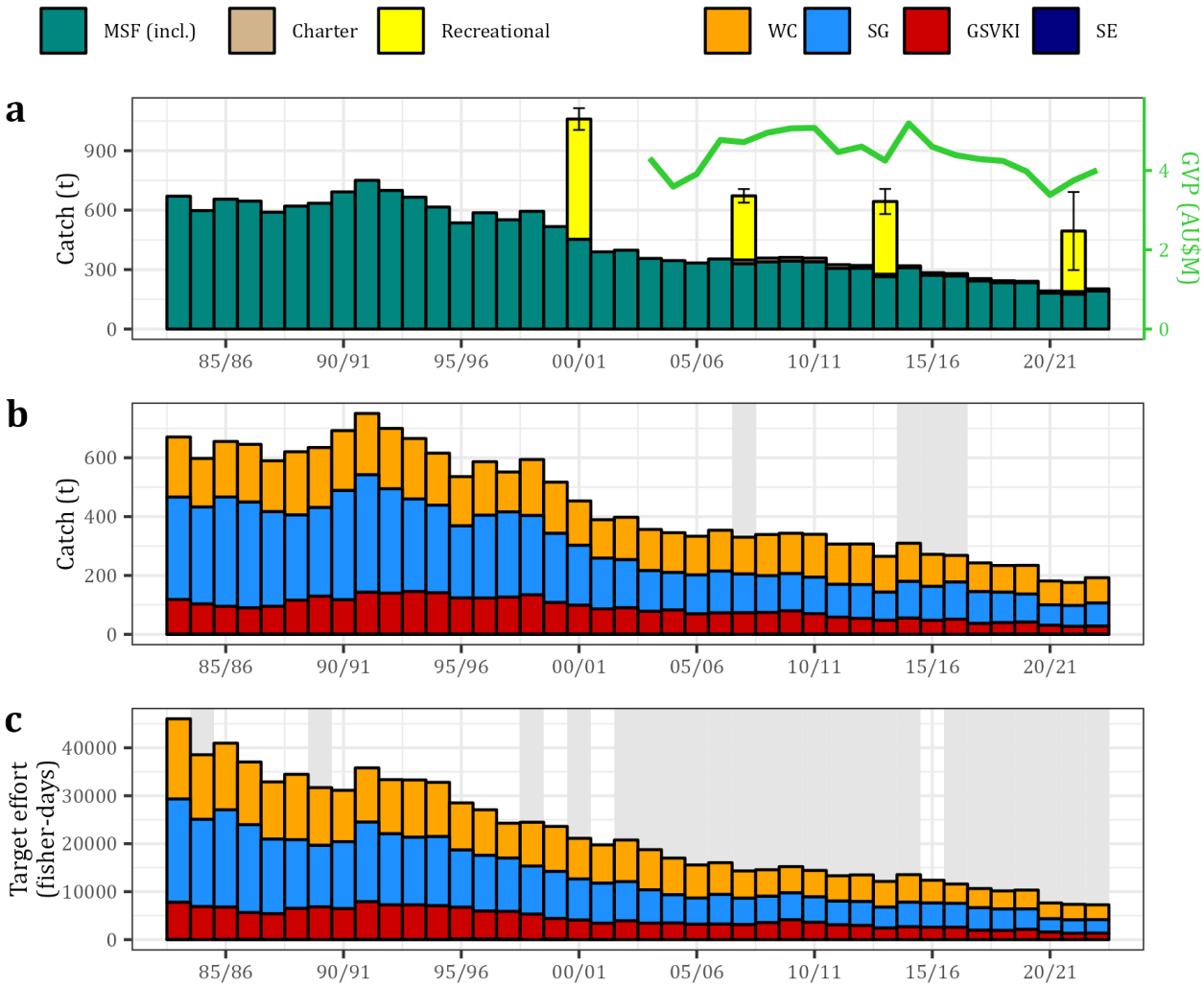


Figure 3.4-1. Fishery statistics for South Australia's King George Whiting Fishery. Long-term trends in annual estimates of: (a) total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP); (b) total commercial catch, by Fishing Zone – West Coast (WC), Spencer Gulf (SG), Gulf St Vincent/Kangaroo Island (GSV/KI) and South East (SE); and (c) commercial effort targeting King George Whiting, by Fishing Zone. Grey shading indicates years when data for one or more Fishing Zones are confidential.

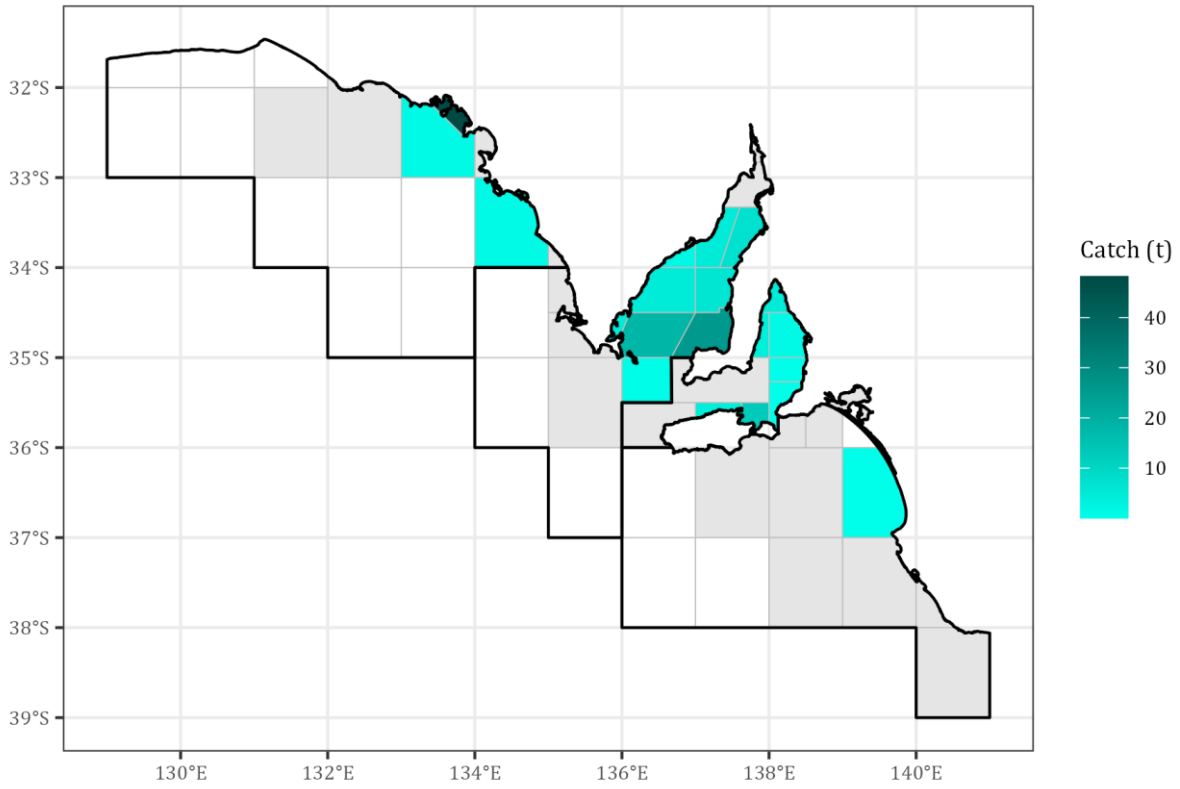


Figure 3.4-2. Spatial distribution of King George Whiting catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

Table 3.4-1. Results of the assessment of the general (G) fishery performance indicators against their trigger reference points at the regional spatial scales for King George Whiting in 2022/23 and assessment of the biological (B) fishery performance indicators from the previous stock assessment in 2023 (Smart et al., 2023)[8]. Lower trigger reference point (LTRP) breaches are indicated in light blue and upper trigger reference point (UTRP) breaches are indicated in blue. - indicates that no trigger has been breached. ● indicates that the trigger for five consecutive decreases has been triggered. - indicates trigger is not assessed. Stock/zone abbreviations: West Coast (WC), Spencer Gulf (SG), Gulf St Vincent/Kangaroo Island (GSV/KI).

PERFORMANCE INDICATOR	TYPE	TRIGGER REFERENCE POINT	WC	SG	GSV/KI
Total catch	G	3rd Lowest/3rd Highest	LTRP	LTRP	LTRP
	G	Greatest % interannual change (+/)	-	-	-
	G	Greatest 5-year trend	-	-	-
	G	Decrease over 5 consecutive years	-	-	-
Target handline effort	G	3rd Lowest/3rd Highest	LTRP	LTRP	LTRP
	G	Greatest % interannual change (+/)	-	-	-
	G	Greatest 5-year trend	-	-	-
	G	Decrease over 5 consecutive years	-	-	-
Target handline CPUE	G	3rd Lowest/3rd Highest	UTRP	UTRP	UTRP
	G	Greatest % interannual change (+/)	-	-	-
	G	Greatest 5-year trend	-	-	-
	G	Decrease over 5 consecutive years	-	-	-
Biomass > 280 *mm* (TL)	B	3-year average is +/- 10% of previous years (1983/84 – 2018/19)	32%	-6%	19%
Fishable biomass	B	3-year average is +/- 10% of previous years (1983/84 – 2018/19)	27%	-11%	8%
Harvest fraction	B	> 28%	5.4%	23.3%	17.6%
Recruitment	B	+/- 10% of average of previous 5 years (2013/14 – 2017/18)	-6.3%	-21.6%	-1.8%
Age composition	B	Change in long term or previous 5 years (2016/17 – 2020/21)	-	-	-

[8] Stock assessment model ('WhitEst') outputs and figures available in Smart et al., (2023).

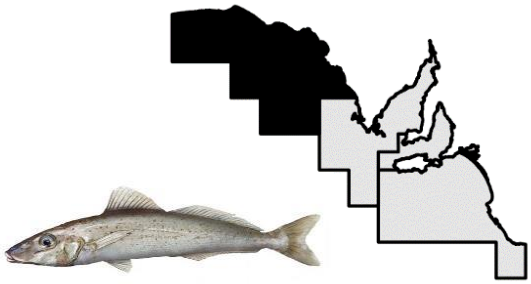
3.4.1. West Coast Fishing Zone

King George Whiting

Sillaginodes punctatus

West Coast Fishing Zone

2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	Target effort *Fisher-days*	Target HL CPUE *kg/fisher-day*	Target HL CPUE *kg/line-hour*	TACC *t*
2018/19	91	3,761	23.9	2.6	-
2019/20	97	3,908	24.4	2.7	-
2020/21	81	3,289	24.4	2.6	-
2021/22	78	3,221	24.2	2.6	473
2022/23	86	3,096	27.7	3.1	183

*HL – Handline, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Smart et al., 2023*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	40	52	-	59

Zonal catch, targeted effort and CPUE trends

The total catch of King George Whiting in the WCFZ was 86 *t* in 2022/23, constituting 47% of the TACC (Figure 3.4-3a). Total annual commercial catches have been between 135–215 *t* in most years between 1983/84 and 2000/01, peaking at 215 *t* in 1988/89 (Figure 3.4-3a). Total commercial catch has remained stable between 2000/01 and 2014/15 but has steadily declined to a historic low of 78 *t* in 2021/22, increasing marginally to 86 *t* in 2022/23 (Figure 3.4-3a). The 2022/23 fishing season is the seventh consecutive fishing season where catch has decreased below 100 *t*. Recreational catch in the 2021/22 fishing survey was estimated at 59 *t* at the SGFZ level (Figure 3.4-3a). In 2022/23, handlines accounted for 99% of the total catch, while haul nets and other gears combined accounting for < 1% of the total commercial catch (Figure 3.4-3a).

Targeted effort has had a long-term declining trend from 16,716 *fisher-days* in 1983/84 to 3,097 *fisher-days* in 2022/23 across all gear types, demonstrating a decrease of 81% over time (Figure 3.4-3b). Targeted effort in 2022/23 was lower than the 3,221 *fisher-days* in 2021/22, reaching a historic low (Figure 3.4-3b).

Targeted handline CPUE by fisher-day has increased steeply from the 2021/22 fishing season and was the highest on record at 27.7 *kg/fisher-day* in 2022/23 (Figure 3.4-3c). Targeted handline CPUE by *kg/line-hour* is available from 2003/04 onwards and closely follows the trend of CPUE by *fisher-day* over the same period (Figure 3.4-3c). Similar to HL CPUE by *fisher-day* in 2022/23, handline CPUE by *kg/line-hour* was the highest on record at 3.1 *kg/line-hour* (Figure 3.4-3c).

The number of licences targeting and catching King George Whiting in the WCFZ using handlines have declined steadily over time and were the lowest on record in 2022/23 at 44 licences, respectively (Figure 3.4-3d). The handline fishery for King George Whiting in the WCFZ has been highly seasonal over the last decade, with the highest catches taken from May to July (Figure 3.4-3e).

Triggered performance Indicators
Biological (includes 'WhitEst' model outputs and age composition for 2021/22, presented in 2023 stock assessment report; Table 3.4-1, Smart et al., 2023). • Fishable biomass – 3-year average ±10% of long-term average (+27% - increasing). **General** (includes total catch, target handline effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.4-1). • Total catch – 3rd Lowest / 3rd Highest (LTRP, 3rd Lowest) • Target handline effort – 3rd Lowest / 3rd Highest (LTRP, Lowest) • Target handline CPUE – 3rd Lowest / 3rd Highest (UTRP, Highest)
Stock assessment summary
The latest stock assessment report (Smart et al., 2023) provides 'WhitEst' model outputs (estimates of fishable biomass, harvest fraction and recruitment) using information up to 2021/22 (inclusive; see biological performance indicators above). In that assessment the stock was classified as 'sustainable'. Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above); rather the CPUE indices suggest abundance is near the historic mean and possibly increasing. Reductions in catch and effort have been expected due to a reduction in licences from the recent fishery reform (Smart et al., 2022b), and the reduction in TACC for 2022/23 was due to a revised target harvest fraction. Since the 2016/17 fishing season all available indicators for this fishery have been positive, with management measures decreasing catch and effort, increases in CPUE, and no issues in age and length structures. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, King George Whiting in the WCFZ is classified as a **sustainable** stock.

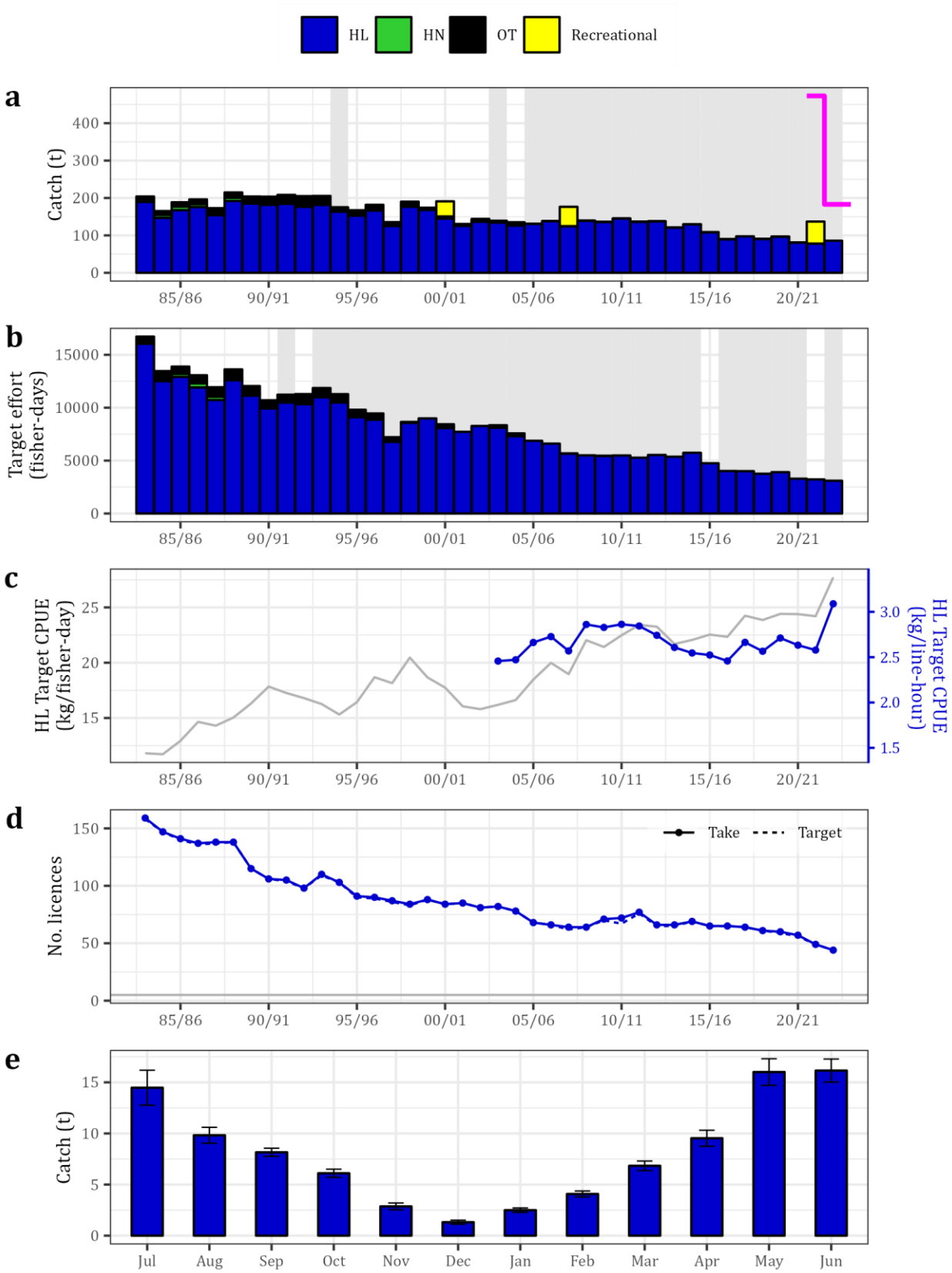


Figure 3.4-3. Key commercial fishery statistics for King George Whiting in the West Coast Fishing Zone, divisible into key gear categories – handline (HL), haul nets (HN) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HL catch per unit targeted effort; (d) number of licences that take and target King George Whiting; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

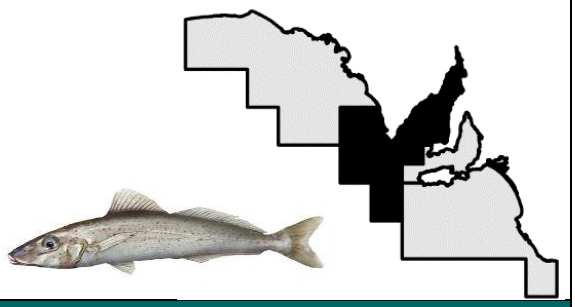
3.4.2. Spencer Gulf Fishing Zone

King George Whiting

Sillaginodes punctatus

Spencer Gulf Fishing Zone

2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	Target HL effort *Fisher-days*	Target HL CPUE *kg/fisher-day*	Target HL CPUE *kg/line-hour*	TACC *t*
2018/19	103	4,291	20.0	2.3	-
2019/20	96	4,180	19.2	2.2	-
2020/21	69	2,694	20.7	2.4	-
2021/22	71	2,651	21.9	2.6	111
2022/23	79	2,619	22.1	2.7	122.7

*HL – Handline, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Smart et al., 2023*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	334	161	-	161

Zonal catch, targeted effort and CPUE trends

The total catch of King George Whiting in the SGFZ was 79 *t* in 2022/23, constituting 71% of the TACC (Figure 3.4-4a). Total annual commercial catches were between 204–399 *t* in most years between 1983/84 and 2000/01, peaking at 399 *t* in 1991/92 (Figure 3.4-4a). Total commercial catch has steadily declined since 2000/01, reaching an historic low of 69 *t* in 2020/21 and increasing marginally to 71 *t* in 2021/22 (Figure 3.4-4a). The 2022/23 fishing season is the fourth consecutive fishing season where catch has decreased below 100 *t*. Recreational catch in the 2021/22 fishing survey was estimated at 161 *t* at the SGFZ level (Figure 3.4-5a). In 2022/23, handlines accounted for 74% of the total catch, while haul nets and other gears combined accounted for ~19% and ~7% of the catch, respectively (Figure 3.4-4a).

Targeted effort has had a long-term declining trend from 16,604 *fisher-days* in 1991/92 to 2,814 *fisher-days* in 2022/23 across all gear types, demonstrating a decrease of 83% over time (Figure 3.4-4b). Targeted effort in 2022/23 was marginally higher than the second lowest fishing season of 2,795 *fisher-days* in 2021/22 (Figure 3.4-4b). Handlines accounted for the majority of targeted effort in 2022/23, consistent with long-term trends in gear use (Figure 3.4-4).

Targeted handline CPUE by *fisher-day* has shown an increasing trend since the 2019/20 fishing season and was the highest on record at 22.1 *kg/fisher-day* in 2022/23 (Figure 3.4-4c). Targeted handline CPUE by *kg/line-hour* is available from 2003/04 onwards and closely follows the trend of CPUE by *fisher-day* over the same period (Figure 3.4-4c). In 2022/23, handline CPUE by *kg/line-hour* was the highest on record at 2.7 *kg/line-hour* (Figure 3.4-4c).

The number of licences taking and targeting and catching King George Whiting in the SGFZ using handlines have declined steadily over time and were the lowest on record in 2022/23 at 72 and 73 licences, respectively (Figure 3.4-4d). The handline fishery for King George Whiting in the SGFZ has been seasonal over the last decade, with the highest catches taken during winter from June to September (Figure 3.4-4e).

Triggered performance Indicators
Biological (includes 'WhitEst' model outputs and age composition for 2021/22, presented in 2023 stock assessment report; Table 3.4-1, Smart et al., 2023). • Fishable biomass – 3-year average ±10% of long-term average (-11% - decreasing) • Recruitment – ±10% of previous 5-year average (-21.6% - decreasing) **General** (includes total catch, target handline effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.4-1). • Total catch – 3rd Lowest / 3rd Highest (LTRP, 3rd Lowest) • Target handline effort – 3rd Lowest / 3rd Highest (LTRP, Lowest) • Target handline CPUE – 3rd Lowest / 3rd Highest (UTRP, Highest)
Stock assessment summary
The latest stock assessment report (Smart et al., 2023) provides 'WhitEst' model outputs (estimates of fishable biomass, harvest fraction and recruitment) using information up to 2021/22 (inclusive; see biological performance indicators above). In that assessment the stock was classified as 'sustainable'. Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above); rather the CPUE indices suggest abundance are near the historic mean and possibly increasing. Reductions in catch and effort have been expected due to a reduction in licences from the recent fishery reform (Smart et al., 2022b). Since the 2016/17 fishing season all available indicators for this fishery have been positive, with management measures decreasing catch and effort, increases in CPUE, and no issues in age and length structures (except NSG age structures displaying lower proportion of age 3+ fish; Smart et al., 2023). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, King George Whiting in the SGFZ is classified as a **sustainable** stock.

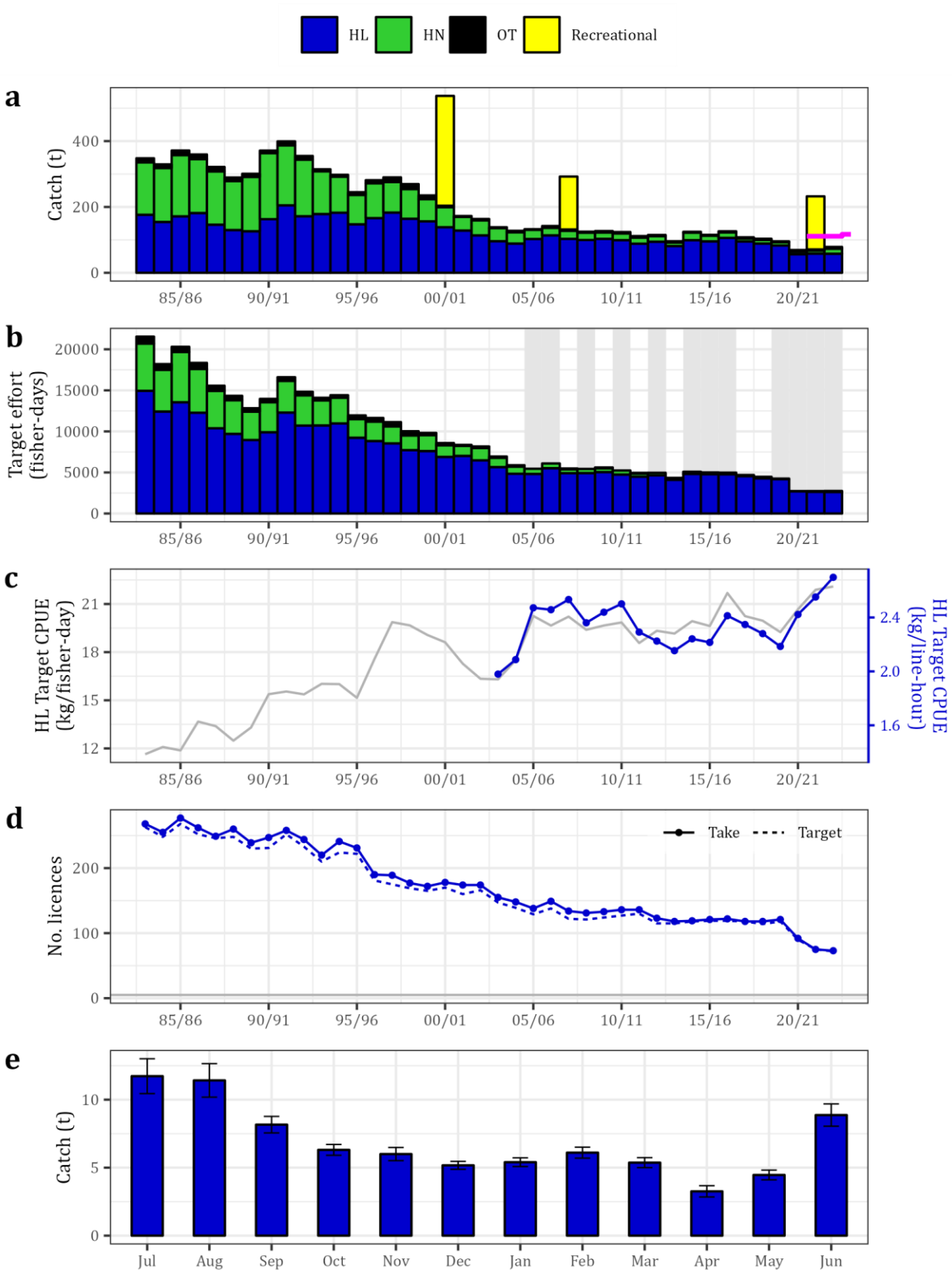


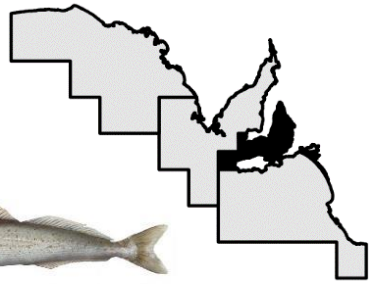
Figure 3.4-4. Key commercial fishery statistics for King George Whiting in the Spencer Gulf Fishing Zone, divisible into key gear categories – handline (HL), haul nets (HN) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HL catch per unit targeted effort; (d) number of licences that take and target King George Whiting; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

3.4.3. Gulf St Vincent/Kangaroo Island Fishing Zone

King George Whiting

Sillaginodes punctatus

Gulf St Vincent/Kangaroo Island Fishing Zone 2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	Target HL effort *Fisher-days*	Target HL CPUE *kg/fisher-day*	Target HL CPUE *kg/line-hour*	TACC *t*
2018/19	40	1,738	15.5	2.2	-
2019/20	42	1,928	15.0	2.2	-
2020/21	31	1,478	15.6	2.2	-
2021/22	27	1,223	15.9	2.3	46
2022/23	28	1,241	16.2	2.5	46.8

*HL – Handline, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Smart et al., 2023*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	138	104	-	76

Zonal catch, targeted effort and CPUE trends

The total catch of King George Whiting in the GSV/KIFZ was 28 *t* in 2022/23, constituting 61% of the TACC (Figure 3.4-5a). Total annual commercial catches have been between 89–145 *t* in most years between 1983/84 and 2000/01, peaking at 145 *t* in 1993/94 (Figure 3.4-5a). Total commercial catch has steadily declined since 2009/10, reaching an historic low of 27 *t* in 2021/22, increasing marginally to 28 *t* in 2022/23 (Figure 3.4-5a). The 2022/23 fishing season is the second fishing season where catch has decreased below 30 *t*. Recreational catch in the 2021/22 fishing survey was estimated at 76 *t* at the GSV/KIFZ level (Figure 3.4-5a). In 2022/23, handlines accounted for 72% of the total catch, while haul nets and other gears combined accounting for ~20% and ~8% of the catch, respectively (Figure 3.4-5a).

Targeted effort has had a long-term declining trend from 7,884 *fisher-days* in 1991/92 to 1,357 *fisher-days* in 2022/23 across all gear types, demonstrating a decrease of 83% over time. Targeted effort in 2022/23 was marginally higher than the record low of 1,339 *fisher-days* in 2021/22 (Figure 3.4-5b). Handlines accounted for the majority of targeted effort in 2022/23, which is consistent with long-term trends in gear use (Figure 3.4-5b).

Targeted handline CPUE by *fisher-day* has had a long-term increasing trend over the history of the fishery and was the highest on record at 16.2 *kg/fisher-day* in 2022/23 (Figure 3.4-5c). Targeted handline CPUE by *kg/line-hour* is available from 2003/04 onwards and closely follows the trend of CPUE by *fisher-day* over the same period (Figure 3.4-5c). In 2022/23, handline CPUE by *kg/line-hour* was the highest on record at 2.5 *kg/line-hour*, an increase of 9% from 2021/22 (Figure 3.4-5c).

The number of licences targeting and catching King George Whiting in the GSV/KIFZ using handlines have declined steadily over time and were the lowest on record in 2022/23 at 24 and 25 licences, respectively (Figure 3.4-5d). The handline fishery for King George Whiting in the GSV/KIFZ has been seasonal over the last decade, with the highest catches taken during winter from June to August (Figure 3.4-5e).

Triggered performance Indicators
Biological (includes 'WhitEst' model outputs and age composition for 2021/22, presented in 2023 stock assessment report; Table 3.4-1, Smart et al., 2023). • Biomass > 280mm (TL) – 3-year average is +/- 10% of previous years (UTRP; 19%). **General** (includes total catch, target handline effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.4-1). • Total catch – 3rd Lowest / 3rd Highest (LTRP, 2nd Lowest) • Target handline effort – 3rd Lowest / 3rd Highest (LTRP, 2nd Lowest) • Target handline CPUE – 3rd Lowest / 3rd Highest (UTRP, highest)
Stock assessment summary
The latest stock assessment report (Smart et al., 2023) provides 'WhitEst' model outputs (estimates of fishable biomass, harvest fraction and recruitment) using information up to 2021/22 (inclusive; see biological performance indicators above). In that assessment the stock was classified as 'sustainable'. Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above); rather the CPUE indices suggest abundance is near the historic mean and possibly increasing. Reductions in catch and effort have been expected due to a reduction in licences from the recent fishery reform (Smart et al., 2022a). Since the 2016/17 fishing season all available indicators for this fishery have been positive, with management measures decreasing catch and effort, increases in CPUE, and no issues in age and length structures. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, King George Whiting in the GSV/KIFZ is classified as a **sustainable** stock.

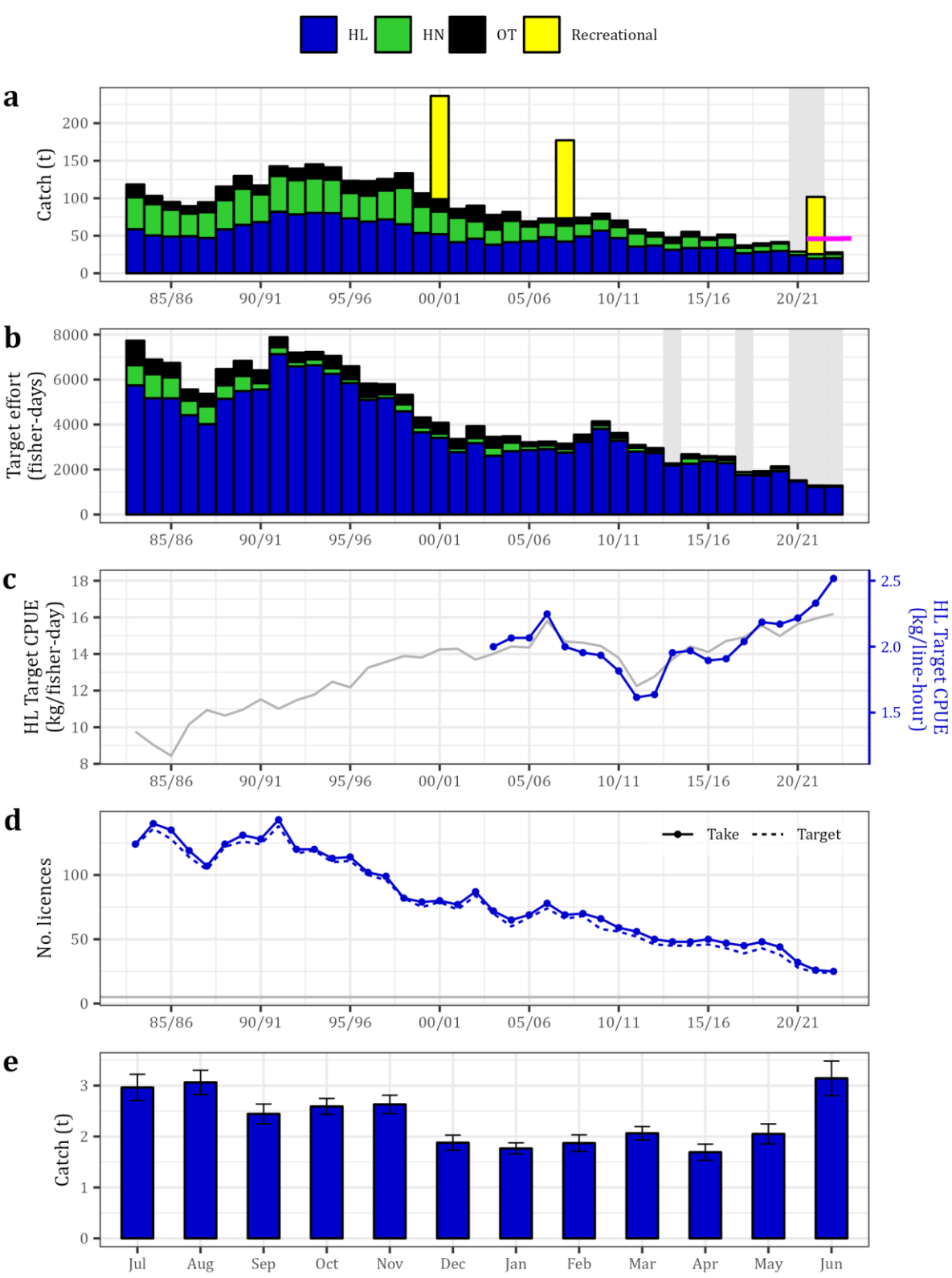


Figure 3.4-5. Key commercial fishery statistics for King George Whiting in the Gulf St Vincent/Kangaroo Island Fishing Zone, divisible into key gear categories – handline (HL), haul nets (HN) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HL catch per unit targeted effort; (d) number of licences that take and target King George Whiting; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

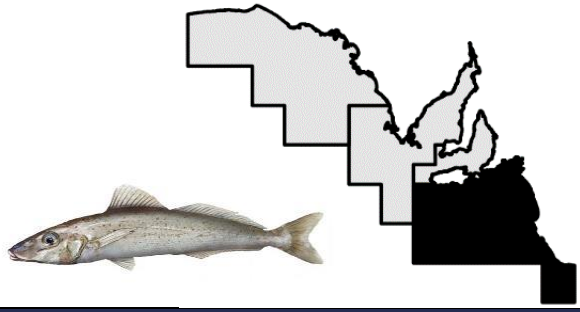
3.4.4. South East Fishing Zone

King George Whiting

Sillaginodes punctatus

South East Fishing Zone

2022/23 (Negligible)



Stock status

2020*	2021/22*	2022/23
Negligible	Negligible	Negligible

Commercial fishery statistics

Fishing season	Total catch *t*	Target HL effort *Fisher-days*	Target HL CPUE *kg/line-hour*
2018/19	*Conf.*	*Conf.*	*Conf.*
2019/20	*Conf.*	*Conf.*	*Conf.*
2020/21	0.22 (HL only)	*Conf.*	*Conf.*
2021/22	*Conf.*	*Conf.*	*Conf.*
2022/23	*Conf.*	*Conf.*	*Conf.*

HL – Handline, CPUE - Catch per unit effort. *Smart et al., 2023

Stock assessment summary

Over the past 40 years, annual commercial catches of King George Whiting in the SEFZ have averaged < 0.5 *t*, which is unlikely to be having a negative impact on the stock. Recreational catch estimates are not presented as they are considered unreliable. Due to historically low catches (Figure 3.4-6), and the stock generally not been subject to targeted fishing, King George Whiting in the SEFZ is classified as a **negligible** stock.

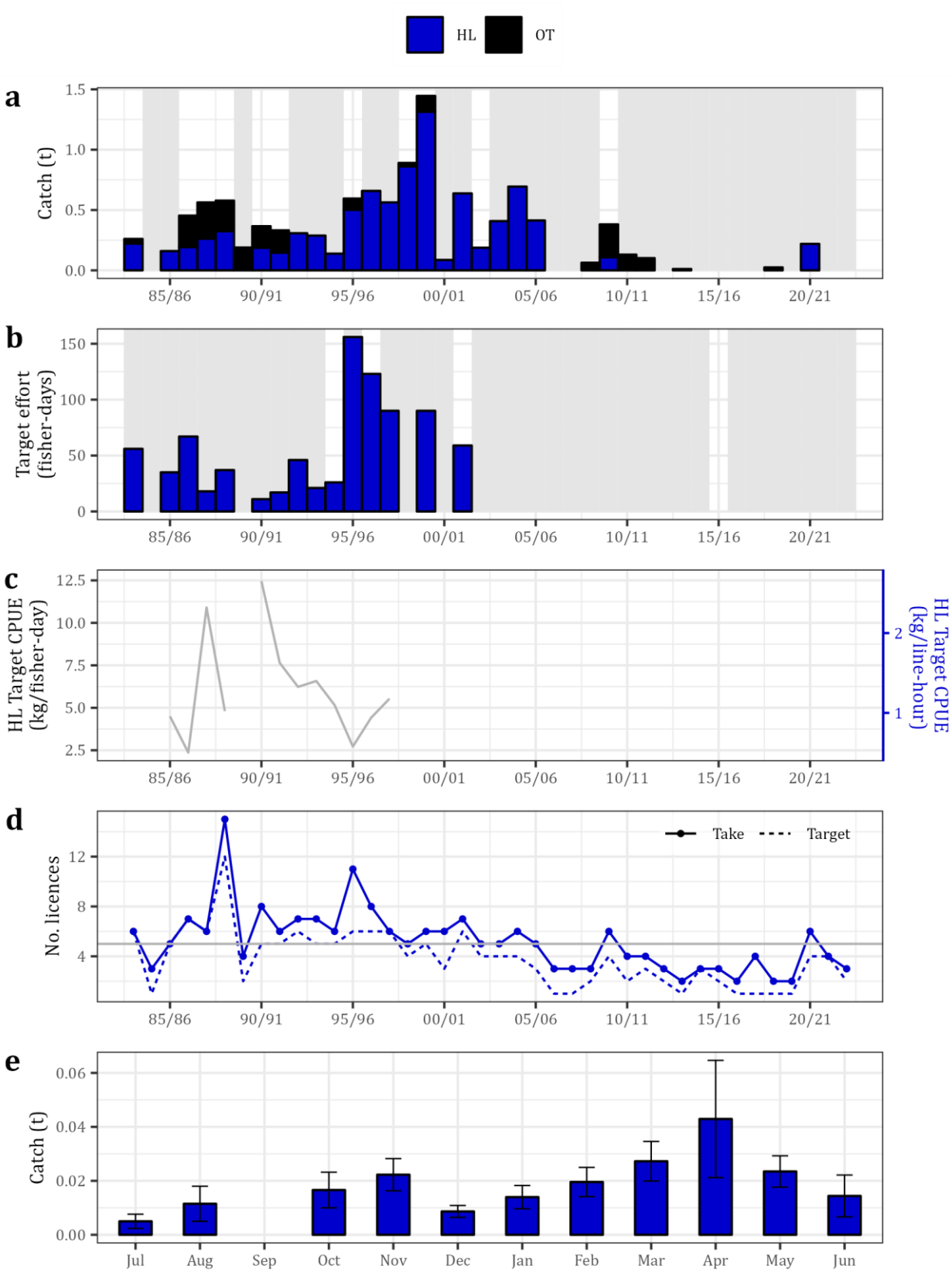


Figure 3.4-6. Key commercial fishery statistics for for King George Whiting in the South East Fishing Zone, divisible into key gear categories – Handline (HL), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch; (b) targeted effort; (c) HL catch per unit targeted effort; (d) number of licences that take and target King George Whiting in the SEFZ; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.5. Southern Garfish

Southern Garfish

Hyporhamphus melanochir

State-wide summary 2022/23

Last stock assessment - Earl et al., 2024

Stock status (Tier 1)		Stock status (Negligible)	
Spencer Gulf Fishing Zone* Recovering	**Gulf St Vincent/ Kangaroo Island Fishing Zone*** Sustainable	**West Coast Fishing Zone*** Sustainable	**South East Fishing Zone*** Sustainable

Fishery statistics (State-wide)

Commercial			Recreational sector			
Fishing Season	**Total catch** *t*	**Targeted effort** *Fisher-days*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	192	3,073	**2000/01**	117 (*20*)	87	13
2019/20	168	2,459	**2007/08**	73 (*13*)	81	19
2020/21	182	2,540	**2013/14**	78 (*22*)	89	11
2021/22	157	2,207	**2021/22**	24 (*5*)	81	19
2022/23	140	1,868	**Earl et al., 2024*			

Biology

Southern Garfish are fast-growing hemiramphid species (commonly known as 'halfbeaks') that is endemic to southern Australia (Smart et al., 2023). They are characterised by an elongated body shape with a distinct lower jaw which forms an extended beak much longer than the upper jaw. They form large schools in sheltered bays and shallow, inshore marine waters, and have a strong association with seagrass beds (*Zostera muelleri*; (Earl et al., 2011). Southern Garfish are particularly abundant in South Australia's northern gulfs, with abundance decreasing moving southward (Fowler, 2019). The movement of adults is limited, remaining associated with an area or bay for the first few years of their lives (Steer et al., 2009a; Steer et al., 2010; Steer & Fowler, 2015).

Southern Garfish is a multiple batch spawning species that has a protracted spawning period from October to March (Fowler, 2019). The estimated length-at-50%-maturity (L_{50}) for female Southern Garfish in South Australia is 215 *mm* total length (TL), which is equivalent to the mean age of 17.5 months (Ye et al., 2002).

Stock structure

The population dynamics and stock structure of Southern Garfish in South Australia has been investigated using a variety of approaches. Movement was inferred through a multi-disciplinary otolith study that involved the analysis of otolith microchemistry (trace elements and stable isotopes; (Steer et al., 2009a) and otolith morphometrics (Steer et al., 2009b, 2009a; Steer & Fowler, 2015), and a concurrent study that considered parasite assemblages (Hutson et al., 2011). These studies, and more recently demographics and population connectivity of Southern Garfish in Gulf St Vincent examined in Fowler (2019) underpinned the conceptual model of stock structure for Southern Garfish in South Australia, i.e., that the State-wide distribution was divided into numerous populations that were largely discrete.

Here, assessment of stock status is presented at the Fishing Zone stock level – WCFZ, SGFZ, GSV/KIFZ, and SEFZ.

Fishery description

Southern Garfish is a significant inshore fishery species of southern Australia, with fisheries also existing in Victoria, Tasmania, and Western Australia. Historically, the national commercial catch for this species has been dominated by South Australia. This species is also a popular target amongst South Australian recreational anglers (Jones, 2009; Giri & Hall, 2015).

In South Australia, Southern Garfish fishing predominantly occurs in the two gulf zones with biomass being highest in the northern region of each gulf. Haul nets are the dominant commercial gear type. However, due to extensive netting restrictions (<5 *m* depth) and closures, their use is largely restricted to the northern parts of the gulfs, while dab nets are the dominant gear types used in the southern gulfs and SE and WCFZ where smaller catches occur. Recreational fishers take garfish mainly using dab nets and traditional hook and line.

Assessment program

- Application of a fully integrated assessment model ('GarEst') and production of a stock assessment report every two or three years (latest assessment see Earl et al., 2024).
- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Length and age structures from market (SAFCOL, Adelaide) and industry (regional) samples.
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Southern Garfish (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach (Table 3.5-1).

Catch and effort trends

- Total annual State-wide commercial catch peaked at 532 *t* in 2000/01 and has since progressively declined to a historic low of 140 *t* in 2022/23 (Figure 3.5-1a).
- The GVP of the commercial catch in 2022/23 was $1.59M, 12% below the mean GVP since 2013/14.
- Since 1983/84, the majority of catch is taken in SGFZ (~55%, range: 38–66%) and GSV/KIFZ (~43%, range: 28–61%; Figure 3.5-1b).
- The long-term decline in commercial catch has been associated with a decline in targeted effort (Figure 3.5-1c).
- Targeted effort declined by 76% from 7,886 *fisher-days* in 1983/84 to 1,868 *fisher-days* in 2022/23. This decrease reflects a consistent reduction in haul net effort across the fishery, with the haul net sector accounting for ~90% of the State-wide harvest since 1983/84 (Smart et al., 2023).
- Since 2018/19, highest catches occurred in NGSV (MFA 35) and SG (MFA 23; Figure 3.5-2).

Current management regulations

- A summary of key historical management changes for the Southern Garfish fishery is provided in the 2024 stock assessment report (Earl et al., 2024).
- LML of 230 *mm* TL applies to all sectors.
- Haul net pocket mesh size set at 36 *mm* in SG and GSV/KIFZ and 32 *mm* in WCFZ and SEFZ.
- SG and GSV/KI managed via TACCs and Individual Transferable Quotas (ITQs)
- Daily recreational limits: 30 for individuals and 90 for boats when 3 or more are onboard.

Tier 1 performance indicators	Negligible performance indicators
Catch, targeted effort, targeted CPUE trends, fishable biomass, harvest fraction, egg production, recruitment, age structure.	Catch, targeted effort, targeted CPUE trends.

Research & development needs

- Investigate alternative assessment model outputs for Garfish stocks using Stock Synthesis.
- Supplement market sampling with industry-direct sampling in the regions to obtain more representative samples (commenced in 2023/24).
- Investigate the potential segregation of sex by depth, area, and/or season to improve skewed sex ratio.
- CPUE standardisation.
- Application of the harvest strategy framework when finalised under the next management plan.
- More regular and reliable estimates of recreational catch.

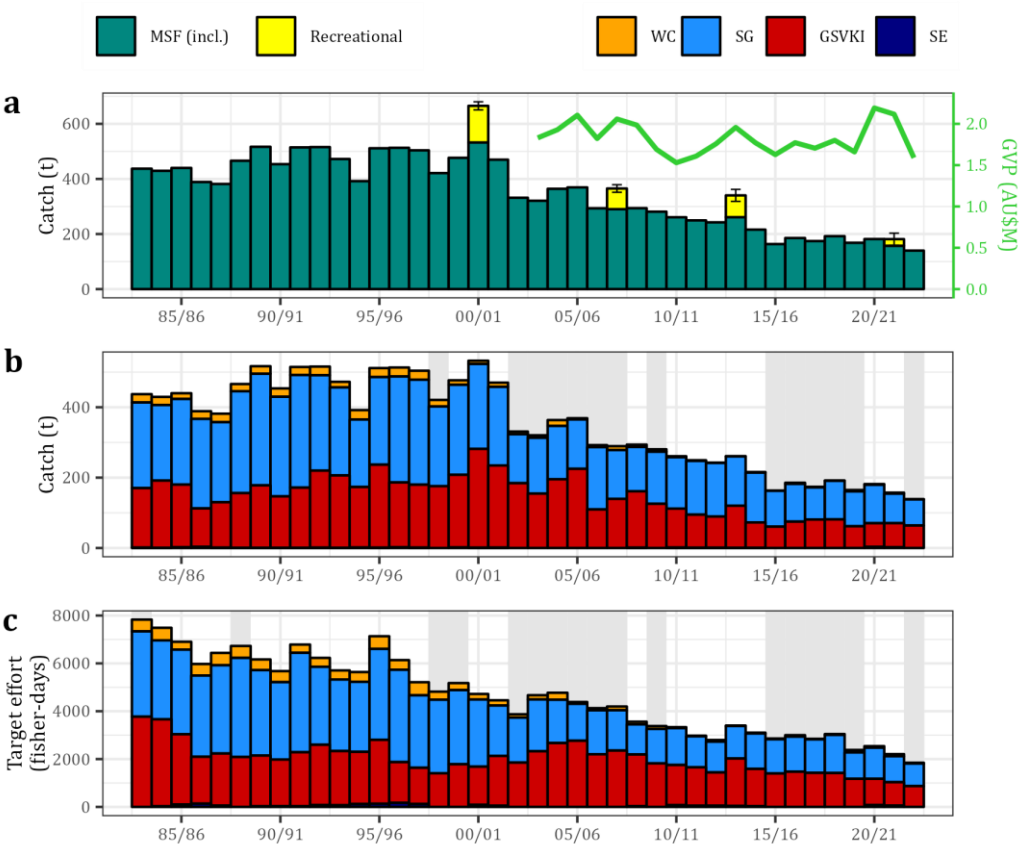


Figure 3.5-1. Fishery statistics for South Australia's Southern Garfish Fishery. Long-term trends in annual estimates of: (a) total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP); (b) total commercial catch, by Fishing Zone – West Coast (WC), Spencer Gulf (SG), Gulf St Vincent/Kangaroo Island (GSV/KI) and South East (SE); and (c) commercial effort targeting garfish, by Fishing Zone. Grey shading indicates years when data for one or more Fishing Zones are confidential.

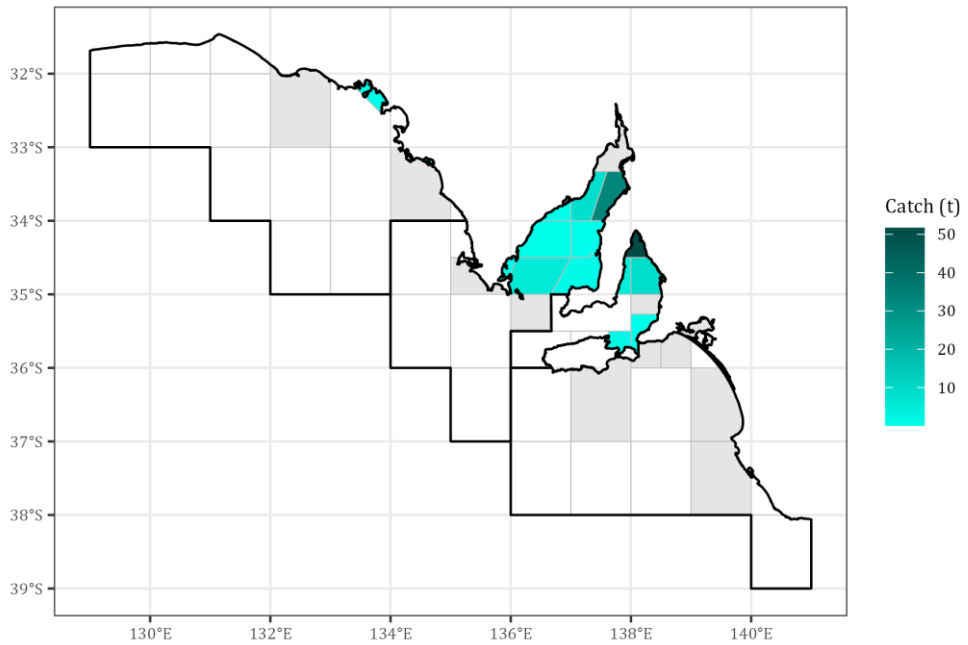


Figure 3.5-2. Spatial distribution of Southern Garfish catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

Table 3.5-1. Results of the assessment of the general (G) fishery performance indicators against their trigger reference points at the regional spatial scales for Southern Garfish in 2022/23 and assessment of the biological (B) fishery performance indicators from the previous stock assessment in 2024 (Earl et al., 2024)[9]. Lower trigger reference point (LTRP) breaches are indicated in light blue and upper trigger reference point (UTRP) breaches are indicated in blue. - indicates that no trigger has been breached. ● indicates that the trigger for five consecutive decreases has been triggered. Conf. identifies confidential data which prevents a PI from being assessed. NA indicates trigger is not assessed. Stock/zone abbreviations: West Coast (WC), Spencer Gulf (SG), Gulf St Vincent/Kangaroo Island (GSV/KI), South East (SE).

PERFORMANCE INDICATOR	TYPE	TRIGGER REFERENCE POINT	WC	SG	GSV/KI	SE
Total catch	G	3rd Lowest/3rd Highest	-	LTRP	LTRP	-
	G	Greatest % interannual change (+/-)	-	-	-	-
	G	Greatest five-year trend	-	-	-	-
	G	Decrease over five consecutive years	-	-	-	-
Target haul net effort	G	3rd Lowest/3rd Highest	*Conf.*	LTRP	LTRP	-
	G	Greatest % interannual change (+/-)	*Conf.*	-	-	-
	G	Greatest five-year trend	*Conf.*	-	-	-
	G	Decrease over five consecutive years	*Conf.*	-	-	-
Target haul net CPUE	G	3rd Lowest/3rd Highest	*Conf.*	-	-	-
	G	Greatest % interannual change (+/-)	*Conf.*	-	-	-
	G	Greatest five-year trend	*Conf.*	-	-	-
	G	Decrease over five consecutive years	*Conf.*	-	-	-
Target dab net effort	G	3rd Lowest/3rd Highest	-	LTRP	LTRP	*Conf.*
	G	Greatest % interannual change (+/-)	-	-	-	*Conf.*
	G	Greatest five-year trend	-	-	-	*Conf.*
	G	Decrease over five consecutive years	-	-	-	*Conf.*
Target dab net CPUE	G	3rd Lowest/3rd Highest	-	-	-	*Conf.*
	G	Greatest % interannual change (+/-)	-	-	-	*Conf.*
	G	Greatest five-year trend	-	-	-	*Conf.*
	G	Decrease over five consecutive years	-	-	-	*Conf.*
Fishable biomass	B	3-year average is ±10% of long-term average	NA	-14%	3%	NA
Harvest fraction	B	35%	NA	35%	29%	NA
Recruitment	B	±10% of previous 5-year average	NA	13%	12%	NA
Egg production	B	< 30% by 2020	NA	14%	16%	NA
Age composition	B	No change or reduction	NA	-14%	-3%	NA

[9] Stock assessment model ('GarEst') outputs and figures available in Earl et al., (2024).

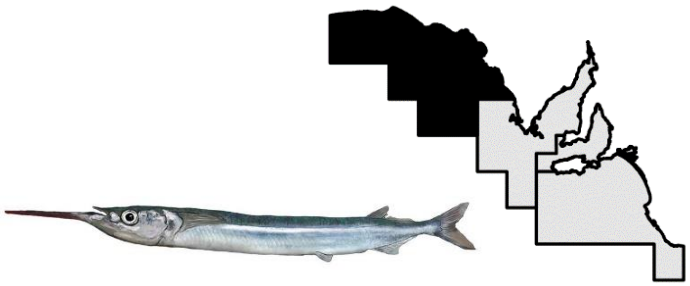
3.5.1. West Coast Fishing Zone

Southern Garfish

Hyporhamphus melanochir

West Coast Fishing Zone

2022/23 (Negligible)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total DN catch *t*	Target DN effort *Fisher-days*	Target DN CPUE *kg/fisher-day*	Target DN CPUE *kg/net-hour*
2018/19	*Conf.*	*Conf.*	*Conf.*	*Conf.*
2019/20	1.62	24	67.6	9.1
2020/21	1.17	35	33.4	5.1
2021/22	2.61	69	37.9	5.8
2022/23	0.89	30	28.1	6.0

*DN – Dab net, CPUE - Catch per unit effort. * Earl et al., 2024*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	1	4	-	1

Zonal catch, targeted effort and CPUE trends

The WCFZ has been the third most productive Fishing Zone for garfish since 1983/84. Annual catches from this zone averaged 22 *t* (S.E. = 0.8 *t*) in the 1980s and 90s, peaking at 27 *t* in 1994/95, with ~85% of catches taken using haul nets (Figure 3.5-3a). From 1999/00–2004/05, haul nets continued to account for most of the catch, which fluctuated between 9–16.7 *t* per year. Since 2005/06, when commercial netting restrictions were implemented in this region, catches have been < 3 *t* in most years and dab nets have become the main gear used to catch garfish. The total catch of 0.96 *t* in 2022/23 was fourth lowest on record (cf. 2.9 *t* in 2021/22), of which 93% was taken using dab nets.

The trends in total catch reflect the trends in targeted effort (Figure 3.5-3b). Effort was highest during the 1990s, peaking of 548 *fisher-days* in 1997/98, and declined during the 2000s. Targeted effort has generally been < 70 *fisher-days* over the last 10 years, most of which was reported by dab net fishers.

Estimates of annual targeted CPUE using haul nets since 2005/06 are confidential (Figure 3.5-3c,e). For dab nets, targeted CPUE has been highly variable over the past decade, ranging from 11.1 *kg/net-hour* in 2014/15 to 5.1 *kg/net-hour* in 2020/21 (Figure 3.5-3d). Similar high interannual variability is also evident in the long-term annual time series for targeted dab net CPUE based on *kg/fisher-day*. In 2022/23, both targeted dab net CPUE measures were similar to their respective long-term averages, although CPUE based on *kg/net-hour* increased for the third successive year.

Up to 13 licences were landing garfish using haul nets each year in the WCFZ prior to the implementation of commercial netting restrictions in this region in 2005/06 (Figure 3.5-3e). Since then, there have been less than three active haul netters operating in this region in most years, whereas the number of licences using dab nets to target and take garfish has been relatively consistent since 1983/84.

The garfish fishery in the WCFZ has been seasonal over the last decade, with most of the catch each year taken during the cooler months from April–August (Figure 3.5-3f).
Triggered performance Indicators
General only (includes total catch, target haul net effort and CPUE, target dab net effort and CPUE for 2022/23; Table 3.5-1). • None triggered.
Stock assessment summary
The latest stock assessment report (Earl et al., 2024) examines commercial fishery statistics and trends up to and inclusive of 2021/22. In this assessment, Southern Garfish in the WCFZ was classified as 'sustainable'. Prior to the implementation of extensive spatial netting closures across the WCFZ in 2005/06, this region supported a small commercial fishery for Southern Garfish that regularly produced annual catches of 20–25 *t* using predominantly haul nets. Since the implementation of commercial netting restrictions in 2005/06, catches have been < 3 *t* in most years and dab nets have become the main gear used to target and catch garfish. The total catch of 0.96 *t* in 2022/23 was fourth lowest on record. The recent low catches have been associated with historically low levels of targeted fishing effort. Targeted catch rates by dab net fishers have been at or above the historic average over at least the last four years, reflecting a moderate–high relative abundance of garfish in the region. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Southern Garfish in the WCFZ is classified as a **sustainable** stock.

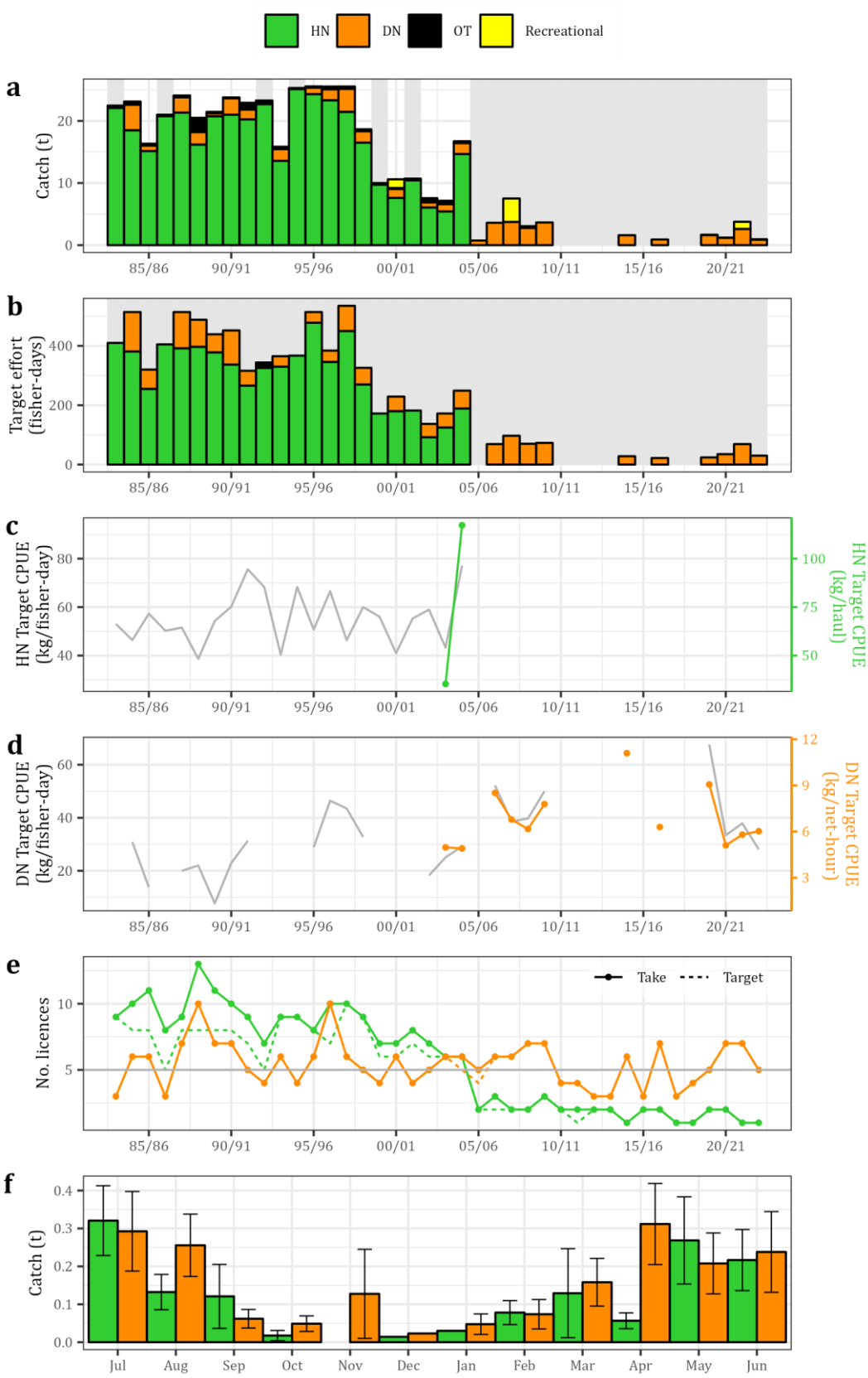


Figure 3.5-3. Key commercial fishery statistics for Southern Garfish in the West Coast Fishing Zone, divisible into key gear categories – haul nets (HN), dab nets (DN) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HN catch per unit targeted effort; (d) DN catch per unit targeted effort; (e) number of licences that take and target Southern Garfish; and (f) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

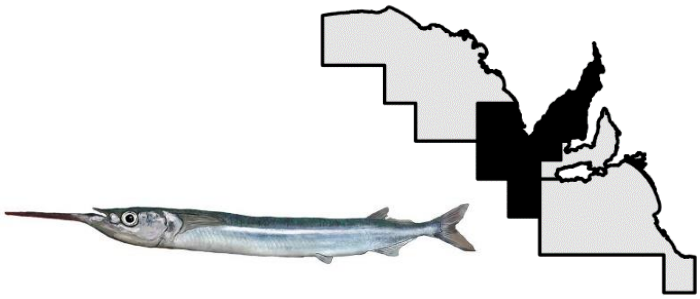
3.5.2. Spencer Gulf Fishing Zone

Southern Garfish

Hyporhamphus melanochir

Spencer Gulf Fishing Zone

2022/23 (Tier 1)



Stock status

2020*		2021/22*	2022/23
Recovering (NSG)	Sustainable (SSG)	Recovering	Recovering

Commercial fishery statistics

Fishing season	Total catch *t*	HN			DN			TACC *t*
		Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/haul*	Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/net-hour*	
2018/19	110	1,282	61.9	68.1	291	41.3	6.8	-
2019/20	99	881	75.4	82.7	202	64.6	11.1	-
2020/21	109	1,102	74.8	91.0	179	45.1	10.9	-
2021/22	84	952	60.7	74.5	130	39.9	9.4	100
2022/23	74	804	60.3	87.3	136	38.1	10.7	107.1

*HN – Haul net, DN – Dab net, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Earl et al., 2024*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	44	37	-	12

Zonal catch, targeted effort and CPUE trends

Annual catches in the SGFZ were > 250 *t* in most years during the 1980s and 1990s, including several years when they exceeded 300 *t* (Figure 3.5-4a). The highest catch was 320 *t* in 1991/92. Catch declined (by 53%) from 298 *t* in 1997/98 to 139 *t* in 2002/03, and then averaged ~147 *t* per year (S.E. = 3.4 *t*) before decreasing and stabilising at ~100 *t* from 2015/16–2020/21. The total catch of 74 *t* in 2022/23 (cf. 83.7 *t* in 2021/22) was 74% of the TACC. On average since 1983/84, catches taken using haul nets and dab nets have accounted for 92% and 7.7% of annual catches in this zone, respectively, continuing in 2022/23 (Figure 3.5-4a).

The long-term declining trends in total catch reflect the trends in targeted fishing effort for the SGFZ (Figure 3.5-4b). Targeted effort was high prior to 2001/02, peaking at 4,156 *fisher-days* in 1991/92, declined sharply during the 2000s and has been < 1,500 *fisher-days* in most of the last 15 years. Effort dropped to 941 *fisher-days* in 2022/23, which was the lowest on record. Haul nets have consistently accounted for most (76–92%) of the targeted fishing effort. In 2022/23, targeted effort using haul nets and dab nets was 804 and 136 *fisher-days*, respectively.

Annual estimates of catch per unit of targeted effort (CPUE) for haul nets in *kg/fisher-day* and *kg/haul* have followed the same trends since 2003/04 (Figure 3.5-4c). Both indices increased to historical peaks between 2009/10 and 2011/12, then declined to 20-year lows in 2015/16 and have since recovered. In 2022/23, targeted haul nets CPUE increased to 87.4 *kg/haul*, which was 6% above the mean catch rate since 2003/04. Estimates of targeted dab nets CPUE have also increased over recent years and reached 10.7 *kg/net-hour* in 2022/23, which was the third highest since 2003/04 (Figure 3.5-4d).

The long-term declines in catch and targeted effort using haul nets reflect declines in the numbers of licences taking and targeting garfish (Figure 3.5-4e). In 2022/23, 17 licences landed garfish in the SGFZ, of which 15 targeted the

species. Since 1983/84, most licences that have landed garfish using dab nets were targeting garfish, and the numbers of licences that have done so each year have been relatively stable over time.

Since 2018/19, there has been no clear seasonality in the average monthly catches of garfish using haul nets (Figure 3.5-4f). Monthly haul net catches have been moderate–high (7–12 *t*) during July–September and January–June, and lowest during October–December (~4.5 *t*). The dab net sector has been more seasonal, with catches highest during summer and autumn (December–April) and lowest during winter and spring (May–November).

Triggered performance Indicators

Biological (includes 'GarEst' model outputs for 2021/22 and age composition for 2022/23, presented in 2024 stock assessment report; Table 3.5-1, Earl et al., 2024).

- Harvest fraction – < 30% (35% - decreasing)
- Egg production – 30% of pristine population (14% - stable)
- Fishable biomass – 3-year average ±10% of long-term average (-14% - increasing)
- Recruitment – ±10% of previous 5-year average (+13% - stable)
- Age composition – decreased proportion of 3+ years of age since last assessment (-14%; *note this has been influenced by LML reduction since last assessment.*)

General (includes total catch, target haul net effort and CPUE, target dab net effort and CPUE for 2022/23; Table 3.5-1).

- Total catch – 3rd Lowest / 3rd Highest (LTRP, Lowest)
- Target haul net effort – 3rd Lowest / 3rd Highest (LTRP, lowest)
- Target dab net effort – 3rd Lowest / 3rd Highest (LTRP, 2nd lowest)

Stock assessment summary

The latest stock assessment report (Earl et al., 2024) provides 'GarEst' model outputs (estimates of fishable biomass, harvest fraction and recruitment) using information up to 2021/22 (inclusive; see biological performance indicators above).

Targeted haul net CPUE declined steeply from 2010/11 to 2015/16 but has since recovered to the historic mean, while targeted dab net CPUE was above the historic mean in 2022/23. These results reflect increasing abundance of garfish across the region in recent years. Higher abundances were also evident in modelled fishable biomass (i.e., biomass ≥ 230 *mm*), which increased from 232 *t* (± 53 *t*, 95% CI) in 2019/20 to 280 *t* (± 54 *t*, 95% CI) in 2021/22 (Earl et al., 2024). Despite these positive trends, fishable biomass remained below the historic mean, while egg production was stable at a moderate level. Harvest fraction continued to trend favourably and reached 35% in 2021/22 but remained above the operational target of < 30%. The current stock assessment detected a slight change in the age structure of the fishery due to the LML reductions and marginally higher modelled numbers of garfish reaching the 1+ age class (i.e., recruitment) in 2020/21 and 2021/22. However, low proportions of fish aged three years and older indicate that the age structure of the stock remains truncated.

The above evidence indicates that the biomass of this stock is likely recovering, with insufficient evidence to warrant a change in status from 'recovering' to 'sustainable'. Nevertheless, if harvest fraction continues to decline, and recruitment is stable, there are likely to be increases in fishable biomass that will be sufficient to move the stock out of its current recruitment impaired state. On this basis, Southern Garfish in the SGFZ is classified as a **recovering** stock.

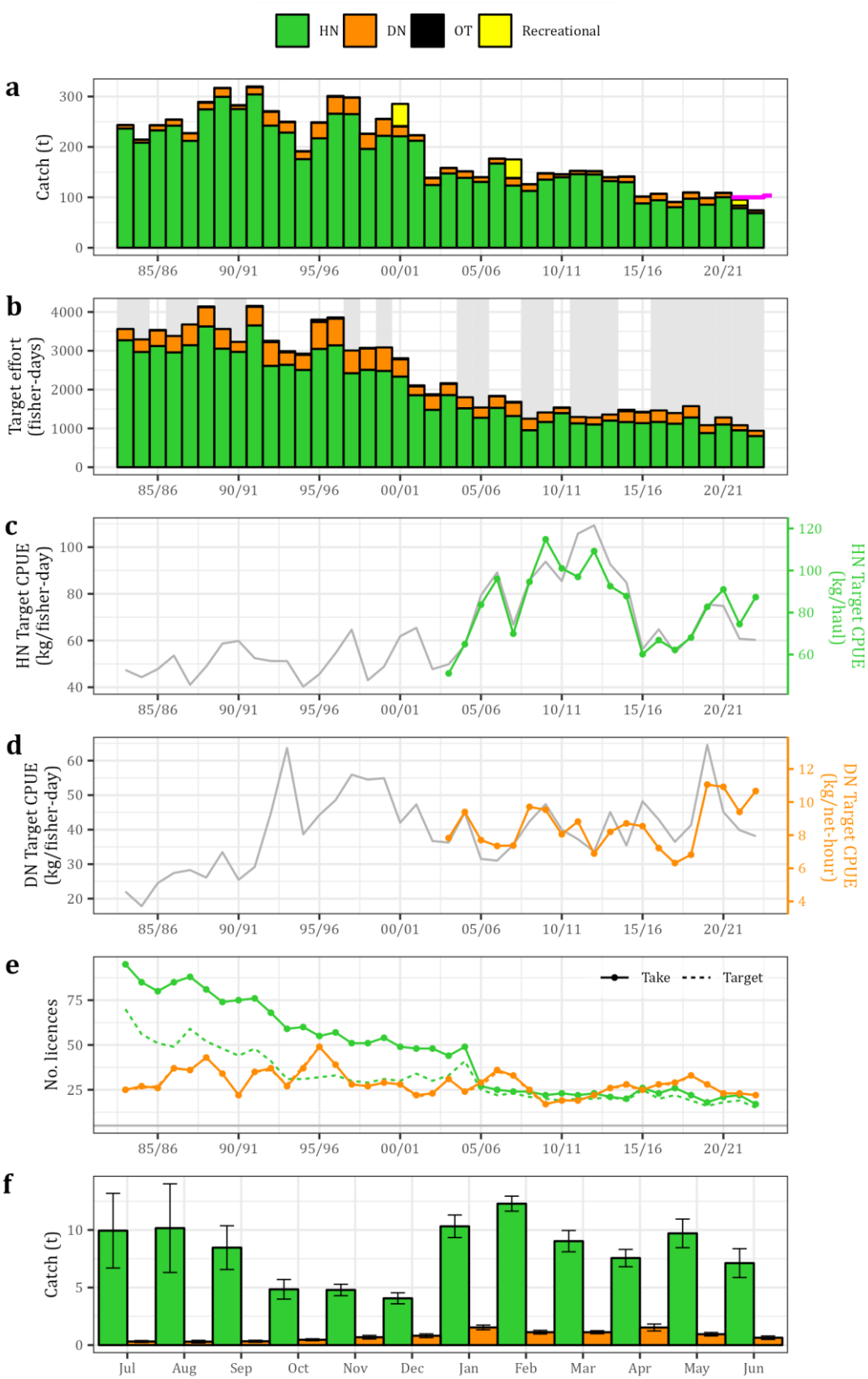


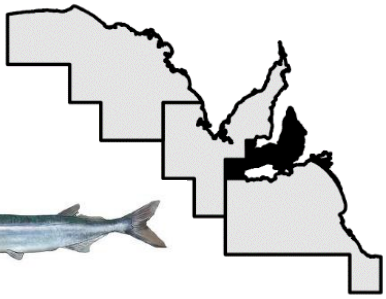
Figure 3.5-4. Key commercial fishery statistics for Southern Garfish in the Spencer Gulf Fishing Zone, divisible into key gear categories – haul nets (HN), dab nets (DN) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HN catch per unit targeted effort; (d) DN catch per unit targeted effort; (e) number of licences that take and target garfish; and (f) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

3.5.3. Gulf St Vincent/Kangaroo Island Fishing Zone

Southern Garfish

Hyporhamphus melanochir

Gulf St Vincent/Kangaroo Island Fishing Zone 2022/23 (Tier 1)



Stock status

2020*		2021/22*	2022/23
Recovering (NGSV)	Sustainable (SGSV)	Recovering	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	HN			DN			TACC *t*
		Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/haul*	Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/net-hour*	
2018/19	81	1,219	49.8	54.5	196	55.8	9.6	-
2019/20	62	909	45.5	65.7	266	56.0	9.8	-
2020/21	67	876	57.8	96.1	219	41.5	7.1	-
2021/22	69	866	64.7	95.8	107	46.2	8.3	71
2022/23	64	767	64.0	111.8	102	48.1	9.5	79.8

*HN – Haul net, DN – Dab net, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Earl et al., 2024*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	56	29	-	9

Zonal catch, targeted effort and CPUE trends

Total annual commercial catches taken in the GSV/KIFZ ranged from 150–235 *t* in most years between 1983/84 and 1999/00 and peaked at 281 *t* in 2000/01 (Figure 3.5-5a). They gradually declined to 60 *t* in 2015/16 and have since been stable at 62–81 *t*. The total catch of 64 *t* in 2022/23, represented 90% of the TACC.

In 2022/23, haul nets accounted for ~92% of the total catch, while dab nets and all other gears combined, accounted for ~7% and ~1% of the catch, respectively (Figure 3.5-5a). Haul nets and dab nets accounted for 88% and 11% of all targeted effort for garfish (Figure 3.5-5b).

Total targeted fishing effort peaked at 3,772 *fisher-days* in 1983/84 with a secondary smaller peak of 2,767 *fisher-days* in 2005/06, and then gradually declined to 871 *fisher-days* in 2022/23 (Figure 3.5-5b).

For haul nets, there was a strong relationship between CPUE based on *kg/fisher-day* and CPUE based on *kg/haul* since 2003/04, when units of effort have been reported in logbooks (Figure 3.5-5c). In 2022/23, the haul net CPUE increased to 111.8 *kg/haul* which was the highest on record.

Similarly for dab nets, there was a strong relationship between CPUE based on *kg/fisher-day* and CPUE based on *kg/net-hour* (Figure 3.5-5d). Dab net CPUE has increased over the last two years, reaching 9.5 *kg/net-hour* in 2022/23, which was the third highest since 2003/04.

During 2022/23, 15 licences landed garfish using haul nets, and of these, 13 actively targeted the species, which was the lowest on record (Figure 3.5-5e). The numbers of licences that landed and targeted garfish using dab nets declined to 10 in 2022/23, which were also the lowest recorded in the fishery.

The haul net fishery for garfish has been seasonal over the last decade, with the highest catches taken from February to June and the lowest catches taken during December (Figure 3.5-5f). For the dab net fishery, most of the catches have been taken during summer (Dec–Feb) and autumn (Mar–May).

Triggered performance Indicators

Biological (includes 'GarEst' model outputs for 2021/22 and age composition for 2022/23, presented in 2024 stock assessment report; Table 3.5-1, Earl et al., 2024).

- Harvest fraction – < 30% (29% - decreasing).
- Egg production – < 30% by 2020 (16% - increasing).
- Fishable biomass – 3-year average is ±10% of long-term average (+3% - increasing).
- Recruitment – ±10% of previous 5-year average (+12% - stable).
- Age composition – decreased proportion of 3+ years of age since last assessment (-3%; *note this has been influenced by LML reduction since last assessment*).

General (includes total catch, target haul net effort and CPUE, target dab net effort and CPUE for 2022/23; Table 3.5-1).

- Total catch – 3rd Lowest / 3rd Highest (LTRP, 3rd Lowest)
- Target haul net effort – 3rd Lowest / 3rd Highest (LTRP, lowest)
- Target dab net effort – 3rd Lowest / 3rd Highest (LTRP, lowest)

Stock assessment summary

The latest stock assessment report (Earl et al., 2024) provides 'GarEst' model outputs (estimates of fishable biomass, harvest fraction and recruitment) using information up to 2021/22 (inclusive; see biological performance indicators above).

Estimates of targeted haul net and dab net CPUE for 2022/23 were the highest and third highest on record, respectively, reflecting high abundance of Southern Garfish across the region. Modelled fishable biomass (i.e., biomass ≥ 230 *mm*) has also followed an increasing trend since 2006/07. The rate of this increase has been highest since 2014/15, during which time biomass increased 39% to a 15-year high of 248 *t* (95%CI ± 56 *t*) in 2021/22. Harvest fraction has trended favourably since 2005/06, declining at a rate of around 4% per year to a record low of 29% in 2021/22 and reaching the operational target of < 30% for the first time in at least 38 years. Egg production has increased to 16% of an unfished stock in 2021/22, which is its third highest level on record, while the numbers of garfish that reached the 1+ age class (i.e., recruitment) increased for the second consecutive year in 2021/22.

Age structures for 2021/22 and 2022/23 demonstrated higher proportions of age 1+ garfish compared to the immediately preceding years, while the proportions of older fish (i.e., age 3+) have declined. However, it is unlikely these changes reflect further age truncation in the population given the recent LML reduction has resulted in smaller, younger fish in the catches.

The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Southern Garfish in the GSV/KIFZ is no longer in a 'recovering' state, but rather is classified as a '**sustainable**' stock.

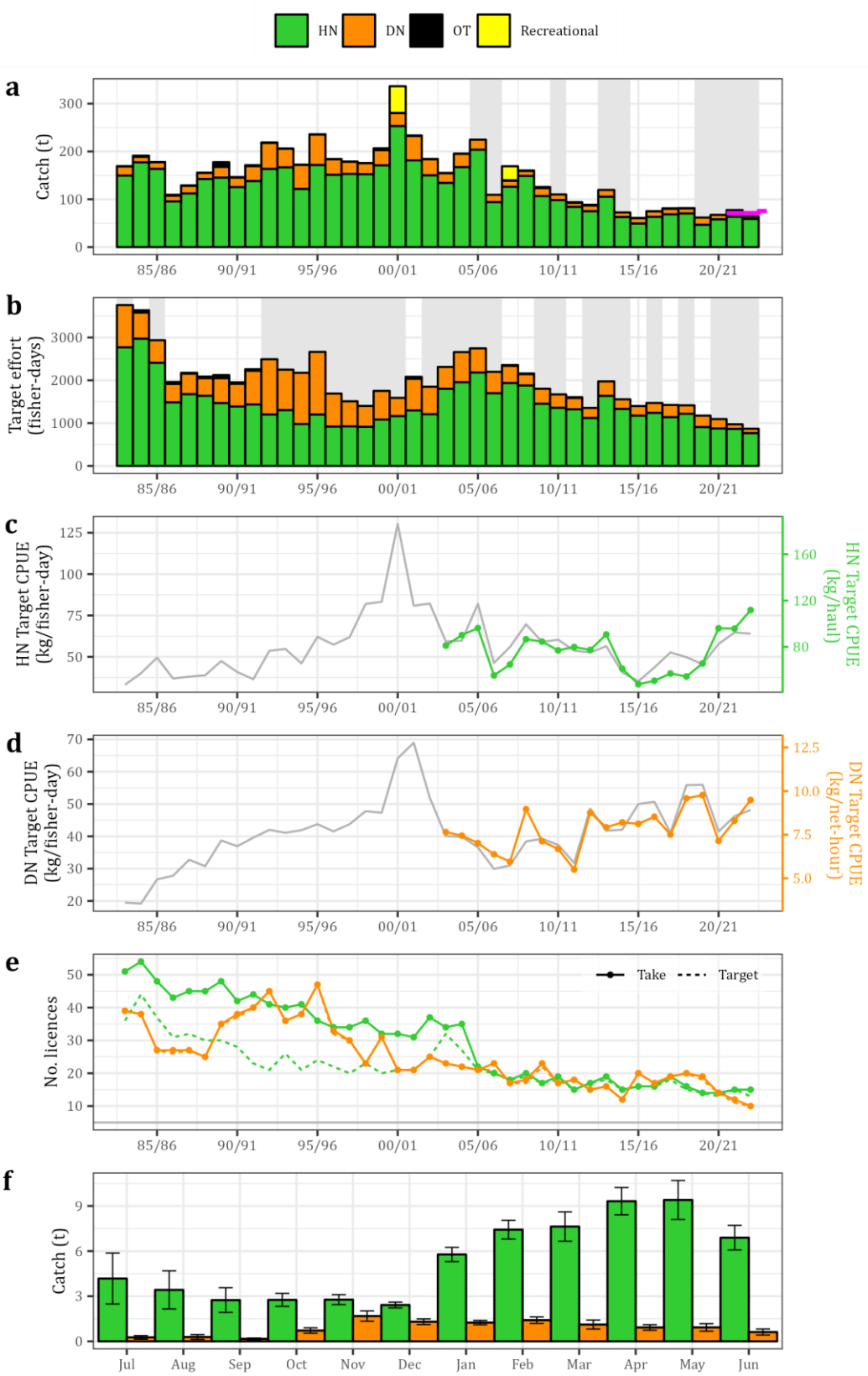


Figure 3.5-5. Key commercial fishery statistics for Southern Garfish in the Gulf St Vincent/Kangaroo Island Fishing Zone, divisible into key gear categories – haul nets (HN), dab nets (DN) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HN catch per unit targeted effort; (d) DN catch per unit targeted effort; (e) number of licences that take and target garfish; and (f) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

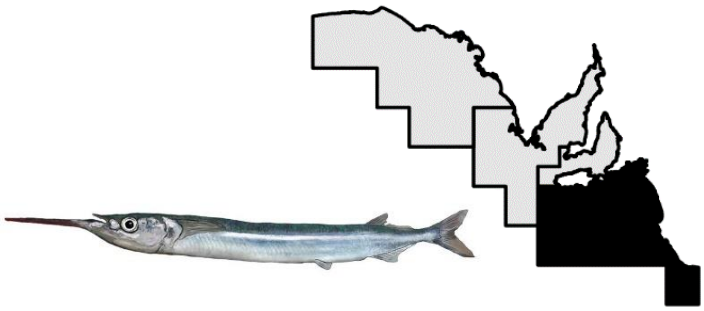
3.5.4. South East Fishing Zone

Southern Garfish

Hyporhamphus melanochir

South East Fishing Zone

2022/23 (Negligible)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total DN catch *t*	Target DN effort *Fisher-days*	Target DN CPUE *kg/fisher-day*	Target DN CPUE *kg/net-hour*
2018/19	*Conf.*	*Conf.*	*Conf.*	*Conf.*
2019/20	*Conf.*	*Conf.*	*Conf.*	*Conf.*
2020/21	3.1	73	41.3	14.7
2021/22	2.2	59	37.2	9.5
2022/23	*Conf*	*Conf.*	*Conf.*	*Conf.*

*DN – Dab net, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Earl et al., 2024*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	11	3	-	2

Zonal catch, targeted effort and CPUE trends

Total annual commercial catches from the SEFZ have been negligible since 1983/83, exceeding 3 *t* in only three years – 1986/87, 2019/20 and 2020/21 (Figure 3.5-6a). Most of the catch is taken using dab nets and targeted effort by dab net fishers has rarely exceeded 50 *fisher-days* per year (Figure 3.5-6b), with 2–6 fishers targeting the species each year (Figure 3.5-6d). Total catch, targeted effort and CPUE data for 2022/23 are confidential. The commercial garfish fishery in the SE has been seasonal over the last decade, with the highest catches taken during the warmer months from October–February (Figure 3.5-6e).

Triggered performance Indicators

General only (includes total catch, target haul net effort and CPUE, target dab net effort and CPUE for 2022/23; Table 3.5-1.

- None triggered.

Stock assessment summary

The latest stock assessment report (Earl et al., 2024) examines commercial fishery statistics and trends up to and inclusive of 2021/22. In this assessment, Southern Garfish in the SEFZ was classified as ‘sustainable’.

The SEFZ has been the least productive region for South Australia’s Southern Garfish fishery since 1983/84. Total catches have generally been < 2 *t*, with contributions to total annual State-wide commercial catches rarely exceeding 0.3%. As only two licences reported targeting and landing garfish in the SEFZ in 2022/23, the catch data are confidential. In 2021/22, the total catch of 2.2 *t* was all taken by dab net. The targeted dab net CPUE of

9.5 *kg/net-hour* in 2021/22 was among the highest on record, reflecting relatively high abundance of Southern Garfish in the areas that were fished.

The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Southern Garfish in the WCFZ is classified as a **sustainable** stock.

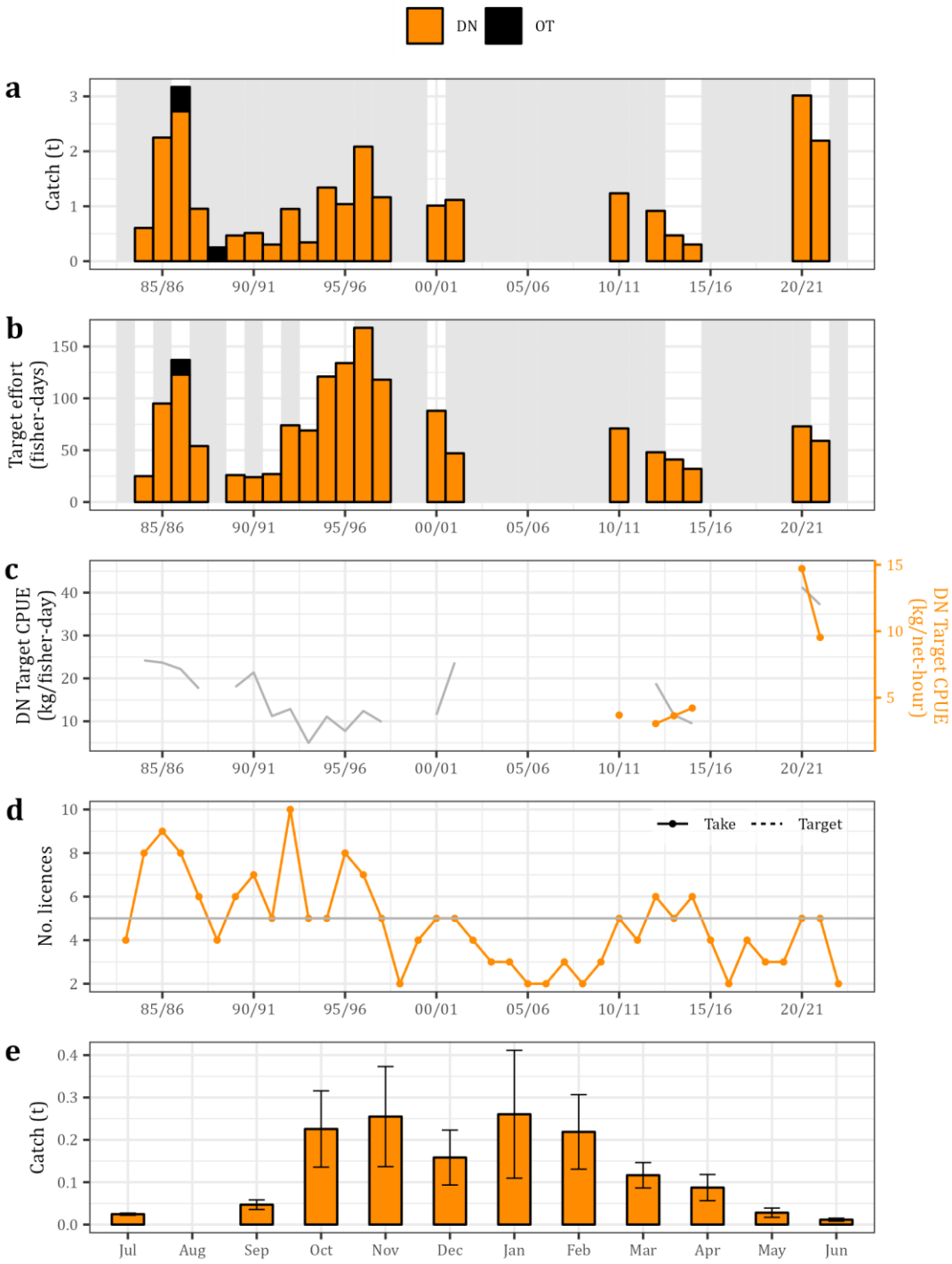


Figure 3.5-6. Key commercial fishery statistics for Southern Garfish in the South East Fishing Zone, divisible into key gear categories – Dab nets (DN) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) DN catch per unit targeted effort; (d) number of licences that take and target Southern Garfish; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential

3.6. Southern Calamari

Southern Calamari

Sepioteuthis australis

State-wide summary 2022/23

Stock status (Tier 1)		Stock status (Tier 2)	Stock status (Negligible)
Spencer Gulf Fishing Zone* Sustainable	**Gulf St Vincent/ Kangaroo Island Fishing Zone*** Sustainable	**West Coast Fishing Zone*** Sustainable	**South East Fishing Zone*** Negligible

Fishery statistics (State-wide)

Commercial (MSF incl.)			Recreational sector			
Fishing Season	**Total catch** *t*	**Targeted effort** *Fisher-days*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	322	10,988	**2000/01**	382 (87)	99	1
2019/20	349	11,194	**2007/08**	208 (29)	98	2
2020/21	350	10,214	**2013/14**	156 (37)	99	1
2021/22	278	8,501	**2021/22**	220 (28)	96	4
2022/23	295	8,760	**Smart et al., 2023*			

Biology

Southern Calamari (*Sepioteuthis australis*) is endemic to southern Australian and northern New Zealand waters. In southern Australia, Southern Calamari ranges from Dampier in Western Australia to Moreton Bay in QLD, including TAS. The life-history of Southern Calamari is characterised by rapid growth and a sub-annual life-span (Jackson, 2004). In South Australia, adults and juveniles are predominantly found in shallow, inshore waters. Offshore waters to depths < 70 *m* tend to be occupied by sub-adults (Winstanley et al., 1983). The patterns of distribution and abundance of adult Southern Calamari in South Australia's gulfs tends to be seasonal and consistent amongst years (Triantafillos, 2001). Adult abundance typically increases for six months to a peak and declines for the remainder of the year. Timing of these peaks varies among regions and follows an anti-clockwise progression around the gulfs. This cycle starts in the south-east during late spring and concludes along the western coasts during late winter. Seasonal patterns in water clarity, associated with the prevailing cross-offshore winds, appear to drive this progression as Southern Calamari spawn in shallow seagrass habitats found along protected leeward shores (Triantafillos, 2001; Steer et al., 2007). Spawning occurs throughout the year and recruitment to the fishery is continuous.

Stock structure

The biological stock structure across the distribution of Southern Calamari is complex and potentially dynamic. One study used allozyme markers to identify three genetic types with overlapping distributions and possible stocks off Western Australia, South Australia, New South Wales and Tasmania (data are not available for Victoria; Triantafillos, 2004). In contrast, another study using microsatellite markers found little genetic differentiation between seven study sites in Western Australia, South Australia, Victoria and Tasmania (Smith et al., 2015). It also identified Tasmania as a possible important site for gene-flow. Life history dynamics, and studies of movement and statolith microchemistry in Tasmania also suggest some localised biological stock structuring (Pecl et al., 2011).

For the purpose of this assessment, stock status is considered to be a component of the southern Australian biological stock but with regional dynamics occurring within each MSF Fishing Zone. Zonal stocks therefore represent management units rather than distinct biological stocks. Here, assessment of stock status is presented at the Fishing Zone stock level – WCFZ, SGFZ, GSV/KIFZ, and SEFZ.

Fishery description

In South Australia, the Southern Calamari resource is shared by multiple sectors. Adult Southern Calamari are targeted by commercial MSF fishers, charter fishery clients, and recreational fishers on the inshore spawning grounds. Juveniles and sub-adult Southern Calamari are incidentally caught by commercial prawn trawlers operating in the deeper (>10 *m*), offshore, gulf waters. The three commercial prawn trawling fleet are permitted to retain and sell Southern Calamari as by-product.

Recreational fishers target Southern Calamari from jetties, breakwaters, and rocky shorelines. The majority of the catch is landed by handlines and rods and reels using squid jigs. Commercial fishers also mostly use jigs, but are also licenced to use haul nets, set nets, and dab nets.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Southern Calamari (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach(Table 3.6-1).

Catch and effort trends

- Total annual State-wide commercial catch including prawn trawl catch peaked at 513 *t* in 2011/12 and has progressively declined to a low of 322 *t* in 2021/22, increasing to 360 *t* in 2022/23 (Figure 3.6-1a).
- The 2022/23 fishing season is the fifth consecutive year below 400 *t* (Figure 3.6-1a). The recreational catch in the 2021/22 survey was estimated at 220 *t* (28 S.E.; (Figure 3.6-1a).
- The GVP of the commercial catch in 2022/23 was $6M, a historic high since 2017/18 ($6M), and since these data became available in 2003/04 (Figure 3.6-1a) making Southern Calamari the most economically important species in the fishery.
- Since 1983/84, the majority of catch has been taken from the GSV/KIFZ (~49%, range 37–60%), followed by the SGFZ (~46%, range 35–59%), and WCFZ (~5%, range 2–9%; Figure 3.6-1b).
- Targeted effort has steadily declined by 31% from the historic high of 12,718 *fisher-days* in 2011/12 to 8,760 *fisher-days* in 2022/23 (Figure 3.6-1c). This gradual decline in effort aligns with the decline in catch.
- Since 2018/19, highest catches occurred in MFA 23 and MFA 32 for SG (5-year average annual catch, ~44 *t* and ~40 *t* respectively), MFA 35 (~38 *t*), MFA 34 (~30 *t*), and MFA 44A (~29 *t*) for GSV/KI, and MFA 9 for WC (~8 *t*; Figure 3.6-2).

Current management regulations

- A summary of key historical management changes for the Southern Calamari fishery is provided in the 2021/22 stock summary report (Smart et al., 2023).
- No LML applies to all sectors.
- SG and GSV/KI managed via Total Allowable Commercial Catches (TACCs) and Individual Transferable Quotas (ITQs).
- Daily recreational limits: 15 for individuals and 45 for boats when 3 or more are onboard.

Performance indicators

Catch, targeted effort, targeted CPUE trends.

Research & development needs

- Developing a cost-effective stock assessment program for Southern Calamari fisheries' (FRDC Project 2021/118).
- CPUE standardisation.
- Application of the harvest strategy framework when finalised under the next management plan.
- More regular and reliable estimates of recreational catch.

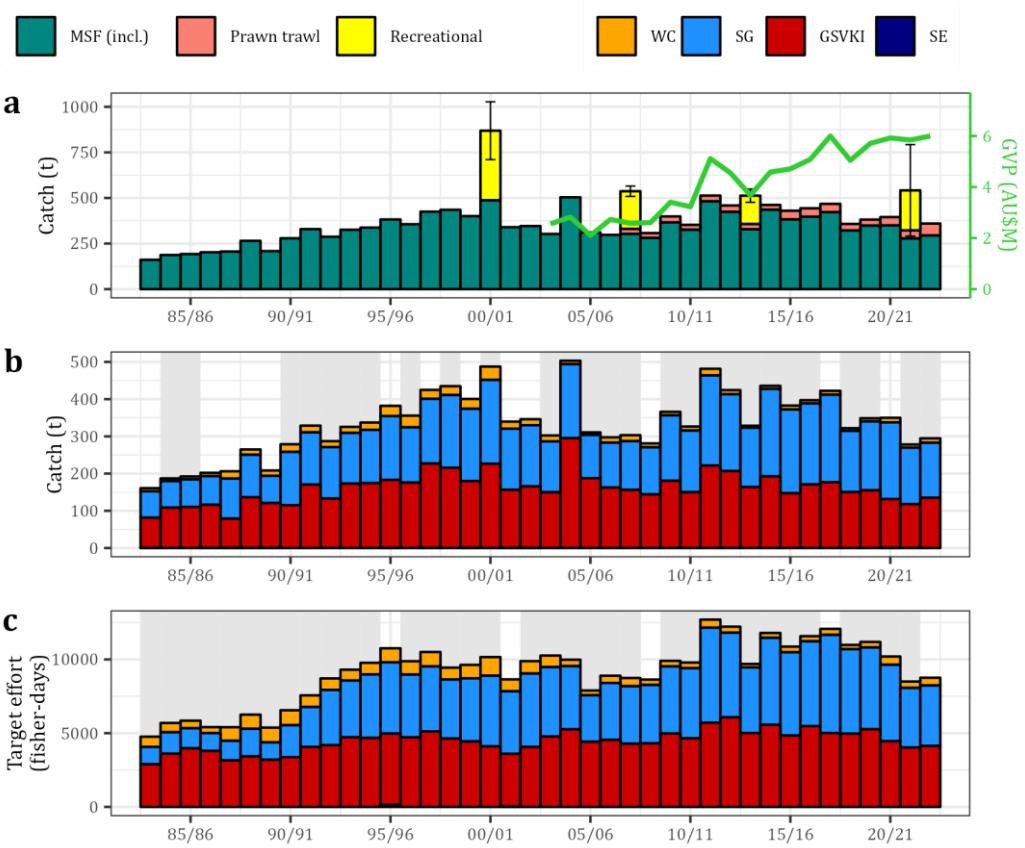


Figure 3.6-1. Fishery statistics for South Australia's Southern Calamari Fishery. Long-term trends in annual estimates of: (a) total catch for the commercial sector (MSF, SZRLF, NZRLF combined), prawn trawl bycatch, and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP); (b) total commercial catch, by Fishing Zone – West Coast (WC), Spencer Gulf (SG), Gulf St Vincent/Kangaroo Island (GSV/KI) and South East (SE); and (c) commercial effort targeting Southern Calamari, by Fishing Zone. Grey shading indicates years when data for one or more Fishing Zones are confidential.

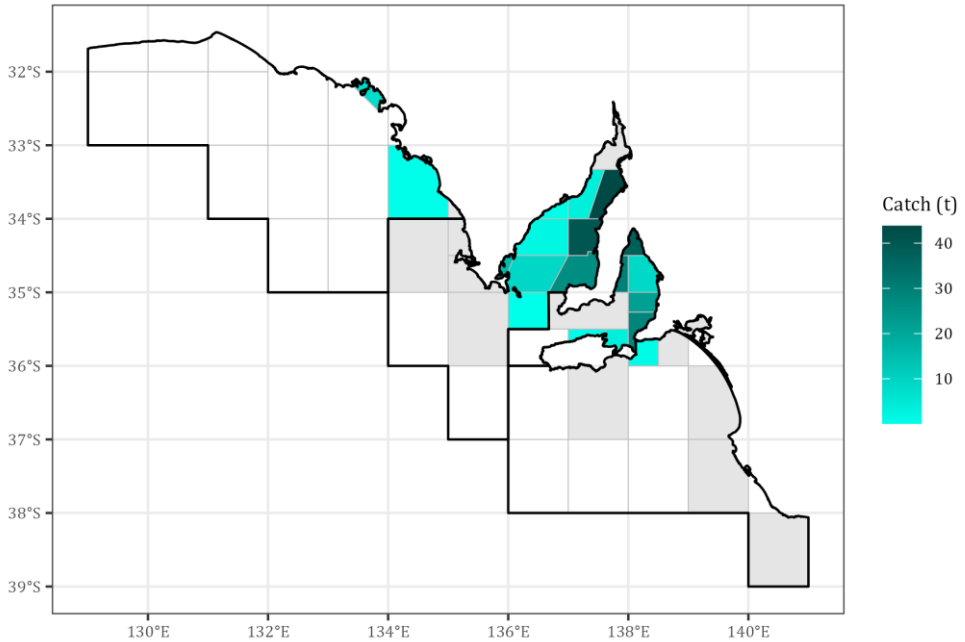


Figure 3.6-2. Spatial distribution of Southern Calamari catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

Table 3.6-1. Results of the assessment of the general (G) fishery performance indicators against their trigger reference points at the regional spatial scales for Southern Calamari in 2022/23. Lower trigger reference point (LTRP) breaches are indicated in light blue and upper trigger reference point (UTRP) breaches are indicated in blue. - indicates that no trigger has been breached. ● indicates that the trigger for five consecutive decreases has been triggered. NA indicates trigger is not assessed. Stock/zone abbreviations: West Coast (WC), Spencer Gulf (SG), Gulf St Vincent/Kangaroo Island (GSV/KI), South East (SE).

PERFORMANCE INDICATOR	TYPE	TRIGGER REFERENCE POINT	WC	SG	GSV/KI	SE
Total catch	G	3rd Lowest/3rd Highest	-	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-	-
	G	Greatest five-year trend	-	-	-	-
	G	Decrease over five consecutive years	-	-	-	-
Target jig effort	G	3rd Lowest/3rd Highest	-	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-	-
	G	Greatest five-year trend	-	-	-	-
	G	Decrease over five consecutive years	-	●	-	-
Target jig CPUE	G	3rd Lowest/3rd Highest	-	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-	-
	G	Greatest five-year trend	-	-	-	-
	G	Decrease over five consecutive years	-	-	-	-
Target haul net effort	G	3rd Lowest/3rd Highest	-	UTRP	UTRP	-
	G	Greatest % interannual change (+/-)	-	-	-	-
	G	Greatest five-year trend	-	-	-	-
	G	Decrease over five consecutive years	-	-	-	-
Target haul net CPUE	G	3rd Lowest/3rd Highest	-	-	-	-
	G	Greatest % interannual change (+/-)	-	-	-	-
	G	Greatest five-year trend	-	-	-	-
	G	Decrease over five consecutive years	-	-	-	-

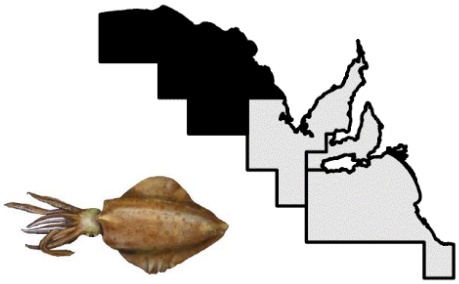
3.6.1. West Coast Fishing Zone

Southern Calamari

Sepioteuthis australis

West Coast Fishing Zone

2022/23 (Tier 2)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	Target SQ effort *Fisher-days*	Target SQ CPUE *kg/fisher-day*	Target SQ CPUE *kg/line-hour*
2018/19	7	284	25.2	2.5
2019/20	9	376	22.5	2.3
2020/21	12	560	21.6	1.9
2021/22	9	432	20.0	3.1
2022/23	12	520	22.6	2.9

*SQ – Squid jig, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Earl et al., 2024*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	56	24	-	9

Zonal catch, targeted effort and CPUE trends

The total MSF catch in 2022/23 was 12 *t* and above the ten-year average for the WCFZ but lower than historical catches of up to 30 *t* (Figure 3.6-3a). The total SQ effort was 520 *fisher-days* in 2022/23 which produced a CPUE by *kg/fisher-day* of 22.6 *kg/fisher-day* (Figure 3.6-3bc). The CPUE by *kg/line-hour* in 2022/23 was 2.9 *kg/line-hour*, which decreased slightly from 3.1 *kg/line-hour* in 2021/22 (Figure 3.6-3c). Both CPUE series had strong alignment across fishing seasons with the exception of 2021/22 when CPUE by *kg/line-hour* had a 18% increase compared to the previous season while CPUE by *kg/fisher-day* had a 10% decrease. In 2022/23, CPUE by *kg/line-hour* decreased by 6% while CPUE by *kg/fisher-day* increased by 12% (Figure 3.6-3c).

The number of licences targeting and taking Southern Calamari was stable at 35, respectively, in the WCFZ in 2022/23 (Figure 3.6-3d). The squid jig fishery for Southern Calamari in the WCFZ shows a seasonal trend over the last decade, with the lowest catches in January which progressively increases to the highest catches taken in April, May and June (Figure 3.6-3e). Generally, there appears to be no discernible upward or downward trend in any MSF fishery statistic for the WCFZ, demonstrating that this fishery is in a period of relative stability.

Triggered performance Indicators

General only (includes total catch, target jig effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.6-1).

- None triggered

Stock assessment summary
The last assessment of Southern Calamari in the WCFZ was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In that assessment, the WCFZ was classified as 'sustainable'. Fishery statistics for 2022/23 do not indicate any stock declines in the WCFZ; consequently, none of the general PIs triggered. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Southern Calamari in the WCFZ is classified as a **sustainable** stock.

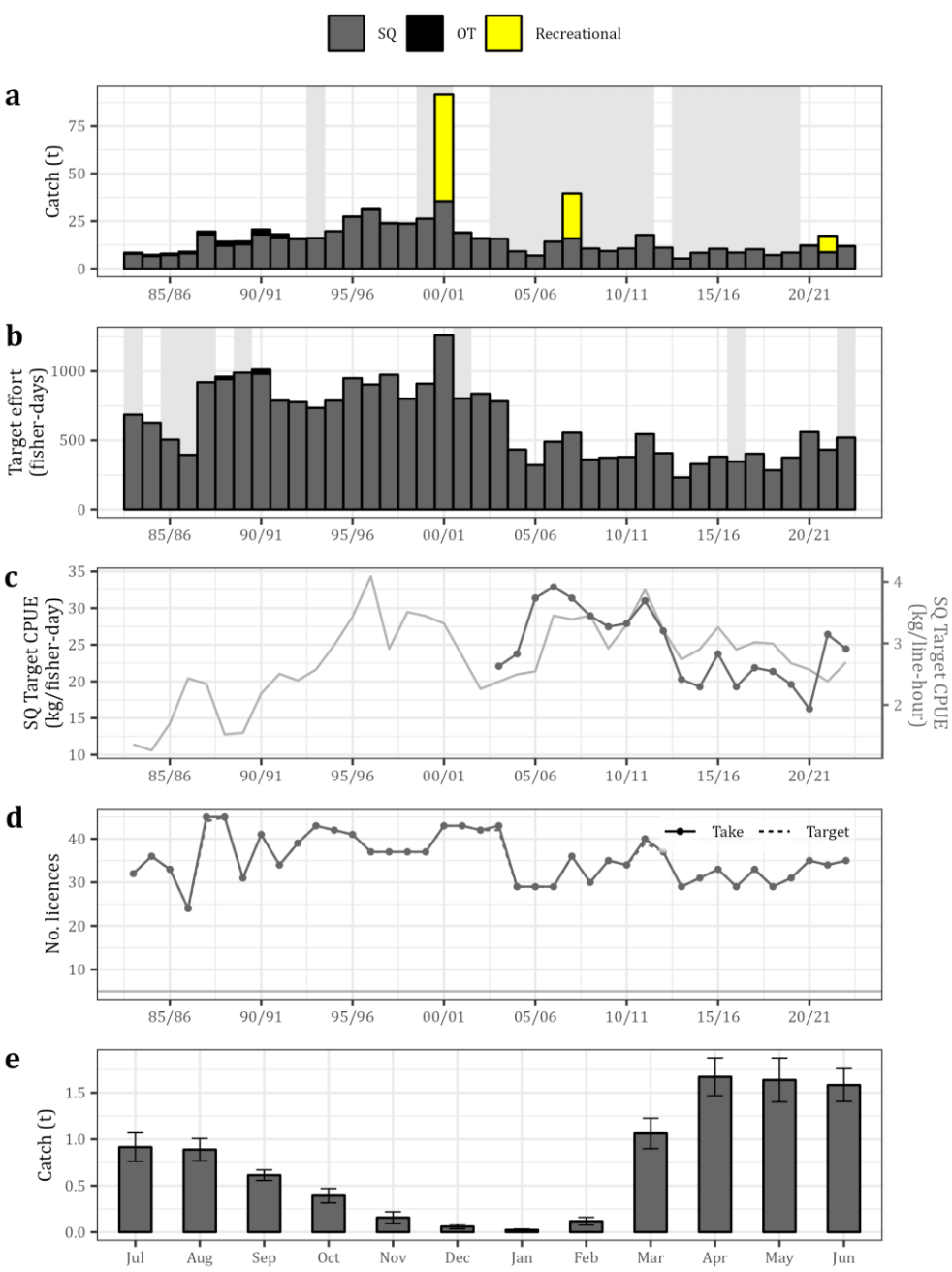


Figure 3.6-3. Key commercial fishery statistics for Southern Calamari in the West Coast Fishing Zone, divisible into key gear categories – Squid jig (SQ) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) SQ catch per unit targeted effort; (d) number of licences that take and target Southern Calamari; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

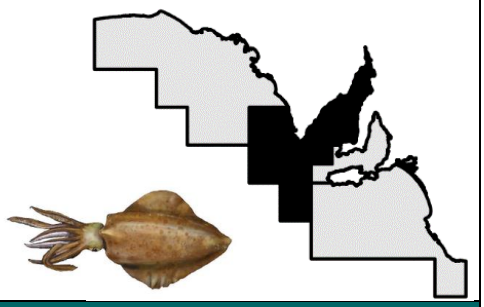
3.6.2. Spencer Gulf Fishing Zone

Southern Calamari

Sepioteuthis australis

Spencer Gulf Fishing Zone

2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	SQ			HN			TACC *t*
		Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/line-hour*	Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/haul*	
2018/19	164	5,314	24.9	2.4	412	45.3	36.1	-
2019/20	185	4,945	25.5	2.4	601	67.8	53.8	-
2020/21	206	4,615	33.5	3.2	566	57.4	44.5	-
2021/22	152	3,606	33.3	3.4	431	39.0	39.2	204
2022/23	148	3,332	29.1	2.9	771	46.9	48.8	211.5

*SQ – Squid Jig, HN – Haul net, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Smart et al., 2023*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	134	79	-	115

Zonal catch, targeted effort and CPUE trends

The total MSF catch of Southern Calamari in the SGFZ was 148 *t* in 2022/23, constituting 73% of the TACC, and the lowest catch since the 2008/09 fishing season (Figure 3.6-4a). Recreational catch in the 2021/22 fishing survey was estimated at 115 *t* at the SGFZ level (Figure 3.6-4a). In 2022/23, squid jigs accounted for 65% of the total commercial catch, while haul nets accounted for ~33% of the catch, consistent with historic trends (Figure 3.6-4a). Total targeted effort has declined from a historic peak of 6,663 *fisher-days* in 2017/18 to 4,106 *fisher-days* in 2022/23, representing a decrease of 38% (Figure 3.6-4b). Decreases in total catch corresponds with decreases in total targeted effort, which in 2022/23 were the second lowest of the past decade (Figure 3.6-4b). Squid jigs accounted for the majority of targeted effort in 2022/23, consistent with long-term trends in gear use (Figure 3.4-5b).

Targeted squid jig CPUE by *kg/fisher-day* and *kg/line-hour* have fluctuated around the historic mean since 2004/05, however, in 2022/23, both *kg/fisher-day* and *kg/line-hour* decreased below that of the past two consecutive years to 29.07 *kg/fisher-day* and 2.9 *kg/line-hour* respectively (Figure 3.4-5c). Targeted haul net CPUE by *kg/fisher-day* and *kg/line-hour* have fluctuated annually but steadily increased since 2006/07. Targeted haul net CPUE increased to 46.8 *kg/fisher-day* and 48.8 *kg/line-hour* in 2022/23 from 38.9 *kg/fisher-day* and 39.1 *kg/line-hour* in 2021/22 (Figure 3.4-5d).

The number of haul net licences taking and targeting Southern Calamari in SG have remained stable over time since 2005/06 (Figure 3.4-5e). However, the number of licences taking and targeting Southern Calamari using squid jigs remained stable until 2021/22, before declining to 75 take and target licences in 2022/23 (Figure 3.4-5e).

The squid jig fishery for Southern Calamari in SG shows a seasonal trend over the last decade, with the lowest catches in July which progressively increase to the highest catches being taken in November (Figure 3.4-5f). In

contrast, haul net catches peak in April and May, before progressively declining to near negligible catches in October to February (Figure 3.4-5f).

Triggered performance Indicators

General only (includes total catch, target jig effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.6-1).

- Target haul net effort – 3rd Lowest / 3rd Highest (UTRP, highest)
- Target jig effort – decreased over 5 consecutive years (Triggered).

Stock assessment summary

The last assessment of Southern Calamari in the SGFZ was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the SGFZ was classified as 'sustainable'.

Fishery statistics for 2022/23 do not indicate any stock declines in the fishery, and reduced catches and effort are the result of fleet rationalisation and the unitisation that occurred through recent fishery reform. However, some stakeholders have expressed concerns of localised population declines that may go undetected at the spatial scale of the MFAs. Additionally, cephalopod populations are susceptible to environmental change and often fluctuate with environmental conditions (Arkhipkin et al., 2021). Given the economic importance of Southern Calamari to the MSF, there would be great benefit in enhancing the assessment program to ensure that stock declines do not unknowingly occur through examining fishery statistics alone.

The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Southern Calamari in the SGFZ is classified as a **sustainable** stock.

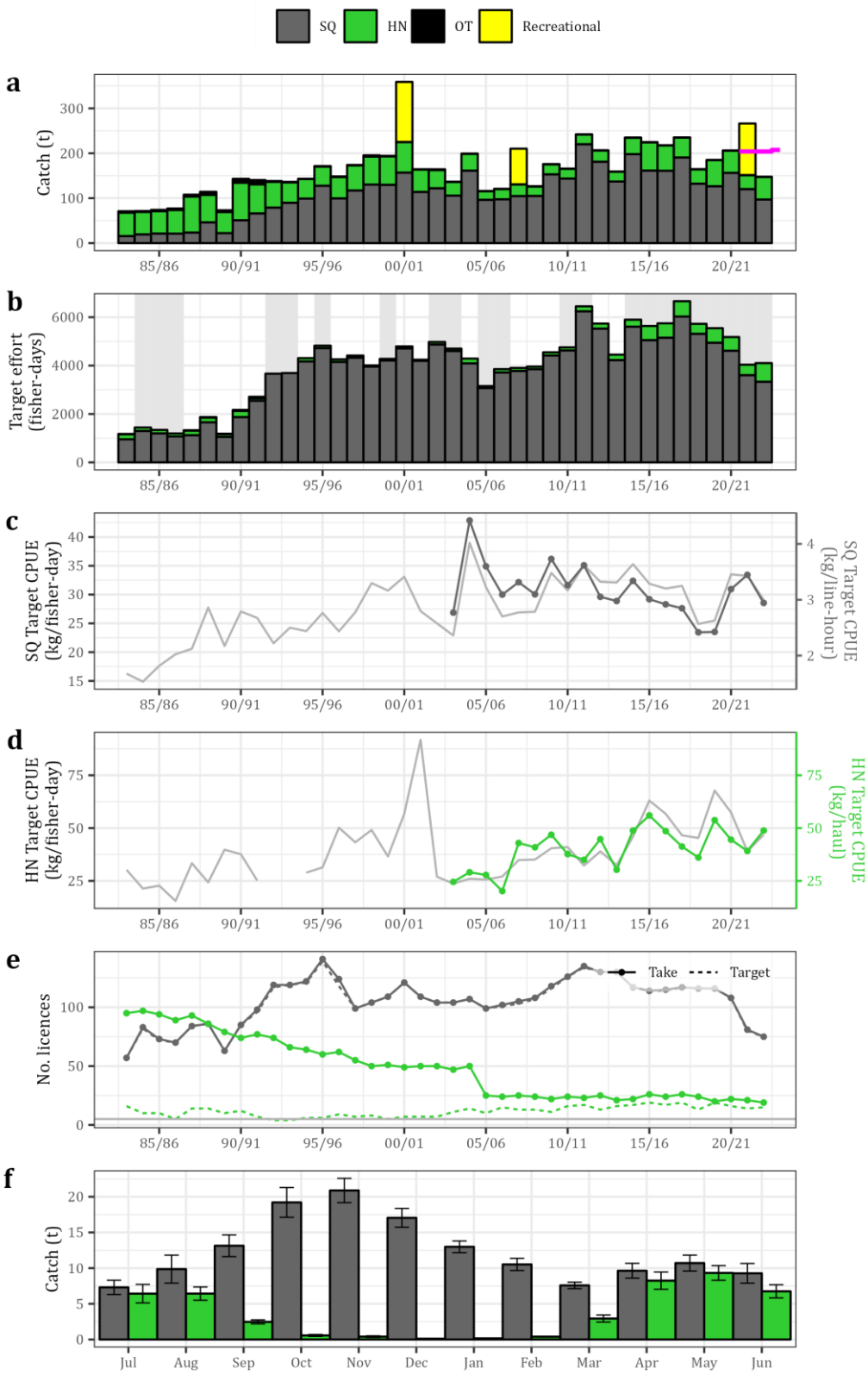


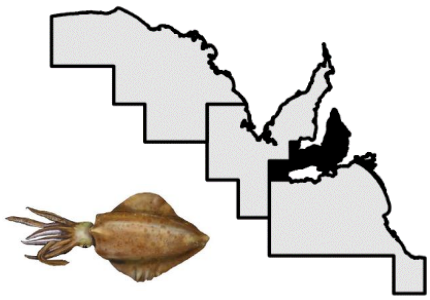
Figure 3.6-4. Key commercial fishery statistics for Southern Calamari in the Spencer Gulf Fishing Zone, divisible into key gear categories – Squid jig (SQ), haul nets (HN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) SQ catch per unit targeted effort; (d) HN catch per unit targeted effort; (e) number of licences that take and target Southern Calamari; and (f) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

3.6.3. Gulf St Vincent/Kangaroo Island Fishing Zone

Southern Calamari

Sepioteuthis australis

Gulf St Vincent/Kangaroo Island Fishing Zone 2022/23 (Tier 1)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Commercial fishery statistics

Fishing season	Total catch *t*	SQ			HN			TACC *t*
		Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/line-hour*	Target effort *Fisher-days*	Target CPUE *kg/fisher-day*	Target CPUE *kg/haul*	
2018/19	150	4,014	29.0	1.8	957	27.0	41.5	-
2019/20	155	4,233	28.7	1.8	1,031	26.4	36.0	-
2020/21	131	3,550	28.4	1.9	905	27.0	45.7	-
2021/22	118	3,042	29.7	2.1	988	23.5	38.3	162
2022/23	135	2,942	34.4	2.5	1,188	24.1	41.7	168.3

*SQ – Squid Jig, HN – Haul net, CPUE - Catch per unit effort, TACC – Total allowable commercial catch. * Smart et al., 2023*

Recreational catch

Survey	2000/01	2007/08	2013/14	2021/22
Estimated catch (*t*)	166	101	-	90

Zonal catch, targeted effort and CPUE trends

The total MSF catch of Southern Calamari in the GSV/KIFZ was 135 *t* in 2022/23, constituting 83% of the TACC (Figure 3.6-5a). Total catch shows no apparent trend since the early 1990s, until 2020/21–2022/23, when the lowest catches over this 30-year period were recorded (Figure 3.6-5a). Recreational catch in the 2021/22 fishing survey was estimated at 90 *t* at the GSV/KIFZ level (Figure 3.6-5a). In 2022/23, squid jigs accounted for 75% of the total commercial catch, while haul nets accounted for ~25% of the catch (Figure 3.6-5a).

Decreases in total catch corresponds with decreases in total effort, which were the lowest on record at 4,030 and 4,132 *fisher-days* in 2021/22 and 2022/23, respectively (Figure 3.6-5b). The total targeted effort in 2022/23 represents a decrease of 32% from the historic peak in total targeted effort of 6,075 *fisher-days* in 2012/13 (Figure 3.6-5b). Squid jigs accounted for the majority of targeted effort in 2022/23, which is consistent with long-term trends in gear use (Figure 3.4-5b).

Targeted squid jig CPUE in *fisher-days* underwent a minor increase from recent fishing seasons in 2022/23 at 34.4 *kg/fisher-day*, the highest CPUE in ~10 years (Figure 3.6-5c). Targeted squid jig CPUE by *kg/line-hour* also increased to 2.5 *kg/line-hour*, the highest CPUE since 2006/07 (Figure 3.6-5c). Targeted haul net CPUE by *kg/fisher-day* has had a long-term decline since the historic peak of 50.9 *kg/fisher-day* in 2004/05 to its lowest point since this peak of 23.5 *kg/fisher-day* in 2021/22, increasing slightly in 2022/23 to 32.4 *kg/fisher-day* (Figure 3.6-5d). However, targeted haul net CPUE in *kg/haul* have fluctuated around the historic mean since this data became available in 2003/04, despite a historic peak in 2011/12 of 62.6 *kg/haul* (Figure 3.6-5d).

The number of haul net licences taking and targeting Southern Calamari in GSV/KI have remained stable since 2005/06 (Figure 3.6-5e). However, the number of licences taking and targeting Southern Calamari using squid jigs remained stable until 2018/19, before declining to the historic low of 47 take and target in 2022/23 (Figure 3.6-5e).

The squid jig fishery for Southern calamari in GSV/KI shows a seasonal trend over the last decade, with the lowest catches in March which progressively increases to the highest catches taken in November (Figure 3.6-5f). In contrast, haul net catches peak in April and May, before progressively declining to near negligible catches in January (Figure 3.6-5f).

Triggered performance Indicators

General only (includes total catch, target jig effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.6-1).

- Target haul net effort – 3rd Lowest / 3rd Highest (UTRP, 2nd highest)

Stock assessment summary

The last assessment of Southern Calamari in the GSV/KIFZ was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In that assessment, the GSV/KIFZ was classified as 'sustainable'.

Fishery statistics for 2022/23 do not indicate any stock declines in the fishery, with declines in catch and effort in recent years the result of fleet rationalisation and the unitisation that occurred through recent fishery reform. Increasing CPUE from a period of relative stability for GSV/KI demonstrates that population declines are unlikely. However, some stakeholders have expressed concerns of localised population declines that may go undetected at the spatial scale of the MFAs. Additionally, cephalopod populations are susceptible to environmental change and often fluctuate with environmental conditions (Arkhipkin et al., 2021). Given the economic importance of Southern Calamari to the MSF, there would be great benefit in enhancing the assessment program to ensure that stock declines do not unknowingly occur through examining fishery statistics alone.

The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Southern Calamari in the GSV/KIFZ is classified as a **sustainable** stock.

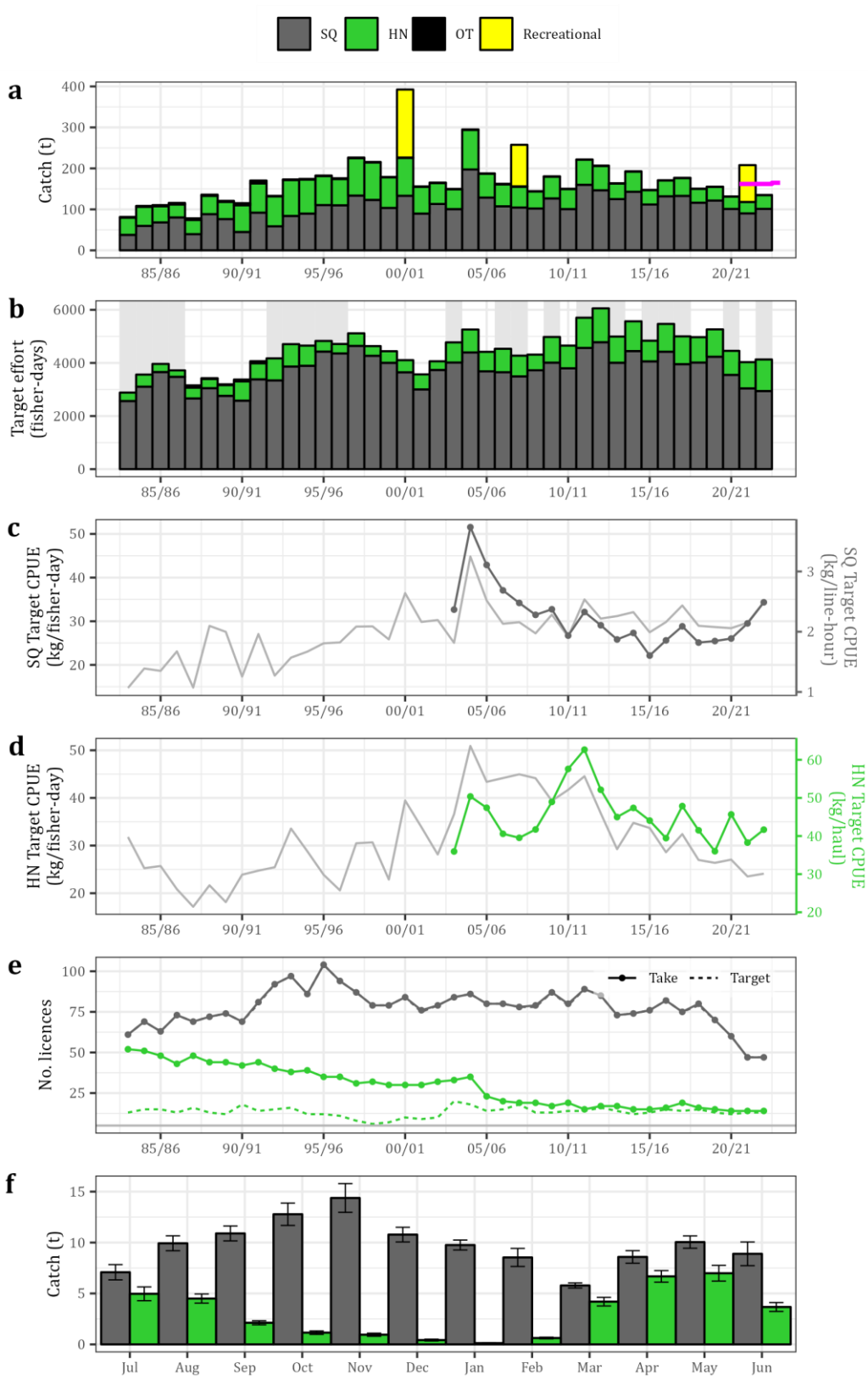


Figure 3.6-5. Key commercial fishery statistics for Southern Calamari in the Gulf St Vincent/Kangaroo Island Fishing Zone, divisible into key gear categories – Squid jig (SQ), haul nets (HN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) SQ catch per unit targeted effort; (d) HN catch per unit targeted effort; (e) number of licences that take and target Southern Calamari; and (f) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Pink line in (a) indicates TACC.

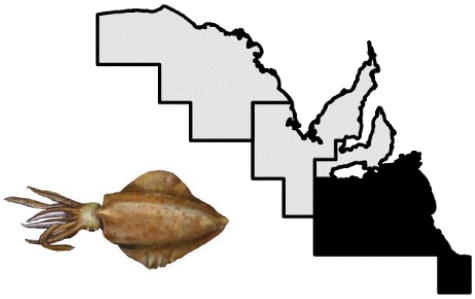
3.6.4. South East Fishing Zone

Southern Calamari

Sepioteuthis australis

South East Fishing Zone

2022/23 (Negligible)



Stock status

2020*	2021/22*	2022/23
No status assigned	Negligible	Negligible

**Smart et al., 2023*

Zonal catch, targeted effort and CPUE trends

Negligible amounts of catch occur in the SEFZ, and the limited amount of fishing effort prevents data from being presented in most fishing seasons due to confidentiality (Figure 3.6-6).

Triggered performance Indicators

General only (includes total catch, target jig effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.6-1).

- None triggered

Stock assessment summary

The last assessment of Southern Calamari in the SEFZ was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the SEFZ was classified as 'negligible' Fishery statistics for 2022/23 do not indicate any stock declines in the SEFZ; consequently, none of the general PIs triggered.

Over the past 40 years, annual commercial catches of Southern Calamari in the SEFZ have been < 0.5 t, which is unlikely to be having a negative impact on the stock. Recreational catch estimates are not presented as they are considered unreliable. Due to historically low catches (Figure 3.6-6), and the stock generally not been subject to targeted fishing, Southern Calamari in the SEFZ is classified as a **negligible** stock.

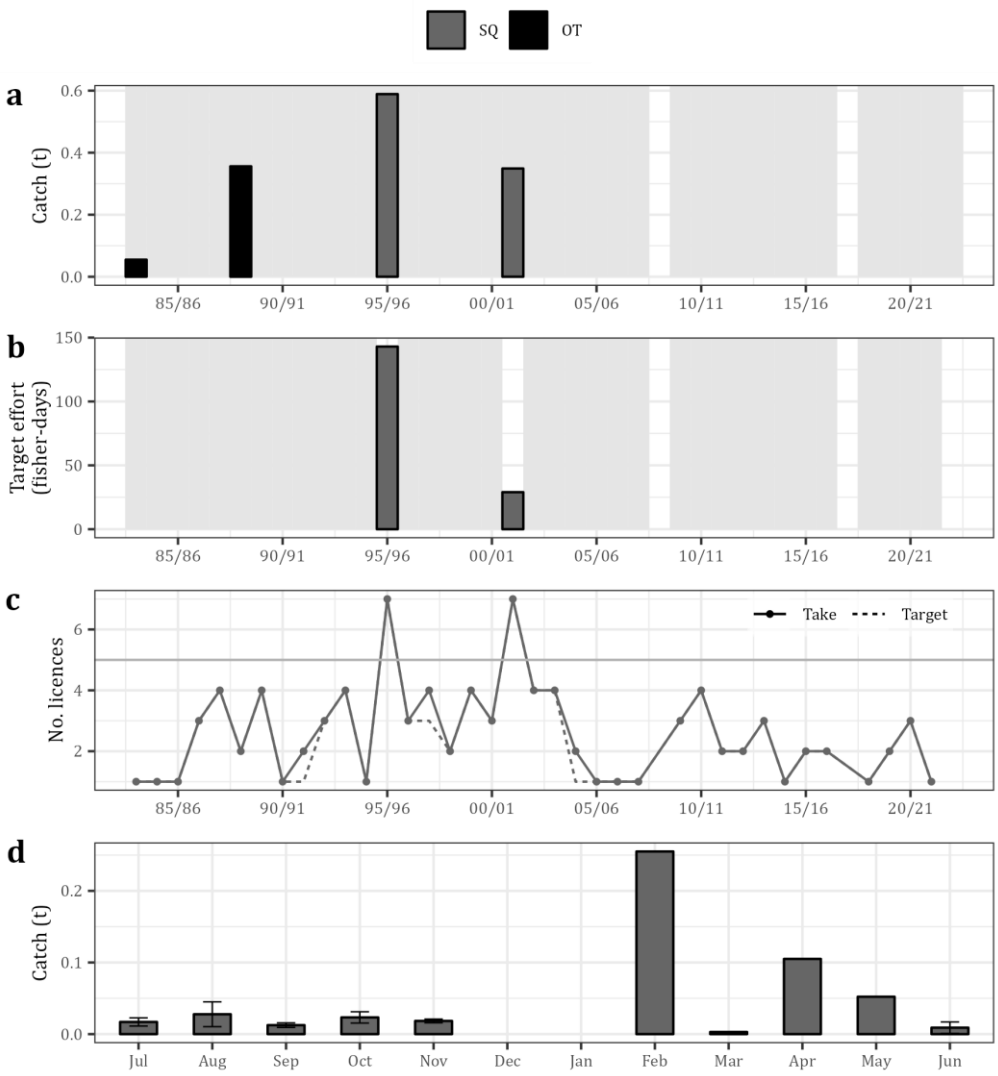


Figure 3.6-6. Key commercial fishery statistics for Southern Calamari in the South East Fishing Zone, divisible into key gear categories – Squid jig (SQ) and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) SQ catch per unit targeted effort; (d) number of licences that take and target Southern Calamari; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Horizontal solid grey line indicates minimum number of licences to be non-confidential (i.e., ≥5 licences)

3.7. Yellowfin Whiting

Yellowfin Whiting

Sillago schomburgkii

State-wide summary 2022/23

Stock status (Tier 2)	
Gulf St Vincent/ Kangaroo Island Fishing Zone*	**Spencer Gulf Fishing Zone***
Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial			Recreational sector			
Fishing Season	**Total catch** *t*	**Total effort** *Fisher-days*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	126	2,992	**2000/01**	53 (25)	78	22
2019/20	132	2,226	**2007/08**	23 (7)	72	28
2020/21	81	1,890	**2013/14**	45 (19)	61	39
2021/22	125	1,825	**2021/22**	28 (14)	70	30
2022/23	97	1,480	**Smart et al., 2023*			

Biology

The Yellowfin Whiting (*Sillago schomburgkii*) is endemic to Australian coastal waters from Dampier to Albany in Western Australia and in South Australia's gulf waters (Kailola et al., 1993). Uncertainty exists about the continuity of the species' distribution through the remote coastal waters between Western Australia and South Australia (Ferguson & Duffy, 2021).

Fishery catches indicate that in South Australia, Yellowfin Whiting occur in highest abundances in the two northern gulfs, with lower abundances in the southern gulfs and the west coast of Eyre Peninsula. The life history of this species appears particularly adapted to habitation of relatively protected, shallow, near-shore gulf and coastal waters. Adults are generally associated with shallow, tidal creeks and coastal sand flats in waters of 1–10 *m* depth (Jones, 1981). Spawning occurs during the summer months, and then between February and April, post-larvae are found along the shallow, protected, sandy beaches of the northern gulfs. Subsequently, juvenile fish occupy similar habitats as well as tidal creeks (Ferguson, 2000). Yellowfin Whiting demonstrate different growth patterns between the sexes that culminates in females reaching larger sizes-at-age than males (Ferguson, 2000). Age estimation of Yellowfin Whiting using otoliths has indicated a longevity of ~12 years, although most fish taken in the commercial fishery were 2 to 4 years old.

Stock structure

Based on the possible discontinuous distribution between South Australian and Western Australian populations, there is the possibility of separate stocks as well as genetic differentiation (Ferguson & Duffy, 2021). However, even within South Australia, the oceanographic separation of the two gulfs during the spawning season in summer must considerably reduce the opportunity for mixing by egg and larval advection. As such, the populations in the two gulfs may constitute separate stocks. This remains to be resolved.

Here, assessment of stock status is presented at the Fishing Zone stock level –SGFZ and GSV/KIFZ

Fishery description

Yellowfin Whiting is a Tier 2 stock in both the SGFZ and GSV/KIFZ due to its economic importance to the commercial MSF, it's level of targeting (when percentage of catch is considered during individual events) and its importance to recreational fishers (Smart et al., 2022b). Commercial catches have been variable as in the past it was targeted when demand for, or availability of, primary species was low. As Yellowfin Whiting is a schooling species that occupies sandy, shallow habitats predominantly in the northern gulfs, it is particularly vulnerable to

net gear types used in the MSF. As such, historically the commercial catches have been dominated by the net sector, with haul nets the predominant gear followed by set nets. Yellowfin Whiting is a popular target species of boat- and shore-based recreational fishers who target them using hook and line. In 2021/22, this sector took an estimated catch of 28 *t* (Beckmann et al., 2023).

Assessment program

- Catch-MSY model (Smart et al., 2023).
- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Yellowfin Whiting (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach (Table 3.7-1).

Catch and effort trends

- Total annual State-wide commercial catch peaked at 181 *t* in 2002/03, declining to an average yearly catch over the last decade of 119 *t* (range 81–152 *t*; Figure 3.7-1a).
- In 2022/23, the total catch was 97 *t* which was a decrease of 28 *t* from 2021/22, although did not reach the anonymously low of 81 *t* in 2020/21 (Smart et al., 2023; Figure 3.7-1a). The recreational catch in the 2021/22 survey was 28 *t* (14 S.E.; Figure 3.7-1a).
- The GVP of the commercial catch in 2022/23 was $1M, 8.7% above the mean GVP since these data became available in 2003/04 (Figure 3.7-1a).
- Since 1983/84, the majority of catch has been taken from the SGFZ (~82%, range 60–97%; Figure 3.7-1b).
- Combined haul net and set net effort declined between 2002/03 and 2007/08 and has been relatively stable since (Figure 3.7-1c).
- Total effort has steadily declined by 83% from 8,718 *fisher-days* in 1983/84 to 1,480 *fisher-days* in 2022/23 (Figure 3.7-1c). The State-wide total effort in 2022/23 is a historic low, and the third consecutive year below 2,000 *fisher-days*.
- Since 2018/19, highest catches occurred in MFA 22 and 23 for SG (5-year average annual catch, ~35 and ~24 *t*, respectively), MFA 35 (~12 *t*) for GSV/KI (Figure 3.7-2).

Current management regulations

- A summary of key historical management changes for the Yellowfin Whiting fishery is provided in the 2021/22 stock summary report (Smart et al., 2023).
- LML of 240 *mm* TL applies to all sectors.
- Daily recreational limits: 20 for individuals and 60 for boats when 3 or more are onboard.

Performance indicators

Catch (SGFZ and GSV/KIFZ), targeted effort (SGFZ only), targeted CPUE trends (SGFZ only).

Research & development needs

- Quantify the extent of the decline in the GSV/KI stock, whether there are any measurable signs of population recovery and whether recruitment impairment has occurred.
- CPUE standardisation.
- Application of the harvest strategy framework when finalised under the next management plan.
- More regular and reliable estimates of recreational catch.

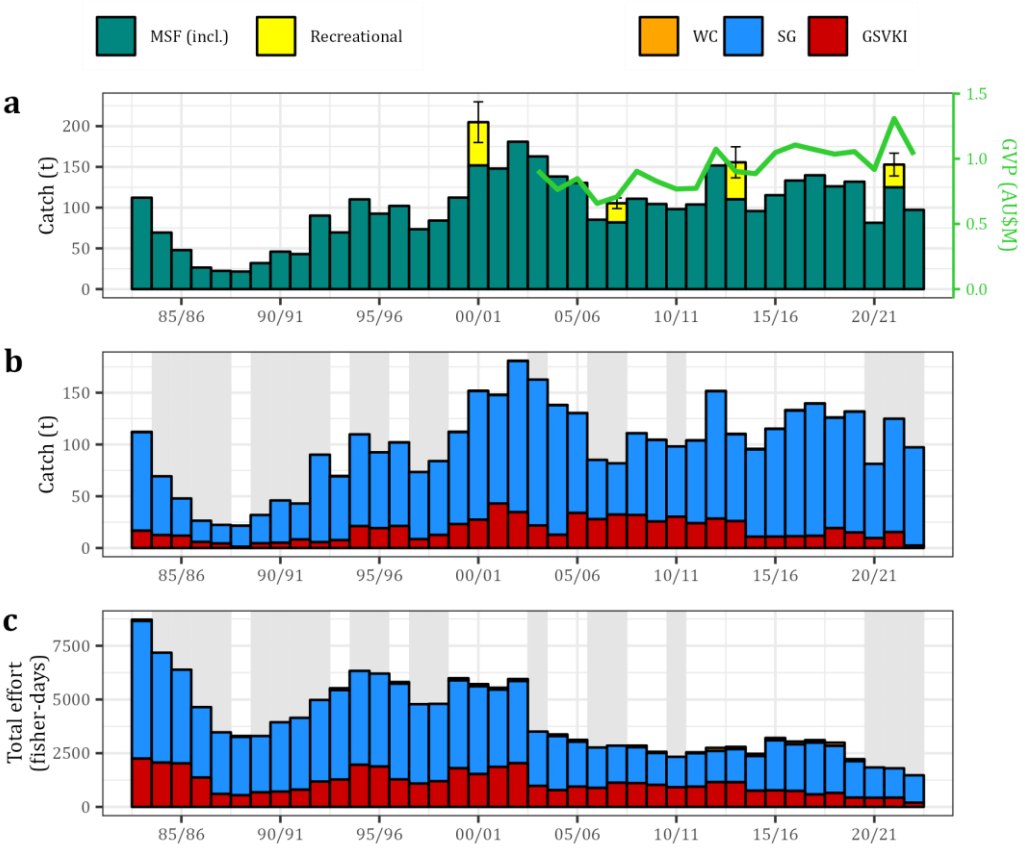


Figure 3.7-1. Fishery statistics for South Australia's Yellowfin Whiting Fishery. Long-term trends in annual estimates of: (a) total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP); (b) total commercial catch, by Fishing Zone – West Coast (WC), Spencer Gulf (SG), and Gulf St Vincent/Kangaroo Island (GSV/KI); and (c) total commercial effort catching Yellowfin Whiting, by Fishing Zone. Grey shading indicates years when data for one or more Fishing Zones are confidential.

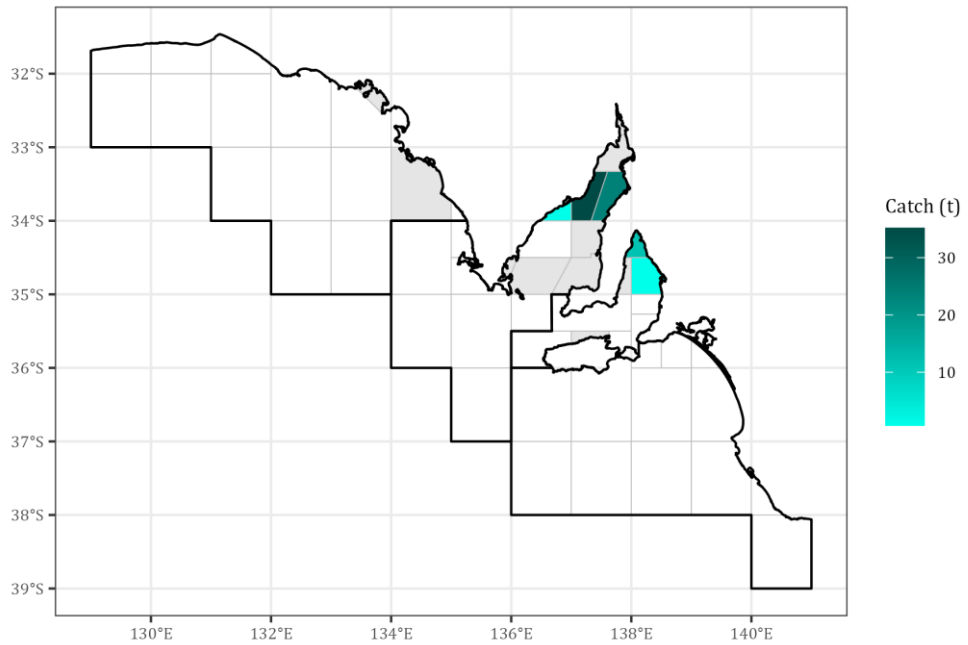


Figure 3.7-2. Spatial distribution of Yellowfin Whiting catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

Table 3.7-1. Results of the assessment of the general (G) fishery performance indicators against their trigger reference points at the regional spatial scales for Yellowfine Whiting in 2022/23. Lower trigger reference point (LTRP) breaches are indicated in light blue and upper trigger reference point (UTRP) breaches are indicated in blue. - indicates that no trigger has been breached. ● indicates that the trigger for five consecutive decreases has been triggered. NA indicates trigger is not assessed. Stock/zone abbreviations: Spencer Gulf (SG), Gulf St Vincent/Kangaroo Island (GSV/KI).

PERFORMANCE INDICATOR	TYPE	TRIGGER REFERENCE POINT	SG	GSV/KI
Total catch	G	3rd Lowest/3rd Highest	-	LTRP
	G	Greatest % interannual change (+/-)	-	LTRP
	G	Greatest five-year trend	-	-
	G	Decrease over five consecutive years	-	-
Target haul net effort	G	3rd Lowest/3rd Highest	-	NA
	G	Greatest % interannual change (+/-)	-	NA
	G	Greatest five-year trend	-	NA
	G	Decrease over five consecutive years	-	NA
Target haul net CPUE	G	3rd Lowest/3rd Highest	UTRP	NA
	G	Greatest % interannual change (+/-)	-	NA
	G	Greatest five-year trend	-	NA
	G	Decrease over five consecutive years	-	NA

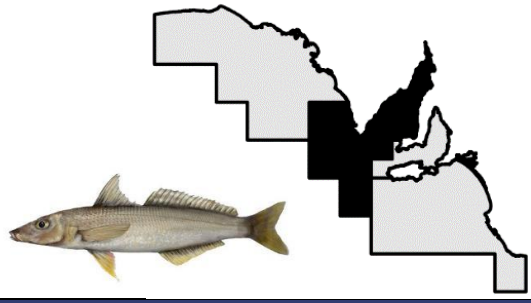
3.7.1. Spencer Gulf Fishing Zone

Yellowfin Whiting

Sillago schomburgkii

Spencer Gulf Fishing Zone

2022/23 (Tier 2)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics

Commercial					Recreational	
Fishing season	**Total catch** *t*	**Target HN effort** *Fisher-days*	**Target HN CPUE** *kg/fisher-day*	**Target HN CPUE** *kg/haul*	**Survey**	**Est. Catch** *t*
2018/19	107	856	104.4	111.4	2000/01	41
2019/20	117	712	142.7	146.9	2007/08	10
2020/21	72	468	122.1	115.9	2013/14	-
2021/22	110	515	187.4	194.2	2021/22	22
2022/23	95	484	171.0	208.5	*HN – Haul net, CPUE - Catch per unit effort.**Smart et al., 2023	

Zonal catch, targeted effort and CPUE trends

The total catch of Yellowfin Whiting in the SGFZ was 95 *t* in 2022/23 (Figure 3.7-3a). This was a decrease from the previous season when catches rose to 110 *t* in 2021/22 from a ten year low of 72 *t* in 2020/21. Total catches were lowest prior to 2000/01 when they were often below 50 *t* per year, before increasing to the historic peak of 165 *t* in 2000/01 (Figure 3.7-3a). Catch and effort for Yellowfin Whiting in the SGFZ are dominated by the haul net sector, while there are also low levels of set net fishing (Figure 3.7-3a-b). The recreational catch was 22 *t* in 2021/22.

Declines in total HN catch reflect a decrease in targeted HN effort from 712 *fisher-days* in 2019/20 to 468 *fisher-days* in 2020/21, which has since remained stable at 484 *fisher-days* in 2022/23 (Figure 3.7-3b). Targeted HN effort has steadily declined from the historic peak in 2017/18 of 1,040 *fisher-days* (Figure 3.7-3b). While targeted effort has been on the decline, haul net CPUE by *fisher-day* and by *kg/haul* have been increasing over time and were the highest on record in 2021/22 and 2022/23 (Figure 3.7-3c). Haul net CPUE by *kg/fisher-day* was the second highest on record since 1983/84 at 171 *kg/fisher-day* in 2022/23 (187 *kg/fisher-day* in 2021/22), while HN CPUE by *kg/haul* was the highest on record since 2003/04 in 2022/23 at 208 *kg/haul* (Figure 3.7-3c).

The number of licences targeting and taking Yellowfin Whiting in the SGFZ using haul nets have declined steadily over time, with the biggest decrease in 2005/06, reaching 14 and 17 licences in 2022/23, respectively (Figure 3.7-3d). The haul net fishery for Yellowfin in the SGFZ has been seasonal over the last decade, with the highest catches taken during winter from June to August (Figure 3.7-3e).

Catch-MSY
The results of the cMSY method demonstrate a 'sustainable' stock (Figure 3.7-4). Recent catches have remained stable and close to, but rarely exceeding, the MSY of 106 *t*. In 2022/23, the total commercial catch of 95 *t* did not exceed the MSY (Figure 3.7-4a). As a result, biomass has remained above the B_{MSY} of 372 *t* and at the end of the 2022/23 fishing season the biomass was estimated at 415 *t* which represents a depletion of 55% (Figure 3.7-4b,d). Accordingly, harvest fractions have remained beneath H_{MSY} throughout the history of the fishery, decreasing to 0.23 in 2022/23 (Figure 3.7-4c). Based on this evidence, commercial catches of Yellowfin Whiting in the SGFZ are at maximum sustainable levels.
Triggered performance indicators
General only (includes total catch, target jig effort and CPUE, target haul net effort and CPUE for 2022/23; Table 3.7-1). • Target HN CPUE – 3rd Lowest / 3rd Highest (UTRP, 2nd highest).
Stock assessment summary
The previous assessment of Yellowfin Whiting in the SGFZ was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the SGFZ was classified as sustainable. cMSY methods demonstrate that stock abundance is high and that the fishing is occurring at maximum sustainable levels. The raw catch and effort statistics align with this and do not demonstrate any issues with the fishery that would cause concern regarding stock health. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Yellowfin Whiting in the SGFZ is classified as a **sustainable** stock.

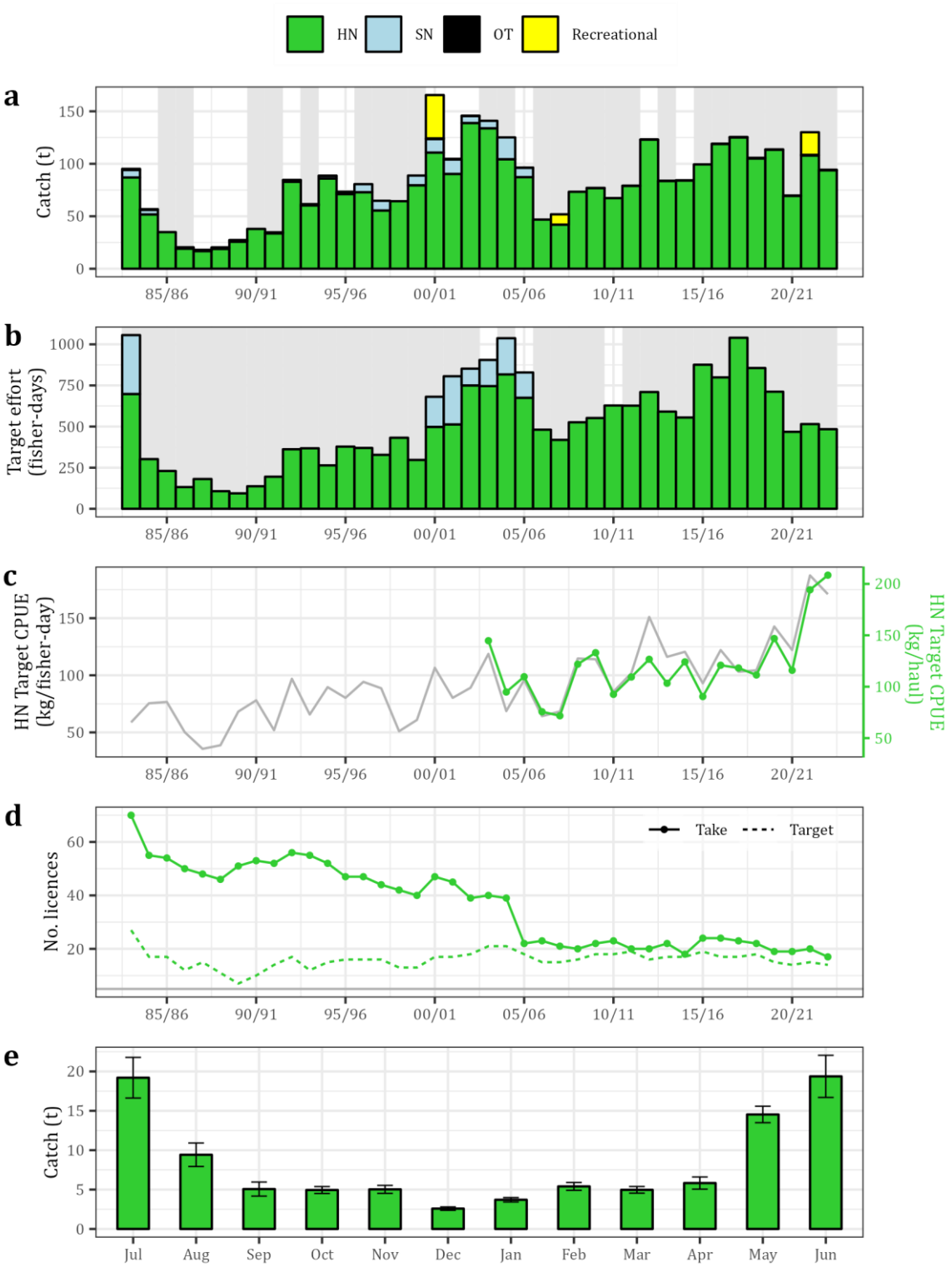


Figure 3.7-3. Key commercial fishery statistics for Yellowfin Whiting in the Spencer Gulf Fishing Zone, divisible into key gear categories – haul nets (HN), set nets (HN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HN catch per unit targeted effort; (d) number of licences that take and target Yellowfin Whiting; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

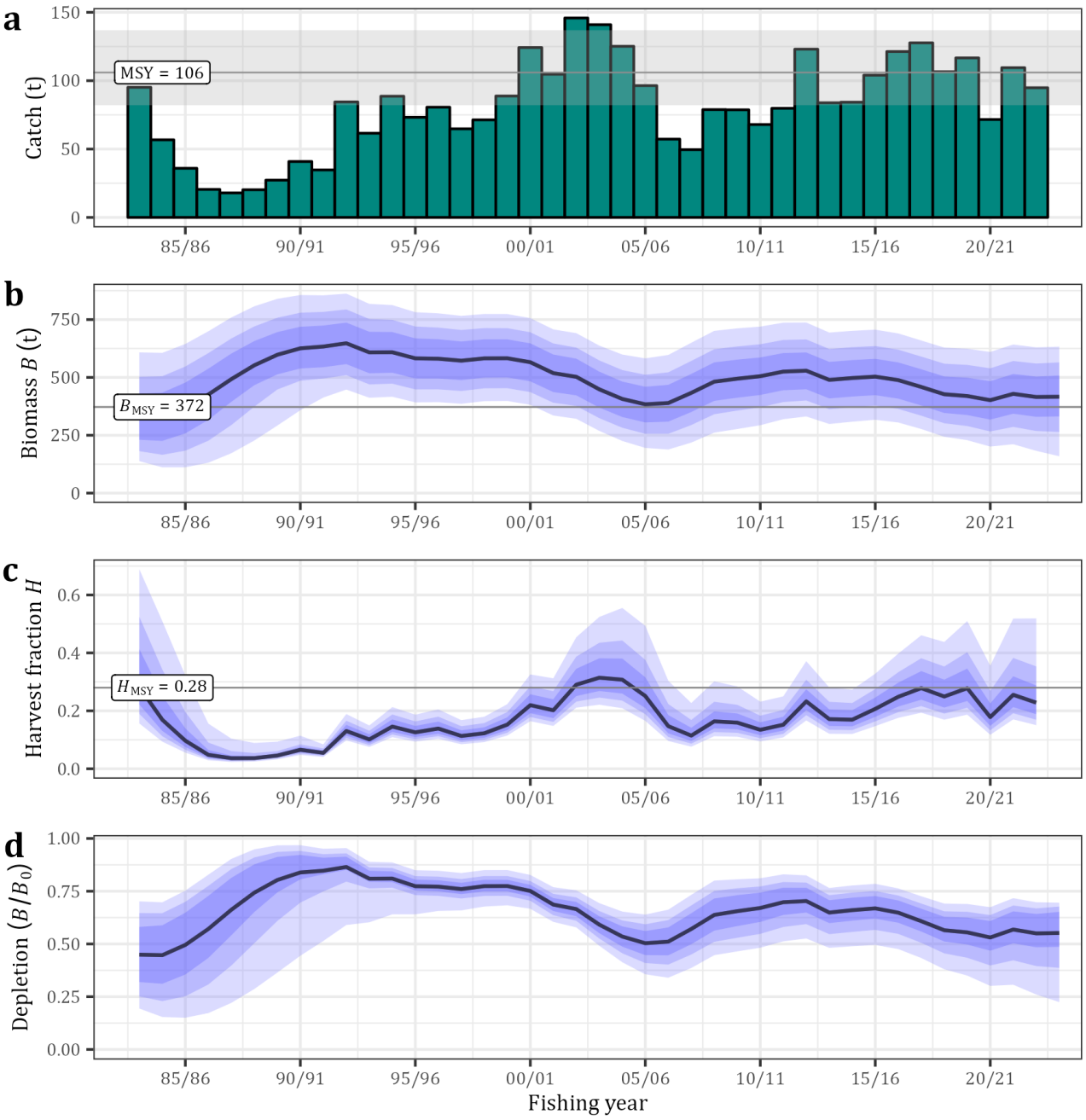


Figure 3.7-4. Outputs of the cMSY method for Yellowfin Whiting in the SGFZ that include (a) the annual commercial catch (b) time series of biomass (black solid line), (c) the annual harvest fraction (*H*; black line), and (d) the exploited biomass depletion from the unexploited biomass (B/B_0; black line). Shaded error bars indicate the 50th, 75th and 95th percentiles (shading that goes from darker to lighter shades, respectively). Panel A–C displays its respective value relating to MSY (grey solid line) and its 95th percentiles (grey shading).

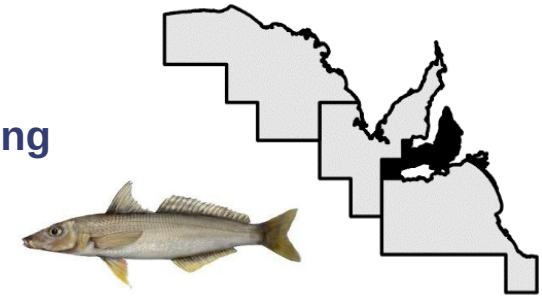
3.7.2. Gulf St Vincent/Kangaroo Island Fishing Zone

Yellowfin Whiting

Sillago schomburgkii

Gulf St Vincent/Kangaroo Island Fishing Zone

2022/23 (Tier 2)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics

Commercial					Recreational	
Fishing season	**Total catch** *t*	**Target HN effort** *Fisher-days*	**Target HN CPUE** *kg/fisher-day*	**Target HN CPUE** *kg/haul*	**Survey**	**Est. Catch** *t*
2018/19	19	54	77.7	121.3	2000/01	20
2019/20	15	*Conf.*	*Conf.*	*Conf.*	2007/08	14
2020/21	10	54	118.3	168.0	2013/14	-
2021/22	15	*Conf.*	*Conf.*	*Conf.*	2021/22	5
2022/23	2	*Conf.*	*Conf.*	*Conf.*	*HN – Haul net, CPUE - Catch per unit effort.**Smart et al., 2023	

Zonal catch, targeted effort and CPUE trends

The total catch of Yellowfin Whiting in the GSV/KIFZ was 2 *t* in 2022/23, which is the second lowest total catch on record (Figure 3.7-5a). This was a decrease from the previous season (2021/22) where catches were 15 *t*. Historically, total catches were lowest prior to 2000/01 when they were often below 20 *t* per year which subsequently increased and were regularly above 25 *t* per year from 2000/01 to 2013/14 before decreasing to 10 *t* in 2015/16. Catches have remained below 20 *t* since then (Figure 3.7-5a). Unlike the SGFZ, the haul net sector does not dominate the catches and in several years most of the catch is attained by set net fishing. The recreational catch was 5 *t* in 2021/22.

Low levels of targeting for Yellowfin Whiting occur in in the GSV/KIFZ, with fishers often recording 'Any Target' in their logbooks even if large numbers of Yellowfin Whiting are caught. As a result, data from a number of fishing seasons remains confidential. Total targeted fishing effort peaked at 258 *fisher-days* in 2012/13 (Figure 3.7-5b). For haul nets, there was a strong relationship between CPUE based on *kg/fisher-day* and CPUE based on *kg/haul* between 2003/04 when these data became available and 2013/14 (Figure 3.7-5c). Haul net CPUE by *kg/haul* increased from 70 *kg/haul* in 2015/16 to 168 *kg/haul* in 2020/22 (Figure 3.7-5c).

In 2022/23, 9 licences recorded taking Yellowfin Whiting using haul nets in the GSV/KIFZ (Figure 3.7-5d). The number of licences taking Yellowfin whiting have declined steadily over time and were the lowest on record in 2022/23 (Figure 3.7-5d). The number of licences targeting Yellowfin Whiting using haul nets has been below 10 since the 2012/13 fishing season (Figure 3.7-5d). The haul net fishery for Yellowfin Whiting in the GSV/KIFZ has been seasonal over the last decade, with the highest catches taken during winter from June to August (Figure 3.7-5e).

Catch-MSY
The results of the cMSY method demonstrate that recent low catches were due to low biomasses that have been less than B_{MSY} since 2008/09 (Figure 3.7-6a-b). The estimated MSY was 22 *t* which was exceeded for several years between 1999/00 and 2013/14. Biomass was reduced during this period through harvest fractions that were above H_{MSY} (Figure 3.7-6c). Since 2015/16, harvest fractions have been reduced and to approximated H_{MSY} and therefore declining biomass has halted and has remained reasonably stable. At the end of the 2022/23 fishing season the biomass was estimated at 56 *t* which represents a depletion of 27% (Figure 3.7-6a,d). Based on this evidence, commercial catches of Yellowfin Whiting in the GSV/KIFZ were unsustainable for a prolonged period and have reduced the biomass below B_{MSY}. Current catch levels and harvest fraction (4% in 2022/23) have been more appropriate and have not further reduced the biomass, rather the biomass is showing signs of an increase (Figure 3.7-6).
Triggered performance indicators
General only (includes total catch 2022/23; Table 3.7-1). • Total catch – 3rd Lowest / 3rd Highest (LTRP, 2nd lowest) • Total catch - Greatest % interannual change (LTRP)
Stock assessment summary
The previous assessment of Yellowfin Whiting in the GSV/KIFZ was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the GSV/KIFZ was classified as 'sustainable'. The cMSY method indicates that stock declines have stabilised since approximately 2015/16 due to lower catches since 2013/14 and have demonstrated slight population increases with the decrease in fishing mortality. Based on a weight of evidence approach, Yellowfin Whiting in the GSV/KIFZ is classified as sustainable based on current fishing mortality. However, it should be noted that the population has previously been overfished and is at a low level. Current catches appear to be sustainable as the population has stabilised at this low level, preventing a 'depleting' status from being considered according to the SAFS definitions (Table 1.6-1). It is not possible to determine if recruitment has previously been or is currently impaired. Therefore a 'depleted' status can also not be considered based on the current evidence, nor can a 'recovering' status be considered as the population has not previously been classified as 'depleted'. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Yellowfin Whiting in the GSV/KIFZ is classified as a **sustainable** stock.

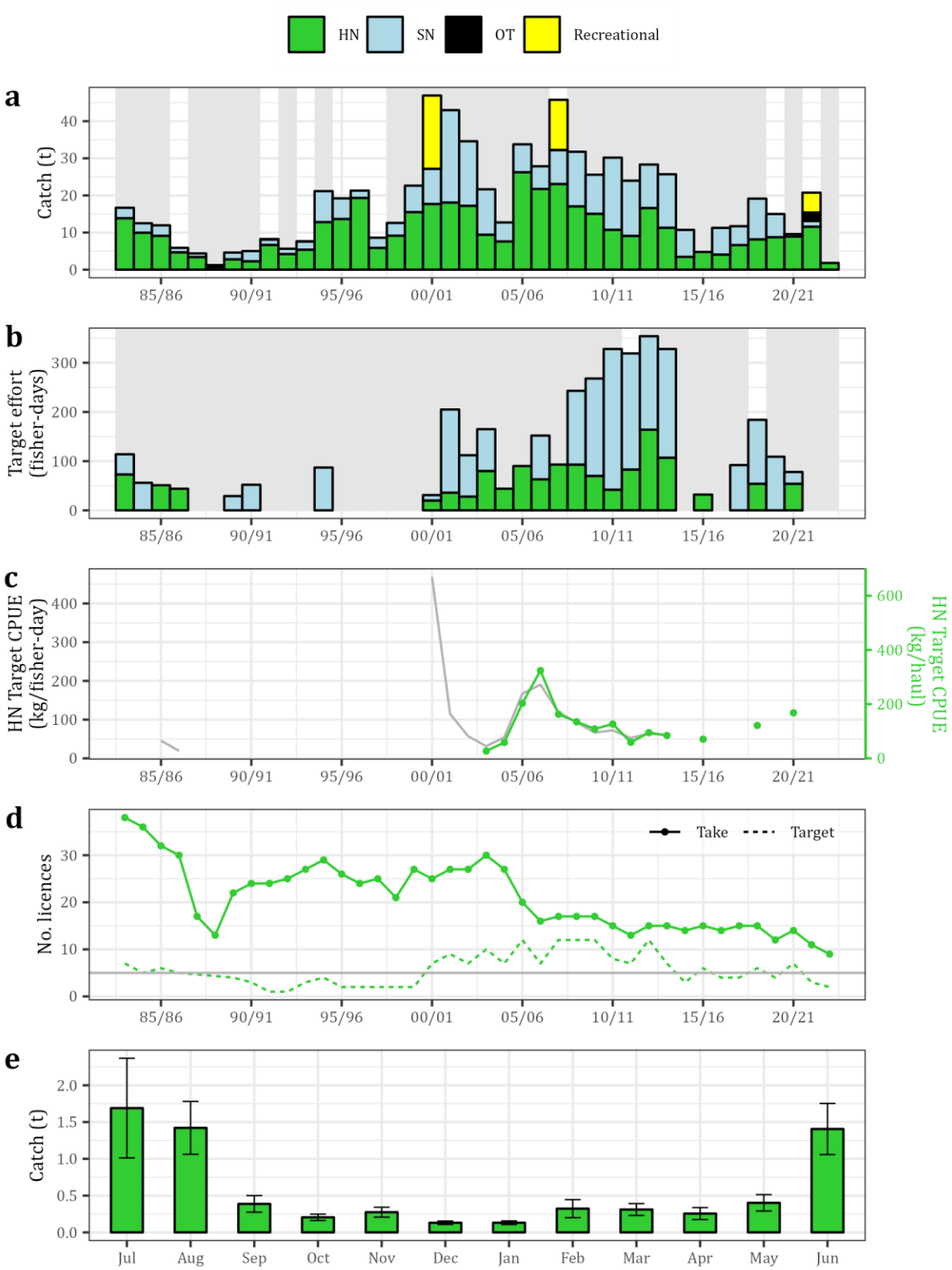


Figure 3.7-5. Key commercial fishery statistics for Yellowfin Whiting in the Gulf St Vincent/Kangaroo Island Fishing Zone, divisible into key gear categories – haul nets (HN), set nets (HN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) HN catch per unit targeted effort; (d) number of licences that take and target Yellowfin Whiting; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

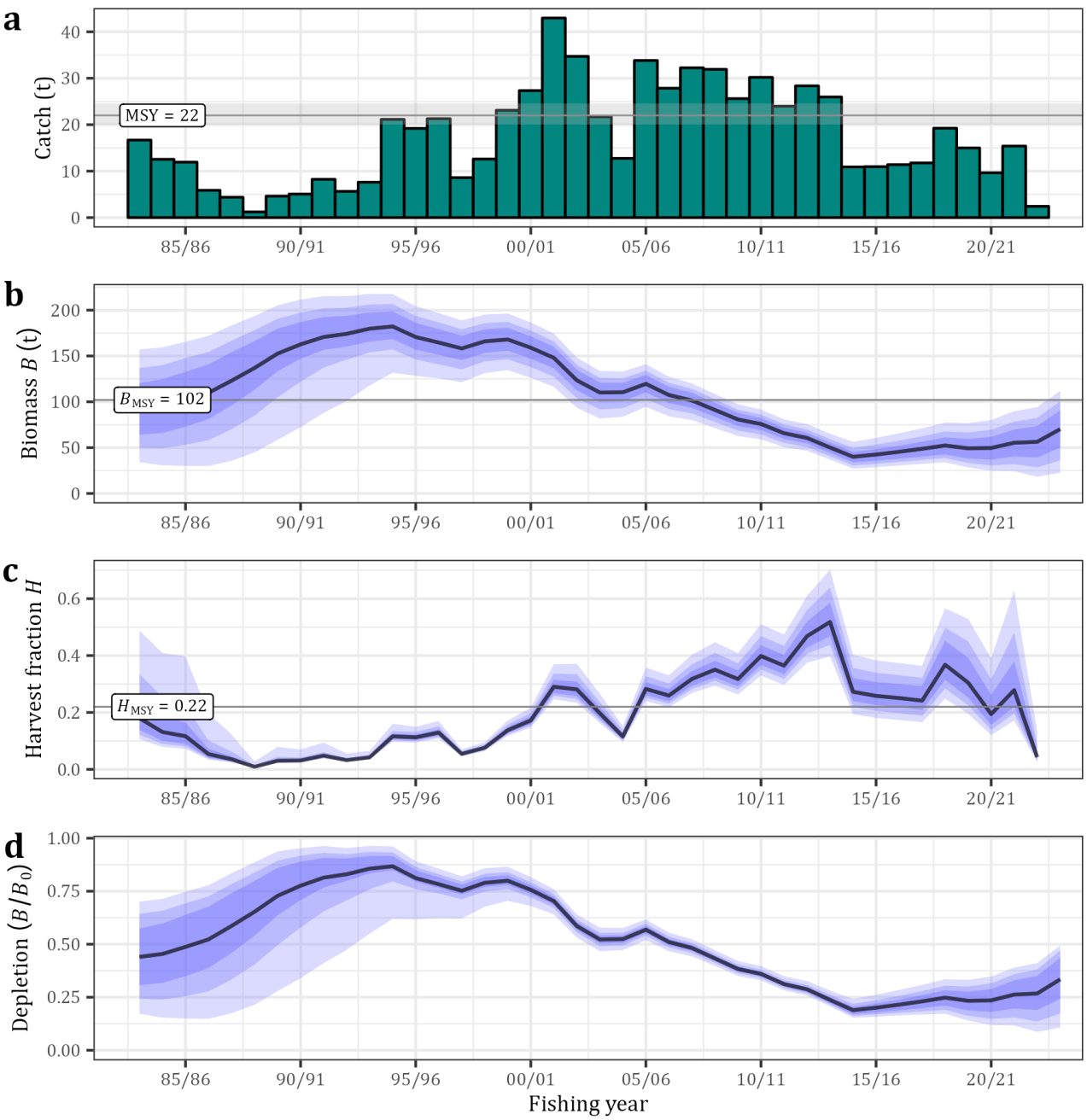


Figure 3.7-6. Outputs of the cMSY method for Yellowfin Whiting in the GSV/KIFZ that include (a) the annual commercial catch (b) time series of biomass (black solid line), (c) the annual harvest fraction (*H*; black line), and (d) the exploited biomass depletion from the unexploited biomass (B/B_0; black line). Shaded error bars indicate the 50th, 75th and 95th percentiles (shading that goes from darker to lighter shades, respectively). Panel A–C displays its respective value relating to MSY (grey solid line) and its 95th percentiles (grey shading).

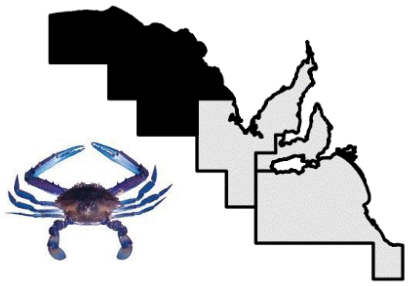
3.8. Blue Crab

Blue crab

Portunus armatus

West Coast Fishing Zone

2022/23 (Tier 2)



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics

Commercial				Recreational	
Fishing season	**Total catch** *t*	**Target CN effort** *Fisher-days*	**Target CN CPUE** *kg/fisher-day*	**Survey**	**Est. Catch** *t*
2018/19	48	746	61	**2000/01**	7
2019/20	51	813	62.7	**2007/08**	10
2020/21	74	898	81.9	**2013/14**	19
2021/22	58	971	59.3	**2021/22**	14
2022/23	29	552	52.6	*CN – Crab net, CPUE - Catch per unit effort.* *Smart et al., 2023.	

Biology

Blue crabs are a highly mobile, short-lived, fast-growing, highly fecund species of portunid crab, distributed within near-shore, marine bays and estuarine systems in Australia and New Caledonia (Edgar, 2000; Lai et al., 2010). They occur in a wide range of algal and seagrass habitats and on sandy and muddy substrata, from the intertidal zone to a depth of at least 50 *m* (Edgar, 2000). Smaller blue crabs are generally found in shallow waters < 1 *m*, while adults are found in deeper waters. Juvenile Blue Crabs live in mangrove creeks and mud flats for eight to twelve months, by which time they attain a size of 80 to 100 *mm* carapace width (CW).

Reproduction and growth typically occur during warmer months (shallow inshore waters), with reduced activity during colder months (adults move to deeper, offshore waters). The spawning season occurs for three to four months over summer/autumn (Kumar et al., 2000). Blue crabs reach a maximum size of ~200 *mm* CW and a maximum age of ~three years, reaching sexual maturity between 70–90 mm CW. In South Australia, Blue Crabs close to the LML (110 *mm* CW) are ~14 to 18 months old and sexually mature, with females producing at least two batches of eggs within on season (Beckmann & Hanamseth, 2024).

Stock structure

Using allozyme markers, Bryars and Adams (1999) determined that the populations of Blue Crab within SG, GSV and WC regions of South Australia represented separate sub-populations with limited gene flow. They also found that inter-regional larval dispersal is restricted, and each sub-population is most likely dependent on its own larval supply. This is supported by microsatellite analysis which found significant genetic differences between samples from SG, GSV and WC region (Chaplin et al., 2001).

Here, assessment of stock status is presented for the WCFZ only. Stock status for the Gulf St Vincent/ Kangaroo Island (GSV/KI) and Spencer Gulf (SG) stocks is determined in the assessment of the Blue Crab Fishery (Beckmann and Hanamseth 2024).

Fishery description

Blue crabs support an important inshore fishery in South Australia, with the commercial fishery valued at $8.4 million (GVP) in 2020/21 (Beckmann & Hanamseth 2024). There are three major stakeholders in the Blue Crab fishery: the commercial pot fishery (Blue Crab Fishery; BCF), the commercial MSF, and the recreational fishery. MSF licences are permitted to take Blue Crabs on the West Coast of South Australia (west of longitude 135°E). MSF operators mostly use hoop/drop nets or dab nets, and recreational fishers mostly use hoop/drop nets or handheld rakes.

Current management regulations

- A summary of key historical management changes for the Blue Crab Fishery is provided in the 2022/23 stock assessment report (Beckmann & Hanamseth 2024).
- LML of 110 *mm* CW and taking of females with external eggs prohibited, applies to all sectors.
- Daily recreational combined limits (Blue Swimmer Crab and/or Sand Crabs): 20 for individuals and 60 for boats when 3 or more are onboard.

Assessment program

- Assessment of stock status for Blue Crab is undertaken at the management unit level (West Coast), while the SG and WC stocks are assessed for the BCF (Beckmann & Hanamseth 2024).
- Catch-MSY model (Smart et al., 2023).
- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for the Blue Crab WCFZ (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status for the WCFZ uses a weight-of-evidence approach (Table 3.8-1).

Zonal catch, targeted effort and CPUE trends

Since 2018/19, highest catches occurred in MFA 9 and 10A for the WCFZ (5-year average annual catch, ~28 and ~24 *t*, respectively; Figure 3.8-1).The total catch of Blue Crab in the WCFZ was 29 *t* in 2022/23 (Figure 3.8-2a). This was a decrease from the previous two years which were the second (74 *t* in 2020/21) and third highest (72 *t* in 2021/22) in the past decade (Figure 3.8-2a). Total catches were lowest prior to 2000/01 when they were often below 10 *t* per year, before increasing to the historic peak of 75 *t* in 2013/14 (Figure 3.8-2a). in 2021/22, the recreational catch in the WCFZ was 14 *t.*

Declines in total catch of Blue Crabs in 2022/23 reflects a decline in both targeted effort and targeted CN CPUE by *fisher-days* (Figure 3.8-2a-c). Targeted effort declined from 971 *fisher-days* in 2021/22 to 552 *fisher-days* in 2022/23 (Figure 3.8-2b), while targeted CN CPUE by *kg/fisher-day* declined from a 20 year peak of 81.9 *kg/fisher-day* in 2020/21 to 52.6 *kg/fisher-day* in 2022/23 (Figure 3.8-2c). The targeted CPUE by *kg/fisher-day* in 2022/23 is 7.7% lower than the long-term average since the 2000/01 fishing season (Figure 3.8-2c).

The number of licences targeting and taking Blue Crab in the WCFZ using crab nets has been variable but has increased steadily over time, reaching 27 licences in 2022/23, respectively (Figure 3.8-2d). The crab net fishery for Blue Crab in the WCFZ has been seasonal over the last decade, with the highest catches taken during summer from January to March (Figure 3.8-2e).

Catch-MSY

The results of the cMSY method demonstrates commercial catches are near levels of maximum production. The estimated MSY for Blue Crab in the WCFZ was 42 *t* which was exceeded for several years between 2007/08 and 2021/22 (Figure 3.8-3a). Biomass was reduced during this period through harvest fractions that were close to or above H_{MSY} (Figure 3.8-3b-c). In 2022/23, total commercial catch was reduced to 29 *t* (13 *t* below MSY), likewise harvest fractions were reduced from historic peaks in 2020/21 and 2021/22 to 0.26 (H_{MSY} = 0.26; Figure 3.8-3a,c). The reduction in total catch and H_{MSY} has halted the decline in biomass, which was estimated at 113 *t* (B_{MSY} = 162 *t*) at the end of the 2022/23 fishing season and represented a depletion of 33% (Figure 3.8-3a-d).

Triggered performance indicators

General only (includes total catch, target crab net effort and CPUE for 2022/23; Table 3.8-1).

- None triggered.

Stock assessment summary
The previous assessment of Blue Crab in the WCFZ was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In that assessment, the WCFZ was classified as 'sustainable'. The cMSY method demonstrate that stock abundance is stable and near maximum sustainable levels, while the fishing is occurring at levels of maximum production. The biomass remained high at approximately 280 *t* for a 20-year period from 1997/98 to 2007/08 when commercial catches were typically less than 25 *t*. As total catch in 2022/23 (29 *t*) approaches levels when biomass remained high, the raw catch and effort statistics align with the cMSY method and do not demonstrate any issues with the fishery that would cause concern regarding stock health. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Blue Crab in the WCFZ is classified as a **sustainable** stock.
Research & development needs
• Development of harvest strategy with performance indicators, reference points and harvest control rules. • Standardisation of commercial CPUE, using improved measures of fishing effort. • More regular and reliable estimates of recreational catch.

Table 3.8-1. Results of the assessment of the general (G) fishery performance indicators against their trigger reference points at the regional spatial scales for Blue crab in 2022/23. - indicates that no trigger has been breached. ● indicates that the trigger for five consecutive decreases has been triggered. NA indicates trigger is not assessed. Stock/zone abbreviations: West Coast (WC).

PERFORMANCE INDICATOR	TYPE	TRIGGER REFERENCE POINT	WC
Total catch	G	3rd Lowest/3rd Highest	-
	G	Greatest % interannual change (+/-)	-
	G	Greatest five-year trend	-
	G	Decrease over five consecutive years	-
Target crab net effort	G	3rd Lowest/3rd Highest	-
	G	Greatest % interannual change (+/-)	-
	G	Greatest five-year trend	-
	G	Decrease over five consecutive years	-
Target crab net CPUE	G	3rd Lowest/3rd Highest	-
	G	Greatest % interannual change (+/-)	-
	G	Greatest five-year trend	-
	G	Decrease over five consecutive years	-

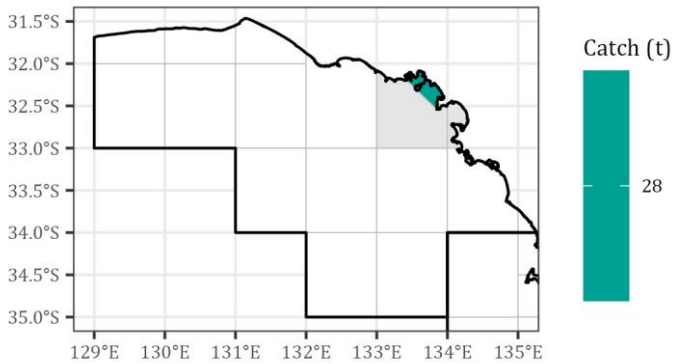


Figure 3.8-1. Spatial distribution of Blue Crab catches taken by the MSF in the West Coast Fishing Zone, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

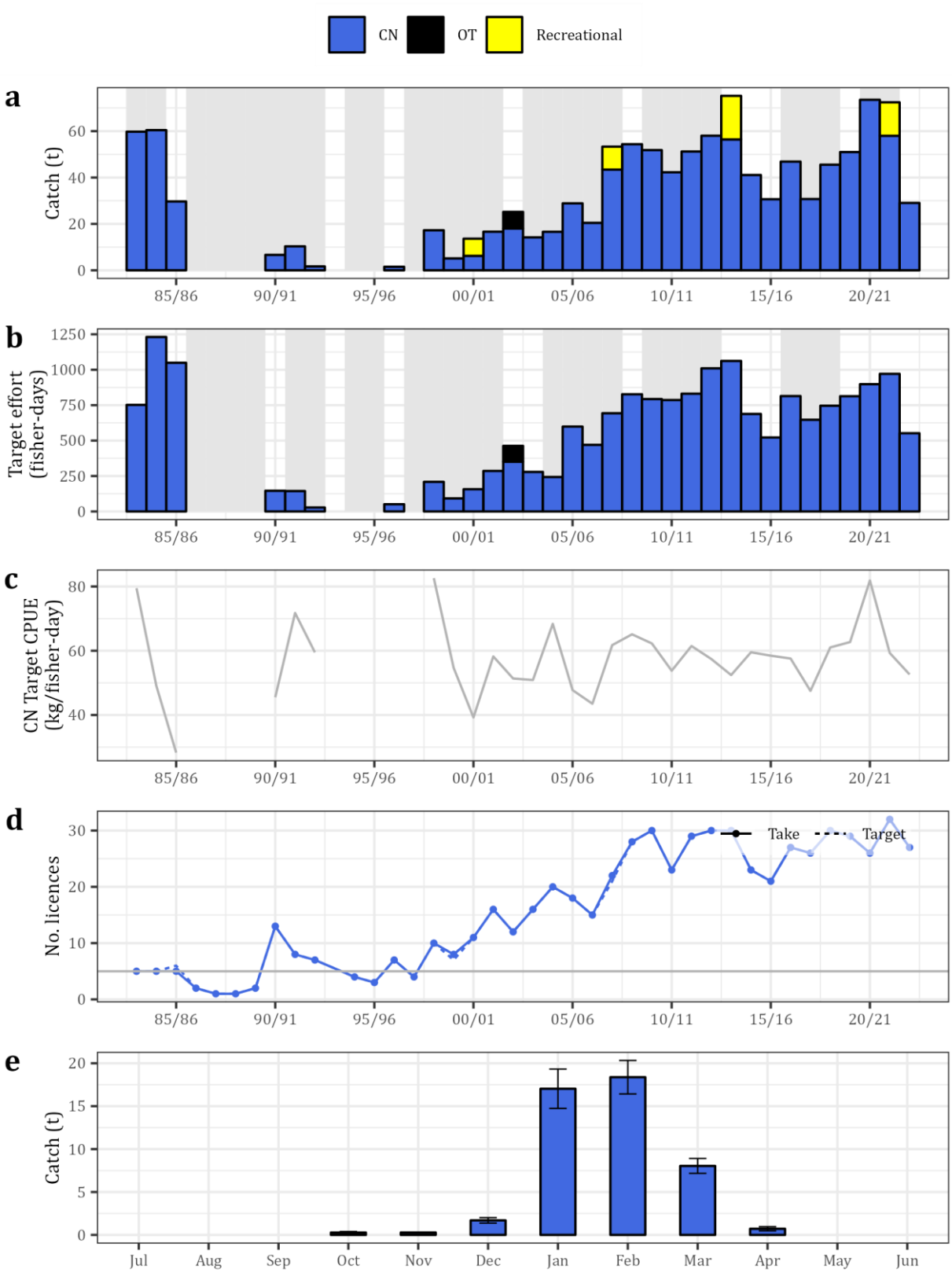


Figure 3.8-2. Key commercial fishery statistics for Blue crab in the West Coast Fishing Zone, divisible into key gear categories – Crab nets (CN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22; (b) targeted effort; (c) CN catch per unit targeted effort; (d) number of licences that take and target Blue crab; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

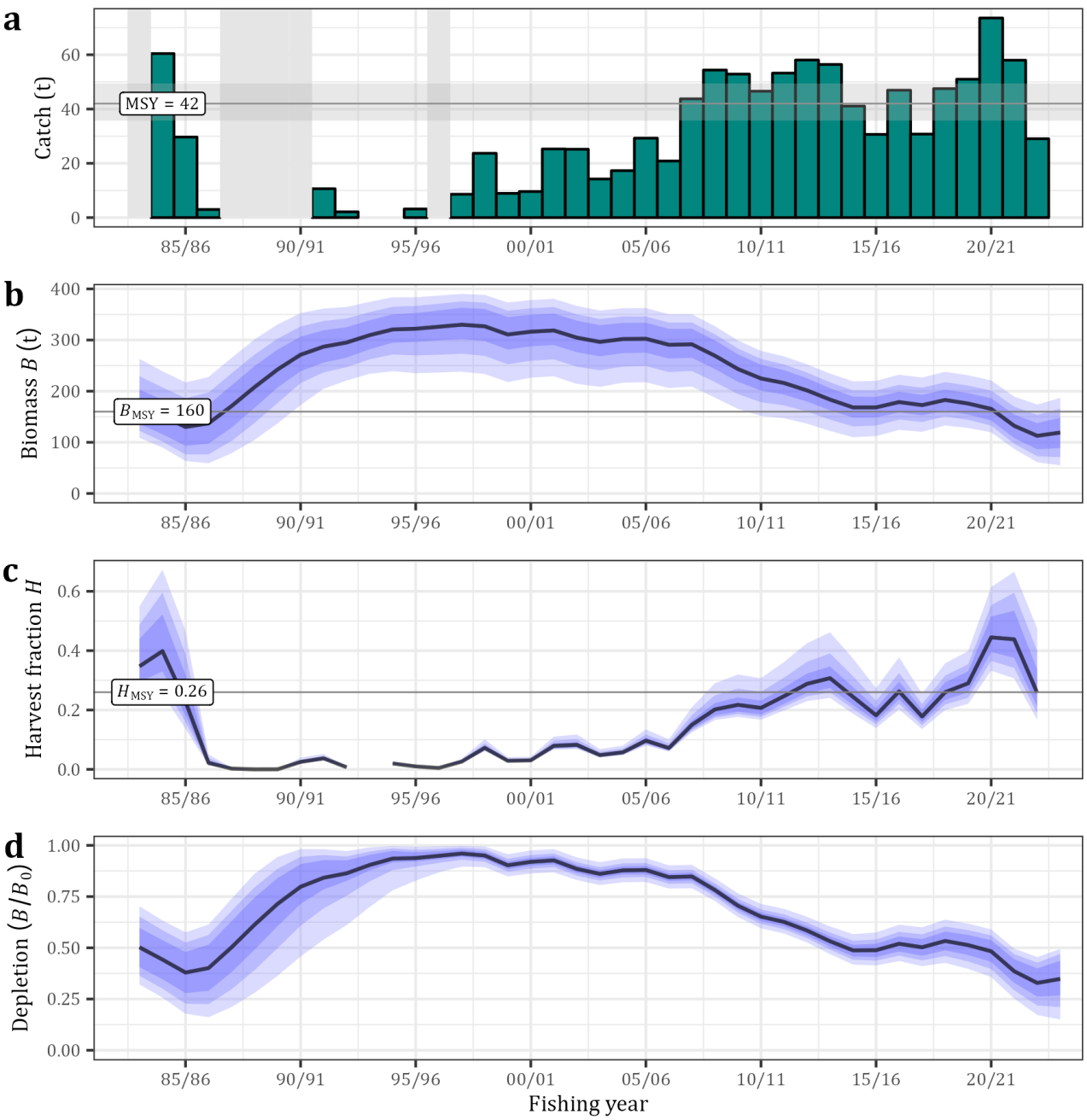


Figure 3.8-3. Outputs of the cMSY method for Blue Crab in the WCFZ that include (a) the annual commercial catch (b) time series of biomass (black solid line), (c) the annual harvest fraction (*H*; black line), and (d) the exploited biomass depletion from the unexploited biomass (B/B_0; black line). Shaded error bars indicate the 50th, 75th and 95th percentiles (shading that goes from darker to lighter shades, respectively). Panel A–C displays its respective value relating to MSY (grey solid line) and its 95th percentiles (horizontal grey shading). Vertical grey shading indicates years when data for one or more gear categories are confidential.

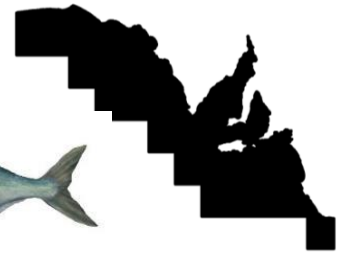
3.9. Western Australian Salmon

Western Australian Salmon

Arripis truttaceus

State-wide summary 2022/23

Tier 2 in SG & GSV/KI, Negligible in WC & SE



Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch** *t*	**Target HN effort** *Fisher-days*	**Target HN CPUE** *kg/fisher-day*	**Target HN CPUE** *kg/haul*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	182	149	216.8	230.8	**2000/01**	335 (70)	75	25
2019/20	189	204	227.7	239.5	**2007/08**	91 (11)	64	36
2020/21	90	182	212.5	218.5	**2013/14**	56 (12)	67	33
2021/22	323	194	293.2	328.8	**2021/22**	82 (16)	55	45
2022/23	362	180	360.5	416.0	*HN – Haul net, CPUE - Catch per unit effort.**Smart et al., 2023			

Biology

- WA Salmon comprises a single biological stock that extends from south-western WA to the western coasts of TAS and VIC, where they occur in schools over seagrass and sand along high-energy beaches and around rocky outcrops (Gomon et al., 2008).
- Pelagic, large-bodied, fast-growing species, max. age 12 years, max. length 900 *mm* TL, L_{50} 650 *mm* TL (4–5 years old; Cappo, 1987).
- Spawning occurs in large aggregations that form near Cape Leeuwin (WA) during autumn and early winter when the eastward flow of the Leeuwin Current is strongest. Eggs and larvae settle along the entire south-western coastline of Australia, with the main nurseries located in SA's gulfs (Jones & Westlake, 2003).
- Juveniles remain in coastal nursery areas for up to three years before moving to exposed coastal waters where they form large schools and begin to migrate westward to join the spawning biomass in WA as 5–6-year-olds (Cappo, 1987).
- There are no records of spawning in waters east of the WA/SA border.
- As a result of these demographic processes, the MSF harvests mainly juveniles and sub-adults.

Fishery description

- Western Australian Salmon supports commercial and recreational fisheries in SA.
- The commercial harvest is mostly targeted by specialised seine (salmon) net fishers in Southern SG and haul net fishers in northern gulf waters.
- The product is typically used for rock lobster bait with an increasing proportion of the catch used for human consumption.
- An iconic recreational fishery species in SA, which is mostly taken by shore-based fishers using bait and lures in inshore coastal waters (Beckmann et al., 2023).

Current management regulations

- LML of 210 *mm* TL applies to all sectors.
- 1,100 *t* catch limit for the commercial sector.
- Daily recreational limits when TL 21–35 *cm:* 20 for individuals and 60 for boats when 3 or more are onboard.
- Daily recreational limits when TL > 35 *cm:* 10 for individuals and 30 for boats when 3 or more are onboard.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Western Australian Salmon (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Catch, targeted effort and CPUE trends

From 1983/84 to 2002/03, annual commercial catches were between 500–600 *t* (Figure 3.9-1). Catches have since remained low, with an increase in 2014/15 in line with an increase in the GVP due to suggested emerging markets for the species (Figure 3.9-1). The GVP in 2022/23 was $1.01M, the highest on record since these data became available. Since 2018/19, highest catches occurred in MFA 30 (5-year average annual catch, ~75 *t*; Figure 3.9-2).

From 1983/84 to 2002/03, the majority of the catch and effort was taken by specialised purse seine fishers and the remainder taken by haul netters (Figure 3.9-3a-b). The increase in 2014/15 was driven by an increase in purse seine activity (Figure 3.9-3a). Total catch in 2022/23 (362 *t*) was the second highest annual catch since 2002/03, an increase of 39 *t* from 2021/22 (Figure 3.9-3a).

Targeted HN CPUE by *kg/haul* is available from 2003/04 onwards and closely follows the trend of CPUE by *fisher-day* over the same period (Figure 3.9-3c). In 2022/23, HN CPUE by *kg/haul* has increased for the second consecutive year and was the second highest CPUE by *kg/haul* (416 *kg/haul*) since these data became available (Figure 3.9-3c). In 2022/23, the number of licences taking Western Australian Salmon using HN decreased to 29, while the number targeting Western Australian Salmon using HN increased to 23 (Figure 3.9-3d). The haul net fishery for Western Australian Salmon has been seasonal over the last decade, with the highest catches taken from June to November, peaking in September (Figure 3.9-3e).

Triggered performance indicators

General only (includes total catch, target HN net effort and CPUE for 2022/23; Table 3.2-3).

- None triggered.

Stock assessment summary

The biological stock of Western Australian Salmon across southern Australia is accessed by fisheries in WA, SA, VIC and TAS. Historically, WA has been the main contributor to annual catches with smaller contributions from SA and minor contributions from VIC and TAS. The stock was classified as 'sustainable' in the 2020 Status of Australian Fish Stocks Report (Duffy et al., 2023). The previous assessment of Western Australian Salmon in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the state-wide stock was classified as sustainable.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Western Australian Salmon in South Australia is classified as a **sustainable** stock.

Research & development needs

- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance

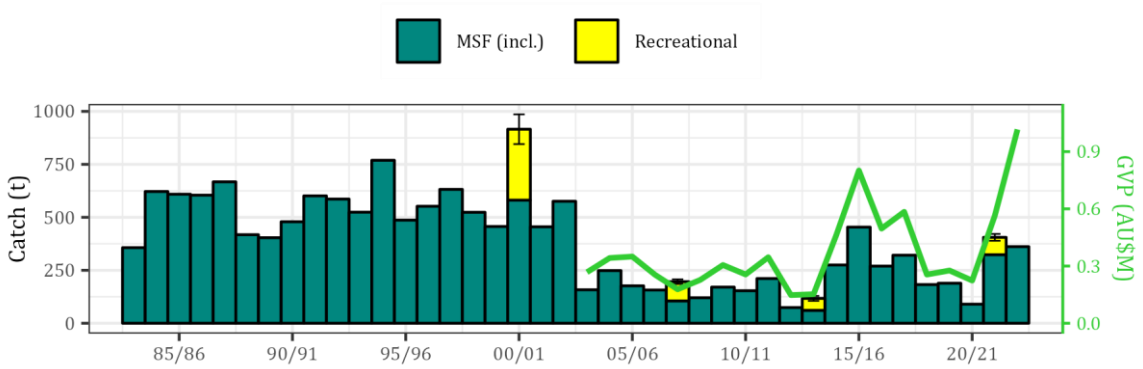


Figure 3.9-1. Fishery statistics for South Australia's Western Australian Salmon Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

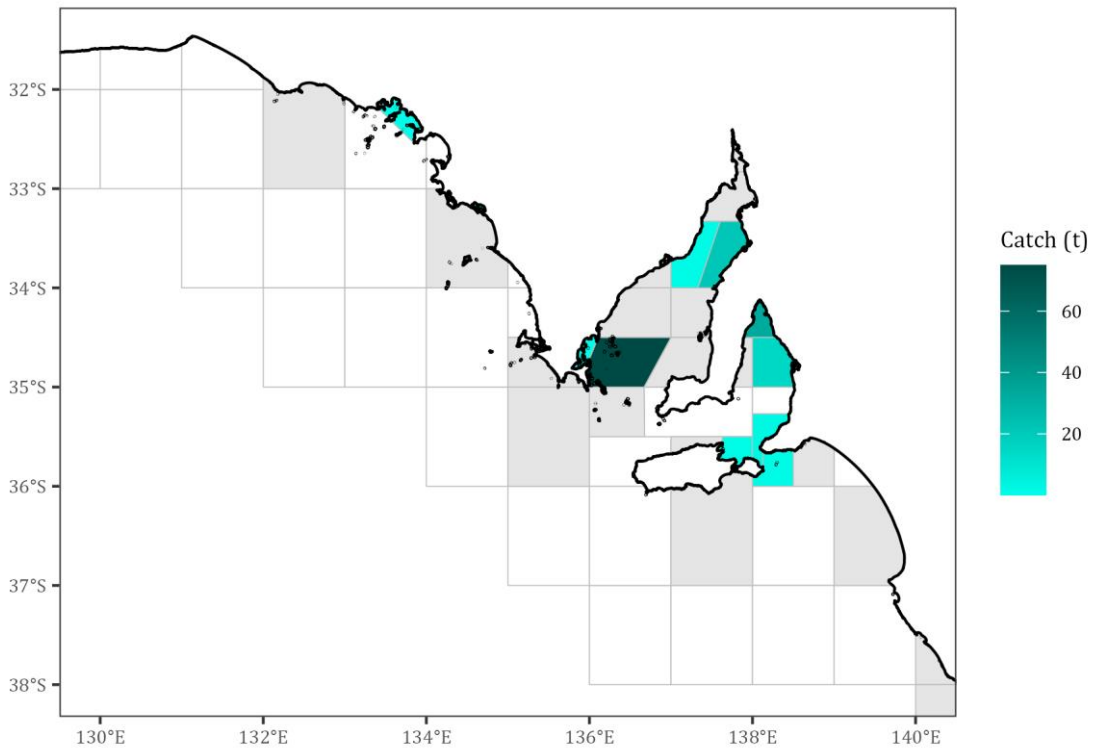


Figure 3.9-2. Spatial distribution of Western Australian Salmon Fishery catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

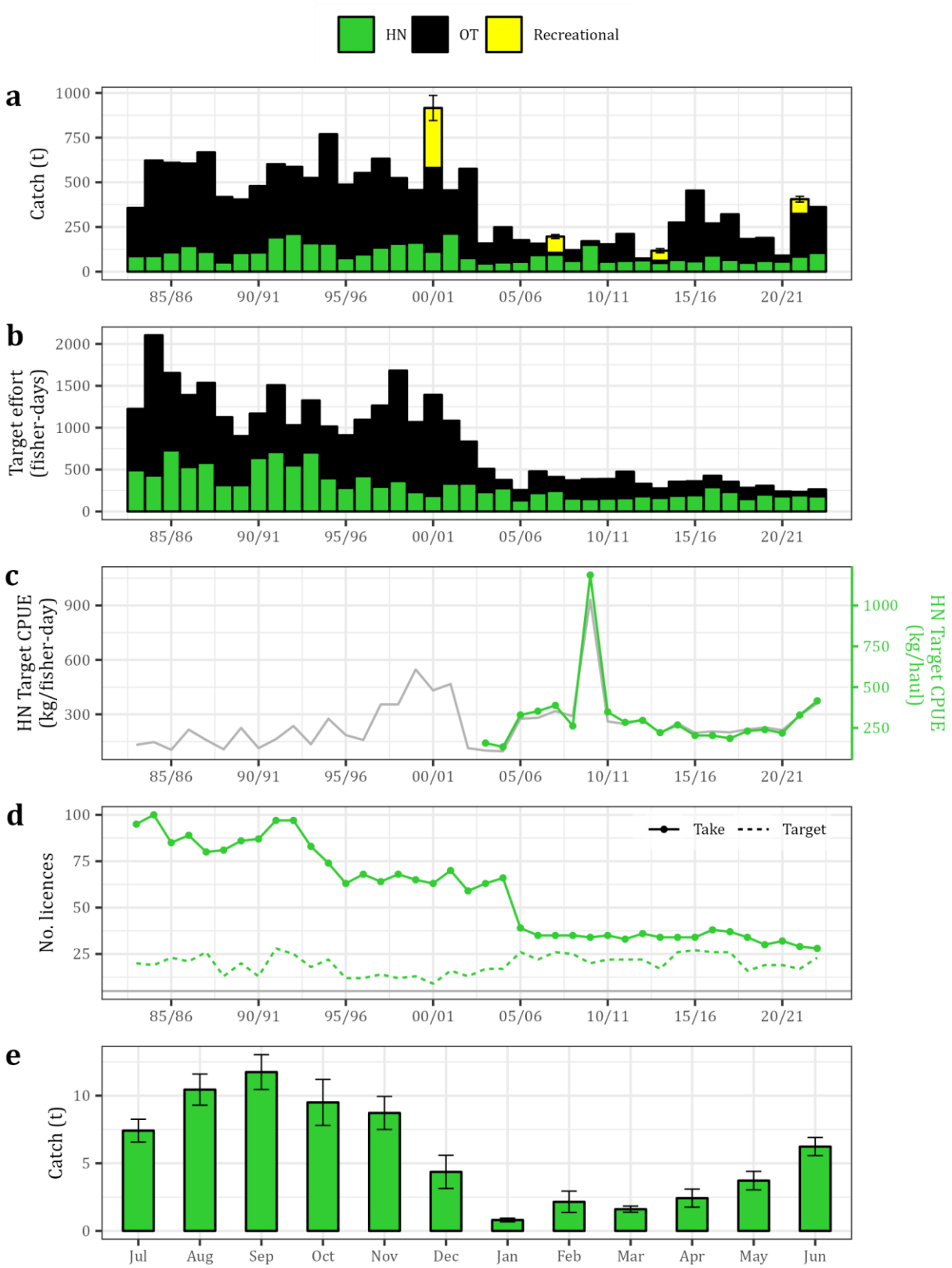


Figure 3.9-3. Key commercial fishery statistics for South Australia's Western Australian Salmon Fishery, divisible into key gear categories – Haul net (HN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) targeted effort; (c) HN catch per unit targeted effort; (d) number of licences that take and target Western Australian Salmon; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.10. Australian Herring

Australian Herring

Arripis georgianus

State-wide summary 2022/23

Tier 2 in SG & GSV/KI, Negligible in WC & SE

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch** *t*	**Target HN effort** *Fisher-days*	**Target HN CPUE** *kg/fisher-day*	**Target HN CPUE** *kg/haul*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	97	479	83.6	65.2	**2000/01**	254 (35)	77	23
2019/20	88	563	75.0	66.7	**2007/08**	90 (12)	69	31
2020/21	110	432	88.1	88.1	**2013/14**	152 (34)	87	13
2021/22	109	477	107.1	98.4	**2021/22**	41 (6)	70	30
2022/23	93	272	110.2	127.5	*HN – Haul net, CPUE - Catch per unit effort.**Smart et al., 2023*			

Biology

- Occur over seagrass, reef and sandy habitats in coastal marine and estuarine waters around southern Australia between Shark Bay in WA and Forster in NSW, although is uncommon east of Bass Strait (Duffy et al., 2023). Australian Herring constitutes a single biological stock across this range (Ayvazian et al., 2000; Ayvazian et al., 2004).
- Pelagic, small-bodied, moderate-growth rate, max. age 12 years, max. length 410 *mm* TL, L_{50} 180–200 *mm* TL (2 years old; Cappo, 1987).
- Spawning occurs in May/June in the south-west of WA, with eggs and larvae dispersed southwards and eastwards by the Leeuwin Current (Smith et al., 2013).
- Fish grow and mature in each jurisdiction before migrating back to the spawning area as 2–3-year-olds, where they remain as adults.
- As a result of these demographic processes, the MSF harvests mainly sub-adults.

Fishery description

- Supports commercial and recreational fisheries in SA.
- In the commercial sector, Australian Herring is mostly taken as by-product by fishers using haul nets to target higher value species in the gulfs.
- Most of the commercial catch is supplied for human consumption, with small quantities supplied as bait for commercial longlining or Rock Lobster fishing.
- An important recreational fishery species in SA that is mostly taken by shore-based fishers using bait and lures in inshore coastal waters (Beckmann et al., 2023).

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .

- The current harvest strategy for Australian Herring (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- No LML applies to all sectors.
- Daily recreational limits: 40 for individuals and 120 for boats when 3 or more are onboard.

Catch, targeted effort and CPUE trends

The total catch of Australian herring peaked at 499 *t* in 1987/88 and has subsequently declined over the past three decades (Figure 3.10-1). In 2022/23, the GVP declined to below the annual average since these data became available in 2003/04 (Figure 3.10-1). Since 2018/19, the highest catches occurred in MFA 23 in SG (5-year average annual catch, ~39 *t*), and MFA 35 and 36 in GSV (~19 *t* and ~15 *t*, respectively; Figure 3.10-2).

In 2022/23, the total commercial catch was 93 *t*, of which 96% was taken using haul nets (Figure 3.10-3a). Targeted effort using haul nets in 2022/23 declined to 272 *fisher-days* from 477 *fisher-days* in 2021/22 (Figure 3.10-3b). However, despite the decrease in targeted effort, in 2022/23, targeted HN CPUE by *fisher-day* (110 *kg/fisher-day*) and *kg/haul* (128 *kg/haul*) increased to its highest since 2008/09 and 2010/11, respectively (Figure 3.10-3c). Both HN CPUE by *fisher-day* and *kg/haul* closely follow the same trend over the same period, with 2022/23 being the third consecutive year increasing from the previous fishing season (Figure 3.10-3c).

Following a series of netting closures in 2005, the number of licences taking Australian Herring using haul nets declined from 78 in 2004/05 to 42 in 2005/06 (Figure 3.10-3d). Since 2005/06, the number of licences taking and targeting Australian herring has remained relatively stable, currently at 34 and 21 licences respectively in 2022/23 (Figure 3.10-3d). The haul net fishery for Australian Herring has been bimodal over the last decade, with the highest catches peaking in October, declining in January, before peaking again in March (Figure 3.10-3e).

Triggered performance indicators

General only (includes total catch, target HN net effort and CPUE for 2022/23; Table 3.2-3).

- None triggered.

Stock assessment summary

The biological stock of Australian Herring across southern Australia is accessed by fisheries in WA, SA, VIC and NSW. Historically, WA has been the main contributor to annual catches with smaller contributions from SA and minor contributions from VIC and TAS. The stock was classified as 'sustainable' in the 2020 Status of Australian Fish Stocks Report (Duffy et al., 2023). The previous assessment of Australian Herring in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the state-wide stock was classified as sustainable.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Australian Herring in South Australia is classified as a **sustainable** stock.

Research & development needs

- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance

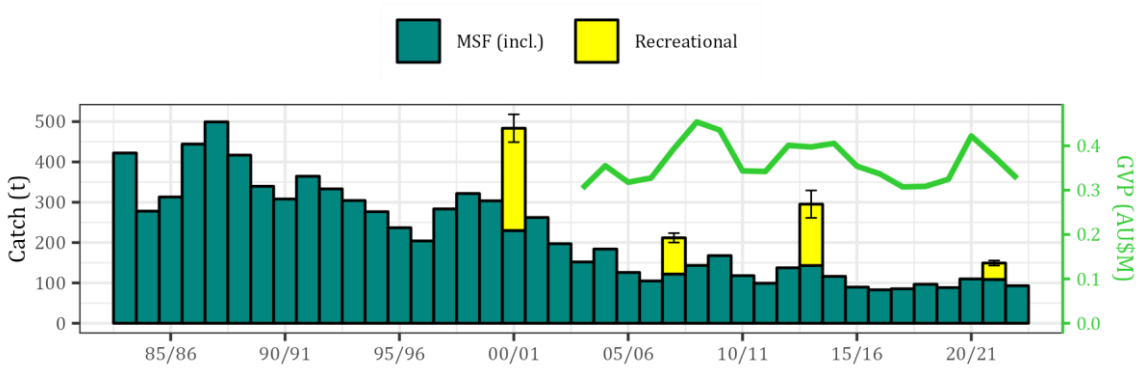


Figure 3.10-1. Fishery statistics for South Australia's Australian Herring Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

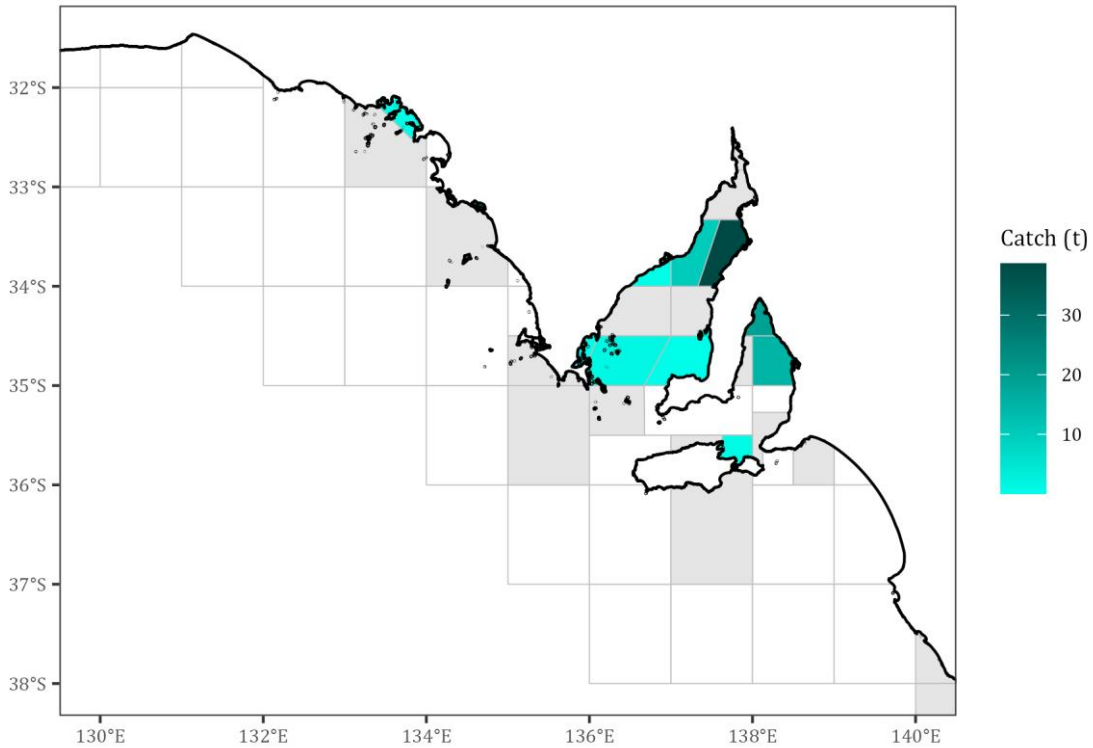


Figure 3.10-2. Spatial distribution of Australian Herring catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

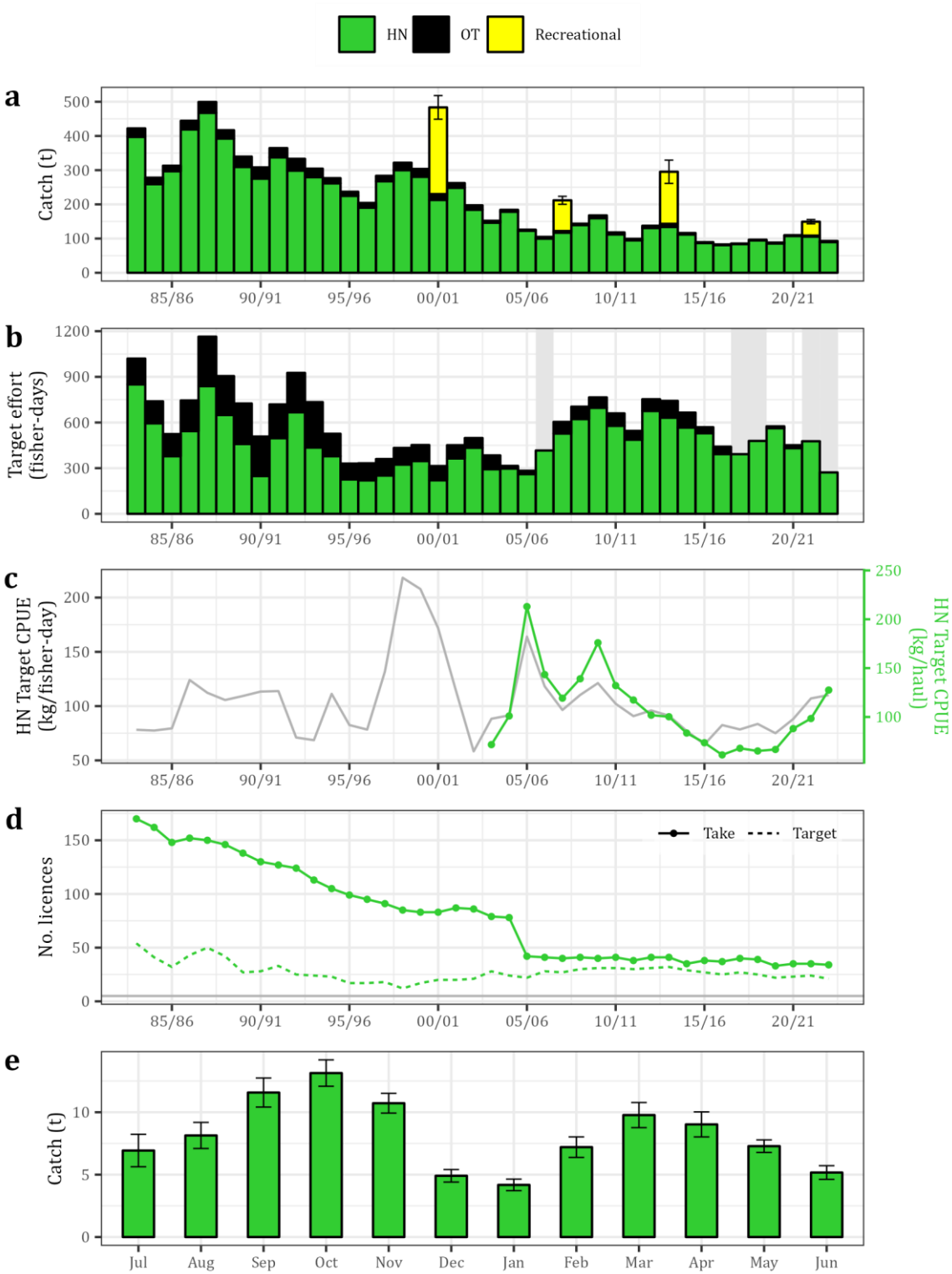


Figure 3.10-3. Key commercial fishery statistics for South Australia's Australian Herring Fishery, divisible into key gear categories – Haul net (HN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) targeted effort; (c) HN catch per unit targeted effort; (d) number of licences that take and target Australian Herring; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.11. Whaler Sharks

Whaler Sharks

Carcharhinus spp.

State-wide summary 2022/23

Tier 2 in WC, SG & GSV/KI,

Negligible in SE

Stock status

2020*	2021/22*	2022/23
Undefined	Undefined	Undefined

Commercial fishery statistics (State-wide)

Fishing season	Total catch *t*	Target LL effort *Fisher-days*	Target LL CPUE *kg/fisher-day*	Target LL CPUE *kg/hook*
2018/19	50	202	161.4	0.66
2019/20	56	246	135.9	0.73
2020/21	67	307	187.6	0.60
2021/22	69	365	134.5	0.69
2022/23	92	485	158.6	0.51

*LL – Longline, CPUE - Catch per unit effort.**Smart et al., 2023. Recreational fishing data not available for Whaler sharks.

Biology

- Two species of Whaler Sharks, the Bronze Whaler (*Carcharhinus brachyurus*) and the Dusky Shark (*C. obscurus*) are taken in the MSF.
- Bronze Whalers are distributed through the warm temperate waters of southern Australia, from Geraldton in WA through to the QLD/NSW state boarder. This species is long-lived (~30 years), with late sexual maturity (16 years both sexes) at lengths of 2.2 *m* TL for males and 2.7 *m* TL for females (Drew et al., 2016).
- Australian Bronze Whaler population is panmictic and considered as a single biological stock.
- Dusky Sharks are broadly distributed through all Australian tropical to warm temperate coastal and continental shelf waters. They are long-lived (max ~50 years), slow growing, have a 3-year breeding frequency and only produce 3–12 pups per litter (McAuley et al., 2007; Romine et al., 2009).
- South Australian Dusky Shark population is considered the eastern component of the Western Australian biological stock.

Fishery description

- Commercial catches are not resolved at species level.
- In recent years Whaler Sharks have been targeted with floating and demersal longlines during spring-autumn in WC, SG and GSV waters.
- MSF longline catches are mostly comprised of juvenile sharks (~90%).
- Recreational fishers target Whaler Sharks for both consumption and as a trophy fish from boats and shore-based fishing.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Whaler Sharks (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status.

Current management regulations

- No LML applies to all sectors.
- Daily recreational limits: one shark for individuals and three for boats when 3 or more are onboard.
- MSF gear restrictions for Whaler Sharks include daily hook limit 400 hook limit in all State waters, maximum leader diameter of 2 mm, and 150 mm minimum mesh size for nets.
- Recreational gear restrictions include the use of wire trace of 2 mm or greater and fishing hook size greater than 12/0.
- Spatial and gear restrictions are in place along the Adelaide coastline between 5:00-and 21:00 for targeting sharks.

Catch, targeted effort and CPUE trends

The total catch of Whaler Sharks peaked at 155 *t* in 2009/10, subsequently declining to its lowest point in almost 30 years in 2014/15 (45 *t*; Figure 3.11-1). Total catch remained at this level for consecutive years, however, has shown an increasing trend over the past three years (Figure 3.11-1). In 2022/23, total catch was its highest in 11 years at 92 *t*, while GVP reached its highest on record since these data became available of $0.55M (Figure 3.11-1). Since 2018/19, the highest catches occurred in MFA 34, 35 and 36, located in the northern region of GSV (5-year average annual catch, ~6.7 *t*, ~8.4 *t*, and ~10.2 *t*, respectively; Figure 3.11-2).

Since 2000/01, long lines have been the dominant gear type for targeting whaler sharks in South Australia (Figure 3.11-3a). In 2022/23, targeted effort reached 485 *fisher-days* using long lines, the second highest on record behind 596 *fisher-days* in 2009/10 (Figure 3.11-1b). LL CPUE by *kg/fisher-day* and *kg/hook* have frequently displayed an opposing trend since 2016/17, however, prior to 2016/17, followed the same trend over the same period (Figure 3.11-1c). In 2022/23, LL CPUE by *kg/fisher-day* (159 *kg/fisher-day*) and *kg/hook* (0.51 *kg/hook*) were both higher than their respective long-term means of 131 *kg/fisher-day* (range 18.75–299.2) and 0.43 *kg/hook* (range 0.14–0.79; Figure 3.11-1c).

The number of LL licences taking whaler sharks peaked at 86 in 2011/12, which has since declined to 52 in 2022/23 (Figure 3.11-1d). The number of LL licences targeting whaler sharks peaked in 2005/06, which has remained relatively stable since, totalling 32 licences in 2022/23 (Figure 3.11-1d). The long line fishery for Whaler Sharks has been seasonal over the last decade, with the highest catches in October to March, before declining leading into winter from April to August (Figure 3.11-1e).

Triggered performance indicators

General only (includes total catch, target LL effort and CPUE for 2022/23; Table 3.2-3).

- Targeted LL effort – 3rd Lowest / 3rd Highest (UTRP, 2nd highest).

Stock assessment summary

There is no published stock assessment for the South Australian Whaler Sharks, and there are no data available to estimate biomass or exploitation rates. In addition, there is no knowledge on recruitment or harvestable biomass, and there are no defined target or limit reference levels. This prevents assessment of current stock size or fishing pressure. Consequently, there is insufficient information available to confidently classify the status of this stock. On this basis, Whaler Sharks in South Australia is classified as an **undefined** stock.

Research & development needs

- Quantify the species composition of the combined Whaler Shark catch.
- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

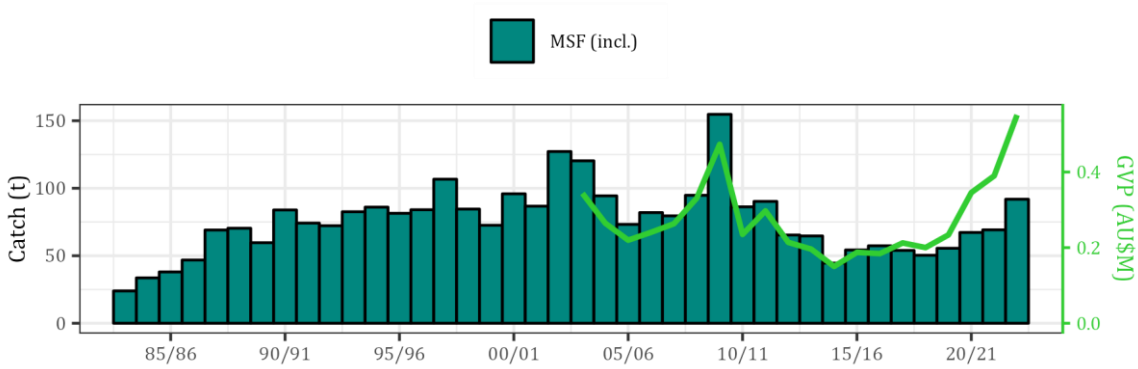


Figure 3.11-1. Fishery statistics for South Australia's Whaler Sharks Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined), and gross value of production (GVP).

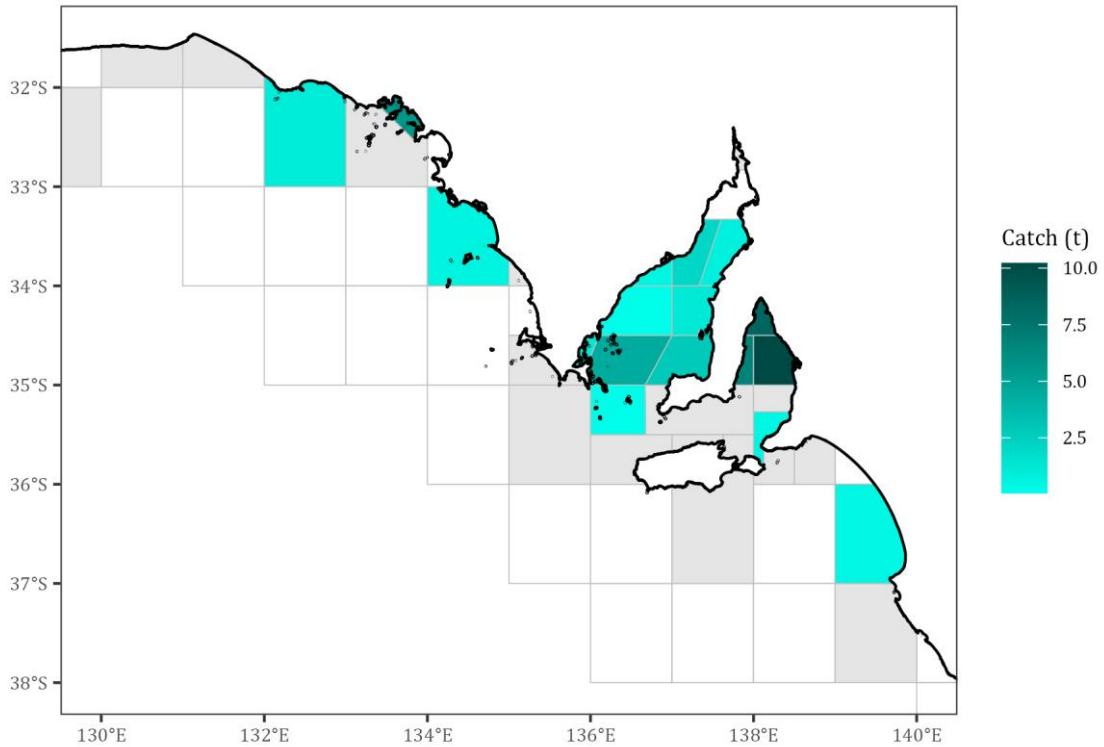


Figure 3.11-2. Spatial distribution of Whaler Sharks catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

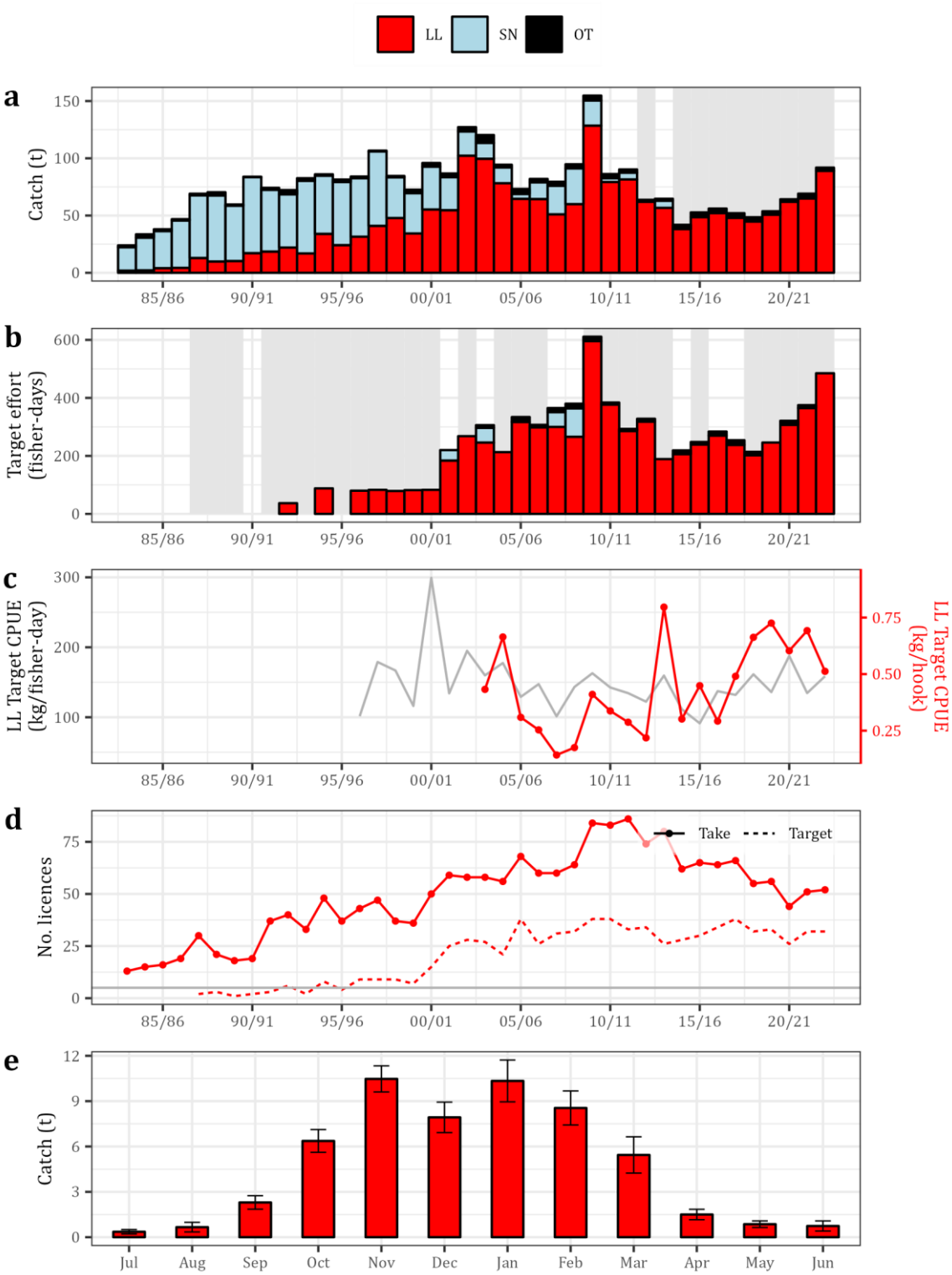


Figure 3.11-3. Key commercial fishery statistics for South Australia's Whaler Sharks Fishery, divisible into key gear categories – Long line (LL), Set net (SN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) targeted effort; (c) LL catch per unit targeted effort; (d) number of licences that take and target Whaler Sharks; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.12. Snook

Snook

Sphyraena novaehollandiae

State-wide summary 2022

Tier 2 in SG & GSV/KI, Negligible in WC & SE

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch** *t*	**Target HN effort** *Fisher-days*	**Target HN CPUE** *kg/fisher-day*	**Target HN CPUE** *kg/haul*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	41	152	63.7	77.5	**2000/01**	71 (16)	93	7
2019/20	39	145	68.1	95.0	**2007/08**	83 (23)	75	25
2020/21	32	152	68.8	101.5	**2013/14**	127 (61)	93	7
2021/22	24	79	55.6	69.7	**2021/22**	23 (7)	95	5
2022/23	34	70	135.8	176.0	*HN – Haul net, CPUE - Catch per unit effort.**Smart et al., 2023			

Biology

- Occur over seagrass beds and reefs in inshore and offshore waters across southern Australia from Perth to Sydney, including around TAS and NZ (Emery et al., 2016).
- Elongate, large-bodied, fast-growing, max. age 12 years, max. length 820 *mm* TL, L_{50} 391 *mm* TL for males and 403 *mm* TL for females (O'Sullivan & Jones, 2003).
- Spawning occurs from September to February (Bertoni, 1994).
- Stock structure of Snook across southern Australia is uncertain.
- Assessment of stock status of Snook in the MSF is undertaken at the management unit level (State-wide).

Fishery description

- Supports commercial and recreational fisheries in SA.
- In the commercial sector, Snook are targeted using troll lines, and are taken as by-product by fishers using haul nets to target higher value species.
- Recreational fishers target Snook from boats with rods and lines using bait and lures in inshore and offshore waters.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Snook (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- LML 450 *mm* TL applies to all sectors.
- Daily recreational limits: 20 for individuals and 60 for boats when 3 or more are onboard.

Catch, targeted effort and CPUE trends

Total catches of Snook in South Australia peaked in 1995/96 and has since declined considerably (Figure 3.12-1). Total catch in 2022/23 was 34 *t*, 10 *t* greater than the total catch for 2021/22, although still the third lowest on record (Figure 3.12-1). Despite declines in catches of snook, the GVP in 2022/23 is equal to the annual mean since these data became available in 2003/04 (Figure 3.12-1). In 2022/23 the recreational catch of snook was estimated at 23 *t* (7 *t* S.E.). Since 2018/19, the highest catches occurred in MFA 35 located in the northern region of GSV (5-year average annual catch, ~10 *t*; Figure 3.12-2).

Despite the majority of the catch being taken using haul nets since 2006/07 (Figure 3.12-3a), the majority of effort was using troll lines for snook (Figure 3.12-3b). In 2022/23, targeted effort using TL was 113 *fisher-days*, while targeted effort using HN was 70 *fisher-days* (Figure 3.12-3b). Haul net CPUE by *kg/fisher-day* and *kg/haul* closely followed the same trend over the same period (Figure 3.12-3c). Targeted HN CPUE by both *kg/fisher-day* and *kg/haul* in 2022/23 reached the highest on record at 136 *kg/fisher-day* and 176 *kg/haul*, respectively, while Targeted HN CPUE by *kg/fisher-day* also showed the greatest 3-year increasing trend on record (Figure 3.12-3c).

Following a series of netting closures in 2005, the number of licences taking Snook using Haul nets declined from 78 in 2004/05 to 41 in 2005/06 (Figure 3.10-3d). Since 2005/06, the number of licences taking and targeting Snook has remained relatively stable, currently at 31 and 12 licences respectively in 2022/23 (Figure 3.12-3d). The haul net fishery for Snook has been seasonal over the last decade, with the highest catches peaking in July through November, before declining to its lowest in January (Figure 3.12-3e).

Triggered performance indicators

General only (includes total catch, target HN effort and CPUE for 2022/23; Table 3.2-3).

- Total catch – 3rd Lowest / 3rd Highest (LTRP, 3rd lowest).
- Total catch – Greatest % interannual change (UTRP).
- Targeted HN CPUE – 3rd Lowest / 3rd Highest (UTRP, highest).
- Targeted HN CPUE – Greatest 3-year trend (UTRP).

Stock assessment summary

The previous assessment of Snook in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the state-wide stock was classified as 'sustainable'.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Snook in South Australia is classified as a **sustainable** stock.

Research & development needs

- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

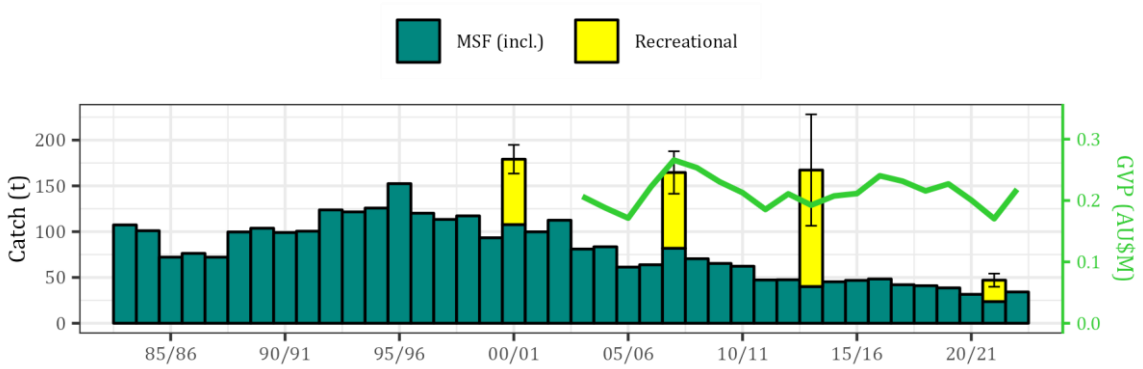


Figure 3.12-1. Fishery statistics for South Australia's Snook Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

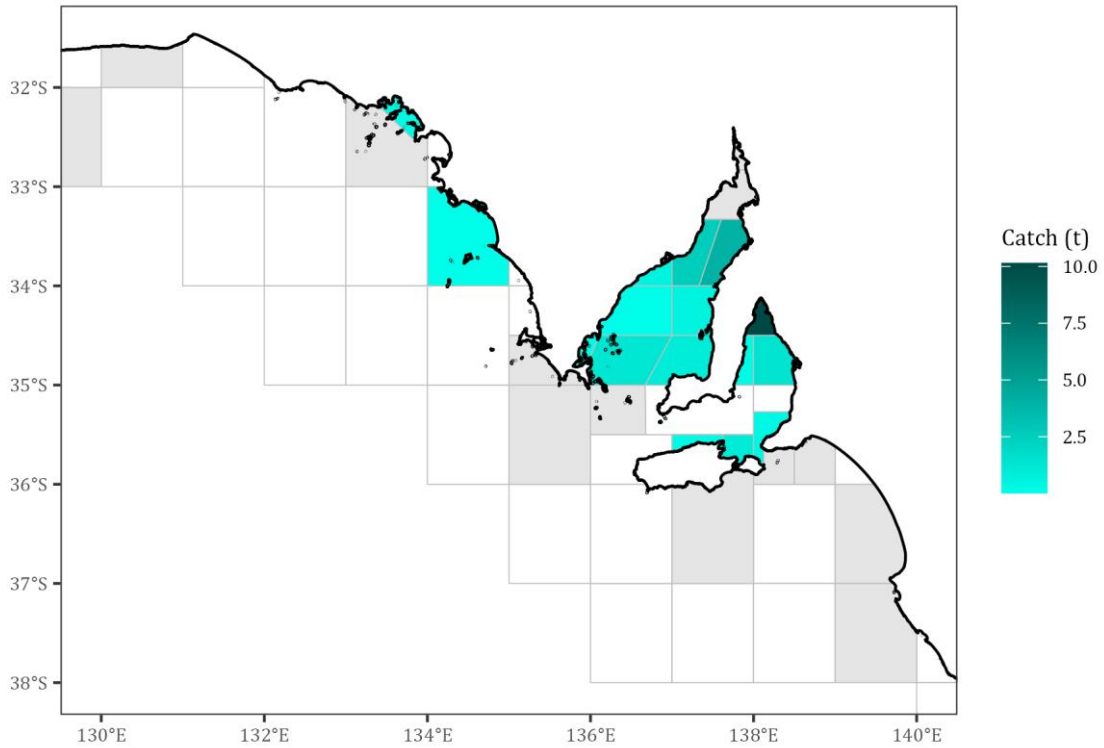


Figure 3.12-2. Spatial distribution of Snook catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

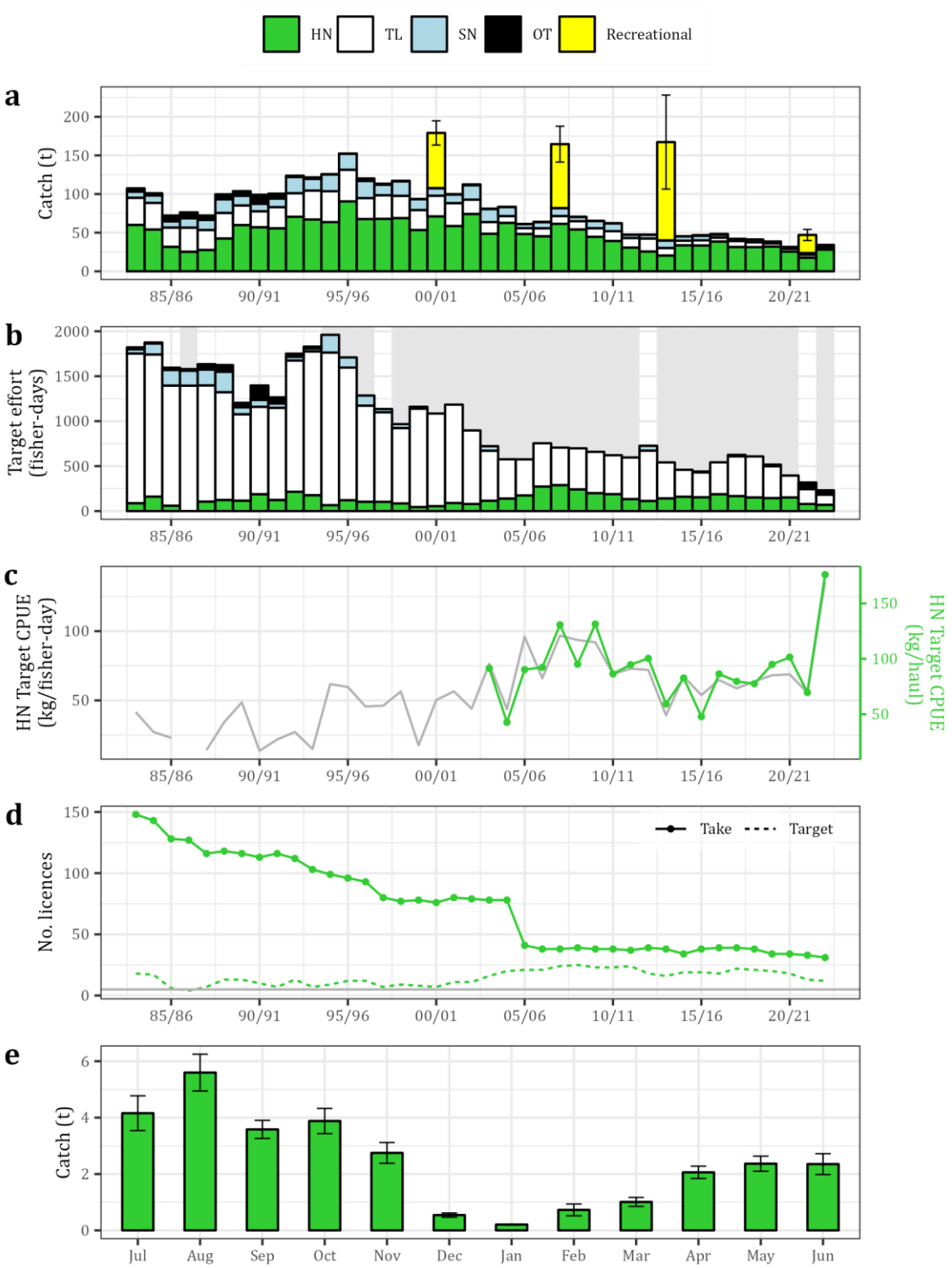


Figure 3.12-3. Key commercial fishery statistics for South Australia's Snook Fishery, divisible into key gear categories – Haul net (HN), troll line (TL), set net (SN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) targeted effort; (c) HN catch per unit targeted effort; (d) number of licences that take and target Snook; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.13. Sand Crab

Sand Crab

Ovalipes australiensis

State-wide summary 2022/23

Tier 2 in SG, Negligible in WC, GSV/KI & SE

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial				Recreational			
Fishing season	**Total catch** *t*	**Target CN effort** *Fisher-days*	**Target CN CPUE** *kg/fisher-day*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	64	444	143.0	**2000/01**	19 (6)	47	53
2019/20	51	355	143.7	**2007/08**	11 (5)	43	57
2020/21	63	389	158.8	**2013/14**	10 (8)	52	48
2021/22	56	334	166.8	**2021/22**	2 (1)	35	65
2022/23	51	279	181.1	*CN – Crab net, CPUE - Catch per unit effort.**Smart et al., 2023			

Biology

- Distributed along surf beaches, in sandy bays, inlets, and offshore waters to ~100 *m* depth across southern Australia from Wide Bay in QLD to Rottnest Island in WA, including the waters of TAS (Kailola et al., 1993).
- Maximum size ~100 *mm* carapace width (CW; Jones & Morgan, 1994).
- Longevity and stock structure is unknown.
- Sand Crabs in Coffin Bay are winter spawners for which reproductive activity peaks in July, with berried females present until late August (Jones & Deakin, 1997).
- Female Sand Crabs attain sexual maturity at a smaller size than males.
- The fishery is largely based on the capture of male crabs, as most females are below the LML (Jones & Deakin, 1997).
- Assessment of stock status for Sand Crab is undertaken at the State-wide scale.

Fishery description

- The commercial fishery was initially developed in Coffin Bay as an experimental trap or pot fishery in 1982 and subsequently extended to southern coastal areas, with active targeting of Sand Crabs using more efficient hoop and drop nets and implementing mechanical net haulers (Jones, 1995; Jones & Deakin, 1997).
- In the early 2000's Sand Crab Pots were introduced as a permitted device with four licences endorsed with this specialised device.
- Recreational fishers target Sand Crabs using hoop or drop nets.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .

- The current harvest strategy for Sand Crab (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- LML 100 *mm* carapace width (measured across the widest point) applies to all sectors.
- Taking of females with external eggs is prohibited.
- Commercial fishers target Sand Crabs using hoop and drop nets, where endorsed on their licence, or in the case of four licences, Sand Crabs are targeted using Sand Crab Pots.
- Daily recreational limits: 20 for individuals and 60 for boats when 3 or more are onboard (combined total with Blue Crabs).

Catch, targeted effort and CPUE trends

The total catch of Sand Crabs in 2022/23 was 51 *t*, declining 5 *t* from 2021/22, and was the second consecutive annual decline in total catch (Figure 3.13-1). The recreational catch in the 2021/22 fishing survey was negligible at 2 *t* (S.E. 1 *t*; Figure 3.13-1). The GVP has followed the same trend as total catch, declining to $0.49M over the previous two years from the historic peak of $0.58M in 2020/21 (Figure 3.13-1). The majority of the catch since 2018/19 was taken in MFA 30 (5-year average annual catch, ~24 *t*), MFA 31 (~14 *t*), and MFA 27B in Coffin Bay (~14 *t*; Figure 3.13-2).

Sand Crab catch and effort in South Australia has historically been dominated by the crab net gear type (Figure 3.13-3a-b). In 2022/23, the total targeted effort using CN was 279 *fisher-days*, a 16% decline from 2021/22, producing a CPUE in 2022/23 of 181 *kg/fisher-day* (Figure 3.13-3b-c). The targeted CN CPUE by *fisher-day* in 2022/23 was the highest on record, increasing for the third consecutive year (Figure 3.13-3c). In 2022/23, the number of licence holders taking and targeting Sand Crabs declined to 11 licences respectively (Figure 3.13-3d). The number of licences targeting Sand Crabs peaked in 1997/98 at 34, which has since progressively declined (Figure 3.13-3d). The crab net fishery for Sand Crabs has been seasonal over the last decade, with the highest catches peaking in October through January, before declining to its lowest in June and July when their reproductive activity peaks (Figure 3.13-3e).

Triggered performance indicators

General only (includes total catch, target CN effort and CPUE for 2022/23; Table 3.2-3).

- Targeted CN CPUE – 3rd Lowest / 3rd Highest (UTRP, highest).

Stock assessment summary

The previous assessment of Sand Crab in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the state-wide stock was classified as 'sustainable'.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above). Increasing CPUE and decreasing catch and effort levels are likely a result of increases in efficiencies in the fishery, rather than evidence of a decline in recruitment. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Sand Crab in South Australia is classified as a **sustainable** stock.

Research & development needs

- Information on stock structure, longevity, size, and age at maturity.
- Standardisation of CPUE to account for changes in efficiency.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

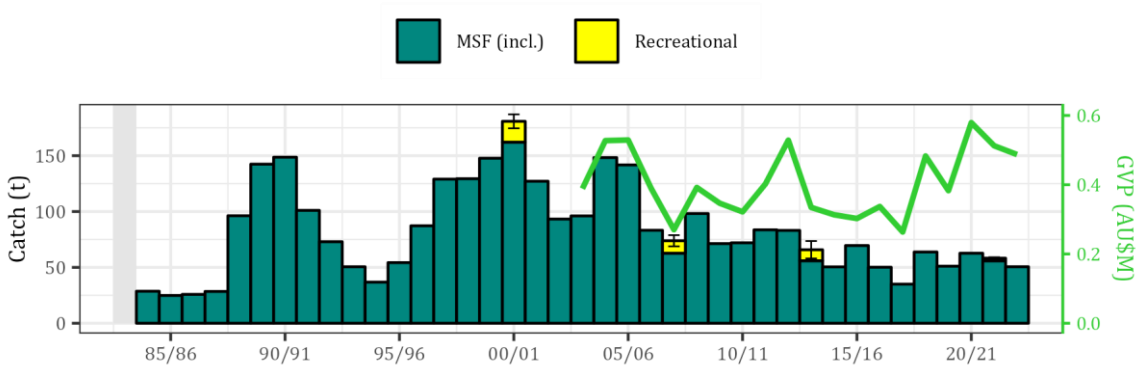


Figure 3.13-1. Fishery statistics for South Australia's Sand Crab Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP). Grey shading indicates years when data for one or more Fishing Zones are confidential.

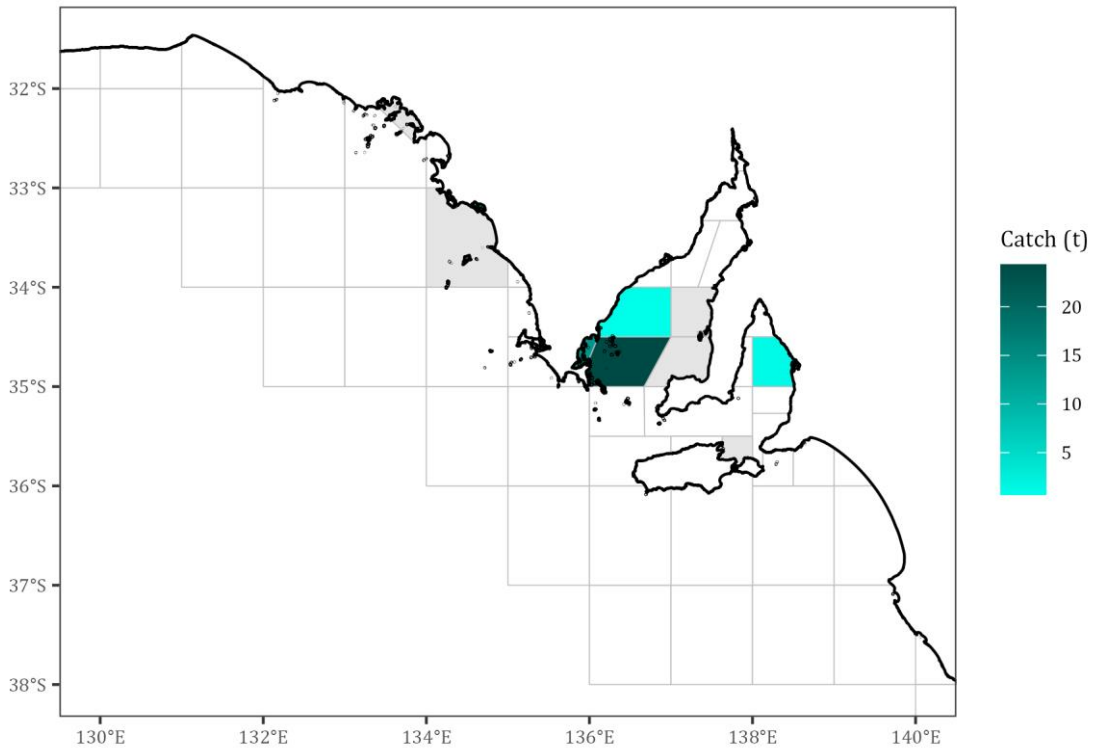


Figure 3.13-2. Spatial distribution of Sand Crab catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

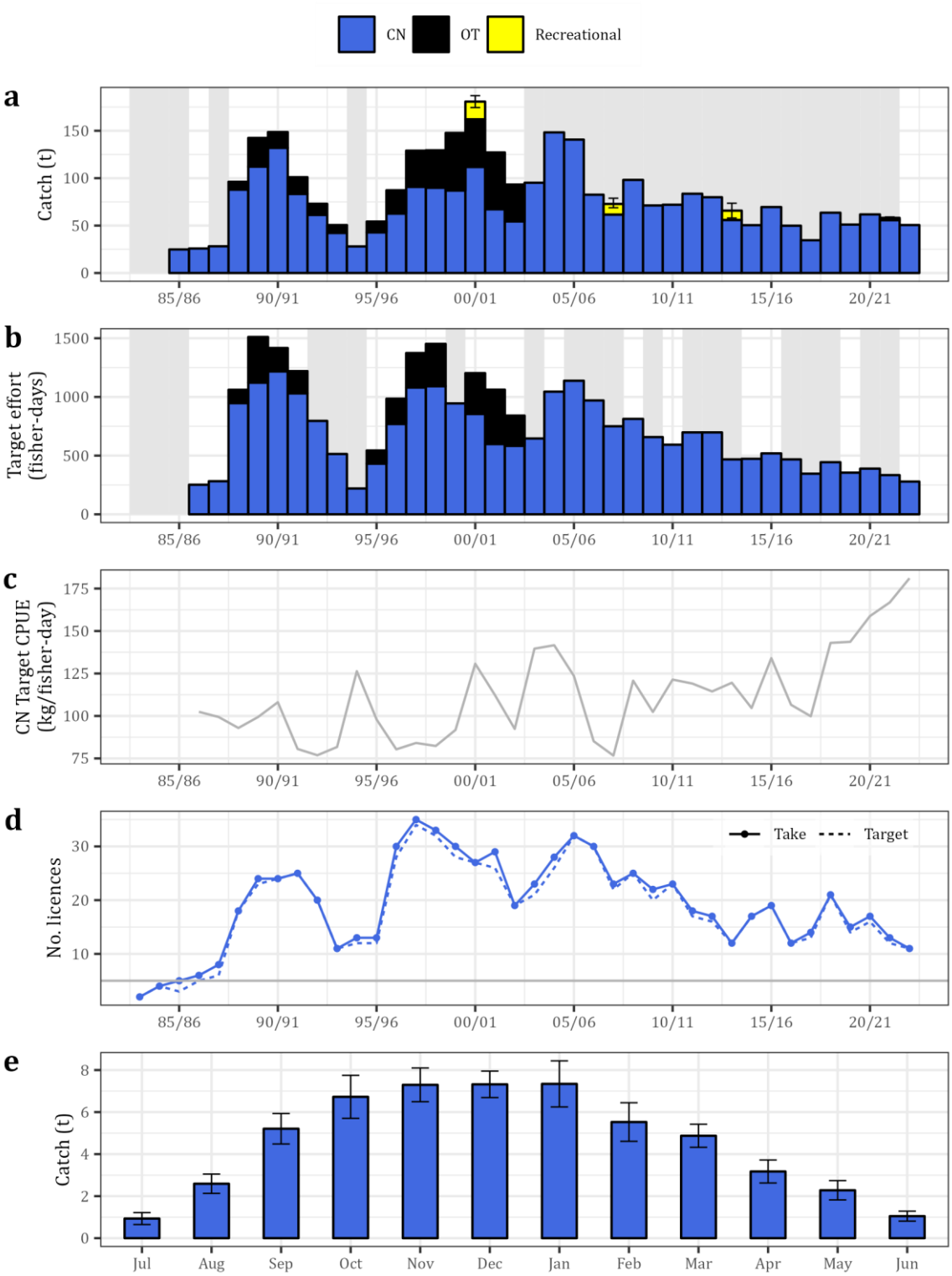


Figure 3.13-3. Key commercial fishery statistics for South Australia's Sand Crab Fishery, divisible into key gear categories – Crab net (CN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) targeted effort; (c) CN catch per unit targeted effort; (d) number of licences that take and target Sand Crab; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.14. Yelloweye Mullet

Yelloweye Mullet

Aldrichetta forsteri

MSF summary 2022/23

Tier 2 in SG, Negligible in WC, GSV/KI & SE

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial (MSF incl.)					Recreational			
Fishing season	**Total catch** *t*	**Total HN effort** *Fisher-days*	**Total HN CPUE** *kg/fisher-day*	**Total HN CPUE** *kg/haul*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	16	602	22.9	18.3	**2000/01**	41 (11)	67	33
2019/20	11	508	18.8	15.8	**2007/08**	28 (5)	57	43
2020/21	9	382	21.2	16.8	**2013/14**	13 (4)	71	29
2021/22	7	303	20.4	18.5	**2021/22**	11 (4)	84	16
2022/23	7	275	20.4	21.9	*HN – Haul net, CPUE - Catch per unit effort.**Smart et al., 2023			

Biology

- Yelloweye Mullet occurs in estuaries and nearshore coastal waters of southern Australia from central NSW to central west coast WA, including TAS (Gomon et al., 2008).
- Common over sandy and muddy substrates to depths of 20 *m* (Kailola et al., 1993).
- Medium-bodied, fast-growing, max. age 10 years, max. length 440 *mm* TL, L_{50} 250 *mm* TL for males and 240 *mm* TL for females (Earl & Ferguson, 2013).
- A marine estuarine-opportunist species, i.e., spawns at sea; regularly enters estuaries, particularly as juveniles, but also uses coastal marine waters as alternative nursery areas (Earl & Ferguson, 2013).
- Spawning occurs from August to February each year.
- Biological stock structure across southern Australia is uncertain.
- Assessment of stock status of Yelloweye Mullet in the MSF is undertaken at the management unit level (State-wide).

Fishery description

- Supports commercial and recreational fisheries in SA.
- In most years, > 90% of the commercial catch is taken by the LCF in the Coorong, with the remainder taken as by-product by the MSF using haul nets in gulf waters.
- Recreational fishers target Yelloweye Mullet from the shore using rod and line in inshore marine waters and estuaries.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Annual catch and effort statistics and trends in the Lakes and Coorong Fishery report (Sarakinis & Earl, 2024).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing.

- The current harvest strategy for Yelloweye Mullet (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- A summary of key historical management changes for the Yelloweye mullet fishery is provided in the 2022/23 LCF report (Sarakinis & Earl, 2024).
- LML 210 *mm* TL applies to all sectors.
- Daily recreational limits: 60 for individuals and 180 for boats when 3 or more are onboard.

Catch, targeted effort and CPUE trends

Yelloweye Mullet is predominantly taken as by-product within the haul net sector of the MSF, with the majority of catch taken by the Lakes and Coorong Fishery (Figure 3.14-1). The recreational catch in the 2021/22 fishing survey was 11 *t* (S.E. 4 *t*; Figure 3.14-1). The GVP has declined since reaching its second historic peak of $0.13M in 2011/12, reaching $0.05M in 2022/23 (Figure 3.14-1). In the MSF, the majority of the catch since 2018/19 was taken in MFA 23 in upper SG (5-year average annual catch, ~5.7 *t*; Figure 3.14-2).

Annual catches peaked at 176 *t* in 1989/90 and have since progressively declined to 7 *t* in 2021/22 and 2022/23 due to a reduction of the haul-net fishery and wholesale prices rather than a declining biomass (Figure 3.14-3). Likewise, total effort peaked 9,039 *fisher-days* in 1983/84, and has since declined to 330 *fisher-days* in 2022/23 (Figure 3.14-3b). Total HN CPUE by *kg/fisher-day* and *kg/haul* have closely followed the same trend over the same period. Both total HN CPUE by *kg/fisher-day* and *kg/haul* peaked in 2011/12 (46.9 *kg/fisher-day* and *kg/haul*, respectively) and has since declined to 20.4 *kg/fisher-day* and 21.9 *kg/haul*, respectively, in 2022/23 (Figure 3.14-3). Despite haul net CPUE declining since 2005/06, it has been relatively stable at levels similar to those during the 1980s and 1990s when a larger proportion of the total catch was taken as targeted catch using haul nets (Figure 3.14-3a-c).

Following a series of netting closures in 2005, the number of licences taking Yelloweye Mullet using Haul nets declined from 60 in 2004/05 to 32 in 2005/06 (Figure 3.14-3d). Since 2005/06, the number of licences targeting Yelloweye Mullet has remained relatively stable, currently at 5 in 2022/23 (Figure 3.14-3d). The haul net fishery for Yelloweye Mullet has not been seasonal over the last decade, with stable catches throughout the year and a minor increase from January to March (Figure 3.14-3e).

Performance indicators

General only (includes total catch, total HN effort and CPUE for 2022/23; Table 3.2-3).

- Total catch – 3rd Lowest / 3rd Highest (LTRP, lowest).
- Total catch – Decrease over 5 consecutive years (Triggered).
- Total HN effort – 3rd Lowest / 3rd Highest (LTRP, lowest).
- Total HN effort – Decrease over 5 consecutive years (Triggered).

Stock assessment summary

The previous assessment of Yelloweye Mullet in South Australia was completed in 2023 for the MSF (up to and inclusive of 2021/22), and in 2024 for the LCF report (up to and inclusive of 2022/23), examining commercial fishery statistics and trends (Sarakinis & Earl, 2024, Smart et al., 2023). In both these assessment, Yelloweye Mullet were classified as ‘sustainable’.

Consideration of additional catch and effort data for 2022/23 for the MSF does not indicate any stock concerns as declines in catch and effort are paired with stable or increasing CPUE by *kg/fisher-day* and *kg/haul*, respectively (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Yelloweye Mullet in the MSF is classified as a **sustainable** stock.

Research & development needs

- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional fishing importance.

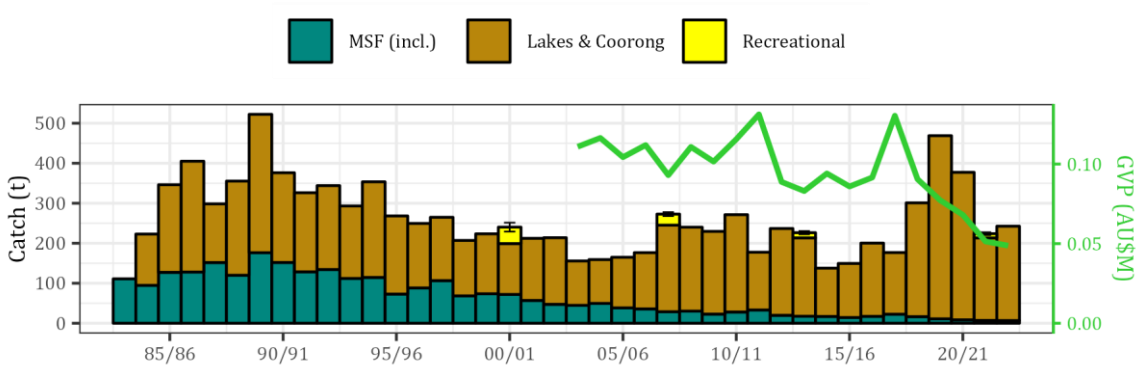


Figure 3.14-1. Fishery statistics for South Australia's Yelloweye Mullet Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined), Lakes and Coorong sector, and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

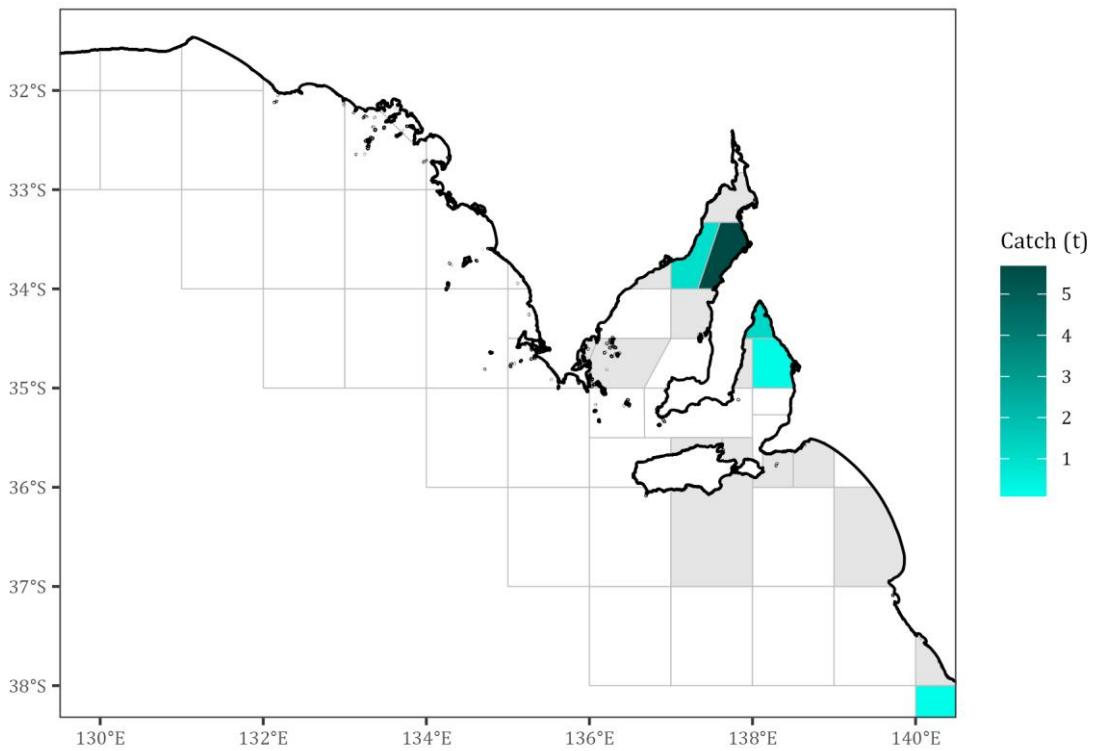


Figure 3.14-2. Spatial distribution of Yelloweye Mullet catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

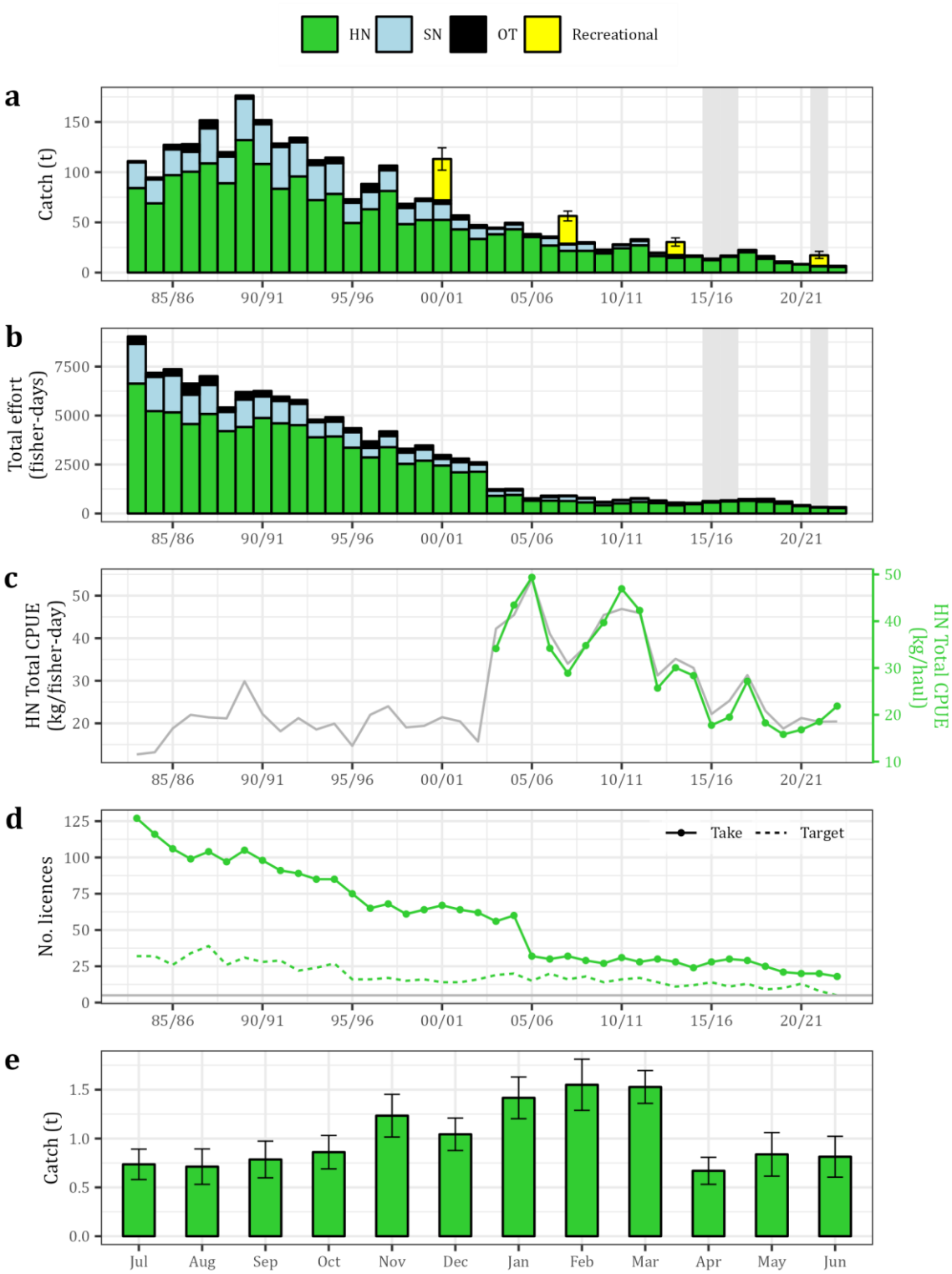


Figure 3.14-3. Key commercial fishery statistics for South Australia's Yelloweye Mullet Fishery, divisible into key gear categories – Haul net (HN), set net (SN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) HN catch per unit total effort; (d) number of licences that take and target Yelloweye Mullet; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.15. Mulloway

Mulloway

Argyrosomus japonicus

MSF summary 2022/23

Negligible

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial (MSF incl.)					Recreational			
Fishing season	**Total catch** *t*	**Total HL effort** *Fisher-days*	**Total HL CPUE** *kg/fisher-day*	**Total HL CPUE** *kg/line-hour*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	9.1	24	25.7	3.9	**2000/01**	83 (28)	32	68
2019/20	3.3	14	27.8	3.6	**2007/08**	102 (32)	15	85
2020/21	0.9	*Conf.*	*Conf.*	*Conf.*	**2013/14**	60 (27)	21	79
2021/22	1.1	*Conf.*	*Conf.*	*Conf.*	**2021/22**	24 (11)	51	49
2022/23	0.1	*Conf.*	*Conf.*	*Conf.*	*HL – Handline, CPUE - Catch per unit effort.*Smart et al., 2023			

Biology

- Mulloway occur in estuaries and nearshore coastal waters in sub-tropical to temperate regions of the Atlantic, Pacific and Indian Oceans, including around southern mainland Australia from North West Cape in WA, to the Burnett River in QLD.
- Juveniles are common in estuaries, while adults predominantly occur in coastal waters, including the surf zone and around the mouths of rivers (Griffiths, 1997).
- Large-bodied, fast-growing, late-maturing, max. age 42 years, max. length 1600 *mm* TL, L_{50} 780 *mm* TL for males and 850 *mm* TL for females (Ferguson et al., 2014).
- A marine estuarine-opportunist species, i.e., spawns at sea; regularly enters estuaries, particularly as juveniles, but also uses coastal marine waters as alternative nursery areas.
- Spawning occurs from October to January each year (Ferguson et al., 2014).
- Evidence of distinct populations along the eastern and western coasts of SA (Ferguson et al., 2014; Barnes et al., 2015).
- Assessment of stock status of Mulloway in the MSF is undertaken at the management unit level (State-wide).

Fishery description

- Supports commercial and recreational fisheries in SA.
- Most of the commercial catch is taken by the LCF in the Coorong Estuary and nearshore marine waters adjacent the Murray Mouth, with the remainder taken as by-product by the MSF using haul nets (Earl et al., 2023).
- Recreational fishers target Mulloway from the shore using rod and line in estuaries and inshore marine waters.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Annual catch and effort statistics and trends in the Lakes and Coorong Fishery report (Sarakinis & Earl, 2024).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).

- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Mulloway (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- A summary of key historical management changes for the Mulloway fishery is provided in the 2022/23 LCF report (Sarakinis & Earl, 2024).
- Mulloway can be taken by MSF fishers in all coastal waters of SA, except those accessible to the LCF.
- LML 820 *mm* TL applies to all sectors outside Coorong waters.
- Daily recreational limits: 2 for individuals and 6 for boats when 3 or more are onboard.

Catch, targeted effort and CPUE trends

Mulloway is predominantly taken as by-product within the haul net sector of the MSF, with the majority of catch taken by the Lakes and Coorong Fishery (Figure 3.15-1). Total catch of Mulloway has been relatively stable at low levels since it declined from a historical peak of 24 *t* in 1995/96 to 3 *t* in 1999/00 (Figure 3.15-1). Total catch in 2022/23 was a historic low of 0.1 *t*, with the lowest GVP on record since 2003/04 when these data became available of $0.0014M (Figure 3.15-1). The majority of the catch in the MSF since 2018/19 was taken in MFA 35 (5-year average annual catch, ~2 *t*; Figure 3.15-2).

The decline in catch and effort of Mulloway reflects the reduction in set net fishing effort in the late-1990s rather than a decline in fishable biomass, as over the past 25 years, Mulloway has been predominantly taken as by-product within the haul net sector of the MSF, and CPUE using haul nets has been relatively high in most years during this period (Figure 3.15-3a-e). Total handline CPUE by *kg/line-hour* reached a historic peak since these data became available of 9.6 *kg/line-hour* in 2012/13 (Figure 3.15-3c). The haul net and set net fishery for Mulloway has not been seasonal over the last decade, with no apparent trends in catch (Figure 3.15-3f).

Triggered performance indicators

General only (includes total catch, total HL and total SN effort and CPUE for 2022/23; Table 3.2-3).

- Total catch – 3rd Lowest / 3rd Highest (LTRP, lowest).
- Total catch – Greatest % interannual change (LTRP).
- Total HL effort and CPUE – Confidential data precluded assessment of this PI.
- Total SN effort and CPUE – No fishing data to assess performance indicator.

Stock assessment summary

The previous assessment of Mulloway in South Australia was completed in 2023 for the MSF (up to and inclusive of 2021/22), and in 2024 for the LCF report (up to and inclusive of 2022/23), examining commercial fishery statistics and trends (Sarakinis & Earl, 2024, Smart et al., 2023). In both these assessments, Mulloway were classified as ‘sustainable’.

In SA, Mulloway is predominantly caught in the LCF, however, consideration of additional catch and effort data for 2022/23 for the MSF does not indicate any stock concerns (see general performance indicators above) due to low effort for the species. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Mulloway in South Australia is classified as a **sustainable** stock.

Research & development needs

- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

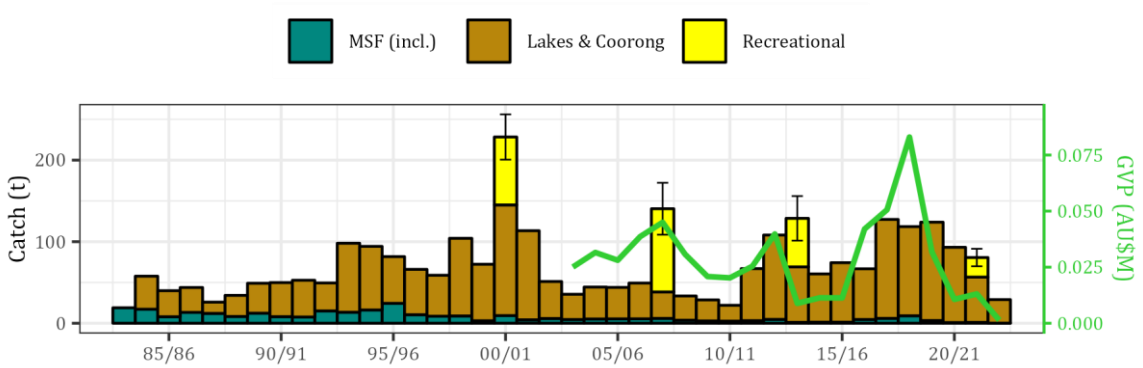


Figure 3.15-1. Fishery statistics for South Australia's Mulloway Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined), Lakes and Coorong sector, and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

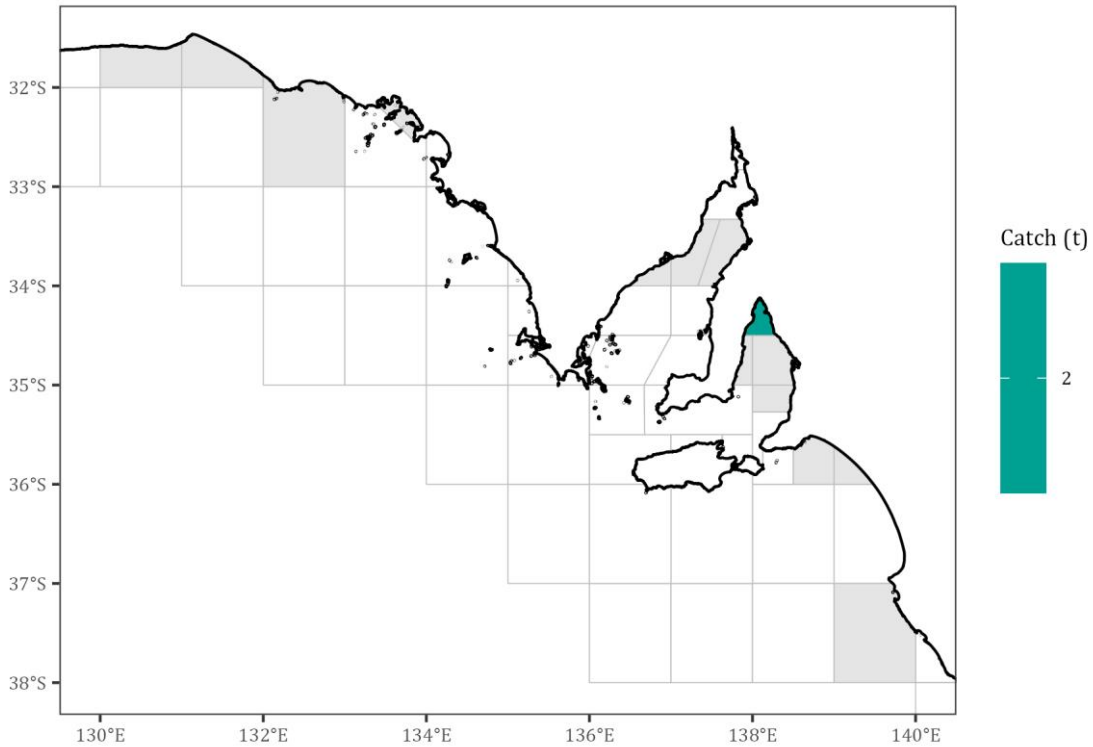


Figure 3.15-2. Spatial distribution of Mulloway catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

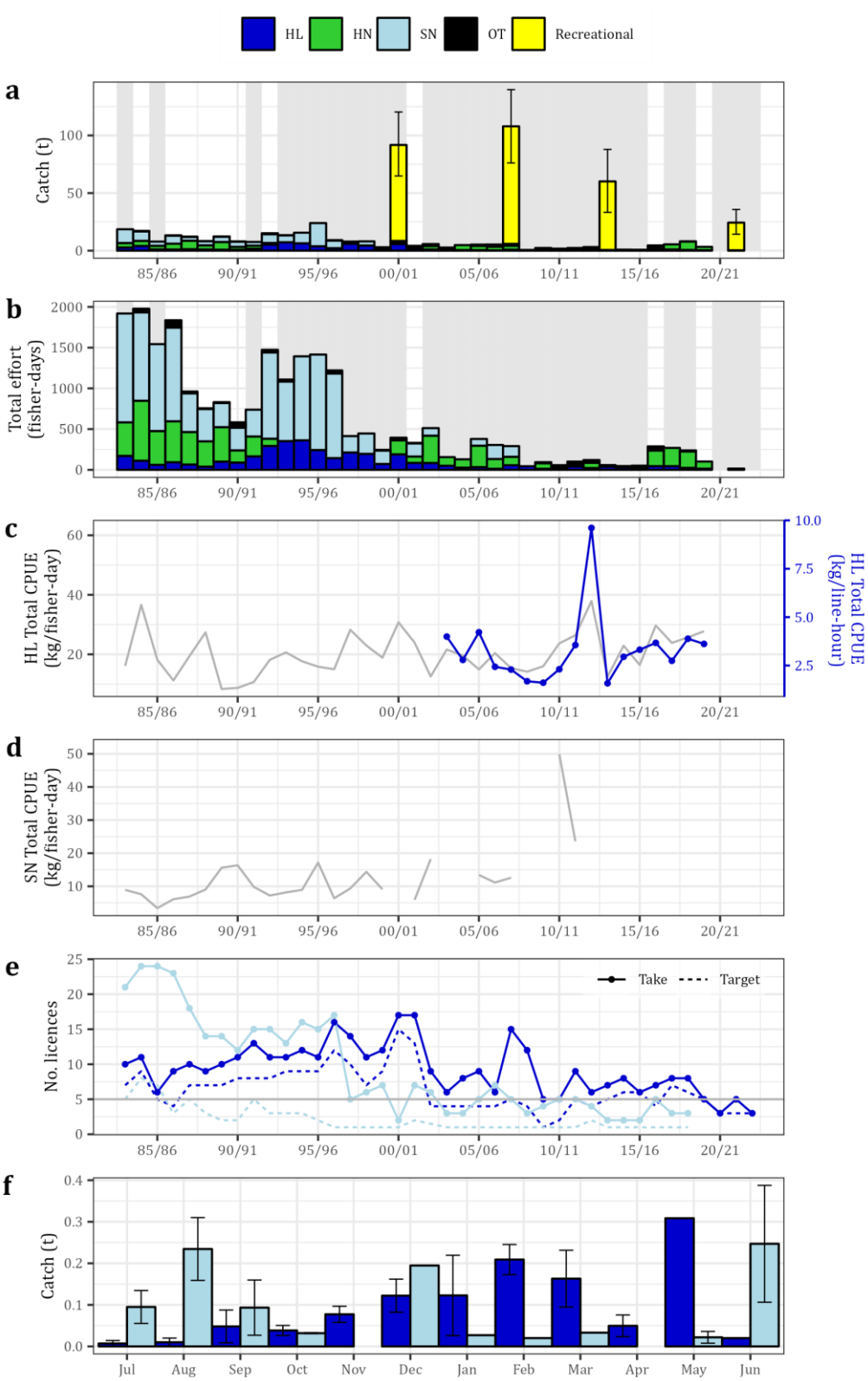


Figure 3.15-3. Key commercial fishery statistics for South Australia's Mulloway Fishery, divisible into key gear categories – Handline (HL), haul net (HN), Set net (SN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) HL catch per unit total effort; (d) SN catch per unit total effort; (e) number of licences that take and target Mulloway; and (f) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.16. Ocean Jacket

Ocean Jacket

Nelusetta ayraudi

State-wide summary 2022/23

Tier 3 in SG, Negligible in WC, GSV/KI & SE

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial*

Fishing season	Total catch *t*	Target FT effort *Fisher-days*	Target FT CPUE *kg/fisher-day*
2018/19	128	*Conf.*	*Conf.*
2019/20	*Conf.*	*Conf.*	*Conf.*
2020/21	*Conf.*	*Conf.*	*Conf.*
2021/22	254	*Conf.*	*Conf.*
2022/23	522	*Conf.*	*Conf.*

*FT – Fish trap, CPUE - Catch per unit effort.**Smart et al., 2023

Biology

- Distribution extends from the central coast of WA, along southern Australian coastal and continental shelf waters to the central QLD coast.
- Juveniles occur in shallow coastal bays, while adults occur over flat, sandy bottom in offshore, continental shelf waters at depths > 60 *m* (Grove-Jones & Burnell, 1991).
- Ocean Jacket is the largest species of leatherjacket in southern Australia, reaching 700 *mm* TL (Gommon et al., 2008).
- Sexually dichromatic species that is fast-growing and short-lived (≥7 years for males and 9 years for females), maturity occurs at 2–4 years of age and at 310 *mm* TL.
- Spawning in SA occurs in April and early May at depths > 85 *m*.
- Stock structure throughout its distribution is currently unknown (Current FRDC project FRDC 2021-009).
- Assessment of stock status of Ocean Jackets in the MSF is undertaken at the management unit level (State-wide).

Fishery description

- Predominantly targeted by commercial fishers using species-specific baited fish traps in offshore waters of the WC and SGFZ, with only four licences endorsed to use Ocean Jacket Fish Traps.
- Negligible targeting by recreational fishers.

Assessment Program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Ocean Jackets (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- Regulations for 'Ocean Jacket traps' differ to those for 'fish traps'.
- Four MSF licences have Ocean Jacket trap endorsements.
- Ocean Jacket traps can only be used in depths > 60 *m* (other fish traps, used to target any species, are restricted to depths < 60 *m*).

Catch, targeted effort and CPUE trends

The Ocean Jacket fishery developed quickly between 1989/90 and 1992/93 resulting in a rapid increase in total annual catch which peaked at 1,024 *t* in 1988/89 (Figure 3.16-1). Here, catch and effort recorded as Leatherjackets ≤ 1991/92 using fish traps was assumed to be Ocean Jackets. Catches predominantly occur in the SGFZ (Figure 3.16-2). The high total catch reflected both an increase in effort as new entrants came into the fishery and the geographic expansion of the fishery (Grove-Jones and Burnell 1991). The fast rate of fishery development caused concerns about sustainability, which led to the introduction of regulations to limit the numbers of fishers, fishing effort and gear type. As a result, the fishery attained its highest productivity in the early 1990s. Since then, the fishery statistics have been dominated by comparatively lower levels of catch, effort, and numbers of specialist fishers (Figure 3.16-3). In 2022/23, the fishery was comprised of moderate catches (522 *t*), and the highest GVP on record since these data became available of $1.3M (Figure 3.16-1). The fish trap fishery for Ocean Jackets has not been seasonal over the last decade, with no apparent trends in catch (Figure 3.16-3e).

Triggered performance indicators

General only (includes total catch, total HL and total SN effort and CPUE for 2022/23; Table 3.2-3).

- Total Catch - No breaches
- Targeted effort and CPUE - Confidential data precluded assessment of this PI.

Stock assessment summary

The previous assessment of Ocean Jackets in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the state-wide stock was classified as 'sustainable'.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Ocean Jackets in South Australia is classified as a **sustainable** stock.

Research & development needs

- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved understanding of southern Australian stock structure (FRDC 2021-009)
- Improved estimates of recreational catch and effort
- Improved understanding of Aboriginal Traditional Fishing importance

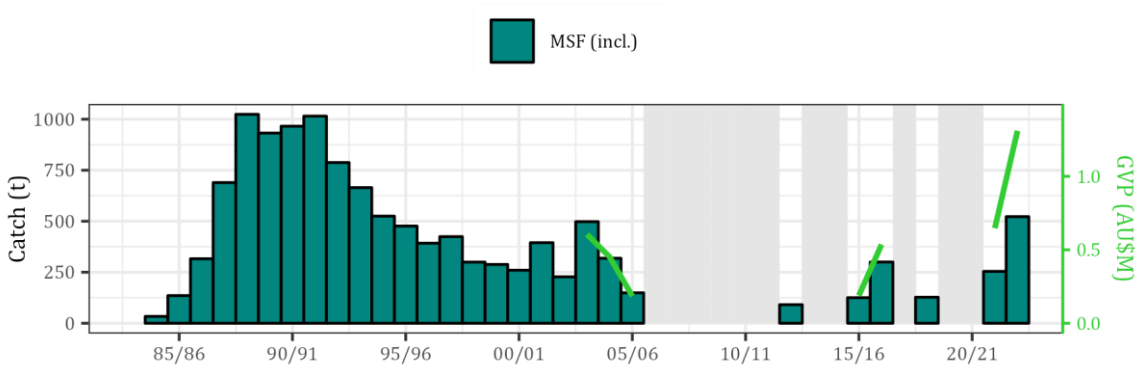


Figure 3.16-1. Fishery statistics for South Australia's Ocean Jacket Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and gross value of production (GVP). Grey shading indicates years when data for one or more Fishing Zones are confidential. Catch recorded as Leatherjackets ≤ 1991/92 using fish traps was assumed to be Ocean Jackets.

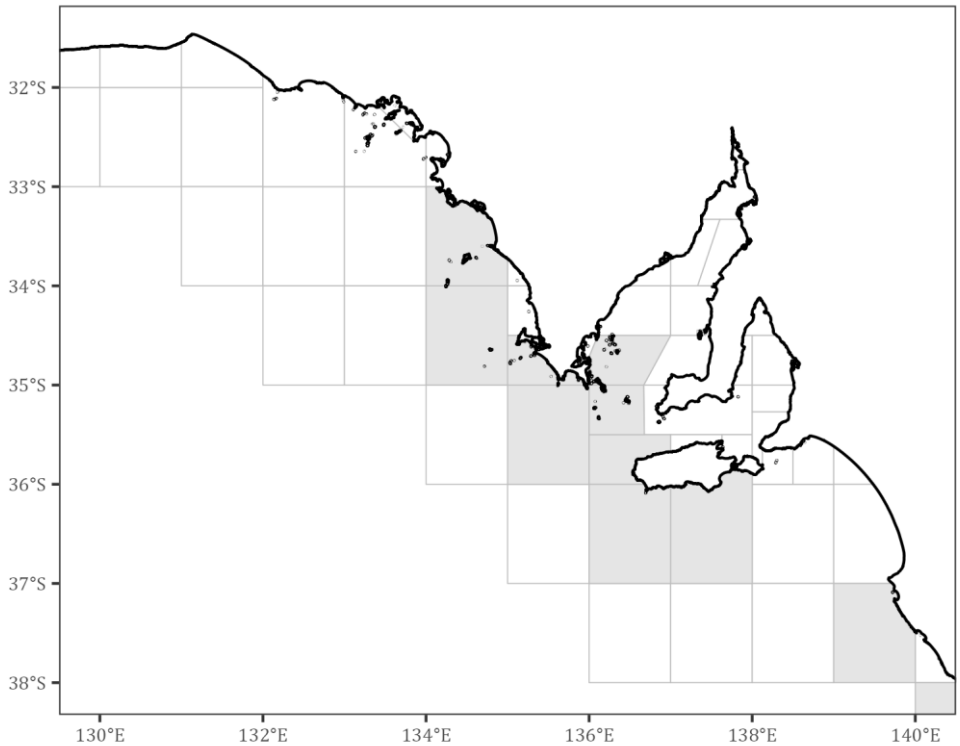


Figure 3.16-2. Spatial distribution of Ocean Jacket catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Grey shading indicates MFA blocks where the catch data are confidential.

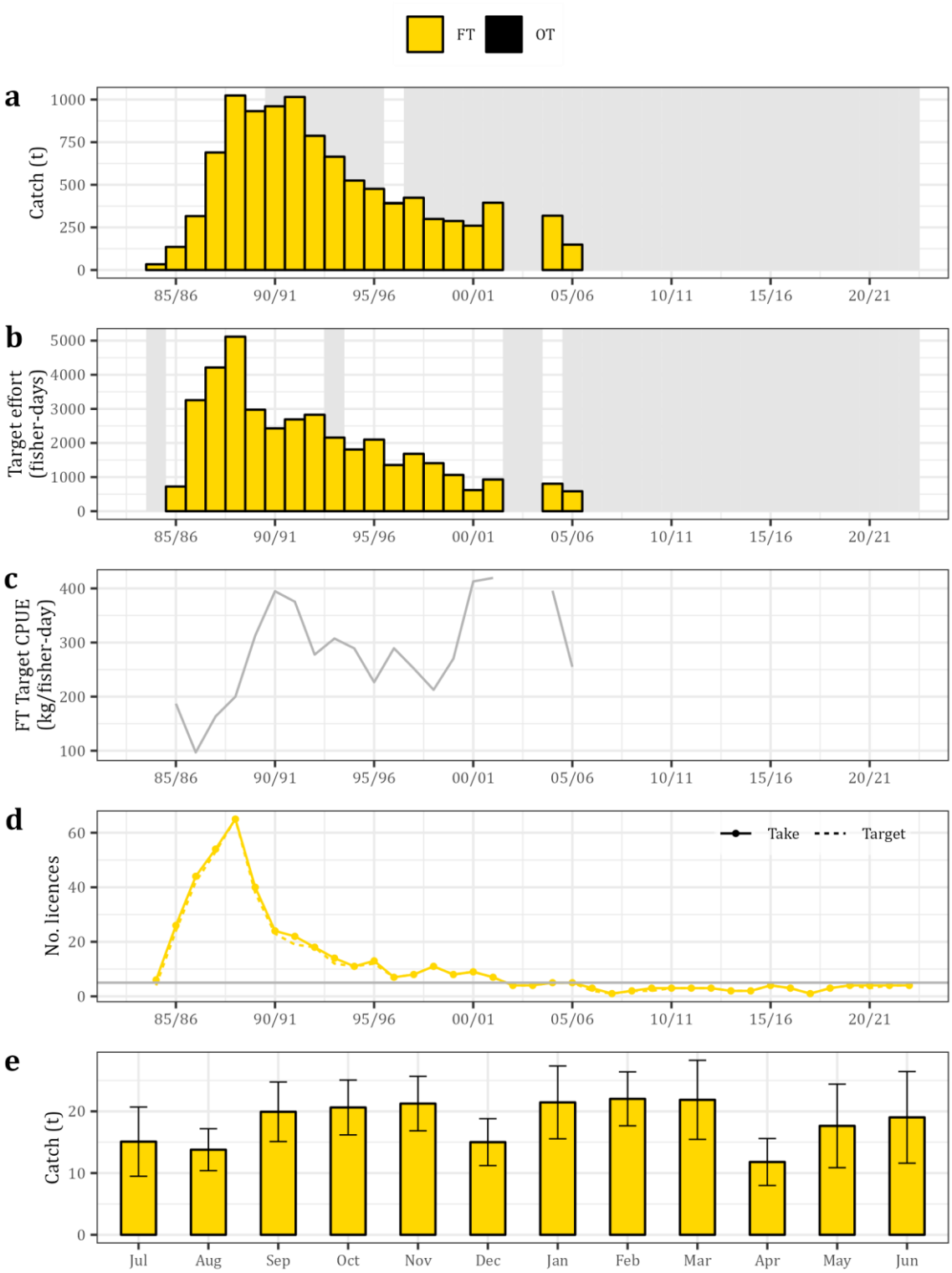


Figure 3.16-3. Key commercial fishery statistics for South Australia's Ocean Jacket Fishery, divisible into key gear categories – Fish trap (FT), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch; (b) targeted effort; (c) FT catch per unit targeted effort; (d) number of licences that take and target Ocean Jacket; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Catch and effort recorded as Leatherjackets ≤ 1991/92 using fish traps was assumed to be Ocean Jackets.

3.17. Bluethroat Wrasse

Bluethroat Wrasse

Notolabrus tetricus

State-wide summary 2022/23

Tier 3 in SG, Negligible in WC, GSV/KI & SE

Stock status*

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch** *t*	**Total HL effort** *Fisher-days*	**Total HL CPUE** *kg/fisher-day*	**Total HL CPUE** *kg/line-hour*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	7	378	11.5	1.3	**2000/01**	23 (7)	-	-
2019/20	6	455	9.4	1.3	**2007/08**	2 (2)	22	78
2020/21	5	395	8.4	1.1	**2013/14**	4 (4)	25	75
2021/22	8	441	13.3	1.8	**2021/22**	2 (1)	17	83
2022/23	10	549	10.0	1.4	*HL – Handline, CPUE - Catch per unit effort.* *Smart et al., 2023, Rec catches include Wrasse (unspecified), average weight 0.35 kg from 2000/01 survey is assumed for 2007/08 and 2013/14 surveys.			

Biology

- Occur on near-shore rocky reefs in the coastal waters of SA, VIC, TAS, and NSW.
- Highly territorial with long-term residency and restricted home ranges on algal beds and near-shore reefs (0–50 *m* depth).
- Bluethroat Wrasse are a monandric, sequential protogynous hermaphrodite, i.e., adult males originate through a sex change from female fish.
- Complex social structure of a single male and a harem of smaller females.
- Maximum size is 400 *mm* TL at 11 years-of-age (Smith et al., 2003).
- Size and age at 50% maturity are 300mm TL and 8 years (Smith et al., 2003).
- No information is available on stock structure across the south-eastern Australian distribution.
- Assessment of stock status for Bluethroat Wrasse is undertaken at the management unit level–MSF (State-wide).

Fishery description

- Historically used as bait for Southern Zone Rock Lobster Fishery.
- Other labrid species also taken in low numbers and reported as 'Parrotfish' in MSF logbooks.
- Targeted and retained as bycatch in commercial longline and handline fisheries.
- Majority of commercial catches from southern SGFZ and WCFZ.
- Recreational fishers catch as bycatch with high discard rates.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Bluethroat Wrasse (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- Commercial fishers permitted use of two handlines at a time with a maximum of three hooks (≤12/0) per line.
- LML 250 *mm* TL applies to all sectors.
- Recreational sector legal maximum length 350 *mm* in 2022/23.
- Daily recreational limits: 5 for individuals and 15 for boats when 3 or more are onboard.

Catch, targeted effort and CPUE trends

Total catch of Bluethroat Wrasse peaked at > 20 *t* per annum between 1987/88 and 2004/05 (Figure 3.17-1), predominantly in the SGFZ (MFA 30, 5-year average annual catch, ~2 *t*; Figure 3.17-2), with total catches aligning with the highest level of targeted handline effort (Figure 3.17-3). In 2022/23, total catches of Bluethroat Wrasse increased to 10 *t* from 8 *t* in 2021/22 and was the highest catch in five years (Figure 3.17-1). Likewise, the total effort using both handlines and longlines increased in 2022/23, with the majority of the catch and effort using handlines (Figure 3.17-3). GVP of Bluethroat Wrasse also increased in 2022/23 to $0.07M (Figure 3.17-3). Recreational catch from the 2021/22 fishing survey was estimated at ~2 *t* (1 *t S.E.*; Figure 3.17-1). Total HL CPUE by *kg/fisher-day* and *kg/line-hour* peaked in 2008/09 at 42 *kg/fisher-day* and 5.7 *kg/line-hour*, which then progressively declined to 10 *kg/fisher-day* and 1.35 *kg/line-hour* in 2022/23 (Figure 3.17-3c). Despite this decline, no performance indicators were triggered in 2022/23. The number of licences taking Bluethroat Wrasse in 2022/23 increased to 28, while the number of licences targeting Bluethroat Wrasse declined to 7 (Figure 3.17-3d). The handline fishery for Bluethroat Wrasse produced its highest catches in July to September over the last decade, with no other apparent trends in catch (Figure 3.17-3e).

Performance indicators

General only (includes total catch, total HL effort and CPUE for 2022/23; Table 3.2-3).

- None triggered.

Stock assessment summary

The previous assessment of Bluethroat Wrasse in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In that assessment, the State-wide stock was classified as ‘sustainable’.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Bluethroat Wrasse in South Australia is classified as a **sustainable** stock.

Research & development needs

- Resolve the stock structure of the south-eastern Australian population.
- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

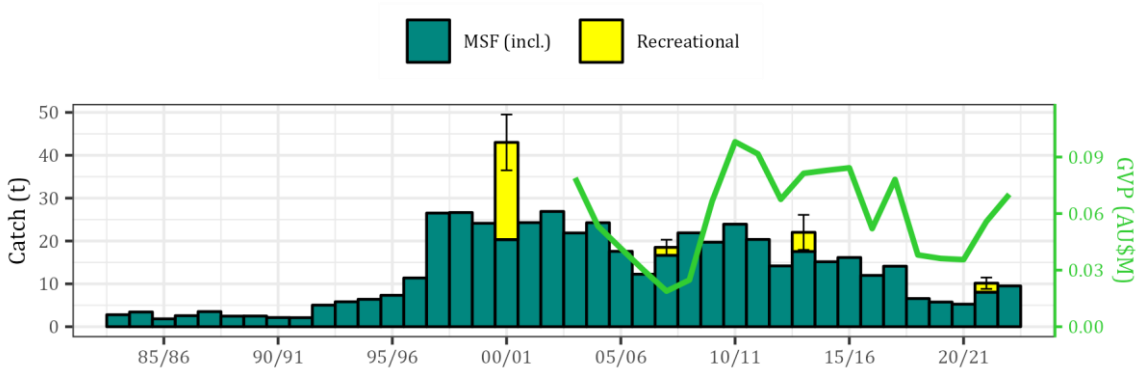


Figure 3.17-1. Fishery statistics for South Australia's Bluethroat Wrasse Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

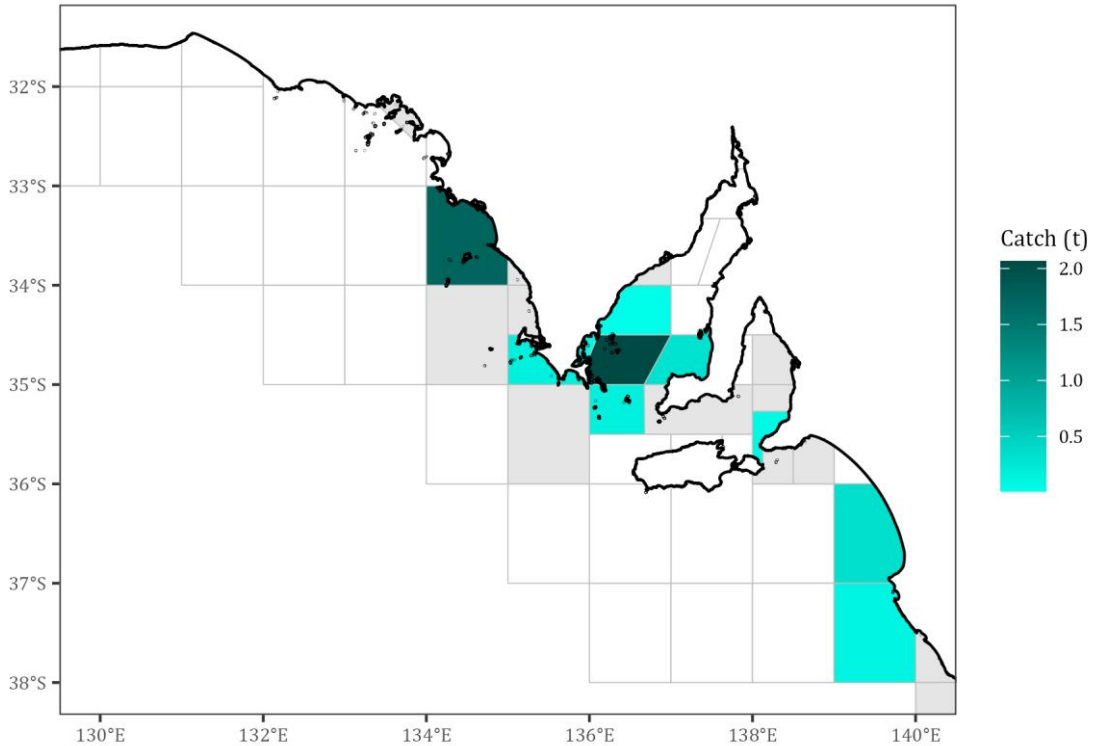


Figure 3.17-2. Spatial distribution of Bluethroat Wrasse catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

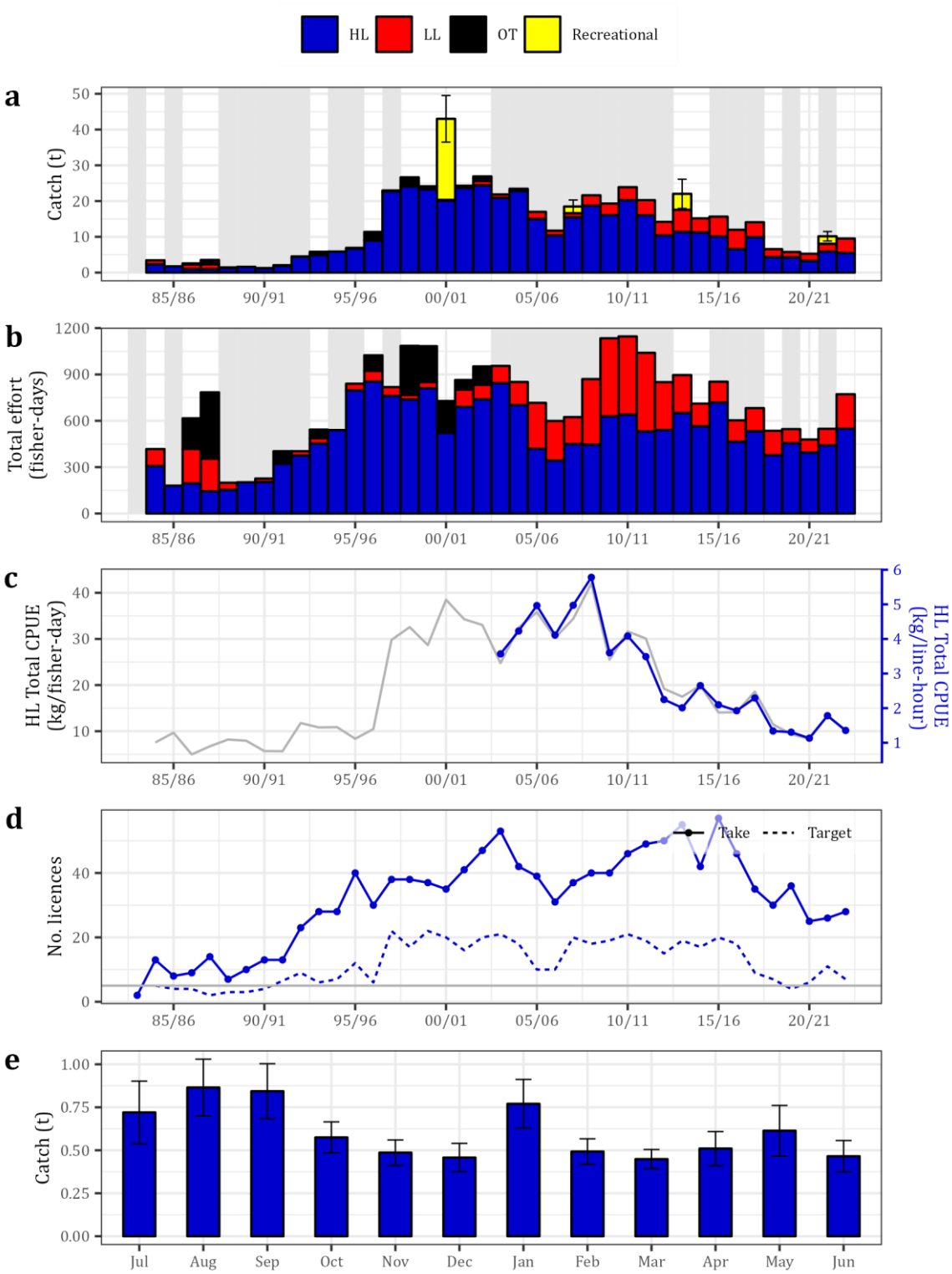


Figure 3.17-3. Key commercial fishery statistics for South Australia's Bluethroat Wrasse Fishery, divisible into key gear categories – Handline (HL), longline (LL), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) HL catch per unit total effort; (d) number of licences that take and target Bluethroat Wrasse; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.18. Silver Trevally

Silver Trevally

Pseudocaranx georgianus

State-wide summary 2022/23

Negligible

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch** *t*	**Total HL effort** *Fisher-days*	**Total HL CPUE** *kg/fisher-day*	**Total HL CPUE** *kg/line-hour*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	5	554	8.8	1.2	**2000/01**	14 (3)	69	31
2019/20	8	841	9.1	1.2	**2007/08**	12 (2)	59	41
2020/21	8	824	9.3	1.3	**2013/14**	15 (7)	77	23
2021/22	9	503	16.2	2.5	**2021/22**	15 (6)	88	12
2022/23	5	357	11.4	1.7	*HL – Handline, CPUE - Catch per unit effort.* *Smart et al., 2023			

Biology

- Inhabits coastal temperate waters across southern Australia from Coffs Harbour in NSW to Perth in WA.
- Schooling species over sandy benthos in estuaries, nearshore coastal and shelf waters (10–230 *m*).
- Large, (690–938mm TL), slow-growing and long lived up to 25 years in NSW waters (Stewart, 2015) and 33 years in NZ waters. Length at 50% maturity is 190–200 *mm* TL.
- Biological stock structure of southern Australian population is currently unresolved (FRDC project commenced FRDC 2021-009).
- Assessment of stock status for Silver Trevally is undertaken at the management unit level–MSF (State-wide).

Fishery description

- Targeted by commercial fishers in the MSF with the use of handlines.
- Majority of catches from the southern SGFZ, southern GSVFZ and WCFZ.
- Annual recreational catch estimates higher than commercial landings.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Silver Trevally (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- Commercial gear restrictions for handlines and haul nets.
- LML 240 *mm* TL applies to all sectors.
- Daily recreational limits: 20 for individuals and 60 for boats when 3 or more are onboard.

Catch, targeted effort and CPUE trends

Total commercial catch of Silver Trevally in 2022/23 was 5 *t*, the lowest since 2018/19 and 4.1 *t* below the average catch since 2009/10 (Figure 3.18-1). Recreational catches of silver trevally frequently exceed that of the commercial catch, with the most recent survey in 2021/22 estimating recreational catch at 15 *t* (6 *t* S.E.; Figure 3.18-1; Beckmann et al., 2023). In 2022/23, the GVP for Silver Trevally declined by 49% from $0.079M in 2021/22 to $0.04M in 2022/23 (Figure 3.18-1). The majority of catches since 2018/19 have come from MFA 14 (5-year average annual catch ~1.7 *t*) and MFA 30 (~1.61 *t*; Figure 3.18-2).

The majority of catch and effort for Silver Trevally is using handlines (Figure 3.18-3a-b). Total effort in 2022/23 declined for the 3rd consecutive year, triggering the total HL effort reference point for the greatest 3-year trend (Figure 3.18-3b). While the total HL effort triggered the reference point, total HL CPUE by both *kg/fisher-day* and *kg/line-hour* declined from 2021/22, however to a level that is consistent with the long-term stable trend since 2003/04 when CPUE by *kg/line-hour* became available (Figure 3.18-3c). CPUE by *kg/fisher-day* and *kg/line-hour* have closely followed the same trend over the same period (Figure 3.18-3c).

The number of licences taking Silver Trevally using HL has declined from 43 in 2021/22 to 39 in 2022/23, while the number targeting Silver Trevally with HLs has remined below 8 since declining from 17 in 2020/21 to 8 in 2021/22 (Figure 3.18-3d). Catches of Silver Trevally have shown some seasonality over the past 10 years, with the highest catches recorded in April–June, while also fluctuating throughout the remainder of the year (Figure 3.18-3e).

Triggered performance indicators

General only (includes total catch, total HL effort and CPUE for 2022/23; Table 3.2-3).

- Total HL effort – Greatest 3-year trend (LTRP).

Stock assessment summary

The previous assessment of Silver Trevally in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the state-wide stock was classified as 'sustainable'.

Consideration of additional catch and effort data for 2022/23 does not indicate any stock concerns (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Silver Trevally in South Australia is classified as a **sustainable** stock.

Research & development needs

- Determining the stock structure of the southern Australian population (FRDC 2021-009).
- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

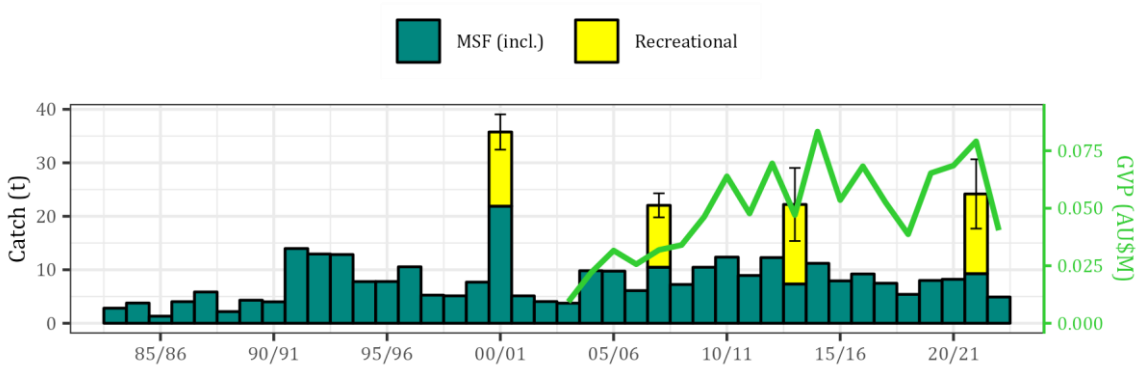


Figure 3.18-1. Fishery statistics for South Australia's Silver Trevally Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

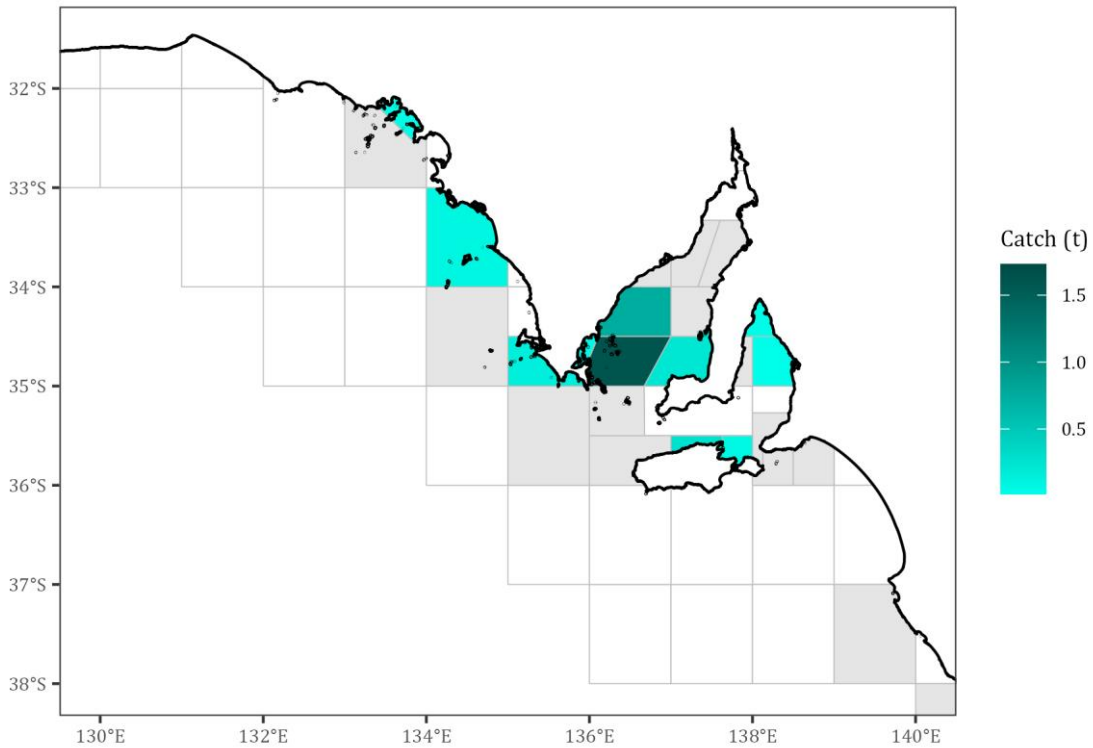


Figure 3.18-2. Spatial distribution of Silver Trevally catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

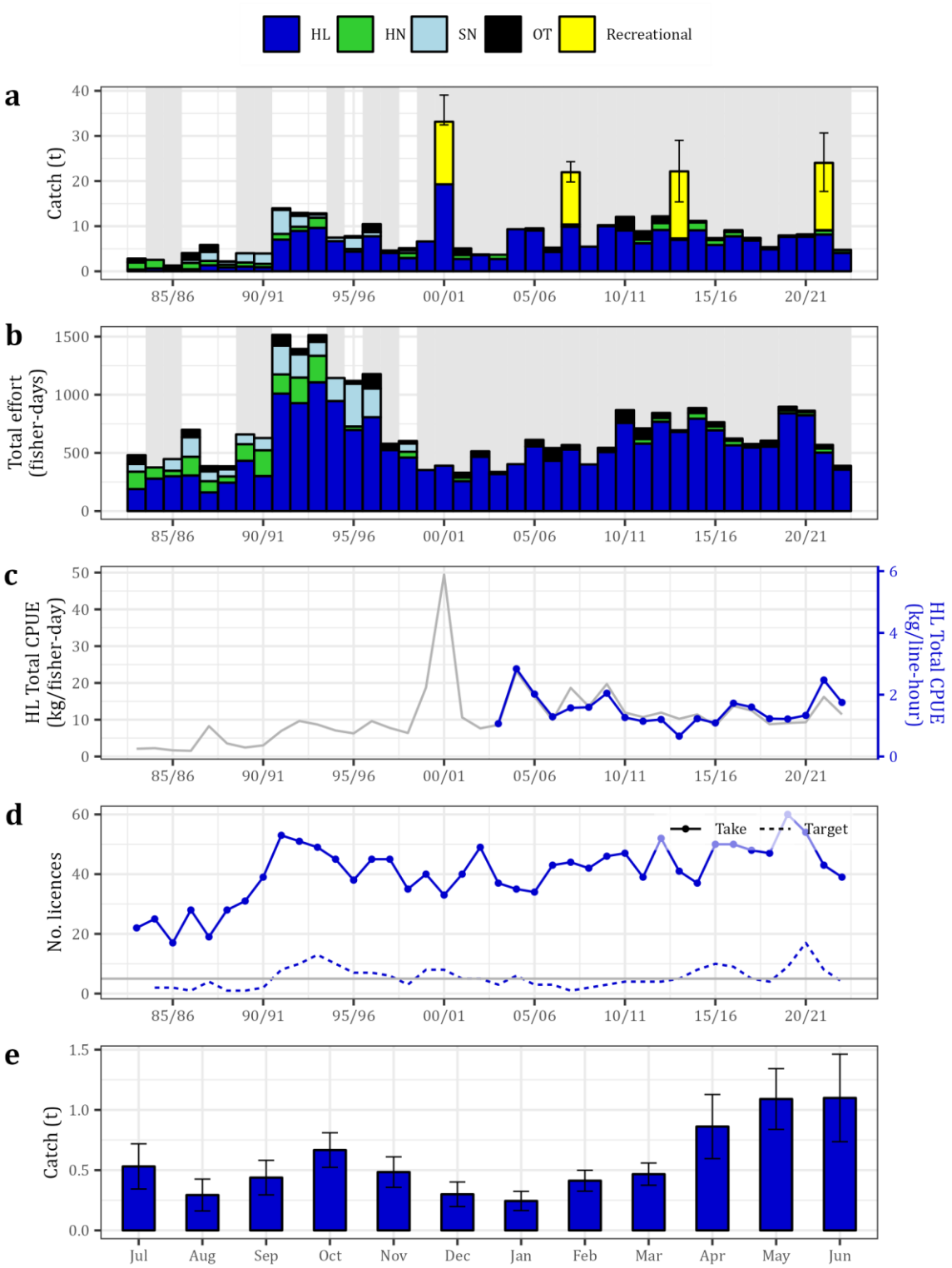


Figure 3.18-3. Key commercial fishery statistics for South Australia's Silver Trevally Fishery, divisible into key gear categories – Handline (HL), haul net (HN), set net (SN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) HL catch per unit total effort; (d) number of licences that take and target Silver Trevally; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.19. Leatherjackets

Leatherjackets

Monacanthidae spp.

State-wide summary 2022/23

Tier 3 in SG & GSV/KI, Negligible in WC & SE

Stock status

2020*	2021/22*	2022/23
Undefined	Undefined	Undefined

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch** *t*	**Total HN effort** *Fisher-days*	**Total HN CPUE** *kg/fisher-day*	**Total HN CPUE** *kg/haul*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	21	1,034	18.0	11.0	**2000/01**	38 (8)	40	60
2019/20	10	716	12.1	9.0	**2007/08**	10 (2)	37	63
2020/21	11	682	13.3	11.9	**2013/14**	15 (6)	-	-
2021/22	12	847	13.6	11.8	**2021/22**	6 (2)	42	58
2022/23	10	673	12.6	13.0	*HN – Haul net, CPUE - Catch per unit effort.*Smart et al., 2023			

Biology

- Leatherjacket catch in the MSF is a multi-species stock of up to 19 species that occur in SA waters.
- Inhabit the inshore reefs and seagrass meadows of coastal South Australia.
- Characterised by compressed, deep-bodied shape, prominent dorsal spine above the eye and rough/leathery skin (Gommon et al., 2008).
- Most species are sexually dimorphic in body shape and colouration (Gommon et al., 2008).
- Assessment of Leatherjackets is undertaken at the management unit level–MSF (State-wide).

Fishery description

- Two species are commonly caught in the MSF, the Horseshoe Leatherjacket (*Meuschenia hippocrepis*) and the Six spine Leatherjacket (*M. freycineti*).
- Predominately taken as by-product, with a small number of fishers targeting these species.
- Mostly caught with haul nets or handlines, also susceptible to fish traps.
- Majority of catch has come from northern SG and GSV waters.
- Recreational fishers catch Leatherjackets using rod and line.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Leatherjackets (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- No size, bag, or boat limits for commercial and recreational fishers.
- Standard commercial gear restrictions on haul nets, set nets, fish traps and handlines.
- Spatial netting closures restrict Leatherjacket catches.

Catch, targeted effort and CPUE trends

The total catch of Leatherjackets has remained stable for the past 4 years, with a total catch in 2022/23 of 10 *t* (Figure 3.19-1). The GVP for Leatherjackets in 2022/23 was $0.07M, $0.01M higher than the long-term average since these data became available in 2003/04 (Figure 3.19-1). Recreational catch of Leatherjackets in the 2021/22 survey was estimated at 6 *t* (2 *t* S.E.; Figure 3.19-1; Beckmann et al., 2023). Since 2018/19, the greatest catch has been taken in MFA 22 (5-year average annual catch ~1.5 *t*) and 23 (~3.9 *t*) in upper Spencer Gulf, and MFA 35 (2.6 *t*) and MFA 36 (2.5 *t*) in upper Gulf St Vincent (Figure 3.19-2).

Haul nets account for the majority of the total catch and effort for Leatherjackets (Figure 3.19-3a-b). Catch and effort recorded as Leatherjackets ≤ 1991/92 using fish traps was assumed to be Ocean Jackets (Figure 3.16-3). The biggest decline in total HN effort occurred in 2004/05 following a series of netting closures, with total HN effort since remaining stable at its current level (Figure 3.19-3b). CPUE by *kg/fisher-day* and *kg/haul* have typically followed the same trend over the same period, however, HN total CPUE by *kg/fisher-day* has remained stable in 2022/23, where HN total CPUE by *kg/haul* has increased to 13 *kg/haul* (Figure 3.19-3c).

The number of licences taking and targeting Leatherjackets have remained stable since the netting closure in 2005, with 27 and 7 taking and targeting Leatherjackets in 2022/23, respectively (Figure 3.19-3d). The haul net fishery for Leatherjackets has been seasonal for the past 10 years, with the highest catches taken in March to May, before declining progressively to a low in December (Figure 3.19-3e).

Triggered performance indicators

General only (includes total catch, total HL, and total SN effort and CPUE for 2022/23; Table 3.2-3).

- Total catch – 3rd lowest / 3rd highest (LTRP, lowest).
- Total HL effort – 3rd lowest / 3rd highest (LTRP, 3rd lowest).

Stock assessment summary

There is no published stock assessment for South Australian Leatherjackets, and there are no data available to estimate biomass or exploitation rates. In addition, there is no knowledge on recruitment or harvestable biomass, and there are no defined target or limit reference levels. This prevents assessment of current stock size or fishing pressure. Consequently, there is insufficient information available to confidently classify the status of this stock. On this basis, Leatherjackets in South Australia is classified as an **undefined** stock.

Research & development needs

- Quantify the species composition of catch within MSF.
- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

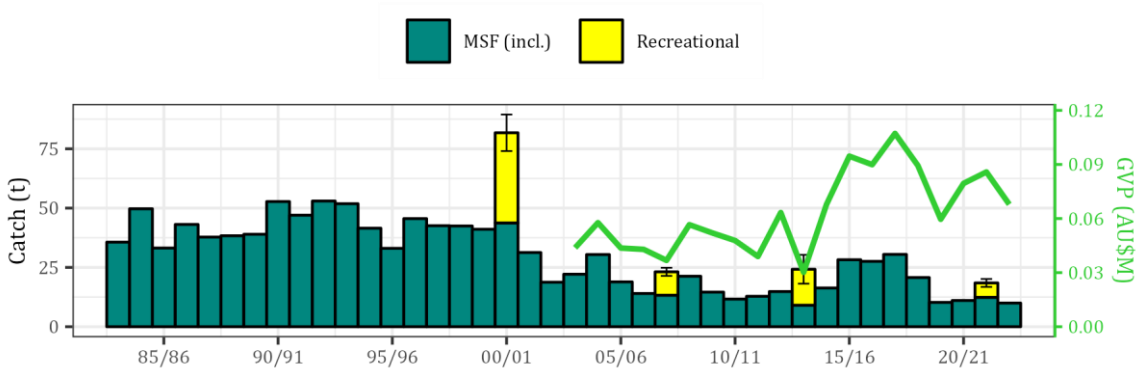


Figure 3.19-1. Fishery statistics for South Australia's Leatherjacket Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and gross value of production (GVP).

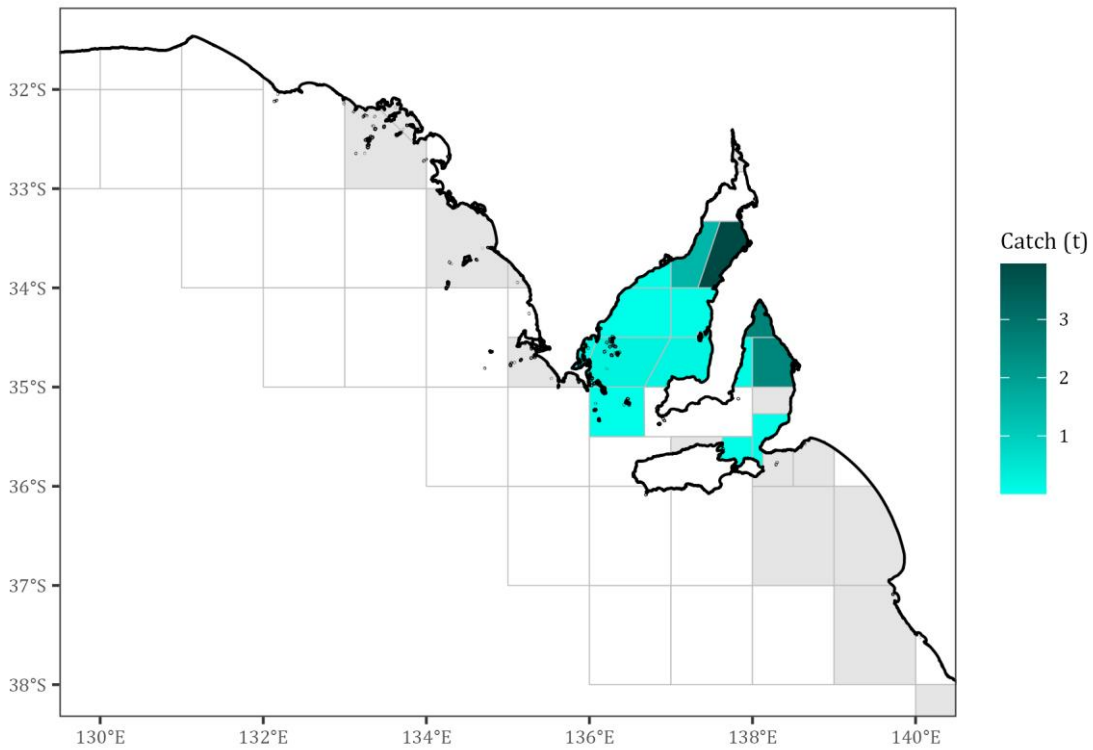


Figure 3.19-2. Spatial distribution of Leatherjacket catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

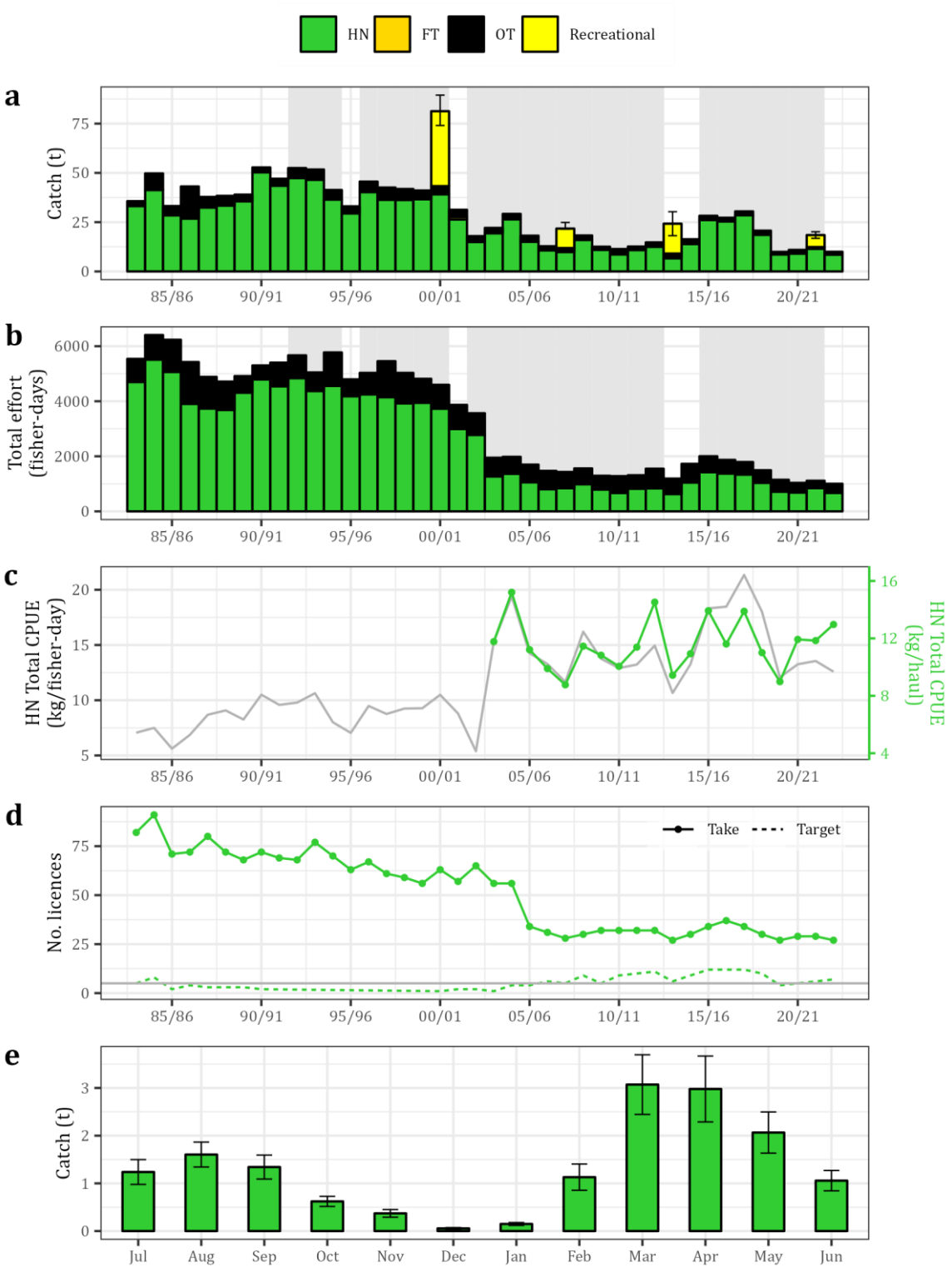


Figure 3.19-3. Key commercial fishery statistics for South Australia's Leatherjacket Fishery, divisible into key gear categories – Haul net (HN), Fish trap (FT), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) HN catch per unit total effort; (d) number of licences that take and target Leatherjacket; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.20. Rays and Skates

Rays and Skates

Myliobatidae, Dasyatidae, and Rajidae spp.

State-wide summary 2022/23

No Tier assigned

Stock status

2020*	2021/22*	2022/23
Undefined	Undefined	Undefined

Commercial fishery statistics (State-wide)

Fishing season	Total catch *t*	LL			HN		
		Total LL effort *Fisher-days*	Total LL CPUE *kg/fisher-day*	Total LL CPUE *kg/hook*	Total HN effort *Fisher-days*	Total HN CPUE *kg/fisher-day*	Total HN CPUE *kg/haul*
2018/19	10	251	20.6	0.10	269	14.9	16.4
2019/20	10	211	33.3	0.10	172	17.7	17.9
2020/21	11	189	45.3	0.05	178	11.7	16.4
2021/22	12	309	26.8	0.05	211	17.3	24.7
2022/23	12	331	29.1	0.07	140	13.5	17.8

*LL – Longline, HN – Haul net, CPUE - Catch per unit effort, *Smart et al., 2023*

Biology

- Southern Eagle Ray inhabits mud flats, seagrass, and sand habitats in the temperate coastal waters of southern Australia, from Jurien Bay (WA) to Moreton Bay (QLD) in Australia (Last et al., 2009). They are also found in the waters of New Zealand, Norfolk Island and Kermadec Islands.
- Southern Eagle Rays have a maximum size of 160 *cm* disc width (300 *cm* TL), males mature at 65 *cm* and females at 80 *cm* disc width (Last and Stevens 2009). Estimates of longevity are > 15 years from males and > 26 years for females in New Zealand.
- Genetic connectivity across multi-jurisdictional sub-populations.
- Assessment of stock status for Rays and Skates is undertaken at the management unit level–MSF (State-wide).

Fishery description

- Catches of rays and skates are not differentiated by species, typically comprised of species from Myliobatiae (Eagle Rays), Dasyatidae (Stingrays), and Rajidae (Skates) families.
- Southern Eagle Ray (*Myliobatis tenuicaudatus*) is the most prominent species landed within the reported rays and skates catch.
- Rays and skates are mostly taken as bycatch in the MSF with the use of longlines and haul nets.
- Highest catches come from the WCFZ, southern GSVFZ and northern SGFZ.
- Recreational fishers mostly land rays and skates as bycatch with rod and line, most are released.
- Limited targeted effort for rays and skates by recreational fishers.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing.

- The current harvest strategy for rays and skates (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- No size, bag or boat limits are enforced for commercial or recreational fishers.
- Gear restrictions for longlines and haul nets in the MSF.

Catch, targeted effort and CPUE trends

Total commercial catch of rays and skates have remained relatively stable for the past 10 years, with catches in 2022/23 of 12 *t* equalling the 10-year average of 12 *t* (range 10–17 *t*; Figure 3.20-1). Gross Value of Production has declined for the second consecutive year from its second highest value on record of $0.04M in 2020/21, falling to $0.031M in 2022/23 (Figure 3.20-1). The vast majority of catches since 2018/19 has occurred in MFA 9 (5-year average annual catch ~3.3 *t*) on the western coast of South Australia, followed by MFA 23 (~1.8 *t*) and MFA 51 (~1.4 *t*; Figure 3.20-2).

Since 1986/87, the catch and effort for rays and skates has been dominated by the longline gear type, with a small portion of the catch and effort also taken using haul nets (Figure 3.20-3a-c). In 2021/22, total LL CPUE by *kg/hook* declined to a historic low of 0.04 *kg/hook*, which has since increased in 2022/23 to 0.07 *kg/hook* (Figure 3.20-3c). Opposing the total LL CPUE trends, total HN CPUE by both *kg/fisher-day* and *kg/haul* declined from 2021/22 to 13.5 *kg/fisher-day* and 17.8 *kg/haul* in 2022/23, respectively (Figure 3.20-3d).

The number of licences taking rays and skates using longlines has gradually declined since 2005/06, reaching 6 in 2022/23 from the historic high of 24 in 1987/88 (Figure 3.20-3). The number of licences taking and targeting Rays and Skates using HN have remained stable since the netting closure in 2005 Figure 3.20-3e). Over the past 10 years, the catches of rays and skates using longlines has peaked in October at 1.4 *t*, before gradually declining to a low of 0.3 *t* in July (Figure 3.20-3f). The Haul net fishery for rays and skates is relatively consistent throughout the year, with a similar low to the LL fishery in July of 0.13 *t* (Figure 3.20-3f).

Triggered performance Indicators

General only (includes total catch, total LL, and total HN effort and CPUE for 2022/23; Table 3.2-3).

- Total LL CPUE – Greatest % interannual change (LTRP).
- Total HN effort – 3rd lowest / 3rd highest (LTRP, lowest).

Stock assessment summary

There is no published stock assessment for rays and skates in South Australia, and there are no data available to estimate biomass or exploitation rates. In addition, there is no knowledge on recruitment or harvestable biomass, and there are no defined target or limit reference levels. This prevents assessment of current stock size or fishing pressure. Consequently, there is insufficient information available to confidently classify the status of this stock. On this basis, rays and skates in South Australia is classified as an **undefined** stock.

Research & development needs

- Quantify the species composition of catch within MSF.
- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

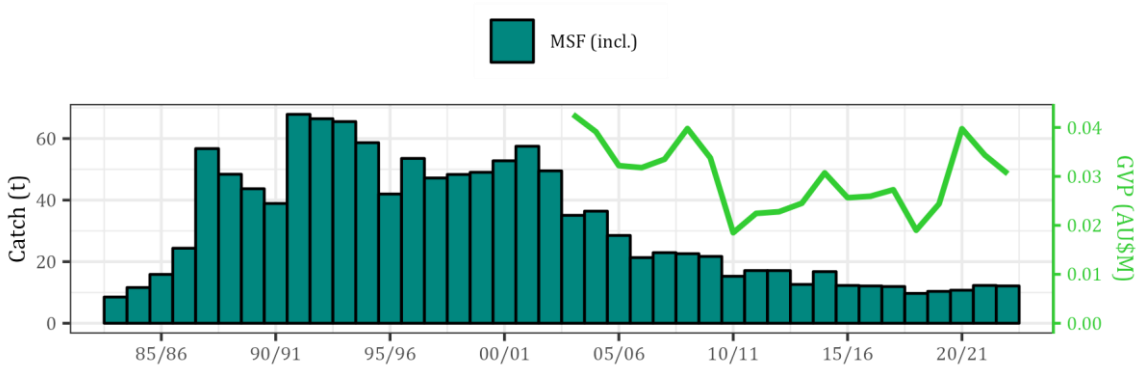


Figure 3.20-1. Fishery statistics for South Australia's Rays and Skates Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined), and gross value of production (GVP).

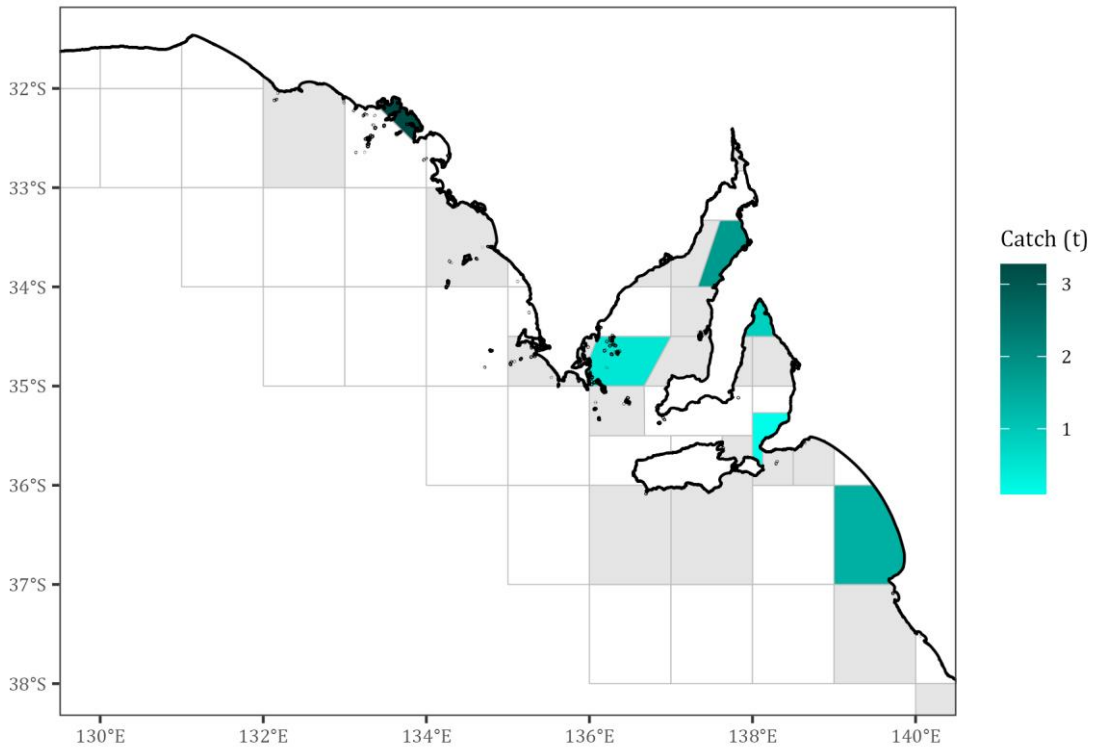


Figure 3.20-2. Spatial distribution of Rays and Skates catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

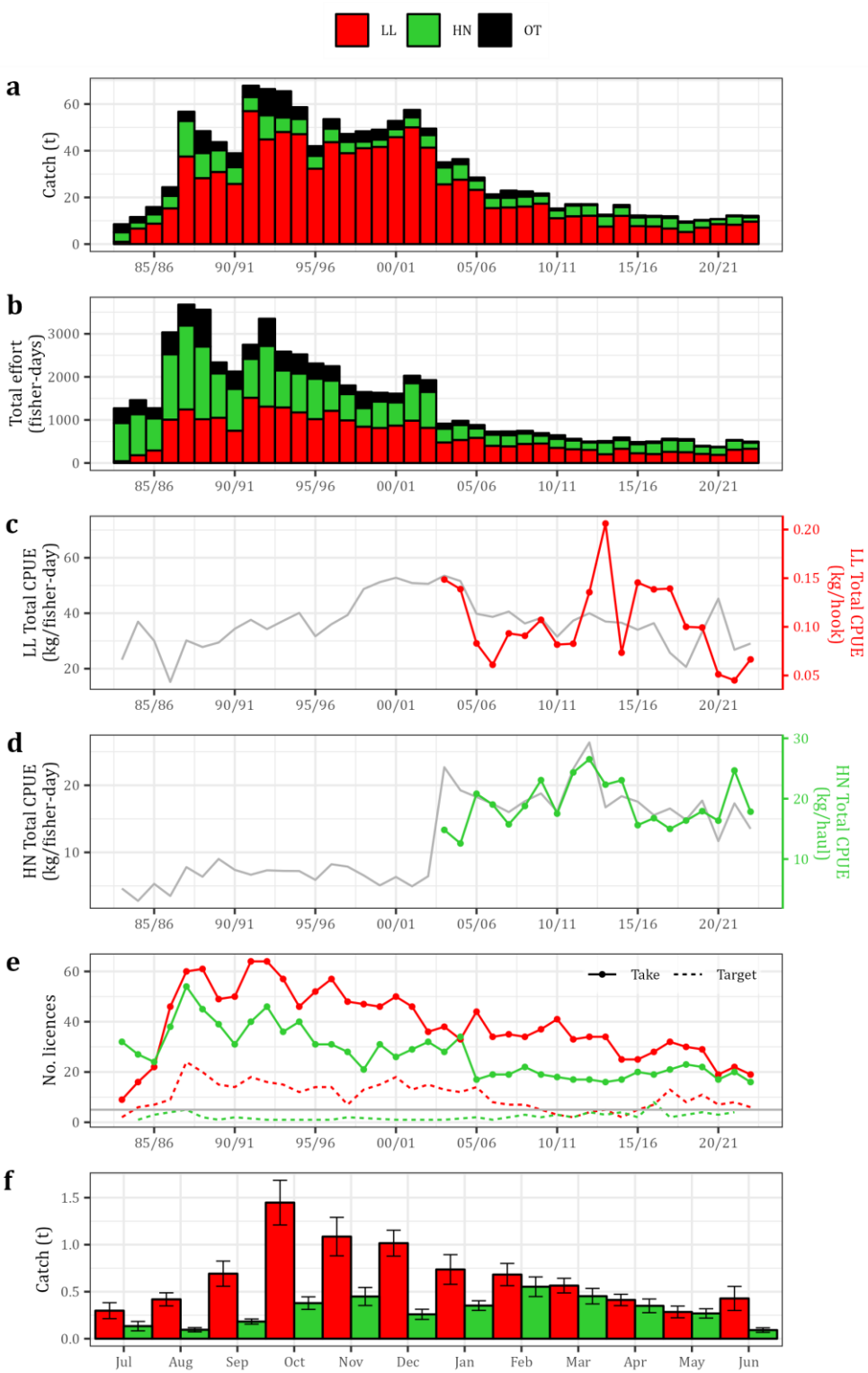


Figure 3.20-3. Key commercial fishery statistics for South Australia's Rays and Skates Fishery, divisible into key gear categories – Longline (LL), haul net (HN), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) LL catch per unit total effort; (d) HN catch per unit total effort; (e) number of licences that take and target Rays and Skates; and (f) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.21. Cuttlefish

Cuttlefish

Sepia apama, Sepia novaehollandia

State-wide summary 2022/23

Negligible

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch** *t*	**Total SQ effort** *Fisher-days*	**Total SQ CPUE** *kg/fisher-day*	**Total SQ CPUE** *kg/line-hour*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	0.9	286	3.0	0.2	**2000/01**	12 (3)	81	19
2019/20	20	328	61.3	4.6	**2007/08**	1 (0.7)	80	20
2020/21	5	401	12.5	1.0	**2013/14**	0.3 (0.2)	54	46
2021/22	1	287	4.6	0.5	**2021/22**	0.8 (0.4)	32	68
2022/23	0.5	174	2.7	0.3	*SQ – Squid jig, CPUE - Catch per unit effort.**Smart et al., 2023			

Biology

- Giant Australian Cuttlefish (*Sepia apama*) and Nova's Cuttlefish (*S. novaehollandiae*) are commercially and recreationally harvested in SA.
- The Giant Australian Cuttlefish is the largest and most abundant local cuttlefish species (Edgar 2000) reaching a maximum size of 500 *mm* mantle length and weighing up to 10.5 *kg* (Jereb & Roper, 2005).
- This species is broadly distributed around southern Australia, from Point Cloates in WA to Moreton Bay in QLD, including TAS (Edgar, 2000), where they occur over seagrass and rocky reef in water depths up to 100 *m* (Jereb & Roper, 2005).
- Two populations of Giant Australian Cuttlefish have been identified in SA (Gillanders et al., 2016). While the Cuttlefish stock in southern SG extends into GSV, the northern stock is restricted to NSG with individuals returning to the site of hatching to breed at either one or two years of age (Hall et al., 2007). The NSG population forms a breeding aggregation at Point Lowly in False Bay (Steer et al., 2013; Gillanders et al., 2016) during late autumn and early winter each year. The species is semelparous, dying soon after spawning (Hall, 2003).
- Assessment of stock status of Cuttlefish in the MSF is undertaken at the management unit level (State-wide).

Fishery description

- Supports commercial and recreational fisheries in SA.
- In the commercial sector, Cuttlefish are targeted using squid jigs on handlines and are taken as by-product by fishers using jigs to target Calamari in gulf waters.
- Recreational fishers mostly take Cuttlefish using squid jigs when targeting Calamari in inshore waters from boats and the shore (Beckmann et al., 2023).

Assessment program

- Annual fishery-independent estimates of Cuttlefish abundance in the breeding aggregation at Point Lowly in NSG since 2008 (Steer et al., 2013).
- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- The current harvest strategy for Cuttlefish (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- No LML.
- Commercial fishers are permitted to use only two handlines at a time with a maximum of three squid jigs/lures on each line.
- Combined cuttlefish and squid daily recreational limits: 15 for individuals and 45 for boats when 3 or more are onboard.
- Permanent Cephalopod Exclusion Zone: The targeting and taking of cephalopods, including Cuttlefish, from False Bay, NSG, is prohibited at all times.
- A temporary Cuttlefish fishing closure was in place from 14 May 2022 to 13 May 2023 in the waters of NSG (i.e., waters north of a line from Wallaroo to near Arno Bay) and this was made permanent closure in May 2023.

Catch, targeted effort and CPUE trends

There is a small, targeted fishery for Cuttlefish in SA, although most of the catch each year is taken as by-product by fishers targeting Southern Calamari (Figure 3.21-1). This is reflected in the considerably higher numbers of fishers that take Cuttlefish each year compared to the number of fishers that actively target the species. Total catch of Cuttlefish increased to 262 *t* in 1996/97 and then declined sharply in 1998/99, corresponding with the implementation of spatial and temporal closures to limit the take of the species in NSG (Steer, 2015). The GVP for cuttlefish has remained at low levels since these data became available, however did increase to a historic peak of $0.12M in 2019/20 (Figure 3.21-1). Since 2018/19, the majority of catch of cuttlefish was taken in MFA 21A (5-year annual average ~2.6 *t*; Figure 3.21-2).

During 2002/03–2018/19, total catch, and total jig CPUE were historically low, with catches averaging 5 *t* per annum (range: 0.8–10.8 *t*; Figure 3.21-3a-c). In 2019/20, catch increased to 20 *t* reflecting higher CPUE and a small number of fishers targeting Cuttlefish where some previously closed areas in NSG were temporarily reopened to commercial fishing in 2020 (Figure 3.21-3). In 2022/23, the total catch of 0.5 *t* was associated with low total jig effort since 1992/93, while total jig CPUE by *kg/fisher-day* and *kg/line-hour* was similar to the average CPUE during 2008/09–2018/19 (Figure 3.21-3c).

The number of licences recording taking Cuttlefish with Squid jigs has declined for the second consecutive year, reaching 19 licences in 2022/23 (Figure 3.21-3d). The SQ fishery for cuttlefish has been highly seasonal for the past 10 years, with the majority of catch taken in June and July (Figure 3.21-3e).

Triggered performance indicators

General only (includes total catch, total SQ effort and CPUE for 2022/23; Table 3.2-3).

- None triggered.

Stock assessment summary

The previous assessment of Cuttlefish in South Australia was completed in 2023, examining commercial fishery statistics and trends up to and inclusive of 2021/22 (Smart et al., 2023). In this assessment, the state-wide stock was classified as ‘sustainable’. Fishery independent surveys of Cuttlefish abundance in the Point Lowly breeding aggregation have been undertaken annually since 2008 (Steer et al., 2013). Annual estimates of abundance were relatively high from 2015-2022, consistently exceeding 100,000 cuttlefish and the 2020 estimate of 247,146 Cuttlefish being the highest on record (Heldt, 2020). In 2021, abundance decreased 56% to 107,847, but then increased 28% in 2022 to 137,999, a value above the average abundance over the 24 years of surveys. The recent estimates of abundance indicate that the population has remained relatively high over the past eight years.

The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Cuttlefish in South Australia is classified as a **sustainable** stock.

Research & development needs
• Development of harvest strategy with performance indicators, reference points and harvest control rules. • Standardisation of commercial CPUE, using improved measures of fishing effort. • Improved estimates of recreational catch and effort.

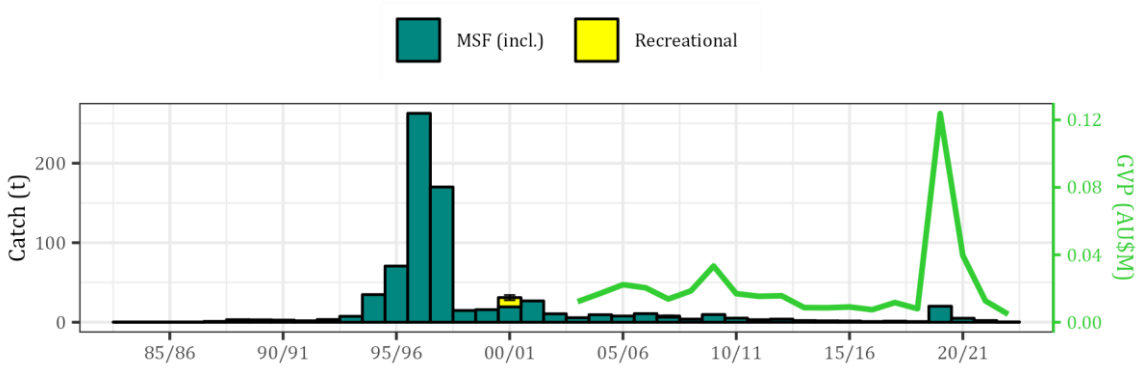


Figure 3.21-1. Fishery statistics for South Australia's Cuttlefish Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined) and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP).

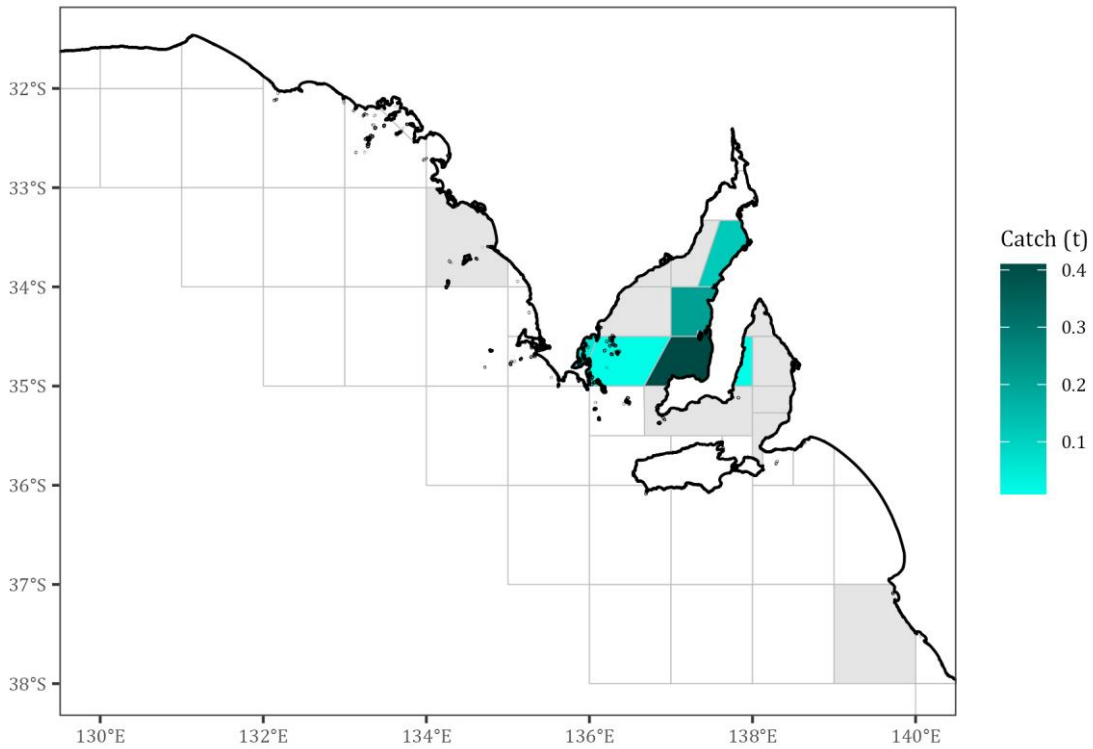


Figure 3.21-2. Spatial distribution of Cuttlefish catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential.

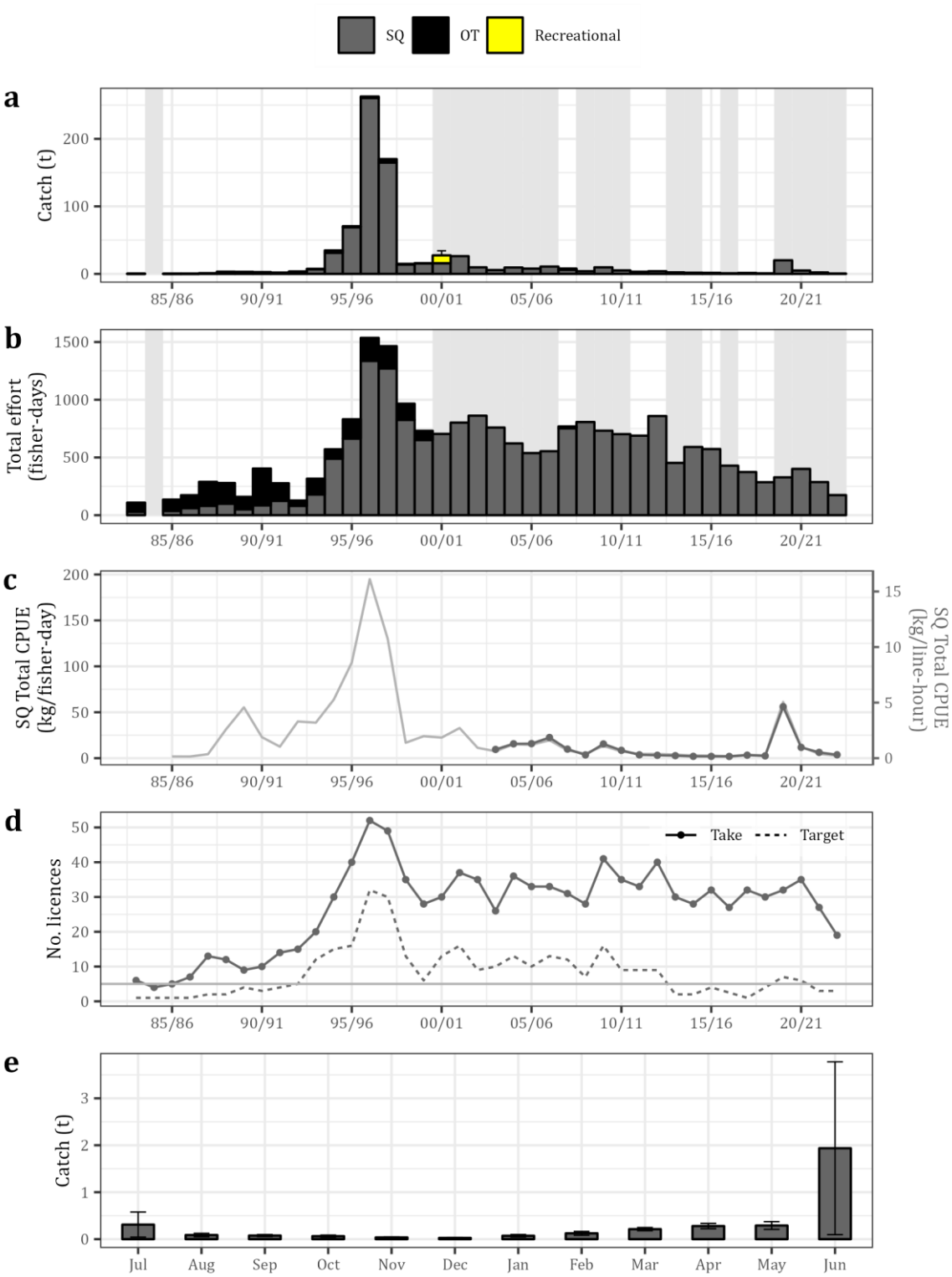


Figure 3.21-3. Key commercial fishery statistics for South Australia's Cuttlefish Fishery, divisible into key gear categories – Squid jig (SQ), and all other gears combined (OT). Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) SQ catch per unit total effort; (d) number of licences that take and target Cuttlefish; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.22. Black Bream

Black Bream

Acanthopagrus butcheri

MSF summary 2022/23

Negligible

Stock status

2020*	2021/22*	2022/23
Sustainable	Sustainable	Sustainable

Fishery statistics (State-wide)

Commercial				Recreational			
Fishing season	**Total catch** *t*	**Total effort** *Fisher-days*	**Total CPUE** *kg/fisher-day*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	3	92	34.3	**2000/01**	32 (13)	37	63
2019/20	*Conf.*	*Conf.*	*Conf.*	**2007/08**	6 (1)	13	87
2020/21	*Conf.*	*Conf.*	*Conf.*	**2013/14**	5 (2)	9	91
2021/22	*Conf.*	*Conf.*	*Conf.*	**2021/22**	6 (3)	24	76
2022/23	0.04	8	4.5	*CPUE - Catch per unit effort.**Smart et al., 2023			

Biology

- Occurs in estuaries and nearshore coastal waters of southern Australia from central NSW to central west coast WA, including TAS (Gomon et al., 2008). In SA, common in the tidal creeks, inlets, and estuaries, including the Coorong.
- Medium-bodied, slow-growing, max. age 32 years, max. length 550 *mm* TL, L_{50} 340 *mm* TL for males and 289 *mm* TL for females (Ye et al., 2013).
- Estuarine-dependent, completing much of their life cycle within a single estuary
- Multiple studies have found limited or no evidence of coastal migration or emigration between estuaries across southern Australia (Norriss et al., 2002; Hindell et al., 2008; Sarakinis et al., 2024).
- Growth and recruitment of Black Bream within estuaries are strongly influenced by environmental conditions associated with freshwater inflows and subsequent changes to water salinity (Partridge & Jenkins, 2002; Williams et al., 2013; Jenkins et al., 2018).
- It is likely that, at local scales at least, annual recruitment strength is dependent on environmental conditions, with substantial inter-annual variation in recruitment affecting local stock demographics and biomasses.
- Assessment of stock status of Black Bream in the MSF is undertaken at the management unit level (State-wide).

Fishery description

- Supports commercial and recreational fisheries in SA.
- In most years, > 70% of the commercial catch is taken by the LCF in the Coorong Estuary, with the remainder taken as by-product by the MSF using haul nets.
- Recreational fishers target Black Bream from the shore using rod and line in inshore marine waters and estuaries.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- Annual catch and effort statistics and trends in the LCF report (Sarakinis & Earl, 2024).
- Recreational catch estimates obtained every several years (Beckmann et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- The current harvest strategy for Black Bream (PIRSA 2013) lacks performance indicators and reference points that are linked to definitions of stock status. Consequently, the assignment of stock status uses a weight-of-evidence approach.

Current management regulations

- LML 240 *mm* TL applies to all sectors.
- Daily recreational limits: 10 for individuals and 30 for boats when 3 or more are onboard.
- General haul net restrictions apply (e.g., max. length 600 *m*, max. drop 10 *m*).
- An annual fishery closure prohibits the take of Black Bream from 1 September–30 November in the area upstream of the South Road Bridge of the Onkaparinga River.

Catch, targeted effort and CPUE trends

Generally the MSF stock of Black Bream is not subject to targeted fishing, with commercial catches between 1983/84 and 2022/23 averaging less than 1 *t* per annum, and data frequently subject to confidentiality constraints due to low numbers of licence holders (Figure 3.22-1; Figure 3.22-2). The total commercial catch from the MSF in 2022/23 was 0.04 *t* from 8 total *fisher-days*, triggering the 3rd lowest or 3rd highest reference points for the second lowest total catch and third lowest total effort (Figure 3.22-3a-b). CPUE by *fisher-day* did not trigger any reference trigger points, with a CPUE of 4.5 *kg/fisher-day* for 2022/23 (Figure 3.22-3c). The number of licences taking Black Bream with any gear type in 2022/23 was 5 (Figure 3.22-3d). Over the past 10 years, the highest catches of bream with any gear type in the MSF has been from July to October (Figure 3.22-3e).

Triggered performance indicators

General only (includes total catch, effort and CPUE for 2022/23; Table 3.2-3).

- Total catch – 3rd lowest / 3rd highest (LTRP, 2nd lowest).
- Total effort – 3rd lowest / 3rd highest (LTRP, 3rd lowest).

Stock assessment summary

The previous assessment of Black Bream in South Australia was completed in 2023 for the MSF (up to and inclusive of 2021/22), and in 2024 for the LCF report (up to and inclusive of 2022/23), examining commercial fishery statistics and trends (Sarakinis & Earl, 2024, Smart et al., 2023). In the 2023 MSF assessment, Black Bream were classified as ‘sustainable’ while in the LCF report they were classified as depleted (Sarakinis & Earl , 2024, Smart et al., 2023).

In 2023, the Black Bream Recovery Strategy for the LCF was developed in response to ongoing concerns about the sustainability of the Black Bream stock in the Coorong Estuary, which has been classified as ‘depleted’ since 2016 (Sarakinis & Earl, 2024). The recovery strategy defines the management intervention to recover the stock, with performance indicators and reference points to monitor stock recovery and the target levels required to achieve a sustainable classification.

Consideration of additional catch and effort data for 2022/23 for the MSF does not indicate any stock concerns due to the negligible catch and effort for Black Bream in the MSF (see general performance indicators above). The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current low level of fishing mortality is unlikely to cause the stock to become recruitment impaired. On this basis, Black Bream in the MSF is classified as a **sustainable** stock.

Research & development needs

- Development of harvest strategy with performance indicators, reference points and harvest control rules.
- Standardisation of commercial CPUE, using improved measures of fishing effort.
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

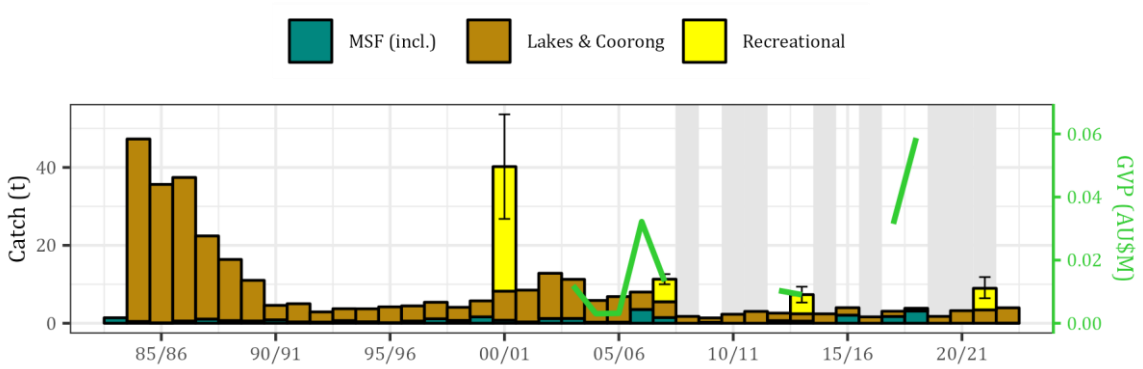


Figure 3.22-1. Fishery statistics for South Australia's Black Bream Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined), Lakes and Coorong sector, and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error), and gross value of production (GVP). Grey shading indicates years when data for one or more fishing zones are confidential.

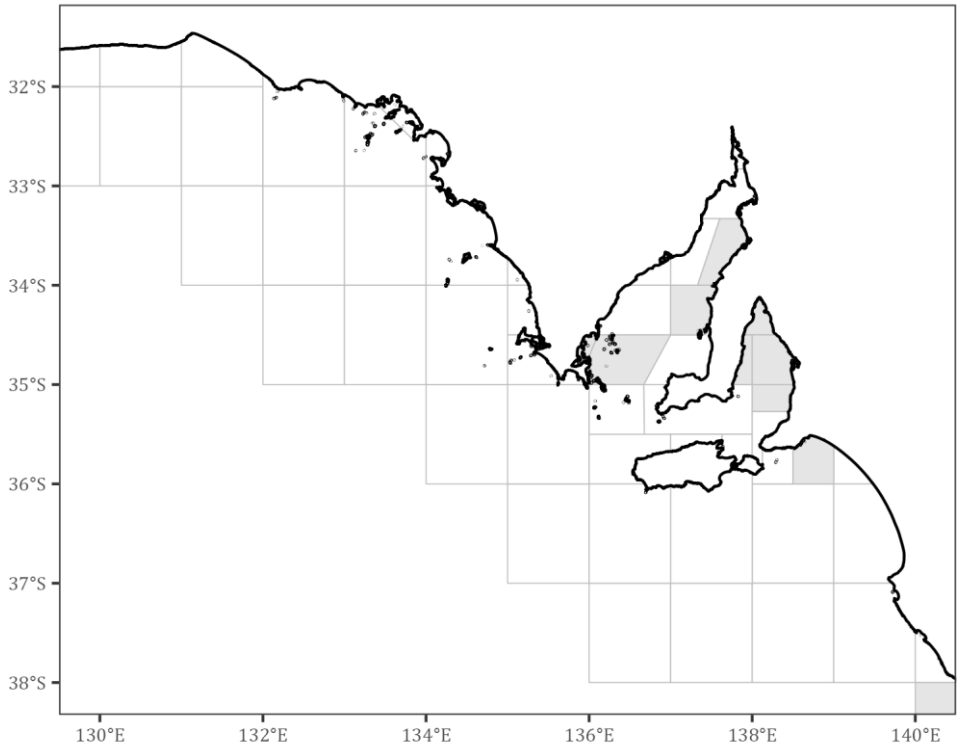


Figure 3.22-2. Spatial distribution of Black Bream catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Grey shading indicates MFA blocks where the catch data are confidential.

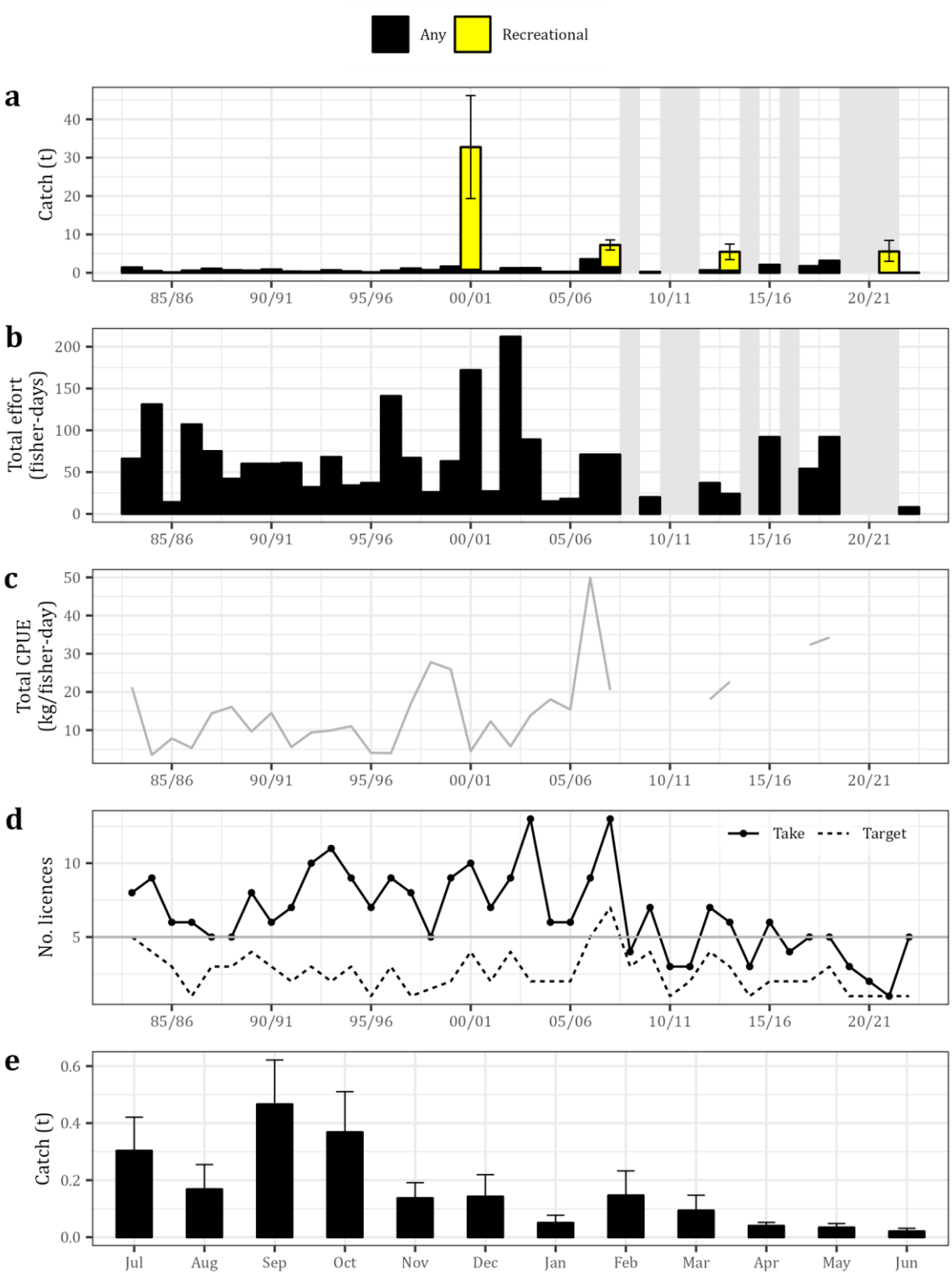


Figure 3.22-3. Key commercial fishery statistics for South Australia's Black Bream Fishery. Long-term trends in annual estimates of: (a) total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total commercial effort; (c) catch per unit total effort; (d) number of licences that take and target Black Bream; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential.

3.23. Gummy Shark

Gummy shark

Mustelus antarcticus

State-wide summary 2022/23

No Tier assigned

Stock status

2020*	2021/22*	2022/23
Not Assessed	Not Assessed	Not Assessed

Fishery statistics (State-wide)

Commercial					Recreational			
Fishing season	**Total catch**** *t*	**Target LL effort** *Fisher-days*	**Target LL CPUE** *kg/fisher-day*	**Target LL CPUE** *kg/hook*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	80	274	51.1	0.11	**2000/01**	16 (5)	-	-
2019/20	63	314	37.7	0.05	**2007/08**	19 (5)	69	31
2020/21	38	254	32.4	0.06	**2013/14**	37 (16)	76	24
2021/22	51	352	33.5	0.05	**2021/22**	8 (2)	65	35
2022/23	64	511	33.6	0.06	*LL – Longline, CPUE - Catch per unit effort.* *Smart et al., 2023 ** Whole weight			

Biology

- Distributed through the temperate waters of southern Australia, from Geraldton (WA) to Jervis Bay (NSW) and in TAS (Gardner & Ward, 2002; Last et al., 2009).
- Demersal species inhabiting the continental shelf from nearshore to 80 *m* depth, sometimes found on the continental slope to 350 *m* depth (Last and Stevens 2009).
- Slender body shape, with pre-dorsal, inter-dorsal and post-dorsal ridges. Pavement-like crushing teeth.
- Bronze to grey colour dorsally with numerous white spots (Last and Stevens 2009).
- Born at 30–35 *cm* TL and reaches a maximum size of 185 *cm* TL, matures at 95 *cm* TL and at 4 years for males and 111 *cm* TL and at 5 years for females.
- Viviparous reproduction, with ~14 pups per litter after a 11–12-month gestation.
- Assessment of stock status for Gummy Shark is undertaken at the biological stock level for the Southern Australia and Eastern Australia stocks by AFMA.

Fishery description

- Historically a targeted species using demersal large mesh set nets, longlines (including droplines) and handlines.
- Transfer to Commonwealth management (AFMA) in 2000, MSF licence holders could retain a combination of 5 Gummy and School Sharks per day with a multiday trip limit of 10 sharks.
- Since 1999, retained as a by-product species when using longlines (including droplines), handlines, and haul nets.
- Prior to Commonwealth management, majority of catch came from the SEFZ, WCFZ, and southern SGFZ. Since 2000, the WCFZ zone has produced most of the catches.
- Recreational fishers target Gummy Shark using rod and line from boats and shore-based fishing.

Assessment Program
• Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023). • No information is currently available for Aboriginal traditional fishing. • Management of Gummy Shark fishing transitioned from state-based to Commonwealth management in 2000.
Current management regulations
• LML 450 *mm*, measured from the 5th gill slit to base of the tail applies to all sectors. • Daily recreational limits: combined total of 2 Gummy and School Sharks for individuals and a Combined total of 6 Gummy and School sharks for boats when 3 or more are onboard. • MSF fishers restricted to a combined total of 5 Gummy and School Sharks per day (midnight to midnight) with a multiday trip limit of 10 sharks. • A state commercial catch cap is in place for Gummy Shark, and a catch cap was also applied to school Shark in 2024. • Gear restrictions include a 400-hook limit for longlines and a 150 *mm* mesh diameter for set nets and haul nets.
Catch, targeted effort and CPUE trends[10]
Management of Gummy Shark fishing transitioned from state-based to Commonwealth management in 2000, resulting in a significant decline in catch in the MSF as Gummy Shark catch was restricted to limited bycatch. Catches prior to 2000/01 averaged 662 *t* per year, with a peak in catch of 1,019 *t* in 1988/89 (Figure 3.23-1). Since 2000/01, annual catch declined and averaged 85 *t* per year, in 2022/23 total catch was 64 *t* (all catch is expressed as whole weight; Figure 3.23-1). Gummy Sharks are caught in all four MSF Fishing Zones, with the highest catch since 2018/19 coming from MFA 30 (annual average catch ~10 *t*), MFA 9 (~9 *t*), MFA 27B (~7 *t*), and MFA 51 (~4 *t*; Figure 3.23-2). The prominent gear type for taking Gummy Shark has been longline (including droplines), with over 82% of the catch taken using these gears since 2000/01 (Figure 3.23-3a). Target LL effort in 2022/23 increased to its 3rd highest on record (Figure 3.23-3b), while targeted LL CPUE by *kg/fisher-day* and *kg/hook* remained stable at 33.6 *kg/fisher-day* and 0.06 *kg/hook*, respectively (Figure 3.23-3c). The number of licences both taking and targeting Gummy Sharks using long lines increased in 2022/23 to 68 and 40 licences respectively (Figure 3.23-3d). The longline fishery for Gummy sharks is consistent throughout the year, with a minor reduction in catch from June to September (Figure 3.23-3e).
Triggered performance indicators
No performance indicators are assessed for the MSF catch of Gummy Sharks as it is a by-catch allocation of the Commonwealth managed stock.
Stock assessment summary
The Southern Australian stock extends across multiple state jurisdictions and is managed by the commonwealth, it is managed as a single biological stock. Gummy sharks are targeted by fishers of the Southern and Eastern Scalefish and Shark Fishery (SESSF). The stock status for Gummy Shark has been assessed at the biological stock level by the Commonwealth and Western Australian jurisdictions. The Southern Australian stock is classified as a 'sustainable' stock.
Research & development needs
• Quantify the post-release survival of commercial and recreational captured Gummy Shark (FRDC Project 2018/055). • Improved estimates of recreational catch and effort. • Improved understanding of Aboriginal Traditional Fishing importance.

[10] Data of total catch provided as whole weights (*t*).

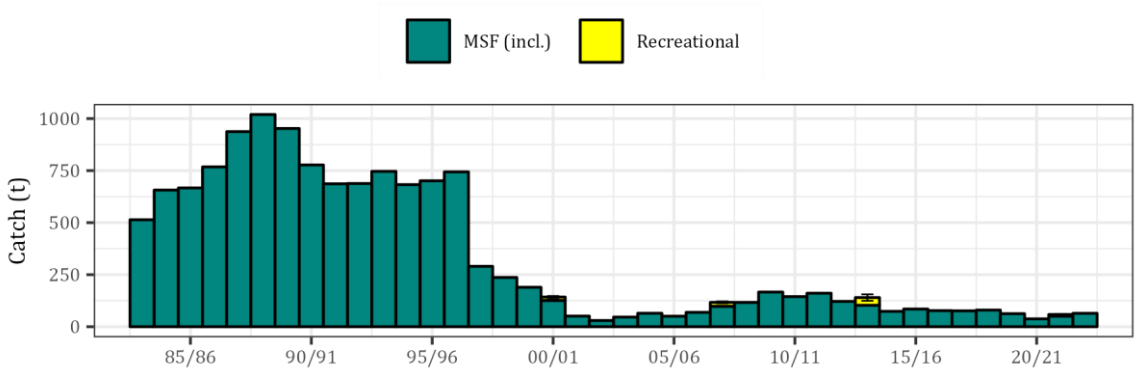


Figure 3.23-1. Fishery statistics for South Australia's Gummy Shark Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined), and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error). Catches are expressed as 'whole weight'.

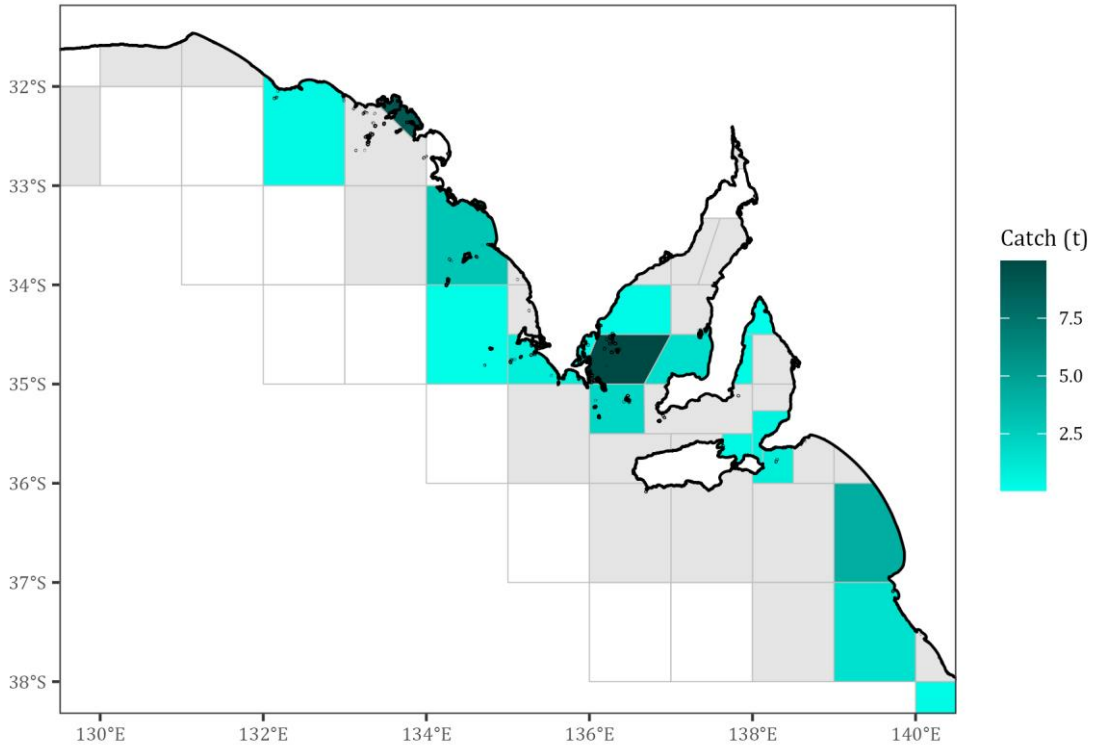


Figure 3.23-2. Spatial distribution of Gummy Shark catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential. Catches are expressed as 'whole weight'.

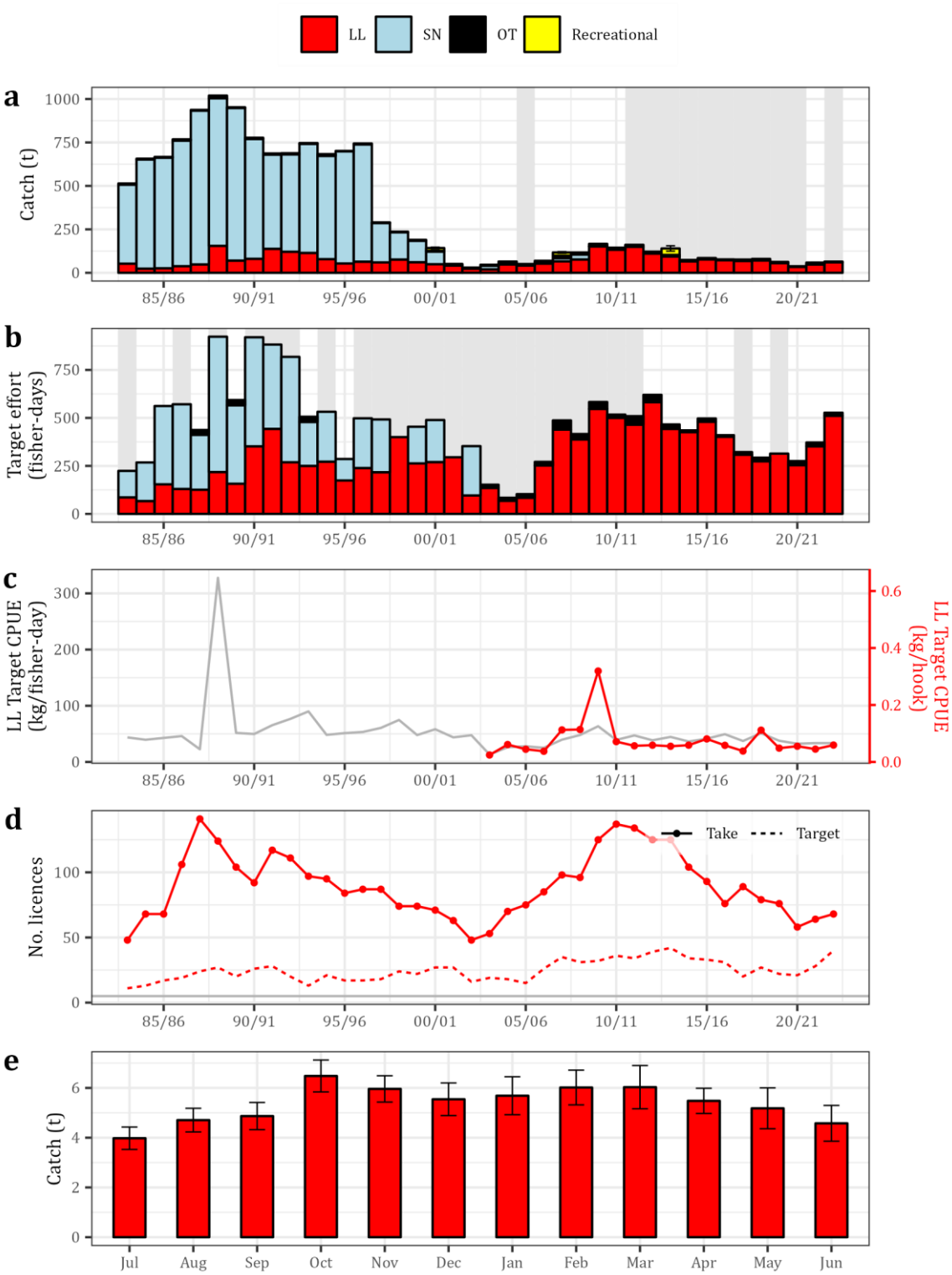


Figure 3.23-3. Key commercial fishery statistics for South Australia's Gummy Shark Fishery, divisible into key gear categories – Longline (LL), set net (SN), and all other gears combined (OT). Long-term trends in annual estimates of total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) targeted effort; (c) LL catch per unit targeted effort; (d) number of licences that take and target Gummy Shark; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Catches are expressed as 'whole weight'.

3.24. School Shark

School Shark

Galeorhinus galeus

State-wide summary 2022/23

No Tier assigned

Stock status

2020*	2021/22*	2022/23
Not Assessed	Not Assessed	Not Assessed

Fishery statistics (State-wide)

Commercial*					Recreational			
Fishing season	**Total catch**** *t*	**Total LL effort** *Fisher-days*	**Total LL CPUE** *kg/fisher-day*	**Total LL CPUE** *kg/hook*	**Survey**	**Est. Catch** *t (± S.E.)*	**Retained** *%*	**Released** *%*
2018/19	24	531	42.4	0.19	**2000/01**	4 (3)	-	-
2019/20	18	402	39.8	0.32	**2007/08**	9 (9)	61	39
2020/21	15	371	39.2	0.22	**2013/14**	53 (41)	93	7
2021/22	24	598	37.7	0.10	**2021/22**	9 (5)	100	0
2022/23	32	716	42.5	0.13	*LL – Longline, CPUE - Catch per unit effort.**Smart et al., 2023, **Whole weight			

Biology

- Widespread distribution through the temperate waters of northeastern and southeastern Pacific, northeastern and southwestern Atlantic and Southern Ocean.
- In Australia, range extends from Perth (WA) along the southern coast to Moreton Bay (QLD; Last and Stevens 2009).
- Inhabits coastal to continental shelf and upper continent slope waters, and to well offshore. Depth ranges from nearshore to ~600 *m* (Last and Stevens 2009).
- Fusiform, slender body with bronze to greyish brown dorsal coloration. Pale ventrally with ventral surface near snout tip translucent (Last and Stevens 2009).
- Born at 30 *cm* TL, reaches maximum size of 175 *cm* TL and ~60 years of age. Matures at 126–131 *cm* TL and 8 years for males and 124–135 *cm* TL and 12 years for females (Woodhams et al., 2020b).
- Viviparous reproduction with an average 30 pups per litter (range 15–54), 12-month gestation period in a three-year reproduction cycle.
- Assessment of stock status for School Shark is undertaken at the biological stock level for the Southern Australia stock by Commonwealth management authority (AFMA).

Fishery description

- Historically a targeted species using demersal large mesh set nets, longlines (including droplines) and handlines.
- Transfer of management from state to Commonwealth (AFMA) in 2000, MSF licence holders could retain as bycatch a combination of 5 Gummy and School Sharks per day with a multiday trip limit of 10.
- Since 1999, retained as a by-product species when using longlines, handlines, and haul nets.
- Prior to Commonwealth management, majority of catch came from the SEFZ, WCFZ, and southern SGFZ zones. Since 2000, the WCFZ zone has produced most of the catches.
- Recreational fishers target School Shark using rod and line from boats and shore-based fishing.

Assessment program

- Annual catch and effort statistics and trends in a stock summary report (Smart et al., 2023).
- No information is currently available for Aboriginal traditional fishing .
- Management of School Shark fishing transitioned from state-based to Commonwealth management in 2000 (AFMA).

Current management regulations

- LML 450 *mm*, measured from the 5th gill slit to base of the tail applies to all sectors.
- Daily recreational limits: combined total of 2 Gummy and School Sharks for individuals and a Combined total of 6 Gummy and School sharks for boats when 3 or more are onboard.
- MSF fishers restricted to a combined total of 5 Gummy and School Sharks per day (midnight to midnight), with a multiday trip limit of 10.
- Gear restrictions include a 400-hook limit for longlines and a 150 *mm* mesh diameter for set nets and haul nets.

Catch, targeted effort and CPUE trends[11]

Management of School Shark fishing transitioned from state-based to Commonwealth management in 2000, resulting in a significant decline in catch in the MSF as School Shark could only be retained as incidental bycatch. Catches prior to 2000/01 peaked at 1,323 *t* in 1988/89 and averaged 886 *t* per annum between 1983/84 and 1996/97 (Figure 3.24-1). Since 2000/01, MSF catch declined and has averaged 13 *t* per year, in 2022/23 total catch was 32 *t* (all catch is expressed as whole weight; Figure 3.24-1). School Sharks are caught in all four MSF Fishing Zones, with the highest catch since 2018/19 coming from MFA 15 (annual average catch ~4 *t*), MFA 10A (~4 *t*), MFA 28 (~2 *t*), and MFA 8A (~2 *t*; Figure 3.24-2).

Most of the catch since 2000/01 in the MSF was incidentally caught by longlines, with 99% of the catch and 92% of the effort was taken by this gear category in 2022/23 (Figure 3.24-3a-b). Total LL CPUE by *kg/fisher-day* remained consistent in 2022/23 at 42.5 *kg/fisher-day*, while total LL CPUE by *kg/hook* increased to 0.13 *kg/hook*, slightly below the long-term average since these data became available (0.15 *kg/hook*, range 0.03–0.32; Figure 3.24-3c). The number of licences taking school sharks using the longline gear type did not change from 53 in 2022/23, while the number of licences targeting School sharks declined from 10 to 9 licences in 2022/23 (Figure 3.24-3d). Over the past decade, the School Shark longline fishery has peaked in March and April at ~2.3 *t*, before declining to the lowest catch in July and August of ~0.9 *t* (Figure 3.24-3e).

Triggered performance indicators

No performance indicators are assessed for the MSF catch of School Sharks as it is a by-catch allocation of the Commonwealth managed stock (AFMA).

Stock assessment summary

The Southern Australian stock extends across multiple state jurisdictions and is managed by the commonwealth, it is managed as a single biological stock, however stock structure remains uncertain (Woodhams et al., 2023). Currently, School Shark cannot be targeted and are taken as bycatch when fishers of the Southern and Eastern Scalefish and Shark Fishery (SESSF) are targeting Gummy Shark. School Shark is listed as Conservation Dependent under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC) and this species is being managed under a rebuilding strategy (Emery et al., 2022).

The status of the Southern Australian biological stock is classified as a **depleted** stock in SAFS 2023 (Woodham et al. 2023).

Research & development needs

- Quantify the post-release survival of commercial and recreational captured School Shark (FRDC Project 2018/055).
- Improved estimates of recreational catch and effort.
- Improved understanding of Aboriginal Traditional Fishing importance.

[11] Data of total catch provided as whole weights (*t*).

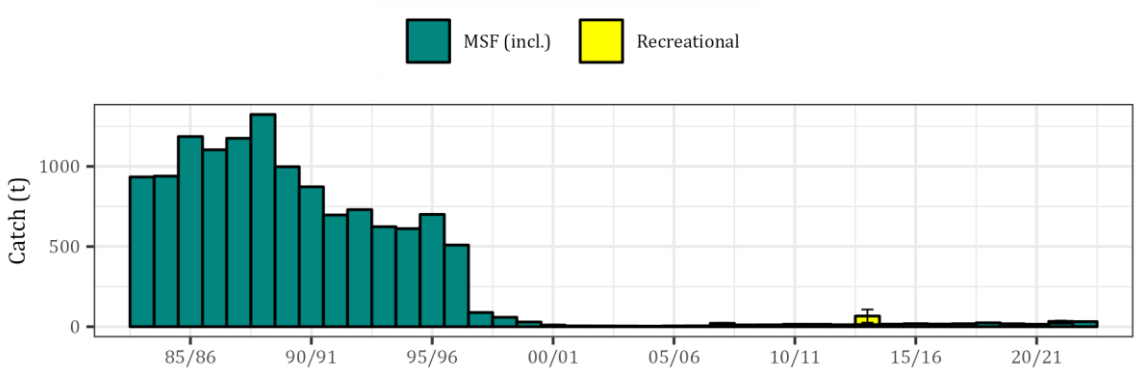


Figure 3.24-1. Fishery statistics for South Australia's School Shark Fishery. Long-term trends in annual estimates of total catch for the commercial sector (MSF, SZRLF, NZRLF combined), and the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error). Catches are expressed as 'whole weight'.

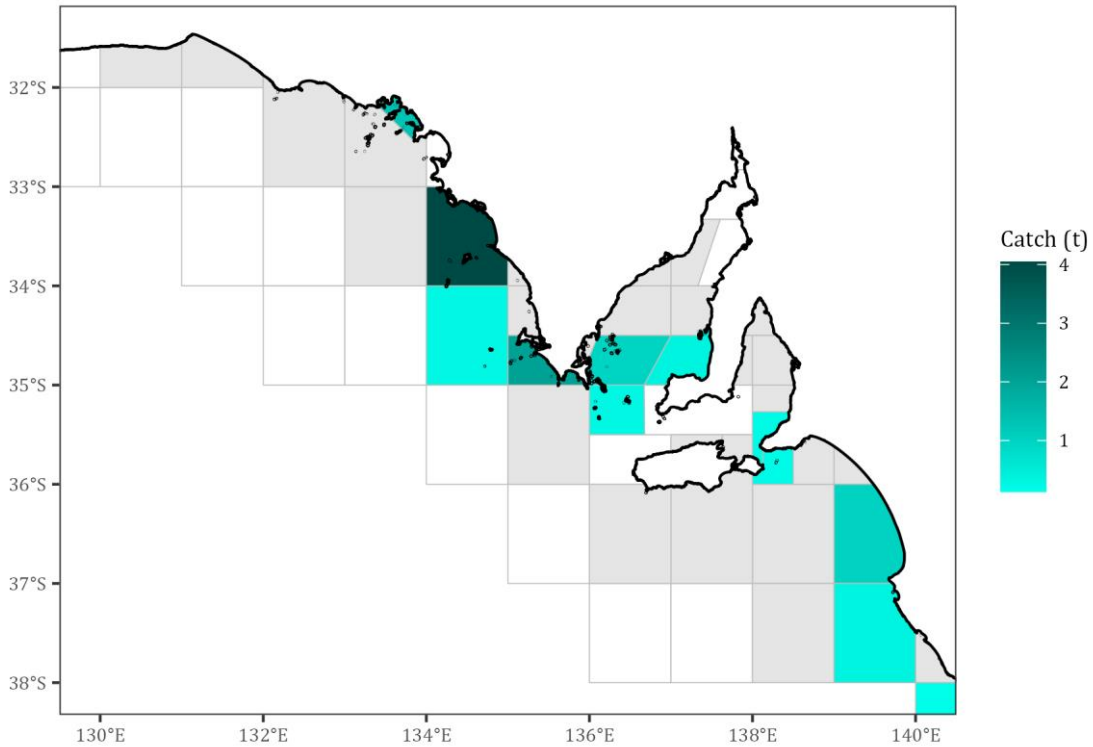


Figure 3.24-2. Spatial distribution of School Shark catches taken by the commercial sector, by MFA block (Figure 1.3-1) from 2018/19–2022/23. Green shadings represent the average annual catches for that period. Grey shading indicates MFA blocks where the catch data are confidential. Catches are expressed as 'whole weight'.

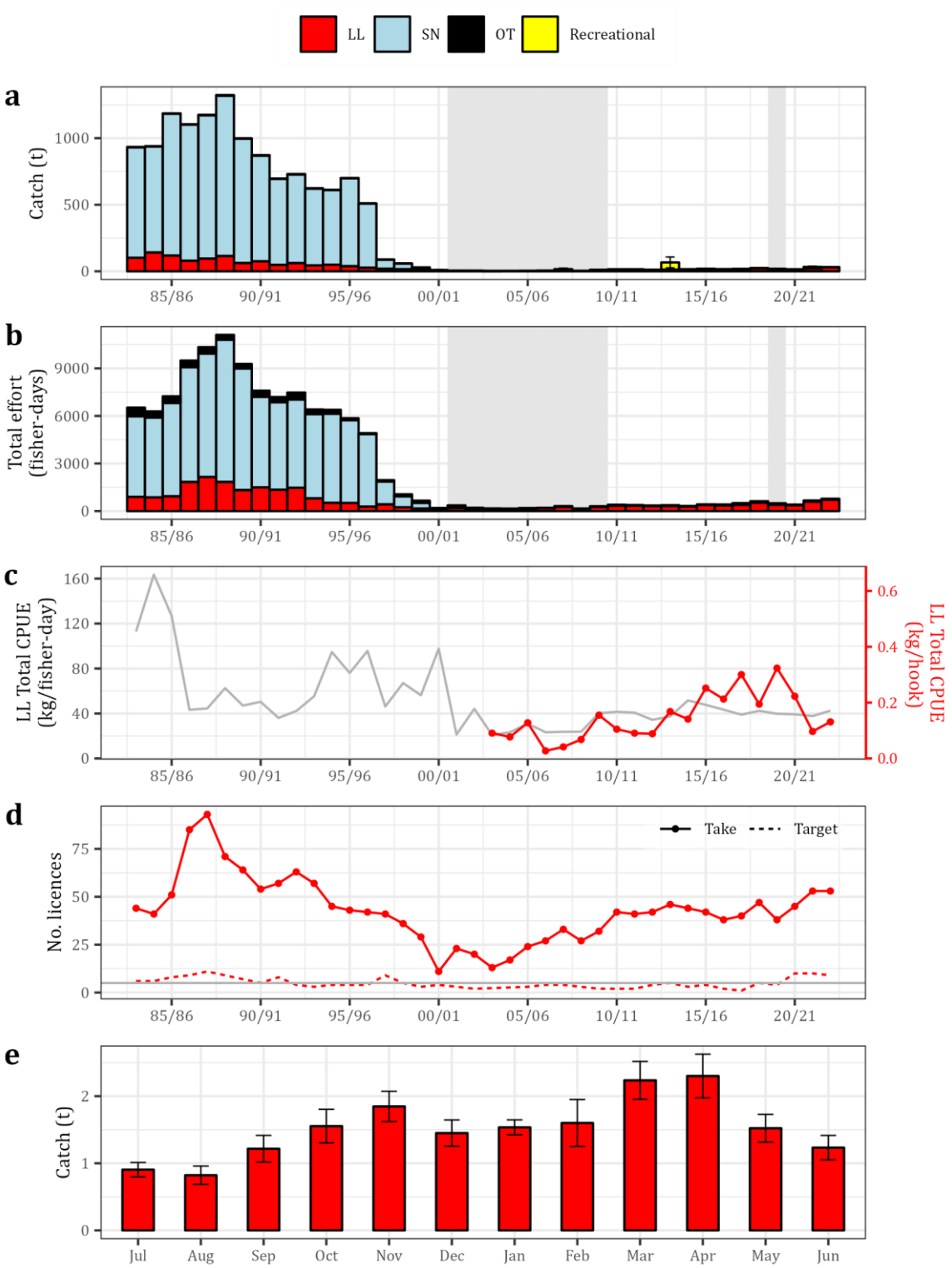


Figure 3.24-3. Key commercial fishery statistics for South Australia's School Shark Fishery, divisible into key gear categories – Longline (LL), set net (SN), and all other gears combined (OT). Long-term trends in annual estimates of total catch, including for the recreational sector from surveys in 2000/01, 2007/08, 2013/14 and 2021/22 (error bars = standard error); (b) total effort; (c) LL catch per unit total effort; (d) number of licences that take and target School Shark; and (e) average catch by month (error bars = standard error) for 2013/14–2022/23. Grey shading indicates years when data for one or more gear categories are confidential. Catches are expressed as 'whole weight'.

4. DISCUSSION

4.1. Assessment Updates and Overview

This report summarises the assessment, catch and effort statistics, fishery performance, and stock status of 20 species/taxonomic groups taken in the MSF based on data available until the end of the 2022/23 fishing season. Collectively, these taxa were considered across 32 management units at a resolution that aligned at the State-wide, zone or biological stock scale. Of these, 24 (~75%) stocks were classified as 'sustainable', two (~6%) were classified as 'depleted', one (~3%) was classified as 'recovering', two were classified as 'negligible' (~6%) and the remaining three (~9%) were classified as 'undefined' as there was insufficient information to assign a stock status. Gummy and School Shark are presented in this assessment, but no status was assigned to these species in this report as they are Commonwealth-managed fisheries. The only change in status from 2021/22 (Smart et al. 2023) is for the Southern Garfish GSV/KIFZ stock, which has been reclassified from recovering to sustainable (see below).

Recent stock assessments for King George Whiting (Steer et al., 2018a; Smart et al., 2023), Southern Garfish (Earl et al. 2024; Steer et al., 2018b; Smart et al., 2022a) and Snapper (Fowler et al., 2020b; Drew et al., 2022) have identified different levels of concern regarding stock sustainability. For Snapper, the SG/WC Stock and the GSV Stock were both classified as depleted in the most recent stock assessments (Fowler et al., 2020b; Drew et al., 2022). This reflected a significant reduction in the spawning biomass, as well as declining catches and CPUE, and recent poor recruitment in both gulf stocks (Fowler et al., 2020b; Drew et al., 2022). In each case, the stock status classifications have supported the development and implementation of specific management arrangements to recover each Snapper stock. In this assessment, only the SE Regional population of Snapper (i.e., the western extremity of the cross-jurisdictional Western Victorian Stock) could be assessed as there were no catch and effort data available since 2019 from the SG/WCS and GSVS owing to their closure. The current assessment, which considered additional catch and effort data from the SE population for the 2022/23 fishing season, did not identify any stock concerns, therefore the sustainable stock status assigned in Drew et al. (2022) was maintained.

The previous King George Whiting assessment classified all three stocks as sustainable based upon model outputs up to and including 2021/22 (Smart et al. 2023), which included several model updates that were undertaken to align stock boundaries with the new zones of management. No signs of stock decline were detected for the WCFZ and GSV/KIFZ in the previous assessment, with both stocks triggering the UTRP for biomass above 280 *mm* TL. However, while the SGFZ remained within the TRPs for biomass above 280 *mm* TL, signs of recent recruitment declines were detected, and these will be monitored in future assessments. The current assessment maintained these statuses following

consideration of catch and effort data for the 2022/23 season, demonstrating reductions in catch and effort but increases in CPUE indices.

The recent stock assessment for Southern Garfish up to and inclusive of the 2022/23 fishing season maintained the SGFZ as a recovering stock, reclassified the GSV/KIFZ as sustainable, with the remaining stocks assigned a sustainable status (Earl et al. 2024). For the SGFZ, despite favourable trends in fishable biomass, harvest fraction and targeted catch rates since the stock assessment in 2022, harvest fraction has not yet reached the operational target of 30% and there has been no improvement in population age structure (Earl et al. 2024). While there is not yet sufficient evidence to warrant a change in status from recovering to sustainable, the management arrangements in place to recover this stock are taking effect and recovery is occurring. The current assessment indicates that changes in management arrangements over the last 15 years have effectively recovered the garfish stock in the GSV/KIFZ. Since the last stock assessment (Smart et al., 2022a), targeted catch rates have increased to historically high levels, fishable biomass has increased to its highest level since 2005/06, harvest fraction has reached the operational target of 30%, and egg production and recruitment have increased. Given this evidence, the current stock assessment reclassified the GSV/KIFZ from recovering to sustainable.

Southern Calamari has recently become the most profitable species in the commercial MSF and has the highest GVP ($6M in 2022/23) in the fishery. This has occurred through the relatively low costs of squid jig fishing and continually increasing market prices. Southern Calamari is a highly productive species with a short life span (<1 year), allowing it to sustain higher harvest fractions than most other MSF species. However, a 7-year decline in CPUE was previously documented in the SSG region, indicating that regional depletion may be occurring (Drew et al., 2021).

Concerns regarding localised declines in productivity have been raised by industry with reports that Southern Calamari have become increasingly difficult to catch in areas that were previously highly productive. In addition, there is currently a lack of eggs in known spawning areas and there has been a notable absence of large animals in catches (Smart et al. 2023). However, targeted squid jig CPUE by *fisher-day* in SSG has increased since this assessment, arresting this decline. This suggests that some stock recovery may have occurred in this region, possibly through a period of stronger recruitment. However, the reliance of the Southern Calamari assessment on commercial fishery data is problematic for several reasons: (1) the spatial coverage of the Southern Calamari fishery can only be examined at the MFA level which may be too broad to detect regional or more localised depletion; (2) a potentially weak correlation between abundance and CPUE prevents the effects of fishing on the population from being determined; and (3) the impact of recreational fishing on Southern Calamari stocks has not been regularly determined but may be a substantial source of fishing mortality. The importance of this species to the MSF warrants future research to determine an appropriate stock

assessment program that befits the fishery's highest value species. A current FRDC project "A cost-efficient stock assessment program for Southern Calamari fisheries" (FRDC 2021/118) is expected to reconcile some of these issues and provide a more advanced and reliable assessment for this species.

The four species with 'Tier 1' stocks, King George Whiting, Snapper, Southern Garfish and Southern Calamari, have historically accounted for more than half of the State-wide total commercial catch in the MSF. However, this has declined in recent years with Tier 1 stocks accounting for 29% of the total MSF catch in 2022/23. There were several reasons for this including the increasing importance of 'Tier 2' and 'Tier 3' stocks to the fishery. The first and second ranked species by State-wide catch in 2022/23 were Ocean Jackets (Tier 3 and Negligible stocks) and Western Australian Salmon (Tier 2 and Negligible stocks), respectively. Catches for both of these species have fluctuated in recent years depending on market demands, as has been typical for many Tier 2 stocks in the MSF. However, given that several Tier 1 stocks are now managed via ITQs, there is potential for greater effort to be focused on the more profitable Tier 2 and Tier 3 stocks by fishers who do not own, or have not yet had the opportunity to buy, Tier 1 quota. Previous research has identified that both of these species could support higher catches and would have the lowest risk to sustainability should fishing effort be displaced to them from Tier 1 stocks (Fowler et al., 2020a). If higher catches were to persist, it would be valuable to develop appropriate assessment programs for both species to ensure increased catches do not jeopardise their sustainability. A current FRDC project "Identifying biological stocks of Silver Trevally and Ocean Jackets for assessment and management" (FRDC 2021-009) will provide further information for the Ocean Jacket stock structure that could be used in an assessment for this species. Likewise, a current FRDC project "Fisheries biology of Western Australian Salmon: improving our understanding of population dynamics in South Australia to enable quantitative stock assessments and improved fisheries management" (FRDC 2018-035) will provide further information for Western Australian Salmon that could be used in an assessment for this species.

Several important updates were continued within this assessment. Firstly, all catch and effort statistics, along with associated PI's were assessed by financial year (previously calendar year) to align with the MSF reform. Secondly, an alternative CPUE series was expressed in higher resolution units (e.g., *kg/line-hour* or *kg/hook* cf. *kg/fisher-day*) to provide for a more indicative measure of abundance. This was achieved for handlines, haul nets, squid jigs, dab nets and longlines, which are the dominant gears for most species. Importantly, many of these gear-specific CPUE indices matched the general trends of CPUE by *fisher-day*. This was a valuable result as CPUE by *fisher-day* can be calculated for every fishing season, whereas gear specific effort units have only been available since 2003/04 when daily logbooks were introduced. This increases the confidence in CPUE by *fisher-day* as an appropriate long-term index of abundance for some species.

4.2. Challenges and Uncertainties in the Assessment

Recreational data remains one of the largest knowledge gaps for assessing the status of the MSF stocks. The recreational sector's total harvest has traditionally been determined through infrequent telephone/diary surveys that are undertaken at six-to-seven-year intervals (Henry & Lyle, 2003; Jones, 2009; Giri & Hall, 2015; Beckmann et al., 2023). Although these surveys adopt a standard methodology that allows the results to be compared through time, their estimates of catch and effort have been infrequent and typically imprecise, especially for more minor species. Improving the precision of the estimates of the recreational catches, either through more frequent surveys or increased participation rates, will improve assessments of stock status. Challenges around the collection of recreational fishing data were highlighted at a workshop in 2018 (Beckmann et al., 2019). Alternative survey methods such as app-based data collection are currently being investigated as part of a research project associated with the recent 2021/22 recreational survey (FRDC 2020-056). The current information available on recreational catches has strong implications for the assessments of King George Whiting, for which the recreational contribution to overall State-wide catch has been highest. In 2021/22, a greater proportion of catch in the SGFZ and GSV/KIFZ was caught by recreational fishers during the recreational survey than the commercial fishery (Beckmann et al., 2023). This has implications for the King George Whiting assessment (Smart et al., 2023) as uncertainty in catches can add substantial uncertainty to model PIs (Van Beveren et al., 2017; Van Beveren et al., 2020).

New performance indicators are required for the MSF, following the new management arrangements in effect since July 2021. Several current PIs for MSF species are based on catch and effort statistics with the entire time series of the fishery used as a reference period. This has proven to be problematic for some species, including Blue Crab where total catch has substantially reduced since the creation of the BCF. This was addressed in the current assessment through assessing Blue Crabs for the WCFZ and applying the PIs at this spatial scale. This has solved previously identified issues where consideration of Blue Crabs at the State-wide scale rendered TRPs ineffective (Smart et al., 2022a). However, the TRPs based on catch are now also ineffective for Tier 1 stocks since TACCs have been applied; essentially capping catches at a prescribed level. Therefore, the ability to exceed the three highest or lowest years on record is no longer of relevance for these stocks. Similarly, the removal of 100 licences has reduced effort across the fishery and therefore limits comparisons to pre-reform effort levels. Research undertaken during the reform identified that changes in CPUE were unlikely to occur from these licence removals due to the degree of associated latent effort (Smart et al., 2022b). These results were substantiated in this year's assessment, but this will need to be examined over subsequent fishing seasons before it can be confirmed that CPUE indices were unaffected by the reform.

Smart et al. (2022b) identified that most TACCs would not be caught in 2021/22 as these were set using recent average catches which preceded the licence surrenders from the reform (i.e., based on catch from a greater number of licences; Smart et al., 2022b). Based on the catch histories of remaining licence holders and the likely quota transfers that would be required, individual fishers would have had to increase their catches in 2021/22 to account for the reduced number of licences in the fishery. It is not unusual for TACCs to be uncaught in the seasons following their initial implementation (Smart et al., 2022b). The operating environment for a fishery can change substantially after ITQs are implemented due to the requirements for initial autonomous quota trades. Therefore, for periods of the 2021/22 and 2022/23 fishing seasons, many fishers may not have owned enough quota to maintain their regular annual catch. Only one Tier 1 stock (GSV/KI Southern Garfish) had most of its TACC caught in the 2022/23 (90%), followed by Southern Calamari in GSV/KI (83%) and SG (73%) and SE Snapper (80%), while the remaining Tier 1 stocks had substantial under-catches. This will likely be resolved in the coming seasons as quota trading continues and TACCs are set using more appropriate methods than pre-reform catch levels. This will be supported through imminent harvest strategy development as part of the new MSF management plan.

4.3. Research Priorities

An updated stock assessment program is required for Southern Calamari, given its importance to the commercial MSF in recent years. Following the MSF reform, 11 stocks of King George Whiting, Snapper, Southern Garfish, and Southern Calamari have been assigned a Tier 1 status and are managed via annual TACCs. The current assessment programs for King George Whiting, Snapper, and Southern Garfish provide sufficient information to set TACCs and can form the foundation of upcoming harvest strategy development, if required. However, no such assessment program exists for Southern Calamari which is only assessed through fishery-dependent information. Therefore, the current assessment program does not match the importance of this species to the fishery and cannot provide sufficient management advice for setting TACCs.

A high priority of MSF research is the development of such an assessment program which will provide appropriate advice for TACC setting. Southern Calamari, like most cephalopods, has biological characteristics and life history that makes it particularly challenging to apply standard fisheries modelling techniques. Therefore, many cephalopod fisheries have struggled to develop appropriate assessments (Arkhipkin et al., 2021). As Southern Calamari are short-lived and highly productive, it was thought that their populations were resilient to fishing. However, this has recently been challenged as the Tasmanian stock is currently classified as ‘depleting’ (Sharples et al., 2023) and fishers have expressed concerns about stock health in SA. This suggests that Southern Calamari may not be as tolerant to high levels of fishing as previously thought and that methods to assess their population status need development. Furthermore, cephalopod population dynamics are influenced

by prevailing environmental conditions, obfuscating the impact of fishing, and causing management complications. Therefore, there are numerous assessment difficulties that must be overcome to provide a science program that can support this fishery.

Preliminary work has been undertaken to assess Garfish SGFZ and GSV/KIFZ stocks using the Stock Synthesis framework, as it potentially provides several benefits to the 'GarEst' model. Preliminary outputs from this work suggests that the apparent bias towards females in haul net catches could have serious implications regarding the spawning biomass and subsequent egg production (Earl et al. 2024). Further work may need to be considered to confirm or describe in greater detail the segregation of sex by depth, area, and/or season. Understanding to what degree spatial segregation of sexes occurs in time and space in both gulfs, relative to the long-term removals of females and males in these areas would be beneficial, particularly if management regulations could be adapted to improve the balance of exploitation across both sexes. Due to numerous potential benefits of using Stock Synthesis compared to custom species-specific models, assessments of Southern Garfish, Snapper and King George Whiting using the Stock Synthesis framework are being investigated and developed alongside the respective 'Est' models.

Given the continuing closure of Snapper fishing in the GSV/KIFZ, SGFZ and WCFZ, there is also a need to develop a recovery plan for Snapper. There are several areas of scientific research that have been identified to support this recovery plan which include: (i) continuation of the adult sampling program to access biological data and monitor regional age structures; (ii) to better understand and monitor inter-annual recruitment variability of 0+ juveniles; (iii) continuation and refinement of DEPM surveys to estimate spawning biomass; (iv) developing forecasting capability in the SnapEst (or alternative) model; (v) improving our understanding of the Snapper population on the WC; (vi) understanding post-release mortality; and (vii) continuing stock enhancement (Drew et al., 2022). All these research projects are being pursued through the $5 million Snapper Science Program jointly funded by the FRDC and SA Government.

Currently, there are uncertainties and limited data around the proportion of species in the catches of the multi-species complexes Whaler shark, Rays and Skates, and Leatherjackets. Consequently, these stocks have been assessed as undefined. Identification at the species level is required to understand their species composition and provide for more informative assessments, and this will be potentially resolved as the MSF catch reporting moves to an electronic reporting system. These species complexes are considered to comprise of predominately one main species (e.g., Southern Eagle Ray in Rays and Skates). Improving species identification in catch reporting will allow us to potentially remove these species from the multi-species complex and assess them individually or appropriately weight the fishery statistics to the known contribution of each species in a stock. This may become a priority for Whaler Sharks which have been assigned a Tier 2 status in several Fishing

Zones following the MSF reform (Smart et al., 2022b). Therefore, research may be required to separate these species as part of an ongoing assessment program.

Following the reform of the fishery, the harvest strategy in the current management plan has become increasingly outdated. A new management plan will soon be developed for the MSF which will include a more appropriate harvest strategy framework. The PIs and TRPs included in this harvest strategy framework should improve our ability to assess stock status and provide clear scientific advice to the MSFMAC and fisheries managers.

Lastly, a better understanding of the importance of MSF fish stocks to Aboriginal Traditional fishers and communities is required. The recent development of the TMF highlighted the paucity of information on Aboriginal Traditional fishing that is available. Subsequently, it was not possible to appropriately determine which stocks would be of most importance to different Aboriginal Traditional fishers and communities as a part of this framework. This has highlighted that a greater research focus is required to better understand the significance of the MSF to the Aboriginal Traditional Fishers sector and to incorporate this in decision making. Although Aboriginal Traditional fishers are defined as one sector under the *Fisheries Management Act 2007*, they encapsulate multiple groups with different languages, values, and cultures. The value to Indigenous peoples of Sea Country's marine, intertidal and estuarine resources is more than just for subsistence; it has value both culturally or spiritually, and includes all living things, beliefs, values, creation spirits and cultural obligations connected to that area. Recognising which stocks are most important to Aboriginal Traditional Fishers and their communities is therefore important and needs to be determined.

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6. APPENDICES

6.1. Tiered Management Framework results.

Table 6.1-1. The results of the Tiered Management Framework for all MSF stocks currently assessed in SARDI MSF assessments. The tiers are only assigned if average five-year annual commercial catches are greater than 5 *t* (Smart et al. 2022b).

Species	Zone	Stock Status	Aboriginal/ Traditional Importance *	Commercial Importance	Management Need	Level of Commercial Targeting	Recreational Importance	Total Score	Tier	Average 5-year catch (t)	Tier Assignment
Southern Garfish	GSV	3	1	3	3	3	3	16	Tier 1	72	Tier Assigned
Snapper	GSV	3	1	3	3	3	3	16	Tier 1	210	Tier Assigned
Snapper	SG	3	1	2	3	3	3	15	Tier 1	47	Tier Assigned
Southern Garfish	SG	2	1	3	3	2	3	14	Tier 1	102	Tier Assigned
Snapper	SE	1	1	3	3	3	3	14	Tier 1	20	Tier Assigned
Southern Calamari	SG	1	1	3	3	3	3	14	Tier 1	205	Tier Assigned
King George Whiting	GSV	1	1	2	3	3	3	13	Tier 1	44	Tier Assigned
King George Whiting	SG	1	1	2	3	3	3	13	Tier 1	110	Tier Assigned
Snapper	WC	3	1	1	3	3	2	13	Tier 1	17	Tier Assigned
Southern Calamari	GSV	1	1	3	2	3	3	13	Tier 1	159	Tier Assigned
King George Whiting	WC	1	1	3	1	3	3	12	Tier 1	97	Tier Assigned
Western Australian Salmon	SE	1	1	1	2	3	3	11	Tier 2	2	Negligible
Blue Crab	WC	1	1	3	1	3	2	11	Tier 2	41	Tier Assigned
Southern Calamari	WC	1	1	1	2	3	3	11	Tier 2	9	Tier Assigned
Yellowfin Whiting	SG	1	1	3	2	2	2	11	Tier 2	115	Tier Assigned
Australian Herring	GSV	1	1	1	3	1	3	10	Tier 2	27	Tier Assigned
Australian Herring	SG	1	1	1	3	1	3	10	Tier 2	60	Tier Assigned
Western Australian Salmon	GSV	1	1	1	2	3	2	10	Tier 2	77	Tier Assigned
Western Australian Salmon	SG	1	1	1	2	3	2	10	Tier 2	204	Tier Assigned
Western Australian Salmon	WC	1	1	1	2	2	3	10	Tier 2	1	Negligible
Blue Crab	SG	1	1	1	1	3	3	10	Tier 2	4	Negligible
Cuttlefish	SG	1	1	1	3	3	1	10	Tier 2	4	Negligible
Southern Garfish	SE	1	1	1	1	3	3	10	Tier 2	1	Negligible
Mulloway	SE	1	1	1	1	3	3	10	Tier 2	1	Negligible
Snook	SE	1	1	1	1	3	3	10	Tier 2	0	Negligible
Yellow-Eye Mullet	SE	1	1	1	1	3	3	10	Tier 2	0	Negligible
Black Bream	GSV	1	1	1	1	3	2	9	Tier 2	2	Negligible
Black Bream	SE	1	1	1	1	3	2	9	Tier 2	0	Negligible

Table 6.1-1 (cont'd)

Whaler Shark	GSV	1	1	1	2	3	1	9	Tier 2	18	Tier Assigned
Whaler Shark	SE	1	1	1	2	3	1	9	Tier 2	2	Negligible
Whaler Shark	SG	1	1	1	2	3	1	9	Tier 2	18	Tier Assigned
Whaler Shark	WC	1	1	1	2	3	1	9	Tier 2	16	Tier Assigned
Southern Garfish	WC	1	1	1	1	3	2	9	Tier 2	2	Negligible
King George Whiting	SE	1	1	1	1	2	3	9	Tier 2	0	Negligible
Octopus	SE	1	1	1	1	3	2	9	Tier 2	0	Negligible
Blue Throat Wrasse	WC	1	1	1	1	3	2	9	Tier 2	2	Negligible
Sand Crab	GSV	1	1	1	1	3	2	9	Tier 2	1	Negligible
Snook	WC	1	1	1	1	3	2	9	Tier 2	2	Negligible
Southern Calamari	SE	1	1	1	1	3	2	9	Tier 2	1	Negligible
Trevally	WC	1	1	1	1	3	2	9	Tier 2	2	Negligible
Yellowfin Whiting	GSV	1	1	1	2	2	2	9	Tier 2	14	Tier Assigned
Australian Herring	SE	1	1	1	1	1	3	8	Tier 3	0	Negligible
Australian Herring	WC	1	1	1	1	1	3	8	Tier 3	2	Negligible
Blue Crab	GSV	1	1	1	1	1	3	8	Tier 3	0	Negligible
Mulloway	WC	1	1	1	1	1	3	8	Tier 3	0	Negligible
Ocean Jacket	SG	1	1	1	1	3	1	8	Tier 3	199	Tier Assigned
Ocean Jacket	WC	1	1	1	1	3	1	8	Tier 3	1	Negligible
Octopus	SG	1	1	1	1	3	1	8	Tier 3	6	Tier Assigned
Octopus	WC	1	1	1	1	3	1	8	Tier 3	6	Tier Assigned
Sand Crab	SG	1	1	1	1	3	1	8	Tier 3	52	Tier Assigned
Sand Crab	WC	1	1	1	1	3	1	8	Tier 3	2	Negligible
Trevally	SE	1	1	1	1	2	2	8	Tier 3	0	Negligible
Trevally	SG	1	1	1	1	2	2	8	Tier 3	5	Negligible
Leather Jacket	GSV	1	1	1	1	1	2	7	Tier 3	10	Tier Assigned
Leather Jacket	SE	1	1	1	1	1	2	7	Tier 3	0	Negligible
Leather Jacket	SG	1	1	1	1	1	2	7	Tier 3	12	Tier Assigned
Leather Jacket	WC	1	1	1	1	1	2	7	Tier 3	1	Negligible
Mulloway	GSV	1	1	1	1	2	1	7	Tier 3	3	Negligible
Blue Throat Wrasse	SG	1	1	1	1	2	1	7	Tier 3	8	Tier Assigned
Snook	GSV	1	1	1	1	1	2	7	Tier 3	21	Tier Assigned
Snook	SG	1	1	1	1	1	2	7	Tier 3	20	Tier Assigned
Trevally	GSV	1	1	1	1	1	2	7	Tier 3	1	Negligible
Yellow-Eye Mullet	GSV	1	1	1	1	1	2	7	Tier 3	3	Negligible
Yellow-Eye Mullet	SG	1	1	1	1	1	2	7	Tier 3	13	Tier Assigned
Yellow-Eye Mullet	WC	1	1	1	1	1	2	7	Tier 3	0	Negligible
Black Bream	SG	1	1	1	1	1	1	6	Tier 3	0	Negligible

Table 6.1-1 (cont'd)

Black Bream	WC	1	1	1	1	1	1	6	Tier 3	0	Negligible
Blue Crab	SE	1	1	1	1	1	1	6	Tier 3	0	Negligible
Cuttlefish	GSV	1	1	1	1	1	1	6	Tier 3	1	Negligible
Cuttlefish	SE	1	1	1	1	1	1	6	Tier 3	0	Negligible
Cuttlefish	WC	1	1	1	1	1	1	6	Tier 3	0	Negligible
Mulloway	SG	1	1	1	1	1	1	6	Tier 3	1	Negligible
Ocean Jacket	GSV	1	1	1	1	1	1	6	Tier 3	0	Negligible
Ocean Jacket	SE	1	1	1	1	1	1	6	Tier 3	0	Negligible
Octopus	GSV	1	1	1	1	1	1	6	Tier 3	0	Negligible
Blue Throat Wrasse	GSV	1	1	1	1	1	1	6	Tier 3	1	Negligible
Blue Throat Wrasse	SE	1	1	1	1	1	1	6	Tier 3	1	Negligible
Sand Crab	SE	1	1	1	1	1	1	6	Tier 3	0	Negligible
Yellowfin Whiting	WC	1	1	1	1	1	1	6	Tier 3	0	Negligible
Yellowfin Whiting	SE	1	1	1	1	1	1	6	Tier 3	0	Negligible

6.2. Annual commercial catches of assessed species

Table 6.2-1. Annual commercial catches (in tonnes) of assessed species taken in the MSF (Includes Marine Scalefish Fishery, Rock Lobster Fisheries and Miscellaneous Fishery licences) between 1983/84 and 2022/23.

FINANCIAL YEAR	SNAPPER	KING GEORGE WHITING	GARFISH	SOUTHERN CALAMARI	YELLOWFIN WHITING	BLUE CRAB	AUSTRALIAN SALMON	AUSTRALIAN HERRING	BRONZE WHALER SHARK	SNOOK	SAND CRAB	YELLOW-EYE MULLET	MULLOWAY	OCEAN LEATHER JACKET	PARROTFISH	TREVALLY	LEATHER JACKET	RAYS AND SKATES	CUTTLEFISH	BLACK BREAM
1983/84	466.2	670.4	437.2	160.8	112.2	86.8	356.8	422.1	23.9	107.4	conf	111.0	19.0		2.8	2.8	35.7	8.5	0.3	1.4
1984/85	469.8	597.6	429.5	187.0	69.4	113.9	621.8	278.0	33.6	101.0	28.7	94.7	17.2	33.6	3.4	3.8	49.7	11.6	0.2	0.5
1985/86	454.8	655.3	439.9	192.3	47.9	170.2	609.0	313.1	38.0	72.1	24.9	127.3	8.0	135.5	1.8	1.3	33.2	15.9	0.3	0.1
1986/87	404.8	645.5	388.8	202.1	26.5	157.4	604.6	444.3	46.8	76.3	25.8	128.0	13.3	316.2	2.6	4.0	43.1	24.4	0.2	0.6
1987/88	333.7	589.6	381.8	206.1	22.3	183.7	667.5	499.3	69.1	72.1	28.5	151.8	12.1	689.4	3.5	5.8	37.8	56.7	1.1	1.1
1988/89	421.8	620.4	466.1	264.8	21.6	282.2	417.9	416.9	70.4	99.7	96.2	120.0	8.3	1023.9	2.5	2.2	38.3	48.4	3.2	0.7
1989/90	423.6	634.8	516.7	208.4	31.9	359.7	403.8	339.6	59.7	103.8	142.4	176.3	12.3	932.0	2.5	4.3	39.0	43.7	3.0	0.6
1990/91	456.8	692.2	453.6	278.9	46.0	433.6	479.1	308.1	83.9	99.1	148.6	151.9	8.1	965.7	2.1	4.0	52.8	38.9	2.7	0.9
1991/92	437.3	750.5	514.5	329.0	43.1	425.1	601.2	364.5	74.2	100.5	101.0	128.5	7.7	1015.1	2.1	14.0	47.0	67.9	1.8	0.3
1992/93	385.6	699.7	515.6	287.2	90.2	510.7	586.1	333.1	72.3	123.8	73.0	134.3	15.1	787.5	5.0	12.9	53.0	66.4	3.4	0.3
1993/94	317.9	665.4	472.3	325.6	69.6	543.8	524.2	304.3	82.6	121.6	50.6	112.0	13.5	664.7	5.8	12.8	51.9	65.5	7.5	0.7
1994/95	223.3	615.7	392.0	337.4	110.1	607.7	769.2	276.6	86.0	125.8	36.8	114.5	16.3	524.9	6.4	7.8	41.5	58.7	34.8	0.4
1995/96	305.5	535.9	511.4	382.1	92.6	654.7	486.7	236.9	81.4	152.4	54.3	73.0	24.4	476.3	7.3	7.8	33.0	42.0	70.6	0.2
1996/97	302.9	586.6	513.0	356.0	102.1	463.9	552.1	204.1	84.1	120.1	87.2	88.3	10.5	392.4	11.4	10.5	45.6	53.5	262.7	0.6
1997/98	390.6	551.6	503.9	424.9	73.5	80.6	631.8	283.5	106.7	113.4	129.0	106.6	8.6	424.5	26.5	5.3	42.6	47.2	170.1	1.1
1998/99	445.2	593.9	421.2	435.1	84.1	111.9	523.7	321.8	84.6	117.2	129.4	68.5	8.9	299.7	26.6	5.1	42.5	48.3	14.8	0.7
1999/00	575.2	517.1	476.7	400.5	112.3	88.0	456.7	303.6	72.6	93.3	147.7	73.7	3.1	288.2	24.1	7.7	41.1	49.0	15.8	1.6
2000/01	577.4	453.3	532.3	487.8	151.8	84.6	581.0	230.0	95.9	107.7	162.1	72.0	9.4	259.9	20.3	21.9	43.8	52.8	19.3	0.8
2001/02	647.4	389.4	470.0	339.7	148.0	77.7	455.2	262.2	86.7	99.8	127.1	57.0	4.2	394.8	24.3	5.1	31.3	57.5	26.8	0.3
2002/03	532.4	397.8	331.7	346.0	180.9	67.8	575.7	197.2	127.2	112.5	93.3	47.3	5.8	227.5	26.9	4.1	18.8	49.5	10.6	1.2
2003/04	410.8	356.5	320.8	302.6	162.9	52.9	157.9	152.0	120.3	81.0	96.1	44.7	4.6	497.9	21.9	3.8	22.1	35.1	5.7	1.2
2004/05	503.8	345.3	364.2	503.6	138.2	47.3	248.5	184.0	94.4	83.5	148.3	49.6	5.2	318.6	24.3	9.8	30.4	36.4	9.4	0.3
2005/06	533.4	333.3	369.3	310.8	130.4	48.2	176.6	125.9	73.2	61.3	141.7	38.4	5.4	149.1	17.6	9.7	18.9	28.5	7.8	0.3
2006/07	642.9	353.7	293.3	297.5	85.2	41.9	156.8	104.9	82.0	63.9	83.2	35.9	5.4	conf	12.3	6.1	14.0	21.3	10.9	3.5
2007/08	742.7	330.1	290.1	303.2	81.9	50.3	105.3	122.0	79.5	81.9	62.7	28.8	5.9	conf	16.7	10.5	13.3	22.9	6.4	1.5
2008/09	785.7	339.2	293.8	281.2	110.9	58.5	120.3	143.4	94.8	70.5	98.2	30.3	3.7	conf	21.9	7.2	21.3	22.6	4.0	conf
2009/10	916.5	343.4	281.1	366.1	104.5	56.9	170.6	167.8	154.7	65.3	71.3	22.8	2.8	conf	19.7	10.5	14.6	21.7	9.7	0.2
2010/11	971.0	339.9	260.9	326.4	98.2	51.2	153.6	118.0	86.2	62.2	72.0	28.1	2.6	conf	23.9	12.4	11.6	15.3	5.2	conf
2011/12	877.5	306.8	249.5	481.9	103.9	57.5	211.1	99.1	90.3	47.3	83.6	33.2	3.2	conf	20.4	8.9	12.8	17.1	3.2	conf
2012/13	548.8	307.0	242.4	424.3	151.7	62.5	74.1	137.5	65.4	47.5	83.1	19.9	4.7	91.0	14.2	12.3	14.8	17.1	3.9	0.7
2013/14	548.7	265.1	261.1	328.5	110.3	61.4	60.9	143.1	64.7	40.1	56.0	17.5	1.1	conf	17.6	7.3	9.1	12.6	1.8	0.5
2014/15	586.5	309.6	216.0	435.9	95.8	44.3	275.0	116.2	44.6	45.3	50.5	17.0	1.3	conf	15.2	11.2	16.3	16.8	1.8	conf
2015/16	428.6	271.8	163.5	382.8	115.3	32.7	453.6	89.6	54.3	46.8	69.6	14.3	1.3	125.3	16.1	7.9	28.2	12.3	1.6	2.1
2016/17	342.6	268.4	185.5	397.4	133.3	51.6	269.7	82.9	57.4	48.3	50.1	17.2	4.6	300.1	12.0	9.2	27.6	12.1	0.9	conf
2017/18	304.4	242.7	174.5	422.4	139.7	35.3	321.1	85.5	53.9	42.1	35.0	22.5	6.0	conf	14.1	7.5	30.5	11.9	1.4	1.7
2018/19	280.7	234.0	192.1	322.0	126.2	51.8	182.5	96.6	50.3	41.0	63.8	16.5	9.1	127.5	6.6	5.4	20.7	9.7	0.9	3.2
2019/20	115.0	234.4	168.2	348.9	131.9	54.7	188.8	88.4	55.5	38.6	51.1	11.0	3.3	conf	5.8	8.0	10.3	10.4	20.1	conf
2020/21	42.9	181.3	181.8	349.9	81.4	76.3	90.0	109.9	67.2	31.6	62.7	8.5	0.9	conf	5.3	8.2	11.1	10.7	5.0	conf
2021/22	25.2	176.3	157.4	278.3	125.0	61.5	323.5	108.7	69.2	23.7	55.9	7.0	1.1	254.2	8.1	9.3	12.4	12.3	1.3	conf
2022/23	29.0	192.4	139.8	294.8	97.3	32.0	361.5	92.9	91.9	34.2	50.6	6.7	0.1	522.5	9.5	4.9	10.0	12.1	0.5	0.0

6.3. Annual commercial catches of permitted species

Table 6.3-1. Annual commercial catches (*t*) of remaining permitted species and species groups taken in the MSF (Includes Marine Scalefish Fishery, Rock Lobster Fisheries and Miscellaneous Fishery licences) between 1983/84 and 2022/23.

FINANCIAL YEAR	ALBACORE	ANCHOVY	BARRACOUTA	BASTARD TRUMPETER	BEACHWORM	BIGHT REDFISH	BLOODWORM	BLUE GRENADIER	BLUE MACKEREL	BLUE MORWONG	BOARFISH	BROADNOSE SHARK	CONGER EEL	CONGOLLI	CROWN CRAB	DEEP SEA TREVALLA	DOG SHARK	DOUGHBOY SCALLOP	DRUMMER	DUSKY MORWONG	ELEPHANT SHARK	ESTUARY CATFISH	EUROPEAN CARP	FISH ROE
1983/84			78.3	conf	conf	3.1	1.4			1.0	0.8			conf		conf	conf		conf	0.4		conf	conf	
1984/85			21.4	conf	conf	8.3	1.3		conf	2.0	1.0			conf		6.2	4.9		conf	0.3	conf	conf		
1985/86			9.9		conf	15.6	0.9		conf	2.6	1.4		conf			6.8	conf			0.2		conf		
1986/87	conf		5.0	conf	conf	13.3	1.3		3.6	3.0	1.7		conf	conf		93.5	9.6			0.5	conf			
1987/88			6.6	3.2	conf	20.6	1.3	conf	conf	2.9	2.4		conf	conf		128.1	10.7			1.0	1.0			
1988/89			11.6	conf	conf	20.1	0.7		1.6	6.6	3.2		conf			57.6	2.8		conf	2.6	conf	conf		
1989/90			12.5	conf	conf	22.5	1.1	conf	0.3	2.8	3.6		conf	conf		75.6	5.1		conf	1.9	conf	conf		conf
1990/91			6.9	conf	conf	13.7	1.4		1.5	3.1	3.2		conf			82.0	13.4			0.3	conf	conf		conf
1991/92	conf		4.5	conf	conf	11.7	1.3	conf	0.8	7.1	3.0		conf			61.7	148.3		conf	0.5	conf	conf		
1992/93		conf	3.2	conf	conf	14.1	1.2	conf	0.4	11.1	2.8		conf	conf	conf	49.6	261.1		conf	0.1	conf	conf		
1993/94			0.4		conf	13.9	0.7	conf	5.9	13.3	2.8		conf	conf	conf	49.8	149.8		conf	conf	conf			
1994/95			0.4	conf	conf	21.0	2.1	conf	5.8	17.0	3.6		conf		conf	19.3	29.2		conf	conf	2.8	conf		
1995/96			0.4	conf	conf	12.6	1.3		5.5	15.8	3.1		conf			8.3	18.0		conf	conf	1.6			
1996/97			0.9	conf	conf	10.3	1.7		3.6	17.5	4.7		conf		conf	4.7	conf		conf	conf	1.5			
1997/98			1.5		conf	5.5	1.5		4.6	10.4	2.0				conf	conf	conf		conf	conf	0.5			
1998/99		conf	conf		conf	4.7	0.5		3.1	2.8	1.4		conf		conf	conf	conf			conf	conf			
1999/00		conf	0.5		conf	5.1	conf		3.7	3.4	conf		conf		conf	conf	conf		conf	conf	conf			
2000/01		conf	conf	conf	conf	1.2	1.1		0.3	0.1	0.5						conf	conf	conf	conf	conf	conf		
2001/02			0.2		conf	3.0	0.6	conf	5.1	0.2	0.7						conf	conf		conf	conf			
2002/03			2.0		conf	4.0	0.8		1.2	0.8	1.7						conf			conf	conf			
2003/04			4.2		conf	3.5	1.1		1.7	0.7	0.4		conf				conf			conf	conf			
2004/05			7.2		conf	7.7	0.7		3.2	1.6	1.5		conf				conf		conf	conf	conf			
2005/06			1.0		conf	4.5	1.1		2.4	1.7	conf		conf				conf		conf	conf	conf			
2006/07			0.7		conf	4.9	0.9		2.8	1.5	conf		conf				conf			conf	conf			
2007/08			0.5		conf	3.2	0.7		4.2	1.5	0.1	3.4	conf						conf	conf	conf			conf
2008/09	conf		1.7		conf	3.8	1.3		3.2	2.1	0.3	2.3	conf				conf				0.1			conf
2009/10			1.2		conf	9.0	0.7		2.5	1.6	conf	4.0	conf						conf		conf			
2010/11			conf		conf	11.8	1.2		1.5	2.8	conf	8.2									conf			
2011/12			conf		conf	12.9	1.0		1.9	1.0	conf	4.7				conf								
2012/13					conf	12.8	1.6		1.4	0.6	conf	3.1												
2013/14			conf		conf	6.4	1.5		2.0	0.5	conf	1.4				conf								
2014/15			conf		conf	9.3	1.6		2.4	0.6		2.6				conf								
2015/16			conf		conf	13.4	2.0	conf	3.0	0.6		1.4				conf				conf				
2016/17			conf		conf	12.8	2.3	conf	3.9	0.8		1.0				conf				conf				
2017/18					conf	25.1	2.0		3.4	0.8		0.7	conf							conf				
2018/19			conf		conf	17.3	2.2		4.7	0.9		0.7							conf	conf				
2019/20					conf	19.2	1.6		4.6	0.8		1.3				conf			conf					
2020/21					conf	33.1	1.6		4.5	0.6		1.6	conf			conf								
2021/22					conf	23.0	1.0		2.8	0.6	conf	conf				conf			conf	conf				
2022/23			conf		conf	19.4	1.3		1.1	0.5		0.1				conf				conf				

Table 6.3-1 (cont'd)

FINANCIAL YEAR	FLATHEAD	FLOUNDER	GEMFISH	GHOST SHARK	GOULDS SQUID	GUMMY And SCHOOL SHARK	GUMMY SHARK	GURNARD PERCH	HAMMER HEAD SHARK	HAPUKA	HARLEQUIN FISH	JACK MACKEREL	JOHN DORY	JUMPER MULLET	KING SCALLOP	KNIFE JAW	LATCHET	LING	LONG FINNED PIKE	LUDERICK	MAKO SHARK	MIRROR DORY	MOONLIGHTER	MORWONG
1983/84	5.2	0.1	conf	conf			513.8	conf		conf		2.0	conf			conf		conf						9.4
1984/85	3.9	0.4	conf				656.6	conf		1.9		conf			conf			conf	conf					10.0
1985/86	3.5	1.3	conf				666.8			1.8		conf				conf		conf	conf					14.1
1986/87	2.9	1.2	1.1		conf		768.0	conf		12.8		14.6			conf	0.2		0.2	conf					18.6
1987/88	4.1	0.2	0.7		conf		937.3	conf		25.4		37.5	conf			0.3		1.2	conf					17.6
1988/89	4.9	0.3	0.2				1019.6	0.1		13.2		conf	conf		conf	conf		0.3	conf					21.8
1989/90	4.5	conf	0.8				952.4	conf		14.7		conf		conf		conf		0.2	conf					23.3
1990/91	6.5	0.2	0.3			297.2	777.1	conf		19.9		conf				1.0		0.1						17.3
1991/92	7.0	0.2	conf	conf		221.8	686.6	conf		14.2		0.2				conf		0.4						11.9
1992/93	4.7	0.2	conf		conf	246.1	688.0	0.7		10.4		0.5				0.6		1.3						3.6
1993/94	4.0	conf	conf		conf	200.1	746.3	0.1		14.8		0.3				conf		1.6						3.5
1994/95	3.6	0.2	conf			191.2	682.8	conf		5.2		0.3	conf			conf		0.5						8.7
1995/96	2.2	0.4	conf		conf	120.4	701.2	conf		10.2		0.2				0.8		1.2	conf					7.0
1996/97	2.3	0.2				90.1	743.9	conf		2.9		conf				conf	conf	1.0						9.1
1997/98	2.4	conf	conf			50.4	290.2			conf		conf				conf		conf						conf
1998/99	2.7	0.4				20.3	236.5	conf		conf		0.2		conf		conf		conf						conf
1999/00	2.1	0.2	conf			7.3	189.5	conf		conf		conf		conf	conf	conf		conf	conf					0.2
2000/01	2.3	conf					126.3	conf				conf	conf		conf	conf	conf	conf						0.1
2001/02	2.1	conf				conf	51.0	0.1				conf		conf	conf							conf		1.2
2002/03	2.3	conf	conf		conf	conf	29.8	conf						conf	conf	conf		conf						1.0
2003/04	1.9	conf					46.3	conf						conf	conf	conf		conf						1.0
2004/05	2.4	0.0				conf	64.7	conf				conf		conf	conf	0.2		0.0						3.4
2005/06	1.8	conf					50.5	conf						conf	conf	conf		conf						0.3
2006/07	2.0	conf				conf	69.1	conf		conf		conf	conf	conf	conf	conf		conf		conf				0.8
2007/08	2.4	conf					98.2		1.4			conf		conf		conf					conf			0.2
2008/09	2.8						116.7	conf	2.0		0.1	conf		conf	conf	0.7		conf			conf	conf		0.9
2009/10	3.5	conf			conf		166.6	conf	5.4		0.1	conf		0.2	conf	conf		conf		conf	conf			0.5
2010/11	6.2						144.6	conf	1.2		0.0	conf		conf	conf	conf		conf		conf				1.3
2011/12	3.5					conf	161.0	conf	0.8		0.0	conf		conf	conf	conf		conf			conf			0.7
2012/13	1.7	conf				conf	121.6		0.8		conf			conf	conf	conf		conf			conf			0.4
2013/14	1.4	conf					103.0	conf	0.9					conf		conf		conf						0.2
2014/15	2.5	0.0					73.9		0.4					conf		conf		conf						0.2
2015/16	1.1	conf			conf		85.0		1.4			conf		conf	conf	conf		conf						0.2
2016/17	0.9	conf					77.3		0.4			conf		conf	conf	conf		conf						0.2
2017/18	1.1	conf					76.3		0.1			conf		conf	conf			conf						0.4
2018/19	1.0	conf					80.0		0.7		conf	conf		conf	conf	conf		conf		conf	conf			0.2
2019/20	1.2	0.1					62.7	conf	conf			conf		conf		conf		conf			conf			0.4
2020/21	1.3	0.1				conf	37.7	conf	conf			conf		conf	conf	conf		conf		conf				0.6
2021/22	0.6	0.1					50.8	conf	0.4			conf		conf	conf	conf		conf					conf	0.1
2022/23	0.5	conf			conf		64.4	conf	1.0			conf		conf		conf		conf			conf			0.1

Table 6.3-1 (cont'd)

FINANCIAL YEAR	MUD COCKLE - GREY	MUD COCKLE - OTHER	MUD COCKLE - YELLOW	MUSSEL	OCTOPUS	ORANGE ROUGHY	OTHER MACKEREL	OTHER OR MIXED SPECIES	OTHER SHARK	PACIFIC OYSTER	QUEEN SCALLOP	RAZOR FISH	RED GURNARD	RED MULLET	ROCK CRAB	ROE	SAMSONFISH	SAW SHARK	SCHOOL SHARK	SCHOOL WHITING	SEA MULLET	SEA URCHIN	SEAWEED WORM	SERGEANT BAKER
1983/84		conf			conf		conf	24.7	4.7			conf		2.6	conf			conf	934.1		conf	conf		
1984/85					conf		conf	26.2	6.2		conf	conf		2.2	conf			1.9	939.3		conf			
1985/86		conf			0.1			42.5	13.6			conf		3.2	conf			4.2	1186.0	conf	conf			
1986/87		22.0			0.7		conf	55.6	25.1			conf		3.6	conf			8.9	1103.4				conf	
1987/88		39.2			3.0		conf	81.4	43.8					3.4	conf		conf	17.2	1175.2	conf	conf		conf	
1988/89		conf			2.4			40.5	46.9			conf		4.5	conf		conf	14.5	1323.7	conf	conf	conf	conf	
1989/90		19.9			3.2			45.6	42.8		conf	conf		5.4	conf		conf	11.0	997.9	conf	conf		conf	
1990/91		25.7		conf	5.1			58.0	56.8					4.9	conf			13.0	872.6	conf			conf	
1991/92		30.0		conf	7.6		conf	40.5	68.2			conf		4.8	conf			6.5	696.7	0.1	conf		conf	
1992/93		36.1			9.8			46.1	52.3			conf		4.5	conf			7.2	730.4	0.1			conf	
1993/94		15.1			4.5			54.5	36.1			conf		4.7	conf			4.8	623.7	0.1				
1994/95		23.6			5.5			40.8	52.9					4.6	0.3		conf	19.0	611.9	0.1			conf	
1995/96		55.6		conf	9.2			56.9	93.4			conf		4.6	conf			10.6	700.4	0.1			conf	
1996/97		73.7		conf	8.9			63.4	81.4					4.1	1.0			11.4	509.4	conf			conf	
1997/98		113.8		conf	6.2			37.9	63.3					4.1	0.8		conf	0.4	88.6	0.1	conf	conf	conf	
1998/99		153.2		conf	conf			38.4	45.8			conf		4.5	1.6			conf	58.7	conf			conf	
1999/00		149.8		conf	6.7			29.2	53.0	conf	conf	16.3		3.8	0.6		conf	conf	29.2	conf		conf	conf	
2000/01		157.4		conf	conf		conf	19.5	60.4		conf	11.9		4.6	conf		conf	0.5	5.9	conf	conf	conf	conf	
2001/02		226.6			conf			20.3	50.9		conf	conf		3.8	1.4			conf	4.9	conf		conf	conf	
2002/03		239.1			5.1	conf		16.4	33.6		conf	conf		3.8	10.6			conf	4.6	conf	conf		conf	
2003/04		271.1			4.6			11.9	30.7		conf	7.6	conf	3.5	2.5		conf	conf	4.2	0.1	conf	conf	conf	
2004/05		346.5			conf			9.6	21.6		conf	conf		3.6	conf		conf	conf	3.1	conf	conf	conf	conf	
2005/06		384.9			5.7			5.1	21.7		conf	10.5	conf	4.9	conf		conf	conf	4.7	conf		conf	conf	
2006/07		281.8			10.9			4.3	21.2		conf	6.3		5.1	conf		conf		5.3	conf	conf	conf	conf	
2007/08		319.6		conf	22.5			4.8	6.2			8.6	conf	4.8	1.1		conf	conf	11.5	conf	conf	conf		
2008/09		171.2		conf	29.8			3.6	5.4		conf	10.2	conf	4.6	1.3		conf	conf	11.1	0.3	conf	42.5		
2009/10		98.9		conf	conf			3.7	7.2		conf	10.3	0.6	4.7	conf	conf	conf	conf	11.7			conf		
2010/11	10.1	54.8	19.8	conf	11.5			4.3	10.4			10.1	conf	3.9	conf		conf	conf	15.2	conf	conf	conf		
2011/12	11.0	35.9	25.1	conf	12.8			5.0	5.2			8.1	conf	2.9	conf		conf	0.3	15.1	conf	conf	conf		
2012/13	10.5	29.9	29.9	conf	8.8			2.8	5.4			5.9	conf	3.7			conf	conf	12.2	0.1	conf	conf		
2013/14	6.7	38.3	26.2	conf	conf			2.5	3.7			4.0	conf	5.3			conf	conf	13.1	conf	conf	conf		
2014/15	2.5	36.7	24.9	conf	11.1			1.7	1.7		conf	4.0	conf	3.6					15.9	0.3	conf	conf		
2015/16	conf	62.2	conf	conf	9.6			2.8	1.1			5.1		3.5					18.8	conf	conf	conf		
2016/17	conf	62.7	conf	conf	14.0			2.0	1.5			5.6		3.4					16.5	conf		conf		
2017/18	conf	62.2	conf	conf	conf			1.8	1.3			11.0		3.5			conf		18.4	conf	conf	conf		
2018/19		62.0	conf	conf	conf			1.3	2.3		conf	13.6	conf	3.5			0.8		24.4	conf	conf	conf		
2019/20		59.9	conf	conf	11.6			1.3	2.0			12.8		3.6			0.5	conf	18.3	conf	conf	conf		conf
2020/21		70.8		conf	22.2			0.9	conf		conf	23.3	conf	2.5			0.3		15.2	conf		conf	conf	
2021/22		56.0	conf	conf	conf			0.7	conf		conf	18.9	conf	2.4	0.7		conf		23.7			conf	conf	conf
2022/23	conf	70.4	conf		conf			0.4			conf	22.5	conf	2.5	conf		0.3		31.6			conf		conf

Table 6.3-1 (cont'd)

FINANCIAL YEAR	SHARK FINS	SILVER DORY	SKIPJACK TUNA	SOUTHERN BLUEFIN TUNA	SOUTHERN ROCK COD	SOUTHERN ROCK LOBSTER	SPIDERCRAB	SPIDERCRAB CLAWS	SWALLOWTAIL	SWEEP	TAILOR	THRESHER SHARK	TUBEWORM	WAREHOU	WEEDY WHITING	WESTERN BLUE GROPER	WESTERN STRIPED GRUNTER	WHISKERY SHARK	WOBBEGONG SHARK	YELLOWTAIL KINGFISH
1983/84				conf	0.3				conf	2.7	conf		15.6		3.7		0.8	6.2		1.2
1984/85		conf		1.2	0.3	conf			conf	2.7			12.3	conf	4.4	conf	10.3	12.0	conf	0.7
1985/86				conf					conf	2.8			14.2		3.7	1.5	4.8	9.0	conf	conf
1986/87			conf	0.8	conf				conf	1.6			11.7		3.6	3.8	0.6	6.8	2.7	0.6
1987/88				conf	0.5	conf			conf	2.3			8.9	0.8	3.3	2.5	1.8	12.5	conf	conf
1988/89				conf	0.3				conf	4.5			10.7	13.0	4.2	conf	2.7	13.7	1.0	conf
1989/90				conf	conf				0.3	11.9			14.1		3.7	conf	5.2	7.9	conf	
1990/91				5.1	conf				0.3	10.9			13.9		3.2	0.5	4.5	9.0	conf	conf
1991/92				conf					0.4	3.2			15.8	conf	3.9	3.3	3.8	8.0	1.2	0.8
1992/93				conf	conf				0.2	4.8			13.5	conf	4.3	1.7	8.8	1.8	conf	2.2
1993/94					conf				0.5	8.5			10.7	conf	3.8	3.0	12.7	1.2	1.5	1.9
1994/95						conf			0.2	4.7			11.2	conf	6.2	9.0	11.2	4.3	1.1	0.4
1995/96					conf				0.4	6.1			11.6	conf	1.4	5.5	12.0	4.5	2.2	0.4
1996/97				conf	conf				0.2	8.0			10.1	conf	1.2	3.2	22.3	4.2	0.7	conf
1997/98					conf				0.1	7.3			9.9	conf	0.9	2.4	18.1	2.3	0.3	conf
1998/99					conf				conf	4.2	conf		10.5	conf	1.0	conf	15.2	1.3	1.8	conf
1999/00			conf		conf				conf	1.4			11.2	conf	2.6	conf	10.1	1.0	1.0	conf
2000/01					conf	conf				1.4			11.1	conf	2.1	conf	15.5	8.9	0.7	conf
2001/02					conf				conf	2.3	conf		8.1	conf	1.0	conf	19.1	2.0	conf	conf
2002/03					conf			1.0	conf	1.6	conf		conf	conf	0.6	conf	23.0	5.3	conf	0.5
2003/04					conf			0.6	conf	1.9			conf	conf	0.8	conf	25.7	1.7	conf	conf
2004/05					conf			conf	conf	1.7			conf	conf	0.7	conf	20.7	5.4	0.4	0.1
2005/06					conf				conf	1.3			conf	conf	1.0	0.3	28.2	2.3	0.6	0.3
2006/07	conf								0.1	0.9			conf	conf	0.4	conf	13.7	1.7	2.0	conf
2007/08					conf				0.1	1.2			conf	conf	0.4	0.3	15.9	1.0	1.8	conf
2008/09					conf				0.3	1.7	conf		conf	conf	0.5	conf	12.6	2.2	0.8	0.5
2009/10					0.3				0.5	2.2		conf	conf	conf	0.6	conf	16.6	1.1	1.8	0.3
2010/11					conf				0.2	3.5	conf	conf	conf	conf	0.5	conf	11.5	1.7	1.3	conf
2011/12					conf		conf		0.2	3.4			conf	conf	0.2	conf	11.1	1.7	1.1	0.2
2012/13	conf			conf	conf				0.4	1.7			conf		0.3	conf	9.0	1.0	conf	conf
2013/14					conf				0.2	2.4		conf	conf		0.2		7.9	1.3	conf	0.4
2014/15									0.0	1.7			conf		0.2	conf	13.0	1.7	conf	2.6
2015/16				conf					0.1	1.0			conf		0.3		14.8	1.6	conf	1.2
2016/17					conf				0.1	0.7			conf		0.3		15.4	2.3	conf	2.3
2017/18	conf				0.1				0.2	1.5			conf		0.3		21.1	2.0	0.4	1.8
2018/19	conf				conf				0.2	0.8		conf	conf		0.3		10.3	9.2	conf	1.8
2019/20					conf				0.1	1.0		conf	conf		0.1	conf	8.0	9.5	conf	4.1
2020/21					conf				0.1	0.5			conf		0.1		7.6	2.4	conf	5.2
2021/22					conf		conf		0.1	0.4			conf	conf	0.2		11.7	3.9	conf	0.8
2022/23				conf					0.1	0.5		conf	conf	conf	0.5	conf	7.4	8.4	conf	1.8