

Black Bream Recovery Strategy

For the Lakes and Coorong Fishery

December 2023 to July 2026



Black Bream Recovery Strategy for the Lakes and Coorong Fishery

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Introduction

Fish stocks are constantly changing and require continual monitoring. As such, fisheries managers and fishers must regularly review management arrangements to ensure the long-term sustainability of South Australian fisheries.

The *Fisheries Management Act 2007* aims to ensure the sustainable harvest of South Australia's aquatic resources.

This recovery strategy has been developed in response to concerns about the sustainability of the Black Bream stock in the Lakes and Coorong Fishery, which in the *Assessment of the South Australian Lakes and Coorong Fishery 2020/21* report has been assigned the stock status classification of 'Depleted' (Earl et al. 2022). The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has also provided a wildlife trade operation (WTO) approval under Part 13A of the Commonwealth *Environment Protection Biodiversity and Conservation Act 1999* to export species taken in the Lakes and Coorong Fishery. The WTO approval provided by DCCEEW is contingent on nine conditions being met by the Department of Primary Industries and Regions (PIRSA), one of which relates to the development and implementation of a long-term recovery strategy for Black Bream stocks. Condition five (5) of the WTO approval states:

By 1 August 2024, the Department of Primary Industries and Regions, South Australia, in collaboration with the Lakes and Coorong Fishery Management Advisory Committee, must develop and implement a long-term recovery strategy for black bream stocks in the South Australian Lakes and Coorong Fishery, to assist transitioning the stock from its current 'depleted' state to a longer term 'sustainable' level.

The Black Bream Recovery Strategy for the Lakes and Coorong Fishery has therefore been prepared to both recover the stock to a sustainable stock status classification and subsequently meet the requirements of condition 5 of the WTO approval provided by DCCEEW.

When a fish stock is classified as 'Depleted' it means the biomass (or proxy) has been reduced through catch and/or non-fishing effects, such that recruitment is impaired, and 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 (Piddocke et al. 2021).

The aim of this recovery strategy is to establish management arrangements that:

- Enable the Lakes and Coorong Black Bream stock to return to a 'sustainable' stock classification.
- Maintain quality recreational fishing opportunities for Black Bream in the Lakes and Coorong region, both now and into the future.
- Ensure the continued supply of commercially-harvested Black Bream.
- Maintain the proportional catches of Black Bream taken by each fishing sector within the allocated shares provided by the *Management Plan for the South Australian Lakes and Coorong Fishery* (PIRSA 2022).

The Black Bream Fishery

In South Australia, Black Bream is harvested by the recreational fishing sector, commercial fishing sector and Aboriginal traditional fishing sector. It is an iconic and highly valued species.

The *Fisheries Management Act 2007* provides that a fishery management plan must specify the share of the fishery resource to be allocated to each fishing sector, based on the existing shares at the time the first management plan is requested. The *Management Plan for the South Australian Lakes and Coorong Fishery* has formally allocated the Black Bream resource between the three fishing sectors across the state as follows:

- Commercial 50.6%
- Recreational 48.4%
- Aboriginal traditional 1%.

State-wide catches of Black Bream were shared almost equally between commercial and recreational fishers at the time the 2016 management plan was developed. A nominal share of 1% was allocated for the Aboriginal traditional fishing sector to allow for the resolution of Indigenous Land Use Agreements. Currently, there is limited information available to inform estimates of Aboriginal traditional catches of Black Bream.

Black Bream is regarded as an important species by the recreational sector in South Australia (Kailola et al. 1993; Beckmann et al. 2023). Recreational fishers primarily use rods and line to take this species but registered monofilament nylon nets can also be used where permitted and are known to target Black Bream in the Coorong estuary (refer to Areas 1 and 2 of Figure 1).

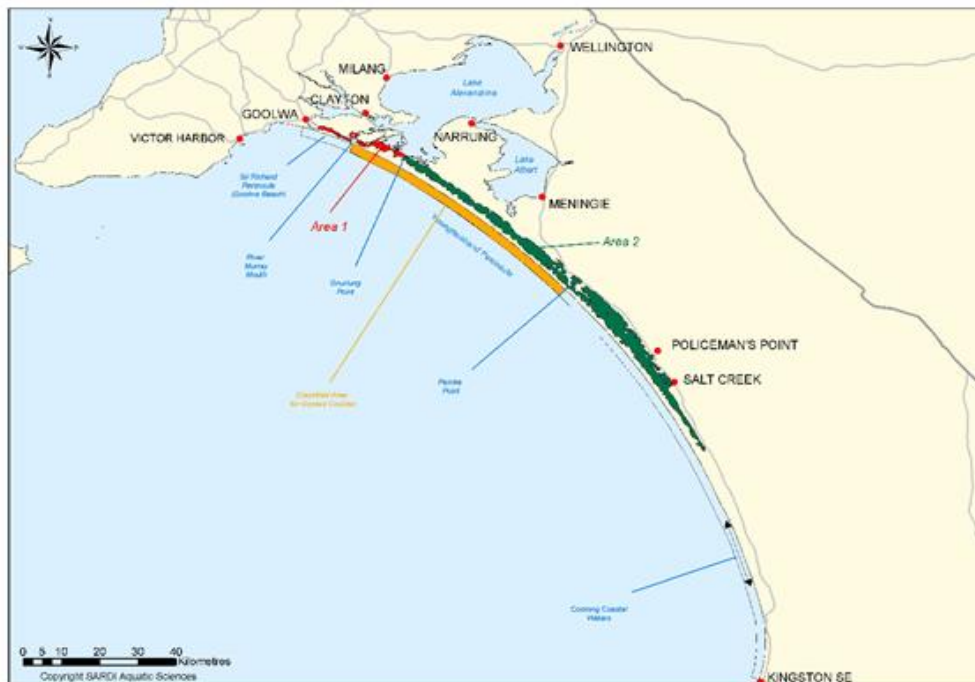


Figure 1: Map of the management areas of the Lakes and Coorong region.

The commercial sector for Black Bream in South Australia has two main fisheries, the Lakes and Coorong Fishery and the Marine Scalefish Fishery. Most (>85%) catches of Black Bream in South Australia are taken by the Lakes and Coorong Fishery in the Coorong estuary. The Lakes and Coorong Fishery primarily uses large-mesh gillnets (115–150 mm mesh) to harvest Black Bream with smaller catches of the species taken with small-mesh gillnets (50–64 mm mesh).

Commercial fishery production for Black Bream in the Coorong estuary (refer to Areas 1 and 2 of Figure 1) has been variable since the 1960s. It peaked at around 70 tonnes (t) per annum in several years during the late 1970s and early 1980s and was 46.8 t in 1984/85 (Figure 3, Earl et al. 2016). Annual catches were around 35 t in 1985/86 and 1986/87 and then rapidly declined to 3.7 t in 1990/91. Catches remained low during the 1990s, averaging 3.7 t.yr⁻¹, before increasing to 11.6 t and 10 t in 2002/03 and 2003/04, respectively. Then, catches gradually declined to 1.7 t in 2008/09 and have been < 2 t in most years since. In 2020/21, catch increased to 3.2 t which was the highest catch since 2007/08, but below the average annual catch of 3-4 t since the fishery collapsed in the early 1990s.

The main gear type used to target Black Bream has been the large-mesh gillnet. The low catches since the early 1990s have been associated with low targeted effort using large-mesh gillnets, with most of the catches taken as by-product when other species were targeted. Over the past three years, on average, 89% of the catches taken each year have been by-product.

Historically, catches of Black Bream have been seasonal with large proportions of the annual catches taken from August to January (Figure 2). Catches have been highest in September and October and lowest from February to May.

The State-wide recreational fishing survey in 2021/22 estimated that 30,878 (SE = 7,853) Black Bream were captured across South Australia, of which about 76% were released, although post-release survival is unknown (Beckmann et al. 2023). The retained fish contributed to an estimated State-wide harvest weight of 5.55 t (SE = 3.37 t), which was approximately 66% of the State-wide combined commercial and recreational harvest of Black Bream, and slightly higher than the 2013/14 estimated state-wide harvest weight of 4.97 t (Giri and Hall 2015) (Figure 3).

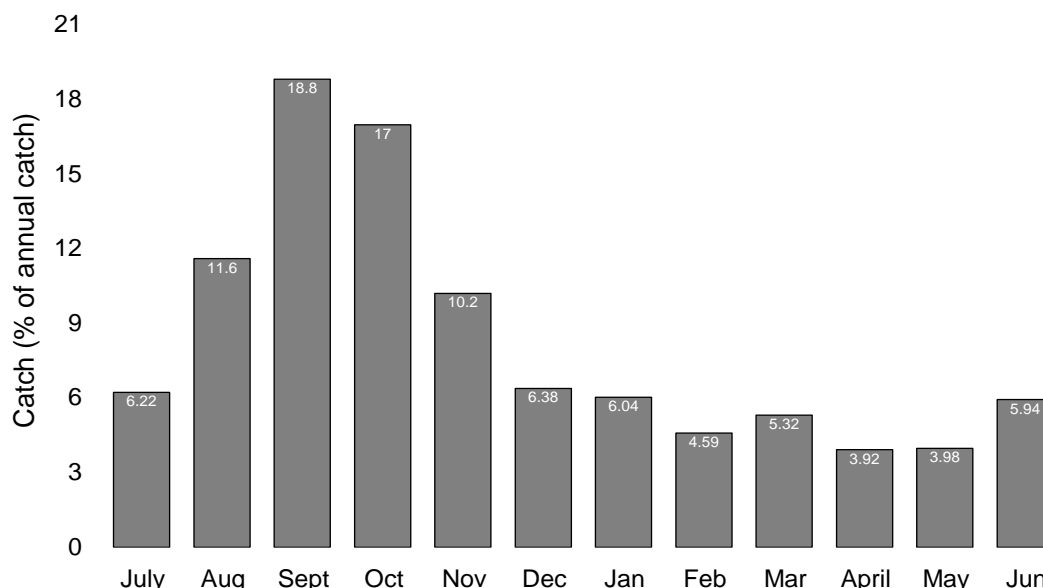


Figure 2: Average monthly catches (± S.E.) for Black Bream in the Lakes and Coorong Fishery from 1984/85–2017/18, expressed as a percentage of annual catch. Catches since 2018/19 are excluded due to implementation of seasonal closures.

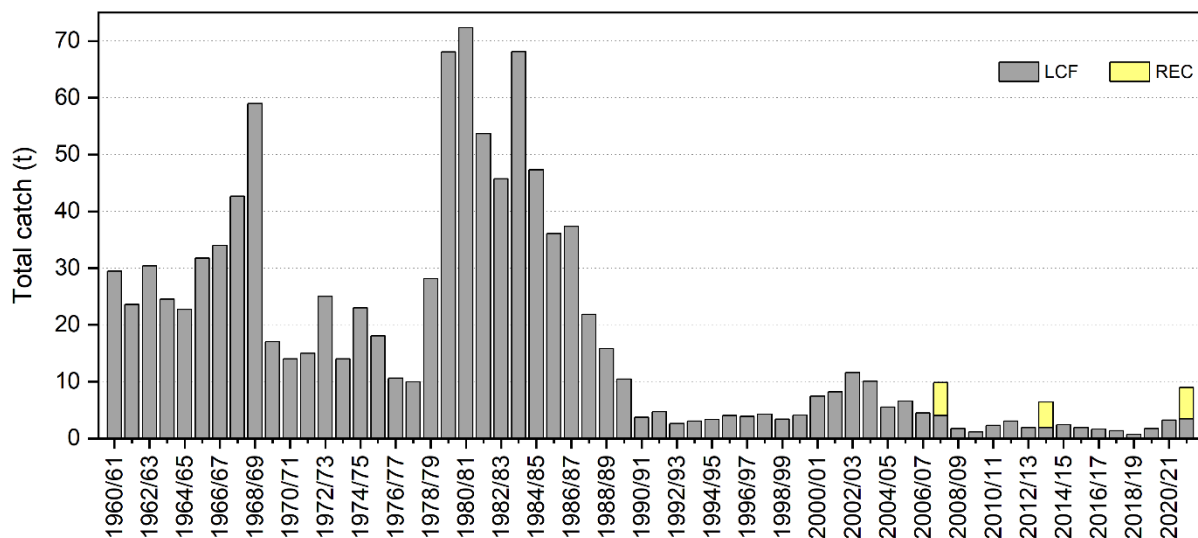


Figure 3: Total catch of Black Bream in the Lakes and Coorong Fishery 1960/61-2020/21. Estimates of total State-wide catch for the recreational sector for 2007/08, 2013/14 and 2021/22 are also shown.

Traditional fishery

The Aboriginal (Ngarrindjeri) history associated with the Lakes and Coorong region extends over at least 45,000 years. Archaeological evidence to support this is provided by middens containing cockle shells and the remains of fish and terrestrial animals, traditional camp sites, meeting places, rock formations and burial sites (Leubbers 1981). These sites are found throughout the Lakes and Coorong region in a greater frequency than other locations throughout Australia (Leubbers 1981).

The high abundance and diversity of natural aquatic and terrestrial resources in the Lakes and Coorong region provided a rich sustenance for the Ngarrindjeri people and formed the basis of large semi-permanent settlements in the region. The Ngarrindjeri population density is likely to have been the largest of any aboriginal group in Australia, with an estimated 3,000 inhabiting the region in the early 1800s, prior to European settlement. The Ngarrindjeri people continue to target Black Bream in the Lakes and Coorong Fishery using a range of traditional apparatus, including nets and spears, as well as rod and line (Jenkin 1979; Olsen 1991).

Recreational fishery

The recreational fishery is regulated through size, bag and boat limits and restrictions on fishing gear. Legal minimum lengths in South Australia are generally set so that most fish will have the chance to spawn at least once. The current legal minimum length of 300 mm (total length) for Black Bream is designed to provide a level of protection to allow for an adequate proportion of fish to spawn before entering the fishery. The estimated length-at-50%-maturity (L_{50}) for male and female Black Bream in the Coorong is 340 mm total length and 289 mm total length, respectively (Cheshire et al. 2013). This allows the replenishment of stocks for the species. Recreational daily bag limits are also a management measure for protecting and maintaining fish stocks, as this restricts the number of fish taken by fishers. Bag limits also serve to provide equitable fishing opportunities between recreational fishers. For Black Bream, a daily bag limit of 10 fish and boat limit of 30 fish applies. Restrictions apply to the specification and number of hand lines, rods and line and mesh nets that may be used by recreational fishers.

Commercial fishery

The Lakes and Coorong Fishery is a small-scale, multi-species, multi-gear fishery that operates in, and adjacent to, the estuary of the Murray River and Coorong lagoons (Coorong Estuary), the lower lakes of the Murray River (Lake Alexandrina and Lake Albert) and the nearshore marine environment adjacent the Coorong estuary along Younghusband and Sir Richard Peninsulas (Figure 1). Fishers in the Lakes and Coorong Fishery primarily use large mesh gillnets (115–150 mm mesh) to harvest Black Bream, along with several other finfish species (Earl et al. 2016).

A wide and complex range of restrictions are in place to control the use of all commercial fishing methods in the Lakes and Coorong Fishery, which reflects the multi-species nature of the fishery. These restrictions are aimed at limiting commercial fishing effort, to restrict gear conflict between sectors, as well as to minimise impacts on fish stocks and the broader aquatic ecosystem and to ensure overall stock sustainability.

A new Management Plan for the South Australian Commercial Lakes and Coorong Fishery has been adopted and took effect on 1 March 2022 (PIRSA 2022). The Plan was developed by PIRSA in collaboration with the Lakes and Coorong Fishery Management Advisory Committee (LCFMAC) and incorporates revised Piri and finfish harvest strategies. The new finfish harvest strategy is based upon habitat condition, which links to the availability of the fishery resources, and includes a new set of biological performance indicators based on estimates of commercial catch per unit effort (CPUE) for key species. Effort controls using net units (number of 50 m large- and small-mesh gillnets) have been implemented to control the level of gillnet fishing effort in key areas of the fishery. Decision rules state that various levels of environmental condition will trigger a specific response in terms of a total allowable commercial effort (TACE) adjustment, to ensure that finfish resources are harvested within ecologically sustainable limits. The new biological indicators and associated reference points have been integrated into the decision rule framework that enables species-specific management responses when required.

History

Management action is needed to enable the Black Bream stock in the Lakes and Coorong region to return to a sustainable status, and support the objectives of the *Management Plan for the South Australian Commercial Lakes and Coorong Fishery*.

Temporary management arrangements were implemented in 2018, 2019, 2021 and 2022/23 to facilitate the recovery of the Black Bream stock in the Coorong, after it was classified as 'overfished' in 2016 (Earl et al. 2016b) and 'depleted' each year from 2017–2022 (Earl et al. 2022). The temporary arrangements applied to Black Bream within the Lower Lakes and Coorong Estuary from 1 September 2017–30 November 2018; from 21 September 2018–30 November 2019; and from 1 August–31 December 2021. The arrangements comprised the following:

- Commercial and recreational nets could not be used within 300 m of barrages located within the Coorong Estuary, including Goolwa, Mundoo, Boundary Creek, Ewe Island and Tauwichee barrages.
- Black Bream could not be targeted, and all incidental catch of Black Bream had to be released by both the commercial and recreational sectors.
- In 2022, temporary management arrangements were implemented for the spawning season to provide some stock protection while longer term strategies to recover the stock were developed, following the ongoing 'Depleted' status (Earl and Bailleul, 2021). Based on advice from the South Australian Research and Development Institute (SARDI) regarding the timing of spawning, which advised that the spawning period extends from

August into February and the spawning closure should be applied from 1 August to 31 January to provide the highest level of protection for spawning aggregations during the peak spawning period, and formation of salt wedge conditions required for successful spawning (Steer et al. 2022). The temporary management arrangements for 2022/23 comprised a fishery closure from 1 August 2022 until 31 January 2023 and a netting closure within 300 m of barrages.

The *Assessment of the Lakes and Coorong Fishery for 2020/21* report produced by SARDI in May 2022 (Earl et al. 2022) considered a synopsis of biological information available for the species, trends in commercial fishery catch and effort data and information on fishery size and age structures by Ye et al. (2021a) to assess stock status. This report classified Black Bream stock in the Coorong estuary as 'Depleted'. The following points are noted:

- Analysis of the long-term chronology of fishery production for Black Bream in the Lakes and Coorong Fishery indicates high variability in fishable biomass in the Coorong Estuary. In the early 1990s, fishery catches dropped to historically low levels and have remained low. The recent low catches have been associated with low targeted effort. The lack of targeting and low catches since the 1980s likely reflects low biomass.
- Annual fishery age structures since 2007/08 comprised mostly 4- to 14-year-olds, despite the potential for this species to live up to 32 years of age. Within any year, few age classes contributed most to the catch, reflecting the relative strength of these year classes. This variation in year class strength relates to inter-annual variation in recruitment.
- In recent years fishery production has remained low despite the recruitment of young fish to the fishable biomass, which indicates that recruitment levels have not been strong enough to support recovery of the stock.
- In 2022, successful recruitment of Black Bream in the Coorong Estuary was evident by the detection of higher-than-average abundances of young-of-year (YOY) that likely originated from spawning that occurred in 2020/21. Recruitment of these juveniles to the fishable biomass has not yet occurred and is expected to take several years.

The SARDI report *Monitoring Salt Wedge Conditions and Black Bream Recruitment in the Coorong during 2017-18* (Ye et al. 2019) noted:

- Recent successful recruitment of Black Bream in the Coorong was evident by the detection of YOY in good numbers throughout the estuary and North Lagoon in autumn 2018. There was an increase in the relative abundance and distribution of YOY in 2018 compared to the previous nine years. This relatively large cohort of YOY originated from spawning that occurred from 26 December–1 February 2018.
- The 2017/18 monitoring demonstrated that barrage flow management, supported by environmental water, can generate favourable conditions (particularly salt wedge habitat) that facilitate successful recruitment events of Black Bream, which are required to support recovery of the population in the Coorong. In a relatively dry year such as 2017/18, without environmental water, barrage flows would not have been maintained throughout spring/summer, which is the reproductive season of Black Bream.
- Promoting more frequent recruitment will help increase abundance over time and rebuild population resilience. Environmental water and barrage management is critical, particularly in the highly modified Coorong Estuary, to provide suitable flow and habitat conditions and increased food resources to improve recruitment.
- Concurrently conservation management should seek to protect the remnant spawning biomass by implementing a fishing closed season during the spawning period and extending closed areas (currently fishing is prohibited within 150 m of the barrages) below the barrages.

- It is important to enhance the survival of new recruits by minimising fishing mortality of undersized Black Bream following initial recruitment success, so that they will contribute to adult population and spawning biomass in future years. The survival and growth of new recruits could also be enhanced by barrage flows to improve estuarine habitat and food resources in the Coorong.

The SARDI Advice Note, *Black Bream in the Lakes and Coorong Fishery* delivered 14 January 2023 (Steer et al. 2023) provided information on the potential influence of high freshwater inflows from the Murray River on: (1) the timing and duration of the spawning period for Black Bream in the Coorong estuary, and (2) the occurrence of salt wedge conditions downstream of the Murray barrages. The following points are noted:

- There is no evidence that high inflows altered the timing and duration of the spawning period for Black Bream.
- It is expected that under high inflow conditions, the salt wedge (the interface between fresh and brackish water)—favorable conditions for Black Bream spawning—would extend beyond the areas immediately below the barrages and into the north lagoon.

The SARDI Report Coorong Fish Condition Monitoring 2008-2020 (Ye et al. 2021) indicated the following:

- In 10 of the last 12 years of monitoring the Black Bream condition was 'extremely poor', 'very poor' or 'poor'. In 2017/18, the condition improved to 'moderate', when there was an increase in abundance and distribution of YOY. In 2019/20, the condition was also 'moderate', based on >50% of commercial catch being taken in the south of Mark Point, and the presence of two strong recently recruited cohorts (2015/16 and 2016/17 year classes). However, commercial fishery catch was among the lowest on record and recruitment based on the relative abundance of YOY was negligible.

Key Objectives

Key objectives in selecting appropriate management measures for returning the Black Bream stock to a 'sustainable' classification are outlined below. These objectives are consistent with the goals of the harvest strategy in the *Management Plan for the South Australian Lakes and Coorong Fishery*. They include, to:

- Ensure the long-term sustainable harvest of Black Bream.
- Maintain catches of Black Bream within agreed allocations for each sector.
- Minimise impacts on the structure, productivity, function and biological diversity of the ecosystem.
- Ensure cost-effective and participative management of the fishery.

PIRSA considers that an effective recovery strategy to return the Black Bream stock to a sustainable level would include translating the above objectives into the following operational objectives:

- Increase Black Bream spawning biomass.
- Enhance Black Bream recruitment.
- Increase Black Bream abundance.
- Rebuild population age structure.
- Maintain recreational and commercial catches within their allocated shares.

Harvest Strategy

The current harvest strategy for finfish in the management plan (PIRSA 2022) does not provide pre-defined reference points that determine when the Black Bream stock is sustainable (i.e., when biomass is at a level sufficient to ensure that, on average, future levels of recruitment are adequate), and therefore lacks an index that explicitly defines stock status. Consequently, the assignment of stock status for Black Bream uses a weight-of-evidence approach that is consistent with that used in the Status of Key Australian Fish Stocks Reports (Pidcocke et al. 2021).

In February 2023, SARDI provided scientific advice on Performance Indicators and associated reference points for the indicators that can be used to monitor the recovery of the stock, and define when the stock returns to a “sustainable” stock status classification (Appendix 1). In addition, the SARDI advice provides a structured decision-making framework to utilise the Performance Indicators and associated reference points to determine stock status classification on an annual basis (see Appendix 1).

The Performance Indicators that were initially discussed at the Black Bream Working Group meeting on 8 December 2022 were:

- 3-year mean non-targeted catch per unit effort (CPUE) using large-mesh gillnets (LMGN)
- Fishery age structures
- Relative abundance of 0+ age classes.

SARDI has advised that of these three Performance Indicators, smoothed (i.e. 3-year mean) incidental CPUE is an appropriate primary indicator for monitoring relative abundance of Black Bream and fishery age structures can be used as a secondary indicator (recent recruitment to the fishable biomass), with relative abundance of YOY Black Bream monitored over time and considered as a future Performance Indicator.

Primary Performance Indicator – Incidental CPUE

The trigger reference point (TrRP) of 0.30 kg.net-day⁻¹ represents a level of relative abundance that has not been observed in the Lakes and Coorong Fishery for Black Bream since the late 1980s when the fishery was last performing at desirable levels (Earl et al. 2022) (see Table 1). The recovery strategy should seek to continue the progressive increases in relative abundance (using smoothed incidental CPUE as a proxy) that have occurred since 2018/19 such that these are persistently (i.e., ≥3 consecutive years) above 0.30 kg.net-day⁻¹, which is then expected to support satisfactory fishery performance.

A limit reference point (LRP) of 0.20 kg.net-day⁻¹ is considered to represent a level of relative abundance at which recruitment is likely to be impaired (see Table 1), and below which targeted fishing should cease. Since the late 1980s, relative abundance has been below 0.20 kg.net-day⁻¹ in all years, except from 2000/01– 2002/03 when it ranged from 0.20–0.25 kg.net-day⁻¹.

These reference points are conservative, but appropriately reflect the current “depleted” status, the fisheries biology of Black Bream (i.e., long-lived, slow growth, episodic recruitment, resident population in a semi-enclosed system), which makes it particularly vulnerable to overfishing, and the paucity of available data which increases the uncertainty of assessment.

Secondary Performance Indicator – Fishery Age Structure

A reference point of at least two strong year class (i.e., $\geq 25\%$ of the overall age structure for each year class) in the first ten years of the fishery age structure provides a benchmark against which recent recruitment to the fishable biomass can be assessed. A prolonged period of poor recruitment (i.e., when strong age classes of fish ≤ 10 years of age are absent from the fishable biomass), particularly when the relative abundance of legal-sized Black Bream is low (i.e., smoothed incidental CPUE is below the trigger reference point of $0.3 \text{ kg.net-day}^{-1}$) is not expected to support stock recovery.

Decision making framework

The structured decision-making framework applied through reference points described in Table 1 is as follows:

Step 1 – Use the primary performance indicator (PI) (smoothed incidental CPUE) to assess relative abundance of legal-sized Black Bream against the proposed trigger reference point (TrRP) and limit reference point (LRP).

Step 2 – Use the secondary PI (number of strong cohorts) to assess levels of recent recruitment to the fishable biomass against the proposed RP.

Step 3 – Combine information from Steps 1 and 2 to assign status using the proposed stock status determination framework (Table 1).

Table 1: Black Bream stock status determination framework. The description of each status classification and its potential implications for fishery management are shown in Appendix 2. PI = performance indicator, TrRP = trigger reference point, LRP = limit reference point.

| Secondary PI - number of strong ($>25\%$) cohorts in first 10 years | Primary PI - smoothed incidental CPUE | | |
|---|--|--|---|
| | Above TrRP $\geq 0.30 \text{ kg.net-day}^{-1}$ for three consecutive years | TrRP \leftrightarrow LRP $0.20\text{--}0.30 \text{ kg.net-day}^{-1}$ for three consecutive years | Below LRP $<0.20 \text{ kg.net-day}^{-1}$ or not above LRP for three consecutive years |
| ≥ 2 | Sustainable | Sustainable | Recovering |
| 1 | Sustainable | Depleting | Depleted |
| 0 | Sustainable | Depleting | Depleted |

For further information in relation to the Performance Indicators and the reference points for the indicators see Appendix 1.

Management arrangements to recover the stock

In order to recover the Black Bream stock in the Lakes and Coorong Fishery from its current “depleted” status, management measures to reduce fishing mortality and protect spawning fish are required. While the rate or level of stock recovery cannot be determined by the management measures applied, annual monitoring of the stock using results of the Performance Indicators will determine the effectiveness of the management measures applied in recovering the Black Bream stock from its current “depleted” stock status classification.

The linking of the annual results of the Performance Indicators to stock status classifications (see Table 1) provides clear direction on the level of the recovery of the stock back to a “sustainable” stock status classification. The progressive increase in the primary performance indicator for

smoothed incidental CPUE over the previous three years suggests that recovery may be occurring.

In order to maintain the rate of recovery of the stock it is considered necessary to maintain the current management arrangements until such time as a sustainable stock status classification is reached. Therefore, under the Recovery Strategy the following current management arrangements will continue to apply:

1. Seasonal closure from 1 August to 31 January that applies to both the recreational and commercial fishing sectors within the area defining the Lakes and Coorong Fishery; and
2. Implement a 300 m spatial closure around the Lakes and Coorong barrages to prohibit fishing for both the recreational and commercial sectors.

Should high flow levels occur, defined as $>30,000 \text{ ML.day}^{-1}$ into the Coorong, the 300 m spatial closure around barrages will be removed and the 150 m spatial closure as outlined in the *Fisheries Management (General) Regulations 2017* will apply. This meta-rule is applied as it is identified that in periods of high water flow the salt wedge near barrages will be located beyond 300 m. Once high-water flows have dissipated the 300 m spatial closure around barrages will be reinstated.

Seasonal closure

The spawning period for the Lakes and Coorong stock of Black Bream extends from August to February, with a peak in spawning activity during October and November. Based on advice from SARDI the spawning closure applied from 1 August to 31 January provides the highest level of protection for spawning aggregations during the peak spawning period (Steer et al. 2023). Historically, around 75% of annual catches of Black Bream have been taken from August to February (Figure 2). A seasonal closure that prohibits the take of Black Bream during this period would provide additional protection to the spawning biomass during this critical reproductive phase. Seasonal closures would likely reduce the capture of mature Black Bream, minimise disturbance to spawning fish caused by fishing activities, as well as reduce fishing pressure/exploitation rate on the stock. The likely benefits are as follows:

- Protects spawning aggregations during the spawning season.
- Reducing the level of disturbance to Black Bream during spawning may enhance spawning success and therefore future recruitment into the fishery.
- May enhance recruitment opportunities, with enhanced recruitment increasing biomass in the fishery.
- Reduce overall fishing mortality.
- Closure is simple, easy for stakeholders to comply with and for compliance to enforce.

What are the potential impacts and other considerations?

- Commercial fishers may increase effort on the other target species during the closure period. However, the impacts of such a shift in effort is likely to be low as targeted fishing effort for Black Bream has been negligible in most years since 2008/09 (Earl et al. 2021).
- Will prohibit recreational and commercial fishers from taking Black Bream during the closure, with various social and economic impacts.

Spatial closure

The main aim of prohibiting fishing for Black Bream in this area (300 m) is to provide additional protection for Black Bream aggregating at the barrage during the spawning season and to support passage of Black Bream using fishways installed in the barrages. The likely benefits are as follows:

- Provides a refuge for juvenile and adult Black Bream in the Coorong (prevents incidental catches).

- Protects aggregations of Black Bream below the barrages where salt wedge conditions required for successful spawning often form, prior to and during the critical spawning time (1 August–31 January).
- Reduces the level of disturbance to Black Bream in these aggregation areas, which may enhance spawning success and therefore future recruitment into the fishery.
- Spatial closures may reduce overall fishing mortality.
- Closure is simple, easy for stakeholders to comply with and for compliance to enforce.

What are the potential impacts and other considerations?

- Loss of spatial access for recreational and commercial fishers.

There are other environmental management options which may assist with Black Bream recovery such as improving water flow delivery to the Coorong, particularly during the spawning period, to promote recruitment and maintain quality estuarine habitat for Black Bream in the Coorong. This would involve working closely with other agencies as it does not directly relate to the *Fisheries Management Act 2007*.

In addition, to management measures to recover the stock it should be noted that depredation of catches by Long-nosed Fur Seals (*Arctocephalus forsteri*) has impacted the Lakes and Coorong Fishery for Black Bream. Since 2009, the number of interactions between Long-nosed Fur Seals and Lakes and Coorong Fishery gillnet fishers has increased and impacts to the fishery through depredation of fish caught in gillnets have been reported (Goldsworthy and Boyle 2019). The impacts occur as seals attempt to remove fish caught in gillnets which can result in catch losses and gear damage. Reliable, quantitative information on the impacts of seals on the fishery in terms of catch losses, as well as possible changes to fisher behavior in response to the presence of seals (i.e., avoiding the long gillnet soak times required to effectively target some species, and using heavier ply mesh gillnets than is optimal for targeting some species) is not available. Nevertheless, any seal depredation of Black Bream caught in gillnets is likely to have resulted in lower catches and CPUE than would otherwise have been realised.

The need for quantitative information on the impacts of seals on the Lakes and Coorong Fishery is expected to be addressed through the collection of seal impact data by commercial fishers as part of the Fisheries Research and Development Corporation (FRDC) Project 2018-036 'Seal-fisher-ecosystem interactions in the Lower Lakes and Coorong: understanding causes and impacts to develop longer-term solutions', which commenced in 2019.

Fishery Independent Survey program

The Black Bream Working Group, which has representation from the commercial industry, recreational sector (RecFish SA), PIRSA and SARDI, has advised that Fishery Independent Surveys (FIS') should be developed and undertaken annually to improve monitoring of changes in the Black Bream stock over time.

Recently, industry and SARDI, in conjunction with PIRSA, have been undertaking various field trials to develop and refine an appropriate FIS methodology. This has involved trialing various fishing gears and identifying suitable sampling times and locations in the Coorong. Once an appropriate FIS methodology has been developed, it is intended that a fixed FIS design will be applied, with this program being funded by industry through the cost recovery process.

Once an effective fixed FIS design has been established it is intended the CPUE information from the FIS will be used as a primary Performance Indicator and incorporated in the decision making framework. The Performance Indicators' associated reference points and decision rules

as outlined in this Recovery Strategy will continue to be used until such time as the effectiveness of applying the CPUE derived from the FIS as a Performance Indicator can be determined. It is not envisaged that an effective survey design and associated reference points for a FIS will be established within at least 3 years.

Once the Black Bream stock has moved to a “sustainable” stock status classification it is intended that the management measures applied to recover the stock may be moderated to permit higher levels of exploitation. Moving to a sustainable stock status classification will also mean the purpose or intent of the Recovery Strategy has been met. Once a sustainable stock status classification has been reached consideration will need to be given to redefining the purpose or intent of the Recovery Strategy. However, continued monitoring and assessment of the Black Bream stock should be undertaken to ensure the stock retains a sustainable stock status classification.

Review of the Recovery Strategy

The Black Bream Recovery Strategy Working Group, the group overseeing the development of the Recovery Strategy, has advised that a review of the recovery strategy, including the harvest strategy component, should not be undertaken within 3 years of the enactment of the document. The 3-year timeframe provides the ability for the management arrangements to run for a period without being modified and the uptake of the CPUE from the FIS to be incorporated in the harvest strategy, should the trialing illustrate CPUE from the FIS can be used as an effective Performance Indicator.

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APPENDIX 1

ADVICE TO: PIRSA FISHERIES AND AQUACULTURE (Prof. Gavin BEGG – Executive DIRECTOR)

FROM: DR JASON EARL (SARDI AQUATIC AND LIVESTOCK SCIENCES)

SUBJECT: PERFORMANCE INDICATORS TO MEASURE THE RECOVERY OF THE BLACK BREAM STOCK IN THE COORONG

DATE: 13 FEBRUARY 2023

KEY ISSUES

- The Black Bream stock in the Coorong estuary has been classified as ‘depleted’ since 2016.
- The Bream/Flounder Working Group (BFWG) was established in October 2022 to develop a recovery strategy for the Black Bream stock in the Coorong.
- This Advice Note presents performance indicators, reference points and a stock status classification framework that could be used to monitor the recovery of the stock.

BACKGROUND

The Black Bream stock in the Coorong estuary supports important commercial and recreational fisheries and has been classified as ‘depleted’ since 2016 (Earl et al. 2016). Whilst management measures aimed at recovering the stock have been implemented in most years since 2018, there are not yet any data to demonstrate measurable improvements to the fishable biomass.

In October 2022, the Bream/Flounder Working Group (BFWG) was established. It comprises representatives from industry, PIRSA Fisheries and Aquaculture, SARDI Aquatic and Livestock Sciences, the recreational fishing sector and an independent chair. A key objective of this group is to develop a recovery strategy for Black Bream in the Coorong, which includes performance indicators (PIs) and reference points (RPs) that can be used to monitor stock recovery. At a recent BFWG meeting (8 December 2022), there was consensus among members that the following PIs should be considered:

- 3-year mean non-targeted catch per unit effort (CPUE) using large-mesh gillnets (LMGN)
- Fishery age structures
- Relative abundance of 0+ age classes

PIRSA has requested advice on the effectiveness of these PIs for monitoring stock recovery, as well as appropriate trigger (TrRP) and limit (LRP) reference points, and how they could be used to measure the recovery of the stock from its current “depleted” status and provide an objective approach for determining stock status.

RESULTS/DISCUSSION

The recovery of the Black Bream stock in the Coorong can be monitored using a primary PI to monitor relative abundance of legal-sized Black Bream, and a secondary PI to monitor recruitment

to the fishable biomass. RPs developed for each PI provide benchmarks against which the recovery of stock can be assessed.

Primary performance indicator - smoothed incidental CPUE

The long-term chronology of total catch for Black Bream in the Lakes and Coorong Fishery (LCF) indicates high variability in fishable biomass in the Coorong (Earl et al. 2016). Catches declined from 46.8 t in 1984/85 to <3 t in 1992/93 and have since been at record-low levels in most years (Figure 1). The recent low catches have been associated with low targeted effort for Black Bream, with most of the catches taken as non-targeted (incidental) catch when other species are targeted using LMGN (Appendix 1). Given the high wholesale value of Black Bream taken by the LCF (EconSearch 2022), the lack of targeting since the 1980s is likely to reflect low fishable biomass.

The three-year weighted mean non-targeted CPUE for LMGN (smoothed incidental CPUE, Figure 1) is an appropriate primary PI to monitor changes in the relative abundance of Black Bream in the Coorong, because: (1) it effectively smooths out the high variability in the annual non-targeted CPUE data; and (2) it follows a similar temporal trend to total catch ($r^2 = 0.82$, $F_{1,36} = 162.6$, $p < 0.001$, Figure 1). Recent trends in smoothed incidental CPUE indicate that relative abundance has progressively increased since 2018/19, which is consistent with reports from industry.

Annual estimates of smoothed incidental CPUE were determined for 1985/86–2021/22 using a 3-step process. First, annual estimates of non-targeted CPUE for LMGN were weighted by their respective estimates of non-targeted catch. Then, a 3-year rolling average that includes data from the years before and after was calculated. These data were then normalised to the average catch rate over the history of the fishery to provide relatable values. This process resulted in a 37-year time series of relative abundance for use in a recovery strategy, which can otherwise be masked by shorter-term trends (noise) in the annual CPUE data.

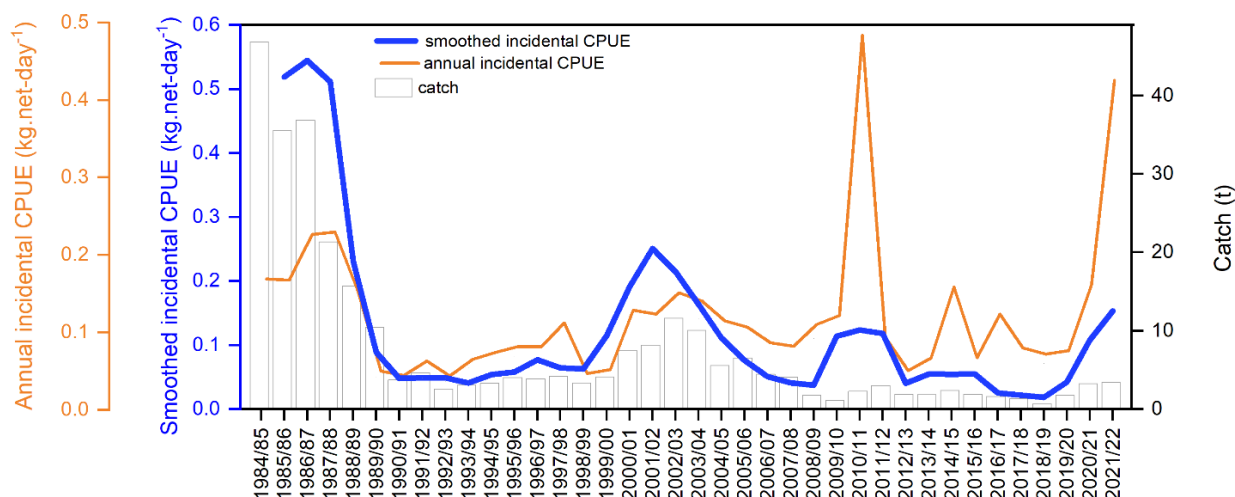


Figure 1. For Black Bream, estimates of the proposed primary performance indicator, smoothed incidental CPUE for LMGN (blue line), annual non-targeted CPUE for LMGN (orange line) and total annual catches (bars).

A proposed trigger reference point (TrRP) of 0.30 kg.net-day⁻¹ represents a level of relative abundance that has not been observed in the LCF for Black Bream since the late 1980s when the fishery last performed at desirable levels (Earl et al. 2022). The recovery strategy should seek to continue the progressive increases in relative abundance (using smoothed incidental CPUE as a proxy) that have occurred since 2018/19 such that these are persistently (i.e., ≥ 3 consecutive years) above 0.30 kg.net-day⁻¹, which is then expected to support satisfactory fishery performance.

A proposed limit reference point (LRP) of 0.20 kg.net-day⁻¹ is considered to represent a level of relative abundance at which recruitment is likely to be impaired. Since the late 1980s, relative abundance has been below 0.20 kg.net-day⁻¹ in all years, except from 2000/01–2002/03 when it ranged from 0.20–0.25 kg.net-day⁻¹. These reference points are conservative, but appropriately reflect the current “depleted” status, the fisheries biology of Black Bream (i.e., long-lived, slow growth, episodic recruitment) which makes it particularly vulnerable to overfishing, and the paucity of available data which increases the uncertainty of assessment.

Secondary performance indicator - fishery age structure

For Black Bream, age structure is an appropriate secondary PI to monitor recruitment to the fishable biomass. Annual age structures have been developed since 2008/09 through a commercial catch sampling program (Ye et al. 2022). Recent age structures have been dominated by fish <10 years of age, despite the potential for this species to reach 32 years of age (Figure 2). Rebuilding the population age structure and increasing its capacity to produce stronger year classes will be important for stock recovery and is dependent upon more fish remaining in the population for longer (Earl et al. 2016).

Estimating year class strength using age structure data is difficult because they reflect the proportional contributions of individual age classes to the catch, rather than the abundance of those age classes within the population. However, when considered in conjunction with abundance data (or proxies such as smoothed incidental CPUE), they provide a useful means for understanding interannual recruitment variability.

A proposed RP of at least one strong year class (i.e., ≥25% of the overall age structure) in the first six years of the fishery age structure provides a benchmark against which recent recruitment to the fishable biomass can be assessed. Since 2008/09, the proposed RP has been reached in five years, including three of the last four years (2008/09, 2011/12, 2017/18, 2019/20, 2020/21). A prolonged period of poor recruitment (i.e., when strong young age classes are absent) is not expected to support stock recovery.

The main limitation to the age structure indicator is the reliance on the existing commercial catch sampling program being representative of the population (Ye et al. 2022). A new fishery-independent survey (FIS) is currently being developed by industry, in conjunction with SARDI and PIRSA, to monitor changes in the relative abundance of different size/age classes of Black Bream in the Coorong. Black Bream collected during the FIS could be utilised to ensure representative sampling and adequate sample sizes of >100 fish are included in annual age structures.

Supplementary performance indicator - relative abundance of 0+ age class

The relative abundance of the 0+ age class is a useful supplementary PI to monitor future abundance and biomass for Black Bream in the Coorong. This is because the population dynamics and fishery productivity of Black Bream populations are fundamentally driven by temporally variable recruitment of 0+ fish (Sarre & Potter, 2000).

Annual research sampling to quantify the relative abundance of 0+ Black Bream has been undertaken using fyke nets at multiple sites in the Coorong estuary since 2008/09 (Figure 3, Ye et al. 2022). While this has provided a 14-year time series of fishery-independent relative 0+ abundance data, it has been undertaken during a period of low recruitment as evidenced by the stable low adult biomass over the last decade. This makes it difficult to determine meaningful RPs. As such, this PI should not be formally assessed against RPs. Nevertheless, future increases in egg production and year class strength are likely to be reflected in higher relative abundances of 0+, and this will be important supplementary information to consider when

monitoring stock recovery and determining stock status. If adequate information becomes available, this PI could be added to the proposed stock status framework below.

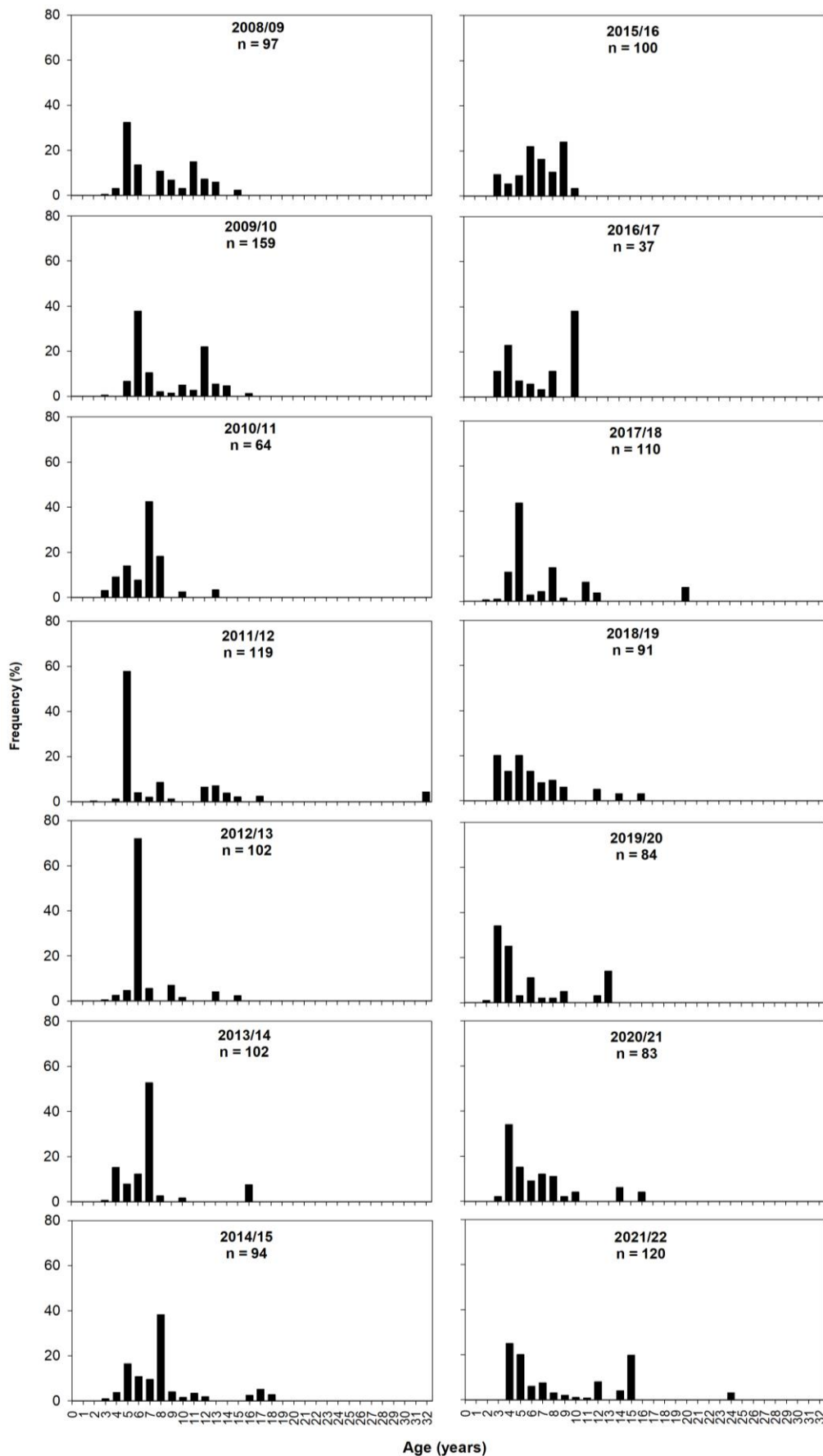


Figure 2. Annual fishery age structure of Black Bream from the Coorong estuary from 2008/09–2021/22, based on commercial fishery samples.

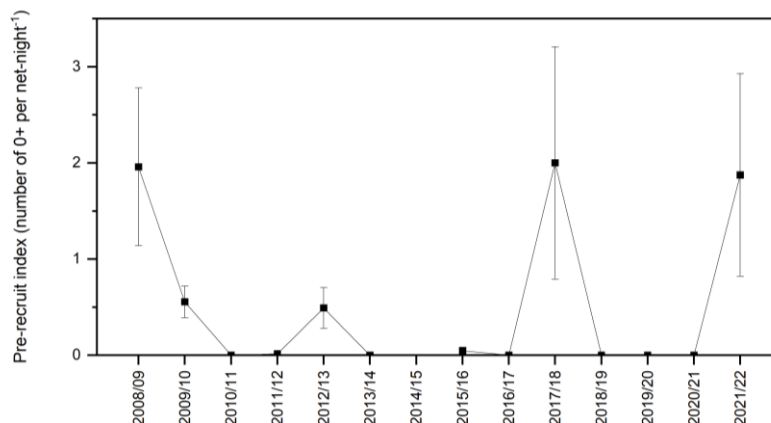


Figure 3. Relative abundance (CPUE, fish.net-night⁻¹ ± standard error) of 0+ Black Bream at eight sampling sites in the Coorong estuary from 2008/09–2021/22.

Stock status determination framework

A modified ‘traffic light’ system can be used to monitor Black Bream stock recovery relative to the proposed primary and secondary PIs and associated RPs (Table 1). It provides a structured decision-making framework that involves three main steps that can be undertaken annually to assign stock status, in accordance with the National Fishery Status Reporting Framework (Appendix 2, Piddocke et al. 2021).

Step 1 – Use the primary PI to assess relative abundance of legal-sized Black Bream against the proposed TrRP and LRP.

Step 2 – Use the secondary PI to assess levels of recent recruitment to the fishable biomass against the proposed RP.

Step 3 – Combine information from Steps 1 and 2 to assign status using the proposed stock status determination framework (Table 1).

Table 1: Proposed Black Bream stock status determination framework. The description of each status classification and its potential implications for fishery management are shown in Appendix 2. PI = performance indicator, TrRP = trigger reference point, LRP = limit reference point.

| Secondary PI - number of strong (>25%) cohorts in first 6 years | Primary PI - smoothed incidental CPUE | | |
|---|---|---|--|
| | Above TrRP ≥0.30 kg.net-day ⁻¹ for three consecutive years | TrRP ↔ LRP 0.20–0.30 kg.net-day ⁻¹ for three consecutive years | Below LRP <0.20 kg.net-day ⁻¹ or not above LRP for three consecutive years |
| ≥2 | Sustainable | Sustainable | Recovering |
| 1 | Sustainable | Depleting | Depleted |
| 0 | Sustainable | Depleting | Depleted |

Additional information obtained through the FIS currently being developed by industry in conjunction with SARDI and PIRSA (e.g., relative abundance of 0+ fish), may enable refinement of the proposed RPs for the primary and secondary PIs, and subsequent potential modification of the stock status determination framework. Once normal fishing resumes, the stock status determination framework requires re-consideration. Notably, a transition away from the three-year weighted mean non-targeted CPUE for LMGN to a more ‘direct’ measure of relative abundance (e.g., targeted CPUE) should be considered.

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Research Director, SARDI Aquatic and Livestock Sciences

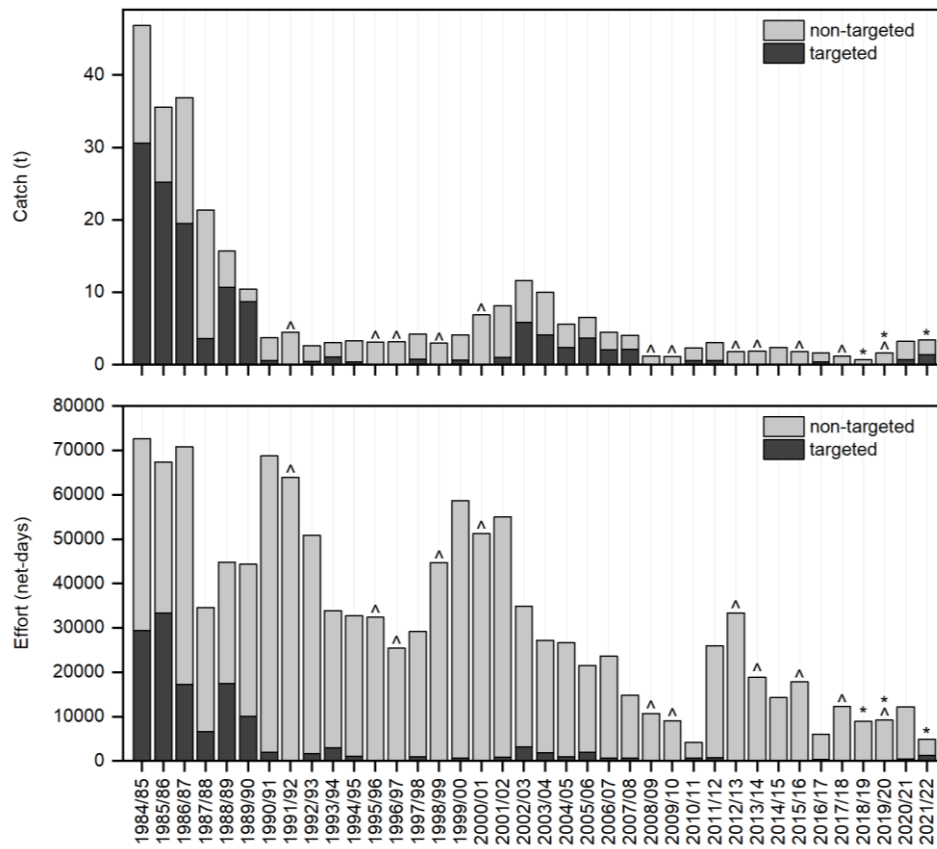
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Appendix 1 - Annual targeted and non-targeted catch (top) and effort (bottom) for Black Bream for LMGN in the LCF. Asterisks (*) indicate years in which short-term fishery closures were in place for Black Bream. Carets (^) indicate years for which targeted catch and effort data are confidential (i.e., from <5 fishers), and are therefore not shown.



Appendix 2 - Classification scheme used to assign fishery stock status.

The description of each stock status classification and its potential implications for fishery management are provided in the below table (Pidcocke et al. 2021).

| | Stock Status | Description | Potential implications for management of the stock |
|--|--------------------|---|--|
| | Sustainable | Biomass (or proxy) is at a level sufficient to ensure that, on average, future levels of recruitment are adequate (recruitment is not impaired) and for which fishing mortality (or proxy) is adequately controlled to avoid the stock becoming recruitment impaired (overfishing is not occurring) | Appropriate management is in place |
| | Depleting | Biomass (or proxy) is not yet depleted and recruitment is not yet impaired, but fishing mortality (or proxy) 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 (or proxy) is depleted and recruitment is impaired, but management measures are in place to promote stock recovery, and recovery is occurring. | Management is in place, and there is evidence that the biomass is recovering. |
| | Depleted | Biomass (or proxy) has been reduced through catch and/or non-fishing effects, such that 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 |