

Murray Cod (2023)

Maccullochella peelii



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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Stock status	Indicators
Australian Capital Territory	Australian Capital Territory	Depleted	Fishery-independent surveys
Queensland	Queensland	Undefined	Fishery-independent surveys, recreational fishing surveys
New South Wales	New South Wales	Depleted	Historical fishery catch, fishery-independent surveys, recreational fishing surveys
Victoria	Victoria	Recovering	Historical fishery catch, fishery-independent surveys, recreational fishing surveys
South Australia	South Australia	Depleted	Historical fishery catch, fishery-independent surveys

STOCK STRUCTURE

Murray Cod is the largest solely freshwater fish in Australia, occurring throughout most of the Murray–Darling system, except for the upper reaches of some tributaries in Victoria, the Australian Capital Territory, Queensland and southern New South Wales. Throughout most of its distribution in the Murray–Darling Basin there is one large genetically panmictic biological

stock [Rourke et al. 2011]. However, genetically distinct populations have been identified in the more isolated Lachlan, Macquarie and Gwydir catchments [Rourke et al. 2011]. This separation appears to be the result of restricted gene flow due to the isolated nature of these catchments [Rourke et al. 2011]. There are differences in available information, environmental conditions and management arrangements and objectives across the species' distribution in various jurisdictions. Further, genetic homogeneity could be a result of low levels of genetic interchange between functionally discrete stocks, and thus it may not be the best approach for stock discrimination to inform management.

Here, assessment of stock status is presented at the jurisdictional level—Australian Capital Territory, Queensland, New South Wales, South Australia and Victoria.

STOCK STATUS

Australian Capital Territory Murray Cod have never been commercially harvested in the Australian Capital Territory but have long been targeted recreationally both in the Murrumbidgee and Molonglo Rivers and in urban lakes. Murray Cod numbers are generally considered to be much lower than pre-European levels. The species declined considerably before 1980, with major declines occurring in the 1960s [Greenham 1981]. A recent compilation of historic newspaper reports of fish catches in the Canberra region identified abundant historical catches compared to present [Kaminskas 2015]. The Australian Capital Territory riverine population is separated from downstream populations by the impassable Burrinjuck Dam. Burrinjuck Dam was constructed in 1928 and has never had a fishway to facilitate connection of upstream and downstream populations, hence populations upstream are a separate management unit. Construction of Tantangara Dam upstream in New South Wales in 1960 diverted 99% of flow from the Murrumbidgee River into the Snowy Scheme for hydroelectricity generation and irrigation [Pendlebury et.al 1997]. Environmental flow releases have been made since 2005 and have averaged 26 gigalitres (GL) per year since 2012 as part of the Snowy Montane Rivers Increased Flows program. However, this represents less than 10% of pre Tantangara Flow with particularly significant reductions of seasonal flushes in low flow periods [Office of the Commissioner of Sustainability and Environment in prep.]. A biennial fish-monitoring program in the Murrumbidgee River from 1994 to present found little change in adult abundance [Lintermans 2000; Malam et al. 2022]. Since 2010, boat electrofishing surveys have detected regular natural recruitment and some increases in abundance and range, but mean CPUE of adult fish has remained below six fish per electrofishing through this period [Malam et al. 2022]. Extremely low flows occurred during the drought in 2019, with minimal release combined with extraction in upstream New South Wales, resulting in the river ceasing to flow in the Australian Capital Territory. This was followed by high flows in 2020–23 delivering large volumes of debris and sediment from the 2020 bushfires. Monitoring since 2019 has shown limited recruitment success in the Australian Capital Territory.

Murray Cod are the most popular recreational fishing target species as reported from a survey of Australian Capital Territory and region residents in 2016. Murray Cod were targeted by 63% of anglers, with 29% reporting captures over the 12 months period with 2% of anglers reporting harvest [Schirmer and Mylek 2016].

Stocking occurs in a number of urban lakes to provide recreational fishing opportunities, as well as to provide an apex predator for these artificial systems [Lintermans 2000; Australian Capital Territory Government 2023]. Approximately

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800,000 fingerlings have been stocked into urban lakes since the program began in 1980 [Australian Capital Territory Government 2023], with an average of 37,000 stocked annually since 2010. Stocked populations in urban lakes continue to provide localised and well-regarded recreational fisheries but are not considered to be self-sustaining. There have been no stockings of the species in riverine environments in the Australian Capital Territory, though downstream displacement from the urban lakes occurs and regular natural recruitment is recorded in the Murrumbidgee River [Australian Capital Territory Government 2023]. In recent years range expansion has been observed in the upper Murrumbidgee, with adults and juveniles being regularly recorded upstream of the Australian Capital Territory border. This expansion potentially originated from stocking by the New South Wales Department of Primary Industries upstream of the Australian Capital Territory since 2008. Larval genetic investigations have identified hybridisation between Murray Cod and Trout Cod (*Maccullochella macquariensis*) in the Australian Capital Territory [Couch et al. 2016]. This hybridisation is more likely to be of conservation concern for stocks of the endangered Trout Cod, than Murray Cod. However, the long-term effects of introgressive hybridisation on either species is unknown.

Management measures (size, gear and bag limits, closed seasons) as well as habitat enhancement projects have been implemented for both lake and riverine habitats. Area closures of no fishing or no take for Murray Cod cover approximately 25% of the Murrumbidgee River in the Australian Capital Territory. A Murray Cod Native Species Conservation Plan was produced in 2017 to manage the species, given its listing as Special Protection Status under the *Australian Capital Territory Nature Conservation Act 2014*, and reporting metrics for the species have been included in the Conservation Effectiveness Monitoring Program for aquatic and riparian ecosystems [Australian Capital Territory Government 2017; Malam et. al. 2022].

The above evidence indicates that in the naturally reproducing river populations, the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. The stock in the artificial urban lakes is entirely maintained by stocking. Current management regulations and high levels of catch and release reported by anglers should be constraining fishing mortality to enable stock recovery; however, measurable improvements are yet to be detected.

On the basis of the evidence provided above, Murray Cod in the Australian Capital Territory is classified as a **depleted stock**.

**New South
Wales**

The abundance of Murray Cod in New South Wales has declined considerably compared to what it was pre-European settlement, with concerns raised as early as 1880, primarily based on diminishing catch rates within the commercial fishery [Rowland 1989; Kearney and Kildea 2001]. While fishing effort remained relatively consistent, annual commercial catches dropped from a peak of approximately 140 tonnes [t] in the mid-1950s to under 35 t by the mid-1960s [Rowland 1989]. Annual catch remained below 35 t for most years until the closure of the commercial fishery in New South Wales in 2001 [Reid et al. 1997; Rowland 2005]. A number of management actions have been implemented to facilitate Murray Cod recovery across New South Wales [Kearney and Kildea 2004; Lintermans 2004; Forbes et al. 2020]. This has included a closed season to protect breeding fish, size and bag regulations, habitat rehabilitation, and restocking [Lintermans 2004; Rowland 2005; Forbes et al. 2020]. Over 17 million hatchery-reared fry and fingerling Murray Cod have been stocked in New South Wales waters since 1977, with the majority stocked into impoundments [11.7 million] for recreational put-and-take fisheries [Miles et al.

2023].

Following considerable growth in the recreational fishery, Murray Cod is now the inland native species most caught by anglers [Murphy et al. 2022]. The growth of the Murray Cod fishery now means it also surpasses the popularity of salmonid fisheries in New South Wales. Data on recreational fishing in New South Wales have been collected through telephone-diary surveys across several years [West et al. 2015; Murphy et al. 2020, 2022]. Fishing effort for freshwater species notably declined from 2013–14 to 2019–20, possibly due to factors such as severe drought, bushfires, flooding in 2019–21, and the COVID-19 pandemic, which impacted human mobility and fishery access [Ochwada-Doyle et al. 2023]. Recent data from 2021–22 suggests fishing effort for both river and dam/lake fisheries has remained stable [Miles et al. 2023]. The latest estimate for recreational catch of Murray Cod in New South Wales was 335,478 [\pm 71,748] individual fish, a significant increase from 2019–20 [198,045 \pm 3448] with rivers being the primary target of catch [80.2% in 2021–22] [Miles et al. 2023], but the retained components of these catches were relatively low compared to previous surveys at 17,483 [\pm 5,763] in 2021–22 and 7,597 [\pm 2,107] in 2019–20 [see Ochiwada-Doyle et al. 2023]. Few other data exist on recreational catch in New South Wales, but creel surveys in the Murray River, Lake Mulwala and Murrumbidgee River all report Murray Cod as being the primary target species [Forbes et al. 2015a, 2020; Miles et al. 2021]. These creel and telephone-diary surveys all suggest an increased focus on catch-and-release practices with only 1–5% of Murray Cod captured being retained, although many discards were mandatory releases of fish below the harvest slot [Forbes et al. 2020, Miles et al. 2021, 2023; Murphy et al. 2022].

Fishery independent monitoring has been undertaken in New South Wales since 1994, providing records for Murray Cod at over 840 sites across the state. These surveys are undertaken using a standardised electrofishing protocol which allows the calculation of catch-per-unit-effort over time and with the use of generalised additive mixed method models (GAMMs), the relative abundance and relative biomass can be calculated [Crook et al. 2023]. Analyses of the data provided no evidence of a sustained recovery in stock biomass since closure of the commercial fishery in 2001 [Miles et al. 2023]. Specifically, the overall relative biomass across New South Wales has fluctuated but has been below the 2001 level since 2020 [Miles et al. 2023]. Further, the relative biomass of mature fish [fish above 500 mm] has declined since 2001 [Miles et al. 2023]. Additionally, the length composition data for Murray Cod reveals that a substantial portion of the population falls below the lower slot limit [550 mm], with few fish within or above the 550–750 mm harvest slot, potentially indicating high fishing mortality once fish reach legal size [Forbes et al. 2015b; Miles et al. 2021, 2023]. However, compared to environmental constraints such as habitat degradation and hypoxic events, fishing mortality seems to exert a lesser influence on recruitment in New South Wales Murray Cod fish stocks [Stocks et al. 2021]. The importance of environmental constraints, compared to fishing mortality, is further supported by catchment-scale data from Crook et al. [2023] which indicates varied abundance trends, with growth in some areas and variability and declines in others over the past decade, implying probable depletion of Murray Cod biomass, alongside limited recruitment in many regions of New South Wales.

The above evidence indicates that the biomass of this stock remains depleted and that recruitment is likely to be impaired in some areas. Furthermore, 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 the basis of the evidence provided above, Murray Cod in New South Wales is classified as a **depleted stock**.

Queensland Anecdotal evidence provided by recreational anglers indicates Murray Cod populations in Queensland have declined from historical levels. It is generally accepted that native fish populations in the Murray–Darling Basin’s rivers have declined to an estimated 10% of pre-European abundances [Murray–Darling Basin Commission 2004]. The decline is thought to have resulted from a combination of flow regulation, habitat degradation, reduced water quality, barriers to movement, introduced species and historical overexploitation from illegal fishing [Murray–Darling Basin Commission 2004].

Approximately 100,000 fingerlings have been stocked each year throughout the species’ range in Queensland since the mid-1980s. A large proportion of these fingerlings are stocked into impounded waters, where natural recruitment levels are low. The Murray–Darling Basin Authority Sustainable Rivers Audit, fishery-independent monitoring and anecdotal evidence from recreational fishers suggest an increase in numbers in the Border Rivers region, which may be attributed to extensive stocking in this catchment [Butler et al. unpublished data]. The audit and other fishery-independent monitoring have been undertaken in several other rivers and catchments in Queensland. However, the lack of consistency in sampling methodologies and the low numbers of Murray Cod recorded during the monitoring makes accurate biomass estimates difficult.

The Queensland area of the Murray–Darling Basin has never supported a commercial fishery, although there is a recreational fishery throughout the northern Murray–Darling catchment. The species is mostly targeted within the Dumaresq, Macintyre, Moonie, Condamine, Balonne and Warrego Rivers and their tributaries; fish are also occasionally reported from the Paroo River [Taylor et al. 2012]. Surveys of recreational participation and catch in 2013–14 and 2019–20 [Webley et al. 2015; Teixeira et al. 2021], could not predict reliable harvest estimates for Murray Cod. An unpublished study in the Border Rivers region suggests that harvest of this species remains high, with most fish being removed from the population within two years of reaching legal size [Butler et al. unpublished data]. While this suggests that fishing pressure is high, fishing mortality cannot be accurately estimated based on existing data.

There is no published assessment of this species, 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 the basis of the evidence provided above, Murray Cod in Queensland is classified as an **undefined stock**.

South Australia In South Australia, previous stock assessments in the Murray River and Lower Lakes noted a significant decline in annual commercial landings from 140 t in the late-1950s, to less than 10 t in the 1970s–80s [Ye et al. 2000; Ye and Zampatti 2007]. Following a moratorium on commercial and recreational fishing from January 1990–December 1993, combined with high flows in the early-1990s, annual catch increased gradually to 28.5 t in 2001–02. The Murray Cod commercial fishery ceased in the South Australian Murray River in July 2003 following restructuring of inland native fisheries. Although Murray Cod was still a ‘permitted species’ to be taken in the commercial Lakes and Coorong Fishery,

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there was a temporary closure (implemented between 2010 and 2021 under the *Fisheries Management Act 2007* [South Australia]) that prohibits commercial harvest. Since 2021, the closure has been transferred to the Fisheries Management (General) Regulations 2017. Unlike other states/jurisdictions, Murray Cod had not historically been stocked in the South Australian reaches of the Murray River [Gillanders and Ye 2011]. From 2016 to 2022, however, the Department of Primary Industries and Regions and RecFish South Australia, released approximately 300,000 fingerlings across the South Australian reaches of the Murray River.

Murray Cod is a popular recreational fish species in South Australian inland waters. The 2007–08 South Australian Recreational Fishing Survey estimated that 507 Murray Cod (around 2.1 t) were harvested from the lower Murray River [Jones 2009]. No Murray Cod were reported as caught in the Lower Lakes region. There was little change in the total number of fish caught from a 2000–01 survey [Henry and Lyle 2003], but release rates increased from 48% in 2000–01 to 73% in 2007–08 [Jones 2009], potentially reducing recreational fishing mortality. The 2007–08 figures should only be considered indicative because the precision levels of all estimates were low as a result of low numbers of participants reporting Murray Cod catch, as well as low numbers of Murray Cod harvested. There was a moratorium on recreational fishing for Murray Cod in South Australia in 2009 and 2010. Since 2011, a catch-and-release fishery has been permitted for this species in the South Australian Murray River except for an annual spawning season closure (August–December), and a year-round closure in Chowilla. No catch was reported for this species in the 2013–14 recreational fishing survey [Giri and Hall 2015]. The most recent South Australian Recreational Fishing Survey in 2021–22 [Beckman et al. 2023] estimated that 2,435 Murray Cod were caught in South Australia, with 74% of the catch from the lower Murray River.

In the absence of a commercial fishery, or dedicated fishery-independent monitoring programs, the primary measures for biomass and fishing mortality are total catch and catch per unit effort (CPUE) from several long-term (8–18 year) fish assemblage monitoring projects in the lower Murray River from 2002 to 2023 [Zampatti et al. 2014; Fredberg et al. in prep., Ye et al. 2023]. From 2002 to 2013 [Zampatti et al. 2014], CPUE data from electrofishing and drum netting indicated that relative abundance was low. Length-frequency distributions indicated that fish collected in main channel habitats of the lower Murray River were predominantly large (more than 800 mm total length) and represented a broad range of age classes (8–46 years). Across the Millennium drought period of 2001 to 2010, Murray Cod recruitment was minimal in the predominantly still-water main channel habitats, although recruitment did occur in the flowing water habitats of the Chowilla anabranch system [Zampatti et al. 2014]. In subsequent years, following increases in river flow (e. g. 2010–11 and 2011–12), some juvenile fish (less than 500 mm total length) were collected in main channel habitats [Zampatti et al. 2014]. From 2014 to 2022, annual recruitment was detected in the main channel of the lower Murray River and Chowilla, in particular during 2019–20, and these cohorts have persisted in the population during subsequent years [Ye et al. 2023]. Electrofishing CPUE data from 2014 to 2023 indicate similar, albeit slightly increased, abundances of Murray Cod across the lower Murray River, relative to 2002 to 2013, reflecting some recent recruitment [Fredberg et al. in prep; Ye et al. 2023]. Overall, the data provide an indication of a stable adult population, and periodic successful recruitment, but no evidence of increases in abundance towards historical levels (i.e. prior to the mid-1960s).

The above evidence indicates that the biomass of this stock is depleted and that

recruitment is likely to be impaired. Current fishing mortality has been reduced by management to a level that should allow the stock to recover with river flow and habitat rehabilitation; however, measurable improvements are yet to be detected.

On the basis of the evidence provided above, Murray Cod in South Australia is classified as a **depleted stock**.

Victoria

In Victoria, during the 19th century, Murray Cod were considered abundant in the Loddon, Campaspe and Goulburn Rivers [Wilson 1857], yet by the middle of the 20th century, populations in these rivers had declined [Cadwallader 1977]. Commercial catches were highest between 1954–55 and 1960–61, at approximately 10–15 t per year, but reduced to about 1.5 t per year on average over the next 10 years and were negligible thereafter—a trend attributed to environmental degradation, river modification works, agricultural, urban, and industrial pollution, and overfishing [Ingram and De Silva 2004]. Prohibition of commercial netting post-1999, recreational bag and size limits, and prohibition of set lines, together with considerable stocking of hatchery-reared fish have contributed to some recovery in some rivers. However, no consistent estimates of long-term trends in harvest by anglers or population abundance have been recorded. Currently, there is no information on fishing pressure, biomass and size composition for Murray Cod in impoundments, where populations are largely sustained by stocking rather than natural recruitment. Consequently, this assessment focuses on Murray Cod in Victorian rivers only.

State-wide assessment of Murray Cod abundance was based on catch per unit effort (CPUE) from electrofishing surveys in seven indicator rivers (Broken Creek, Broken River, Campaspe River, Goulburn River, Gunbower Creek, Loddon River and Ovens River). Together these rivers represent approximately 44% of the habitat known to have been historically occupied by Murray Cod in Victoria [Murray–Darling Basin Authority 2021]. To provide a benchmark for assessing changes in Murray Cod biomass over recent years (2015 to present), CPUE from these surveys was compared with a reference-level CPUE, calculated as the average CPUE over the period 1990 to 2015.

Although electrofishing surveys have been infrequent and irregular, since about 2014–2015 CPUE appears to have increased relative to the reference period in most indicator rivers (except the Loddon River) [Bell et al. 2023]. Prior to this, CPUE trends showed abundance was declining in the Broken and Kiewa Rivers [Davies et al. 2012]. During the period 2014 to 2022, CPUE in the Broken Creek, Broken River, Campaspe River, Goulburn River, Gunbower Creek and Ovens River has shown two to five-fold increases and has been above the reference level [Bell et al. 2023]. However, CPUE in the Loddon River has remained low for most of the last decade [Bell et al. 2023].

Murray Cod have been stocked into Victorian rivers since 1979 to enhance populations. During the 1990s and 2000s, 0.06–0.4 million were stocked annually but since then the number of fish stocked has increased substantially and, in the last six years, (2017–22) 1.16–3.65 million were stocked annually into the state's water bodies, including six of the seven indicator rivers (excluding the Ovens River). Murray Cod less than one year old were present in most rivers in recent years indicating either natural recruitment (Ovens River) or presence of stocked hatchery-reared fish [Bell et al. 2023]. Anecdotal reports from anglers also indicate increased recreational catches from waters where stocking has occurred. However, the extent of the contribution made by stocked fish to population trends across the river systems described above is variable

and uncertain. For example, although the Broken Creek and River and Goulburn River are stocked annually, otolith microchemistry analyses or presence/absence of hatchery calcein markers showed that most Murray Cod sampled from these rivers were naturally spawned [Tonkin et al. 2019]. These results indicate that CPUE increases in the Broken Creek, Broken River and Goulburn River, are primarily due to natural recruitment rather than stocking. In the Ovens River, the CPUE increase is due solely to natural recruitment as no stocking has occurred in that waterway.

The last State-wide recreational catch survey, conducted two decades ago in 2000–01, estimated that 11,943 Murray Cod were harvested, equating to around 27.4 t [Henry and Lyle 2003]. Subsequently, between 2006 and 2008, creel surveys conducted on selected river reaches including the Goulburn, Ovens, Loddon and Murray Rivers [Fulton 2011] estimated total catch at more than 98,000 Murray Cod, of which just over 6,500 were retained. There is no more recent information on recreational harvest or effort at state level. Numerous measures are implemented to limit fishing mortality. Murray Cod are protected in Victorian rivers by a fishing slot limit, with a minimum size limit of 55 cm and a maximum size limit of 75 cm between which fish may be legally retained. A closed season applies from 1 September to 30 November inclusive [Victorian Fisheries Authority 2021]. In recent years most Murray Cod were below the minimum legal size limit of the fishing slot [Bell et al. 2023].

Mature fish (> 55 cm) were present in six of the seven indicator rivers (except the Loddon River), but in low proportions in most rivers. Between 2015 and 2022, the proportion of fish that were mature was > 5% in six rivers, > 10% in most years in three rivers and exceeded 20% in some years in three rivers.

The increasing CPUE trends in six of seven indicator rivers suggest that recovery of Murray Cod abundance and biomass has been occurring since at least 2014. Natural recruitment, substantial stocking of hatchery-reared Murray Cod into Victorian waters during the past two decades, and current fishing regulations appear to have facilitated some degree of stock recovery in most rivers. However, there are still low numbers of large mature fish in most rivers.

The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. However, over the past five years, electrofishing CPUE and studies of the relative contributions made by stocked fish or natural recruitment to the populations indicate that the stock is recovering. The above evidence also indicates that the current level of fishing mortality should allow the stock to continue to recover from its recruitment impaired state.

On the basis of the evidence provided above, Murray Cod in Victoria is classified as a **recovering stock**.

BIOLOGY

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Murray Cod biology: Information on Murray Cod longevity and size and age at maturity is provided in the Biology Table below [Whitley 1955; Pollard 1966; Lake 1967; Rowland 1985; Anderson et al. 1992; Gooley et al. 1995; Rowland 1998a; King et al. 2009; Koehn et al. 2020; Butler et al. unpublished data].

Additional summary points on Murray Cod biology and ecology are:

- Murray Cod are a demersal species [Koehn 2009a] that prefer the main channel of rivers, flowing anabranches and creeks [Humphries et al. 1999; King 2004; Koehn 2009b; Leigh and Zampatti 2013], within which both juveniles and adults have an affinity for hydraulically diverse lotic (i.e. flowing) habitats with abundant physical habitat cover, particularly large woody debris [Boys and Thomas 2006; Jones and Stuart 2007; Koehn 2009b; Koehn and Nicol 2013]. Habitat alteration, such as removal of snags from the main channel and anabranches, and loss of fast-flowing water habitats due to river regulation, water extraction or drought will decrease habitat availability and likely have negative impacts on Murray Cod populations.

- Murray Cod spawn in spring at water temperatures > 15°C, with adhesive eggs laid in a nest that is guarded until the larvae leave and drift in the water column [Rowland 1998b; Humphries 2005; Koehn and Harrington 2005, 2006; Koehn et al. 2020].

- Enhanced recruitment of Murray Cod in lowland areas has been linked to increased river flow or flooding [King et al. 2009; Ye and Zampatti 2007]. The exact mechanism driving recruitment is unknown, but it is likely to be linked to flowing water environments [Zampatti et al. 2014] and potentially an increase in food resources for larvae and juveniles following high river flows and floodplain inundation [King et al. 2009].

- In lowland rivers, adult Murray Cod can undertake small- to large-scale movements (up to 120 km) from their home sites within the main river channel and anabranches, and between these habitats [Koehn et al. 2009; Leigh and Zampatti 2013; Koehn and Nicol 2016]. Lateral and longitudinal disconnection (for example, by structures or reduced flow) will alter the movement patterns of the species [Carpenter-Bundoo et al. 2020]. In upland rivers, movements are likely to be limited by natural barriers such as gorges and waterfalls.

- Cold-water pollution, due to low-level releases from dams, can limit spawning and egg and larval survival [Todd et al. 2005; Sherman et al. 2007], affect juvenile growth rates [Whiterod et al. 2018], adult movement behaviour and survival of juvenile fish [Tonkin et al. 2020], and has been deemed responsible for the loss of Murray Cod populations downstream of a number of major impoundments [Lugg and Copeland 2014].

- Anoxic blackwater events in lowland environments that may occur as a result of flooding after prolonged periods of low flow, and other poor water quality events such as the 2019 fish kills in the lower Darling River, can result in considerable mortality of Murray Cod [Koehn 2005; King et al. 2012; Leigh and Zampatti 2013; Thiem et al. 2017; Vertessy et al. 2019].

Species	Longevity / Maximum Size	Maturity (50 per cent)
Murray Cod	At least 48 years, approximately 1,800 mm TL , 83 kg	First maturity at approximately 4–5 years, 400–600 mm TL for both sexes. Variable across geographic regions.

DISTRIBUTION

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Distribution of Murray Cod based on reported catch

TABLES

Fishing methods	Australian Capital Territory	New South Wales	Queensland	South Australia	Victoria
Commercial					
Unspecified	✓	✓	✓	✓	✓
Recreational					
Hook and Line	✓	✓	✓	✓	✓

Management Methods	Australian Capital Territory	New South Wales	Queensland	South Australia	Victoria
Recreational					
Area closures	✓	✓		✓	
Bag limits	✓	✓			✓
Bag/possession limits			✓		
Gear restrictions			✓		✓
Licence					✓

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Mandatory catch and release	✓				
Possession restrictions				✓	
Seasonal closures	✓	✓		✓	✓
Seasonal or spatial closures			✓		
Size limit	✓	✓			✓
Size limits			✓		

Catch	Australian Capital Territory	New South Wales	Queensland	South Australia	Victoria
Commercial		0 t	0 t	0 t	0 t
Indigenous	Unknown	Unknown	Unknown	Unknown	Unknown
Recreational	Unknown	397 941 individual Murray Cod, with ~8 per cent of these harvested.	Unknown	Unknown	Unknown

Commercial (Management Methods). Murray Cod captured by the Lakes and Coorong Fishery are currently protected under South Australian fishing regulations.

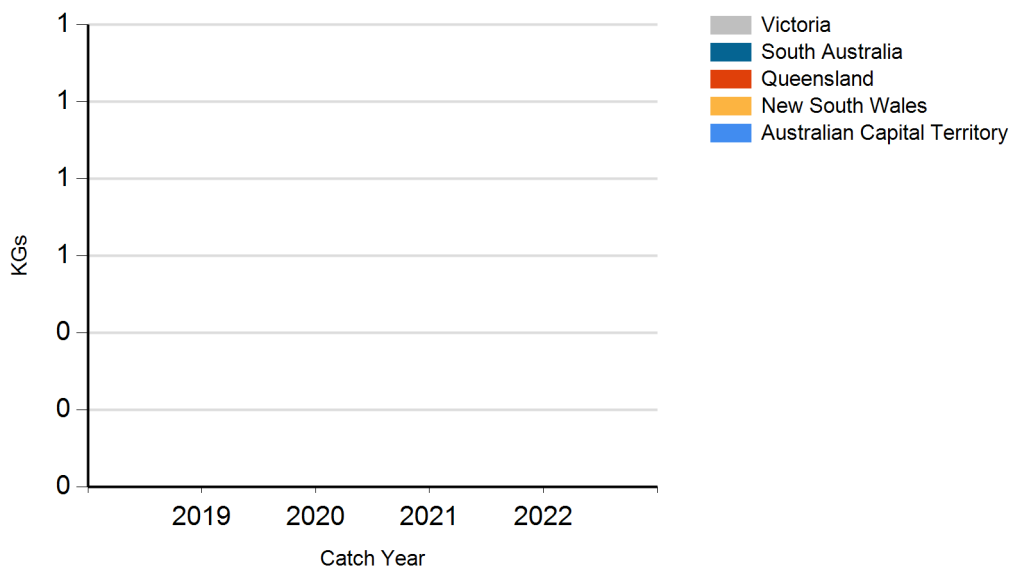
Indigenous (Management Methods). Indigenous fishers who can satisfy the requirements of the *Native Title Act 1993* (Cth) in relation to their connection to the specific area or waters may take sufficient Murray Cod to satisfy their customary, non-commercial domestic needs in South Australia and Queensland. Indigenous fishers who do not satisfy these requirements are subject to the standard recreational bag limits, size limits and closures.

Queensland – Indigenous (Management Methods). For more information see: <https://www.daf.qld.gov.au/business-priorities/fisheries/traditional-fishing>

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

South Australia and Australian Capital Territory - (Management Methods). Catch and release zones exist for Murray Cod in these jurisdictions. Murray Cod can be targeted and caught but not possessed or retained in these zones. Seasonal closures may also apply.

CATCH CHART



Commercial catch of Murray Cod—no commercial fishery

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