

Barramundi (2023)

Lates calcarifer



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STOCK STATUS OVERVIEW

| Jurisdiction | Stock | Stock status | Indicators |
|--------------------|------------------------------|--------------|--|
| Western Australia | Western Australia | Sustainable | Catch, effort, CPUE |
| Northern Territory | Northern Territory | Sustainable | Stock assessment, biomass, fishing mortality, catch, catch rate |
| Queensland | Central East Coast | Sustainable | Stock assessment, catch, effort, standardised catch rate |
| Queensland | Mackay | Sustainable | Stock assessment, catch, effort, standardised catch rate |
| Queensland | North-East Coast | Sustainable | Stock assessment, catch, effort, standardised catch rate, length and age frequencies |
| Queensland | Northern Gulf of Carpentaria | Sustainable | Stock assessment, catch, effort |
| Queensland | Princess Charlotte Bay | Undefined | Catch, effort |
| Queensland | South-East Coast | Negligible | Catch |

STATUS OF AUSTRALIAN FISH STOCKS REPORT
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| | | | |
|------------|------------------------------|--------------------|--|
| Queensland | Southern Gulf of Carpentaria | Sustainable | Stock assessment, catch, effort, standardised catch rate, length and age frequencies |
|------------|------------------------------|--------------------|--|

STOCK STRUCTURE

Barramundi (*Lates calcarifer*) are a large, predatory fish distributed across most of the Indo-West Pacific region, from the Arabian Gulf to China, Taiwan, Papua New Guinea and northern Australia [FAO 2020]. They are protandrous hermaphrodites (maturing as males first, then changing sex to female; Moore [1979]) that exhibit individual variation in habitat utilisation/migratory patterns during their life history [Crook et al. 2016]. The productivity of Barramundi populations is closely linked to variation in rainfall, with wetter years linked to enhanced juvenile growth, recruitment, and fishery productivity [Staunton-Smith et al. 2004; Robins et al. 2005; Halliday et al. 2010; Leahy and Robins 2021; Crook et al. 2022].

The genetic stock structure of Barramundi in Australia is complex. Keenan [1994] described 16 subpopulations of this species (through allozyme analyses) across most of its Australian range, with each subpopulation encompassing an individual catchment, or several adjacent catchments. More recently, Jerry et al. [2013] and Loughnan et al. [2019] described 21 distinct subpopulations (through microsatellite analyses) from samples collected over a wider geographic range than that of Keenan [1994]; noting that both recent works were based on the same set of tissue samples, many of which were initially collated by Keenan [1994].

Difficulties in obtaining relevant biological and catch-and-effort information from each biological stock in Western Australia and the Northern Territory precludes individual assessments of these stocks. Therefore, the assessments for these jurisdictions were undertaken at the level of the management unit (Kimberley Gillnet and Barramundi Managed Fishery, Western Australia; and Barramundi Fishery, Northern Territory). For Queensland, six biological stocks described by Keenan [1994] [Fisheries Queensland 2010] with an additional seventh stock of ‘vagrant’ fish, that venture south of 26° South have been assessed. An eighth stock of Barramundi was identified in Queensland in more recent studies [Jerry et al. 2013; Loughnan et al. 2019], however tag-recapture information indicates that the boundaries of these subpopulations are somewhat porous, with individual fish moving between subpopulations [Infotish Australia 2014, 2020]). Additionally, there are practical limits on the number of assessments that can be undertaken on this species. The seven biological stocks assessed in Queensland are: Southern Gulf of Carpentaria, Northern Gulf of Carpentaria, Princess Charlotte Bay, North-East Coast, Mackay, Central East Coast and South-East Coast.

Here, assessment of stock status is presented at the management unit level—Kimberley Gillnet and Barramundi Managed Fishery (Western Australia), Barramundi Fishery (Northern Territory); and the biological stock level—Southern Gulf of Carpentaria, Northern Gulf of Carpentaria, Princess Charlotte Bay, North-East Coast, Mackay, Central East Coast and South-East Coast (Queensland).

STOCK STATUS

Central East Coast The most recent stock assessment included data up to 2017 and estimated the exploitable biomass of the stock to be 71% of unfished levels, with egg production at 50% [Streibert et al. 2019]. High river flow increases catchability and produces strong year-classes for this species [Staunton-Smith et al. 2004]. Floods in 2010, 2011, 2013 and 2017 in this area, affected catch and recruitment into the fishery. In 2011, there was a five-fold increase in commercial catch, mainly due to stocked fish from Lake Awoonga and other impoundments moving into the stock following the flood in late 2010 and early

2011. Benefits from these events are no longer directly evident and catches and catch rates have declined. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

Reductions in net licences and exclusion of commercial fishing from the main Barramundi fishing area in late 2015 has reduced commercial fishing pressure. Size limits and seasonal closures for recreational and commercial Barramundi fishing ensure a proportion of the spawning stock is protected [Russell and Garrett 1985]. Standardised catch rates for the 2021 calendar year, exceeded pre-flooding levels. The average retained catch (2017–21) from recreational, charter and Indigenous fishers combined is estimated 11 t. Although recreational harvest could not be estimated at stock level within acceptable error level from the 2019–20 survey [Teixeira et al. 2021], results suggest increasing harvest and release numbers. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the Central East Coast biological stock is classified as a **sustainable stock**.

Mackay

The most recent stock assessment on 2017 data estimated the exploitable biomass of the stock to be 59% of unfished levels, with egg production at 43% [Streipert et al. 2019]. Reported commercial catch in 2021–22 from the Mackay stock has reduced to 37% of the from the historical high level of 101 t in 2015–16, coinciding with reductions in licences and substantial expansion of closed areas. Standardised catch rates rose though the 1992–93 to 2021–22 time series. Increased catchability and productivity following the 2010–11 high rainfall event caused significantly elevated standardised catch rates until 2017. The 2021 catch rate remains above the levels reported prior to the flooding, from 1988 to 2010. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

Days fished have fluctuated along with annual catch over the past 20 years. There has been a generally decreasing trend in the number of operators and number of days fished since 2015–16 when a net free zone and associated licence buy backs occurred. The retained catch from 2019–20 from domestic recreational, charter and Indigenous fishers combined [Teixeira et al. 2021].

is estimated at 13 t. Queensland's 580–1200 mm slot size limits for Barramundi ensures the protection of a proportion of the spawning stock by protecting both small males and large females. Seasonal (1 November–1 February) and spatial closures reduce fishing pressure. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

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

North-East Coast

The most recent stock assessment using 2017 data estimated the exploitable biomass of the stock to be 53% of unfished levels, with egg production lower at 25% [Streipert et al. 2019]. Commercial catches have fallen each year from 2017–18 to 2021–22. However, the standardised catch rate has maintained a relatively stable trend since the 2004 calendar year, with the exception of a notable spike in 2011 due to flooding increasing the catchability of Barramundi. Fishery dependant monitoring [Fishery Monitoring 2010] derived

age frequencies (based on annual age-length key and length frequency data) show continued recruitment into the fishery. Biological monitoring a [Fishery Monitoring 2010] and anecdotal reports indicate there are large (> 1000 mm) fish present in the stock. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

In September 2021 a regional quota system based on management regions was introduced for the East Coast Inshore Fin Fish Fishery. The number of active commercial operators accessing this stock over the last five years has been the lowest since 1998 when compulsory logbook records began. The number of days fished commercially has also declined to 881 days in 2021–22, the lowest since 1992–93. Data from the 2019–20 survey [Teixeira et al. 2021], estimated recreational charter and Indigenous 2019–20 harvests combined are 48 t and an additional 42,000 Barramundi were released after capture. Although Barramundi have a high release survival rate (approximately 90%) [Halliday et al. 2001; de Lestang et al. 2004] a proportion of released fish should be considered in fishing mortality estimates. Spatial closures for the stock have been demonstrated to benefit Barramundi [Ley and Halliday 2004]. Queensland size limits (580–1,200 mm slot limit) protect a proportion of the spawning stock. This is because individuals can attain sexual maturity as males at 535 mm [Garrett and Russell 1982] but they do not reach a 50% female ratio until 920 mm [Budd et al 2022]. A seasonal closure from 1 November–1 February protects Barramundi during the October–February spawning season [Russell and Garrett 1985]. Stocked fish contribute to the biomass of this stock [Leahy et al. 2022]. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the North-East Coast biological stock is classified as a **sustainable stock**.

Northern Gulf of Carpentaria

The small river systems in the Northern Gulf of Carpentaria are unlikely to support a high biomass of Barramundi. The most recent stock assessment on 2017 data estimated the exploitable biomass of the stock to be 73% of unfished levels, with egg production at 61% [Streipert et al. 2019]. Commercial catch reported in 2021–22 was below 2017 levels at 12 t. Catch peaked in 2015–16 to 2019–20, averaging 29 t per year. The 10 years previous and three years since were approximately half this level at 14 to 15 t. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

Commercial fishing is still relatively low within the region, with only five active operators and 161 fishing days reporting catch in 2021–22. Recreational harvest could not be estimated at stock level within acceptable level of error. A seasonal closure during October–January protects the stock during the spawning season. Biological evidence indicates that the growth rate of fish in this stock may be slower and fish may mature earlier than in other stocks [Davis 1987], therefore the Queensland minimum size limit (580 mm) protects a much larger proportion of the spawning population. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the Northern Gulf of Carpentaria biological stock is classified as a **sustainable stock**.

Northern Territory

The most recent assessment of the Barramundi Fishery (Northern Territory) management unit (using data to the conclusion of 2019) indicated that this stock was impacted by high fishing pressure in the late 1970s and early 1980s, falling to 36% of the unfished (1950) biomass [Grubert et al. unpublished]. However, there has been a strong recovery since that time, with the annual biomass as a proportion of virgin biomass exceeding 60% for the last two decades, reaching 88% by the end of 2019. Commercial effort has declined substantially during the last decade due to a range of operational challenges (e.g., declining profitability, the loss of access to fishing grounds, the Covid-19 pandemic). At the time of the most recent (2019) assessment, annual commercial catch was 276 t, having declined from 736 t in 2012. Since that time, commercial catch has declined further to historic lows of 176 t in 2022.

Monitored stocks have a broad length and age distribution, with little sign of a reduction in the proportion of older age classes [NTG 2018]. The above evidence indicates that the biomass of the stock is unlikely to be depleted and that recruitment is unlikely to be impaired.

The contemporary (2019) fishing mortality rate, as a proportion of fishing mortality at maximum sustainable yield (*MSY*), was estimated at 19%, roughly one fifth of the rate required to achieve *MSY* [Grubert et al. unpublished]. Recaptures from tagging programs also suggest that the annual harvest rate for all sectors combined is consistently below five per cent. The above evidence indicates that the current level of fishing pressure is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, the Barramundi Fishery (Northern Territory) management unit is classified as a **sustainable stock**.

Princess Charlotte Bay

The Princess Charlotte Bay stock extends around 600 km from Cape Bedford north of Cooktown to the tip of Cape York [Keenan 1994]. Recreational harvest could not be estimated at stock level within acceptable error level from statewide or national surveys. Recreational catch surveys from 1986 to 1991 estimated the catch of Lakefield National Park visitors at between 4.4 t and 9.4 t by 1,150 to 2,450 visitors per year [Russell and Hales 1993]. In 2017 over 18,000 visitors camped in national parks in this region [QDES 2018], and off-park accommodation continues to expand. Extrapolation of the data is not possible due to the possible changes in length of stay and reasons for visits.

The commercial net fishery peaked in 1999–2000 at 59 t. However, recent commercial harvest has been very small (averaging less than 6 t per year over the last 10 years), in 2020–21 no commercial catch was reported as commercial fishing operations no longer harvest this area. Large spatial closures were introduced in Princess Charlotte Bay in 2009, to limit fishery interactions with protected species and restricted fishing to very low levels. The introduction of a regional quota system in 2021 and the purchase of the vast majority of quota by WWF as a conservation measure further reduced the fishing effort. Fishing pressure is low and therefore biomass is unlikely to be impacted and primarily driven by the environmental factors. However, there is insufficient information to meet the requirements of status classifications for this stock.

On the basis of the evidence provided above, the Princess Charlotte Bay biological stock is classified as an **undefined stock**.

- South-East Coast** Stock status for the Queensland South-East Coast biological stock is reported as Negligible. Suitable habitat for Barramundi is limited in this area, and this stock is therefore considered a marginal or extralimital population. The stock is not subject to targeted fishing. Over the last decade, the average commercial catch was 0.045 t, with three of those years recording no harvest. Phone and boat ramp surveys have not recorded any recreational catch. Fishing is unlikely to be having a negative impact on the stock.
- Southern Gulf of Carpentaria** The biomass of the southern Gulf of Carpentaria stock was considered to be heavily depleted in the early-1980s [Welch et al. 2002; Campbell et al. 2017], prompting management changes to aid recovery [Healy 1992]. The commercial catch exhibited an increasing trajectory, from 304 t in 1993–94 to 805 t in 2011–12. Subsequently, both catches and standardised catch rates experienced a substantial decline, reaching a low of 340 t in 2014–15. However, a notable resurgence in commercial catches and standardised catch rates has been observed since then. In 2021–22 commercial harvest was 675 t, and the highest standardised catch rate in the entire time series was the 2021 calendar year, underscoring this positive trend. Fishery-dependent monitoring [Fisheries Queensland 2010] indicated a broad spread of ages are present in the fishery. The most recent stock assessment on 2017 data estimated the exploitable biomass of the stock to be 39% of unfished levels, although egg production was lower at 27% [Streipert et al. 2019]. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired.
- Fishing pressure on this stock is moderated by the existing size limits (580–1,200 mm slot limit). These size limits serve to safeguard large, highly fecund females [Davis 1984], while also permitting most males to reach maturity before they enter the fishery [Davis 1982]. It's important to note that the transition to a 50% ratio of females in southern Gulf of Carpentaria barramundi occurs at sizes ranging from 770 to 920 mm, with the specific timing varying by location [Budd et al. in 2022]. Fishing pressure is also reduced by a seasonal closure during most of the spawning season and by spatial closures for commercial fishing that include all freshwater reaches in the stock area. Recreational harvest could not be estimated at stock level within acceptable level of error but is considered to average at around 100 t [Streipert et al. 2019] and may have been significantly lower during the covid travel restrictions in 2020 to 2022. Fishery-dependent monitoring [Fisheries Queensland 2010] indicates there is no evidence of truncation of fish sizes and size frequency distributions have been consistent from 2015–22. The above evidence indicates that the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.
- On the basis of the evidence provided above, the Southern Gulf of Carpentaria biological stock is classified as a **sustainable stock**.
- Western Australia** Barramundi is an indicator species [see Newman et al. 2018] for the North Coast Nearshore and Estuarine Resource (NCNER) and as such the stock status of Barramundi subsequently determines the risk-level for the sustainability of the suite of species in the NCNER. Barramundi is currently only landed commercially in the Kimberley Gillnet and Barramundi Managed Fishery (KGBMF). The harvest strategy of the KGBMF is based on a constant commercial catch policy, where the annual commercial catches of Barramundi are allowed to vary within a target catch range, based on a historical catch range in a period when the fishery was

stable (1989–99), and exploitation was considered sustainable. The target catch range was calculated as 33–44 tonnes (t) [Trinnie et al. 2023] with a limit reference range of 23–54 t. This assessment of Barramundi is supported by predictions for biomass and harvest rate from a data-limited Catch-MSY assessment model, with catches compared periodically to a model prediction for maximum sustainable yield (MSY).

In 2022, commercial Barramundi catch within the KGBMF of 46.7 t was above the upper end of the target catch range, but below the upper end of the limit range. Over the past 10 years, commercial catches have generally been between the upper end of the target catch range but below upper end of limit range. Commercial catch per unit effort (CPUE) over the last 10 years has generally been increasing, reaching historically high levels. Although there is some uncertainty regarding the reliability of this CPUE as an index of abundance for Barramundi, the trend is not indicative of a substantive decline in abundance of this species in recent years. Moreover, overall effort directed towards this species has declined, in part due to two commercial licenses being removed in 2013 from the Broome coast area of the fishery [Newman et al. 2022], along with closures to commercial gillnet fishing along the Pilbara coast and Eighty-mile beach areas in the mid-2000s. This large area of the NCNER is now only exposed to recreational, charter, and indigenous fishing.

Catch levels of Barramundi across the NCNER over the last 10 years (2013–22) have ranged from 42.7–78.9 t, with a mean annual catch of 60.2 t, with the latter value slightly higher than the average catch for the previous 10 years at 55.4 t. Barramundi are mostly caught by commercial fishing, with the recreational and charter component of the total catch averaging approximately 16% in the past 10 years. The Catch-MSY model applied to annual catch data for Barramundi since 1976, indicate that catches since the mid-1990s remained at or below the mean predicted value for maximum sustainable yield (MSY). This is consistent with the predicted values for biomass in recent years being slightly above BMSY, and fishing mortality remaining below FMSY. However, it is important to recognise that Catch-MSY is a data-limited technique with relatively strong assumptions, dependent on user inputs. For this assessment, these included specified ranges for initial depletion (0.4–0.8, based on assumed catch pre-1976), final depletion (0.15–0.7, calculated by the program based on recent catches relative to maximum recorded annual catch) and low resilience ($r=0.1$ –0.6, noting that this species has a longevity of >30 years). The above evidence indicates that the biomass of this stock is unlikely to be depleted and recruitment is unlikely to be impaired. Furthermore, the current level of fishing mortality is unlikely to be sufficiently high to cause the stock to become recruitment overfished.

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

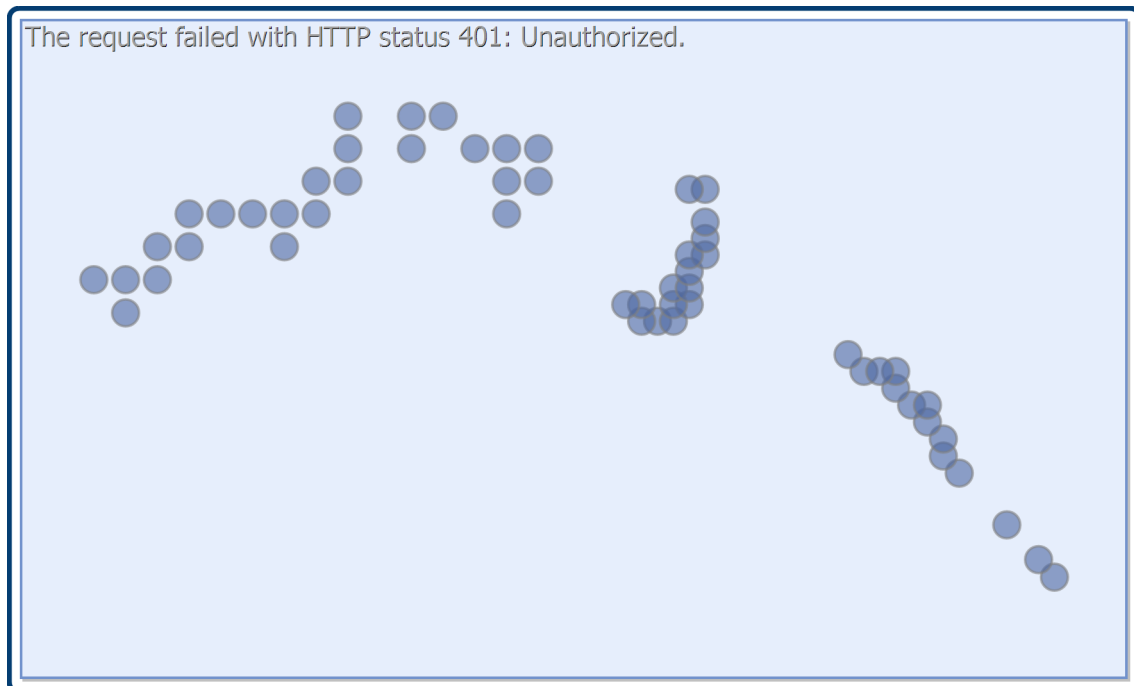
BIOLOGY

Barramundi biology [Davis 1982; Roberts et al. 2021; Budd et al. 2022]

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| Species | Longevity / Maximum Size | Maturity (50 per cent) |
|------------|--------------------------|---|
| Barramundi | 35 years, 1,500 mm TL | <p>Maturity (50%) Northern Territory: Males 2–5 years, 730 mm TL Females 5–7 years, 910 mm TL.</p> <p>Queensland: Males 2–5 years, 640 mm TL, Females 5–10 years, 770–920 mm TL.</p> <p>Western Australia: Females 7 years, 930 mm.</p> |

DISTRIBUTION



Distribution of reported commercial catch of Barramundi

TABLES

| Fishing methods | Northern Territory | Queensland | Western Australia |
|-------------------|--------------------|------------|-------------------|
| Charter | | | |
| Handline | | ✓ | ✓ |
| Hook and Line | ✓ | ✓ | ✓ |
| Commercial | | | |
| Gillnet | ✓ | | ✓ |

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| | | | |
|---------------------|---|---|---|
| Net | | ✓ | |
| Unspecified | ✓ | | |
| Recreational | | | |
| Handline | ✓ | ✓ | ✓ |
| Hook and Line | ✓ | ✓ | ✓ |
| Net | ✓ | | |
| Spearfishing | ✓ | ✓ | ✓ |

| Management Methods | | | |
|------------------------------|---------------------------|-------------------|--------------------------|
| | Northern Territory | Queensland | Western Australia |
| Charter | | | |
| Bag limits | | | ✓ |
| Bag/possession limits | | ✓ | |
| Boat limits | | ✓ | |
| Gear restrictions | ✓ | ✓ | |
| Limited entry | ✓ | | ✓ |
| Passenger restrictions | ✓ | | ✓ |
| Possession limit | ✓ | | ✓ |
| Processing restrictions | | ✓ | |
| Seasonal closures | ✓ | | |
| Seasonal or spatial closures | | ✓ | |
| Size limit | ✓ | | ✓ |
| Size limits | | ✓ | |
| Spatial closures | ✓ | | ✓ |
| Spatial zoning | ✓ | | ✓ |
| Commercial | | | |
| Gear restrictions | ✓ | ✓ | ✓ |
| Harvest Strategy | | ✓ | |

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| | | | |
|--|---|---|---|
| Individual transferable quota | | ✓ | |
| Limited entry | ✓ | ✓ | ✓ |
| Mesh size regulations | ✓ | ✓ | |
| Processing restrictions | | ✓ | |
| Seasonal closures | ✓ | | ✓ |
| Seasonal or spatial closures | | ✓ | |
| Size limit | ✓ | | ✓ |
| Size limits | | ✓ | |
| Spatial closures | ✓ | | ✓ |
| Spatial zoning | ✓ | | ✓ |
| Total allowable catch | | ✓ | |
| Vessel restrictions | ✓ | ✓ | ✓ |
| Recreational | | | |
| Bag limits | | | ✓ |
| Bag/possession limits | | ✓ | |
| Boat limits | | ✓ | |
| Gear restrictions | ✓ | ✓ | ✓ |
| Licence | | | ✓ |
| Licence (Recreational Fishing from Boat License) | | | ✓ |
| Possession limit | ✓ | | ✓ |
| Processing restrictions | | ✓ | |
| Seasonal closures | ✓ | | |
| Seasonal or spatial closures | | ✓ | |
| Size limit | ✓ | | ✓ |

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| | | | |
|-------------------------|---|---|---|
| Size limits | | ✓ | |
| Spatial closures | ✓ | | ✓ |
| Spatial zoning | ✓ | | |

| Catch | | | |
|---------------------|---------------------------|--------------------------|--------------------------|
| | Northern Territory | Queensland | Western Australia |
| Charter | 24.5 t | included in recreational | 4.58 t |
| Commercial | 222.794 t | 788.749 t | 48.9735 t |
| Indigenous | 110 t (in 2000) | Unknown | Unknown |
| Recreational | 155 t (in 2010) | 126 t (2019–20) | 5.81 t ± 1.77 se |

Western Australia – Recreational (catch). Boat-based recreational catch between 1 September 2020 and 31 August 2021 from Ryan et al. [2022]. Please note that catches of Barramundi are underestimates as shore-based and boat-based fishers that only operated in freshwater were out of scope of the survey.

Western Australia – Recreational (management methods). A Recreational Fishing from Boat Licence is required for the use of a powered boat to fish or to transport catch or fishing gear to or from a land-based fishing location.

Western Australia – Indigenous (management methods). Subject to application of Section 211 of the *Native Title Act 1993* (Cth), and the exemption from a requirement to hold a recreational fishing licence, the non-commercial take by Indigenous fishers is covered by the same arrangements as that for recreational fishing.

Northern Territory - Indigenous (management methods). The Fisheries Act 1988 (NT), specifies that: “Unless expressly provided otherwise, nothing in this Act derogates or limits the right of Aboriginal people who have traditionally used the resources of an area of land or water in a traditional manner to continue to use those resources in that area in that manner.”

Northern Territory – Charter (management methods). In the Northern Territory, charter operators are regulated through the same management methods as the recreational sector, but are subject to additional limits on licence and passenger numbers.

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

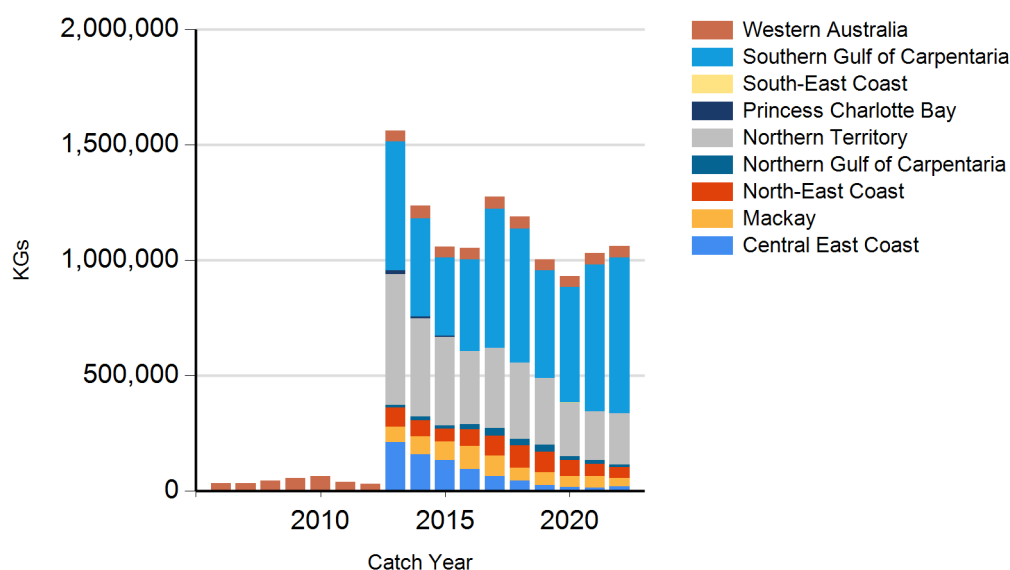
Queensland – Recreational Fishing (Catch). Data are based at the whole of Queensland level and derived from statewide recreational fishing surveys. Where possible, estimates have been converted to weight (tonnes) using best known conversion multipliers. Conversion factors may display regional or temporal variability. In the absence of an adequate conversion factor, data presented as number of fish.

Queensland – Commercial (Catch). Queensland commercial and charter data has been sourced from the commercial fisheries logbook program. Further information available through the Queensland Fisheries Summary Report <https://www.daf.qld.gov.au/business-priorities/fisheries/monitoring-research/data/queensland-fisheries-summary-report>

Queensland – Commercial (Management Methods). Harvest strategies are available at: <https://www.daf.qld.gov.au/business-priorities/fisheries/sustainable/harvest-strategy>

CATCH CHART

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Commercial catch of Barramundi - note confidential catch not shown.

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