

Sea Mullet (2023)

Mugil cephalus



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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Stock status	Indicators
Western Australia	Western Australia	Sustainable	Catch, CPUE, length and age compositions, fishing mortality, spawning stock biomass
Queensland, New South Wales	Eastern Australia	Sustainable	Spawning stock biomass, Catch, Effort, CPUE, Length and age compositions, Stock Assessment

STOCK STRUCTURE

Sea Mullet (*Mugil cephalus*) was formerly regarded as a single species with a global distribution; however recent genetic evidence indicates that they are in fact a complex of many cryptic species. Sea Mullet along the west and east coasts of Australia are regarded as distinct species [Durand et al. 2012; Krück et al. 2013]. The population structure within Western Australia is yet to be fully examined but given the extensive coastline and wide latitudinal range, it is possible that this jurisdiction hosts more than one biological stock (or species). Given this uncertainty, Sea Mullet within each Bioregion are currently managed as separate units. Limited tagging and genetic studies [Thomson 1951; Watts and Johnson 1994] suggest mixing of fish throughout the West Coast Bioregion (WCB), where most of the catch is taken. Extensive tagging studies [Kesteven 1953] suggest a single east coast biological stock of Sea Mullet, extending from central Queensland to eastern Victoria.

Here, assessment of stock status is presented at the jurisdictional stock level for Western Australia and the biological stock level for Eastern Australia.

STOCK STATUS

Eastern Australia

This cross-jurisdictional biological stock is fished in Queensland and New South Wales. Each jurisdiction monitors the part of the biological stock that occurs in its waters. The status presented here for the entire biological stock has been established using evidence from both jurisdictions.

The most recent stock assessment estimated that at the end of 2020 the Eastern Australia biological stock of Sea Mullet was at approximately 37% of unfished levels [Lovett et al. 2022], and above the limit reference point of 20%. The stock assessment used a two-sex, age-structured population model, fit to age and length data, and constructed within the Stock Synthesis modelling framework. Eight scenarios were run, covering a range of modelling assumptions. None of the model scenarios indicated that the biomass of Sea Mullet had declined to below the limit reference point of 20% of unfished levels at any time during the history of the assessment (1899 to 2020). The stock is not considered to be recruitment impaired.

The total landed catch (New South Wales and Queensland combined) in 2020 was approximately 4102 t and below the estimated Maximum Sustainable Yield (MSY) of 5353 t [Lovett et al. 2022]. The relative biomass at 37% of unfished levels was above the estimated biomass at MSY, being 33% of unfished levels. This level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

Since the final year modelled in the stock assessment (2020), nominal catch rates in the New South Wales estuary fishery have increased, whereas in the Queensland Ocean Beach Fishery they declined substantially, likely due to adverse weather conditions during the fishing season [Stewart 2023]. Harvest and fishing effort in New South Wales have been at historical lows. Recent age composition data for New South Wales show a strong year class moving through the fishery, first identified as 2-year old fish in 2018 through to 6 year old fish in 2022. The age compositions in the most recent years (2021 and 2022) show a good spread of ages in the fishery [Stewart 2023]. In Queensland recent harvest (918 t in 2021–22) was less than half the long-term average of 1,980 t (1988–22). This reduction may be due to a range of factors including management changes, licence buy backs, marine park expansion into historic fishing areas, introduction of TACC and subsequent reporting requirements in 2021, and an ageing demographic of fishers. Length and age frequency information from routine monitoring show stability in the sizes of fish being harvested and evidence of recent strong year classes. Nominal effort in the Queensland component of the fishery has reduced markedly from 7,563 days in 2015–16 to 2,503 in 2021–22, and the number of fishers reporting 'Mullet - (unspecified)' catch has reduced from 250 fishers to 164 fishers during the same period. These trends indicate that the stock and fisheries in both jurisdictions have not changed substantially since the final year in the last stock assessment, being 2020 [Lovett et al. 2022].

On the basis of the evidence provided above, the entire Eastern Australian biological stock is classified as a **sustainable stock**. Monitoring show stability in the sizes of fish being harvested and evidence of recent strong year classes. Nominal effort in the Queensland component of the fishery has reduced markedly from 7,563 days in 2015–16 to 2,503 in 2021–22, and the number of fishers reporting 'Mullet - (unspecified)' catch has reduced from 250 fishers to 164 fishers during the same period. These trends indicate that the stock and fisheries in both jurisdictions have not changed substantially since the final year in the last stock

assessment, being 2020 [Lovett et al. 2022].

On the basis of the evidence provided above, the entire Eastern Australian biological stock is classified as a **sustainable stock**

Western Australia

Sea Mullet (*Mugil cephalus*) is primarily targeted by the commercial net fishing sector, with catches by the recreational sector and customary fishers likely to be low relative to commercial catches. The commercial catch of sea mullet in the South, West and Gascoyne Coast bioregions shows a gradual increase from 1941 to around 1980, peaking at just under 700 t. However, changes in management and market demand led to a reduction in effort and commercial targeting of sea mullet, and catches have since declined to their current annual level of around 200 t. Over the past five years, 62% of the catch was taken by haul netting, 19% by beach seining and 19% by gillnetting.

A stock assessment for Sea Mullet was completed in 2022 [Duffy et al 2022] using the Western Australian Department of Primary Industries and Regional Development's risk-based Weight of Evidence approach. This assessment considered catch (including catch-MSY (maximum sustainable yield) analyses), effort, catch distribution, standardised catch per unit effort (CPUE), vulnerability and susceptibility to fishing (PSA) analysis, age and length composition data, catch curve estimates of (long-term average) fishing mortality, and a non-state space biomass dynamic model applied to nominal CPUE data. Based on a combination of relatively low recent annual catches, light-moderate truncation of age structures for fish from the Gascoyne region (assumed to be representative of the spawning stock) and estimates of current biomass and fishing mortality that were BMSY and below FMSY, respectively, the assessment concluded that the stock is sustainable.

More recently, additional analyses for Sea Mullet in Western Australia involving the use of two more sophisticated (state space) biomass dynamics models, including 'Just Another Bayesian Biomass Assessment (JABBA) [Winker et al. 2018] and 'Surplus Production model in Continuous-Time' (SPiCT) [Pederseen and Berg, 2018], applied to standardised CPUE (adjusted for assumed changes in fishing efficiency), yielded similar but slightly less optimistic results than produced in the previous assessment (DPIRD, unpublished data). Outputs from the recent analysis using the JABBA assessment model, for example, suggest that the current level of catch of approximately 200 t is well below the estimated Maximum Sustainable Yield (MSY) for the stock of 749 t (95% CLs: 515–1,808t). The JABBA point estimate for current biomass is at MSY (i.e. $B/BMSY=1.0$, 95% CLs: 0.67–1.45), and the estimate for current fishing mortality is well below FMSY (i.e. $F/FMSY=0.22$, 95% CLs: 0.08–0.42). Thus, these results from the recent biomass dynamics modelling indicate that the stock is sustainable, and that overfishing is highly unlikely to be occurring.

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

On the basis of the evidence provided above, the Western Australia jurisdictional stock of Sea Mullet is classified as a **sustainable stock**.

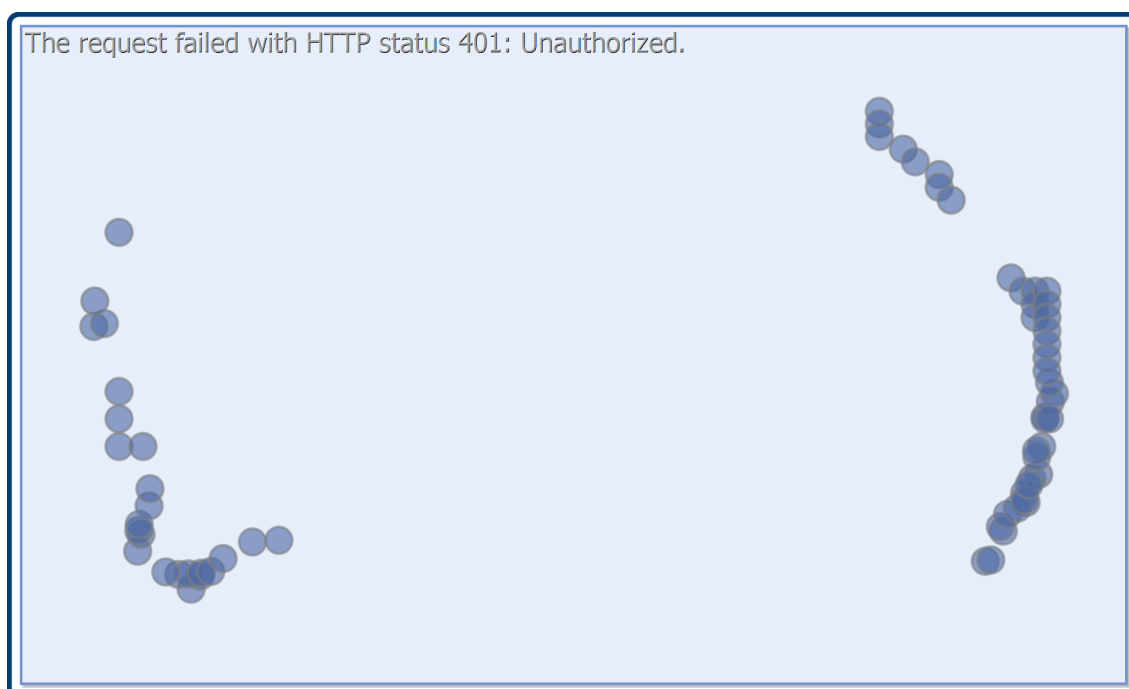
BIOLOGY

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Sea Mullet biology [Virgona et al. 1998; Smith and Deguara 2002; Gaughan et al. 2006; Fisheries Queensland 2018]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Sea Mullet	Western Australia 12 years, 790 mm FL; Eastern Australia 16 years, 640 mm FL	Western Australia Males and Females 370 mm TL; Eastern Australia Males 300 mm TL, Females 330 mm TL

DISTRIBUTION



Distribution of reported commercial catch of Sea Mullet

TABLES

Fishing methods	New South Wales	Queensland	Western Australia
Charter			
Hook and Line	✓	✓	
Commercial			
Beach Seine			✓
Gillnet			✓
Haul Seine	✓		✓

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Line		✓	
Mesh Net	✓		
Net		✓	
Various	✓		
Recreational			
Beach Seine		✓	
Cast Net		✓	✓
Coastal, Estuary and River Set Nets			✓
Hook and Line	✓	✓	✓
Traps and Pots	✓		

Management Methods			
	New South Wales	Queensland	Western Australia
Charter			
Bag/possession limits	✓	✓	
Gear restrictions	✓	✓	
Seasonal or spatial closures	✓	✓	
Size limits	✓	✓	
Commercial			
Gear restrictions	✓	✓	✓
Harvest Strategy		✓	
Limited entry	✓	✓	✓
Marine park closures	✓		
Seasonal or spatial closures		✓	
Size limits	✓	✓	
Spatial closures	✓		✓
Temporal closures	✓		

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Total allowable catch		✓	
Vessel restrictions	✓	✓	✓
Recreational			
Bag/possession limits	✓	✓	✓
Gear restrictions	✓	✓	✓
Licence	✓		✓
Marine park closures	✓		
Seasonal or spatial closures		✓	
Size limits	✓	✓	
Spatial closures	✓		✓

Catch	New South Wales	Queensland	Western Australia
Charter			Negligible
Commercial	1768.94 t	902.931 t	179.36 t
Indigenous	Unknown	Unknown	Unknown
Recreational	Unknown	Negligible	Insufficient data

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

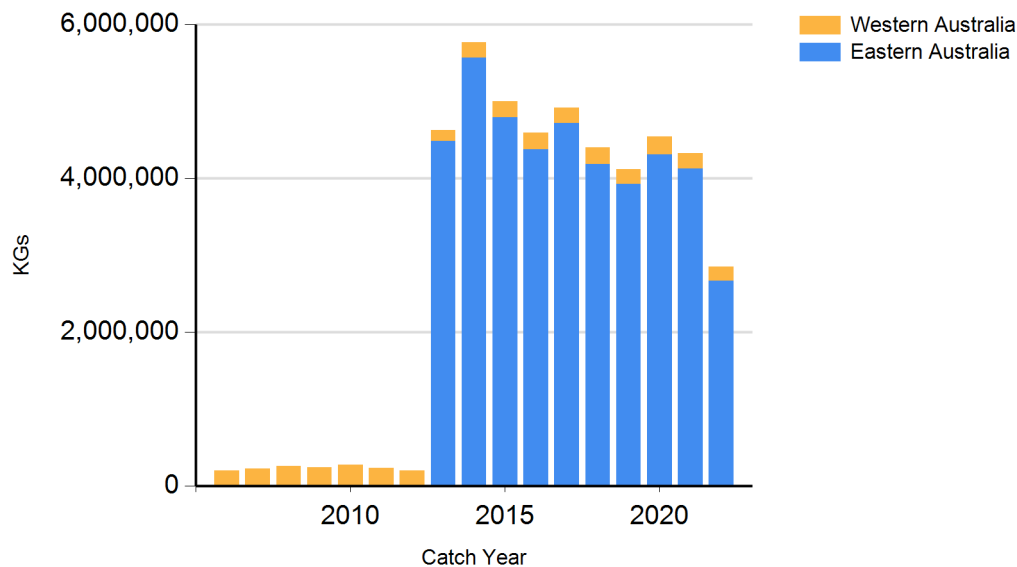
Queensland – Commercial (Catch). Queensland commercial and charter data have been sourced from the commercial fisheries logbook program. Further information are available through the Queensland Fisheries Summary Report: <https://www.daf.qld.gov.au/business-priorities/fisheries/monitoring-research/data/queensland-fisheries-summary-report>

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

New South Wales – Indigenous (Management Methods).
<https://www.dpi.nsw.gov.au/fishing/aboriginal-fishing>

CATCH CHART

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Commercial catch of Sea Mullet - note confidential catch not shown

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