

Hapuku (2023)

Polyprion oxygeneios



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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Stock status	Indicators
Commonwealth	Commonwealth	Undefined	Catch
Western Australia	Western Australia	Sustainable	Spawning potential ratio, fishing mortality
Queensland	Queensland	Negligible	Catch history
New South Wales	New South Wales	Undefined	Catch, effort, standardised catch rate, nominal catch rate
South Australia	South Australia	Negligible	Catch history

STOCK STRUCTURE

The stock structure of Hapuku throughout Australian waters is unknown. Life history characteristics similar to Bass Groper (*Polyprion americanus*) suggest mixing across broad geographic areas [Ball et al. 2000]. However, Beentjes and Francis [1999] inferred the likelihood of separate stocks within New Zealand based on tagging studies of Hapuku, despite recorded movements of up to about 1,400 km. Paul [2002] reported on the stock structure of Hapuku (and Bass Groper) in New Zealand, concluding that stock structure could not be described, and that there was insufficient data describing the life history characteristics to distinguish different stocks. Wakefield et al. [2010] described differences in aged-based demography and reproduction of Hapuku among regions of Western Australia, and likely pan-oceanic mixing of the broader Hapuku population (including Indian Ocean). No such

investigations have been done on Hapuku throughout eastern and south-eastern Australian waters to develop our understanding of stock structure. It is likely Hapuku in eastern and south-eastern Australian waters constitute one or more stocks of a greater population and fisheries within this region access this stock or subset of stocks in support of their annual catches. Panmixia could be expected throughout the region, owing to the extended larval/juvenile phase (years) and large-scale genetic homogeneity of congener *P. americanus* which has similar life-history traits [Ball et al. 2000; Roberts 1996; Sedberry et al. 1999; Wakefield et al. 2010]. Evidence in support of a single biological stock, or stock structuring within broader Australian waters is limited.

Here, assessment of stock status is presented at the jurisdictional level—Commonwealth, Western Australia, Queensland, New South Wales and South Australia.

STOCK STATUS

Commonwealth Hapuku is captured in multiple sectors of the Southern and Eastern Scalefish and Shark Fishery (SESSF) within Australia's exclusive economic zone (EEZ), and by Australian-flagged vessels operating in the high seas. In general, most of the commercial catch in Commonwealth fisheries is taken within Australia's EEZ by the Gillnet Hook and Trap Sector (GHTS), Commonwealth Trawl Sector (CTS) and Great Australian Bight Trawl Sector (GABTS).

Over the past decade, total catches across all Commonwealth sectors increased from roughly 31 t in 2012–13 to a peak of more than 41 t in 2016–17, before falling to around 8.6 t in 2021–22. In 2021–22, 8.6 t was taken in the SESSF (5 t in the GHTS, 3 t in the CTS, and < 1 t in the GABTS) and no catch was taken in the high seas.

A number of different analyses have been undertaken on Hapuku in Commonwealth fisheries in recent years, however none have provided sufficiently robust information to reliably determine status.

In 2021, Sustainability Assessment for Fishing Effects analyses for the CTS and GABTS assessed Hapuku as low risk, which meant that estimated fishing mortality rates (F) within these sectors during 2012 to 2016 (the period assessed) were less than the F required to drive the stock below the maximum sustainable mortality level (FMSM) [Sporcic et al. 2021a, b]. In the same year, a Scale, Impact, Consequence Analysis for demersal longline in the SESSF, categorised the species as low risk for the period analysed (2015 to 2019) [Bulman et al. 2021]. However, none of these analyses are able to provide information on biomass status which is a product of historical (not just recent) catch levels.

In 2018, a model-assisted catch-only assessment (Catch-Maximum Sustainable Yield (MSY) method) [Martell and Froese 2013] was fitted to commercial catches of Hapuku across all sectors of the SESSF from 1986 to 2017 [Penney et al. 2018]. The Catch-MSY method uses population productivity (r) and carrying capacity (K) parameters of an underlying Schaefer production model to estimate the ranges in biomass and harvest rate that could have resulted in the annual catches. The assessment estimated biomass to have been above the biomass at MSY (BMSY) from 1986 to 2006 and between BMSY and 20% of unfished biomass since 2007. The mean estimate of biomass in 2017 was approximately 33% of the unfished level (95% confidence interval of 11–55%). Reported catch, mostly from the CTS, increased in 2017, but remained below the mean estimated MSY of 51 t. However, F in 2017 was estimated to be 0.15, above the

FMSY level of 0.11. Five-year constant-catch projections at the 2017 catch level of 48 t predicted that biomass would decline slowly. However, there is a high degree of uncertainty in the estimates of biomass depletion, harvest rate and MSY derived using the Catch-MSY method due to the deterministic nature of the assessment method. There is also a high degree of uncertainty in stock structure.

There is insufficient information to confidently classify this stock and as a result, the stock is classified as an **undefined stock**.

New South Wales

Hapuku are primarily caught as a by-product species in the Ocean Trap and Line (OTL) Fishery on dropline gear, where the target species is commonly Blue-eye Trevalla (*Hyperoglyphe antarctica*), although the proportion of total catch from different gears is changing with the general decrease in catch through time. Since 1997–98, commercial catches of Hapuku have been reported separately from Bass Groper (*P. americanus*). The annual reported commercial catches of Hapuku have steadily declined since at least the early 2000s, with this trend also reflected in the associated effort series and is consistent with reduced numbers of active fishing businesses in the OTL Fishery harvesting Hapuku. Within at least the last decade (2012–13 to 2021–22) the total annual commercial catch of Hapuku reported in NSW has averaged < 1.5 t, and within in the last 5 years (2017-18 to 2021–22) the average commercial catch was 0.9 t. Together with information on the mean weight (7.6 kg) of Hapuku caught and retained in the OTL Fishery, from unpublished data from an observer survey [Macbeth and Gray 2016], the commercial fishery for Hapuku in NSW is responsible for the removal of an average of < 120 individual fish per year over the last 5 years.

From 1998-99, standardised catch rates (kg.day⁻¹) from droplining and that of nominal catch rates from handlining have not shown a clear trend over the time series of data available, with variance associated with the annual estimates substantially larger since about 2009-10, associated with fewer reported fishing events [Chick and Fowler 2023].

Although NSW commercial catches are low, the impact of fishing on the Hapuku stock in NSW remains uncertain. Recreational catch is potentially substantial relative to more recent commercial catches. This is despite state-wide surveys of recreational fishing not reporting recreational catches, due primarily to the design of the surveys, with large-scale phone and diary surveys like those of Henry and Lyle [2003], West et al. [2015] and Murphy et al. [2022] underestimating catches from small specific fisheries like the offshore deep-water recreational fishery. However, it is likely that the recreational component of the total catch has increased through time, due in part to the technological improvements that facilitate angling in deep water.

Together with the uncertainty in total fishing mortality, demographic characteristics of late maturity, slow growth in later life and extended longevity reported from other regions and congener species suggest that the NSW stock is vulnerable to exploitation [Sedberry et al. 1999; Peres and Haimovici 2004; Wakefield et al. 2010]. Demography also likely varies across the extent of the stock(s) structure, as reported for south-western Australian stocks [Wakefield et al. 2010] and the extent of stock connectivity could be complex given life-history characteristics and oceanography of the region e.g. south-east Australian stocks of Blue-eye Trevalla, [Williams et al. 2017]. Added to these stock and species-specific uncertainties are broader pressures placed on stocks from human induced environmental processes such as climate change (e.g. ocean temperature and pH changes), resulting in greater variability in population

responses to all pressures including fishing but also changes that are also likely to impact on fishing activities [Fulton et al. 2020]. These uncertainties, together with fishing pressures, could precipitate localised depletions or demographic shifts in stocks.

A review of indicators (weight-of-evidence) approach was used to assess the status of Hapuku in NSW. There are insufficient data available to support more quantitative stock assessment methods. Important knowledge gaps and areas of uncertainty for Hapuku assessment include (i) stock structure, biology and quantified levels of recreational catch, (ii) low and decreasing levels of commercial catch together with similar patterns in effort (days), and (iii) low and variable catches and effort between different commercial fishing gears and methods, which exacerbate uncertainty surrounding estimates of standardised and nominal catch rates and their use as a proxy for change in biomass, provide insufficient information with which to support a reliable determination of stock status for NSW [Chick and Fowler 2023].

On the basis of the evidence provided above, Hapuku in New South Wales is classified as an **undefined stock**.

Queensland Hapuku reaches its northerly (i.e. warm-water) range limits off southern Queensland [Kailola et al. 1993] and only negligible catches have been reported. Stock status is reported as **Negligible** due to historically low catches and the stock has not been subject to targeted fishing. The QLD commercial catch from 2010-11 to 2021-22 averaged approximately 0.4 t per annum, and Hapuku is not a major component of recreational landings. Fishing is unlikely to be having a negative impact on the stock.

**South
Australia**

Stock status for Hapuku in South Australia is reported as **Negligible** due to historically low catches in this jurisdiction and the stock has generally not been subject to targeted fishing. South Australia's commercial catch of Hapuku over the past 20 years has averaged < 200 kg per annum, and the species is not a major component of recreational landings. Fishing is unlikely to be having a negative impact on the stock.

**Western
Australia**

The Hapuku catch in Western Australia is predominantly taken by commercial line fishers operating along the lower west and south coasts. An age-based assessment from sampling the 2005 and 2006 south coast catches estimated fishing mortality (F) to be within target and threshold levels [Wakefield et al. 2010]. More robust modelling of the same data was undertaken in 2018, assuming variable recruitment and age-based selectivity. This updated and unpublished assessment generated two spawning potential ratio estimates (\pm 95% confidence intervals) using the per recruit and dynamic pool methods: 0.48 (0.43–0.54) and 0.44 (0.38–0.50) respectively, indicating a high likelihood that the spawning potential was above the threshold reference level of 0.30. Simultaneously generated estimates of F and natural mortality M per year were 0.045 (0.04–0.05) and 0.09, respectively, giving an F/M estimate of 0.50 (0.42–0.60), well below the threshold reference level of 0.67. The new analysis shows the breeding stock was adequate and fishing mortality sustainable at the time the sample was collected, when annual commercial south coast catches had ranged around 20–25 t. Since then, catches have fluctuated between 7 and 40 t with around 30% sourced from a 1° x 1° block adjacent to Albany. The

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recreational catch was too small to estimate with reliable precision in a boat-based recreational catch survey in 2020–21 [Ryan *et al.* 2022].

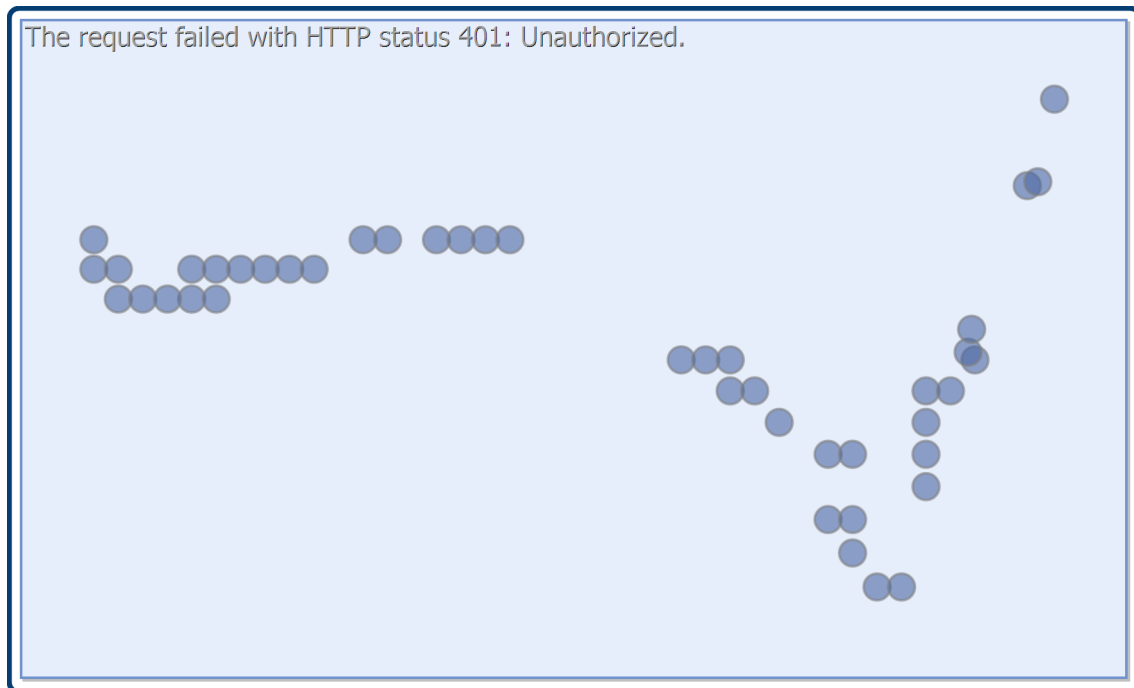
Based on the evidence provided above, Hapuku in Western Australia is classified as a **sustainable stock**.

BIOLOGY

Hapuku biology [Ball *et al.* 2000; Paxton *et al.* 1989; Wakefield *et al.* 2010]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Hapuku	52 years Females 1 114 mm TL Males 702 mm TL	Females 7.1 years, 760 mm TL Males 6.8 years, 702 mm TL

DISTRIBUTION



Distribution of reported commercial catch of Hapuku

TABLES

Fishing methods	Commonwealth	New South Wales	Queensland	South Australia	Western Australia
Charter					
Hook and Line		✓	✓		✓
Rod and reel					✓

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Various					✓
Commercial					
Demersal Longline	✓				
Dropline	✓	✓			✓
Fish Trap					✓
Hand Line, Hand Reel or Powered Reels					✓
Hook and Line		✓			
Line			✓		✓
Longline (Unspecified)					✓
Midwater Trawl	✓				
Otter Trawl	✓				
Unspecified				✓	
Various		✓			
Recreational					
Hook and Line		✓	✓		✓
Various					✓

Management Methods				
	Commonwealth	New South Wales	Queensland	Western Australia
Charter				
Bag and possession limits		✓		✓
Bag/possession limits			✓	
Boat limits		✓		
Gear restrictions		✓	✓	
Licence		✓		✓
Limited entry				✓
Marine park closures		✓		

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Seasonal or spatial closures			✓	
Spatial closures		✓		✓
Temporal closures				✓
Commercial				
Effort limits				✓
Effort limits (individual transferable effort)				✓
Gear restrictions	✓	✓	✓	✓
Harvest Strategy			✓	
Licence	✓			
License				✓
Limited entry		✓	✓	✓
Marine park closures		✓		✓
Quota		✓		
Seasonal or spatial closures			✓	
Spatial closures	✓	✓		✓
Spatial zoning				✓
Total allowable catch		✓		
Total allowable effort				✓
Vessel restrictions		✓	✓	
Recreational				
Bag and possession limits		✓		✓
Bag limits				✓
Bag/possession limits			✓	
Boat limits		✓		

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Gear restrictions		✓	✓	✓
Licence		✓		
Licence (Recreational Fishing from Boat License)				✓
Marine park closures		✓		
Seasonal closures				✓
Seasonal or spatial closures			✓	
Spatial closures		✓		✓

Catch	Commonwealth	New South Wales	Queensland	South Australia	Western Australia
Commercial	8.56767 t	0.13867 t	0 t	0 t	26.4938 t
Indigenous		Unknown	Unknown		Unknown
Recreational		Unknown	Unknown		7.4 t ± 2.9 (se) (Boat based)

Commonwealth – Commercial (Management Methods/Catch). Data provided for the Commonwealth align with the Commonwealth Southern and Eastern Scalefish and Shark Fishery and the High Seas Fishery for the 2021–22 financial year.

Commonwealth – Recreational. The Australian Government does not manage recreational fishing in Commonwealth waters. Recreational fishing in Commonwealth waters is managed by the state or territory immediately adjacent to those waters, under its management regulations.

Commonwealth – Indigenous. The Australian Government does not manage non-commercial Indigenous fishing in Commonwealth waters, with the exception of the Torres Strait. In general, non-commercial Indigenous fishing in Commonwealth waters is managed by the state or territory immediately adjacent to those waters.

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

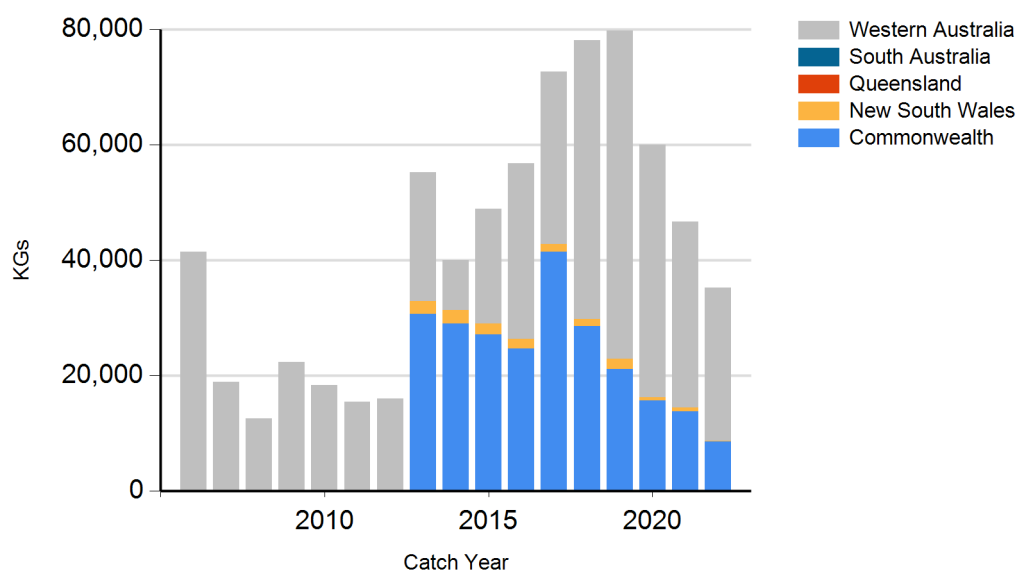
Queensland – Indigenous (Management Methods). For more information see: <https://www.daf.qld.gov.au/business-priorities/fisheries/traditional-fishing>

Queensland – Commercial (Catch). Queensland commercial and charter data 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 – Recreational Fishing (Catch). Data with high uncertainty (Residual Error > 50 %) have been excluded and listed as unknown. More information available at: <https://www.daf.qld.gov.au/business-priorities/fisheries/monitoring-research/monitoring-reporting/statewide-recreational-fishing-surveys>

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

CATCH CHART



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Commercial catch of Hapuku - note confidential catch not shown

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