Hapuku (2020)

Polyprion oxygeneios

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STOCK STATUS OVERVIEW

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

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. 1996, 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 are 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 outside Australia's EEZ in the South Pacific Regional Fisheries Management Organisation (SPRFMO) area and the Southern Indian Ocean Fisheries Agreement (SIOFA) area. Most of the catch in Commonwealth fisheries within Australia's EEZ is taken by demersal longlines in the Gillnet Hook and Trap (GHAT) Sector and by trawling in the Commonwealth Trawl Sector (CTS) and Great Australian Bight (GAB) Sector. Total annual catches across all sectors declined from over 110 tonnes (t) in 2008 to around 26 t in 2013. Since then, catches have increased to approximately 42 t in 2019, with around 20 t of this being taken in the SIOFA area, 14 t in the GHAT, 6 t in the CTS, 1 t in the GAB and <1 t in the SPRFMO area. The increase in the proportion of overall Commonwealth catches being taken in SIOFA and the decrease in the proportion of overall Commonwealth catches being taken within Australia's EEZ has important implications for status determination, as catches taken from the SIOFA area are unlikely to be from the same biological stock (or sub-stock) as that in eastern Australia.

In 2012, a Sustainability Assessment for Fishing Effects (SAFE) analysis assessed Hapuku as precautionary extreme high risk in the SESSF due to the cumulative impacts of fishing from the CTS and demersal longline fishing in the GHAT Sector [Zhou et al. 2012]. A residual risk analysis that considered additional scientific information did not reduce the overall risk rating for Hapuku [AFMA 2014]. The SAFE analysis was based on catch data from 2007 to 2010, when the average catch was about 82 t, and indicated that it was plausible that Hapuku could have been subject to overfishing during those years.

Due to the risk rating from the 2012 SAFE assessment, Hapuku is currently a priority species in the application of an Ecological Risk Management strategy for the SESSF [AFMA 2015]. Specific management measures adopted by AFMA to reduce the impact of demersal longline fishing on Hapuku include a limit on the number of hooks deployed, spatial and temporal closures, and the mandatory installation of electronic monitoring on all auto longline vessels.

In 2018, a model-assisted catch-only assessment (Catch-MSY method) [Martell and Froese 2013] was fitted to 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 BMSY from 1986 to 2006 and between BMSY and 20 per cent of unfished biomass (0.2B0) since 2007. The mean estimate of biomass in 2017 was approximately 33 per cent of B0 (95 per cent CI of 11–55 per cent). Reported catch, mostly from the CTS, increased in 2017, but remained below the mean estimated MSY of 51 t. However, the harvest rate in 2017 was estimated to be 0.15, above the FMSY level of 0.11, as a result of the 2017 increase in reported trawl catch. Five year projections at the 2017 catch level of 48 t predicted that biomass would decline slowly at this catch level. Catches from the eastern Australian component of this management

unit are likely to have been around 22 t in 2019.

The estimated harvest rates from this assessment are consistent with estimates of fishing mortality derived from the SAFE assessment by Zhou et al. [2012]. However, there is high uncertainty in the estimates of biomass depletion, harvest rate and MSY that have been derived using the Catch-MSY method due to the deterministic nature and uncertainty about the stock structure of Hapuku. Given the broad distribution of Hapuku within Australian waters, it is plausible that there are a number of separate biological stocks with limited connectivity across the extent of the SESSF and more broadly across other Australian jurisdictions and internationally. These may have been subject to different exploitation patterns. Resolving the stock structure of Hapuku would help reduce the uncertainty in the status of the species.

On the weight of available evidence, it is plausible that maintaining the levels of fishing pressure estimated in 2017 would cause the Commonwealth Hapuku stock to decline below its current level and lead to it being recruitment impaired. However, catches in 2019 from the relevant components of the Commonwealth management unit appear to have fallen to around half of the levels estimated in 2017 and on which projections for future stock status were done. The available evidence indicates that the biomass of the stock is uncertain and that it is unclear whether recruitment has been impaired.

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

New South Wales

Hapuku have primarily been caught as a by-product species in the Ocean Trap and Line (OTL) Fishery on dropline gear, where target species are commonly Blue-eye Trevalla (*Hyperoglyphe antarctica*). Since 1997–98, commercial catches of Hapuku have been reported independently of Bass Groper (*P. americanus)*. Annual commercial catches of Hapuku have declined from a peak of 15.6 t in 1999–2000. Within the last decade (2009–10 to 2018–19) the average annual commercial catch of Hapuku was <3 t, and within in the last five years (2014–15 to 2018–19) was 1.6 t. Similarly, annual total effort (days fished) has declined steadily over the same period. Together with information on the mean weight (7.6 kg) of Hapuku caught and retained in the OTL Fishery [Macbeth and Gray 2015], the commercial fishery for Hapuku over the last five years, is responsible for the harvest of an average annual number of <250 individual fish.

From 1997–98 to 2009–10 droplining accounted for about 90 percent of total annual commercial catches. Since 2009–10, annual catches on dropline gear steadily declined, with decreasing levels of effort (days), to an average of about 60 per cent of total annual catch. Commensurate with these changes were increases in catch (and days of effort) and the percent of total annual catch on handline gear. Standardised catch rates (kg per day) for droplining in the OTL Fishery showed no significant trend between 1997–98 and 2018–19, with larger variance surrounding estimates after 2007–08 and particularly in 2018–19, associated with fewer active fishing businesses and fewer catches. From 2009–10, mean estimates of standardised catch rates declined to a historical low in 2014–15, where it has generally remained, with some indication of an increase in 2018–19. Median nominal catch rate (kg per day) for handlining also showed no clear trend between 1997–98 and 2018–19. As similarly indicated in standardised dropline catch rate, handline nominal median catch rate also increased in 2018–19 [Chick and Fowler 2020].

Although New South Wales commercial catches are low, the impact of fishing on the Hapuku stock in New South Wales remains uncertain. Recreational and Indigenous catch of Hapuku is not well understood in New South Wales. Henry and Lyle [2003] estimated the New South Wales annual recreational harvest of Rock Cod/Gropers (including Hapuku and nine other 'offshore/deep' species) to be 4 770 (± 1 532) individuals, with offshore (> 5 km from shore) recreational fishing effort representing 1.3 per cent of the State-wide total. West et al. [2015] and Murphy et al. [2020] reported no recreational catch of Hapuku in 2013–14 or 2018–19, respectively.

A review of indicators (weight-of-evidence approach) was used to assess the status of Hapuku in New South Wales. There are insufficient data available to support more quantitative stock assessment methods. Important knowledge gaps and areas of uncertainty for Hapuku assessment include (i) Hapuku stock structure, biology and 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. Point (iii) exacerbates uncertainty surrounding estimates of standardised and nominal catch rates. The cumulative effect of these uncertainties means there is insufficient information available to confidently classify the status of this stock [Chick and Fowler 2020].

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 minor catches have been reported. Hapuku is a line caught species and there is no formal stock assessment in Queensland waters. Historically, the Deep Water Fin Fish Fishery (DWFFF) targeted Hapuku with an average harvest of 4 t between 1997–2002. The average annual catch has since declined below 1 t as overall effort in the fishery has reduced [QFISH 2020]. Current reported catch is incidental harvest in the Rocky Reef Fin Fish Fishery (RRFFF). There has been no recreational harvest of Hapuku reported in Queensland's recreational fishing surveys [Webley et al. 2015]. It is unlikely that the Queensland line harvest is significantly impacting the overall stock. The above evidence indicates that the biomass of this stock is unlikely to be depleted, recruitment is unlikely to be impaired, and the current level of fishing mortality is unlikely to cause the stock to become recruitment impaired.

On the basis of the evidence provided above, Hapuku in Queensland is classified as a **sustainable 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

The Hapuku catch in Western Australia is predominantly by commercial line

Australia

fishers operating along the lower west and south coasts. An age-based assessment from sampling 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 (± 95 per cent 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 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. An updated age-based assessment with recent data is underway.

On the basis of 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					✓
Commercial					
Demersal Gillnet	✓				
Demersal Longline	✓				
Dropline	✓				✓
Hand Line, Hand Reel or Powered Reels					✓
Line		✓	✓		
Otter Trawl	✓				
Unspecified				✓	
Various		✓			
Recreational					
Hook and Line		✓	✓		✓
Various					✓

Management Methods				
	Commonwealth	New South Wales	Queensland	Western Australia
Charter				
Bag and possession limits		✓		✓
Boat limits		✓		
Gear restrictions			✓	
Licence		✓		✓
Limited entry				✓
Possession limit			✓	
Spatial closures		✓		✓
Temporal closures				✓
Commercial				
Effort limits				✓
Effort limits (individual transferable effort)				✓

Gear restrictions	✓	✓	✓	✓
Licence	✓		✓	
License				✓
Limited entry		✓	✓	✓
Marine park closures				✓
Spatial closures	✓	✓		✓
Spatial zoning				✓
Total allowable effort				✓
Vessel restrictions		✓	✓	
Recreational				
Bag and possession limits		✓		✓
Bag limits				✓
Boat limits		✓		
Gear restrictions			✓	✓
Licence		✓		
Licence (Recreational Fishing from Boat License)				✓
Possession limit			✓	
Seasonal closures				✓
Spatial closures		✓		✓

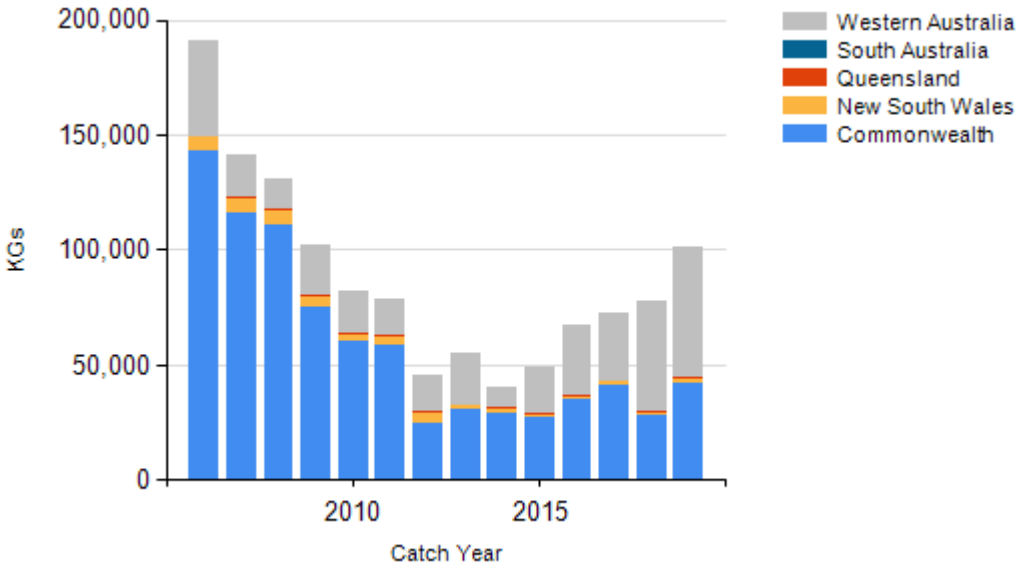
Catch					
	Commonwealth	New South Wales	Queensland	South Australia	Western Australia
Commercial	42.205 t	1.7594 t	0.591 t	0 t	56.9662 t
Indigenous		Unknown	Unknown		Unknown
Recreational		Unknown	Unknown		Unknown

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

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

CATCH CHART



Commercial catch of Hapuku - note confidential catch not shown

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