Stock status summary

Information provided in this summary constitutes a review of stock structure and indicators consistent with informing a species status determination using a weight-of-evidence approach such as is used in the Status of Australian Fish Stocks reports (SAFS; www.fish.gov.au/). Where data are unavailable or insufficient to reliably inform those criteria, this has been indicated by 'NA', rather than removing the criteria. This format has been maintained to transparently represent the data available and highlight areas where alternate data sources or analyses may be required to improve species status determination into the future.

Biology and stock structure

Hapuku (*Polyprion oxygeneios*) is a large demersal perciform broadly distributed in the temperate waters of all southern oceans between the latitudes of 28°S and 43°S (Paxton et al. 1989). The species occurs throughout NSW, with adults found on the continental slope in depths ranging from 200 m to 500 m.

Demographic information, including age, maturity, and fecundity, is unavailable for the species in NSW. Investigations from Western Australia and New Zealand indicate the species can attain a large size (up to 180 cm total length, TL) and weight (78 kg), are long-lived (up to 63 years), and moderate- to late-maturing (7–13 years; Francis et al. 1999; Wakefield et al. 2010). Francis et al. (1999) also indicate natural mortality (*M*) may be 0.1 or less.

A length sample obtained from the commercial fishing sector in NSW during the 1990s indicated that fish were of similar size to those caught in Western Australia and New Zealand (Francis et al. 1999; Wakefield et al. 2010).

The stock structure of Hapuku in NSW is unknown, but panmixia is 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 (Roberts 1996; Sedberry et al. 1996; Ball et al. 2000; Wakefield et al. 2010).

Stock status and assessment method

On the basis of the evidence provided the NSW Hapuku stock is classified as **undefined**.

A review of indicators (weight-of-evidence approach) was used to assess the NSW Hapuku stock. Insufficient data are available to support more quantitative stock assessment methods. Current uncertainty regarding Hapuku stock structure and biology, low levels of catch and low numbers of reported daily catch between different fishing methods, that exacerbate uncertainty surrounding estimates of catch rate, provide insufficient information with which to determine a stock status.

Fishery statistics summary

Information presented in figures and tables below is summarised by fiscal year (July–June). Reference to 'year' refers to the first year within a fiscal year unless otherwise stated. For example, 2009 refers to the fiscal year 2009/10.

Between 1997/98 and 2008/09 (inclusive), fishers reported monthly catch and effort (in days). From 2009/10, monthly reports of daily catch and effort (hours) metrics have been required. To construct a longer time series of data (i.e. from 1997/98 to present), daily records from 2009/10 are re-aggregated into monthly catches (kg) by fisher and gear type, with effort in days per month estimated from the number of distinct fishing dates in each month when the method was used and there was a reported landing of the species of interest in that month, irrespective of whether the species was reported on each day, to be consistent with earlier reporting.

Management arrangements including input controls and modified Ocean Trap and Line (OTL) Fishery endorsements to restrict fishing east and west of the 100 fathom depth contour (i.e. OTL–Line East and OTL–Line West, respectively) are described in the NSW Fisheries Management (Ocean Trap and Line Share Management Plan) Regulation 2006 (NSW DPI Fisheries 2017). Changes to the endorsement limited the number of fishers endorsed to access deep waters, and hence Hapuku, and prohibited OTL–Line West-endorsed fishers from landing Hapuku (as well as other species). Given the historical catch considerations in the allocation of the endorsements and the generally deep-water distribution of Hapuku, the change to this fishing endorsement is not considered to have substantially impacted on the catch of Hapuku through time. All reported catches of Hapuku are presented below, unless otherwise stated in the text and captions.

Catch information

Commercial

Single-species data is only available after 1997/98 when reporting for Hapuku was separated from congener *P. americanus* (Bass Groper).

Hapuku are caught in three fisheries within NSW; the OTL Fishery, the Ocean Fish Trawl Fishery, and the Ocean Prawn Trawl Fishery. The OTL Fishery accounts for 83–100% of total annual catch by weight.

Total annual reported commercial catch of Hapuku is relatively low (<10 t since 2003/04, <2 t since 2012/13; Figure 1). Catch has declined since 2002/03 (12.1 t) and 1.2 t was caught in 2016/17.

Droplining accounts for most of the total catch (mean: 76%, range: 46–99%). The trend in dropline catch was similar to total catch, with a decrease from 2002/03 (9.4 t) to 2016/17 (0.7 t).

Handlining accounts for most of the remaining catch (mean 12%, range: 0–52%). Trends in handline catch differed to trends in both total catch and dropline catch. Catch increased between 2009/10 (0.3 t) and 2013/14 (0.9 t), then decreased to 2016/17 (0.1 t).

Catch information

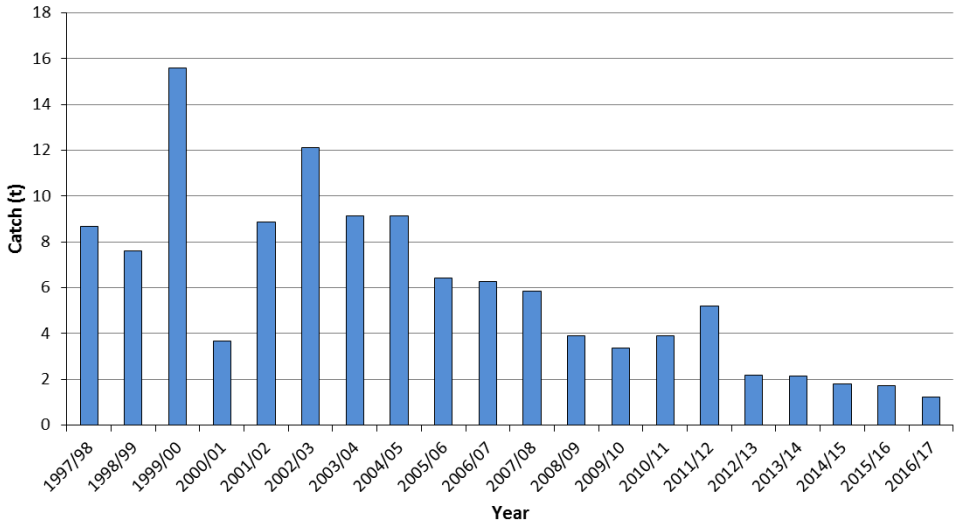

Figure 1. **All methods and fisheries combined – Total catch (t) of Hapuku from 1997/98 to 2016/17.**

Recreational and Indigenous

Recreational and Indigenous catches of Hapuku are unknown. However, Henry and Lyle (2003) estimated the NSW annual recreational harvest of Rock Cod/Gropers (including Hapuku and nine other 'offshore/deep' species) in 2000/01, to be 4,770 (± 1,532) individuals. West et al. (2015) reported no recreational catch of Hapuku in NSW in 2013/14.

There is a combined recreational bag limit of five and a boat limit of ten Hapuku, Banded Rockcod, Bass Groper, Gemfish and Blue-eye Trevalla. The boat limit applies to all recreational fishers, including charter fishing. In 2016/17 the NSW charter fishing sector reported catching two individual Hapuku.

Anecdotal evidence, including social media reports of catches of Hapuku and Bass Groper, suggests the 2016/17 NSW recreational catch of these species may equate to a substantial proportion (>15%) of the current reported commercial catch.

Illegal, Unregulated and Unreported

The extent of Illegal Unregulated and Unreported (IUU) fishing is unknown.

Effort information

Commercial

Total effort decreased between 1997/98 and 2016/17, from ~1000 days to <200 days (Figure 2). The trend in dropline effort was similar to total effort, with a decrease over the same reporting period. Patterns in dropline effort were also similar to those of dropline catch. Handline effort showed no clear trend between 1997/98 and 2008/09. A peak in effort of 49 days was observed during 2002/03. Effort increased between 2009/10 (49 days) and 2012/13 (150 days), then decreased to 18 days during 2016/17.

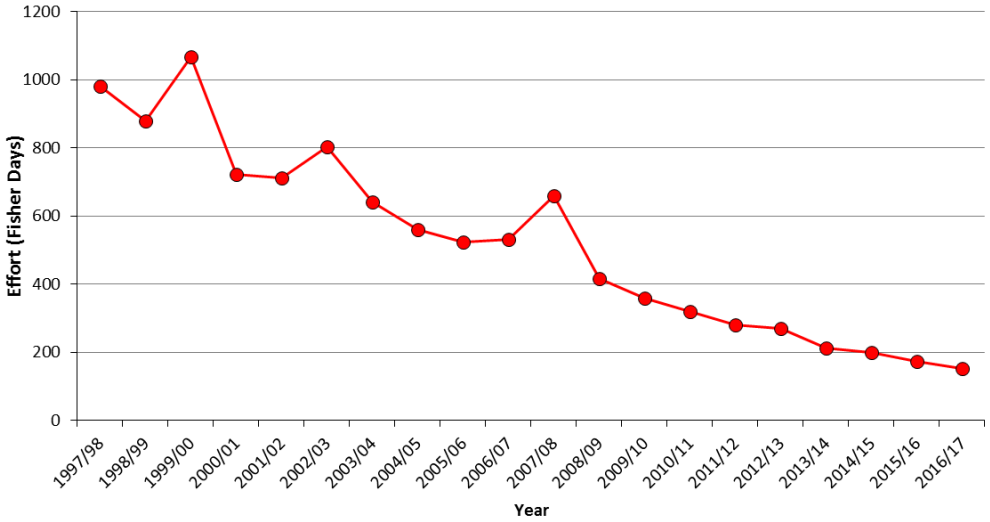

Figure 2. **All methods and fisheries combined – Total effort (days) for Hapuku from 1997/98 to 2016/17.**

Recreational and Indigenous

Data for recreational and Indigenous effort for Hapuku are unknown.

Henry and Lyle (2003) reported that recreational offshore (>5 km from shore) fishing effort in NSW was 1.3% of the state-wide total, equating to 101,480 (± 32,176) fishing events. West et al. (2015) reported offshore (>5 km) fishing effort comprised <2% (54,773 fisher days) of all reported NSW recreational fishing effort.

Catch rate information

Standardised catch per unit effort (CPUE) in days ($CPUE_{dy}$) for droplining showed no clear trend between 1997/98 and 2016/17, with large variance surrounding estimates after 2007/08 (Figure 3).

Median nominal $CPUE_{dy}$ for handlining also showed no clear trend between 1997/98 and 2016/17. Peaks in median $CPUE_{dy}$ were observed during 2002/03 and 2011/12.

Catch rate information

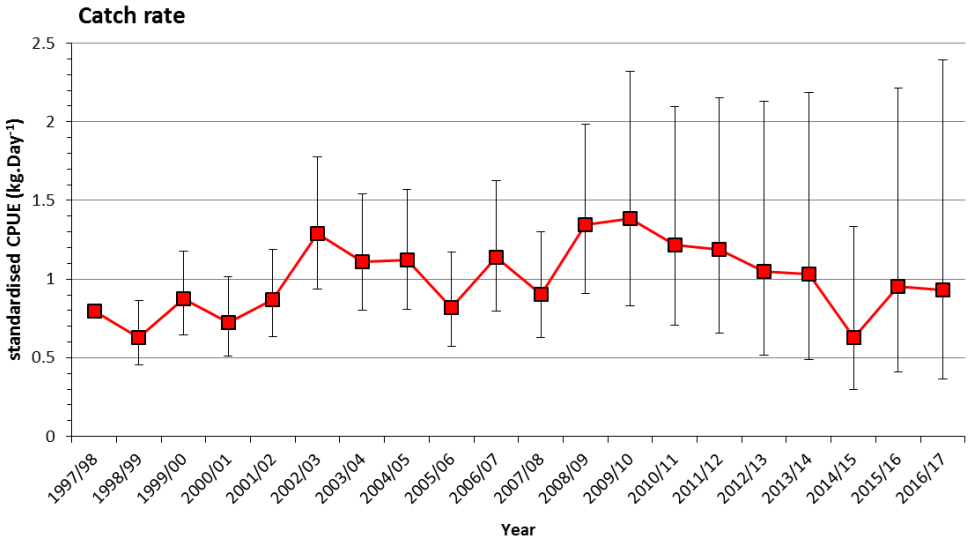

Figure 3. Droplining - Standardised CPUE (kg.day^{-1}) for Hapuku from 1997/98 to 2016/17. Error bars indicate 95% confidence intervals.

Stock assessment - list of indicators

Year of most recent assessment	2018 – **undefined**
Assessment method	Weight of evidence
Main data inputs	Commercial catch (t) – 1997/98 to 2016/17 Standardised CPUE dropline (kg.day^{-1}) – 1997/98 to 2016/17 Median nominal CPUE handline (kg.day^{-1}) – 1997/98 to 2016/17
Main data inputs (rank)[†]	Commercial catch – 2 (medium quality): historical time series, but some reporting changes and likely misreporting, limited quality control/error validations Standardised CPUE dropline – 3 (low quality): compromised by significant reporting changes and inaccuracies in effort data Median nominal CPUE handline – 3 (low quality): compromised by significant reporting changes and inaccuracies in effort data

Stock assessment - list of indicators	
Key model structure and assumptions	NA – no model-based quantitative assessment approach was used
Sources of uncertainty evaluated	Known or likely uncertainties in the key indicators were taken into consideration in ranking data inputs to these indicators, and in reaching a conclusion regarding stock status based on the relative weighting of these indicators

† Main data inputs (rank)

1 – High quality: data have been subjected to documented quality assurance and peer review processes, are considered representative and robust and provide a high level of confidence to support fisheries management decisions.

2 – Medium quality: data have been subjected to some internal quality assurance processes, have some documented limitations, but are still considered sufficiently accurate and informative to be useful to inform management decisions with some caveats.

3 – Low quality: data have been subjected to limited or no quality assurance processes, may be compromised by unknown or documented limitations that have not been fully explored, but are considered the best available information and require a high level of precaution to be exercised when interpreted to inform management decisions.

Status indicators and limits – reference levels	
Biomass indicator or proxy	Standardised CPUE. Used to indicate whether biomass is likely to be increasing, decreasing or stable under current catches and effort
Biomass limit reference level	NA – no biomass limits or targets have been set
Fishing mortality indicator or proxy	NA – no agreed proxy of fishing mortality has been defined
Fishing mortality limit reference level	NA – no fishing mortality limit has been set
Target reference level	NA – no fishing mortality targets have been set

Stock assessment results – review of indicators	
Biomass status in relation to limit	NA – no biomass limits or targets have been set
Fishing mortality in relation to limit	NA – no fishing mortality limit has been set
Previous SAFS stock status	Previously unassessed
Current SAFS stock status	Scheduled for national SAFS assessment in 2018

Fishery interactions

Hapuku are primarily caught as bycatch when droplining for Blue-eye Trevalla (*Hyperoglyphe antartica*). Catches of Hapuku and associated fishery statistics may therefore be influenced by changes in the Blue-eye fishery.

Hapuku are landed in Australian Commonwealth fisheries from waters off the east coast of Australia (AFMA 2018; average catch of 41.5 $t.yr^{-1}$ between 2007 and 2016; 18.5 t caught in 2016). However, Hapuku are not a quota-managed species in the Commonwealth and the Australian Fisheries Management Authority does not undertake fishery assessments on this species.

References

AFMA (Australian Fisheries Management Authority). 2018. Reported landed annual catch from Commonwealth fisheries catch disposal records. Accessed 30/05/2018. www.data.gov.au/dataset/0cd2ec97-d13c-4b02-8071-fd778fdcdee7.

Ball, A. O., Sedberry, G. R., Zatcoff, M. S., Chapman, R. W., and Carlin, J. L. 2000. Population structure of the wreckfish *Polyprion americanus* determined with microsatellite genetic markers. Marine Biology, 137: 1077–1090.

Francis, M. P., Mulligan, K. P., Davies, N. M., and Beentjes, M. P. 1999. Age and growth estimates for New Zealand hapuku, *Polyprion oxygeneios.* Fishery Bulletin 97(2): 227–242.

Henry, G.W., and Lyle, J.M. 2003. The national recreational and Indigenous fishing survey. Fisheries Research and Development Corporation, Canberra.

NSW DPI Fisheries. 2017. Assessment of the NSW Ocean Trap and Line Fishery. Prepared for the Department of the Environment and Energy for the purpose of assessment under Part 13 and 13(A) of the *Environment Protection and Biodiversity Conservation Act* 1999. www.environment.gov.au/system/files/pages/9d8670c9-3f67-456a-b68b-1f87f8ffed62/files/application-2017.pdf

Paxton, J. R., Hoese, D. F., Allen, G. R., and Hanley, J. E. 1989. Pisces. Petromyzontidae to Carangidae Zoological Catalogue, 7. Australian Government Publishing Service, Canberra, Australia.

Roberts, C. D. 1996. Hapuku and bass: the mystery of the missing juveniles. Seafood New Zealand, 4: 17–21.

Sedberry, G. R., Carlin, J. L., Chapman, R. W., and Eleby, B. 1996. Population structure in the pan-oceanic wreckfish, *Polyprion americanus* (Teleostei: Polyprionidae), as indicated by mtDNA variation. Journal of Fish Biology, 49: 318–329.

Wakefield, C. B., Newman, S. J., and Molony, B. W. 2010. Age-based demography and reproduction of hapuku, *Polyprion oxygeneios*, from the south coast of Western Australia: implications for management. ICES Journal of Marine Science, 67(6): 1164–1174.

West, L. D., Stark, K. E., Murphy, J. J., Lyle, J. M., and Ochwada-Doyle, F. A., 2015. Survey of recreational fishing in New South Wales and the ACT, 2013/14. Fisheries Final Report Series No. 149. NSW Department of Primary Industries, Wollongong.