Sandbar Shark (2023)

Carcharhinus plumbeus

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STOCK STATUS OVERVIEW

Jurisdiction	Stock	Stock status	Indicators
Western Australia, Northern Territory	Western Australia	Recovering	Catch, CPUE , fishing mortality
Queensland, New South Wales	Eastern Australia	Sustainable	Catch, NeOGen genetic population estimate

STOCK STRUCTURE

Sandbar Shark (*Carcharhinus plumbeus*) occurs primarily off both the east and west coasts of Australia, from approximately latitude 17–32°S off the east coast, and latitude 13–36°S off the west coast [McAuley et al. 2007a; Last and Stevens 2009]. The species is also encountered off the northern Australian coast, although in much lower numbers. In addition to genetic analysis that suggests limited gene flow between eastern and western Sandbar Shark stocks [Portnoy et al. 2010], there are limited recorded catches in the Gulf of Carpentaria and southern Australia. Conventional tagging data and recent genomic studies indicate that Sandbar Sharks form a single population within Western Australia (McAuley et al. 2005; Pember et al 2023). Thus, the species is considered to be represented by separate Eastern and Western biological stocks in Australian waters.

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

STOCK STATUS

Eastern Australia

In New South Wales, whaler sharks (*Carcharhinus* spp.), including Sandbar Shark, have historically not been adequately identified and reported at a species level in commercial catch data. However, observer data indicate that Sandbar Shark represents the largest single-species component of catches in the Ocean Trap and Line Fishery (New South Wales), at 35% of the overall shark catch between 2008 and 2009 [Macbeth et al. 2009]. Since the introduction of new logbooks in 2009, fishers are required to report all landed sharks to species level with improved reliability of species identification following development of a species identification guide and at-sea education via an observer program [Macbeth et al. 2018]. Since new management arrangements were introduced in 2013–14, catch has not exceeded 3.8 tonnes (t) per annum, with 3.26 t reported for the fiscal year 2021–22. Insufficient information is available to undertake a quantitative stock assessment of any whaler shark species in NSW [Rowling et al. 2010]. Therefore, a weight-of-evidence approach combining catch data and analysis of Effective Population Size has been used to determine stock status.

In Queensland, Sandbar Shark are retained in negligible quantities across the net and line fishery components of the East Coast Inshore Fishery (ECIF). The species makes a minor contribution to the total Queensland shark harvest with less than one t reported through the logbook program each year since 2003–04 apart from 2007–08 (1.6 t) and 2009–10 (1.9 t).

Outside the commercial fishing sector, the catch of Sandbar Sharks in Queensland waters is low to negligible. On average, nine Sandbar Sharks are caught in the Queensland Shark Control Program each year (2001–2017 data) [Queensland Government, 2023]. No recreational or charter data is available for this species [Teixeira et al. 2021]. However, recreational harvest is limited by a one shark in possession limit and a maximum legal size limit of 1.5 m total length.

New software, known as NeOGen [Blower et al 2019], has been developed which estimated the total population size of Sandbar Sharks on the eastern Australian coastline to be approximately 105,000 individuals based on 476 genetic samples [Blower 2020; Peddemors et al. 2020]. Simulations at the historically higher fishing levels recorded in 2008–09 indicated those observed fishery harvest volumes to be sustainable [Blower 2020; Peddemors et al. 2020]. The above evidence indicates that the biomass of this stock is unlikely to be depleted and that recruitment is unlikely to be impaired. The above evidence also 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 Eastern Australia biological stock is classified as a **sustainable stock**.

Western Australia

In Western Australia, Sandbar Shark is targeted by the West Coast Demersal Gillnet and Demersal Longline Fishery, and is also taken in lesser quantities by the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery [McAuley et al. 2015]. Sandbar Shark was also previously targeted by the Western Australian North Coast Shark Fishery [McAuley and Rowland 2012]. The Western Australia stock assessment uses current and historical data from all of these fisheries. Minor catches historically reported from the Offshore Net and Line Fishery (Northern Territory) are assumed to be from the Western Australia biological stock, as are recently quantified catches from the Memorandum of Understanding (MoU) Box Shark Fishery [Marshall et al. 2016, Braccini et al. 2021].

The status of this stock was initially assessed using demographic modelling techniques and fishing mortality rates estimated from tagging studies between 2001 and 2004 [McAuley et al. 2005; McAuley et al. 2007b]. This assessment indicated that combined levels of fishing mortality in Western Australian targeted shark fisheries, non-target commercial fisheries and the recreational fishing sector became increasingly unsustainable between 2001 and 2004 (when reported catches peaked at 918 t) and had probably exceeded sustainable levels since 1997–98. These conclusions were supported by fishery-independent survey data that indicated declining breeding stock abundance between 2002 and 2005 [McAuley et al. 2005; McAuley and Rowland 2012].

Since 2010, Sandbar Shark catches have remained well below the levels expected to allow a gradual recovery of the breeding stock [McAuley et al. 2015]. The expected reductions in recruitment from historical excessive exploitation of the breeding stock are likely to have been ameliorated by this significant reduction in targeted fishing effort. Therefore, the more recent levels of fishing were considered suitably precautionary to ensure the recovery of this biological stock [McAuley et al. 2015].

In 2018, a stock assessment was conducted based on a risk-based weight of evidence approach using all available lines of evidence, including simulated biomass trajectories derived from a combination of demographic modelling and catch-only modelling [Braccini et al. 2018]. This assessment estimated a "Medium" current sustainability risk from fishing for the Sandbar Shark stock [Braccini et al. 2018].

Updated stock assessments using a range of catch-only methods, a state-space biomass dynamics model (JABBA, Winker et al. 2018), integrated age-structured models (Stock Synthesis, Methot and Wetzel, 2013), and time series of reconstructed catches, catch rates, abundance and length composition are underway (Braccini et al. unpublished). Preliminary findings, based on catch only methods and the biomass dynamics model, indicate that for the last 10 years total catches have been below those required to achieve MSY and that the recent biomass trajectory has considerably increased. In addition, fishery independent surveys of the adult component of the stock in northern western Australia show a strong increasing trend since 2008.

The above evidence indicates that the biomass of this stock is likely to be depleted and that recruitment is likely to be impaired. However, for the period 2015 to 2022 these indicators suggest a recovering stock. The above evidence indicates that the current level of fishing mortality should allow the stock to recover from its recruitment impaired state.

On the basis of the evidence provided above, the Western Australia biological stock is classified as a **recovering stock**.

BIOLOGY

Sandbar Shark biology [McAuley et al. 2006; McAuley et al. 2007a; Geraghty et al. 2013]

Species	Longevity / Maximum Size	Maturity (50 per cent)
Sandbar Shark	30–40 years, 1 660 mm FL, 2 150 mm TL	Females: 16.2 years, 1 360 mm FL Males: 13.8 years, 1 270 mm FL

DISTRIBUTION

Distribution of reported commercial catch of Sandbar Shark

TABLES

Fishing methods				
	New South Wales	Northern Territory	Queensland	Western Australia
Charter				
Hook and Line		✓	✓	
Rod and reel				✓
Unspecified				✓
Commercial				
Demersal Longline	✓			
Gillnet				✓
Hook and Line	✓			
Line			✓	
Longline (Unspecified)				✓
Mesh Net	✓			
Net			✓	
Otter Trawl	✓			

Unspecified		✓		
Various	✓			
Recreational				
Hook and Line	✓	✓	✓	✓
Unspecified				✓

Management Methods				
	New South Wales	Northern Territory	Queensland	Western Australia
Charter				
Bag limits	✓			✓
Bag/possession limits			✓	
Gear restrictions			✓	
Licence (boat-based sector)				✓
Processing restrictions			✓	
Seasonal or spatial closures			✓	
Size limits			✓	
Spatial closures				✓
Commercial				
Bag/possession limits	✓		✓	
Catch limits				✓
Effort limits	✓			
Effort limits (individual transferable effort)				✓
Gear restrictions	✓	✓	✓	✓
Harvest Strategy			✓	
Limited entry	✓		✓	✓
Processing restrictions	✓	✓	✓	✓
Quota		✓		

Seasonal or spatial closures			✓	
Size limits			✓	
Spatial closures	✓	✓		✓
Total allowable catch			✓	
Vessel restrictions	✓	✓	✓	
Recreational				
Bag limits	✓			✓
Bag/possession limits			✓	
Gear restrictions	✓	✓	✓	✓
Licence (boat-based sector)				✓
Possession limit		✓		
Processing restrictions			✓	
Seasonal or spatial closures			✓	
Size limits			✓	
Spatial closures				✓

Catch				
	New South Wales	**Northern Territory**	**Queensland**	**Western Australia**
Charter		Unknown but likely to be negligible	Unknown	0.06 t
Commercial	3.2571 t	0.096 t	0 t	38.9515 t
Indigenous	Unknown but likely to be negligible	Unknown but likely to be negligible	Unknown but likely to be negligible	Unknown but likely to be negligible

Recreational	Unknown but likely to be negligible	Unknown but likely to be negligible	Unknown but likely to be negligible	<10 t retention of all whaler sharks caught from boats, shore-based catches are likely to be negligible

Western Australia – Recreational (Management methods) A recreational fishing from boat licence is required for recreational fishing from a powered vessel in Western Australia.

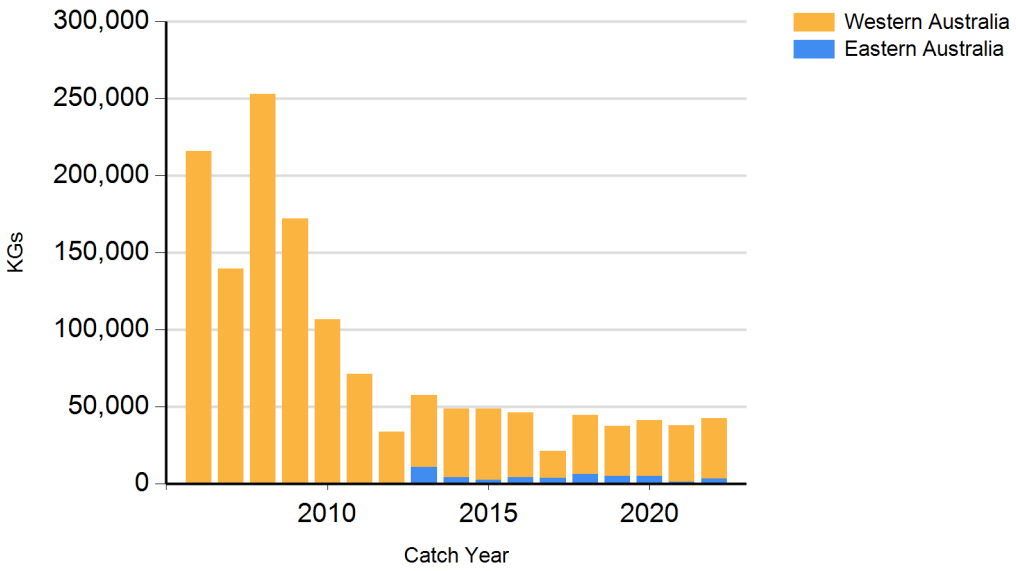
Queensland – Commercial QLD commercial and charter data has been sourced from the commercial fisheries logbook program. Further information available through the Fisheries Summary Report (https://www.daf.qld.gov.au/business-priorities/fisheries/monitoring-research/data/queensland-fisheries-summary-report)

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

Recreational and Indigenous (catch) Given the offshore distribution of Sandbar Shark, near-shore catches are likely to be negligible.

CATCH CHART



Commercial catch of Sandbar Shark - note confidential catch not shown

References

Last and Stevens 2009	Last, PR and Stevens, JD 2009, Sharks and rays of Australia, 2nd edn, CSIRO Publishing, Collingwood.
McAuley et al. 2007a	McAuley, RB, Simpfendorfer, CA, Hyndes, GA and Lenanton, RCJ 2007, Distribution and reproductive biology of the Sandbar Shark, Carcharhinus plumbeus, (Nardo, 1827) in Western Australian waters, Marine and Freshwater Research, 58: 116–126.
Portnoy et al. 2010	Portnoy, DS, McDowell, JR, Heist, EJ, Musick, JA and Graves, JE 2010, World phylogeography and male-mediated gene flow in the Sandbar Shark, Carcharhinus plumbeus, Molecular Ecology, 19: 1994–2010.
McAuley et al. 2015	McAuley, R, Braccini, M, Newman, SJ and O'Malley, J 2015, Temperate Demersal Gillnet and Demersal Longline Fisheries Status Report, in WJ Fletcher and K Santoro (eds), Status Reports of the Fisheries and Aquatic Resources of Western Australia 2014/15, Western Australian Department of Fisheries, Perth, 261–272.
McAuley and Rowland 2012	McAuley, R and Rowland, F 2012, Northern Shark Fisheries status report, in WJ Fletcher and K Santoro (eds), Status reports of the fisheries and aquatic resources of Western Australia 2011/12, Western Australian Department of Fisheries, Perth, 222–227.
Marshall et al. 2016	Marshall L, Giles, J and Johnson, GJ 2016, Catch composition of a traditional Indonesian shark fishery operating in the MOU Box, northwestern Australia: Results of shark fin identification from Operation Snapshot (May 2015), Australian Fisheries Management Authority, Canberra.
McAuley et al. 2005	McAuley, R, Lenanton, R, Chidlow, J, Allison, R and Heist, E 2005, Biology and stock assessment of the Thickskin (Sandbar) Shark, Carcharhinus plumbeus, in Western Australia and further refinement of the Dusky Shark, Carcharhinus obscurus, stock assessment, final report to the Fisheries Research and Development Corporation, project 2000/134, Fisheries research report 151, Western Australian Department of Fisheries, Perth.
McAuley et al. 2007b	McAuley, RB, Simpfendorfer, CA and Hall, NG 2007, A method for evaluating the impacts of fishing mortality and stochastic influences on the demography of two long-lived shark stocks, ICES Journal of Marine Science, 64: 1710–1722.
Macbeth et al. 2009	Macbeth, WG, Geraghty, PT, Peddemors, VM and Gray, CA 2009, Observer-based study of targeted commercial fishing for large shark species in waters off northern New South Wales, Fisheries final report series 114, Industry and Investment New South Wales, Cronulla.
Rowling et al. 2010	Rowling, KA, Hegarty, A and Ives, M 2010, Status of fisheries resources in NSW 2008/09, Industry and Investment New South Wales, Cronulla.
Geraghty et al. 2013	Geraghty PT, Macbeth, WG, Harry, AV, Bell, JE, Yerman, MN and Williamson, JE 2013, Age and growth parameters for three heavily exploited shark species off temperate eastern Australia, ICES Journal of Marine Science, 71: 559–573.
McAuley et al. 2006	McAuley, RB, Simpfendorfer, CA, Hyndes, GA, Allison, RR, Chidlow, JA, Newman, SJ and Lenanton, RCJ 2006, Validated age and growth of the sandbar shark, Carcharhinus plumbeus (Nardo, 1827) in the waters off Western Australia, Environmental Biology of Fishes, 77: 385–400.
Macbeth et al. 2018	Macbeth, WG, Butcher, PA, Collins, D, McGrath, SP, Provost, SC, Bowling, AC, Geraghty, PT and Peddemors, VM 2018, Improving reliability of species identification and logbook catch reporting by commercial fishers in an Australian demersal shark longline. Fisheries Management and Ecology, 25: 186–202.
Braccini et al. 2018	Braccini, M, Blay, N, Hesp, A, and Molony, B 2018. Resource Assessment Report Temperate Demersal Elasmobranch Resource of Western Australia. Department of Primary Industries and Regional Development. Fisheries Research Report No. 294 Department of Primary Industries and Regional Development, Western Australia. 149 pp
Ryan et al 2019	Ryan, K.L., Hall, N. G., Lai, E. K., Smallwood, C. B., Tate, A., Taylor, S. M. and Wise, B. S. (2019). Statewide survey of boat-based recreational fishing in Western Australia 2017/18. Fisheries Research Report No. 297, Department of Primary Industries and Regional Development, Western Australia
Blower 2020	Blower, D. C. 2020. Estimating contemporary abundance, demography, and vulnerability to change for long-lived species with effective population size and population simulation. PhD thesis. School of Biological Sciences, p. 257. The University of Queensland.
Blower et al 2019	Blower D.C., C. Riginos, J.R. Ovenden. (2019). NeOGen: A tool to predict genetic effective population size (Ne) for species with generational overlap and to assist empirical Ne study design. Molecular Ecology Resources 19: 290-271.
Queensland Government 2023	Queensland Government, 2023, Shark Control Program: Shark Catch Statistics by Year. Available at: https://www.data.qld.gov.au/dataset/shark-control-program-shark-catch-statistics (Accessed: 2 August 2023).

Teixeira et al. 2021	Teixeira, D, Janes, R, and Webley, J 2021, 2019–20 Statewide Recreational Fishing Survey Key Results. Project Report. State of Queensland, Brisbane.
Braccini et al. 2021	Quantifying the unreported and unaccounted domestic and foreign commercial catch of sharks and rays in Western Australia. Ambio 50: 1337-1350
Pember et al. 2023	Population genomic and size distribution data suggest high genetic connectivity in the sandbar shark (Carcharhinus plumbeus) along a 2700 km coastline. Fisheries Research 266: 106779
Winker et al. 2018	JABBA: Just Another Bayesian Biomass Assessment. Fish. Res. 204, 275–288
Methot, R.D., Wetzel, C.R., 2013	Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management. Fish. Res. 142, 86–99
Peddemors et al 2020	Peddemors, V, Macbeth, W, Collins, D, Goulstone, A, Ives, M., Ovenden, J., Butcher, P. 2020. Shark Futures: Sustainable management of the NSW whaler shark fishery. Port Stephens, NSW. 190pp.