Threatened Species Assessment

Carcharias taurus
Grey Nurse Shark

Taxonomy

Carcharias taurus Rafinesque, 1810

Current conservation status

Listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999*.

Listed as threatened under the *Flora and Fauna Guarantee Act 1988* (SAC 1998).

Categorised as Data deficient in the 2013 Advisory list of threatened vertebrate fauna in Victoria (DSE 2013).

Proposed conservation status

Critically Endangered in Victoria

Criterion D

Species Information

Description and Life History

Grey Nurse Sharks are slow, but strong, swimmers and are thought to be more active at night (Pollard et al. 1996 as cited in DoE 2019a). The Grey Nurse Shark generally occurs as solitary individuals or in small schools. Larger aggregations of individuals may occur for courtship and mating (Compagno 1984 as cited in DoE 2019a).

Generation Length

The generation length of the Grey Nurse Shark is estimated to be 25 years. Research in the north-western Atlantic Ocean by Goldman et al. (2006) indicates that growth rates of the sexes are similar up to the age of five years, at which time females outgrow males at a significant rate. The age of Grey Nurse Sharks from the above-mentioned population, and the southwestern Indian Ocean has been validated using bomb radiocarbon dating with maximum ages of 40 and 34 years for females and males respectively (Passerotti et al. 2014).

Analyses of the western North Atlantic Grey Nurse Shark population suggests that total length at maturity for females is 2.2-2.6 m (9-10 years) and for males 1.9-2.2 m (6-7 years) (Goldman, et al., 2006). Based on analysis of the Australian population, 50 per cent of males are reproductively mature at a total length of 2.1 m and 50 per cent of females are reproductively mature at a total length of 2.6 m (Otway, et al., 2009; Otway and Ellis, 2011 as cited in DoE 2014b).

In the absence of more thorough information on population age structure, the generation length is taken to be the average between the age at maturity and the maximum age. It is assumed that females continue to breed throughout their life as senescence has infrequently been described in elasmobranchs and to best knowledge, not in any closely related species. The generation time is estimated to be around 25 years based on the age of female maturation and maximum age (i.e. 10 to 40 years). While this is probably an overestimate because older mature individuals are likely to be less abundant in the population, it represents a precautionary estimate using the published information available. Additionally, while large, older females are likely to be less abundant in the population they are likely to produce larger litters.

Carcharias taurus
Grey Nurse Shark

Distribution

Grey Nurse Sharks have been recorded from the Mediterranean Sea and the Atlantic, Indian and Pacific oceans but are now restricted to waters off the east coast of the USA, Uruguay, Argentina, South Africa and Australia (Last and Stevens 1994; NSW Fisheries 2003 as cited in DoE 2019a).

There are two separate, genetically distinct Grey Nurse Shark populations in Australian waters: one off the east coast and one on the west coast (Stow et al., 2006 as cited in DoE 2014a). The west coast population of Grey Nurse Sharks is predominantly found in the south-west coastal waters of Western Australia (Environment Australia 2002a) and has been recorded as far north as the North West Shelf (Stevens 1999; Pogonoski et al. 2002 as cited in DoE 2019a). It is unlikely that the west coast population occurs in Victorian waters.

The east coast subpopulation migrates within its range, making seasonal north-south movements to form aggregations at critical habitat sites, thought to be related to breeding (Bansemer and Bennett 2008 as cited in DoE 2019b). At certain times of the year, it is thought that the Grey Nurse Shark aggregates according to sex. A northerly migration to the Capricorn channel off Yeppoon of mature males has been observed over autumn-winter. Males predominate in southern Queensland waters during July and October, while a high proportion (77.4 percent) of the catch from bather protection programs off central New South Wales during the same period is of females (Reid and Krogh 1992 as cited in DoE 2019b). Females are also known to head south over summer and migrate north in winter to meet males for reproduction along the east coast. Immature and mature male Grey Nurse Sharks, and immature female are known to migrate to southern New South Wales (DoE 2019b).

Following the Victorian government bounty on Grey Nurse Sharks in the late 1900's, due to concerns of eating too many fish, they no longer occur in Port Phillip Bay, the last record being 1970. The east coast population is now extremely rare in Victorian waters with only two other records in the last 50 years, namely Mallacoota in 1994 and Corner Inlet in 2016.

Habitat

Grey Nurse Sharks tend to be found in groups at specific localities. These localities are known as aggregation sites. Grey Nurse Sharks are often observed aggregating around inshore rocky reefs or islands. At these locations they are typically found near the sea bed (at depths of 10-40 m) in deep sandy or gravel filled gutters, or in rocky caves (Otway et al., 2003; Otway and Burke, 2004; Dicken, 2006; Last and Stevens, 2009 as cited in DoE 2014a).

Otway et al. (2003 as cited in DoE (2014a) defined 'key aggregation sites' as being locations where five or more Grey Nurse Sharks were consistently found throughout the year and recommended that these sites be considered habitat critical to the survival of the species.

Threats

The principal threats to Grey Nurse Sharks in Australia are shark control activities such as beach meshing or drum-lining and accidental capture by commercial and recreational fishers (DoE 2014a). Shark meshing and drum-lining involves the placement of nets off beaches and other waters to protect the public from sharks

Other potential threats to the species include impacts from ecotourism, collection for public aquaria, pollution and disease and ecosystem effects as a result of habitat modification and climate change including changes in sea temperature and ocean acidification (DoE 2014a).

IUCN Criteria

Criterion A. Population size reduction.
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a*) *cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

Ineligible under Criterion A

There is insufficient evidence to determine whether there has been or will be a reduction in population sufficient to meet any threshold for Criterion A.

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

Ineligible under Criterion B

The Extent of Occurrence (EoO) across the taxon's range, based on accepted, post-1970 records in the Victorian Biodiversity Atlas (VBA), is estimated to be 27,900 km² which exceeds the threshold for criterion B.

The Area of Occupancy (AoO) across the taxon's range, based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA, is estimated to be 12 km² but other thresholds under this criterion have not been met.

Criterion C. Small Population size and decline		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals				

Evidence:

Ineligible under Criterion C

It is estimated that there are 1 to 50 mature individuals, but other thresholds under this criterion have not been met.

Criterion D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)	<·50	<·250	<·1,000
D2 Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time.	-	-	D2. Typically: AoO <·20 km2 or number of locations ≤·5

Evidence:

Eligible under Criterion D as Critically Endangered

The taxon is estimated to have 1 to 50 mature individuals. Recent research has obtained a relatively robust population estimate for the east coast Grey Nurse Shark population. Recent studies estimate there are 1365 individual Grey Nurse Sharks, with 95 per cent confidence intervals for this population estimate of between 1146 and 1662 individuals (DoE 2014b). The number of mature individuals was not provided in this paper however.

There is no information about the current population size in Victoria. On the basis of past records, only three since 1970, it is not unreasonable to assume that the number of mature individuals present in Victoria any one time is below 50 individuals, unless there are one or more aggregation sites that have yet to be identified, which is relatively unlikely.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.

References

Bradford, R. W.,Thomson, R.; Bravington, M., Foote, D.; Gunasekera, R., Bruce, B. D., Harasti, D., Otway, N., Feutry, P. (2018). A close-kin mark-recapture estimate of the population size and trend of east coast Grey Nurse Shark. Report to the National Environmental Science Program, Marine Biodiversity Hub. CSIRO Oceans and Atmosphere, Hobart, Tasmania.

D. D. Reid, W. D. Robbins and V. M. Peddemors (2011) Decadal trends in shark catches and effort from the New South Wales, Australia, Shark Meshing Program 1950]2010. *Marine and Freshwater Research*, 2011, 62, 676-693

DoE (2014a). Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*). Department of Environment, Canberra. Available from: http://www.environment.gov.au/system/files/resources/91e141d0-47aa-48c5-8a0f-992b9df960fe/files/recovery-plan-grey-nurse-shark-carcharias-taurus.pdf

DoE (2014b). Issues Paper for the Grey Nurse Shark (*Carcharias taurus*) Department of Environment, Canberra. Available from: http://www.environment.gov.au/system/files/resources/91e141d0-47aa-48c5-8a0f-992b9df960fe/files/issues-paper-grey-nurse-shark-carcharias-taurus.pdf

DoE (2019a). *Carcharias taurus* (west coast population) in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68752

DoE (2019b). *Carcharias taurus* (east coast population) in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68751

DSE (2013). *Advisory List of Threatened Vertebrate Fauna in Victoria - 2013.* Department of Sustainability and Environment, Melbourne

McCoy, F. (1882) Prodromus of the Zoology of Victoria. Part VII, Plate 64; pp 13-15. Government Printer, Melbourne. https://www.biodiversitylibrary.org/item/27160#page/108/mode/2up

Passerotti, M.S., Andrews, A. H., Carlson, J. K., Wintner, S. P., Goldman, K.J. and Natanson, L.J. (2014) Maximum age and missing time in the vertebrae of sand tiger shark (*Carcharias taurus*): validated lifespan from bomb radiocarbon dating in the western North Atlantic and southwestern Indian Oceans. *Marine and Freshwater Research* 65(8) 674-687 Available from: https://doi.org/10.1071/MF13214

Pollard, D.A., M.P. Lincoln-Smith and A.K. Smith (1996). The biology and conservation of the Grey Nurse Shark (*Carcharias taurus* Rafinesque 1810) in New South Wales, Australia. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 6. 1-20.

Reid, D.D., Robbins, W.D. and Peddemors, V. M. (2011) Decadal trends in shark catches and effort from the New South Wales, Australia, Shark Meshing Program 1950-2010. *Marine and Freshwater Research,* 62: 676-693

SAC (1998). Flora and Fauna Guarantee Scientific Advisory Committee: Final Recommendation on a Nomination for Listing. Nomination No. 420 *Carcharias taurus*