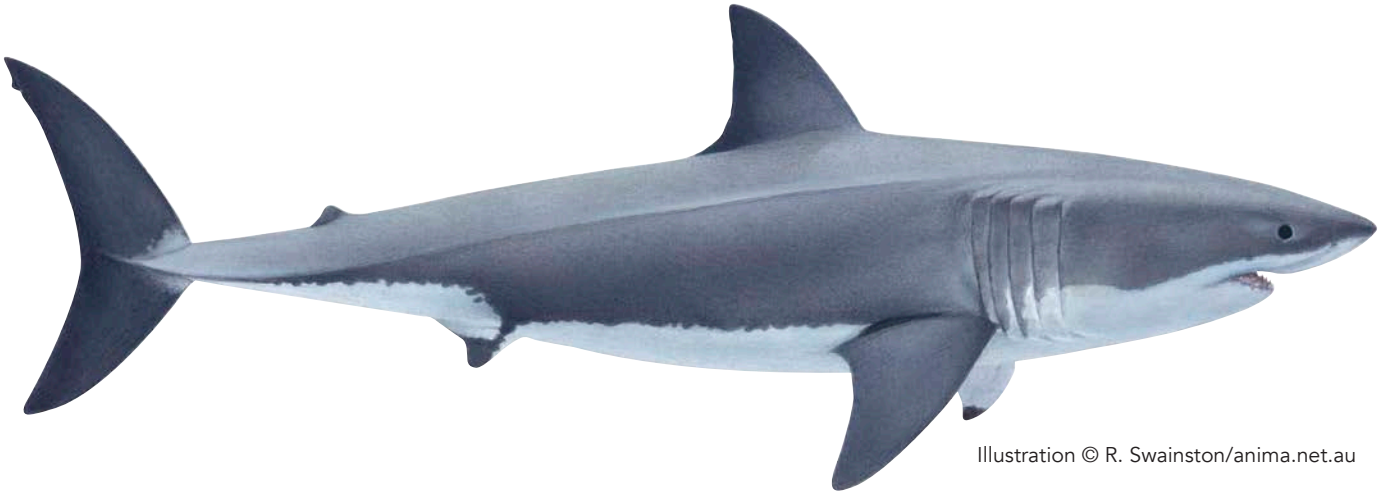
White shark movement and population



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White shark biology

The white shark (*Carcharodon carcharias*), also known as the great white or white pointer shark, generally occurs in cool temperate to subtropical latitudes around the world. White sharks possess a heat-exchanging circulatory system which allows them to maintain a body temperature up to 14° C above that of the surrounding sea water, enabling them to tolerate a wide range of ocean temperatures.

Until recently, white sharks were thought to live only in continental shelf waters[1], but satellite tagging data has now revealed that they may also travel into and across deep oceans, such as across the Indian Ocean from Western Australia to South Africa, and across the Tasman Sea between Australia and New Zealand.

White shark numbers

Since 1997, the white shark has been listed as a vulnerable species under Commonwealth legislation[2], and also as totally protected under Western Australian legislation[3]. The reasons for the listing include evidence of a declining population; that the sharks were under pressure through commercial fishing; along with mortality from mitigation programs on the east coast (nets and drumlines) and recreational fishing, and that it is a long lived species with low levels of reproduction.

Until recently, estimates of white shark population size were based on historical fishing catch data, which was unreliable. In a world first, reliable estimates of white shark abundance in Australia became available in 2018 when scientists from the CSIRO

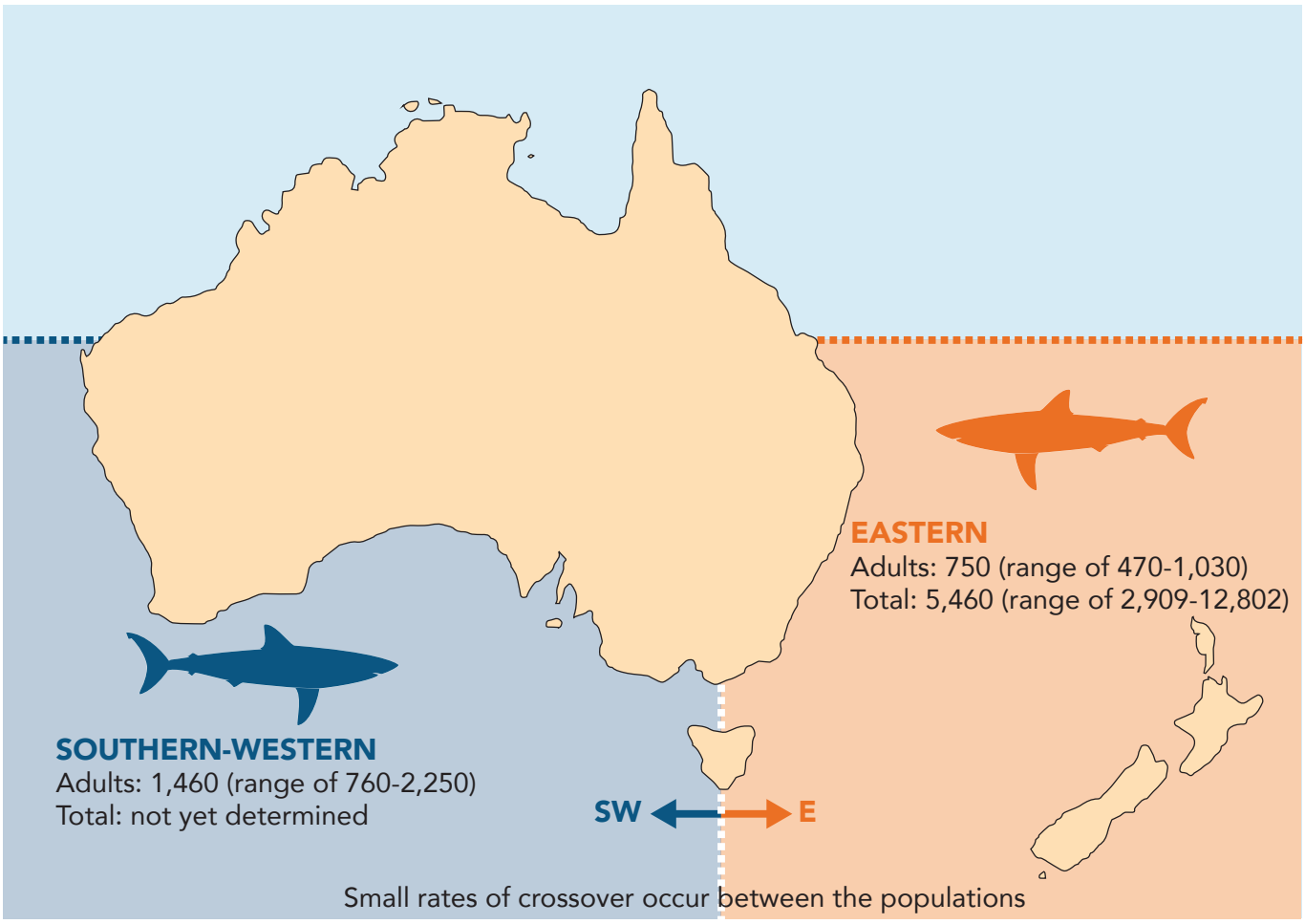
developed novel genetic and statistical techniques to provide direct estimates of white shark population size. The techniques – called 'Close-kin mark-recapture' – use genetic information gathered from small flesh samples of sharks to estimate the abundance and trends in the adult population[4].

The CSIRO study found that there are between about 760 and 2,250 **adult** sharks (best estimate of 1,460 sharks) in the southern-western population off South and Western Australia, and between about 470 and 1,030 **adult** sharks off eastern Australia (best estimate of 750 sharks).

The **total** white shark population off eastern Australia was estimated to be between 2,909 and 12,802 sharks (best estimate of 5,460 sharks) but due to a lack of genetic data for juveniles, the total number of the southern-western population could not be directly estimated using these techniques. Further research and genetic sampling is therefore needed to determine the total size of the southern-western population.

In addition to estimating the number of sharks in each population, the CSIRO study also estimated the trends in adult shark numbers – that is, whether numbers are increasing, stable or decreasing. The study found that adult shark numbers in both southern-western and eastern populations are estimated to have been stable since the commencement of white shark protection with no significant change in adult shark numbers since the late 1990s.

White shark distribution and numbers in Australia



Estimates published online by the NESP Marine Biodiversity Hub in February 2018. www.nespmarine.edu.au

White sharks occur from the central Queensland coast, around the south coast of Australia, to the north-western coast of Western Australia.

Genetic data collected from sharks and satellite tagging data which tracks their movement demonstrate that there are two distinct populations of white sharks in Australian waters, separated east and west by Bass Strait. Sharks in the two populations are thought to rarely mingle, giving them distinct genetic material.

The southern-western population extends from western Victoria across the south of Australia and up the Western Australian coast. This represents the typical range of the southern-western population, but satellite tagged sharks have been tracked far south into the Southern Ocean and to South Africa.

The eastern population extends from the east coast of Australia to New Zealand and south-western Pacific, including waters off New Caledonia, Vanuatu and Tonga.

White shark movements

Another recent world-first study of the long-range movements of 89 acoustically tagged sub-adult and adult white sharks has provided the first reliable evidence to describe how white shark numbers and distribution varies around the State's extensive coastline[5].

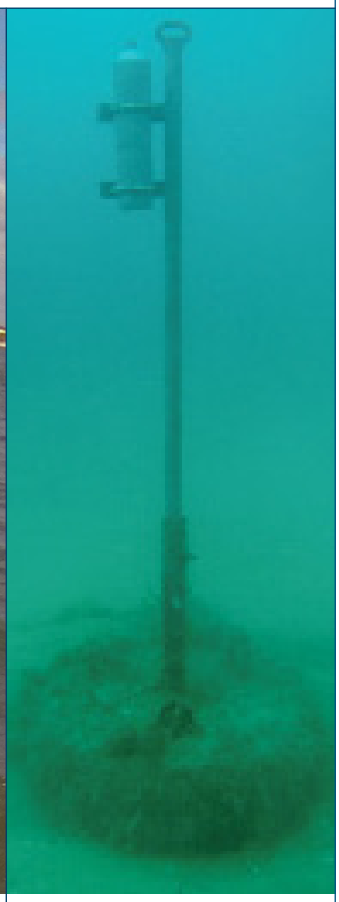
The sharks' movements were monitored by a network of acoustic receivers ('listening stations') off the south and west coasts of Australia between December 2008 and May 2016. In total, these 89 sharks travelled over 185,092 kilometres and commonly maintained travelling speeds of over 3 kilometres per hour over distances of thousands of kilometres (up to a maximum of 5.6 kilometres per hour).

The majority of sharks were detected in waters more than 50 metres deep and more than 10 kilometres from the mainland coast, where they are too far offshore to be encountered by most water users.

Results from this study found that white sharks may be present off most of the south and lower west coasts of Western Australia throughout the year, but are more common off the lower west coast (including Perth, Mandurah and Bunbury) during spring and

Acoustic receiver ('listening stations')

Satellite-linked (VR4G) acoustic receivers transmit detection data in real-time via satellite.



Data-recording (VR2W) acoustic receivers did not transmit data but stored it in the receivers' onboard memory. These receivers were recovered annually during the research project so that stored data could be downloaded and the receivers serviced.

early summer and least likely to be present during late summer and autumn.

Despite these seasonal patterns in shark numbers, the direction of individuals' movements was generally uncoordinated, with sharks travelling in both directions between monitored areas at all times of the year.

These findings do not support the popular theory that white sharks follow predictable patterns of whale migrations along the Western Australian coast. This study also found limited evidence that sharks predictably return to any particular areas or locations around the WA coast, or that they are being attracted to expanding fur seal colonies.

1 Continental shelf waters are the relatively shallow waters, up to around 200 metres deep, that directly surround the Australian land mass.

2 Currently the Environment Protection and Biodiversity Conservation Act 1999

3 Fish Resources Management Act 1994

4 A National Assessment of the Status of White Sharks, February 2018

5 Fisheries Research Report No. 273 – Evaluation of Passive Acoustic Telemetry Approaches for Monitoring and Mitigating Shark Hazards Off the Coast of Western Australia, March 2016

Further information

SharkSmart
www.sharksmart.com.au

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