Recovery Plan for the White Shark *(Carcharodon carcharias)*

2013

The issues paper linked to this recovery plan is obtainable from:
www.environment.gov.au/biodiversity/threatened/recovery-list-common.html

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Front and back cover left to right: white shark over seabed — Rachel Robbins, white shark in open water — Barry Bruce, close up image of white shark — Les Parsons, white shark on the water's surface — Mark Allen

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Abbreviations

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities, Commonwealth
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
HSI	Humane Society International
IUCN	International Union for Conservation of Nature
NSRG	National Shark Recovery Group
TRAFFIC	Trade Records Analysis of Flora and Fauna in Commerce
TSSC	Threatened Species Scientific Committee

1 SUMMARY

This document constitutes the Australian National Recovery Plan for the White Shark. The plan considers the conservation requirements of the species across its range and identifies the actions to be taken to ensure the species' long-term viability in nature and the parties that will undertake those actions. This is a revision of the 2002 White Shark *(Carcharodon carcharias)* Recovery Plan (EA, 2002) and should be read in conjunction with the 2013 Issues Paper for the White Shark *(Carcharodon carcharias)* (DSEWPaC, 2013), which is available for download from the department's website at: www.environment.gov.au/biodiversity/threatened/recovery-list-common.html.

A review of the 2002 White Shark *(Carcharodon carcharias)* Recovery Plan, finalised in November 2008, concluded that it was not possible to determine if the white shark population in Australian waters has shown any sign of recovery (DEWHA, 2008). Considering the lack of evidence supporting a recovery of white shark numbers—together with historical evidence of a greater decline in white shark numbers over the last 60 years as compared to other shark species — the review supports the white shark's current status as vulnerable under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The review concluded that a new recovery plan should be developed to remove the completed actions and include new conservation priorities.

In addition to the white shark listing under Commonwealth legislation, the species is fully protected in the coastal waters of Tasmania, South Australia, Victoria and Western Australia; and protected in the coastal waters of New South Wales and Queensland with exemptions made for shark control measures for bather protection (e.g. beach meshing and/or drumlining) in these two states. In some circumstances, the destruction of individual sharks is also authorised under Western Australia's *Fish Resources Management Act 1994*.

The principal threats and likely contributors to the lack of white shark recovery in Australia are mortality resulting from the accidental or illegal (i.e. targeted) capture by commercial and recreational fishers and shark control activities. Other potential threats to the species include the impacts of illegal trade in white shark products, ecosystem effects as a result of habitat modification and climate change (including changes in sea temperature, ocean currents and acidification) and ecotourism, including cage diving.

This recovery plan sets out the research and management actions necessary to stop the decline of, and support the recovery of, the white shark in Australian waters. The overarching objective of this recovery plan is to assist the recovery of the white shark in the wild throughout its range in Australian waters with a view to:

- improving the population status, leading to future removal of the white shark from the threatened species list of the EPBC Act
- ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future.

An accompanying issues paper has also been developed to provide background information on the biology, population status and threats to the white shark. Both the issues paper and the recovery plan can be found at: www.environment.gov.au/biodiversity/threatened/recovery-list-common.html

2 BACKGROUND

2.1 Species description and distribution in Australian waters

The white shark *(Carcharodon carcharias)*, also known as the great white shark or the white pointer, is a close relative of the mako and porbeagle sharks in the family Lamnidae (Last & Stephens, 2009). White sharks are long-lived, living for 30 years or more (Bruce, 2008), and are found throughout temperate and sub-tropical regions in the northern and southern hemispheres (Last & Stephens, 2009).

In Australia, the white shark has a range extending from central Queensland, around the southern coastline, and up to the North West Cape in Western Australia (Last & Stephens, 2009; Appendix 1). The white shark is primarily an inhabitant of continental and insular shelf waters but is also known to inhabit the open ocean. It often occurs close inshore near the surf-line, and may move into shallow bays.

The species is also commonly found in inshore waters in the vicinity of islands, and often near seal colonies (Malcolm et al., 2001). These areas include locations such as the Neptune Islands off the Eyre Peninsula, South Australia; Wilsons Promontory, Victoria (particularly juveniles); the coastal region between Newcastle and Port Stephens, New South Wales (particularly juveniles) and the Recherche Archipelago and the islands off the lower west coast of Western Australia (Malcolm et al., 2001; EA, 2002).

2.2 Population trends

Determining trends in the Australian white shark population is difficult because the species is a widely dispersed, low density, highly mobile apex predator. In addition, it is not targeted by fishers in Australian waters, limiting catch reports as an index of population status. Recent evidence from the New South Wales Shark Meshing (Bather Protection) Program suggests that white shark numbers may have stabilised over the last 30 years in that state. There is, however, historical evidence of a greater decline in white shark numbers Australia-wide over the last 60 years, and no evidence to suggest that white shark numbers have recovered substantially since receiving protection (Reid et al., 2011). However, it is difficult to distinguish population change from the high rates of inter-annual variability in the numbers observed within any one site or region (Cliff et al., 1996). This high level of inter-annual variability means that what may be seen as a decline or increase in numbers over a stretch of a few years may actually be the

result of changes in the distribution of white sharks from one place to another (Bruce, 2008). In addition to this variability caused by movements of white sharks, any rate of increase in the population size of white sharks will be inherently low because of their life history characteristics and will therefore be difficult to detect.

2.3 Habitat critical to the survival of the white shark

The white shark is widely but not evenly distributed in Australian waters, with observations more frequent in some areas (Appendix 1). These areas include waters in and around some fur seal and Australian sea lion colonies such as: the Neptune Islands (South Australia); areas of the Great Australian Bight as well as the Recherche Archipelago and the islands off the lower west coast of Western Australia (Malcolm et al., 2001; EA, 2002). Juveniles appear to aggregate seasonally in certain key areas including the Corner Inlet−90 Mile Beach area of eastern Victoria and the coastal region between Newcastle and Forster in New South Wales, with particular concentrations in the Port Stephens area (Bruce & Bradford, 2008, 2012). The data collected by Bruce & Bradford (2012) demonstrate that these areas were utilised repeatedly on a seasonal basis across different years and are consistent with the definition of 'shark nursery areas' applied by Heupel et al. (2007).

These regions of higher concentration have been mapped as part of the Australian Government's marine bioregional planning process. Appendix 1 shows the biologically important areas for white sharks in Australia's Commonwealth Marine Regions. This map shows not only the broad distribution of white sharks within Australian waters but also identifies high density foraging sites, mostly around seal and sea lion colonies, and juvenile aggregation sites, where known.

The white shark is not known to form and defend territories and is only a temporary resident in areas it inhabits. However, its ability to return on a highly seasonal or more regular basis implies a degree of site fidelity that has implications for repeat interactions with site-specific threats (Bruce et al., 2005). Recent genetic studies have supported the theory that white sharks are philopatric — that is, they return to their birth place for biological purposes such as breeding (Blower, et al. 2012). Previously it was thought that only females exhibited philopatry (Pardini et al., 2001), but evidence in Blower et al. (2012) suggests that males may also display a degree of philopatry. Identified foraging areas, aggregation areas, and sites to which white sharks return on a regular basis may represent habitat critical to the survival of the species. However, further research is needed to identify such habitat.

3 CONSERVATION STATUS

Since the late 1990s, the white shark has been fully protected in Australia under Commonwealth and state legislation and is listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix II (CITES, 2004a, 2004b, 2004c).

The white shark is listed as:

Commonwealth:	Vulnerable and migratory under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 1999.
New South Wales:	Vulnerable under Section 5, Part 1, *Fisheries Management Act 1994,* in 1999. This legislation also contains an exemption for accidental catches in beach meshing.
Queensland:	Protected under Schedule 78(1), *Fisheries Act 1994* in 1997. This legislation also contains an exemption for accidental catches in beach meshing.
South Australia:	Protected under Schedule 42, *Fisheries Act 1982* in 1998.
Tasmania:	Protected under Schedule 135(2), *Threatened Species Protection Act 1995*, in 2000, Section 135(2), *Living Marine Resources Management Act 1995*, in 1998 and declared vulnerable under the Fisheries (General and Fees) Regulations 1996, in 2005.
Victoria:	Protected under Schedule 71, *Fisheries Act 1995*, in 1998.
Western Australia:	Listed as rare or likely to become extinct under Schedule 5 of the *Wildlife Conservation Act 1950*, in 1999 and protected under Schedule 46 of the *Fish Resources Management Act 1994*, in 1997.
International:	• Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), in 2004. • Appendices I and II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), in 2002. • 2012 International Union for the Conservation of Nature (IUCN) Red List, listed as vulnerable, in 1996.

4 REASONS FOR LISTING UNDER THE EPBC ACT

The white shark was listed as vulnerable under the EPBC Act on 16 July 1999. This listing was based on a number of factors, including evidence of a declining population; its life history characteristics (long-lived and low levels of reproduction); limited local distribution and abundance; and, at the time of listing, significant ongoing pressure from the Australian commercial fishing industry. At the time of listing the available data strongly suggested a significant decline in the size of white shark populations in Australian waters (Table 1).

Table 1: Data available at time of listing on abundance and size of white shark populations in Australian waters

Year	Location	Data Used	Trend	Data Source
1950–1999	New South Wales	Annual catch per unit effort in beach protection nets	70% decline	Reid & Krogh, 1992; Malcolm et al., 2001
1950–1970	New South Wales	Average length of sharks caught in nets	Decline from 2.5–1.7m	NSW Fisheries, 1997
1962–1998	Queensland	Annual catch per unit effort in beach protection nets and drumlines	60–75% decline since 1962	Malcolm et al., 2001
1961–1999	South eastern Australia	Capture in sports fishery relative to other large sharks	95% decline	Pepperell, 1992
1980–1990	South Australia	Annual game fishing catch	94% decline	Presser & Allen, 1995

5 EVALUATION OF PERFORMANCE OF THE PREVIOUS RECOVERY PLAN FOR THE WHITE SHARK

A recovery plan for the white shark in Australia was made in July 2002 (EA, 2002). Under the EPBC Act (section 279 (2)), recovery plans need to be reviewed every five years. The purpose of the review is to summarise the actions undertaken against those specified in the 2002 White Shark Recovery Plan, and to assess whether:

- there is an ongoing need for a recovery plan under the EPBC Act
- the recovery plan needs to be varied to ensure further protection for the species.

A review of the 2002 White Shark *(Carcharodon carcharias)* Recovery Plan was completed in November 2008 (DEWHA 2009). The review can be downloaded from the department's website at: www.environment.gov.au/biodiversity/threatened/recovery-list-common.html

The review found that progress had been made on most of the 34 actions listed in the 2002 white shark recovery plan. Of the 34 actions, 14 have been completed, nine have been partially completed, four are ongoing, four have had minimal action recorded against them and three have not been initiated. A summary of the status of the actions identified in the 2002 white shark recovery plan is provided at Appendix 2.

The review noted that since the introduction of the 2002 white shark recovery plan, the number of instances of white shark mortality in the commercial fishing sector appeared to be decreasing and there have been no reports of incidental white shark take in Commonwealth or state waters from the recreational fishing sector. Limited official reporting of interactions is likely to reflect the low encounter rate with white sharks but it may also reflect a lack of reporting of interactions when they do occur. Continuation of efforts to raise awareness of the reporting requirements for protected species interactions is a priority.

Despite modest progress against some of the listed actions, the review concluded that since 2002 there had been no reliable published information suggesting the white shark population in Australian waters was recovering. The review considered the lack of documented recovery was not unexpected given the white shark's low reproductive rate, ongoing uncertainty about the size of the population, and the relatively short period of time since the original recovery plan was made.

Considering the lack of evidence supporting a recovery of white shark numbers, the review provided no reason to alter the white shark's current status as vulnerable under the EPBC Act. The review also concluded that a new recovery plan should be developed for the white shark to remove the completed actions and include new conservation priorities.

The present (revised) recovery plan builds on the 2002 White Shark *(Carcharodon carcharias)* Recovery Plan (EA 2002) and was developed by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) in consultation with representatives from Australian and state government agencies, commercial and recreational fishers, environment non-government organisations and research agencies.

An accompanying issues paper has been developed to provide detailed background information on the biology, population status and threats to the white shark, as well as to identify research and management priorities. The 2013 Recovery Plan for the White Shark *(Carcharodon carcharias)* in Australia should therefore be read in conjunction with the 2013 Issues Paper for the White Shark *(Carcharodon carcharias)* (DSEWPaC, 2013), which can be found at: www.environment.gov.au/biodiversity/threatened/recovery-list-common.html

6 THREATS

The principal threats to the white shark in Australia are outlined in the 2013 Issues Paper for the White Shark *(Carcharodon carcharias)* (DSEWPaC, 2013). These threats are similar to those identified in the 2002 White Shark *(Carcharodon carcharias)* Recovery Plan (EA, 2002) and can be summarised as:

- Mortality related to being caught accidentally (bycatch) or illegally (targeted) by commercial and recreational fisheries, including issues of post release mortality.
- Mortality related to shark control activities such as beach meshing or drumlining (east coast population).

Other potential threats to the species include the impacts of illegal trade in white shark products; ecosystem effects as a result of habitat modification and climate change (including changes in sea temperature, ocean currents and acidification); and ecotourism, including cage diving. The life history characteristics and habitat use of the white shark requires that actions to manage these threats are focused on minimising impacts on survivorship and protecting critical habitat.

7 POPULATIONS THAT REQUIRE PROTECTIVE MEASURES

The actions described in this recovery plan are designed to provide ongoing protection for the white shark throughout its Australian range.

There is evidence of genetic structuring within the Australian white shark population. Recent genetic evidence provides support for maternal structuring between the eastern and south-western coastal regions (Blower et al., 2012). It is suggested that this structuring is a result of philopatry, where individuals range widely but return to their birth place for biological purposes, such as breeding (Blower et al., 2012). These results are in accordance with the tracking data, which show individual white sharks moving up and down the east and west coasts but not moving between the regions (Bruce et al., 2006, Bruce & Bradford, 2012). Blower et al., (2012) also found evidence of maternal genetic structuring between the New South Wales and Queensland white shark populations, which may be a result of as yet unidentified pupping grounds existing in Queensland.

The genetically distinct populations on the eastern and south-western coasts of Australia could be exposed to detrimental genetic effects from population declines (Blower et al., 2012). This suggests that the Australian population should be managed as two management units, one on the east coast and one on the south-west coast. Further research is required to better understand population structure, size and diversity (Blower et al., 2012).

8 OBJECTIVES

The overarching objective of this recovery plan is to assist the recovery of the white shark in the wild throughout its range in Australian waters with a view to:

- improving the population status leading to future removal of the white shark from the threatened species list of the EPBC Act
- ensuring that anthropogenic activities do not hinder recovery in the near future, or impact on the conservation status of the species in the future.

The specific objectives of the plan are presented below.
The objectives are numbered for ease of reference and are not in order of priority.

Objective 1:	Develop and apply quantitative measures to assess population trends and any recovery of the white shark in Australian waters and monitor population trends.
Objective 2:	Quantify and minimise the impact of commercial fishing, including aquaculture, on the white shark through incidental (illegal and/or accidental) take, throughout its range in Australian waters.
Objective 3:	Quantify and minimise the impact of recreational fishing on the white shark through incidental (illegal and/or accidental) take, throughout its range in Australian waters.
Objective 4:	Where practicable minimise the impact of shark control activities on the white shark.
Objective 5:	Investigate and manage (and where necessary reduce) the impact of tourism on the white shark.
Objective 6:	Quantify and minimise the impact of international trade in white shark products through implementation of CITES provisions.
Objective 7:	Continue to identify and protect habitat critical to the survival of the white shark and minimise the impact of threatening processes within these areas.
Objective 8:	Continue to develop and implement relevant research programs to support the conservation of the white shark.
Objective 9:	Promote community education and awareness in relation to white shark conservation and management.
Objective 10:	Encourage the development of regional partnerships to enhance the conservation and management of the white shark across national and international jurisdictions.

9 ACTIONS TO ACHIEVE THE SPECIFIC OBJECTIVES

Actions identified for the recovery of the species covered by this plan are described below. It should be noted that some of the objectives are long-term and may not be achieved prior to the scheduled five-year review of the recovery plan. Priorities assigned to actions should be interpreted as follows:

Priority 1:	Taking prompt action is necessary in order to mitigate the key threats to the white shark and also provide valuable information to help identify long-term population trends.
Priority 2:	Action would provide a more informed basis for the long-term management and recovery of the white shark.
Priority 3:	Action is desirable, but not critical to the recovery of the white shark or assessment of trends in that recovery.

9.1.1 Objective 1: Develop and apply quantitative measures to assess population trends and any recovery of the white shark in Australian waters and monitor population trends.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
1.1	Develop and implement a monitoring program (involving a range of factors, e.g. survival, connectivity, fecundity, age-at-maturity, absolute abundance) to assess population trends and dynamics (link to Objective 8 and Section 6.1 of the Issues Paper).	1	• A reliable methodology to assess population trends and dynamics has been developed and implemented. • Data and population trends are reported annually to DSEWPaC.	DSEWPaC, DAFF, AFMA, state governments and research agencies	Initial program $1.8m over three years. Ongoing program $200–5 000 per annum, depending on scale.
1.2	Develop a national database to record white shark interactions with recreational and commercial fishers.	2	• Monitoring protocols and database established. • Annual reporting of population monitoring data initiated. • Database maintained and updated annually.	DSEWPaC, state governments, research agencies	

9.1.2 Objective 2: Quantify and minimise the impact of commercial fishing, including aquaculture, on the white shark through incidental (illegal and/or accidental) take, throughout its range in Australian waters.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
2.1	Monitor the bycatch and mortality of white sharks in relevant fisheries (all interactions are recorded) and report annually to DSEWPaC.	1	• Bycatch and mortality (including post release mortality) numbers are monitored by Commonwealth and state government agencies and reported annually to DSEWPaC. • Observer programs collect data on white shark interactions and report annually to DSEWPaC. Assess effectiveness of observer coverage. • Non-lethal interactions are recorded and reported annually to DSEWPaC. • Tagging program developed, where appropriate, to evaluate post-release mortality.	DSEWPaC, DAFF, AFMA and state governments	Core government business $50–100 000 for initial project and for each subsequent year the project operates.
2.2	Where relevant, work with the aquaculture industry to improve reporting of interactions with white sharks.	1	• Where appropriate, observer programs collect data on white shark interactions and report annually to DSEWPaC.	DSEWPaC, state governments and the aquaculture industry	Core government business
2.3	Ensure that fisheries management plans that are reviewed for accreditation under the EPBC Act contain actions that are consistent with the recovery of the white shark (where relevant), including minimising the impacts of bycatch and recording of all interactions.	1	• Relevant fisheries management plans/strategies accredited after the adoption of this plan include measures to minimise the impacts of bycatch, including the use of best-handling practices, and appropriate mechanisms to record all interactions with white sharks (where relevant). • Bycatch management arrangements assessed and approved by DSEWPaC.	DSEWPaC and AFMA	Core government business

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
2.4	Ensure actions to reduce levels of white shark mortality are considered when relevant state and territory fisheries management plans are reviewed.	1	• Reviews of fisheries management plans to consider measures to minimise levels of white shark mortality undertaken.	State governments	Core government business

9.1.3 Objective 3: Quantify and minimise the impact of recreational fishing on the white shark through incidental (illegal and/or accidental) take, throughout its range in Australian waters.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
3.1	Develop mechanisms and protocols that facilitate reporting by recreational fishers of interactions with white sharks. Mechanisms chosen should foster the understanding that any reported interaction will be received without prejudice.	1	• White shark sightings/interactions program developed for recreational fishers, including identification guides and reporting protocols.	DSEWPaC, state governments, research agencies, recreational fishing groups and conservation groups.	Core government business
3.2	Encourage recreational fishers to utilise the sighting program (link to Action 3.1) to report and provide, where possible, photographic evidence of sightings of and interactions with white sharks. Requested information from fishers should include estimated number, size and weight of sharks, as well as site location and depth.	2	• White shark sightings/interactions program developed and utilised by recreational fishers. • Practical identification materials distributed. • Report detailing catch levels is prepared on an annual basis.	DSEWPaC, state governments, recreational fishing groups and conservation groups.	
3.3	Quantify, through monitoring, reports and where necessary estimates, of white shark bycatch, mortality and non-lethal interactions, in recreational fishing sectors and report annually to DSEWPaC.	2	• The rate of bycatch and mortality of white sharks from recreational fishing, as obtained through the white shark sightings/interactions program, are monitored and reported annually.	DSEWPaC and state governments.	

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
3.4	Work with recreational fishing associations to ensure they continue to provide information on the protection of white sharks to their members (Link to Action 9.2).	2	• White shark educational material provided to recreational fishers and published in recreational fishing media.	Australian and state governments, recreational fishing groups and conservation groups.	

9.1.4 Objective 4: Where practicable, minimise the impact of shark control activities on the white shark.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
4.1	Shark control programs to continue to report catches annually to the New South Wales and Queensland state governments.	1	• Ongoing collection and assessment of catch data.	DSEWPaC, New South Wales (NSW) and Queensland (Qld) governments.	Core government business
4.2	Maintain the current review processes (by the NSW and Qld governments) of the effect of shark control programs on the white shark. • Ensure similar review of any new shark control programs put in place during the life of this recovery plan.	1	• Levels of white shark mortality/interaction during shark control activities are quantified. • In areas where there is regular mortality/interaction with white sharks during shark control activities, seasonal trends and post release mortality have been monitored. • Options that may facilitate a reduction in white shark captures at locations where there is regular interaction/mortality of white sharks during shark control activities are identified.	State governments.	Core government business
4.3	Where feasible and practical, undertake biological recording and sampling of white sharks caught in shark control programs (Link to Action 4.1).	2	• Protocols for shark control program contractors modified to require, where feasible and practical, retention and delivery to governments and research agencies of white sharks killed in beach safety programs.	NSW and Qld governments.	

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
4.4	Develop a tagging program, where appropriate (including genetic sampling, where possible) for white sharks caught in shark control programs, in conjunction with new and existing programs.	2	• Tagging program developed where possible/appropriate. • Released sharks tagged, and genetic sample retained where possible. • Post-release mortality of released sharks monitored.	State governments and research agencies.	
4.5	Continue to evaluate alternatives to beach meshing/drumlining, including the use of non-lethal methods or alternative strategies.	3	• Alternatives are evaluated and implemented if effective. • The use of beach meshing nets and drumlines to decline as alternatives are developed.	State governments and research agencies.	

9.1.5 Objective 5: Investigate and manage (and where necessary reduce) the impact of tourism on the white shark.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
5.1	Investigate the impact of increased cage diving activity and develop appropriate management responses if required.	3	• Impact of cage diving activities measured. Adaptive management measures applied where required	DSEWPaC, state governments and cage dive operators.	
5.2	Require daily logbook reporting of white shark interactions by cage dive operators.	3	• Cage dive operators provided with logbooks to record white shark interactions daily. • Annual reporting of white shark interactions by cage dive operators.	DSEWPaC, state governments and cage dive operators.	
5.3	Engage cage dive operators in shark research and education programs.	3	• Volunteer dive surveys continued. • Tourism education strategy and initiatives developed and implemented.	DSEWPaC, state governments, research organisations and cage dive operators.	

9.1.6 Objective 6: Quantify and minimise the impact of international trade in white shark products through implementation of CITES provisions.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
6.1	Investigate and quantify protected shark product in trade.	1	• Investigation undertaken into effective ways to quantify protected shark product traded in Australia. Report to also provide a current best estimate of the volume of protected shark products traded.	DSEWPaC and DAFF.	$20–50 000 for report.
6.2	Refine and implement techniques (DNA and morphological) to identify shark products.	2	• Research initiated with a view to refining techniques (DNA and morphological) to identify shark products.	DSEWPaC, DAFF and research agencies.	
6.3	Undertake market place testing of shark products to ascertain the level of supply.	2	• Develop effective ways of undertaking market place testing of shark products. • Market place testing undertaken.	DSEWPaC, DAFF and state and Northern Territory governments and research agencies.	

9.1.7 Objective 7: Continue to identify and protect habitat critical to the survival of the white shark and minimise the impact of threatening processes within these areas.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
7.1	Continue research to locate habitat critical to the survival of the white shark, including pupping, nursery and foraging areas. • Develop and apply a suite of criteria to characterise and identify habitats critical to the survival of the white shark.	1	• Important habitats (e.g. pupping, nursery, foraging, migration areas) for the white shark are identified and mapped (e.g. Biologically Important Areas; Link to Action 7.2) and criteria are developed and applied to characterise such habitats as habitats critical to the survival of the species.	DSEWPaC, state governments and research agencies.	Core government business

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
7.2	Update and refine information on existing Biologically Important Areas (BIAs) identified as part of DSEWPaC's Marine Bioregional Plans, and seek to identify new BIAs as information from research and other processes becomes available (Link to Action 7.1).	1	• Scientific information on white shark behaviour and distribution are improved to allow new biologically important areas to be defined, particularly habitat critical to the survival of the white shark (Link to Action 7.1). • Currency of BIA maps in the conservation values atlas is maintained.	DSEWPaC, state governments and research agencies.	Core government business
7.3	Monitor white shark occupancy and utilisation of BIAs, particularly habitats critical to the survival of the species.	2	• Monitoring program developed to determine white shark occupancy and utilisation of BIAs, particularly habitats critical to the survival of the species.	DSEWPaC, state governments and research agencies.	
7.4	Use BIA maps to help inform the development of appropriate conservation measures, including through the application of advice in DSEWPaC's Marine Bioregional Plans on the types of actions that are likely to have a significant impact on the species. Update such conservation measures as new information becomes available.	1	• Biologically important areas for white sharks, particularly juvenile aggregation sites, pupping grounds and foraging areas are adequately taken into account when assessing the impact of proposed activities in the marine environment and adequately protected.	DSEWPaC, state governments.	Core government business

9.1.8 Objective 8: Continue to develop and implement relevant research programs to support the conservation of the white shark.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
8.1	Collect, analyse and disseminate age, growth, reproduction, survival, mortality and diet information to improve understanding of the population dynamics, habitat requirements and the role of the white shark as an apex predator.	1	• Knowledge of reproductive biology of white sharks improved. • Methodology for field measurement of white sharks identified. • Ages estimated for the majority of incidentally caught and killed white sharks. • Dietary preferences established.	DSEWPaC, state governments and research agencies.	$100–500 000 per annum to support research.
8.2	Continue to collect and analyse biological material for toxicology research and genetic analysis (for example to determine the stock structure, inbreeding depression, population boundaries and abundance); improve coordination of reporting and sampling programs; and coordinate the collation of results and the storage of collected genetic and biological material.	1	• Genetic and biological material collected and processed. • Population genetics clarified by analysis of data. • The use of close-kin genetics is explored (and utilised where appropriate) to determine population abundance. • Coordination of reporting and sampling programs improved.	DSEWPaC, state governments and research agencies.	$100–500 000 per annum to support research. (Some overlap and cost savings will occur if done in conjunction with activities outlined in 1.1 and 8.1)
8.3	Examine habitat use (with a focus on identifying breeding areas, pupping grounds and juvenile aggregation sites) and regional connectivity across life history stages through the use of conventional and electronic tagging technologies including acoustic listening station networks and satellite tagging.	2	• Tagging program developed and implemented using appropriate tagging methods to minimise impacts to tagged sharks.	DSEWPaC, state governments and research agencies.	
8.4	Investigate post-release mortality issues.	2	• Appropriate methodologies to undertake an investigation into post-release mortality issues developed.	DSEWPaC, state governments and research agencies.	

9.1.9 Objective 9: Promote community education and awareness in relation to white shark conservation and management.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
9.1	Promote community education on the threatened status of white sharks.	1	• Community education strategy and initiatives developed and implemented.	DSEWPaC, state governments, research agencies and non-government organisations	$20–50 000 per annum, depending on the size of the program.
9.2	Strengthen awareness of, and compliance with, the requirement to report white shark bycatch and mortality in commercial fisheries, aquaculture operations and recreational and charter fishing operations (Link to Action 3.4).	2	• White shark educational material provided to commercial fishers and recreational fishers and published in recreational fishing media.	Australian, state and Northern Territory governments and commercial and recreational fishing groups.	
9.3	Ensure effective communication by the Commonwealth with relevant stakeholders in regards to any changes in legislative arrangements concerning white sharks.	2	• As appropriate, community education strategy and initiatives developed and implemented.	DSEWPaC.	
9.4	Update DSEWPaC's white shark recovery plan web page to reflect the most current information on the white shark, which can thereby be used as a primary source of information. Ensure the web page is presented in a form that is easily understood by the public and is linked to the relevant website of other jurisdictions with an interest in conservation of white sharks.	2	• DSEWPAC's website is up to date and linked to available information on important websites. • Information available on government websites is consistent and kept up to date.	DSEWPaC and state and Northern Territory governments.	

9.1.10 Objective 10: Encourage the development of regional partnerships to enhance the conservation and management of the white shark across national and international jurisdictions.

Action	Description	Priority	Performance Criteria	Jurisdiction	Indicative cost *Only Priority 1 Actions are costed*
10.1	Assess the availability of information on regional threats to white sharks.	2	• Consistent information on threats is available across jurisdictions.	DSEWPaC, state and Northern Territory governments and research agencies.	
10.2	Identify and promote opportunities for regional collaboration to promote the recovery of white sharks.	2	• Within appropriate fora, such as CMS and CITES meetings, workshops/meetings are held to ensure a coordinated approach to white shark management.	DSEWPaC, state governments and research agencies.	

10 CURRENT MANAGEMENT PRACTICES

Management practices and measures, other than those contained in this plan, have been developed and are being implemented through a number of agencies and programs. These include Australian Fisheries Management Authority (AFMA) procedures and protocols, Department of Agriculture, Fisheries and Forestry (DAFF) policies and programs, and state government programs. Measures include the compulsory use of logbooks by commercial fishers to record incidental capture of white sharks in Commonwealth fisheries; mechanisms to encourage recreational fishers to report interactions and observer programs designed to provide fisheries independent measures of threatened species, such as white shark, mortality in state and Commonwealth waters.

In July 2012, Senator the Hon. Joe Ludwig, Minister for Agriculture, Fisheries and Forestry released Australia's second National Plan of Action for the Conservation and Management of Sharks 2012 (Shark-plan 2). Shark-plan 2 outlines how Australia will manage and conserve sharks, and ensure that Australia meets international conservation and management obligations. The plan identifies research and management actions across Australia for the long-term sustainability of sharks, including actions to help minimise the impacts of fishing on sharks. Shark-plan 2 can be downloaded from the DAFF website at: www.daff.gov.au/fisheries/environment/sharks/sharkplan2

Shark-plan 2 was developed in conjunction with state, Northern Territory and Australian government agencies, and has been endorsed by the Shark-plan Implementation and Review Committee and the Australian Fisheries Management Forum.

The white shark is protected under the EPBC Act. As such, it is an offence to kill, injure, take, trade, keep, or move any individual without a permit in Commonwealth waters. However, the EPBC Act does contain certain provisions that allow an action that is reasonably necessary to prevent a risk to human health or to deal with an emergency involving a serious threat to human life. In addition, all listed threatened species are considered matters of national environmental significance, and any action that may have an impact on a matter of national environmental significance must be referred to the minister responsible for the environment for assessment and approval.

The environmental performance of Commonwealth, state and the Northern Territory-managed wild harvest fisheries is assessed under the EPBC Act. The EPBC Act requires that:

- all Commonwealth-managed and state wild capture marine fisheries with an export component be assessed to ensure they are being managed in an ecologically sustainable way
- all Commonwealth-managed fisheries are also assessed to determine the impact of actions taken under a fishery management plan on matters of national environmental significance
- all Commonwealth-managed fisheries and any state-managed fisheries that operate in Commonwealth waters must also be assessed to determine the impacts of fishing operations on cetaceans, listed threatened species and ecological communities, migratory species, and listed marine species under the EPBC Act.

The assessments consider the impacts of the relevant fishery on target and non-target species caught, and the impacts of fishing activities on the broader marine environment. As a listed threatened species, white sharks cannot be taken in fisheries in Commonwealth or state waters. Interactions are required to be recorded in threatened species interaction logbooks in Commonwealth fisheries and in Western Australian, South Australian, Victorian and New South Wales state fisheries. Interactions with white sharks as well as the life status of the animal when it is captured (e.g. whether it is released alive) are considered in the assessment of fisheries operating in Commonwealth waters.

Other relevant management practices include management planning processes for areas that contain breeding and/or aggregation sites for white sharks, and the incorporation of important sites into marine reserves, both at the Commonwealth (e.g. through the marine bioregional planning process) and state level. The white shark is also protected across its range in state waters. Details of the legislation under which white sharks are protected in Australian waters are provided in the 2013 Issues Paper for the White Shark *(Carcharodon carcharias)* (DSEWPaC, 2013).

Shark control activities are undertaken by the Queensland and New South Wales governments to protect bathers from shark attack. These states have mechanisms in place to monitor the impacts of these activities on protected species and, where possible and without compromising bather safety, reduce those impacts. Evidence from both the Queensland and New South Wales shark control programs indicates a long-term decline in the capture of white sharks, at least during the period since the identification of shark species was recorded. In the New South Wales Shark Meshing (Bather Protection) Program (SMP), there is an indication of an

increase in catch numbers from 2000−2008 from the previous decade (1990−2000) but it is uncertain whether this reflects an actual increase in white shark numbers or is a result of natural variability. Recorded catches (1980s, 1990s, and 2000s) in the shark meshing program are only a third of those from the 1950s and 1970s (Table 2). In addition, catch-per-unit-effort fell from about 3.5 to < 1 shark(s) per 1000 nets (>70 per cent decrease) in the same period (Malcolm et al., 2001).

Table 2: Reported catches of white sharks in the NSW SMP, 1950/51–2010/11 (NSW DPI, 2009, 2011, 2012).

Year	1950/ 51–59/60	1960/ 61–69/70	1970/ 71–79/80	1980/ 81–89/90	1990/ 91–99/00	2000/ 01–09/10	2010/2011
Number of white sharks	151	106	161	59	44	69	6

The Queensland Shark Control Program has been in existence since 1962 and had caught 631 sharks in nets and on drumlines by 1998 (Malcolm et al., 2001). Catch-per-unit-effort is highly variable but has substantially decreased over time by about 60-75 per cent. Data on white sharks caught per year are available from 1985. There were 63 white sharks caught from 1985−1990, 101 caught from 1990−2000, and 62 caught from 2000−2010. In 2011, six white sharks were caught (QOESR, 2012).

The actions set out in this recovery plan in regard to shark control activities focus on maximising the useful data the programs can provide on white shark biology and ecology and minimising the mortalities on non-target species, without reducing the effectiveness of the programs in maintaining bather safety. Shark control activities for bather protection largely occur in state waters and are therefore subject to state legislation. In Commonwealth waters it is an offence under the EPBC Act to kill a white shark, although the Act does allow for some actions that are reasonably necessary to prevent a risk to human health or to deal with an emergency involving a serious threat to human life.

10.1 Marine bioregional plans

Marine bioregional plans have been prepared under section 176 of the EPBC Act for the South-west, North-west, North and Temperate East marine regions in Commonwealth waters around Australia. Each marine bioregional plan describes the conservation values of the region, identifies and characterises the pressures affecting these conservation values, and identifies regional priorities and outlines strategies to address them. As part of the marine bioregional

planning process, the white shark has been identified as a regional priority in the South-west Marine Region and the Temperate East Marine Region. The pressures affecting the white shark have been identified and characterised for these regions. In addition, Schedule 2 of both the South-west and Temperate East marine bioregional plans include guidance for people planning to undertake actions that have the potential to impact on white sharks within these regions. Further information on marine bioregional planning is available on the department's website at: www.environment.gov.au/coasts/marineplans/index.html

DSEWPaC, as the Australian Government department responsible for administering the EPBC Act, maintains a suite of interactive tools that allow users to search, find and generate reports on information and data describing matters of national environmental significance including the white shark. The conservation values atlas shows the location and spatial extent of conservation values (where sufficient information exists) and is available at: www.environment.gov.au/coasts/marineplans/cva/index.html Further information about the white shark is available on the Species Profile and Threats Database (SPRAT) at: www.environment.gov.au/cgi-bin/sprat/public/sprat.pl This database includes links to conservation value report cards, which were developed to support the information provided in each marine bioregional plan.

As part of the marine bioregional planning process biologically important areas have been identified for a number of species, including the white shark. Biologically important areas are areas that are particularly important for the conservation of protected species and where aggregations of individuals display biologically important behaviour such as breeding, foraging, resting or migration. The presence of the observed behaviour is assumed to indicate that the habitat required for the behaviour is also present. Biologically important areas have been identified using expert scientific knowledge about species' distribution, abundance and behaviour in the region, and biologically important area maps and descriptions for the white shark are available in the conservation values atlas at: www.environment.gov.au/coasts/marineplans/cva/index.html

10.2 Commonwealth marine reserves

Marine reserves (also known as marine protected areas or marine parks) are parts of the ocean that are managed primarily for the conservation of their ecosystems, habitats and the marine life they support. Forty new Commonwealth marine reserves were declared around Australia in November 2012. The new Commonwealth marine reserves network includes examples of all of Australia's different marine ecosystems and habitats. Commonwealth marine reserves are managed according to management plans made under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A single management plan is being developed for each regional marine reserves network and for the Coral Sea Commonwealth Marine Reserve. Draft management plans are available at: www.environment.gov.au/marinereserves/index.html. Transitional management arrangements are in place until management plans come into effect in July 2014.

The Commonwealth marine reserves network protects habitats important for threatened species, including the white shark. For example, many of the Commonwealth marine reserves intersect with biologically important areas for the white shark identified in the marine bioregional plans. In particular, the important juvenile aggregation site at Port Stephens intersects with the Hunter Commonwealth Marine Reserve in the Temperate East Commonwealth Marine Reserve Network. In addition, nine of the 14 Commonwealth Marine Reserves in the South-west Commonwealth Marine Reserve Network overlap with biologically important areas for foraging for the white shark. More information is available at: www.environment.gov.au/coasts/marineplans/cva/index.html.. Three of the 14 Commonwealth Marine Reserves in the South East Commonwealth Marine Reserve Network overlap with biologically important areas for foraging for the white shark (Figure 1) and an additional seven of these Commonwealth marine reserves potentially provide further important foraging habitat because they intersect fur seal haul out sites.

11 EFFECTS ON OTHER NATIVE SPECIES OR ECOLOGICAL COMMUNITIES

Reducing anthropogenic impacts from activities such as fisheries activities or encounters with shark protection devices may benefit other threatened marine species, such as other shark species, marine turtles, seabirds and marine mammals. The consequences for other native species, should white shark numbers increase substantially as a result of this plan, is unknown and difficult to predict. Possible negative impacts include increased mortalities of the Australian sea lion *(Neophoca cinerea)*, a listed threatened species, and impacts on other marine mammals and other large marine vertebrates.

12 BIODIVERSITY BENEFITS

The white shark is an ecologically important apex predator that is recorded in low numbers in comparison with other large sharks, even in its known centres of abundance.

The South-west and Temperate East marine bioregional plans have identified the white shark as a regional priority on the basis of their unique association within the regions and their habitats.

Although the white shark is a wide-ranging species that is found in all seas, the South-west Marine Region appears to be an important area for the species. Available records of incidental catches of white sharks in Australian waters are higher in the South-west Marine Region than in any other region, and are not well correlated with fishing effort. Fishing activities along the west coast of Western Australia (Shark Bay to Bunbury) and in the Great Australian Bight appear to have significantly higher interactions with white sharks than in other areas, which indicates that these areas may be particularly important for the species.

Given this recovery plan focuses on removing threats from white shark habitats, it is also likely to have positive implications for a diversity of non-target native species that occur within the same habitats as this species.

13 SOCIAL AND ECONOMIC CONSIDERATIONS

13.1 Commercial and recreational fishing

White sharks have been fished throughout their range in the past and, although there is no legal directed catch of white sharks, incidental and illegal catch remains a major threat to the species. The actions outlined in this recovery plan in relation to commercial fishing focus on improving reporting mechanisms for incidental take and other interactions with white sharks, including potentially an increase in observation coverage. Implementation of these actions is expected to have a minimal degree of economic impact on commercial fisheries.

Recreational fishers have generally been supportive of measures designed to ensure their sport is sustainable. However, recreational line fishing is still considered to be a threat to the white shark. The actions outlined in this recovery plan focus on ensuring compliance with reporting requirements and ensuring adequate reporting mechanisms are in place to assess the impact of recreational fishing on this species. Implementation of these actions will have minimal economic impact on recreational fishers.

13.2 Shark control programs

Shark control (bather protection) activities take place at popular beaches in Queensland and New South Wales and at the time of printing are being considered in Western Australia. Shark-control programs are expensive in that the equipment deployed requires regular boat-based maintenance, and they also incur associated environmental costs. Catches are not confined to dangerous shark species, but include species that pose little threat to human safety (Cliff & Dudley, 2011). The trialling of non-lethal methods to deter sharks is included as an objective of this recovery plan and may provide a sustainable solution to the dual issues of white shark conservation and human safety.

13.3 Ecotourism

In South Australia, cage diving with white sharks is an iconic ecotourism experience. White shark tourism has been conducted in South Australian waters since the 1970s and has been confined to the Neptune Islands Conservation Park since 2002. The white shark is listed as a protected species under the Fisheries Management (General) Regulations 2007 providing full protection for this species in South Australian waters (DENR, 2012).

White sharks are of economic value for ecotourism (boat watching, aerial observations and cage diving), which has the potential to increase coastal community income. However, berleying to attract white sharks may affect their behaviour and therefore Bruce & Bradford (2011) have recommended that the amount of berleying allowed be reduced or capped to minimise further white shark behavioural impacts.

13.4 International trade in shark products

Despite listing on CITES under Appendix II and on Appendices of the CMS, illegal trade still poses a threat to the global and Australian populations of white sharks. Traded products derived from white sharks include fins, jaws, teeth and meat (fresh, frozen or salted for human consumption), cartilage (used as a health food product), oil and hide (for leather products). White shark body parts are of considerable value (Malcolm et al., 2001; CITES, 2004d) and can be bought and sold via the internet. Despite stricter regulations on a national and international scale, the high prices obtained for white shark products provide some incentive for illegal trade.

Illegal fishers generally target larger sharks for their teeth and jaws and this could have a significant, long-term impact on population numbers. As female white sharks reach sexual maturity at approximately 4.5 to 5 metres long — compared to males that reach sexual maturity at smaller sizes — it is the reproductively active females and larger males that are being targeted.

The impact of shark finning on global shark numbers has driven international concern over recent times. While finning bans are in place in Australian waters, it is likely that white sharks are caught in international waters as part of the fin trade.

13.5 Habitat modification/degradation

Habitat degradation (development, pollution and overfishing) also threatens this species and may largely exclude it from areas, perhaps traditionally utilised for feeding or as nurseries, where it was historically much more abundant. As near-coast areas are often a preferred habitat (Fergusson et al., 2009), white shark populations could be adversely affected by coastal habitat degradation and anthropogenic activities in these regions (CITES, 2004d). As habitats critical to the survival of the species are identified, there is potential for developments to be restricted under the EPBC Act development assessment and approval process.

14 DURATION AND COST OF THE RECOVERY PROCESS

It is anticipated that the recovery process will not be achieved prior to the scheduled five year review of the recovery plan. The 2013 Recovery Plan for the White Shark *(Carcharodon carcharias)* in Australia will therefore remain in place until such time as the Australian population of the white shark has improved to the point at which the population no longer meets threatened species status under the EPBC Act.

The cost of implementation of this plan should be incorporated into the core business expenditure of the affected organisations and through additional funds obtained for the explicit purpose of implementing this recovery plan. It is expected that state and Commonwealth agencies will use this plan to prioritise actions to protect the species and enhance its recovery, and that projects will be undertaken according to agency priorities and available resources. Actions which cross jurisdictional boundaries (i.e. states and Commonwealth) may be funded jointly on agreement by relevant parties.

15 AFFECTED INTERESTS

Organisations likely to be affected by the actions proposed in this plan include Australian, state and Northern Territory government agencies, particularly those involved with environmental and fisheries concerns, commercial and recreational fishers, local Indigenous communities, researchers, tourism operators, conservation groups, wildlife interest groups, and proponents of coastal development in the vicinity of important habitat areas. This list should not be considered exhaustive. There may be other interest groups that would like to be included in the future or need to be considered when specialised tasks are required.

16 EFFICIENT AND EFFECTIVE USE OF RESOURCES

In order to maximise the conservation outcomes and cost effectiveness of this plan, the actions proposed in this recovery plan complement those of other threatened species recovery plans (e.g. the Recovery Plan for the Grey Nurse Shark *(Carcharias taurus)*).

17 CONSULTATION

The 2013 Recovery Plan for the White Shark *(Carcharias taurus)* in Australia has been developed through extensive consultation with a broad range of stakeholders. The review of the 2002 White Shark *(Carcharias taurus)* Recovery Plan (EA, 2002) was completed in November 2008, with the assistance of the then National Shark Recovery Group (NSRG). The review was completed by the department and tabled at the 37th meeting of the Threatened Species Scientific Committee — established under the EPBC Act — in November 2008 prior to being endorsed by the then Minister for Environment Protection, Heritage and the Arts.

The NSRG comprised representatives from relevant Australian Government agencies, all states and the Northern Territory, and key stakeholder groups, including the Humane Society International, TRAFFIC, representatives from the commercial and recreational fishing sectors, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Australian Institute of Marine Science (refer to Appendix 3 for a full list of NSRG representatives).

The review found that although progress had been made on many of the actions listed in the recovery plan there was no evidence to suggest a recovery of the white shark population in Australian waters. The review recommended that the 2002 White Shark (Carcharias taurus) Recovery Plan be varied to remove completed actions and include new conservation priorities.

Following endorsement by the Threatened Species Scientific Committee to prepare a revised white shark recovery plan, a stakeholder workshop was held in March 2009 with members from the NSRG and selected shark experts to develop a new recovery plan for the white shark. The revised recovery plan was sent to the Federal environment minister in March 2010 for agreement to enter into the public consultation period. The draft revised recovery plan and issues paper were open to public consultation in April 2010 for a period of three months.

18 ORGANISATIONS/ PERSONS INVOLVED IN EVALUATING THE PERFORMANCE OF THE PLAN

This plan should be reviewed no later than five years from when it was endorsed and made publically available. The review will determine the performance of the plan and assess:

- whether the plan continues unchanged, is varied to remove completed actions, or varied to include new conservation priorities
- whether a recovery plan is no longer necessary for the species as either conservation advice will suffice, or the species is removed from the threatened species list.

As part of this review, the listing status of the species will be assessed against the EPBC Act species listing criteria.

The review will be coordinated by DSEWPaC in association with relevant Australian and state government agencies and key stakeholder groups such as commercial and recreational fishing sectors, non-governmental organisations, tourism operators and scientific research organisations.

Key stakeholders who may be involved in the review of the performance of the 2013 recovery plan for the white shark, including organisations likely to be affected by the actions proposed in this plan, include:

Australian Government

Australian Fisheries Management Authority

Commonwealth Scientific and Industrial Research Organisation

Department of Agriculture, Fishing and Forestry

Department of Resources, Energy and Tourism

Department of Innovation, Industry, Science, Research and Tertiary Education

Department of Sustainability, Environment, Water, Population and Communities

Great Barrier Reef Marine Park Authority

Indigenous Land Corporation

Industry and non-government organisations

Commercial fishers and associations
Conservation groups
Indigenous land councils and communities
Local communities
Nature-based tourism industry
Marine/ocean energy industry
Universities and other research organisations
Recreational fishers and associations
Recreational boating

State/territory governments

Department of Environment and Conservation, WA
Department of Environment and Natural Resources, SA
Department of Primary Industries, Parks, Water and Environment, TAS
Department of Environment and Heritage Protection, QLD
Department of Sustainability and Environment, VIC
Fisheries agencies
Museums
NSW National Parks
Parks and Wildlife Commission, NT
Parks Victoria
Natural resource management bodies/Catchment management authorities in coastal regions
Shipping, oil and gas exploration and development agencies
Local government in coastal regions

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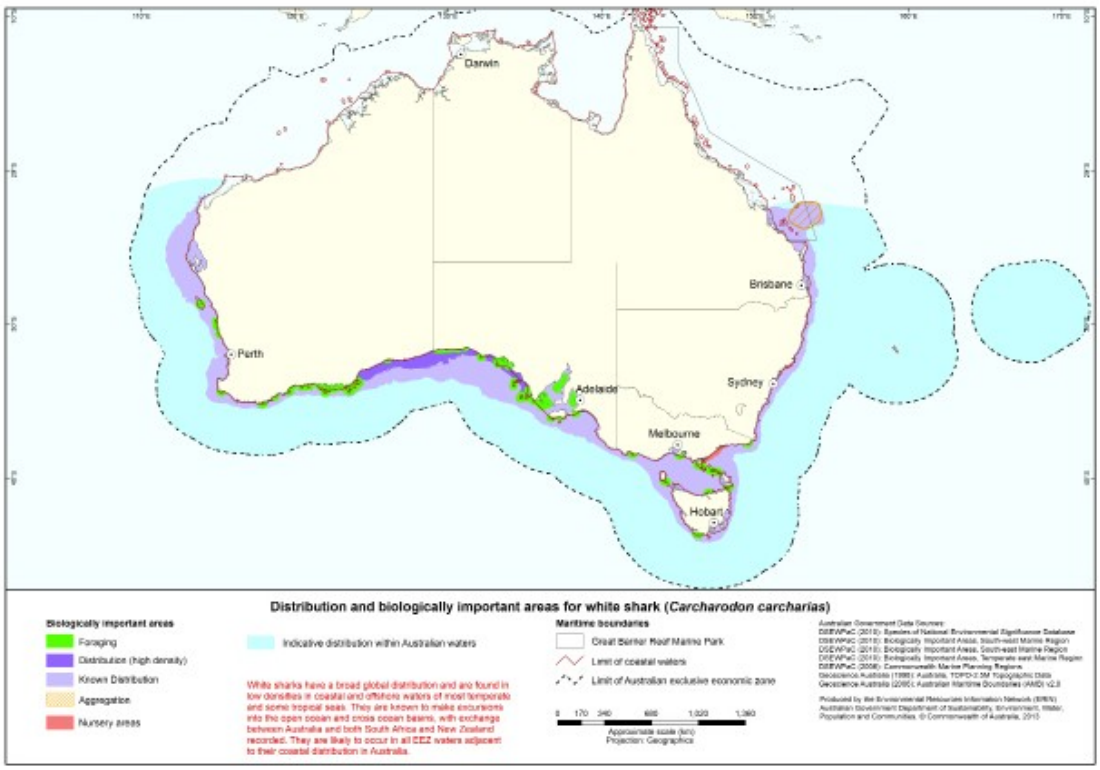
20 APPENDICES

20.1 Appendix 1. Biologically important areas

Figure 1: Distribution, foraging and aggregation sites for the white shark identified through the Marine Bioregional Planning process.



20.2 Appendix 2. Progress on 2002 White Shark *(Carcharodon carcharias)* Recovery Plan

Table 3: Summary of the status of the actions identified in the 2002 White Shark (Carcharodon carcharias) Recovery Plan (EA, 2002).

A. Monitor and reduce the impact of commercial fishing

Prescribed Action	Criteria for Success	2008 Review of Actions
A1. Monitor level of bycatch and mortality in relevant fisheries.	Relevant fisheries report level of bycatch annually	Partially completed. Most jurisdictions introduced reporting requirements for threatened species, including the white shark.
A2. Relevant fisheries to modify logbooks to record bycatch of white shark.	Logbooks used within all relevant fisheries are modified by the end of 2002.	Completed. All jurisdictions have introduced logbooks for threatened species to facilitate reporting of white shark interactions.
A.3. Observer programs to record interactions with white shark.	Observer programs collect data.	Partially completed. Most jurisdictions now have fishery observers in a number of fisheries that record information on target catch, bycatch and protected species interactions.
A.4. Strengthen legislation, awareness and compliance to improve reporting of white shark mortality and bycatch, including recreational charters and finfish cage aquaculture operations.	Captures reported in all relevant fisheries	Partially completed. Education programs have been undertaken by states and the Australian Government. Reporting of interactions is also being streamlined through a number of memorandums of understanding (MoU) developed between the states and DSEWPaC.

Prescribed Action	Criteria for Success	2008 Review of Actions
A.5. and **A.6.** Ensure that fisheries management plan review includes incorporation of actions that will assist the recovery of white shark; and Action A6: Where fisheries management plans are reviewed, consider actions to reduce white shark mortality.	All fisheries management plans that are accredited under EPBC Act contain actions that are consistent with the recovery of the white shark.	Completed and ongoing. When Australian Government fisheries management plans are made or reviewed they must consider provisions to avoid mortality of, or injuries to, protected marine species. The states also have provisions in place to consider the management of protected species in the state managed fisheries.

B. Investigate and reduce the impact of recreational fishing.

Prescribed Action	Criteria for Success	2008 Review of Actions
B.1. Develop a standardised reporting format to record white shark bycatch and sightings and encourage fishers, including gamefishers and aquaculture operators, to report such records to fisheries management agencies.	Regular report detailing current catch levels is prepared for the recovery team annually.	Minimal action. Since the introduction of the White Shark Recovery Plan there have been no reports of incidental white shark take in Commonwealth or state waters from the recreational fishing sector.

C. Monitor and reduce the impact of shark control activities

Prescribed Action	Criteria for Success	2008 Review of Actions
C.1. Numbers of white sharks taken in shark control activities monitored annually.	Take of white sharks in shark control activities is made public.	Completed and ongoing. Comprehensive monitoring programs of shark control activities operate in Queensland and NSW.
C.2. Develop and trial non-lethal shark control alternatives to beach meshing and drumlines with a view to phasing out bottom set shark netting programs of shark control.	Alternatives are developed and trialled.	Minimal action. Alternate shark control methods have been trialled and changes have been made to the beach protection programs to reduce bycatch of non-target species. However, the programs still rely on lethal shark control methods and bottom set nets remain in place in NSW.
C.3. Continue recording, tagging and biological sampling of shark meshing captures and information collated.	Records be made public.	Partially completed. The level of biological information gathered from animals captured in shark control programs (SCPs) in both Queensland and NSW has been poor to date.
C.4. Undertake a review of the effectiveness of shark control programs on public beaches.	Review undertaken within five years of this plan.	Partially completed. A number of reviews in the Queensland SCP have been undertaken, the most recent being in 2006. NSW held a Scientific Shark Protection Summit in 2006 and are currently working on a review of their program.

Prescribed Action	Criteria for Success	2008 Review of Actions
C.5. Develop effective predator nets for finfish cage aquaculture operations that protect sharks and aquaculture operations from harm.	Alternatives developed and trialled.	Completed and ongoing. A number of actions have been undertaken to reduce interactions between sharks and the aquaculture industry.

D. Identify and manage the impact of tourism

Prescribed Action	Criteria for Success	2008 Review of Actions
D.1. Examine the significance of deliberate attracting actions on the behaviour and movement of white sharks.	Research conducted to report to the Recovery Team within five years of this plan	Completed. The research concluded that the impacts of berleying appeared to have a localised effect increasing the detection rate of sharks for a relatively short period at sites close to the berleying operation but no significant long-term effects.
D.2. Ensure minimised disturbance to white sharks by marine based tourism activities, including through development and implementation of code of conduct, and review of those codes and review effectiveness of existing codes of conduct, regulations and permits.	Minimised disturbance of white sharks in their natural environment	Completed.

Prescribed Action	Criteria for Success	2008 Review of Actions
D.3. Support and continue a tag/resighting program with shark cage dive operators to improve knowledge of demography and migration patterns and estimation of bycatch levels.	Sightings recorded and reported to the permitting authority (DEHSA), PIRSA and CSIRO.	Ongoing. A tagging of white sharks and the logbook program has been maintained by CSIRO in conjunction with tour operators in South Australia since 1999.
D.4. Ensure all people participating in tagging programs are trained to ensure minimal disturbance to white sharks.	All operators trained and permits for tagging programs. Include as one of the conditions that people undertaking tagging operations are trained.	Completed. Training programs are in place.

E. Monitor and reduce the trade in white shark products.

Prescribed Action	Criteria for Success	2008 Review of Actions
E.1. Seek to establish a global prohibition of trade between countries in white shark products and parts thereof.	The white shark is included on Appendix II of CITES as a step towards the establishment of a ban in trade.	Completed. The white shark is now listed on Appendix II of CITES.
E.2. Prepare national plan of action for sharks to give effect to the FAO's International Plan of Action for Sharks.	Australia submits the plan to FAO at COFI 2002.	Completed.
E.3. Examine the extent of finning in Australia of white sharks and where necessary strengthen compliance with relevant legislation prohibiting the take of white sharks.	No white shark fins are landed.	Partially completed. All jurisdictions prohibit finning of sharks and dumping carcasses at sea. However, no survey has been undertaken to determine the extent of illegal finning of white sharks in Australian waters.

Prescribed Action	Criteria for Success	2008 Review of Actions
E.4. Consider nominating the white shark on relevant international agreements, particularly Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals.	The white shark is included on Appendix II of CMS.	Completed.

F. Indentify habitat critical to the survival of white sharks and establish suitable protection of this habitat from threatening activities

Prescribed Action	Criteria for Success	2008 Review of Actions
F.1. Identify habitat critical to the survival of the species for the white shark.	Habitat critical for the survival of the white shark is identified, reported and listed on the register for critical habitat under the EPBC Act and relevant state legislation.	Ongoing. A number of projects were completed that increased understanding of critical white shark habitat. However, relatively little is still known about this species and further work on identifying critical habitat is important.
F.2. Consider white shark habitat in identifying and managing marine protected areas throughout the white sharks range.	White shark habitat is a criteria used in developing the National Representative System of Marine Protected Areas (NRSMPA).	Completed and ongoing. The habitat requirements of protected species are routinely considered when developing marine parks in both state and Commonwealth waters.

G. Promote community education and awareness in relation to white sharks.

Prescribed Action	Criteria for Success	2008 Review of Actions
G.1. Develop a community education strategy for white sharks aimed at the general public, divers and commercial/game/recreational fishers including: • identification and biology • role and importance in the ecosystem • current threats and status • reasons for listing • safe swimming guidelines • safe diving guidelines • shark control activities.	A community education strategy is developed and being implemented by end of 2003.	Completed and ongoing. The volume of publicly available information regarding white sharks increased dramatically since the White Shark *(Carcharodon carcharias)* Recovery Plan was made in 2002.
G.2. Develop awareness of reporting requirements of incidental catch and bycatch.	Increase in reports lodged and accuracy of information.	Partially completed. Information on reporting requirements regarding incidental interactions with white sharks is available on state and Commonwealth government websites.
G.3. Encourage recreational and game fishing organisations to promote awareness of white shark biology, juvenile identification, conservation status and reasons for listing.	Evidence of targeted promotional/education activities provided annually to Recovery team.	Minimal action. Recreational fishing groups have passed on information about the protected status of white sharks but this information has been limited in its scope.
G.4. Explore avenues in tourism to promote greater understanding and acceptance of the need to protect white sharks.	Evidence of activities promoting an understanding of the need to protect the white shark provided annually to the Recovery Team.	Partially completed. Cage dive operators promote the white shark to their clients. Other avenues of promotion are used where appropriate.

H. Develop research programs toward the conservation of white sharks.

Prescribed Action	Criteria for Success	2008 Review of Actions
H.1. Continue to undertake necropsies on all dead white sharks landed by fishers under permit.	Continuation of cooperation between CSIRO and states.	Ongoing. Necropsies are undertaken but not all white shark carcases are used.
H.2. Develop a population dynamics model for the white shark to assist in understanding population status, rates of recovery and population structure and distribution.	Model is developed within three years.	Not initiated. However, the importance of developing a population model remains, and this action should be a priority for any new recovery plan.
H.3. Continue to collect and analyse genetic material to determine the genetic status of Australian white shark populations on a national and a global level.	• Material is collected. • Initial stock analysis of Australian population is completed by mid-2004.	Partially completed. Genetic techniques have been used to investigate the interconnectedness of white sharks at a global level.
H.4. Continue research directed at determining characteristics of the white shark that will contribute to identifying the habitat critical to the survival of the white shark	Research results are made publicly available.	Ongoing. Research into the white shark is ongoing.
H.5. Evaluation of sublethal effects, cryptic mortality and scientific benefits of targeted/permitted tag and release activities be conducted.	Evaluation prepared and results agreed by scientific community and Environment Australia.	Not initiated. The importance of this action should be re-assessed when developing a new recovery plan for this species.
H.6. Request Coastwatch patrols to report sightings of white sharks.	Coastwatch provides reports on white shark sightings to Environment Australia.	Completed.

I. Develop a quantitative framework to measure the recovery of the white shark.

Prescribed Action	Criteria for Success	2008 Review of Actions
I.1. Develop a quantitative framework to assess the recovery of the species.	Quantitative framework established to measure recovery of the species within three years of the 2002 white shark recovery plan's implementation.	Not initiated. Completion of this action requires a reliable baseline estimate of the white shark population in Australian waters and robust technique for measuring changes in the population over time.
I.2. Identify a central point/agency to take responsibility for the collection, storage and maintenance of data.	Central agency identified.	Minimal action. The CSIRO maintains most of the genetic sample material, but a centralised agency was not established.

20.3 Appendix 3. National Shark Recovery Group (NSRG)

Table 4: Organisations represented on the previous National Shark Recovery Group (NSRG)

Organisation	Acronym
Humane Society International	HSI
Queensland Environment Protection Agency	QLD EPA
Commonwealth Fisheries Association	ComFish
Department of Agriculture Fisheries and Forestry	DAFF
Tasmanian Department of Primary Industries, Parks, Water and Environment	DPIPWE
Trade Records Analysis of Flora and Fauna in Commerce	TRAFFIC
Commonwealth Scientific and Industrial Research Organisation	CSIRO
Primary Industries and Regions, South Australia	PIRSA — Fisheries
Australasian Regional Association of Zoological Parks and Aquaria	ARAZPA
RecFish Australia	RecFish
New South Wales Department of Primary Industries	NSW DPI
Australian Institute of Marine Science	AIMS
Great Barrier Reef Marine Park Authority	GBRMPA
Victorian Department of Primary Industries	Vic DPI
Australian Fisheries Management Authority	AFMA
Department of Fisheries Western Australia	WA Fisheries
Northern Territory Department of Resources (Fisheries)	NT DOR
Queensland Department of Agriculture Fisheries and Forestry	QLD DAFF
Indigenous Advisory Committee	IAC