Shark futures: A report card for Australia's sharks and rays

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Contents

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Abbreviations

AFMA	Australian Fisheries Management Authority
ASIS	Australian Shark Information System
CAAB	Codes for Australian Aquatic Biota
CITES	Convention on International Trade of 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
DEE	Department of the Environment and Energy
EPBC	Environment Protection and Biodiversity Conservation
ERA	Ecological Risk Assessments
ESD	Ecologically Sustainable Development
IUCN	International Union for Conservation of Nature
NPF	Northern Prawn Fishery
OCS	Oceania Chondrichthyan Society
SAFS	Status of Key Australian Fish Stocks
SESSF	Southern and Eastern Scalefish and Shark Fishery
Shark-Plan 2	Australia’s 2nd National Plan of Action for the Conservation and Management of Sharks
SSC	Species Survival Commission
SSG	Shark Specialist Group
WTO	Wildlife Trade Operations

Executive Summary

In response to increasing concerns for the status of shark and ray populations world-wide and increasing pressure to ensure Australia's shark and ray species are effectively managed and conserved, this project synthesised the scattered information, assessed individual species' status and provided a clear and concise overview of the state of Australia's shark and rays. Project staff from the Centre for Sustainable Tropical Fisheries and Aquaculture collected available data from peer-reviewed literature, government reports, observer programs and fellow scientists to produce comprehensive databases on species and management measures with input from CSIRO on the most recent taxonomy of this diverse group. A workshop of experts updated the status of more than 200 Australian sharks and rays to generate 194 unique individual species summaries that define their most up-to-date status within the context of Australian fisheries. A Report Card overview indicates that the majority of species are sustainable and in a healthy state; and while Australia's approach to managing its shark stocks has to date been very good, this needs to be maintained and supported by ongoing research and monitoring. The significant resources generated by the project are available on a website created specifically to support and house the information, the Australian Shark Information System.

Australia has one of the most diverse and distinctive shark and ray faunas in the world. About a quarter of the more than 320 species occurring in Australian waters are endemic, and effectively managing these species is important for the sustainable use of marine resources as well as maintenance of biodiversity. One of the greatest challenges for the sharks and rays is that more than any other taxa they exist across the spectrum of interests from sustainable fisheries resources to threatened species requiring conservation. Australia's abilities both in management of sharks and rays, and the science that underpins it, are recognised as world-leading. Despite this, there remain many challenges that face our sharks and rays. There is a need for decision makers in government to have access to comprehensive and accurate information. Currently, the available information is fragmentary and difficult to access, and most assessment is focused on only a few species targeted by fisheries. The growing information needs of initiatives such as Shark-Plan 2 and Environment Protection Biodiversity Conservation listing struggle to be met because of the lack of a synthesis of information across this group. Locally relevant information on the status of sharks and rays, and the synthesis of knowledge about them is critical to addressing the challenges that face this group in Australian waters.

The project aim was to synthesise available information on sharks and rays in Australian waters, and to produce a report card on the status of Australia's sharks and shark-like rays. The taxonomic scope of the project covered all extant shark species in Australian waters and the shark-like rays because of morphological similarities to sharks, and as their fins are included in the shark fin trade.

To collate and combine the data and information, a number of tasks were undertaken: organisation of an advisory group of shark and rays professionals, development of a database of information on species along with a database of management measures relevant to sharks and rays in Australian jurisdictions, production of individual species summaries for every Australian shark and shark-like ray, and creation of a website to house all the synthesised data and information. While there is a considerable amount of information in the peer-reviewed literature, there is also a large amount of data that is available but not always formally published. The main sources of this type of data are observer programs, shark control programs, fisheries data, stock and fisheries assessments and expert knowledge and opinion.

The status of all the individual sharks and shark-like rays was assessed through consideration of existing status assessments, the other available information on the species' and assessment against a set of standardised criteria. To facilitate this process, a workshop was held to bring together experts in the field and to apply the IUCN Red List Categories and Criteria which provided the basis for assessing species status under the new Common Assessment Method being used by the Commonwealth and most State governments. To indicate the sustainability of the species or stock in Australian fisheries, the IUCN Red List status for each individual species or stock was translated into the status categories of the Australian Government's Status of Key Australian Fish Stocks Reports (SAFS). For a consistent and rationale translation, the project created an equivalency table that aligned each of the IUCN Categories with a SAFS category.

The data synthesis of all the available information and the status assessments were compiled in 194 individual species summaries. These included 180 shark and 14 shark-like ray species. Two of the shark species (Grey Nurse Shark *Carcharias taurus* and the Endeavour Dogfish *Centrophorus moluccensis*) have two separate stocks in Australian waters, an east coast stock and a west coast stock, thus 196 stocks were assessed. The format for all individual species summaries was consistent and headed by the Australian SAFS status and the IUCN Red List status followed by a summary paragraph about the species, habitat, threats and any documented declines. This information was then detailed in short sections on stock structure and distribution, stock status, fisheries and habitat and ecology followed by links to the IUCN Red List Shark References webpages and a list of references. All 194 individual species summaries are available on the Australian Shark Information System (ASIS) website that was created for the project.

The individual species summaries and their status were collated and summarised in an Australian Shark Report Card document that describes the status of species, and identifies those most at-risk, those that require management intervention, gaps in management, and research priorities. The Report Card found that overall, Australia's sharks and shark-like rays are in relatively good condition. One hundred and twenty-six stocks (62.3%) were assessed as Sustainable. A further 39 (21.1%) were assessed as Undefined, meaning there was insufficient information to determine their status. There was no information to suggest any of these Undefined stocks are under immediate threat from human pressures, including fishing. Therefore, the majority of the Undefined stocks are likely to be sustainable but further investigation is needed to better understand the status of these mainly deepwater species. The primary potential threat to most Australian sharks is fishing. However, the results of the assessment indicate that for the large majority of species, the interactions with fisheries has not led to unsustainable outcomes. Of the 196 stocks, only 18 (9.0%) were assessed as overfished. Importantly, further examination of these shows that 16 stocks are either protected or have specific fisheries management measures under Commonwealth, state or Territory regulations or legislation to attempt to reverse the status. This leaves just two overfished stocks, Whitefin Swellshark *Cephaloscyllium albipinnum* and Colclough's Shark *Brachaelurus colcloughi*, that would likely benefit from improvements in management, monitoring and research.

The major implication of the project is that Australia is effectively managing its sharks and shark-like rays as the majority are considered sustainable. It highlighted the species of concern that are either still in decline or overfished, and species for which management needs to be introduced to ensure stocks do not become overfished. Managers and decision makers can use the project outputs to develop fishery and bycatch management plans, ESD assessments, identify future research priorities and to inform international treaty processes such as CITES, CMS and Shark-Plan 2. Industry representatives may use the generated information to advance discussions on industry requirements to meet management targets. The public, consumers and seafood businesses including retailers can easily access information on Australian sharks and shark-like rays and be cognisant of the good management that is in place, the species that are of concern and the actions that are needed to maintain the sustainability of these species.

There are three main recommendations that would further disseminate and develop the results of the project: migrate the material from the ASIS website to an appropriate site with long-term support, such as the FRDC website or the SAFS website; carry out the process of information synthesis, assessment and reporting developed in the project at regular intervals to ensure the information and status are updated and remain relevant and current; and undertake the project process for rays to ensure they are included in the sustainable management of Australian fisheries.

Keywords Sharks, rays, fisheries, management, status

Introduction

Background

Australia has one of the most diverse and distinctive shark and ray faunas in the world (Last and Stevens 2009). With more than 320 species occurring in Australian waters, more than a quarter of them endemic, effectively managing these species is important for the sustainable use of marine resources as well maintenance of biodiversity. Sharks and rays have an inherent vulnerability to exploitation, a result of their life history which is generally less productive than bony fish and invertebrates. Thus, in situations where fishing mortality is poorly controlled, and exceeds critical levels, populations can decline rapidly and are slow to recover (Dulvy *et al.* 2014). Despite this general inherent vulnerability, there is considerable diversity in the life history of sharks and rays that means that some species can sustain valuable fisheries (e.g. 2200 tonne of gummy shark is sustainably caught in southern Australia each year; http://fish.gov.au/), while others decline rapidly with relatively limited fishing (e.g. two species of gulper sharks have recently been listed under the *Environment Protection Biodiversity Conservation (EPBC) Act 1999* despite limited targeted fishing; http://www.environment....threatenedlist.pl) (Simpfendorfer and Dulvy 2017). The result of this diversity of life histories is that unlike almost any other taxa, sharks and rays exist across a spectrum from sustainable fishery targets to species of conservation need.

The challenge for fisheries, biodiversity managers and decision makers is to recognise the position of species within this spectrum of vulnerability. To do this, managers and decision makers need to have access to the best available information on these species. However, all too often this information is hard to locate, difficult to interpret and not directly comparable between species, or worse not available at all. This project, developed out of discussions with managers and decision makers in several state and federal government departments and agencies, highlighted the difficulties in accessing high quality information. That information is also often viewed in isolation, and the ability to place it within the broader context of other shark and ray species enhances managers' abilities to prioritise actions towards species with the greatest need. Often these priorities are distorted because of the lack of comparative information and misconceptions based on media or public bias. With an increasing focus on sharks in decision making processes, the need for managers and decision makers to have access to this information is increasing. Examples of the government processes that require this information includes:

1. Domestic fisheries management
    a. Development of state and federal fishery management plans
    b. Bycatch management plans
    c. Ecologically Sustainable Development (ESD) assessments

2. Domestic biodiversity management
    a. Wildlife Trade Operation (WTO) approval processes
    b. Federal and State Endangered Species listings
    c. Marine park management

3. International treaty obligations and processes
    a. FAOs International Plan of Action for Sharks (Shark-Plan 2; www.agriculture.gov.au../sharks)
    b. Convention for the International Trade in Endangered Species (CITES; www.cites.org/)
    c. Convention on Migratory Species (CMS; http://www.cms.int/)

Development of this project also grew out of the realisation that decision makers do not have access to locally relevant information. This is especially important as globally the status of sharks becomes a topic of considerable importance, driven by declines in many species. While these global concerns are relevant to Australian decision makers, it is also important to understand that Australia has some of the best management of sharks and rays in the world that is supported by some of the best research. Thus, providing decision makers with locally relevant information will be critical to best-practice decision making on sharks and rays.

This project synthesised information from a large number of previous and current research projects to generate both a repository of accessible knowledge, as well as a report card on the status of sharks and rays in Australia. This included research funded by FRDC, Australian Research Council, state and federal fisheries agencies, research institutions (CSIRO) and universities. This breadth of research is important because over the past 20 years there has been a change in where relevant research has occurred. Originally most shark research occurred in fisheries agencies, while more recently there has been a trend towards a more university focus.

The project has also been developed to interface with several ongoing related initiatives. These include the implementation of Shark-Plan 2 (Australia's second National Plan of Action for the Conservation and Management of Sharks) which will benefit from the outputs of the project. The project will interact with the Status of Key Australian Fish Stocks Report, providing input where appropriate to the ongoing reporting on key shark stocks.

Need

With growing concerns for the status of shark and ray populations world-wide, and increasing pressure to ensure Australia's 320 species are effectively managed and conserved, there is a need for decision makers in government to have access to comprehensive and accurate information. One of the greatest challenges for the sharks and rays is that more than any other taxa they exist across the spectrum of interests from sustainable fisheries resources to threatened species requiring conservation. Further complicating the assessment and management of these species is the fact that many species' ranges extend beyond Australia's territorial waters, where management is implemented differently and populations may have a very different status. Australia's abilities both in management of sharks and rays, and the science that underpins it, are recognised as world-leading. Despite this, there remain many challenges that face our sharks and rays, but they may not always be those that are faced by other nations in our region. The available information is often fragmentary and difficult to access, and most assessment is focused on only a few species targeted by fisheries. The growing information needs of initiatives such as Shark-Plan 2, CITES, CMS, ESD, WTO and Environment Protection Biodiversity Conservation listing struggle to be met because of the lack of a synthesis of information across this group. Locally relevant information on the status of sharks and rays, and the synthesis of knowledge about them is thus critical to addressing the challenges that face this group in Australian waters. This project is a step in synthesising this knowledge and developing a report card for Australia's sharks and rays.

Objectives

1. To synthesise available information on sharks and rays in Australian waters.
2. To produce a report card on the status of Australia's sharks and rays.

The original intention of the project was to include all sharks and rays, but funding limitation meant there was a need to reduce the scope of the project without altering the aim and purpose of the work. This was achieved by a reduction in the taxonomic scope from all shark and ray species, to all shark and shark-like rays (Pristidae, Rhinidae, Rhinobatidae, Glaucostegidae and Trygonorrhinidae). The shark-like rays were included because of morphological similarities to sharks, and as their fins are included in the shark fin trade.

Method

Synthesis of available information

While some information on sharks and rays is widely available through the published literature, much more is less accessible in places such as university theses, state and federal government research agency reports, reports to funding agencies and state and federal fisheries databases. With the available information on sharks and rays currently fragmented, a key part of this project was to synthesise information across all species for which it is available. To achieve this several tasks were undertaken:

a. Organisation of an advisory group of shark and ray professionals with experience in research and management. This group included staff from Australian universities, federal government research and management agencies and state fisheries agencies. Their role was to assist in the procurement of information as well as to provide a forum for discussion on the status of species.

b. Development of a database of information on species was populated by the project team using all available information identified during the project. This database houses information on individual species and their main life history parameters. The database is downloadable and accessible to outside decision makers (available at: https://www.sharkreportcard.org/).

c. Collection of information on the management measures relevant to sharks and rays. This information was used to populate a database that outlines the management of sharks and shark-like rays by all jurisdictions and fisheries and is downloadable (available at: https://www.sharkreportcard.org/).

d. Production of individual species summaries that provide information on distribution, key life history and demographic parameters, threats and status of the Australian population. This species summary template will consider the information requirements of management decision-makers.

e. A website was created where the species and management databases and individual species summaries are stored and available. This enables end users to access information generated by the project.

Information to populate the databases was gathered through computer searches, personal contact with key researchers and managers, and the collective resources of the advisory group. The taxonomic scope of the project covered all extant shark species in Australian waters (Orders Hexanchiformes, Squaliformes, Squatiniformes, Pristiophoriformes, Heterodontiformes, Orectolobiformes, Lamniformes and Carcharhiniformes) as well as the shark-like rays (Order Rhinopristiformes with the families Pristidae, Rhinidae, Rhinobatidae, Glaucostegidae and Trygonorrhinidae) (Last and Stevens 2009; Last *et al.* 2016).

Assessment of Australian status

Several forms of information are currently available on the status of some species in this group: stock assessments, ecological risk assessments, threatened species listing assessments and IUCN Red List of Threatened Species assessments. To assess the status of all of the shark and shark-like ray species requires consideration of these existing status assessments along with compilation of all other available information on the species' and assessment against a set of standardised criteria. To facilitate this process, a workshop was held to bring together experts in the field and the best available science on these species (largely through the data accumulated by the above process) and applied to established IUCN Red List Categories and Criteria (http://www.iucnredlist.org/technical-documents/categories-and-criteria). The IUCN Red List Categories and Criteria are the established International standard protocols for assessing species, and provide the basis for assessing species status under the new common assessment method being used by the Commonwealth and most State governments. More information on the common assessment method is available at: http://www.environment.gov.au/biodiversity/threatened/cam.

Report card

The data synthesis and IUCN Red List assessments were incorporated into individual species summaries for each of the Australian sharks and shark-like rays. To indicate the sustainability of each species or stock in Australian fisheries, the status for each individual species or stock was generated from the IUCN Red List Category using the categories and criteria of the Australian Government's Status of Key Australian Fish Stocks Reports (SAFS). To translate the IUCN Red List extinction risk approach to the SAFS framework of sustainability of stocks an equivalency table was created by the project. In this table, each of the six relevant IUCN Red List Categories (Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern and Data Deficient) are translated into one of the five relevant SAFS categories (Depleted, Depleting, Recovering, Sustainable and Undefined). As the IUCN Red List extinction risk and SAFS framework of sustainability of stocks use different terminology and criteria for the categories, a rationale that linked the two was developed and employed. The majority of Australian sharks and shark-like rays do not have stock assessments, and accordingly a synthesis of stock assessments, which SAFS does, was not a viable approach to consistently apply to all species and stocks. Rather, the IUCN risk based approach was employed with the SAFS criteria as a comparison using available information and expert interpretation. The equivalency table is presented as an Appendix in the Australian Shark Report Card document (Appendix E).

The individual species summaries and their status were collated and summarised in a report card that describes the status of the species, and identifies those most at-risk, those that require management intervention, gaps in management, and research priorities. The report card provided a simple framework for interpreting the extensive range of information synthesised during the project to enable it to be understood by a wide range of stakeholders and the public.

Data sources

A wide range of data are available for the status assessments and while there is a considerable amount of information in the peer-reviewed literature, there is also a large amount of data that is available but not always formally published. The main sources of this type of data synthesised for the individual species summaries and report card were from observer programs, shark control programs, fisheries data, stock and fisheries assessments and expert knowledge and opinion. Shark-reference.com website (http://shark-references.com/) is also a valuable source of the most up-to-date peer-reviewed literature and was used for the species summaries.

Observer programs

Observer programs are essential for ongoing monitoring of species caught incidentally in fisheries with a number of different observer programs in place across Australian jurisdictions and fisheries. In the Commonwealth fisheries, the Australian Fisheries Management Authority (AFMA) has an Observer Program that operates across all of the approximately 20 fisheries. The majority of these fisheries interact with sharks and rays. Detailed information of the type and frequency of observer coverage along with data from the Observer Program is available in a range of publicly available reports produced by AFMA and the Department of Environment and Energy for each of the Commonwealth fisheries, such as Bycatch Action and Work Plans, Data Summaries, Status Reports, Assessment Reports and Wildlife Trade Operation Reports. The state and Territory fisheries each have their own Observer Programs that vary in scope and range of fisheries covered. Most of the state and Territory observer information and data is publicly available in a wide range of bycatch and fishery reports that are compiled by both state and Commonwealth agencies.

Shark Control Programs

Two long term shark control programmes operate in Australia: the New South Wales Shark Meshing Program since the 1930s and the Queensland Shark Control Program since the 1960s. Detailed catches and catch rates are available for the sharks and rays taken in these two programs and provided a useful source of information on shark catches, with data on species, size and sex available online for Qld catches from 2001 and for NSW catches since 2012.

Fisheries data

Some specific datasets on sharks and rays that cover both large areas and a large number of species were used in this project to inform the individual species summaries. These data sets include two from Commonwealth and two from state fisheries. The two Commonwealth fisheries that have some of the most comprehensive monitoring and analyses of sharks and rays are the Northern Prawn Fishery (NPF) and the Southern and Eastern Scalefish and Shark Fishery (SESSF). The Northern Prawn Fishery shark and ray bycatch was intensively studied in the late 1990s with the data available in some published papers, but the most detailed information provided in an FRDC Report. The SESSF has extensive shark and ray data, both from logbooks (1970–2006) and an Integrated Scientific Monitoring Program on sharks, rays and holocephalans (1994–2006). This data has been presented in detail and analysed in Walker and Gason (2007, 2009).

In New South Wales, a comparison of catches between 1976–77 and 1996–97 provides a comparative study of shark and ray catches over 20 years and is a valuable source of data for this region with the original data provided in Andrew *et al.* (1997) and subsequently published in Graham *et al.* (2001). In Queensland, a study of prawn trawl bycatch during the early 2000s generated a significant quantity of data on catches of sharks and rays that is presented in the most detail in Courtney *et al.* (2007).

Stock and fisheries assessments

Some shark species in Australia have been subject to quantitative stock assessments that generate measures of stock status and levels of sustainable catch. Assessments of these stocks occur regularly and many are reported in the Status of Key Australia Fish Stocks Reports (SAFS) that are available online (http://fish.gov.au/). The species and stocks that have been assessed in these SAFS Reports are: Blacktip Shark species complex (*Carcharhinus limbatus, C. tilstoni* and *C. sorrah*), Dusky Whaler (*C. obscurus*), Gummy Shark (*Mustelus antarcticus*), Sandbar Shark (*C. plumbeus*), School Shark (*Galeorhinus galeus*) and Sawsharks (*Pristiophorus cirratus* and *P. nudipinnis*).

In addition to full stock assessments, many sharks and rays caught in Australian fisheries have been assessed as part of ecological risk assessments (ERA). The ERAs identify those species that may be at risk from a specific fishery and need to have this risk mitigated through an appropriate mechanism. These ERAs have been conducted in all the Commonwealth fisheries and are publicly available both through AFMA and the Department of the Environment and Energy (DEE). All Australian fisheries that involve an export component are required to provide submissions to the Commonwealth Department of the Environment and Energy (DEE) that demonstrate the fishery complies with the Ecological Sustainable Development of Fisheries (ESD). These submissions are publicly available through the DEE and are a useful source of information on bycatch that can include sharks and rays, which is required to be included in the submission.

Expert knowledge and opinion

In Australia, there are now a significant number of scientists studying sharks and rays. The majority of their knowledge is available in peer-reviewed publications, but not all the specific data is published and the more recent data is yet to be published. The workshop for this project brought together some of these experts (Appendix B) and provided the opportunity for their expertise on different taxa to be collected and used in the species assessments. It also enabled a forum for discussion on the status of species, particularly where there were minimal data or difficulty in assigning status.

Another aspect of the project that provided the ability to garner expert knowledge was through the website that was created. During the development phases of this project, a portal was developed where researchers and managers were invited to download the species and management measures databases and validate the data, update fisheries information, contribute data, papers and university theses, and nominate expert contacts for each of the species. The project staff then integrated this knowledge into the databases to provide the most up-to-date information on the shark and ray species and fisheries within Australia.

Online access to published species information

The *shark-references.com* website is a living online bibliographic database of all sharks, skates, rays and chimaeras (http://shark-references.com). It is continuously updated with the latest peer-reviewed literature and currently holds more than 22,000 data inputs. Many shark and ray scientists from around the world regularly send the website editors notification of their new publications along with relevant images. Not only does this online database have a bibliography of all scientific literature relevant to sharks and rays, it also has a description of each species with links to relevant papers. In each of the species summaries produced for the project, a link was included to the species description at shark-references.com, along with a link to the IUCN Red List species assessment. This ensures that the latest published research, information and IUCN status is available for each Australian shark and shark-like ray species.

Results

Synthesis of information

An advisory group of shark and ray professionals was formed. It included representatives from university, management and research agencies to encompass the breadth of knowledge across both research and management relevant to Australian sharks and rays. The persons in the advisory group and their affiliations are detailed in Appendix A. This group contributed information on species and management, and assisted with the determination of status for some of the species.

Information on each of the shark and shark-like ray species was gathered from all available sources that included the scientific literature, university theses and expert knowledge. This was compiled into a database where the information for each species included the species and common name, CAAB Code (Codes for Australian Aquatic Biota; http://www.marine.csiro.au/caab/), habitat, depth range, Australian regions of occurrence, size at birth, maximum size, longevity, size at maturity, number of pups, reproductive frequency, key threats, IUCN status, EPBC status and CITES status. This species database is available on the project website (https://www.sharkreportcard.org/).

Available data on management of all Commonwealth and state fisheries was collected from a variety of sources including management agency websites, published literature and personal communications with fisheries experts. Over 600 documents were assembled including management plans, assessments (stock assessments and ecological risk assessments), fisheries reports, and fisheries independent research with most of the information for the period 2011–2015. A large number of these documents were sorted by jurisdiction and were made available on the website created for this project (https://www.sharkreportcard.org/shark-fishery-documents). The management measures relevant to sharks and rays were arranged in a database by jurisdiction and fishery with information on the fishery method, sector and number of permits; whether sharks and rays were taken as target, byproduct or bycatch; and management arrangements that included information on observer coverage in terms of annual percent cover, number of trips observed and when they are regulated to be onboard, along with other management information such as regulations on shark fin retention, bycatch measures, spatial, temporal and depth closures, size limits and total allowable catch. Similar to the species database, the management measure database is on the project website.

The data and databases are housed at James Cook University (JCU)'s eResearch Centre, which provided a collaborative workspace for project participants to access. When the project is finalised and the most up-to-date databases are made available to the public, they will be migrated to the Tropical Data Hub, which is part of the Australian National Data Services. Both of these storage sites have daily backup routines to ensure data integrity.

A website was created for the project, titled 'the Australian Shark Information System ASIS' available at https://www.sharkreportcard.org/. During development of the project the initial species information and management measures databases were placed on the website and a request made to fishery managers and researchers to validate and populate them. This request was made through various channels that included the Oceania Chondrichthyan Society (OCS) membership via the OCS newsletter and the OCS members email. Contributions on both the species information and management measures were received and incorporated into the databases. Other information compiled and made available on the ASIS website included:

1. A species checklist compiled by Dr William White (CSIRO Australian National Fish Collection) that provides an accurate source of the taxonomic information on all sharks and ray species in Australia. It is presented by family, scientific name, common name and type location.
2. Several hundred fishery management documents compiled by jurisdiction that provide a comprehensive source of information on management of all Australian fisheries. These documents also provide a source of detailed fisheries catch data, research and monitoring being undertaken in the fisheries.

3. Links to other major reports on Australian sharks and rays and to websites for other relevant websites such as the Status of Key Australian Fish Stocks, IUCN Shark Specialist Group, Shark References and CSIRO Fish Map.
4. List of Masters (MSc) and Doctorate (PhD) theses completed on Australian sharks and rays. The database includes information on the species studied, degree type, year, university and thesis links.
5. Facts about sharks and rays and frequently asked questions and answers.
6. Relevant news such as meetings, conferences and recent publications.

Assessment of Australian status

The five–day workshop was held 16–20 February, 2015 at James Cook University, Townsville, Australia. The workshop updated the IUCN Red List Assessments for Australian sharks and rays which enabled the latest IUCN Red List status to be used for the project and information on all of the species to be collated for the project. There were 23 attendants of Australia's leading shark and ray scientists from all states and Territories and the Co–Chairs of the IUCN SSC Shark Specialist Group, the IUCN SSG Program officer and the IUCN Red List Authority. All staff on this project actively participated in the workshop. A list of the attendees is provided in Appendix B.

Over 200 Australian shark and ray species were re-assessed at the workshop with all the relevant information updated on their taxonomy, distribution, population, biology and threats. This was combined and considered by the participants within the strict Criteria and guidelines for using the IUCN Red List Categories and Criteria to determine the updated Red List Category for each of the species. A summary of the five Criteria is include in Appendix C with more detailed explanations of the Category, Criteria and their application available at http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria.

This process was highly beneficial for the project as it not only provided the most up-to-date data and information for the project but also enabled discussions and decisions on the most appropriate status category for each of the species. The majority of the updated IUCN Red List assessments have since been reviewed and are available on the IUCN Red List website (http://www.iucnredlist.org/).

Report Card

For the Australian Shark Report Card document, 194 individual species summaries were produced. These included 180 shark and 14 shark-like ray species. Five of the shark species (e.g. Grey Nurse Shark and the Endeavour Dogfish) have separate stocks in Australian waters, an east coast stock and a west coast stock that each have different status assessments. The format for all individual species summaries is consistent and headed by a summary table that stated the Report Card status, the IUCN Red List status (both Australian and Global), the assessors and any remarks. This is followed by a summary paragraph about the species, habitat, threats, any documented declines and an explanation for the IUCN and SAFS assigned status. This information is then detailed in short sections on stock structure and distribution, stock status, fisheries and habitat and ecology followed by links to the IUCN Red List Shark References webpages and a list of references. All 194 individual species summaries are available on the Australian Shark Information System website (https://www.sharkreportcard.org/).

The Australian Shark Report Card document (Appendix E) summarised the status of all 194 species and found that overall, Australia's sharks and shark-like rays are in relatively good condition. One hundred and twenty-six stocks (62.3%) were assessed as Sustainable. For these stocks, catches in Australian fisheries are likely to be below the level at which recruitment overfishing is likely to occur, and thus from a risk based perspective can be considered sustainable. A further 39 (21.1%) were assessed as Undefined, meaning there was insufficient information to determine their status. Most of these are rare deep water species with no information to suggest any of these Undefined stocks are under immediate threat from human pressures, including fishing. As such, the majority of these Undefined stocks are likely to be sustainable though further investigation is required to better understand their status.

The primary potential threat to most Australian sharks is fishing. However, the results of the assessment indicate that for the large majority of species, the interactions with fisheries have not led to unsustainable outcomes. Of the 196 stocks, 9 (4.5%) were recovering from historic declines (Recovering) while only 6 (3.0%) were Depleting and 18 (9.0%) were assessed as Depleted (Australian Shark Report Card, Appendix E, Table 1). Importantly, further examination of these species shows that 16 stocks are either protected or have specific fisheries management measures under Commonwealth, state or Territory regulations or legislation. This leaves just two Depleted stocks (1%) – Whitefin Swellshark and Colclough's Shark– that would likely benefit from improvements in management, monitoring and research. Both of these species are only caught incidentally in fisheries. These results, along with supporting tables, are presented more comprehensively in the Australian Shark Report Card document (Appendix E).

Discussion

The majority of Australian sharks and shark-like rays are currently considered to be sustainably fished. The stock levels and management of 62% of the 194 species assessed in this project are sufficient to ensure adequate levels of recruitment. Although another 20% of these species could not be assessed due to insufficient data and information, as far as could be ascertained, these species are presently not under any immediate threat from fishing and are likely to be sustainable. There are just 8% of Australian species considered overfished (Depleted) with nearly all of these either protected or being actively managed through rebuilding plans and associated legislation.

Good management of Australian sharks and shark-like rays was further evident in the updated IUCN Red List assessments. These indicate that while 13% of the 194 sharks and shark-like rays are in a threatened category (Critically Endangered, Endangered or Vulnerable) in Australia, that is about half of the level that are in a threatened category globally. This indicates that globally, these same species face either greater fishing pressure or less stringent management, or a combination of both. In terms of number of species, this means that 21 species have a better status in Australian waters than globally. There is only one stock that has a worse status in Australia than globally, the east coast stock of Grey Nurse Shark. The state of this stock is being addressed in Australia where there has been a National Recovery Plan for the Grey Nurse Shark in place since the dramatic declines were recognised in the stock. The Plan identifies the research and management actions to be taken to halt the declines and ensure the long-term viability of the stock with these actions monitored and updated as needed (http://www.environment.gov.au/resource/recovery-plan-grey-nurse-shark-carcharias-taurus).

The project identified two Depleted species in Australian waters that are not currently protected or managed, the Colclough's Shark and the Whitefin Swellshark. Both of these are endemic to Australia (Last and Stevens 2009) and are taken incidentally in fisheries, with the majority of the take in trawl fisheries. Both species would likely benefit from improvements in research, monitoring and management. The Colclough's Shark species summary notes that it has a very small population with a restricted distribution along the east coast, while the Whitefin Swell shark species summary suggests that management measures may be needed to recover this southern Australian species. These two species should be a priority for research and management intervention.

A large amount of existing information on sharks and shark-like rays in Australian waters was synthesised by the project. The majority of this information will now be publicly available through the Australian Shark Report Card and the individual species summaries on the ASIS website at https://www.sharkreportcard.org/. The Australian Shark Report Card provides a simple framework that interprets a wide range of information collated during the project to make it easy to understand by the public and a broad spectrum of stakeholders. These include fishery and biodiversity managers in state and federal agencies, environmental non-government organisations and fishing industry representatives. The Report Card presents the most up-to-date scientific account of the status of 194 of Australia's sharks and shark-like rays. Each of the species summaries includes a link to the species on two other websites which are both maintained and include the latest peer-reviewed papers relevant to the species (shark-references.com) and their status (IUCN Red List). This ensures these species summaries will continue to remain a reliable source of current information for the species.

The shark and shark-like ray information that was scattered and for some species, difficult to locate, is now accessible, comparable and much easier to understand and locate. This accessibility and reliability of the data and collation of locally relevant information can be used to improve management and conservation outcomes, to prioritise and improve fishery management and conservation efforts and to assist WTO and ESD assessments. The focus on synthesising the information into a consistent format for each species and determining the status of each species in terms of sustainability in Australian fisheries will enable managers and decision makers to have a much more comprehensive understanding of the Australian status of sharks and shark-like rays. It has highlighted that most of our sharks and shark-like rays are subject to some level of management, either at a fishery, state or Commonwealth level and that this is currently maintaining the majority of stocks at sustainable levels. Bycatch management plans have an important management role for

those shark and ray species that are incidentally caught. However, there are some undefined stocks which are data-poor where a more robust assessment of status would be enabled by better data collection and monitoring of the incidental fisheries catch. The project has listed those particular species and also those species in decline and overfished where more stringent management must be maintained and where further work could improve the outcomes for the species.

The project identification of the shark and shark-like ray species of concern has already been used to focus other work in Australia. Two hammerhead species were classed as overfished, the Scalloped Hammerhead *Sphyrna lewini* and Great Hammherhead *S. mokarran*. The identified need to better understand stock structure and linkages with Indonesia, where fishing pressure is intense, has led to support for a specific research project driven by the Australian Institute of Marine Science and funded by the National Environmental Science Programme (https://www.nespmarine.edu.au/project/project-a5-defining-connectivity-australia%E2%80%99s-hammerhead-sharks). The work is using tagging and genetic sampling to improve the knowledge of the stock structure and connectivity of stocks and better inform and support Australian and international conservation and management initiatives for these species.

Only relatively few of the Australian rays, the shark-like rays, were able to be included in the project. There are approximately 125 species of rays in Australian waters (Last and Stevens 2009; Last *et al.* 2016) and while 14 of the shark-like rays were assessed, this leaves a large numbers of rays, that includes skates, stingrays, stingarees and devil rays, whose status in Australian waters has not been assessed. The majority of these rays are endemic (69%) and are demersal, that is, live on or near the seafloor. This habitat preference exposes many of the species to fisheries interactions. Like sharks, rays have a considerable diversity of life histories (Last *et al.* 2016) that means they range across the spectrum of vulnerability to fishing pressure, from an ability to sustain fishing to species of conservation need. A global analysis of threats to sharks, rays and chimaeras found that five out of the seven most threatened families were rays, with rays increasingly dominating the shark and ray catches (Dulvy *et al.* 2014). Similar to sharks, fishing pressure through target and incidental catch is the major threat to rays (Davidson *et al.* 2015). This group has not been as well studied as sharks and the scientific community are now drawing attention to the need for this to change (Cortés *et al.* 2014; Lawson *et al.* 2017; IUCN Shark Specialist Group publications at http://www.iucnssg.org/publications.html). Within Australia, rays are mainly taken as incidental catch with much of the information on catch, biology and ecology scattered across university studies, state and federal research reports and databases. It is a challenge to ensure rays are being included in the sustainable management of Australian fisheries and it would be highly beneficial to apply the same process of information synthesis and status assessment used in the project to the Australian ray species. This would ensure that this group is being managed to ensure that the ray stocks are sustainable and not being overexploited.

Conclusion

The project has synthesised the scattered information on Australian shark and shark-like rays to make it more easily understood and accessible to a broad audience of managers, decision makers and the public. The individual species summaries provide consistent and comparable descriptions of the status, distribution, biology and threats for all the sharks and shark-like rays in Australia that is now readily available online in one place. This provides a significant resource that will enhance the understanding of these species by a much wider range of people, including the general public. The description of the status of each species in terms of sustainability in Australian fisheries enables fishery and conservation managers to have a more comprehensive understanding of their status. The summary of all shark and shark-like ray status in a concise and non-technical summary in the Australian Shark Report Card places all species in context along the spectrum of vulnerability and enhances the ability to recognise the species of greatest concern and prioritise actions towards those species. The project has greatly improved the availability of information and understanding of Australian shark and shark-like ray species and can be used to help manage these species for sustainability and biodiversity conservation.

Implications

The major implication of the project is that Australia is effectively managing its sharks and shark-like rays as the majority are considered sustainable. It has highlighted the species of concern that are either still in decline or overfished and species for which management needs to be introduced to ensure stocks do not become overfished. This implies that although management is effective, it needs to be maintained with ongoing research and monitoring critical to maintain the healthy status of the stocks. These implications are valuable for a range of end users that can implement the required actions. Domestic fisheries management can use the project to benefit development of state and federal fishery management plans, bycatch management plans and ESD assessments and to identify future research priorities. Federal government agencies also benefit with more reliable, accessible and comparable information to inform international treaty processes such as CITES, CMS and Shark-Plan 2.

Industry representatives will be able to present the locally relevant status of the shark and shark-like rays that their fisheries interact with and discuss their effective management with members and advisory groups. This can advance discussions on industry requirements to meet management targets. Finally, the public and consumers can now much more easily access information on Australian sharks and shark-like rays and be cognisant of the good management that is in place, the species that are of concern and the actions that are needed to maintain the sustainability of these species.

Recommendations

There are three main recommendations that would further disseminate and develop the results of the project:

1. Migrate the materials on the website to an appropriate site that is supported long-term.
2. Carry out the process developed in the project at regular intervals.
3. Undertake the process for rays.
4. Collate information to review the status of the mostly deepwater Undefined stocks.

The rationale for the recommendations are:

1. One of the major outcomes of the project was the creation of the website, Australian Shark Information System, where the species databases, individual species summaries and Australian Shark Report Card are stored and available. Long term maintenance of this website will be compromised without continuing support, which can be difficult to secure. To ensure the outcomes of the project are available in the long-term and disseminated, it is recommended that consideration be given to migrating the main materials of the project to an appropriate and relevant website where long-term support can be provided. The FRDC website or the newly created website, the Status of Australian Fish Stocks Reports, may be suitable and relevant candidate sites.

2. It is recommended that the process of information synthesis, assessment and reporting undertaken in the project occur in the future at regular intervals. This would ensure that the healthy status of Australian shark and shark-like rays continues and that management improves for species of concern. It would provide a standard mechanism to incorporate new biological, fisheries and ecological data and changes to habitat and climate to update the locally relevant Australian assessment of the species' sustainability.

3. To undertake the project process for the remaining Australian ray species that were not assessed would be highly beneficial. This group of species interacts with fisheries in Australia and has been identified as under significant threat globally with calls from the scientific community to consider and manage these species. The synthesis of information and assessment of status of Australian rays would enable rays to be included in the sustainable management of Australian fisheries. Australia is recognised globally for the good management of its fisheries and sharks (Dulvy *et al.* 2014), and by including rays in that management, Australia could be a leader and maintain the good reputation of Australian fisheries management.

4. Nearly all of the stocks with Undefined stock status were deepwater species. This group of shark species are generally more vulnerable to fishing impacts than those from coastal and pelagic habitats (Rigby and Simpfendorfer 2015). In recognition of this greater vulnerability, in recent years there has been an effort to train fishers in identification of these species and to better record these species in observer programs. This recent data is held within various jurisdictions and government agencies and was not readily available without specific data requests which was beyond the scope of this project. A focussed project to collate this information to review the status of this group of species would be highly valuable to ensure these deepwater stocks are being fished sustainably.

Extension and Adoption

The project was extended and communicated to the stakeholders and end users through the Australian Shark Information System website. The species and management databases, the individual species summaries and the Australian Shark Report Card are all available and accessible on this website. Thus, it also continues to provide access to the outcomes of the project. The site also provides a species checklist, several hundred fishery management documents, links to other major reports and websites on Australian sharks and rays, and a list of university theses.

Project coverage

Information on the project was disseminated to relatively large audiences of the broader science community and other end users through two media releases, five articles, four conference presentations, and one scientific publication that is in draft.

Media releases

A media release by James Cook University was made in 2013 about the Shark Report Card when the website, Australian Shark Information System, came online.

A media release by Australian Broadcasting Corporation (ABC) News 24 was made in 2013 that described the Shark Report Card project and aims and projected outcomes.

Articles

Chin, A. 2013 Maximising your impact: Getting the information from your projects to the people who need it most. OCS (Oceania Chondrichthyan Society) Newsletter 27th Edition, 2013, p. 5-6.

Chin, A. 2014 ASIS update. Getting the information from your project to the people who need it most. OCS Newsletter 28th Edition, 2014, p. 13-14.

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Clarry, S. 2014 The shark and ray report. Fisheries Research and Development Corporation News FISH March 2014 Volume 22 Number 1, 32-33 (http://frdc.com.au/stories/Pages/32_the-shark-and-ray-report.aspx).

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Presentations

Simpfendorfer, C.A. 2013 A report card on the status of Australia's sharks. Oceania Chondrichthyan Society 4th Conference, 1-20th September, Brisbane, Australia.

Sherman, S., Chin, A., Simpfendorfer, C.A., 2015. How effective is Australia's management of sharks in commercial fisheries? New Zealand Marine Sciences Society & Oceania Chondrichthyan Society 2015 Conference, 6-9th July, Auckland, New Zealand.

Sherman, S., Simpfendorfer, C.A., Chin, A. 2015. How effective is Australia's management of sharks in commercial fisheries? Australian Society for Fish Biology Annual Conference, 11-14th October, Sydney, Australia.

Chin, A. 2015 Australia's shark report card. Australian Shark Assessment Workshop. 16-20th February, 2015, James Cook University, Townsville, Australia.

Publications

Sherman, S., Chin, A., Simpfendorfer, C.A. (in draft) How effective is Australia's management of sharks in commercial fisheries?

Project materials developed

The project created a website; Australian Shark Information System (ASIS) at https://www.sharkreportcard.org/.

The main outputs of the project were the 194 individual species summary documents and the Australian Shark Report Card, both of which are available on the ASIS website. The Australian Shark Report Card is also appended to this Final Report in Appendix E.

Other material created and compiled for the project was also included on the website, that is:

1. A species checklist
2. Several hundred fishery management documents organised by jurisdiction.
3. List of Masters (MSc) and Doctorate (PhD) theses completed on Australian sharks and rays.
4. Facts about sharks and rays and frequently asked questions and answers.

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Appendix A Advisory Group

Person	Organisation
Shalan Bray	Department of Agriculture and Water Resources (DAWR)
Barry Bruce	Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Peter Kyne	Charles Darwin University (CDU)
Ivan Lawler	Department of the Environment and Energy
Vic Peddemors	NSW Department of Primary Industries (DPI)

Appendix B Project workshop attendees

Person	Organisation
Leontine Baje	James Cook University/PNG National Fisheries Authority
Adam Barnett	James Cook University
Barry Bruce	CSIRO
Andrew Chin	James Cook University
Christine Dudgeon	University of Queensland
Nicholas Dulvy	IUCN Shark Specialist Group Co-Chair/Simon Fraser University (Canada)
Lucianna Ferreria	University of Western Australia
Kenneth Graham	Australian Museum
Adrian Gutteridge	Marine Stewardship Council
Alistair Harry	Department of Fisheries, Western Australia
Michelle Heupel	Australian Institute of Marine Science
Charlie Huveneers	Flinders University
Ian Jacobsen	Department of Agriculture and Fisheries, Queensland
Grant Johnson	Northern Territory Fisheries
Peter Kyne	Charles Darwin University
David Morgan	Murdoch University
Cassandra Rigby	James Cook University
Colin Simpfendorfer	IUCN Shark Specialist Group Co-Chair/James Cook University
Jonathan Smart	James Cook University
Samantha Sherman	James Cook University
William Smyth	James Cook University
Terence Walker	Department of Primary Industries, Victoria
Rachel Walls	IUCN Shark Specialist Group/ Simon Fraser University (Canada)

Appendix C Summary of IUCN Red List

Summary of IUCN Red List Categories and Criteria (reproduced from the IUCN Red List website technical documents, Annex 4 Summary of the IUCN Red List Criteria *In* 2001 IUCN Red List Categories and Criteria version 3.1) **(**http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria**)**

SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN AN IUCN RED LIST THREATENED CATEGORY (CRITICALLY ENDANGERED, ENDANGERED OR VULNERABLE).[1]

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 where the causes of the reduction are clearly reversible AND understood AND have ceased.

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

A3 Population reduction projected, inferred 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 (AOO), extent of occurrence (EOO) and/or habitat quality
(d) actual or potential levels of exploitation
(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
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			

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 at 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			

D. Very small or restricted population

	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	D1. < 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 taxon to CR or EX in a very short time.	-	-	D2. typically: AOO < 20 km² or number of locations ≤ 5

E. Quantitative Analysis

	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

1 Use of this summary sheet requires full understanding of the *IUCN Red List Categories and Criteria* and *Guidelines for Using the IUCN Red List Categories and Criteria*. Please refer to both documents for explanations of terms and concepts used here.

Appendix D Researchers and project staff

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Tamara Parr	Centre for Sustainable Tropical Fisheries & Aquaculture, James Cook University
Nicholas Hill	Centre for Sustainable Tropical Fisheries & Aquaculture, James Cook University

Appendix E Australian Shark Report Card

A Report Card for Australia's Sharks

Colin Simpfendorfer[1], Andrew Chin[1,2], Peter Kyne[3], Cassandra Rigby[1], Samantha Sherman[1], William White[4]

March 2019

[1]Centre for Sustainable Tropical Fisheries & Aquaculture, James Cook University

[2]Australian Institute of Marine Science

[3]Research Institute for the Environment and Livelihoods, Charles Darwin University

[4]CSIRO Australian National Fish Collection, National Research Collections

Status of Australia's Shark Stocks

194 **Species assessed**

Australia is home to more than a quarter of the worlds species of shark's, rays and chimaeras. This Report Card covers all of Australia's known species of sharks, and the rays that have bodies like sharks.

124 **Sustainable Stocks**

Stocks that have been assessed to be sustainable at current levels of fishing. Many are managed through fishing regulations. Others are sustainable because the level of fisheries take is very small. Example: Gummy Shark (*Mustelus antarcticus; southern stock*)

9 **Recovering Stocks**

Stocks that have declined in the past, but through improved management and protection are recovering. Example: Grey Reef Shark (*Carcharhinus amblyrhynchos*).

6 **Depleting Stocks**

Stocks that are taken in fisheries and have declined in abundance, but not below levels that can be sustained. Need to be carefully monitored and managed. Example: Shortfin Mako (*Isurus oxyrinchus*).

18 **Depleted Stocks**

Stocks that have been adversely affected by fishing. Most are already protected or being actively managed for recovery. Only 2 species lack sufficient management. Example: Grey Nurse Shark (*Carcharias taurus*; east coast stock).

42 **Undefined Stocks**

Some species are extremely rare or have very limited information on which to base assessments. These species require more data collection but are not believed to be at immediate risk from human pressures. Example: Blotched Catshark (*Asymbolus funebris*)

FRDC Fisheries Research & Development Corporation · James Cook University Australia · Centre for Sustainable Tropical Fisheries & Aquaculture · CSIRO · Charles Darwin University

Australia's sharks, rays and chimaeras

Australia's waters contain a rich and diverse range of chondrichthyan fishes – sharks, rays and chimaeras – at last count 322 species and increasing thanks to new scientific studies. Of these, 182 are sharks, 125 are rays and the remaining 15 are chimaeras (ghost sharks). These species account for more than a quarter of the global biodiversity of this group. Importantly, approximately half are endemic to Australia, that is, they are found nowhere else in the world [1]. This rich diversity of species provides Australia with considerable benefit. Some species are economically important to Australian fisheries (e.g. Gummy Sharks), and have wide ranging social and economic values, including acting as tourism attractions (e.g. Whale Sharks (*Rhincodon typus*) at Ningaloo reef, Reef Manta Rays (*Mobula alfredi*) at Lady Elliot Island). Sharks and rays are also important to many Indigenous Australians featuring in the traditions, cultures and livelihoods of Aboriginal and Torres Strait Islander peoples. In addition to these direct benefits to human communities, these animals play important roles in maintaining and regulating marine ecosystems, keeping marine systems in balance, and thus providing indirect benefits via a healthy marine environment [2].

Unfortunately, many species of sharks and rays are also vulnerable to threats such as fishing and habitat loss. Many shark species grow slowly and produce relatively few young, meaning that their populations can be quickly depleted and once depleted can take a long time to recover [3]. Globally, sharks and rays are under increasing pressure, with a quarter of the known species threatened with an elevated risk of extinction according to the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species [4]. While Australia's marine systems do not face the intensity of pressures faced in many other parts of the world, some Australian sharks are at significant risk due to a combination of historical and ongoing pressures, and certain ecological and life history traits that make them sensitive to these pressures. Some species, such as the Green Sawfish have disappeared from some regions of Australia where they once lived.

Purpose

Given the global threats to sharks, and the concerns about the status of this group of key marine predators, it is important that the status of this group in Australian waters is considered to ensure that there is a broad understanding of their status to make sure that environmental managers, policy makers, advocacy groups and the public can act to address any concerns. This Report Card for Australia's Sharks is designed to fulfil this purpose. It reports the status of all species of sharks and shark-like rays to provide a snapshot of the health of Australia's stocks[1]. It provides a summary for each of the stocks assessed (available online at http://www.sharkreportcard.org/) and compiles the outcomes of the assessments into this report card document.

[1] Shark species can form separate populations in different geographical areas that are referred to as stocks

Methodology

The Australian Shark Report Card presents a systematic assessment of the status of all of Australia's sharks, as well as rays with shark-like bodies (sawfishes, wedgefishes, guitarfishes, giant guitarfish, and banjo rays; also referred to as shark-like rays). Importantly, the Report Card covers all Australian sharks, the majority of which are probably unknown to most Australians. In doing so, the Report Card provides a scientifically robust account of what is happening to Australia's shark resources, identifying the species and stocks that are currently healthy and likely to be healthy into the future, and those species that are in decline and need further management intervention and conservation.

To assess the status of all of these species required the compilation of a large amount of information, and its assessment against a set of standardised criteria. To facilitate this process, a workshop of 23 of Australia's leading shark and ray scientists was held at James Cook University in 2015. These experts brought together the best available science on these species and applied the IUCN RED List Categories and Criteria (http://www.iucnredlist.org/technical-documents/categories-and-criteria). The IUCN Red List Categories and Criteria are the established International standard protocols for assessing species' extinction risk, and provide the basis for assessing species status under the new Common Assessment Method being used by the Commonwealth and most state and territory governments. The assessment process also incorporated the categories and criteria of the Australian Government's *Status of Key Australian Fish Stocks Reports* to indicate the sustainability of these species in Australian fisheries. The stock status was determined from the IUCN Red List category using a guide specifically developed for this purpose (Appendix A). Using these systematic assessment protocols, the Australian Shark Report Card presents the most up-to-date scientific account of the status of 194 of Australia's sharks and shark-like rays. The status of Australia's rays (except for the shark-like rays) and chimaeras are not considered here.

The Australian Shark Report Card assessed the status of a total of 194 species. Five of the species (e.g. Grey Nurse Shark and the Endeavour Dogfish (*Centrophorus moluccensis*) have two separate stocks in Australian waters, giving a total of 196 stocks that were assessed. A summary of the assessments for each stock (both the *Status of Australian Fish Stocks* and IUCN Red List) are given in Appendix B, and individual species summaries are available in the Species Compendium (http://www.sharkreportcard.org/).

The status of Australia's sharks and shark-like rays[2]

Overall, Australian sharks are in relatively good condition (Table 1). A total of 124 stocks (62.3%) were assessed as Sustainable. For these stocks, catches in Australian fisheries are likely to be below the level at which recruitment overfishing will occur. A further 42 (21.1%) were assessed as Undefined, meaning there was insufficient information to determine their status. In most cases

[2] Henceforth, the term sharks encompasses shark-like rays, unless shark-like rays are specified.

these are deepwater species, some rarely encountered and known only from a few specimens. There was no information to suggest any of these Undefined stocks are under immediate threat from human pressures, including fishing. The majority of the Undefined stocks are likely to be sustainable but further investigation is needed to better understand the that status of these mainly deepwater species.

Table 1. Summary of assessment outcomes for Australia's sharks and shark-like rays

Status of Australian Fish Stocks category	Number of stocks
Sustainable	124
Recovering	9
Depleting	6
Depleted	18
Undefined	42
Total	199

The primary potential threat to most Australian sharks is fishing. However, the results of this assessment indicate that for the large majority of species, the interactions with fisheries have not led to unsustainable outcomes. In fact, for many species there are only low levels of fishery interactions. Only 18 stocks (9.0%) were assessed as Depleted. Importantly, further examination of these species shows that 16 are either now protected or have specific fisheries management measures under Commonwealth, state or Territory regulations or legislation (Table 2). This leaves just two Depleted stocks (1%) – Whitefin Swellshark (*Cephaloscyllium albipinnum*) and Colclough's Shark (*Brachaelurus colcloughi*)– that would likely benefit from improvements in management, monitoring and research. Both of these species are caught incidentally in fisheries.

Table 2. Australian shark and shark-like ray stocks with evidence of population declines (Depleted, Depleting, Recovering) and the type of management arrangements in place (if any). Fishery rules – species-specific rules in place in main fisheries; Protected species – protected under Commonwealth/state/Territory legislation; Rebuilding plan – species with a rebuilding plan under the Commonwealth Harvest Strategy Policy or Conservation Dependent (*Environment Protection Biodiversity Conservation Act 1999* (*EPBC*) listing).

Species	Common name	Aust. management
Overfished		
Centrophorus granulosus	Gulper Shark	Rebuilding plan
Centrophorus harrissoni	Harrisson's Dogfish	Rebuilding plan
Brachaelurus colcloughi	Colclough's Shark	None
Rhincodon typus	Whale Shark	Protected species
Carcharias taurus (East coast of Australia stock)	Grey Nurse Shark	Protected species
Odontaspis ferox	Sand Tiger Shark	Protected species (NSW)

Cephaloscyllium albipinnum	Whitefin Swellshark	None
Carcharhinus longimanus	Oceanic Whitetip Shark	Fishery rules
Galeorhinus galeus	School Shark	Rebuilding plan
Carcharodon carcharias	White Shark	Protected species
Glyphis garricki	Northern River Shark	Protected species
Glyphis glyphis	Speartooth Shark	Protected species
Sphyrna lewini	Scalloped Hammerhead	Rebuilding plan
Sphyrna mokarran	Great Hammerhead	Fishery rules
Pristis clavata	Dwarf Sawfish	Protected species
Pristis pristis	Largetooth Sawfish	Protected species
Anoxypristis cuspidata	Narrow Sawfish	Protected species
Pristis zijsron	Green Sawfish	Protected species
Depleting		
Squatina albipunctata	Eastern Angelshark	None
Cephaloscyllium variegatum	Saddled Swellshark	None
Alopias pelagicus	Pelagic Thresher	Fishery rules
Alopias superciliosus	Big-eye Thresher	Fishery rules
Isurus oxyrinchus	Shortfin Mako	Fishery rules
Galeocerdo cuvier	Tiger Shark	None
Recovering		
Squalus chloroculus	Greeneye Spurdog	Fishery rules
Squalus grahami	Eastern Longnose Spurdog	Fishery rules
Squalus montalbani	Philippine Spurdog	Fishery rules
Centrophorus moluccensis (Eastern Australian stock)	Endeavour Dogfish	Fishery rules
Deania quadrispinosa	Longsnout Dogfish	Fishery rules
Carcharhinus amblyrhynchos	Grey Reef Shark	Fishery rules
Carcharhinus obscurus (western Australian stock)	Dusky Shark	Fishery rules
Carcharhinus plumbeus (western Australian stock)	Sandbar Shark	Fishery rules
Triaenodon obesus	Whitetip Reef Shark	Fisheries rules

Further evidence that threats to Australian sharks are being addressed is that there are nine species that have suffered historical declines, but that are now rebuilding thanks to improved management regimes. This group includes important fishery species (e.g. Dusky Shark (*Carcharhinus obscurus*) and Sandbar Shark (*C. plumbeus*)) and also those taken incidentally in fisheries for other species, especially in the waters of the continental slope (e.g. Longsnout Dogfish (*Deania quadrispinosa*), Philippine Spurdog (*Squalus montalbani*)) and on the Great Barrier Reef (e.g. Grey Reef Shark (*Carcharhinus amblyrhynchos*)). These species require careful ongoing management to ensure full recovery, but are showing positive signs that Australian management processes are being successful.

Six species were assessed as Transitional Depleting. These are species where there are ongoing declines in the stock, but not yet to levels that cannot be sustained. Three species – Shortfin Mako (*Isurus oxyrinchus*) and two species of thresher shark (*Alopias pelagicus, A. superciliosus*) – are managed as bycatch in pelagic longline and recreational fisheries. However, the other three species – Tiger Shark (*Galeocerdo cuvier*), Saddled Swellshark (*Cephaloscyllium variegatum*), and Eastern Angelshark (*Squatina albipunctata*)– currently have little management. As such, they need to be carefully monitored, and management introduced, to ensure populations do not become overfished.

Overall, the results of the assessments indicate that Australia's shark stocks are in a healthy state. While there are some that are Depleted, the vast majority of these already have management actions in place. Very few appear to have insufficient protection. This indicates that Australia's overall management of sharks is good, with the majority sustainable (64%), about 20% likely to be sustainable and 5.6% recovering from historic declines. Further evidence of good management of sharks comes from the results of the IUCN Red List assessments, which show that 12.8% of species were in a threatened category (Critically Endangered, Endangered or Vulnerable), about half of the level seen globally. This includes 21 species that have a better status in Australian waters than globally (Table 3). Only one stock had a worse status than the global status – the east coast stock of Grey Nurse Shark.

Table 3. Australian threatened sharks and shark-like rays based on IUCN Red List Categories.

Red List Assessment	CR	EN	VU	NT	LC	DD
Global	5	10	31	28	83	39
Australia	6	6	13	27	109	35

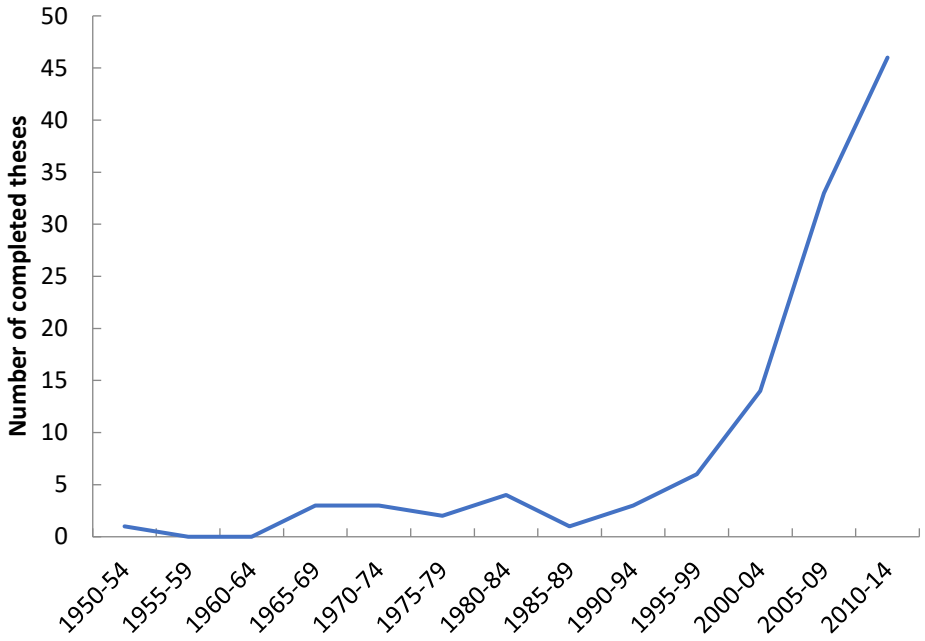
Australia's capacity to research, monitor, assess and manage sharks

While the results of this assessment demonstrate that Australia has done a good job managing its sharks, it is important that these efforts are maintained. There is a long history of research, monitoring and assessment of sharks in Australia. This has provided a sound base for the management of stocks and is one of the reasons that so few species are Depleted and nearly all of those have some form of management in place to reverse declines. Ongoing monitoring and research are critical to maintaining the healthy state of Australia's sharks. Without the knowledge of when action is required, managers are unable to act.

Australia's long history of shark research, dates back to the work of Gilbert Whitley (taxonomy), Alan Olsen (fisheries biology), Terry Walker (fisheries biology), John Stevens (fisheries biology, taxonomy), Peter Last (taxonomy) and others. Initially research capacity was focused at CSIRO and state and Territory fisheries agencies. However, as resources for some agencies have declined, and alternative sources of funding have become available, there has been a shift towards research

capacity also being located at universities. This trend is best illustrated by the exponential increase in PhD and MSc research on Australia's sharks and rays since the 1990s (Figure 1). This changing research landscape has broadened the scope of research. Up until about 2000, most research was focused on the species targeted in Australian fisheries (e.g. Gummy, School, Dusky, Whiskery and Australian Blacktip Sharks). Subsequently, research has focused across a wide array of species, many of them not important commercially or important only as incidental catch, and important in terms of the broader marine ecosystem and biodiversity. It is this broadening of research that has helped facilitate the production of this Report Card and other similar outputs. This broad base of research has positioned Australia well to continue to be able to address concerns about the status of its shark stocks into the future.

Figure 1. The number of PhD and MSc theses on sharks and rays completed at Australian universities in five year periods from 1950 to 2014.



The monitoring of Australia's shark stocks occurs in a wide variety of ways. For some target species, there are specific monitoring programs that provide data to stocks assessments. This includes many of the species targeted by fisheries, or those that are subject to rebuilding plans under the Commonwealth Harvest Strategy. However, most monitoring occurs via ongoing or one-off fishery observer programs or the collection of catch and effort data by fisheries agencies. Fishery observer programs are essential for ongoing monitoring of species caught incidentally in fisheries and formed the basis of the assessments that underpinned this Report Card. Despite the importance of ongoing monitoring for understanding the status of Australia's sharks the availability, coverage and focus of observer programs varies dramatically among Australian jurisdictions. Ongoing support for monitoring programs that provide data on the status of Australia's sharks and rays will be important for ensuring that the healthy nature of most stocks

identified in this Report Card can be maintained. Without such programs, the ability to detect stocks that have become Depleted is more difficult and opportunities to recover stocks are lost.

The assessment of the state of Australia's shark stocks is fundamental to maintaining them in a healthy state. The assessment of most species only occurs infrequently and is done using the IUCN Red List Categories and Criteria. This was first done in 2003 when a selection of Australian species was assessed, and again as part of this Report Card process. These assessments, however, are a measure of extinction risk and cannot be used to set sustainable fishing limits. A much smaller subset of species is subject to quantitative stock assessments that generate measures of stock status and levels of sustainable catch. Assessments of these stocks occur regularly and many are reported in the Status of Australia Fish Stocks reports (see www.fish.gov.au). In addition to full stock assessments, many sharks and rays caught in Australian fisheries have been assessed as part of ecological risk assessments (ERA). These ERAs identify those species that may be at risk from a specific fishery and need to have this risk mitigated via an appropriate mechanism. The ongoing assessment using all of these approaches is an important part in ensuring that Australia's sharks are managed to ensure the vast majority remain in a healthy state and those that are not are recovered.

The culmination of research, monitoring and assessment is the implementation of management. The results of this Report Card demonstrate that Australia's approach to managing its shark stocks has to date been very good. There are few species that are considered Depleted and most of those are subject to species-specific management action. Given the broad ranges and movements of many shark species this management often requires the cooperation of multiple jurisdictions. The primary responsibility for management of fisheries falls to state, Territory and Commonwealth fisheries agencies. However, the Department of the Environment and Energy also plays an important role through the *EPBC* and Wildlife Trade Operation certification processes that ensures fisheries management meets Australia's Ecologically Sustainable Development guidelines. There is also some coordination of the management of sharks through Australia's National Plan of Action for Sharks (Shark Plan) that is currently in its second iteration (http://www.agriculture.gov.au/fisheries/environment/sharks). This is part of the United Nations Food and Agriculture Organisation's International Plan of Action for Sharks which aims to ensure the conservation and management of sharks and their long-term sustainable use (http://www.fao.org/ipoa-sharks/en/). The results of this Report Card should contribute to all of these management processes to enable the best possible management of Australia's sharks.

References

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Appendix A. Equivalency table between IUCN Red List categories and Australia Fish Stock Status (SAFS) categories.

IUCN Red List category	Aligns to SAFS category	Rationale	Comments
Extinct	Not Applicable	An Extinct species cannot be fished and thus cannot be included in a SAFS report. Thus, there is no corresponding SAFS category.	There are no sharks or rays in this category (globally)
Extinct in the Wild	Not Applicable	A species that is Extinct in the Wild cannot be fished and thus cannot be included in a SAFS report. Thus, there is no corresponding SAFS category.	There are no sharks or rays in this category (globally)
Critically Endangered (CR)	**Depleted**	The VU, EN, and CR categories describe scenarios where significant (>30% to >90%) population reductions have occurred over the last ten years or three generations, may occur in the future or occur over a time period encompassing both the past and the future*. This scenario aligns with *Depleted* in the SAFS assessment framework which indicates scenarios where recruitment levels are significantly reduced and *current management is not adequate to recover the stock*#. However, a VU or EN species may also align with *Recovering* where management has halted and is reversing previous declines. A fish listed as VU, EN or CR may not be subject to targeted fishing pressure. However, VU, EN and CR species may still be incidentally taken as bycatch, and fishing pressure is the causative factor in the VU, EN and CR assessment for almost all shark and rays. Consequently, *Depleted* is an appropriate term that could be applied to all three IUCN categories. The exception to this are some species assessed as VU where stocks have been depleted but *management measures are now in place to promote stock recovery, and recovery is occurring*# (Recovering).	Using IUCN assessment Criteria A1, A2, A3 and A4 which assess population trends; Criteria B that assess restricted ranges and Criteria C which assess declines in mature individuals. Where fishing mortality on these species has demonstrably ceased or decreased, the Shark Report Card *Species Assessment Summary* will highlight that while stocks are still in a reduced state, overfishing was historical and is no longer occurring. Population/stock recovery depends on management intervention.
Endangered (EN)	**Depleted**		
Vulnerable (VU)	**Depleting** **Recovering**		
Near Threatened (NT)	**Sustainable**	NT indicates that a species is depleting or has declined to levels approaching the >30% population reduction threshold in ten years/three generations of the VU category. However, population reductions have not yet reached levels that are likely to threaten the species with extinction. Fishing may also reduce a stock to depleted but *stable* state where further reductions toward extinction is unlikely due to management.	The Shark Report Card *Species Assessment Summary* will specify if the species is considered to be Sustainable, Depleting or Recovering In Transitional stocks (Recovering or Depleting)s, new management intervention may be needed to halt

		This scenario aligns with the SAFS category for sustainable fishing (Sustainable) where a depleted but stable population is being held at Maximum Sustainable Yield; OR categories where fishing pressure is *moving the stock in the direction of becoming recruitment overfished*[#] (Depleting).	and reverse a decline, or existing management needs to be maintained to continue population/stock recovery to target levels.
Least Concern (LC)	**Sustainable**	LC indicates that the species is not at risk of extinction. This category aligns with the SAFS *Sustainable* category which describes scenarios where stock levels are sufficient to ensure adequate levels of future recruitment and where existing management is sufficient to maintain adequate recruitment levels.	Existing management continued to maintain current population/stock levels.
Data Deficient (DD)	**Undefined Stock**	Both are categories that indicate there is insufficient information to assess the status of the population/stock against the assessment criteria.	Data required to assess populations/stocks
Not Evaluated (NE)	No corresponding category	The SAFS is a fisheries assessment, so a fished species that is not assessed is not included in the SAFS report. Thus, there is no corresponding SAFS category.	

* 'Facing high to extremely high risk of extinction in the wild' IUCN Red List Categories and Criteria Version 3.1

[#] Table 1: Stock status terminology for the Status of Key Australian Fish Stocks Reports

Environmentally Limited: The SAFS category *Environmentally Limited* can apply equally to the IUCN NT, VU, EN and CR Categories. Consequently, it is not aligned with any specific category. Nevertheless, if environmental factors are causing significant declines in recruitment levels of an NT, VU, EN or CR shark or ray, this will be specifically mentioned in the individual Species Summary (http://www.sharkreportcard.org/).

Appendix B. Summary of assessment outcomes for all species of Australian sharks and shark-like rays. UCN Red List Categories: CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near Threatened, LC – Least Concern, DD – Data Deficient.

Order	Family	Taxon	Common name	SAFS Status	Australian Red List	Global Red List
Carcharhiniformes	Carcharhinidae	*Carcharhinus albimarginatus*	Silvertip Shark	Sustainable	LC	VU
Carcharhiniformes	Carcharhinidae	*Carcharhinus altimus*	Bignose Shark	Sustainable	LC	DD
Carcharhiniformes	Carcharhinidae	*Carcharhinus amblyrhynchoides*	Graceful Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus amblyrhynchos*	Grey Reef Shark	Recovering	NT	VU
Carcharhiniformes	Carcharhinidae	*Carcharhinus amboinensis*	Pigeye Shark	Sustainable	LC	VU
Carcharhiniformes	Carcharhinidae	*Carcharhinus brachyurus*	Bronze Whaler	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus brevipinna*	Spinner Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus cautus*	Nervous Shark	Sustainable	LC	LC
Carcharhiniformes	Carcharhinidae	*Carcharhinus coatesi*	Coates's Shark	Sustainable	LC	LC
Carcharhiniformes	Carcharhinidae	*Carcharhinus falciformis*	Silky Shark	Sustainable	NT	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus fitzroyensis*	Creek Whaler	Sustainable	LC	LC
Carcharhiniformes	Carcharhinidae	*Carcharhinus galapagensis*	Galapagos Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus leucas*	Bull Shark	Sustainable	NT	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus limbatus*	Common Blacktip Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus longimanus*	Oceanic Whitetip Shark	Depleted	CR	CR
Carcharhiniformes	Carcharhinidae	*Carcharhinus macloti*	Hardnose Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus melanopterus*	Blacktip Reef Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus obscurus* (western Australian stock)	Dusky Shark	Recovering	NT	VU
Carcharhiniformes	Carcharhinidae	*Carcharhinus obscurus* (eastern Australian stock)	Dusky Shark	Undefined	NT	VU
Carcharhiniformes	Carcharhinidae	*Carcharhinus plumbeus* (western Australian stock)	Sandbar Shark	Recovering	NT	VU
Carcharhiniformes	Carcharhinidae	*Carcharhinus plumbeus* (eastern Australian stock)	Sandbar Shark	Undefined	NT	VU
Carcharhiniformes	Carcharhinidae	*Carcharhinus sorrah*	Spot-tail Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Carcharhinus tilstoni*	Australian Blacktip Shark	Sustainable	LC	LC
Carcharhiniformes	Carcharhinidae	*Galeocerdo cuvier*	Tiger Shark	Depleting	NT	NT
Carcharhiniformes	Carcharhinidae	*Glyphis garricki*	Northern River Shark	Depleted	CR	CR
Carcharhiniformes	Carcharhinidae	*Glyphis glyphis*	Speartooth Shark	Depleted	EN	EN

Carcharhiniformes	Carcharhinidae	*Loxodon macrorhinus*	Sliteye Shark	Sustainable	LC	LC
Carcharhiniformes	Carcharhinidae	*Negaprion acutidens*	Lemon Shark	Sustainable	LC	VU
Carcharhiniformes	Carcharhinidae	*Prionace glauca*	Blue Shark	Sustainable	NT	NT
Carcharhiniformes	Carcharhinidae	*Rhizoprionodon acutus*	Milk Shark	Sustainable	LC	NT
Carcharhiniformes	Carcharhinidae	*Rhizoprionodon taylori*	Australian Sharpnose Shark	Sustainable	LC	LC
Carcharhiniformes	Carcharhinidae	*Triaenodon obesus*	Whitetip Reef Shark	Recovering	NT	VU
Carcharhiniformes	Hemigaleidae	*Hemigaleus australiensis*	Australian Weasel Shark	Sustainable	LC	LC
Carcharhiniformes	Hemigaleidae	*Hemipristis elongata*	Fossil Shark	Sustainable	LC	VU
Carcharhiniformes	Pseudotriakidae	*Pseudotriakis microdon*	False Catshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Apristurus albisoma*	White-bodied Catshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Apristurus ampliceps*	Roughskin Catshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Apristurus australis*	Pinocchio Catshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Apristurus bucephalus*	Bighead Catshark	Undefined	DD	DD
Carcharhiniformes	Pentachidae	*Apristurus longicephalus*	Smoothbelly Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Apristurus melanoasper*	Fleshynose Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Apristurus pinguis*	Bulldog Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Apristurus platyrhynchus*	Bigfin Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Apristurus sinensis*	Freckled Catshark	Undefined	DD	DD
Carcharhiniformes	Pentachidae	*Asymbolus analis*	Grey Spotted Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Asymbolus funebris*	Blotched Catshark	Undefined	DD	DD
Carcharhiniformes	Pentachidae	*Asymbolus occiduus*	Western Spotted Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Asymbolus pallidus*	Pale Spotted Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Asymbolus parvus*	Dwarf Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Asymbolus rubiginosus*	Orange Spotted Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Asymbolus submaculatus*	Vareigated Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Asymbolus vincenti*	Gulf Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Bythaelurus incanus*	Dusky Catshark	Undefined	DD	DD
Carcharhiniformes	Pentachidae	*Figaro boardmani*	Sawtail Shark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Figaro striatus*	Northern Sawtail Shark	Undefined	DD	DD
Carcharhiniformes	Pentachidae	*Galeus gracilis*	Slender Sawtail Shark	Undefined	DD	DD
Carcharhiniformes	Pentachidae	*Halaelurus sellus*	Speckled Catshark	Sustainable	LC	LC
Carcharhiniformes	Pentachidae	*Parmaturus bigus*	Short-tail Catshark	Undefined	DD	DD
Carcharhiniformes	Scyliorhinidae	*Atelomycterus fasciatus*	Banded Catshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Atelomycterus macleayi*	Marbled Catshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Atelomycterus marnkalha*	Eastern Banded Catshark	Undefined	DD	DD
Carcharhiniformes	Scyliorhinidae	*Aulohalaelurus labiosus*	Blackspotted Catshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium albipinnum*	Whitefin Swellshark	Depleted	CR	CR

Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium cooki*	Cook's Swellshark	Undefined	DD	DD
Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium hiscosellum*	Reticulate Swellshark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium laticeps*	Draughtboard Shark	Sustainable	LC	LC
Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium signourum*	Flagtail Swellshark	Undefined	DD	DD
Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium speccum*	Speckled Swellshark	Undefined	DD	DD
Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium variegatum*	Saddled Swellshark	Depleting	NT	NT
Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium zebrum*	Narrowbar Swellshark	Undefined	DD	DD
Carcharhiniformes	Sphyrnidae	*Eusphyra blochii*	Winghead Shark	Sustainable	LC	EN
Carcharhiniformes	Sphyrnidae	*Sphyrna lewini*	Scalloped Hammerhead	Depleted	EN	EN
Carcharhiniformes	Sphyrnidae	*Sphyrna mokarran*	Great Hammerhead	Depleted	VU	EN
Carcharhiniformes	Sphyrnidae	*Sphyrna zygaena*	Smooth Hammerhead	Sustainable	NT	EN
Carcharhiniformes	Triakidae	*Furgaleus macki*	Whiskery Shark	Sustainable	LC	LC
Carcharhiniformes	Triakidae	*Galeorhinus galeus*	School Shark	Depleted	VU	VU
Carcharhiniformes	Triakidae	*Hemitriakis abdita*	Darksnout Houndshark	Undefined	DD	DD
Carcharhiniformes	Triakidae	*Hypogaleus hyugaensis*	Pencil Shark	Sustainable	LC	LC
Carcharhiniformes	Triakidae	*Iago garricki*	Longnose Houndshark	Sustainable	LC	LC
Carcharhiniformes	Triakidae	*Mustelus antarcticus*	Gummy Shark	Sustainable	LC	LC
Carcharhiniformes	Triakidae	*Mustelus ravidus*	Grey Gummy Shark	Sustainable	LC	LC
Carcharhiniformes	Triakidae	*Mustelus stevensi*	Western Spotted Gummy Shark	Sustainable	LC	LC
Carcharhiniformes	Triakidae	*Mustelus walkeri*	Eastern Spotted Gummy Shark	Undefined	DD	DD
Carcharhiniformes	Triakidae	*Hemitriakis falcata*	Sicklefin Houndshark	Sustainable	LC	LC
Heterodontiformes	Heterodontidae	*Heterodontus galeatus*	Crested Hornshark	Sustainable	LC	LC
Heterodontiformes	Heterodontidae	*Heterodontus portusjacksoni*	Port Jackson Shark	Sustainable	LC	LC
Heterodontiformes	Heterodontidae	*Heterodontus zebra*	Zebra Hornshark	Sustainable	LC	LC
Hexanchiformes	Chlamydoselachidae	*Chlamydoselachus anguineus*	Frill Shark	Sustainable	LC	LC
Hexanchiformes	Hexanchidae	*Heptranchias perlo*	Sharpnose Sevengill Shark	Sustainable	NT	NT
Hexanchiformes	Hexanchidae	*Hexanchus griseus*	Bluntnose Sixgill Shark	Sustainable	NT	NT
Hexanchiformes	Hexanchidae	*Hexanchus nakamurai*	Bigeye Sixgill Shark	Undefined	DD	DD
Hexanchiformes	Hexanchidae	*Notorynchus cepedianus*	Broadnose Sevengill Shark	Sustainable	LC	DD
Lamniformes	Alopiidae	*Alopias pelagicus*	Pelagic Thresher	Depleting	VU	VU
Lamniformes	Alopiidae	*Alopias superciliosus*	Bigeye Thresher	Depleting	VU	VU
Lamniformes	Alopiidae	*Alopias vulpinus*	Common Thresher	Sustainable	LC	VU
Lamniformes	Cetorhinidae	*Cetorhinus maximus*	Basking Shark	Undefined	VU	VU
Lamniformes	Lamnidae	*Carcharodon carcharias*	White Shark	Recovering	VU	VU
Lamniformes	Lamnidae	*Isurus oxyrinchus*	Shortfin Mako	Depleting	VU	VU
Lamniformes	Lamnidae	*Isurus paucus*	Longfin Mako	Undefined	VU	VU
Lamniformes	Lamnidae	*Lamna nasus*	Porbeagle	Sustainable	NT	VU

Lamniformes	Megachasmidae	*Megachasma pelagios*	Megamouth Shark	Sustainable	LC	LC
Lamniformes	Mitsukurinidae	*Mitsukurina owstoni*	Goblin Shark	Sustainable	LC	LC
Lamniformes	Odontaspididae	*Carcharias taurus* (East coast)	Grey Nurse Shark	Depleted	CR	VU
Lamniformes	Odontaspididae	*Carcharias taurus* (West coast)	Grey Nurse Shark	Sustainable	NT	VU
Lamniformes	Odontaspididae	*Odontaspis ferox*	Sand Tiger Shark	Depleted	VU	VU
Lamniformes	Pseudocarchariidae	*Pseudocarcharias kamoharai*	Crocodile Shark	Sustainable	NT	NT
Orectolobiformes	Brachaeluridae	*Brachaelurus colcloughi*	Colclough's Shark	Depleted	VU	VU
Orectolobiformes	Brachaeluridae	*Brachaelurus waddi*	Blind Shark	Sustainable	LC	LC
Orectolobiformes	Ginglymostomatidae	*Nebrius ferrugineus*	Tawny Shark	Sustainable	LC	VU
Orectolobiformes	Hemiscylliidae	*Chiloscyllium punctatum*	Grey Carpetshark	Sustainable	LC	NT
Orectolobiformes	Hemiscylliidae	*Hemiscyllium ocellatum*	Epaulette Shark	Sustainable	LC	LC
Orectolobiformes	Hemiscylliidae	*Hemiscyllium trispeculare*	Speckled Carpetshark	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Eucrossorhinus dasypogon*	Tasselled Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Orectolobus floridus*	Floral Banded Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Orectolobus halei*	Gulf Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Orectolobus hutchinsi*	Western Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Orectolobus maculatus*	Spotted Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Orectolobus ornatus*	Ornate Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Orectolobus parvimaculatus*	Dwarf Spotted Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Orectolobus reticulatus*	Network Wobbegong	Undefined	DD	DD
Orectolobiformes	Orectolobidae	*Orectolobus wardi*	Northern Wobbegong	Sustainable	LC	LC
Orectolobiformes	Orectolobidae	*Sutorectus tentaculatus*	Cobbler Wobbegong	Sustainable	LC	LC
Orectolobiformes	Parascylliidae	*Parascyllium collare*	Collar Carpetshark	Sustainable	LC	LC
Orectolobiformes	Parascylliidae	*Parascyllium elongatum*	Elongate Carpetshark	Undefined	DD	DD
Orectolobiformes	Parascylliidae	*Parascyllium ferrugineum*	Rusty Carpetshark	Sustainable	LC	LC
Orectolobiformes	Parascylliidae	*Parascyllium sparsimaculatum*	Ginger Carpetshark	Undefined	DD	DD
Orectolobiformes	Parascylliidae	*Parascyllium variolatum*	Varied Carpetshark	Sustainable	LC	LC
Orectolobiformes	Rhincodontidae	*Rhincodon typus*	Whale Shark	Depleted	EN	EN
Orectolobiformes	Stegostomidae	*Stegostoma fasciatum*	Leopard Shark	Sustainable	LC	EN
Pristiophoriformes	Pristiophoridae	*Pristiophorus cirratus*	Common Sawshark	Sustainable	LC	LC
Pristiophoriformes	Pristiophoridae	*Pristiophorus delicatus*	Tropical Sawshark	Sustainable	LC	LC
Pristiophoriformes	Pristiophoridae	*Pristiophorus nudipinnis*	Southern Sawshark	Sustainable	LC	LC
Rhinopristiformes	Glaucostegidae	*Glaucostegus typus*	Giant Shovelnose Ray	Sustainable	LC	VU
Rhinopristiformes	Pristidae	*Anoxypristis cuspidata*	Narrow Sawfish	Depleted	EN	EN
Rhinopristiformes	Pristidae	*Pristis clavata*	Dwarf Sawfish	Depleted	EN	EN
Rhinopristiformes	Pristidae	*Pristis pristis*	Largetooth Sawfish	Depleted	CR	CR
Rhinopristiformes	Pristidae	*Pristis zijsron*	Green Sawfish	Depleted	CR	CR

Rhinopristiformes	Rhinidae	*Rhina ancylostoma*	Shark Ray	Sustainable	NT	VU
Rhinopristiformes	Rhinidae	*Rhynchobatus australiae*	Bottlenose Wedgefish	Sustainable	NT	VU
Rhinopristiformes	Rhinidae	*Rhynchobatus palpebratus*	Eyebrow Wedgefish	Sustainable	NT	NT
Rhinopristiformes	Rhinobatidae	*Rhinobatos sainsburyi*	Golden Shovelnose Ray	Sustainable	LC	LC
Rhinopristiformes	Trygonorrhinidae	*Aptychotrema rostrata*	Eastern Shovelnose Ray	Sustainable	LC	LC
Rhinopristiformes	Trygonorrhinidae	*Aptychotrema timorensis*	Spotted Shovelnose Ray	Undefined	VU	VU
Rhinopristiformes	Trygonorrhinidae	*Aptychotrema vincentiana*	Western Shovelnose Ray	Sustainable	LC	LC
Rhinopristiformes	Trygonorrhinidae	*Trygonorrhina dumerilli*	Southern Fiddler Ray	Sustainable	LC	LC
Rhinopristiformes	Trygonorrhinidae	*Trygonorrhina fasciata*	Eastern Fiddler Ray	Sustainable	LC	LC
Squaliformes	Centrophoridae	*Centrophorus granulosus*	Gulper Shark	Depleted	VU	VU
Squaliformes	Centrophoridae	*Centrophorus harrissoni*	Harrisson's Dogfish	Depleted	EN	EN
Squaliformes	Centrophoridae	*Centrophorus moluccensis* (East coast)	Endeavour Dogfish	Recovering	NT	DD
Squaliformes	Centrophoridae	*Centrophorus moluccensis* (West coast)	Endeavour Dogfish	Sustainable	LC	DD
Squaliformes	Centrophoridae	*Centrophorus squamosus*	Leafscale Gulper Shark	Undefined	VU	VU
Squaliformes	Centrophoridae	*Centrophorus westraliensis*	Western Gulper Shark	Undefined	DD	DD
Squaliformes	Centrophoridae	*Deania calcea*	Brier Shark	Sustainable	LC	LC
Squaliformes	Centrophoridae	*Deania quadrispinosa*	Longsnout Dogfish	Recovering	NT	NT
Squaliformes	Dalatiidae	*Dalatias licha*	Black Shark	Sustainable	NT	NT
Squaliformes	Dalatiidae	*Euprotomicrus bispinatus*	Pygmy Shark	Sustainable	LC	LC
Squaliformes	Dalatiidae	*Isistius brasiliensis*	Cookie-cutter Shark	Sustainable	LC	LC
Squaliformes	Dalatiidae	*Isistius plutodus*	Largetooth Cookie-cutter Shark	Sustainable	LC	LC
Squaliformes	Dalatiidae	*Squaliolus aliae*	Smalleye Pygmy Shark	Sustainable	LC	LC
Squaliformes	Echinorhinidae	*Echinorhinus brucus*	Bramble Shark	Undefined	DD	DD
Squaliformes	Echinorhinidae	*Echinorhinus cookei*	Prickly Shark	Sustainable	NT	NT
Squaliformes	Etmopteridae	*Centroscyllium kamoharai*	Bareskin Dogfish	Undefined	DD	DD
Squaliformes	Etmopteridae	*Etmopterus baxteri*	Southern Lanternshark	Sustainable	LC	LC
Squaliformes	Etmopteridae	*Etmopterus bigelowi*	Slender Lanternshark	Sustainable	LC	LC
Squaliformes	Etmopteridae	*Etmopterus brachyurus*	Short-tail Lanternshark	Undefined	DD	DD
Squaliformes	Etmopteridae	*Etmopterus dianthus*	Pink Lanternshark	Sustainable	LC	LC
Squaliformes	Etmopteridae	*Etmopterus dislineatus*	Lined Lanternshark	Sustainable	LC	LC
Squaliformes	Etmopteridae	*Etmopterus evansi*	Blackmouth Lanternshark	Sustainable	LC	LC
Squaliformes	Etmopteridae	*Etmopterus fusus*	Pygmy Lanternshark	Sustainable	LC	LC
Squaliformes	Etmopteridae	*Etmopterus lucifer*	Blackbelly Lanternshark	Sustainable	LC	LC
Squaliformes	Etmopteridae	*Etmopterus molleri*	Moller's Lanternshark	Undefined	DD	DD
Squaliformes	Etmopteridae	*Etmopterus pusillus*	Smooth Lanternshark	Sustainable	LC	LC

Squaliformes	Etmopteridae	*Etmopterus unicolor*	Bristled Lanternshark	Undefined	DD	DD
Squaliformes	Oxynotidae	*Oxynotus bruniensis*	Prickly Dogfish	Undefined	DD	DD
Squaliformes	Somniosidae	*Centroscymnus coelolepis*	Portuguese Dogfish	Sustainable	NT	NT
Squaliformes	Somniosidae	*Centroscymnus owstonii*	Owston's Dogfish	Sustainable	LC	LC
Squaliformes	Somniosidae	*Centroselachus crepidater*	Golden Dogfish	Sustainable	LC	LC
Squaliformes	Somniosidae	*Scymnodon plunketi*	Plunket's Dogfish	Sustainable	NT	NT
Squaliformes	Somniosidae	*Scymnodalatias albicauda*	Whitetail Dogfish	Undefined	DD	DD
Squaliformes	Somniosidae	*Scymnodalatias sherwoodi*	Sherwood's Dogfish	Undefined	DD	DD
Squaliformes	Somniosidae	*Somniosus antarcticus*	Southern Sleeper Shark	Undefined	DD	DD
Squaliformes	Somniosidae	*Zameus squamulosus*	Velvet Dogfish	Undefined	DD	DD
Squaliformes	Squalidae	*Cirrhigaleus australis*	Mandarin Shark	Undefined	DD	DD
Squaliformes	Squalidae	*Squalus acanthias*	Whitespotted Spurdog	Sustainable	LC	VU
Squaliformes	Squalidae	*Squalus albifrons*	Eastern Highfin Spurdog	Undefined	DD	DD
Squaliformes	Squalidae	*Squalus altipinnis*	Western Highfin Spurdog	Undefined	DD	DD
Squaliformes	Squalidae	*Squalus chloroculus*	Greeneye Spurdog	Recovering	NT	NT
Squaliformes	Squalidae	*Squalus crassispinus*	Fatspine Spurdog	Undefined	DD	DD
Squaliformes	Squalidae	*Squalus edmundsi*	Edmund's Spurdog	Sustainable	NT	NT
Squaliformes	Squalidae	*Squalus grahami*	Eastern Longnose Spurdog	Recovering	NT	NT
Squaliformes	Squalidae	*Squalus megalops*	Piked Spurdog	Sustainable	LC	NT
Squaliformes	Squalidae	*Squalus montalbani*	Philippine Spurdog	Recovering	VU	VU
Squaliformes	Squalidae	*Squalus nasutus*	Western Longnose Spurdog	Undefined	DD	DD
Squaliformes	Squalidae	*Squalus notocaudatus*	Bartail Spurdog	Undefined	DD	DD
Squatiniformes	Squatinidae	*Squatina albipunctata*	Eastern Angelshark	Depleting	VU	VU
Squatiniformes	Squatinidae	*Squatina australis*	Australian Angelshark	Sustainable	LC	LC
Squatiniformes	Squatinidae	*Squatina pseudocellata*	Western Angelshark	Sustainable	LC	LC
Squatiniformes	Squatinidae	*Squatina tergocellata*	Ornate Angelshark	Sustainable	LC	LC