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Foreword

Australian waters are home to a diverse and unique array of sharks, rays and related species, which are an important part of our aquatic biodiversity and ecosystems, and of some Australian fisheries. Australian governments are committed to the conservation and management of sharks and their long-term sustainable use. Australia's second *National Plan of Action for the Conservation and Management of Sharks 2012* (hereafter referred to as Shark-plan 2) will play a key role in achieving these goals. Shark-plan 2 builds on the lessons learned from Australia's 2004 *National Plan of Action for the Conservation and Management of Sharks* recognising its achievements and also identifying areas where improvements are still needed.

Shark-plan 2 provides an updated assessment of the conservation and management issues concerning sharks in Australian waters and identifies the research and management actions across Australia's state, territory and Commonwealth jurisdictions that will be pursued over the life of the plan (to be reviewed within four years of implementation).

Management actions focus mainly on fisheries activities, where Shark-plan 2 can have the most influence and impact. Australia's approach to conserving and managing sharks should be guided by the principles of ecologically sustainable development, with an emphasis on applying a precautionary approach in the absence of comprehensive information. A better understanding of Australia's trade in shark products will also help to guarantee the long-term sustainability of Australian shark populations. Improved shark-handling procedures may help to minimise the undesirable impacts of fishing on sharks.

Research actions remain fundamental to an improved understanding of shark biology, ecology, and population status, and to assessing the impact of human activities on sharks. While our information base has improved, our ability to address many shark conservation and management issues is still constrained by the quality of data on shark catch and effort. Shark-plan 2 calls for continued improvement in the identification of shark species caught, coordination of research and sharing of information. A more consistent approach to identifying and quantifying risks relating to shark conservation and management would result in better communication among government agencies and with the public, and better-informed decision-making.

Australia is a world leader in the ecologically sustainable management and use of natural resources. Shark-plan 2 provides a framework for the long-term conservation of Australia's shark populations, and for guiding the industries and communities that affect them.



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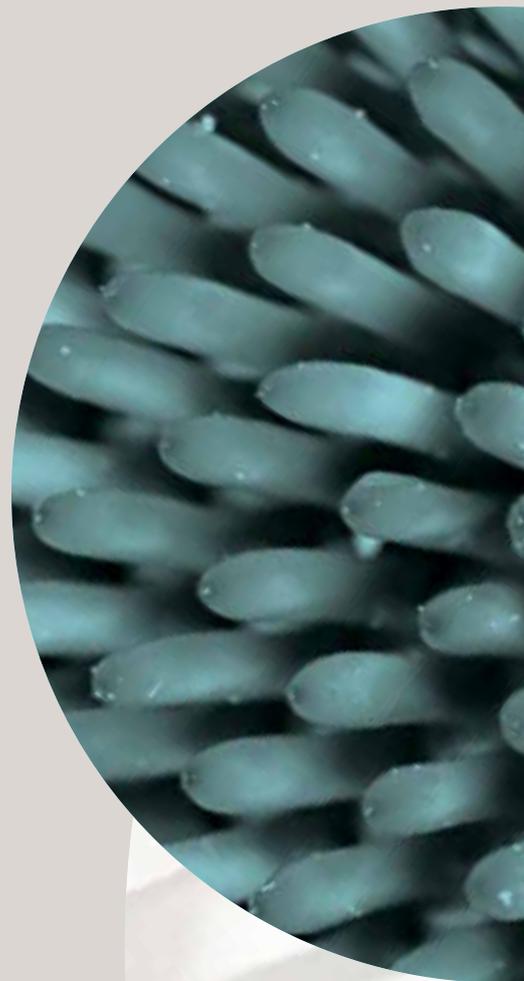
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Abbreviations

ABS	Australian Bureau of Statistics
AFMA	Australian Fisheries Management Authority
AQIS	Australian Quarantine and Inspection Service
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	The Department of Agriculture, Fisheries and Forestry
EPBC	The Environment, Protection and Biodiversity Conservation Act
ERAEF	Ecological Risk Assessment for the Effects of Fishing
ESD	Ecologically Sustainable Development
FAO	United Nations Food and Agriculture Organisation
FRDC	Fisheries Research and Development Corporation
IPOA	International Plan of Action
MERI	Natural Resource Management Monitoring, Evaluation, Reporting and Improvement Framework
NGO	Non-Government Organisation
NPOA	National Plan of Action
NRM	Natural Resource Management
RFMO	Regional Fisheries Management Organisation
SAFE	Sustainability Assessment for Fishing Effects
SAR	Shark Assessment Report
SIRC	Shark-plan Implementation and Review Committee

Glossary

Customs – Australian Customs and Border Protection Service.

Jurisdiction – a collective term to describe the Commonwealth and state/territory governments and their agencies.

Commonwealth – Australian Government.

Precautionary Approach – Knowing that our knowledge is limited, we should apply the precautionary principle while employing adaptive management approaches using new science and practical experience. The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage (Natural Resource Management Ministerial Council 2010).



Introduction

Around one quarter (322 species) of all known species of shark are found in Australian waters¹. Of these, more than half are found nowhere else in the world (Last and Stevens 2009). Given this diversity there is national and international interest in conserving and managing Australian sharks. Australian governments are committed to the conservation and management of sharks and their long-term sustainable use.

Fishing is one of the main human activities that interact with sharks. Some fisheries target shark species, while others catch them incidentally while targeting other species. There is global concern that high levels of shark catch are affecting shark species in several areas of the world's oceans (FAO 1999; Clarke 2009). In general, sharks are more vulnerable to fisheries impacts than bony fish, as they tend to be slow-growing, mature at a later age and have few young (Last and Stevens 1994). Some shark species also have naturally small population sizes, which makes them especially vulnerable. These characteristics mean that, in the absence of scientific advice, a precautionary approach to managing fisheries and other human impacts on sharks is necessary (FAO 2000).

Fisheries management in Australia is generally of a high standard (Pitcher et al. 2009). For the small number of shark species that are targeted by fisheries there are formal fisheries management arrangements, complemented by monitoring and research. However, a large part of the Australian shark catch is incidental (non-target)—being either kept and sold (byproduct) or discarded (bycatch). For these components of the catch there is generally less known about the species' biology or the full extent of the catch.

1. The term 'shark' refers to all species of shark, skates, rays and chimaeras (Class Chondrichthyes) unless otherwise specified.

In 1999, member countries of the Food and Agriculture Organisation of the United Nations (FAO) developed the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) (FAO 1999) in recognition of the expanding global catch of sharks and the potential negative impacts on shark populations. The IPOA-Sharks is a voluntary international instrument developed for member nations to take positive action to ensure the conservation and management of sharks, and their long-term sustainable use. The IPOA-Sharks suggests that members develop a National Plan of Action if their vessels conduct targeted fishing for sharks or if they regularly catch sharks in fisheries targeting other species.

The following is an extract from the IPOA Sharks:

The IPOA-Sharks (FAO 1999) has the objective, 'to ensure the conservation and management of sharks and their long-term sustainable use' and prescribes the following aims:

- Ensure that shark catches from directed and non-directed fisheries are sustainable.
- Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use.
- Identify and provide special attention, in particular to vulnerable or threatened shark stocks.
- Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States.
- Minimise unutilised incidental catches of sharks.
- Contribute to the protection of biodiversity and ecosystem structure and function.
- Minimise waste and discards from shark catches in accordance with article 7.2.2.(g) of the *Code of Conduct for Responsible Fisheries* (for example, requiring the retention of sharks from which fins are removed).
- Encourage full use of dead sharks.
- Facilitate improved species-specific catch and landings data and monitoring of shark catches.
- Facilitate the identification and reporting of species-specific biological and trade data.

Australia has been supportive of the IPOA-Sharks and proactive in developing its own National Plan of Action (hereafter called the Shark-plan). As a member of the United Nations FAO, Australia published its first *National Plan of Action for the Conservation and Management of Sharks* (Shark-plan 1) in 2004 (DAFF 2004). This document represents Australia's second iteration of this initiative, following Shark-plan 1. Shark-plan 1 was based on the first Shark Assessment Report (hereafter SAR1), published in 2001, which identified issues for the management of sharks and rays in Australian waters.

Shark-plan provides guidance to fisheries and conservation managers and the public to improve conservation and management of sharks, and details actions to encourage the effective and sustainable management of Australia's shark populations. Shark-plan relies on the FAO's technical guidelines for the conservation and management of sharks (FAO 2000) and encourages those responsible for implementing actions under the plan to consider this framework. Efforts have been made to address the objectives of IPOA-Sharks throughout Shark-plan 2, while acknowledging national and emerging priorities in Australia.



Development of Shark-plan 2

The IPOA-Sharks (FAO 1999) directs member states that implement a Shark-plan to assess its implementation at least every four years, in order to identify strategies for increasing the effectiveness of the plan. In 2008, the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) instigated a performance review of Shark-plan 1 in collaboration with the Shark-plan Implementation and Review Committee (SIRC). The *Review of Australia's 2004 National Plan of Action for the Conservation and Management of Sharks: Final report to the Department of Agriculture, Fisheries and Forestry* (Bodsworth et al. 2010) (hereafter called the Review) provides a comprehensive insight into the strengths and weaknesses of Shark-plan 1 and its implementation, and makes recommendations for consideration in the development of a new plan. At the same time, Australia's second Shark Assessment Report (Bensley et al. 2010) (hereafter SAR2) was published to support the review process. SAR2 and the Review are the primary documents that have been used in the formulation of Shark-plan 2.

Shark-plan 2 aims to coordinate action on shark conservation and management in Australia through existing fisheries management and conservation processes. It acknowledges the achievement of Australia's management jurisdictions over the life of Shark-plan 1 and sets the direction for shark conservation and management in the future.

This new plan, based on the objective and aims of IPOA-Sharks, builds on the conservation and management issues identified in Shark-plan 1 by prioritising these issues and identifying actions to address them.

Issues identified in Shark-plan 1

SAR1 identified 24 conservation and management issues for sharks in Australia. These were clarified and refined into 18 issues addressed in Shark-plan 1 (listed below). Given the significant investment of resources and expertise dedicated to the development of Shark-plan 1 (including SAR1), these issues form the basis for the development of Shark-plan 2. The Review and SAR2 were used to determine whether the issues identified by Shark-plan 1 remain relevant, to inform the prioritisation of issues and identify actions to be pursued.

- Issue 1.** Improved identification of shark species by all resource users.
- Issue 2.** Secure, accessible and validated data sets that record all catch data and are consistent over time with compatible resolution between jurisdictions over the full range of each species from all resource users.
- Issue 3.** Full utilisation of dead sharks and an improved understanding of the markets for and trade in shark products.
- Issue 4.** Coordination of shark research.
- Issue 5.** Continued effort to maintain and improve the standard of stock assessments for target shark species in dedicated shark fisheries.
- Issue 6.** Reliable assessments for bycatch and byproduct shark species.
- Issue 7.** Assessment of the adequacy of management for all shark species and more innovative approaches to dealing with identified shark management issues.
- Issue 8.** Improved understanding of the impacts of and, where required, implementation of better management for, recreational and game fishing.
- Issue 9.** Reduce cryptic fishing mortality of shark species.
- Issue 10.** Assessment of shark handling practices for the conservation and management of sharks.
- Issue 11.** Better understanding and, where necessary, recognition in management arrangements, of shark fishing by Indigenous people.

- Issue 12.** Risk assessments for all shark species from all impacts on those species.
- Issue 13.** Where necessary, develop strategies for the recovery of shark species and populations.
- Issue 14.** Reduce or, where necessary, eliminate shark bycatch.
- Issue 15.** Better understanding of the effects of shark fishing, control programs for bather protection and management practices on ecosystem structure and function.
- Issue 16.** Reduce the impact of environmental degradation on sharks.
- Issue 17.** More information on the impact on sharks of sound waves in the marine environment.
- Issue 18.** More information on the impact on sharks of electromagnetic fields, for example, high voltage electric cables and shark protection devices.

Recommendations from the review of Shark-plan 1

The Review evaluated the effectiveness of Shark-plan 1 against its stated objectives. The intention was that the findings would contribute to the development of Shark-plan 2. The Review used a systematic natural resource management (NRM) program evaluation methodology, referred to as the monitoring, evaluation, reporting and improvement (MERI) approach.

A review framework comprising targeted evaluation questions was used to assess the extent to which the objectives, issues, and actions defined in Shark-plan 1 had been addressed. Information was collected by reviewing the relevant literature, such as SAR2, conducting a series of regional stakeholder workshops and interviewing additional selected stakeholders.

Overall, the Review found that Shark-plan 1 had contributed to improved conservation and management outcomes for shark species occurring in Australian waters. However, it suggested that Shark-plan 1 had not been a major driver of these improvements. A number of stakeholders commented that fisheries' sustainability assessments under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) had been a major driver for commercial fisheries.

The Review found that considerable enhancements to management and supporting data systems were needed before fisheries taking sharks could be considered to fully comply with the *EPBC Act Guidelines for Ecologically Sustainable Management of Fisheries*.

Risk assessment methodologies were found to vary considerably among fisheries and jurisdictions. The Review notes:

the nature and timing of management responses to risk assessment outcomes is also variable across jurisdictions, with reluctance in some cases to act on potential risks, or take a methodical approach to the mitigation of substantial risks for elasmobranch bycatch species. In many cases, except for higher value target species, there is little evidence that the effectiveness of shark focussed management responses has been assessed.

The Review found good examples of the precautionary approach being applied to address risks associated with sustainability. However, it also found examples where the precautionary approach was demonstrably not applied. Further, it found that ecosystem research had taken a back seat to more species-specific research activities such as understanding the impacts of exploitation rates on target species and/or higher-risk shark species.

Looking forward, the Review stated that Shark-plan 2 will benefit from more active engagement by all jurisdictions and greater clarity and accountability against Shark-plan outcomes. Resourcing for the implementation of actions, monitoring and evaluation will also be critical to the effectiveness of Shark-plan 2. The Review states that, for efficiency, Shark-plan 2 should link effectively with existing management strategies and build on proven initiatives that are already underway in the various jurisdictions. Determining an appropriate and low-cost NPOA performance management framework is important and warrants consideration.

The Review identified barriers to, and drivers for, the effectiveness of Shark-plan 1. It also made a number of recommendations for the development of Shark-plan 2 (listed below). Consult the Review (Bodsworth et al. 2010) for a full description of recommendations.

Group A: ecological sustainability

- REV-A1.** There is a need for greater use of the precautionary principle in the management of sharks, including non-target and high risk species.
- REV-A2.** The CSIRO/AFMA Ecological Risk Assessment approach (ERAEF, or SAFE), or the FRDC sponsored National ESD Risk Assessment approach for fisheries, are both well recognised risk assessment methods that can be scaled to suit fishery circumstances. Alternative methods that inform about fishery risks to ecological and/or ESD objectives to an equivalent standard are also available. The recent FRDC project *Development of national guidelines to improve the application of risk-based methods in the scope, implementation and interpretation of stock assessments for data poor species* (Scandol et al. 2009), also makes an important contribution.
- REV-A3.** In the medium term (two to five years) fishery risk assessments and data sharing must evolve to the point where cumulative risks to vulnerable or high risk species are recognised and then addressed.
- REV-A4.** Credible and efficient fisheries risk assessments that can operate to species level where necessary, are a critically important tool for effective and efficient shark management at a range of spatial scales.

Group B: improved data and reporting

- REV-B1.** The costs and benefits of activities to improve the value and relevance of trade related data (Customs, ABS, AQIS) to support improved shark management need to be clear.
- REV-B2.** Although there have been improvements in data collection and sharing there remain persistent barriers. These barriers should be addressed systematically.



REV-B3. There is a need to understand how the timeliness and extension of shark related data/information to managers, researchers, and other key shark stakeholders like the public and environment NGOs, might be improved.

REV-B4. Noting some of the risks associated with heavy reliance on fishery dependent data, there should be greater adoption of carefully designed and targeted observer programs (or alternative independent monitoring strategies) to enable higher quality information on shark catch and the nature of fishing operations and impacts on sharks.

REV-B5. Strong examples of collaborative/ joint management, research initiatives, and/or policy instruments should be highlighted and supported, and used as models to drive improvements in these areas.

REV-B6. The ongoing constraints to obtaining better data and information on recreational, and to a lesser degree Indigenous shark catch (and the importance of sharks to Indigenous communities) require closer examination and more effective measures to address these gaps.

REV-B7. High quality risk assessments should be completed and implemented across all jurisdictions where they have not already been done.

Group C: engagement and empowerment

Coordination and priority setting

REV-C1. The Shark-plan could play a stronger role to coordinate shark research, particularly at a regional or national scale.

REV-C2. The Shark-plan could play a stronger role in helping to guide and prioritise national, multi-jurisdictional, and regional approaches to shark management, as well as on high-risk shark species.

REV-C3. Greater consideration should be given to the adequacy of funding for shark research, the advantages and disadvantages of having a national funding framework for shark research, and the potential for better understanding and alignment between the priorities of shark researchers and those of shark managers.

Regional capacity building

REV-C4. Australia should continue to engage strongly with relevant international and regional treaty arrangements (CITES, CMS), and push for the adoption of best practice shark management in RFMOs .

REV-C5. Species identification is still a major issue in Australian fisheries, and also throughout the region. Well considered and appropriate fisher education and engagement strategies will be fundamentally important in this regard. The current heavy reliance on high level and relatively bureaucratic bilateral and multilateral meetings will have limited impact on fisher behaviour in the region.

REV-C6. Improved consistency for anti-finning regulations in the jurisdictions may enable more effective regional negotiations on these issues.

REV-C7. More of a *bloc* approach to fisheries management and conservation initiatives in the Indian Ocean region may deliver improved shark conservation and management outcomes regionally.

REV-C8. A stronger more national focus for the Shark-plan is appropriate, particularly for more migratory and straddling shark stocks.

Governance

- REV-C9.** Provide the Shark-plan with more authority, credibility, and enable improved management and research coordination through a range of mechanisms.
- REV-C10.** The resourcing implications for implementation of actions and strategies, and performance monitoring for the Shark-plan need to be clearer.

Engagement, consultation and communications

- REV-C11.** The Shark-plan should include a well considered engagement strategy that can operate at a national, regional and jurisdictional level.

Group D: optimum use

- REV-D1.** A more complete understanding of the cumulative protection offered by the range of initiatives like marine parks, spatial closures, and large scale effort reductions would be valuable in determining the need for further protection of vulnerable and/or protected shark species.
- REV-D2.** The potential for the Shark-plan to contribute to broader community recognition of Australia's performance with regard to shark sustainability should be further considered.
- REV-D3.** The potential of trade related measures to reduce the risk of illegal shark finning should be investigated further, and barriers preventing a credible evaluation of the effectiveness of finning bans should be identified and addressed.
- REV-D4.** An evaluation of the need for further refinement of trade related shark catch data and processes associated with the collection, analysis, and use of these data should be considered.

Key findings of the second Shark Assessment Report (SAR2)

The second Shark Assessment Report (SAR2) builds upon the information provided in SAR1 and aims to identify substantial changes that have occurred in fisheries since the release of SAR1 and any new or ongoing concerns. SAR2 includes the presentation, and where possible, analysis of:

- resource information, including fishing methods, catch and effort data, and stock assessments
- conservation and management arrangements
- fisheries management arrangements, including regulatory frameworks.

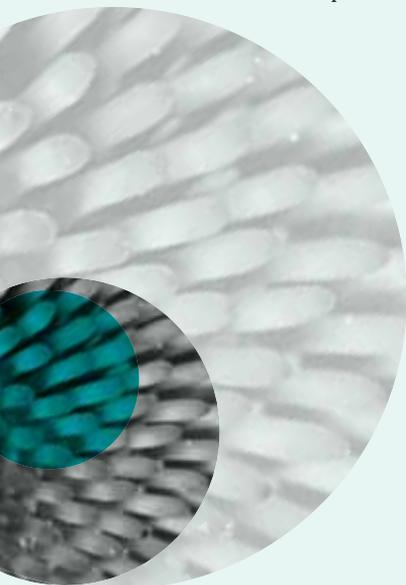
In summary, SAR2 found that, although it was evident that considerable work on shark conservation and management had been undertaken since SAR1, a range of issues were yet to be addressed.

It found that addressing many of the issues identified relied on the fundamental need for improvement in the quality of data on shark catch and effort. Significant data gaps and constraints to improving shark data collection and validation remain in all jurisdictions. SAR2 suggests that addressing these gaps and constraints is critical to ensuring significant progress in resolving shark conservation and management issues in the long term. As a priority in the short-term, there is a need for:

- SAR2-1.** Improved application of data verification methods (observer programs, targeted research and analysis, etc) in target and non-target shark fisheries.
- SAR2-2.** Effective implementation of robust management measures and recovery actions to mitigate threats to high-risk and threatened, endangered and protected species, and to rebuild over-exploited stocks.
- SAR2-3.** Precautionary measures to prevent any further declines in shark species.

SAR2 recommended that the development of actions to address these needs should be a priority for consideration during the development of Shark-plan 2. Addressing these issues would facilitate more rapid progress towards assessing a wider range of threats to Australian sharks and the ecosystem services that depend on them. SAR2 noted that, in the longer-term, there was a need to:

- SAR2-4.** Develop abundance or fishing mortality indices and conduct stock assessments for significant target and byproduct shark species.
- SAR2-5.** Ensure further and more consistent application of risk-based approaches to shark conservation and management.
- SAR2-6.** Assess the significance of cumulative fisheries and other impacts on high-risk species.
- SAR2-7.** Review the need for and, where necessary, the methods to obtain accurate market and trade data.
- SAR2-8.** Examine the need for improved management measures to reduce or restrict the targeting of sharks for the purpose of supplying shark fin to export markets.
- SAR2-9.** Support the development of more effective shark bycatch mitigation methods.
- SAR2-10.** Conduct assessments of the risk non-commercial fisheries pose to sharks.
- SAR2-11.** Continue to encourage the effective monitoring and management of the harvest and bycatch of pelagic shark species on the high seas.
- SAR2-12.** Assess the sustainability of imported shark products.





From recommendations to issues

The recommendations from the Review and the key findings of SAR2 have been used to determine whether the issues identified by Shark-plan 1 remain relevant for consideration in Shark-plan 2.

The Review and SAR2 were also considered for the identification of any new issues not identified by Shark-plan 1. In general, the conservation and management issues for sharks in Australia remain similar to those detailed in Shark-plan 1. Where problems with implementation or effectiveness were raised by the Review or SAR2, these have been addressed in Shark-plan 2 through associated actions and/or through the implementation, monitoring, and evaluation section. Shark-plan 2 has fewer actions than Shark-plan 1, and a greater emphasis is placed on the application of the precautionary approach within actions.

Shark-plan 1 provides a detailed description of how the individual issues relate to the overarching objective of the IPOA, so this has not been repeated here.

Table 1 presents the issues identified in Shark-plan 1 and the corresponding recommendations from the Review and findings from SAR2. An assessment is made of the relevance of the issue to Shark-plan 2.

Table 1: Issues identified in Shark-plan 1, recommendations from the Review, findings from SAR2 and the relevance of issues to the development of Shark-plan 2.

Issues for shark conservation and management identified in Shark-plan 1		Recommendations from the Review and findings from SAR2	Relevant to Shark-plan 2 (Yes/No)
Issue 1.	Improved identification of shark species by all resource users	The Review found that well considered and appropriate fisher education is fundamental to species identification, domestically and regionally (REV-C5). While not included in the list of key findings of SAR2, issues of species identification and the grouping of species under the one category in catch data are discussed in SAR2.	Yes
Issue 2.	Secure, accessible and validated data sets that record all catch data and are consistent over time with compatible resolution between jurisdictions over the full range of each species from all resource users	Improvements to data collection, validation, storage and sharing are addressed a number of times in the recommendations of the Review (REV-B1–REV-B6). The need to improve data collection is discussed as a key issue for effective conservation and management of sharks in Australia. Species identification, grouping of species in catch data and differences in catch reporting systems between jurisdictions are highlighted in SAR2 as key issues. The relatively poor quality of byproduct and bycatch reporting is also discussed. Improved data verification methods were identified as a key issue in SAR2-1. Importantly, SAR2 also notes that a lack of focus on data collection for sharks in the past now limits the scope for quantitative assessment for the majority of shark species.	Yes
Issue 3.	Full utilisation of dead sharks and an improved understanding of the markets for and trade in shark products	Improved anti-finning regulations and the use of trade-related mechanisms were identified by the Review (REV-C3, REV-D3 & REV-D4) as areas for consideration in the development of Shark-plan 2. Further clarity concerning the costs and benefits of improved trade-related data was also recommended (REV-B1). Review of the need for more accurate market and trade data was identified as a key finding in SAR2-7. Further investigation into the need for improved management measures to reduce or restrict targeting of sharks for fin markets was identified in SAR2-8.	Yes
Issue 4.	Coordination of shark research	Recommendations REV-B5, REV-C1, REV-C3 and REV-C9 from the Review covered several aspects of shark research. Examples include the need for strong collaborative research initiatives at a national level and the adequacy of resourcing. <i>Shark futures</i> ² was also discussed in the Review. SAR2 discusses the need for targeted research and analysis in fisheries that interact with sharks, particularly to improve data verification. Also discussed is the need for research to improve survival rates of released sharks and to improve the benefits of tag-and-release studies.	Yes
Issue 5.	Continued effort to maintain and improve the standard of stock assessments for target shark species in dedicated shark fisheries	Although discussed in the Review, maintenance or improvements to stock assessments are not explicitly mentioned in the recommendations. The need for abundance indices and stock assessments are identified as an area for further development (in the longer term) for target and byproduct species (SAR2-4).	Yes
Issue 6.	Reliable assessments for bycatch and byproduct shark species	As per issue 5.	Yes
Issue 7.	Assessment of the adequacy of management for all shark species and more innovative approaches to dealing with identified shark management issues	Not explicitly covered in either the Review or SAR2. An assessment of the adequacy of management of shark species is undertaken to some extent through the completion of Shark Assessment Reports, as per the guidelines in the IPOA.	Yes

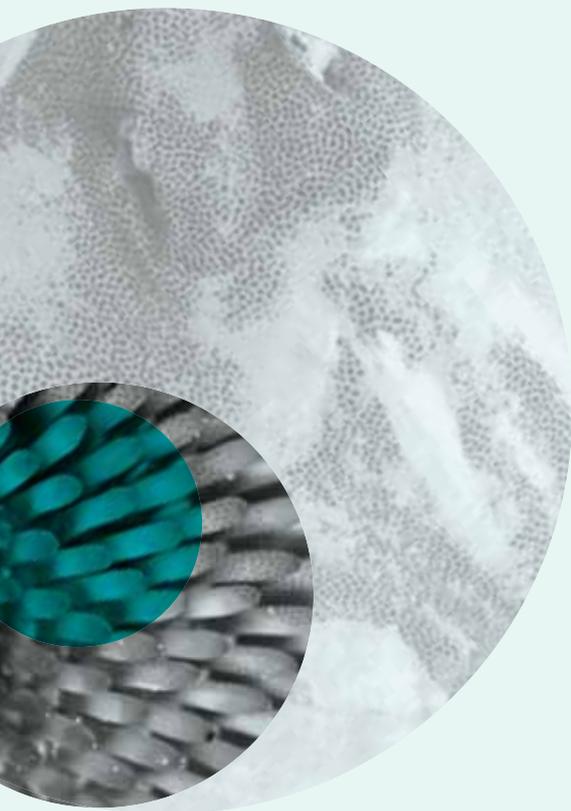
2. *Shark futures: Sustainable shark fisheries—A national research, development and extension framework*. Fisheries Research and Development Corporation (FRDC) project 2009–088.



Issues for shark conservation and management identified in Shark-plan 1		Recommendations from the Review and findings from SAR2	Relevant to Shark-plan 2 (Yes/No)
Issue 8.	Improved understanding of the impacts of and, where required, implementation of better management for, recreational and game fishing	While this issue is discussed in the Review, it is not explicitly mentioned in the recommendations. Assessment of the impacts of non-commercial fishing on sharks is discussed in SAR2-10. Data collection and verification are also addressed in SAR2. Understanding the impact of non-commercial fishing activities on sharks remains an important conservation and management issue for Shark-plan 2.	Yes
Issue 9.	Reduce cryptic fishing mortality ³ of shark species	This issue is discussed in the Review, but not explicitly mentioned in the list of recommendations. While cryptic mortality is not explicitly covered in SAR2's key findings, SAR2 does discuss the high degree of uncertainty about post-release survival. The development of more effective shark bycatch mitigation methods is discussed in SAR2-9.	Yes
Issue 10.	An assessment of shark handling practices for the conservation and management of sharks	While this issue is discussed in the Review and SAR2, it is not explicitly mentioned in the key findings or recommendations of either publication. However, development of more effective shark bycatch mitigation methods is discussed under SAR2-9. Effective handling practices are highlighted as one of the primary tools at the disposal of managers in the <i>Chondrichthyan guide for fisheries managers</i> (Patterson and Tudman, 2009). While refinement of shark-handling practices is prescribed in this reference, there remains a need for improved understanding of the issues in each fishery and a targeted approach to address the issues identified.	Yes
Issue 11.	Better understanding and, where necessary, recognition in management arrangements, of shark fishing by Indigenous people	Closer examination of constraints to obtaining better data on recreational and Indigenous shark catch is addressed in the Review (REV-B6). The need for better understanding of Indigenous shark fishing is not explicitly covered in the key findings of SAR2 but the need for improved data collection is discussed. SAR2 highlights the need for improved national data collection of commercial, recreational and Indigenous fishing activities involving taking sharks and the need for risk assessments looking at the impact of non-commercial fishing operations on sharks (SAR2-10).	Yes
Issue 12.	Risk assessments for all shark species from all impacts on those species	Credible and efficient risk assessments (to species level where necessary) are addressed in the Review (REV-A4). Implementation of high-quality risk assessments are also discussed (REV-B7). Further and more consistent application of risk-based approaches is addressed in SAR2-5.	Yes
Issue 13.	Where necessary, develop strategies for the recovery of shark species and populations	The Review discusses recovery strategies and listing processes but it makes no specific recommendations on associated issues. Implementation of effective management measures for high-risk, threatened, endangered and protected species and rebuilding of over-exploited stocks are addressed in SAR2-2.	Yes
Issue 14.	Reduce or, where necessary, eliminate shark bycatch	Greater use of the precautionary principle and the management of sharks, including non-target, high-risk and bycatch sharks, are discussed in the Review (REV-A1). While reducing or eliminating bycatch is not explicitly covered in any of the key findings, SAR2-9 advocates more effective bycatch mitigation methods in its acknowledgement that the impact of fisheries on non-target stocks should be as little as possible.	Yes

3. Definition of cryptic fishing mortality: unobserved fishing mortality, where individuals die due to being caught but this is not observed in normal fishing operations. Cryptic fishing mortality includes pre-catch losses (individuals that dropout of nets or off hooks) and post-release mortality (where an individual is released but dies due to injuries).

Issues for shark conservation and management identified in Shark-plan 1		Recommendations from the Review and findings from SAR2	Relevant to Shark-plan 2 (Yes/No)
Issue 15.	Better understanding of the effects of shark fishing, control programs for bather protection and management practices on ecosystem structure and function	While ecosystem structure and function are discussed in the Review and SAR2, they are not reflected in the key findings/recommendations. Shark-plan 2 has a role in advocating research to better understand this issue, making appropriate links with <i>Shark futures</i> . The Review notes that ecosystem-focused research in relation to sharks has been a lower priority than species-specific research aimed at better understanding the impacts of fishing on target or high-risk species. This also reflects the complexity and expense of broad-scale ecosystem research.	Yes
Issue 16.	Reduce the impact of environmental degradation on sharks	Not highlighted as a priority area in the Review or SAR2. Therefore, while the issue remains a research interest, it is not a key issue requiring specific action within this Shark-plan.	No
Issue 17.	More information on the impact on sharks of sound waves in the marine environment	Not highlighted as a priority area in the Review or SAR2. Therefore, while the issue remains a research interest, it is not a key issue requiring specific action under this Shark-plan.	No
Issue 18.	More information on the impact on sharks of electromagnetic fields, for example, high voltage electric cables and shark protection devices	Not highlighted as a priority area in the Review or SAR2. Therefore, while the issue remains a research interest, it is not a key issue requiring specific action under this Shark-plan.	No





From issues to actions

Having identified the relevant issues (Table 1), actions are prescribed. The findings of both Shark Assessment Reports (SAR1 and SAR2), the recommendations of the Review were considered in the development of actions. The Fisheries Research and Development Corporation's (FRDC) *Shark futures: Sustainable shark fisheries—a national research, development and extension framework* (Bodsworth and Scandol 2010) was also considered in the development of actions.

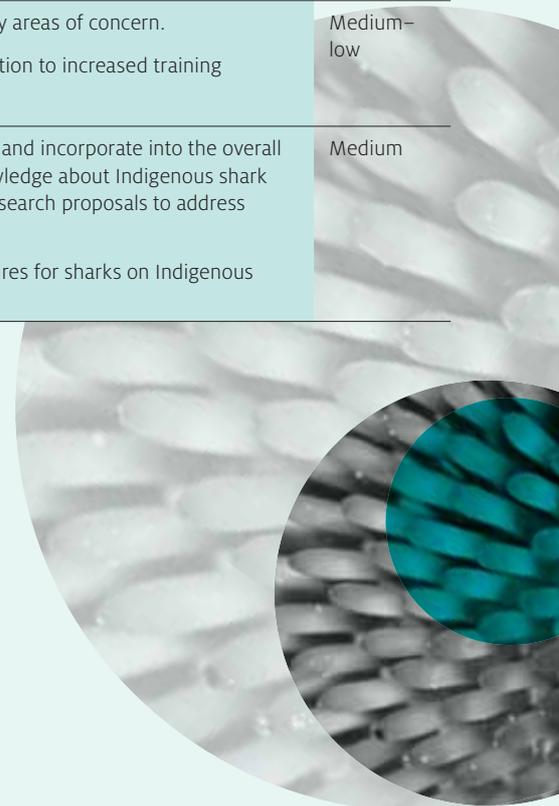
Action table

Table 2 details the issues relevant to Shark-plan 2, priority for implementation and corresponding actions. Performance management of Shark-plan 2 will be carried out by the responsible jurisdictions and through relevant shark groups or committees as discussed in the implementation, monitoring and evaluation section.

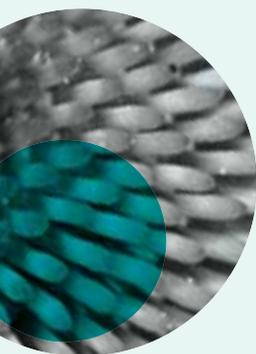
Table 2: Shark-plan 2 — Issues, actions and priorities

Issues for shark conservation and management identified in Shark-plan 1		Actions	Priority of issue
Issue 1.	Improved identification of shark species by all resource users	<ol style="list-style-type: none"> 1. Review existing shark species identification guides (and any in development), implementing the best available identification guides in all relevant fisheries: <ul style="list-style-type: none"> • ensure guides are culturally appropriate, including the use of Indigenous species names where appropriate • ensure the best available guides have been provided to relevant user groups, including fishers, processors, compliance officers, observers and scientists. 2. Monitor the effectiveness of identification guides. 3. Investigate the potential for additional tools for shark identification, such as morphological diagnostic tools or DNA identification kits. 	High
Issue 2.	Secure, accessible and validated data sets that record all catch data and are consistent over time with compatible resolution between jurisdictions over the full range of each species from all resource users	<ol style="list-style-type: none"> 4. Develop and implement national minimum data standards for all commercial, recreational, bather protection and Indigenous fishing operations that take sharks. 5. Obtain better understanding of illegal, unregulated and unreported shark catch. 6. Develop and implement data verification systems with clear objectives and performance measures. 	High
Issue 3.	Full utilisation of dead sharks and an improved understanding of the markets for and trade in shark products	<ol style="list-style-type: none"> 7. Implement anti-finning measures for all Australian fisheries and assess their effectiveness across jurisdictions. Measures should be promoted for adoption regionally and internationally. 8. Assess the potential for more comprehensive trade data collection and analysis to improve shark conservation and management outcomes and implement a more comprehensive trade data collection system as appropriate. 	Medium–high
Issue 4.	Coordination of shark research	<ol style="list-style-type: none"> 9. Support the FRDC National Research, Development and Extension Framework, <i>Shark futures</i>. 10. Investigate opportunities for collaborative research initiatives to address the aims and objective of Shark-plan 2. 	High
Issue 5.	Maintain and improve the standard of stock assessments for target shark species in dedicated shark fisheries	<ol style="list-style-type: none"> 11. Maintain and/or improve stock assessments, risk assessments and status determination processes for target, bycatch and byproduct species. 12. Assess the need for implementation of formal harvest strategies to manage shark catch. 	High
Issue 6.	Reliable assessments for shark bycatch/byproduct	Covered under Issue 5.	Medium
Issue 7.	Assessment of adequacy of management for all shark species and more innovative approaches to dealing with identified shark management issues	<ol style="list-style-type: none"> 13. Iterative/ongoing jurisdictional assessment of the adequacy of shark management, including the implementation of harvest strategies and compliance, enforcement and education strategies to support sustainability objectives for sharks. 14. Explore mechanisms for greater collaboration among jurisdictions regarding research, assessment and management of shared stocks. 	High

Issues for shark conservation and management identified in Shark-plan 1		Actions	Priority of issue
Issue 8.	Improved understanding of the impacts of and, where required, implementation of better management for, recreational and game fishing	<p>15. Review the effectiveness of management measures for recreational and game fishing in achieving sustainability objectives for shark species and develop recommendations for future management approaches, should this be found to be necessary.</p> <p>16. Assess the findings of the Review under action 16 and relevant recreational and Indigenous fishing surveys to:</p> <ul style="list-style-type: none"> • identify gaps in existing monitoring and data collection programs for recreational, charter and Indigenous fishing • determine the nature and role of state and territory recreational fishing surveys • determine the required frequency of future national surveys • determine the adequacy of reporting on recreational and Indigenous fishing issues at national level • where necessary, update existing survey methodologies or introduce effective supplementary or alternative data collection mechanisms • review and where necessary revise recreational and game fishing management arrangements to ensure that impacts on sharks are sustainable • where necessary, increase education and enforcement programs in recreational and game-fishing sectors. 	Medium
Issue 9.	Reduce cryptic fishing mortality of shark species	<p>17. Improve understanding of the cryptic mortality of high-risk sharks in commercial, recreational and Indigenous fisheries.</p> <p>18. Implement strategies to reduce cryptic mortality, noting the link with Theme 2 of <i>Shark futures</i>, which focuses on minimising the environmental impacts of fisheries on sharks.</p> <p>19. Ensure cryptic mortality is accounted for in the setting of catch quotas (where information is available).</p>	Medium-low
Issue 10.	Assessment of shark handling practices for the conservation and management of sharks	<p>20. Investigate shark-handling practices to identify any areas of concern.</p> <p>21. Implement solutions as required, giving consideration to increased training and enforcement requirements.</p>	Medium-low
Issue 11.	Better understanding and, where necessary, recognition in management arrangements, of shark fishing by Indigenous people	<p>22. Assess the extent of Indigenous fishing for sharks and incorporate into the overall management arrangements. Identify gaps in knowledge about Indigenous shark fishing and, where a need is identified, develop research proposals to address these gaps.</p> <p>23. Assess the impact of existing management measures for sharks on Indigenous subsistence fishing practices.</p>	Medium



Issues for shark conservation and management identified in Shark-plan 1		Actions	Priority of issue
Issue 12.	Risk assessments for all shark species from all impacts on those species	<p>24. Implement management responses for species (or species groups) already assessed as high-risk.</p> <p>25. Undertake best practice risk assessments for shark species not already assessed.</p> <p>26. Continue to refine risk assessment processes for target, bycatch and byproduct shark stocks, seeking to include all available data and consideration of cumulative impacts. Collection of data on species biology and human impacts will be foundational to the success of this action.</p> <p>27. Evaluate the methodologies for risk assessment and assess the need for national risk assessment guidelines.</p> <p>28. Implement management measures for any subsequent high-risk species.</p> <p>29. Identify important habitat and broader environmental and habitat requirements for shark species and appropriate protection and management of these areas.</p>	Medium-high
Issue 13.	Develop strategies for the recovery of shark species and populations	<p>30. For species designated as requiring recovery, implement recovery strategies. Recovery strategies should be monitored and revised as appropriate to ensure effectiveness.</p>	Medium-high
Issue 14.	Reduce or, where necessary, eliminate shark bycatch	<p>31. Initiate action (as required) to ensure effective bycatch reduction methods have been developed for all fisheries in which shark are caught as bycatch, giving priority to species identified through risk assessment as 'high-risk'.</p> <p>32. Assess the effectiveness of current shark bycatch reduction measures in reducing shark mortality (including cryptic mortality) and develop performance measures for shark bycatch reduction.</p> <p>33. Promote adoption of effective shark bycatch reduction measures internationally.</p>	Medium-high
Issue 15.	Better understanding of effects of shark fishing, control programs for bather protection and management practices on ecosystem structure and function	<p>34. Undertake periodic assessment/support research of the impact of targeted shark fishing on non-target species (particularly threatened species) and identify priority issues for management.</p> <p>35. Undertake periodic assessment/support research of the impact of fishing operations on structure and function of shark species/stocks and identify priority issues for management.</p> <p>36. Periodic assessment of the ecological impacts of shark control programs for bather protection.</p> <p>37. Investigate methods for modelling the population ecology of sharks and distinguishing between natural and fishing-induced variation, so as to better understand population status and rates of recovery.</p> <p>38. Consider ecosystem structure and function in the development and implementation of management measures, including trophic system interactions and how changes in systems may be measured.</p>	Medium-low





Priority of issues

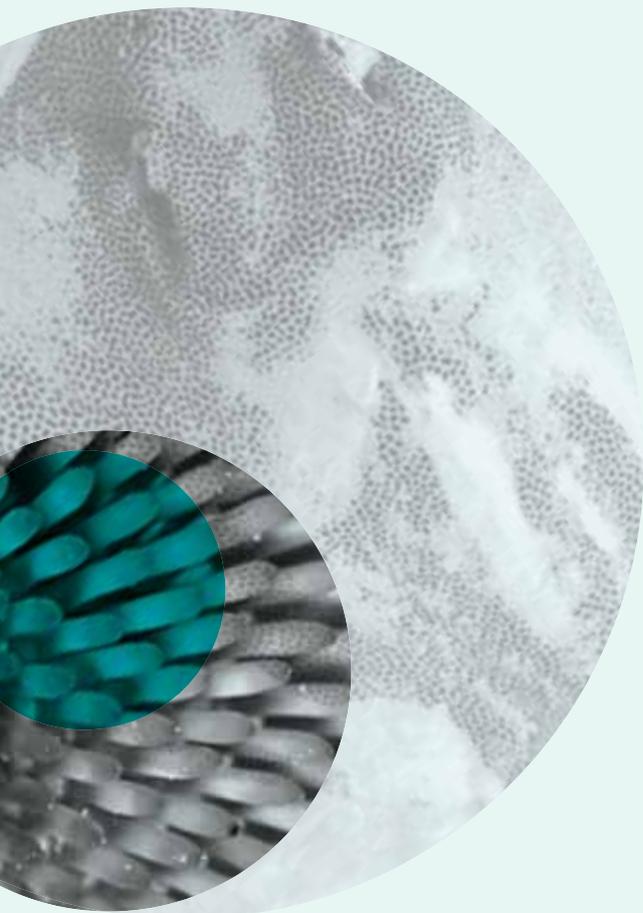
Issues are prioritised in light of a number of considerations. Higher priority is given to issues and associated actions that are fundamental to achieving the overarching aims and objectives of the plan. Priority is given to issues where there is an immediate information need or sustainability risk. Similarly, issues considered to be a lower immediate risk or that rely on the delivery of preceding actions are given a lower priority.

While this is a national plan of action, there will inevitably be some variation among jurisdictions in the timing and implementation of actions. Not all actions will be relevant to all jurisdictions and this will need to be captured effectively in the *Operational Strategy for Australia's National Plan of Action for the Conservation and Management of Sharks 2012 Shark-Plan 2*. It is anticipated that jurisdictions will identify, from the actions in Shark-plan 2, priority actions to be addressed over the life of the plan. Table 3 provides a guide to when actions should be initiated.

Given that the plan must be flexible and accommodate capacity and competing demands for resources, jurisdictions should follow the guidance given in the implementation, monitoring and evaluation section.

Table 3: Priority and implementation schedule for Shark-plan 2 issues and associated actions

Priority	Action initiated
High	Within 12 months of implementation of this plan
Medium	Within two years of implementation of this plan
Low	Within four years of implementation of the plan





Implementation, monitoring and evaluation

The Department of Agriculture, Fisheries and Forestry (DAFF) (Fisheries Branch) is the lead agency responsible for the development of Shark-plan 2 and will remain responsible for coordinating its implementation. Collectively, the SIRC or other representative shark group will be responsible for assessing the overall implementation of Shark-plan 2 during the operational period of the plan. The plan's structure, actions, prioritisation of issues and delivery timeline should enable relevant shark groups and their members to monitor progress. The group will ultimately report to DAFF, which reports to the Australian Government Minister for Agriculture, Fisheries and Forestry.

At the operational level, the state, Northern Territory and Australian governments have prime responsibility for implementing most of the actions identified in Shark-plan 2. The status and effectiveness of these actions to conserve and manage sharks in Australia will be subject to reassessment and review. The implementation and monitoring of actions in Shark-plan 2 will be underpinned by an operational strategy administered by DAFF, with input and reporting from each jurisdiction. It is unrealistic to expect that all of the issues identified in this plan will be fully addressed by all jurisdictions over the life of the plan. Instead, the *Operational Strategy for Australia's National Plan of Action for the Conservation and Management of Sharks 2012 Shark-Plan 2* will detail specific actions jurisdictions will implement, progress and report on over the life of Shark-plan 2.

The success of Shark-plan 2 will require strong cooperation among jurisdictions, and commercial fishers, Indigenous groups, conservation/environmental bodies, recreational and game-fishing associations and scientific and research organisations.

On conclusion of the operational period of Shark-plan 2, jurisdictions will evaluate its overall performance against its aims and objectives. Shark-plan 2 does not have a dedicated budget for its implementation. The delivery of the actions identified in the plan depends on the resources available within the existing budgets of fisheries management and conservation agencies. Supplementary funds for shark-related research may be obtained from other sources. Applications to FRDC should follow the guidance provided in the national research, development and extension framework, *Shark futures*.

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The biosphere is relevant to the work we do and aligns with our mission – we work to sustain the way of life and prosperity of all Australians. The biosphere imagery used in Shark-plan 2 represents the environment, habitat and shark and ray species relevant to the *National Plan of Action for the Conservation and Management of Sharks 2012 Shark-plan 2*.



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