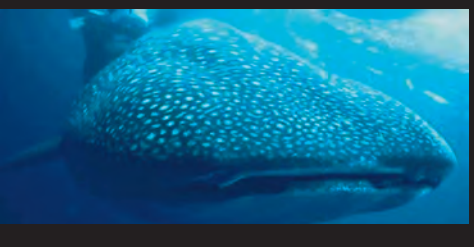
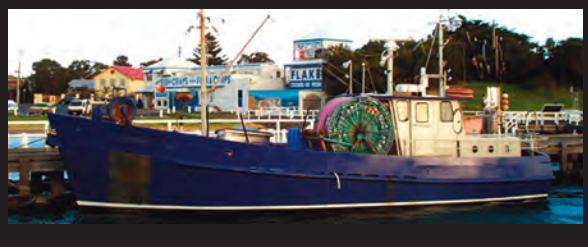
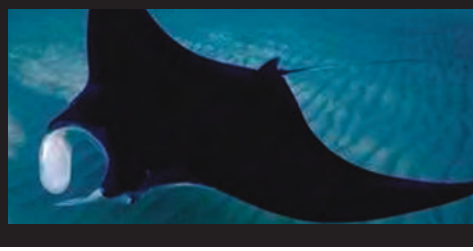
Australian Government

Department of Agriculture, Fisheries and Forestry

National Plan of Action for the Conservation and Management of Sharks (Shark-plan)







May 2004

DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY

Australian Government

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National Plan of Action for the Conservation and Management of Sharks

(Shark-plan)

Prepared for the Australian Government Department of Agriculture, Fisheries and Forestry by the Shark Advisory Group and Mary Lack.

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FOREWORD

Australia's Shark-plan was developed according to guidelines as set out in the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). The overall objective of the IPOA-Sharks and Australia's Shark-plan is to ensure the conservation and management of sharks and their long-term sustainable use. The Shark-plan is a first for Australia in that it is a national guide for managers and interested stakeholders on how to better incorporate shark conservation and management issues into the management of fisheries and the broader marine environment.

The Shark-plan is split into two sections, whereby:

PART A

- provides a description of why the Shark-plan has been developed and how it will be implemented;
- lists the conservation and management issues the Shark-plan strives to address;
- presents the Shark-plan, and associated actions; and
- provides a discussion of issues relating to its implementation and review.

PART B

- provides a brief overview of Australia's shark fisheries; and
- provides a description of each of the conservation and management measures addressed by the Shark-plan. The reader is encouraged to refer to the Shark Assessment Report (Rose and SAG 2001) for more detailed information of the status of shark stocks and management of sharks in Australia[1].

[1] The Shark Assessment Report can be viewed at http://www.daff.gov.au/sharkplan

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PART A
Shark-plan

Introduction

There is worldwide concern over the increase of shark catches and the consequences this has for the populations of some shark species in several areas of the world's oceans (FAO 1999a). Concern for the sustainability of shark stocks stems from the low productivity of shark stocks in general and the particularly low productivity, naturally small population size or rarity of some species of shark. Shark stocks can be rapidly depleted and may be slow to recover from the effects of overfishing. These characteristics imply that the precautionary approach is particularly applicable to this group of fish (FAO 2000). However, despite the inherently low productivity of sharks and their consequent vulnerability to overfishing and other impacts, the relatively low market value of sharks has resulted in few countries managing their shark fisheries.

This situation prompted member countries of the Food and Agriculture Organisation of the United Nations (FAO) to develop an International Plan of Action for the Conservation and Management of Sharks (IPOA—Sharks) (FAO 1999a). The IPOA–Sharks (see Appendix A) suggests that member States of the FAO (of which Australia is one) should develop, voluntarily, a Shark-plan if their vessels conduct target fisheries for sharks or their vessels regularly catch sharks in non-target fisheries. To date only six countries, apart from Australia, have completed Shark-plans and ten have partially completed their Shark-plans (FAO 2003). While Australia is not a major fishing nation it is recognised that shark are an important part of the total quantity of Australia's wild fish production and that Australian vessels regularly take shark as target and non-target catch.

Australian fisheries management is generally of a high standard and each of its target shark fisheries are subject to formal management arrangements. For the relatively small number of shark species targeted in these fisheries there exists monitoring and stock assessment regimes and scientific knowledge is generally regarded as adequate. However, for the bulk of the shark species found and caught in Australian waters, largely as bycatch or byproduct, there is a lack of biological and catch data. Apart from specific protection afforded to nine shark species under Commonwealth and/or State/Northern Territory legislation (see Appendix F) there are few species-specific management measures for bycatch and byproduct shark species.

The pursuit of ecologically sustainable development (ESD) is an integral part of the management objectives of each fisheries management jurisdiction in Australia. In recent times, a wide range of initiatives has been introduced through cooperation between industry and management in response to ESD concerns. However, Australia recognises the special concerns relating to the conservation and management of sharks and that existing management arrangements may need to be improved to address these concerns.

As a result, and in line with the recommendations of the IPOA–Sharks, Australia established a Shark Advisory Group (SAG) in 2000 to oversee the development of a Shark Assessment Report. The report was released in 2001 (Rose and SAG 2001). The Shark Assessment Report identified 24 conservation and management issues and it was agreed that the development of an Australian Shark-plan was necessary to ensure the conservation and management of Australia's shark resources and their ecologically sustainable use.

The Shark-plan has been developed by the SAG in consultation with stakeholders representing all resource users (commercial, Indigenous, recreational fishers), management, fisheries policy, Indigenous research and scientific agencies in each jurisdiction, and government and non-government environment and conservation agencies. Those individuals and agencies involved in the development of the Shark-plan are listed in Appendix B. A list of the organisations and individuals who submitted comments on the draft Shark-plan during the public consultation phase is provided in Appendix C.

The Shark-plan acknowledges the cultural and spiritual significance of shark resources to Indigenous communities and seeks to provide increased opportunities for Indigenous people to contribute to the management and conservation of sharks and to foster an awareness in all Australians of the cultural connections between Indigenous people and shark resources.

The success of the Shark-plan will require increased cooperation between Australia's internal jurisdictions, and by commercial fishers, Indigenous groups, conservation/environmental bodies, recreational and game fishing associations and scientific and research organisations. It will also require increased cooperation between Australia and other nations, particularly those with whom Australia shares shark stocks, for example, Indonesia, East Timor and Papua New Guinea. This international cooperation may require the development of bi-lateral and multi-lateral arrangements and an increased focus by regional fisheries management organisations on shark management issues.

By building on Australia's existing structures for the conservation and management of sharks, the implementation of the Shark-plan will result in significant progress over the next four years. However, it would be unrealistic to expect that all of the issues identified in this report will be fully addressed in that time frame. The Shark-plan is a living document. The status and effectiveness of conservation and management of sharks in Australia will be subject to ongoing reassessment and regular review. It is planned that a second assessment of Australia's conservation and management measures for shark will be initiated in 2005 and that a review of the Shark-plan will be conducted in response to that assessment. A review of the Shark-plan every four years will assess to what extent its objectives have been achieved.

Context

In Australia sharks are taken by commercial, Indigenous, recreational and game fishers and in shark control programs for bather protection. Sharks are taken as target species and as incidental catch, which is either retained or discarded. Sharks are also valued for their intrinsic contribution to marine ecosystems.

Management responsibility for sharks is shared between the six State Governments, the Northern Territory and the Australian Government. The Shark-plan has been developed to ensure that all Australia's shark species are managed sustainably regardless of fishery or jurisdictional boundaries. The Shark-plan will ensure that special conservation and management needs of shark are not overlooked in managing the impacts of all resource users on the marine environment. However the Shark-plan is not intended to over-ride or supplant existing management arrangements. Nor is the Shark-plan an additional layer of management. The Shark-plan provides nationally endorsed advice and guidance as to how the conservation and management of sharks can be integrated into management arrangements for target and non-target fisheries by the jurisdictions responsible for those fisheries.

At the operational level, the States, the Northern Territory and the Australian Government have prime responsibility for implementation of most of the actions identified in the Shark-plan. Those actions relating to review and improvement of existing conservation and management measures will be implemented at the local level through the existing management advisory and consultative arrangements in place in each of the fisheries management jurisdictions (e.g. MACs). These processes will ensure that implementation involves a wide range of stakeholders.

The Shark-plan relies heavily on the FAO's technical guidelines for the conservation and management of sharks (FAO 2000). The guidelines identify four elements of the IPOA-Sharks:

- species conservation;
- biodiversity maintenance;
- habitat protection; and
- management for sustainable use.

Each of these four elements are addressed by actions identified in this Shark-plan. The guidelines also refer to the Sustainable Development Reference System (SDRS) as described by the FAO (1999b). The SDRS has four dimensions - economic, social, ecological and governance. The Shark-plan encourages those responsible for implementing actions under this plan to consider this framework as a template. Many aspects of the SDRS are already reflected in Australia's fisheries management regimes and are consistent with Australia's framework for ESD of fisheries, endorsed by the then Standing Committee on Fisheries and Aquaculture[2] for national application of sustainability indicators.

In the Shark-plan, as in the FAO guidelines (FAO 2000), the term 'shark' is taken to include all species of shark, skates, rays and chimaeras (Class Chondrichthyes) unless otherwise specified, in which case the term 'true sharks' refers to sharks only, that is, separate from skates, rays and chimaeras. The term 'shark catch' is taken to mean shark that is caught, either as target, byproduct (retained for sale) or bycatch (discarded, either dead or alive, or killed as a result of interaction with fishing gear) by commercial, Indigenous, recreational fishing sectors and in shark control programs.

Objectives

The objectives of this Shark-plan are those identified in the IPOA-Sharks. Those objectives are:

i to ensure that shark catches from target and non-target fisheries are sustainable;

ii to 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;

iii to identify and provide special attention, in particular, to vulnerable or threatened sharks;

iv to improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States;

v to minimise unutilised incidental catches of sharks;

vi to contribute to the protection of biodiversity and ecosystem structure and function;

vii to minimise waste and discards from shark catches in accordance with article 7.2.2. (g)[3] of the Code of Conduct for Responsible Fishing (FAO 1995) (for example, requiring the retention of sharks from which fins are removed);

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[2] The Standing Committee on Fisheries and Aquaculture has been replaced by the Natural Resource Management Ministerial Council Marine and Coastal Committee.

[3] Article 7.2.2 of the Code of Conduct for Responsible Fishing requires management measures to provide that "pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species are minimised, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques." The full text of the Code can be found at http://www.fao.org/fi/agreem/codecond/codecon.asp

viii to encourage full use of dead sharks;

ix to facilitate improved species-specific catch and landings data and monitoring of shark catches; and

x to facilitate the identification and reporting of species-specific biological and trade data.

As well as providing a more secure basis for the long term management and conservation of Australia's shark resources, the Shark-plan will help to raise awareness, nationally and internationally, of Australia's commitment to the long-term sustainability of shark resources. Australia will ensure that implementation of the Shark-plan is consistent with its obligations under relevant international treaties and agreements, eg the Convention on Biological Diversity and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Issues in the conservation and management of sharks

The Shark Assessment Report (Rose and SAG 2001) identified 24 conservation and management issues. These issues have been clarified and refined in the Shark-plan consultation process. The revised list of 18 issues is set out in Box 1 and linked to the IPOA objective(s) to which it relates. A brief discussion of each issue is provided in Part B.

Box 1 Issues addressed by the Shark-plan

1 The need to improve identification of shark species by all resource users (Objectives ix and x)

2 The need for secure, accessible and validated data sets that record all catch and are consistent over time with compatible resolution between jurisdictions over the full range of each species from all resource users (Objective ix)

3 The need for full utilisation of dead sharks and an improved understanding of markets for and trade in shark products (Objectives vii, viii and x)

4 The need for coordination of shark research (Objectives iv and vii)

5 The need for continued effort to maintain and improve the standard of stock assessments for target shark species in dedicated shark fisheries (Objective i)

6 The need for reliable assessments for bycatch and byproduct shark species (Objectives i and ii)

7 The need for assessment of the adequacy of management for all shark species and more innovative approaches to dealing with identified shark management issues (Objectives i and ii)

8 The need for improved understanding of the impacts of and, where required, implementation of better management for recreational fishing (Objective iv)

9 The need to reduce cryptic fishing mortality of shark species (Objectives v and vii)

10 The need for an assessment of shark handling practices for the conservation and management of sharks (Objective ii)

11 The need for a better understanding and, where necessary, recognition in management arrangements, of shark fishing by Indigenous people (Objective iv)

12 The need for risk assessments for all shark species from all impacts on those species (Objectives ii, iii and vi)

13 Where necessary develop strategies for the recovery of shark species and populations (Objective iii)

14 The need to reduce or, where necessary, eliminate shark bycatch (Objectives v and vii)

15 The need for a better understanding of the effects of shark fishing, control programs for bather protection and management practices on ecosystem structure and function (Objective vi)

16 The need to reduce the impact of environmental degradation on sharks (Objectives ii and vi)

17 The need for more information on the impact on sharks of sound waves in the marine environment (Objectives ii and vi)

18 The need for more information on the impact on sharks of electromagnetic fields, for example, high voltage electric cables and shark protection devices (Objectives ii and vi)

Interpreting the Shark-plan

The Shark-plan responds to these issues and promotes the ecologically sustainable development of shark stocks through six broad themes. These six themes are:

1 Review existing conservation and management measures;

2 Improve existing conservation and management measures;

3 Improve data collection and handling;

4 Undertake targeted research and development;

5 Initiate focused education/awareness raising programs; and

6 Improve coordination and consultation.

Under the six themes are 43 actions. The Shark-plan specifies priorities and responsibility for the implementation of each action. The Shark-plan links each action to the issue(s) it addresses by reference to the numbered issues in Box 1. Linkages between the objectives of the IPOA-Sharks and the issues and actions of the Australian Shark-plan are shown in Appendix C.

Priorities

Each action identified in the Shark-plan has been allocated a priority ranking (1A, 1B, 1C, 2 or 3). The distinction between 1A and 1B is made in order to acknowledge that, while all priority 1 actions need to be initiated as soon as possible, the feasible time frame for completion of these actions will vary. It is reasonable to expect that actions categorised as 1A and 1B can be initiated within the first year of the Shark-plan and that actions with a 1A rating can be completed within 2 years. A 1B rating acknowledges that it is not possible to specify a completion date for some actions. A 1C rating recognises that an action is dependent on the completion of another action or other work underway, for example, those actions that rely on the results of risk assessments to be carried out under this Shark-plan.

Shark species vary in their distribution in Australian waters as does the fisheries where sharks are captured and the jurisdiction, which has responsibility for managing the fisheries. Therefore, even though this is a National Shark-plan, there will inevitably be some variation between jurisdictions in the timing and implementation of actions and not all actions will be relevant to all jurisdiction.

The broad interpretation of each priority category is provided in Table 1.

Table 1 Interpretation of Priorities

Priority	Action Initiated	Action Completed	Management Funding (where required)	Research Funding (where required)
1A	Within 12 months	Within 2 years, if not sooner	Funding identified immediately	Advise funding bodies of the reasons for the high priority Submit funding proposals as a priority
1B	Within 12 months	In shortest possible timeframe	Funding identified immediately	Advise funding bodies of the reasons for the high priority Submit funding proposals as a priority
1C	Within 12 months of prerequisite work completed	In shortest possible timeframe	Need for funding foreshadowed in management budgets	Advise funding bodies of reasons for the priority of the research required Submit funding proposals based on expected timing of completion of prerequisite work
2	Within 3 years	Within 3 years	Need for funding included in next management budget following adoption of the Shark-plan	Advise funding bodies of reasons for the level of priority of the research required Submit funding proposals in the next round of funding proposals following adoption of the Shark-plan
3	Within 4 years if not sooner	As soon as feasible		Advise funding bodies of reasons for the priority of the research required

Note: The timeframes stipulated above are from the date the Shark-plan is publicly launched

Implementation

The responsibility for implementation of each action has been allocated to the relevant government agency or agencies that are ultimately accountable for ensuring ecologically sustainable shark populations. These agencies are shown in bold type. In many cases "All fisheries agencies" (that is, the agencies responsible for fisheries management in each State, the Northern Territory and the Australian Government) are identified as having that primary responsibility. However the Shark-plan is not intended to be overly prescriptive about how responsibilities under the Shark-plan are met.

As acknowledged above, the nature and extent of that responsibility and the priority of specific actions will inevitably vary across the jurisdictions. In some cases, for example, a State may have handed jurisdiction for the bulk of its shark catch to the Australian Government, in which case the Australian Government will have the prime responsibility, however the State may retain some residual responsibility in terms of shark bycatch in other fisheries. In other cases a particular agency may take the lead in identifying appropriate measures to address an action and other jurisdictions may simply draw on, or contribute in a minor way to, the outcomes.

The cooperation of stakeholders will be a critical determinant of the Shark-plan's success. The primary stakeholders associated with each action (commercial, Indigenous, recreational fishers, conservation agencies and other government agencies) are therefore also identified in the Shark-plan (agencies/stakeholder groups in standard type). It is not intended however that the list of interested stakeholders be restrictive. In carrying out their responsibilities under the Shark-plan each agency will adopt its usual consultative processes. This will provide any interested party with an opportunity to play a role in implementation of the actions specified in the Shark-plan. While particular groups, for example non-government organisations, cannot be required by the Shark-plan to carry out specific actions, many of these groups have expertise which will be of considerable assistance to those who are ultimately responsible for ensuring that actions are implemented.

THEME 1 REVIEW EXISTING CONSERVATION AND MANAGEMENT MEASURES

Action	Priority	Responsible/ Interested Agency
1 (a) Assess current management arrangements for sharks against the objectives of this Shark-plan and the issues that this Shark-plan seeks to address; (b) in particular, assess whether these arrangements are consistent with ecological sustainability of sharks and a precautionary approach, and are enforceable; and (c) address any deficiencies within 12 months of that assessment. **(Issue 7)**	1A	**All fisheries agencies** DEH State/NT conservation agencies GBRMPA
2 (a) Assess current management arrangements for listed threatened shark species against the requirements of recovery plans for those species; and (b) address any deficiencies within 12 months of that assessment. **(Issue 7)**	1A	**All fisheries agencies** DEH State/NT conservation agencies
3 (a) Assess the effectiveness of current shark bycatch reduction measures in reducing shark mortality, paying particular attention to: i. the effectiveness of limits and bans on retention of shark byproduct; and ii. the effectiveness of "generic" limits on shark byproduct in non-target fisheries; (b) address any deficiencies identified in these assessments; and (c) encourage the adoption of effective shark bycatch reduction measures. **(Issues 7, 14)**	1A	**All fisheries agencies** Commercial fishers GBRMPA
4 (a) Initiate an assessment of the impact of current shark bycatch reduction measures in order to detect any unintentional increases in bycatch of any species, particularly threatened species; and (b) assess the impact of bycatch reduction measures for other species on shark bycatch. **(Issue 15)**	3	**All fisheries agencies** Commercial fishers
5 (a) Assess whether finning bans, requiring fins to be landed when either attached to or accompanied by trunks, are being implemented effectively and are achieving their objectives; and (b) identify any deficiencies and address these. **(Issues 1, 7, 10)**	1A	**AFMA** **Fisheries agencies in Tas., Vic., NSW, WA** Commercial fishers GBRMPA

(Theme 1 continued...)

(...Theme 1 continued)

Action	Priority	Responsible/ Interested Agency
6 Review the effectiveness of Offshore Constitutional Settlement arrangements in the management of sharks, identify any deficiencies and take action to develop cooperative management arrangements to address these. **(Issue 7)**	2	**DAFF** **All fisheries agencies** Commercial fishers GBRMPA
7 Initiate an assessment of the ecological impacts of shark control programs for bather protection (including drumlines and nets) or if this assessment has recently been undertaken, continue to monitor the ecological impacts. **(Issue 14)**	2	**Fisheries & relevant agencies** in Qld/NSW Conservation groups
8 Review the effectiveness of management measures for recreational and game fishing in achieving ecological sustainability of shark species. **(Issue 8)**	2	**All fisheries agencies** Recreational fishers Game fishers
9 Assess the impact of existing management measures for sharks on Indigenous fishing. **(Issue 11)**	1C	**All fisheries agencies** Indigenous fishers GBRMPA

[4] Agencies with major responsibility for implementation of each action are indicated in bold type.

Priority:
- **1A** Action initiated within 12 months and completed within 2 years, if not sooner
- **1B** Action initiated within 12 months and completed in shortest possible timeframe
- **1C** Action initiated within 12 months of completion of prerequisite work completed in shortest possible timeframe
- **2** Action initiated and completed within 3 years
- **3** Action initiated within 4 years if not sooner and completed as soon as feasible

THEME 2 IMPROVE MANAGEMENT AND CONSERVATION MEASURES

Action	Priority	Responsible/ Interested Agency
10 Ensure that management arrangements for target shark species include precautionary management triggers and pre-determined management processes, including timeframes, should these triggers be reached. **(Issue 7)**	1C	**All fisheries agencies** GBRMPA
11 Ensure that, where a species is taken in two or more fisheries within a jurisdiction or in two or more jurisdictions: (a) processes are in place to collect/report data from all fisheries and jurisdictions involved in the management of that species uniformly and are included, when data became available, in subsequent stock assessments or risk assessments conducted for that species; (b) the potential of multi-jurisdictional or 'across-fishery' approaches to shark management have been assessed and introduced where possible; (c) effective communication and consultation mechanisms between all stakeholders are in place; and (d) management measures are complementary and consistent with an ESD approach. **(Issues 5, 7)**	1C	**All fisheries agencies** Commercial fishers
12 (a) Initiate action to identify habitat critical to the survival of shark species and where identified as necessary take action to protect, and minimise threats, to these habitats; and (b) within the relevant statutory timeframes protect, and minimise threats to, habitats critical to the survival of species listed under Commonwealth/State/NT legislation. **(Issue 16, 18)**	1B	**All fisheries agencies** DEH State/NT conservation agencies Conservation NGOs Commercial fishers Indigenous fishers Recreational fishers Game fishers Divers
13 Within 12 months of risk assessments being completed identify those species requiring rehabilitation and develop rehabilitation strategies for these species based on the requirements set out in Guidelines 1.2.1 and 1.2.2 of the Commonwealth Guidelines for the Ecologically Sustainable Management of Fisheries (EA 2001). **(Issue 13)**	1C	All fisheries agencies DEH State/NT conservation agencies Commercial fishers Conservation NGOs
14 Within 12 months of a risk assessment finding of "high risk" for a shark species initiate management and research actions to minimise risk including the introduction of precautionary management triggers and pre-determined managed processes, including timeframes, should these triggers be reached. **(Issue 6)**	1C	**All fisheries agencies** DEH Commercial fishers Indigenous fishers Recreational fishers Game fishers

(Theme 2 continued...)

(...Theme 2 continued)

Action	Priority	Responsible/ Interested Agency
15 Identify areas of uncertainty in current stock assessments for target shark species in target shark fisheries and ensure that research efforts for these species are focused on reducing this uncertainty, or where stock assessments do not exist, give priority to undertaking them. **(Issue 5)**	2	**All relevant fisheries agencies**
16 Implement processes to ensure that the scientific research potential of sharks caught in shark control programs is maximised. **(Issue 7)**	1A	**NSW and Qld fisheries agencies** Scientific agencies
17 Initiate action to ensure effective bycatch reduction methods are developed and introduced in all fisheries in which shark are caught as bycatch giving significant priority to species identified as 'high risk": i. in fisheries taking species currently identified by risk assessments or other processes as being at "high risk" methods should be introduced by 2003; and ii. where "high risk" is identified after the adoption of this Shark-plan, methods should be introduced within 12 months of identification. **(Issue 14)**	1C	**All fisheries agencies** Scientific Agencies Research Funders Commercial fishers
18 Investigate the potential for DNA identification kits for use in identifying shark species. **(Issue 1)**	1A	**DEH** AQIS Customs All fisheries agencies

[4] Agencies with major responsibility for implementation of each action are indicated in bold type.

Priority:
- **1A** Action initiated within 12 months and completed within 2 years, if not sooner
- **1B** Action initiated within 12 months and completed in shortest possible timeframe
- **1C** Action initiated within 12 months of completion of prerequisite work completed in shortest possible timeframe
- **2** Action initiated and completed within 3 years
- **3** Action initiated within 4 years if not sooner and completed as soon as feasible

THEME 3 IMPROVE DATA COLLECTION AND HANDLING

Action	Priority	Responsible/ Interested Agency
19 Within 6 months of this Shark-plan being adopted prepare a submission to all fisheries agencies seeking commitment to and proposing a process to achieve inter-jurisdictional data compatibility at the level recommended by FAO (2000) and including consideration of the recommendations in Appendix D of this Shark-plan. **(Issue 2)**	1A	**DAFF** All fisheries agencies ASIC GBRMPA
20 Assess the findings of the National Recreational and Indigenous Fishing Survey to: (a) identify gaps in existing monitoring and data collection programs for recreational, charter and Indigenous fishing; (b) determine the nature and frequency of future national surveys; (c) determine the nature and role of State/Northern Territory recreational fishing surveys; (d) determine its adequacy for reporting on the issues for the whole of Australia; and (e) where necessary introduce appropriate and effective supplementary or alternative data collection mechanisms to ensure adequate information on recreational, charter and Indigenous fishing is collected for management purposes. **(Issues 2, 8, 11)**	2	**DAFF** State/NT fisheries agencies Indigenous fishers Recreational fishers Game fishers
21 Ensure that where possible processes for the validation of shark catch data from commercial fisheries and charter operations, using observer, monitoring, fishery-independent research programs or other appropriate methods, have been initiated. **(Issue 2)**	1A	**All fisheries agencies** Commercial fishers Indigenous fishers Recreational fishers Game fishers GBRMPA Shark control programs
22 Ensure that processes for the collection of data necessary for risk assessments of shark species (including availability, catchability, productivity, distribution) have been implemented. **(Issues 2, 12)**	1C	**All fisheries agencies**
23 Develop protocols whereby data can be shared between relevant agencies, yet remain secure through appropriate confidentiality agreements that protect commercially sensitive information and intellectual property rights. **(Issue 2)**	2	**All fisheries agencies** **DAFF** Commercial fishers Indigenous fishers
24 Ensure data are well managed in data bases such that data are secure, have automated internal verification and validation checks, are corrected for double reporting and have procedures for efficient data extraction, exchange and summarisation. **(Issue 2)**	2	**All fisheries agencies**

(Theme 3 continued...)

(...Theme 3 continued)

Action	Priority	Responsible/ Interested Agency
25 (a) Ensure, where feasible, that appropriate data is collected on quantifiable aspects of cryptic fishing mortality as an input to stock assessments and risk assessments; and (b) evaluate the sublethal effects of gamefishing, the scientific benefits of targeted/permitted tag and release activities and, where possible, the extent of cryptic fishing mortality arising from recreational and game fishing. **(Issue 2, 9)**	1B	**All fisheries agencies** CSIRO DEH State/NT conservation agencies Rec./game fishers GBRMPA
26 Assess availability of Australian export and import data for shark products against the recommendations of the FAO (FAO, 2000) and CITES decisions on trade codes identify deficiencies and address these. **(Issue 3)**	2	**DAFF** Conservation NGOs AQIS Customs Australian Bureau of Statistics Importers/Exporters Commercial fishers

[4] Agencies with major responsibility for implementation of each action are indicated in bold type.

Priority:
- **1A** Action initiated within 12 months and completed within 2 years, if not sooner
- **1B** Action initiated within 12 months and completed in shortest possible timeframe
- **1C** Action initiated within 12 months of completion of prerequisite work completed in shortest possible timeframe
- **2** Action initiated and completed within 3 years
- **3** Action initiated within 4 years if not sooner and completed as soon as feasible

THEME 4 TARGETED RESEARCH AND DEVELOPMENT

Action	Priority	Responsible/ Interested Agency
27 Evaluate the methodologies for risk assessment and adopt a single national risk assessment framework (see Appendix E), consistent across species, fisheries and other impacts, for shark species and a timetable for carrying out risk assessments. **(Issues 6, 12)**	1A	**All fisheries agencies** Scientific agencies Research funders DEH State/NT conservation agencies
28 Based on the methodology developed under Action 27 initiate risk assessments for all target, byproduct and bycatch shark species including, as far as possible, the risks associated with all impacts on these species, in accordance with the agreed national risk assessment framework and risk assessment timetable and ensure that the data necessary to undertake these risk assessments is collected. **(Issues 2, 6, 12, 17, 18)**	1C	**All fisheries agencies** Scientific agencies Research funders DEH State/NT conservation agencies GBRMPA
29 Initiate an assessment of opportunities for increasing utilisation/value adding of shark products from currently harvested species and encourage commercial fisheries to exploit these opportunities subject to the long-term ecologically sustainable harvest of shark species. **(Issue 3)**	1A	**Commercial fishers** Seafood Services Australia ASIC Scientific agencies Research funders All fisheries agencies
30 Initiate research to determine the impact on the biology and behaviour of sharks of electromagnetic fields including personal shark protection devices. **(Issue 18)**	2	**DEH** DITR All fisheries agencies Research funders Tourism operators
31 Initiate an evaluation of the methodology, and where possible apply the methodology, to assess the impact of shark management and conservation measures on ecosystem structure and function. **(Issue 15)**	3	**DAFF** **DEH** All fisheries agencies Research funders GBRMPA
32 Produce an information paper on Indigenous shark fishing highlighting the traditional, cultural and spiritual significance of sharks to Indigenous people so as to better accommodate these issues in the development of management arrangements. **(Issue 11)**	1A	**DAFF** **ATSIC** **Indigenous fishers/researchers** Research funders All fisheries agencies

(Theme 4 continued...)

(...Theme 4 continued)

Action	Priority	Responsible/ Interested Agency
33 Identify gaps in knowledge about Indigenous shark fishing and, where the need is identified, develop research proposals to address these gaps. **(Issue 11)**	1C	**All fisheries agencies** **ATSIC & Indigenous fishers/researchers** Scientific agencies Research funders
34 Aim to initiate development of appropriate methods for modelling the population dynamics of chondrichthyans in the ecosystem and develop a basis for distinguishing between natural variation and trends in the system so as to assist in understanding population status, rates of recovery, population structure and distribution. **(Issues 5, 6, 15)**	3	**All fisheries agencies** **DEH** Scientific agencies Research funders
35 Develop a quantitative framework to assess the recovery of listed threatened species. **(Issue 13)**	2	**DEH** Scientific agencies Research funders All fisheries agencies State/NT conservation agencies GBRMPA
36 Initiate a review of shark handling practices to identify any areas of concern and possible solutions where the need is identified for the conservation and management of sharks. This review could include: (a) the chase of the shark common in game fishing; (b) the issue of finning of live sharks; (c) the issue of towing live sharks back to shore; and (d) the keeping of live shark in aquaria either for display or for restaurant use. **(Issue 10)**	2	**DEH** **HSI** Scientific agencies Commercial fishers Recreational fishers Game fishers GBRMPA

[4] Agencies with major responsibility for implementation of each action are indicated in bold type.

Priority:
- **1A** Action initiated within 12 months and completed within 2 years, if not sooner
- **1B** Action initiated within 12 months and completed in shortest possible timeframe
- **1C** Action initiated within 12 months of completion of prerequisite work completed in shortest possible timeframe
- **2** Action initiated and completed within 3 years
- **3** Action initiated within 4 years if not sooner and completed as soon as feasible

THEME 5 UNDERTAKE EDUCATION AND AWARENESS RAISING

Action	Priority	Responsible/ Interested Agency
37 Introduce a community education strategy aimed at the general public, commercial, recreational, Indigenous and game fishers. The strategy should aim to: (a) raise national awareness of the vulnerability of particular shark species and in particular their role in the marine ecosystem, current threats and status, the cumulative impact of shark bycatch, the need to return sharks to the sea and to maximise their chances of survival and of safe swimming and safe diving guidelines; (b) educate resource users about the rationale for and use of recorded shark catch data; (c) raise national awareness of the cultural significance of shark to Indigenous peoples based on the outcomes of relevant research as it becomes available; (d) develop an awareness amongst all resource users of the threatened species provisions, reporting requirements and penalties; (e) encourage the trial of techniques to improve shark species identification(eg photos taken with disposable cameras, retention of unknown species for confirmation of species identification), by user groups; and (f) encourage recreational, game fishing and tourist sectors to address specific issues relevant to those sectors. **(Issues 1, 8, 9)**	1A	**DAFF** **DEH** **All fisheries agencies** Conservation groups Commercial fishers Indigenous fishers Indigenous researchers Recreational fishers Game fishers GBRMPA Tourism operators, eg cage divers, scuba operators
38 (a) Undertake an assessment of existing shark species identification guides and those under development; (b) ensure guides are culturally appropriate, including the use of Indigenous species names where appropriate; (c) develop a coordinated approach to production of region specific, waterproof species identification charts using existing species guides; (d) ensure the best available guides have been provided to all user groups, processors, compliance officers, observers and scientists involved in each fishery known to take sharks; and (e) develop measures to monitor the effectiveness of the guides. **(Issue 1)**	1A	**All fisheries agencies** Scientific agencies Commercial fishers Indigenous fishers Recreational fishers Game fishers

[4] Agencies with major responsibility for implementation of each action are indicated in bold type.

Priority:
1A Action initiated within 12 months and completed within 2 years, if not sooner
1B Action initiated within 12 months and completed in shortest possible timeframe
1C Action initiated within 12 months of completion of prerequisite work completed in shortest possible timeframe
2 Action initiated and completed within 3 years
3 Action initiated within 4 years if not sooner and completed as soon as feasible

THEME 6 IMPROVE COORDINATION AND CONSULTATION

Action	Priority	Responsible/ Interested Agency
39 Within 6 months of this Shark-plan being adopted: (a) establish a sub-program for shark research in the Fisheries Research and Development Corporation (FRDC);or (b) if, within 6 months of this Shark-plan being adopted, an FRDC shark subprogram has not been established, form a shark research consultative forum to facilitate coordination and collaboration on shark research and develop a strategic plan that responds to the research needs identified in the Shark-plan. **(Issue 4)**	1A	**DAFF** **FRDC** **Scientific agencies** **Indigenous researchers** All fisheries agencies Commercial fishers Indigenous fishers GBRMPA Recreational fishers Game fishers
40 Identify and incorporate appropriate sources of advice on fishing for sharks by Indigenous people into shark management decision-making processes where relevant. **(Issues 7, 11, 12)**	1A	**All fisheries agencies** **ATSIC** **Indigenous researchers** Indigenous fishers
41 Seek the advice of Indigenous representatives to identify and implement where necessary effective mechanisms for obtaining reliable catch information and advice from Indigenous communities. **(Issues 2, 11)**	2	**All fisheries agencies** **ATSIC** **Indigenous researchers** Indigenous fishers
42 Actively promote the implementation of the IPOA-Sharks and improved regional management of shark stocks, particularly shared stocks, and protection of threatened species in relevant regional fisheries management organisations and under other relevant international conventions eg CITES and the Convention on Migratory Species. **(Issue 7)**	1B	**DAFF** AFMA DEH Conservation NGOs GBRMPA
43 Initiate discussions with countries in the region eg Indonesia, Papua New Guinea, East Timor, New Zealand, in relation to complementary and collaborative management of straddling shark stocks. These discussions should include: the identification and implementation of collaborative measures to enhance the capacity of these countries to collect, analyse and share data on straddling shark stocks; and encourage and assist with the development of national plans of action. **(Issue 7)**	1B	**DAFF** DEH AFMA GBRMPA

[4] Agencies with major responsibility for implementation of each action are indicated in bold type.

Priority:
1A Action initiated within 12 months and completed within 2 years, if not sooner
1B Action initiated within 12 months and completed in shortest possible timeframe
1C Action initiated within 12 months of completion of prerequisite work completed in shortest possible timeframe
2 Action initiated and completed within 3 years
3 Action initiated within 4 years if not sooner and completed as soon as feasible

Monitoring and Review

The lead agency in the development and review of the Shark-plan is the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF). However, as the Shark-plan indicates, agencies in each jurisdiction and a broad range of stakeholders have an interest in implementation of actions under the Shark-plan. The SAG therefore supports the establishment of broadly based implementation and review group and that there is value in the group being integrated into existing inter-jurisdictional consultative arrangements. It is envisaged, therefore, that the implementation and review group will be formed as a sub-committee under the Marine and Coastal Committee (MCC). Membership of the sub-committee will be broader than the jurisdictions represented on the MCC and include representatives from the commercial fishing industry, recreational fishers, Indigenous sectors, conservationists and science organisations.

The role of the sub-committee may include:

- developing a strategy for implementation;
- overseeing implementation;
- providing any coordination required;
- developing a schedule for undertaking actions within each priority group;
- acting as a central depository for advice by responsible agencies on progress;
- disseminating to all interested stakeholders annual advice on progress and any other information relevant to the conservation and management of sharks;
- preparing reports for FAO's Committee on Fisheries on progress in the implementation of the Shark-plan;
- acting as the Steering Committee for the proposed FRDC Shark subprogram;
- initiating and overseeing updating of the Shark Assessment Report; and
- initiating and overseeing the four yearly review of the Shark-plan.

The completion of each action identified in this Shark-plan is an output of the Shark-plan. Monitoring of the implementation and the review of the Shark-plan will involve determining how many, and to what extent, these outputs have been achieved. However, the critical determinant of the Shark-plan's success will not be measured by its outputs. The 2006 review of the Shark-plan must judge the Shark-plan's success on the extent to which the Shark-plan has achieved its objectives, that is, on the outcomes of the Shark-plan. Performance indicators have therefore been developed for outcomes (Table 2) in order to supplement the monitoring of outputs. The performance indicators suggested will be subject to ongoing review and refinement.

Table 2 Performance indicators against IPOA-Sharks objectives

Outcomes sought (objectives)	Management funding (where required)
i ensure that shark catches from target and non-target fisheries are sustainable;	• The % of fisheries managed by the Australian Government in which shark is taken that meet the requirements of the strategic assessments under the EPBC Act (Target 100%) • The % of State/Northern Territory fisheries in which shark is taken that meet the requirements of sustainability assessments under the EPBC Act (Target 100%) • The % of State/Northern Territory fisheries in which shark is taken but that are not subject to sustainability assessments under the EPBC Act, that meet the requirements of ESD as assessed under the SCFA-ESD reporting framework (Target 100%)
ii 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;	• The % of shark species taken by all sectors in Australian fisheries for which risk assessments have been conducted in accordance with the national risk management framework (Target 100%) • The % of high risk, threatened and protected species for which appropriate management responses have been implemented including the identification and protection of critical habitats (Target 100%)
iii identify and provide special attention, in particular to vulnerable or threatened sharks;	• The % of shark species categorised as critically endangered, endangered, vulnerable or conservation dependent which have been protected by legislation (Target 100%) • The % of listed species for which recovery plans have been developed within the required timeframe (Target 100%) • The % of States/NT having legislation which provides for the development of recovery plans for protected species (Target 100%) • The % reduction in the number of protected species killed by commercial, Indigenous, recreational and game fishers and in shark control programs (Target 70%) • The % of species that have been identified as requiring rehabilitation for which rehabilitation strategies are operational • The % of species that have rehabilitation strategies in place that are experiencing a recovery

(Table 2 continued...)

(...Table 2 continued)

Outcomes sought (objectives)	Management funding (where required)
iv improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States;	• An FRDC subprogram for sharks is operational and delivering research outputs consistent with the needs identified in the Shark-plan • The % of shark management and research committees on which key stakeholders are represented (Target 100%) • The % of shark management and research committees that include participation of representatives from other fisheries/jurisdictions catching the same species (Target 100%)
v minimise unutilised incidental catches of sharks;	• The % of fisheries in which shark is taken that have adopted shark bycatch mitigation measures (Target 100%) • Where baseline data exists, % reduction in shark bycatch (Target 50%) • See also indicators for objectives vii and viii
vi contribute to the protection of biodiversity and ecosystem structure and function;	• Research underway to examine the ecosystem impact of shark management measures
vii minimise waste and discards from shark catches in accordance with article 7.2.2. (g) of the Code of Conduct for Responsible Fishing (FAO, 1995) (for example, requiring the retention of sharks from which fins are removed);	• Markets identified and accessed by operators for previously discarded shark products/species where retention of these species is consistent with ecologically sustainable management • The effectiveness of compliance and enforcement of finning bans has increased • See also indicators for objective v
viii encourage full use of dead sharks;	• See indicators for objectives v and vii
ix facilitate improved species-specific catch and landings data and monitoring of shark catches; and	• The number of fisheries agencies to have adopted a minimum data set for shark data in commercial fisheries consistent with the FAO Guidelines (Target 100%) • The % of fisheries in which validated commercial shark bycatch data is collected (Target 100) • The % of target shark fisheries in which processes for fishery-independent monitoring have been implemented (Target 100%) • Number of States/Northern Territory in which validated data on indigenous, recreational and game fisher catch of shark is collected (Target 7)

(Table 2 continued...)

(...Table 2 continued)

Outcomes sought (objectives)	Management funding (where required)
	• Number of States/Northern Territory in which validated data on indigenous, recreational and game fisher catch of shark is collected (Target 7) • The extent of double reporting between jurisdictions in official shark statistics (Target 0) • The extent to which official shark statistics of all jurisdictions are recorded in standard carcass form as beheaded and gutted shark with all fins attached except for chimaeras where the pectoral fins and bellyflaps are removed (Target 100%)
x facilitate the identification and reporting of species-specific biological and trade date.	• The % of total shark catch classified as "unidentified" (Target 10%) • Trade codes for shark products imported to and exported from Australia provide improved species and product identification • The % of on-board monitoring programs collecting species specific biological data on sharks (Target 100% in relevant fisheries)

PART B
Background to the Shark-plan

Background

Shark species in Australian waters

Of the 1025 species of chondrichthyans identified worldwide nearly 300 species are found in Australian waters and more than half of these are endemic to Australia. The Shark Assessment Report (Rose and SAG 2001) identified 178 species that have been recorded as shark catch from Australian waters. Of these the Assessment Report provided a conservation status for 60 species and 5 families. The conservation status of many of these species/families has been reviewed and that of other species assessed since the Assessment Report was released. The most recent assessments are provided in appendix F[5]. The list includes those on the Red List compiled by the International Union for Conservation of Nature and Natural Resources (IUCN 2000), those that have been assessed against the IUCN criteria by Pogonoski et al. (2002) and those identified as potentially of concern on the basis of consistently high catch rates recorded in Commonwealth managed fishery logbooks. It is acknowledged that as more information on these species becomes available and as more comprehensive risk assessments are possible, the conservation status ascribed to these species will change. There is also some doubt that the listing criteria used for assessment against the IUCN categories are directly applicable to marine species. The conservation status of the species in Appendix F should, therefore, be regarded as the best available at this point in time rather than a definitive statement of the relative conservation status of shark species found in Australian waters. Appendix F is not intended to pre-empt the outcomes of the more thorough risk assessments that will be undertaken as actions arising from this Shark-plan.

Shark fisheries

There are seven recognised commercial target shark fisheries in Australia targeting school shark (*Galeorhinus galeus*), gummy shark (*Mustelus antarcticus*), dusky shark (*Carcharhinus obscurus*), whiskery shark (*Furgaleus macki*), sandbar shark (*C. plumbeus*) blacktip shark (Australian blacktip shark (*C. tilstoni*) and spot-tail shark (*C. sorrah*)). Sharks are also targeted in two shark control programs[6] and by recreational and game fishers. Sharks are taken as bycatch and/or byproduct in more than 70 other commercial fisheries. Some targeting of shark species may occur in many of these fisheries. Shark is also taken for traditional purposes by Indigenous fishers and for use in the aquarium trade. The fisheries in which sharks are taken and jurisdictional responsibility for these fisheries are listed in Table 3.

Jurisdiction for Australian marine resources, including sharks, rests with the six States, the Northern Territory and the Australian Government. In general terms the States/Northern Territory have jurisdiction over waters from their shoreline out to 3 nautical miles and the Australian Government has jurisdiction for waters outside these limits to the edge of the 200 nautical mile Exclusive Economic Zone (EEZ). However agreed alternative jurisdictional arrangements for particular species, fisheries or methods are reflected in agreements made under the Offshore Constitutional Settlement (OCS) between the Australian Government, States and the Northern Territory. The OCS allows stocks to be managed through either a Joint Authority of State/Northern Territory and Australian Government bodies or under the management of a single jurisdiction throughout a species' range. The States/Northern Territory and the Australian Government have used the OCS to rationalise management arrangements for shark species (see Rose and SAG 2001 pp. 24-27 for further detail).

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5 The Shark Assessment Report identified 53 species and 5 families as "of concern" however a more recent report (Pogonoski et al. 2002), which was not available to the SAG when developing the Shark Assessment Report, has reassessed many shark species found in Australian waters against the IUCN criteria. These updated assessments are included in Appendix F.

6 Shark control programs are designed to protect bathers by removing dangerous shark species from swimming beaches.

Table 3 Australian Shark Fisheries (target and non-target)

Target Fisheries	
Southern Shark Fishery[1]	Australian Government
Northern Shark Fishery	Three Joint Authorities (the Australian Government and Western Australia, Queensland and the Northern Territory respectively)
Gulf of Carpentaria (7-25nm)	Queensland
Southern Demersal Gillnet and Demersal Longline Fishery	Joint Authority (Australian Government/Western Australia)
West Coast Demersal Gillnet and Demersal Longline Fishery	Western Australia
Western Australian North Coast Shark Fishery	Western Australia
Shark Control Program	New South Wales
Shark Control program	Queensland
Target and Non-Target	
Tasmanian Scalefish Fishery Coral Sea Fishery	Tasmania, Australian Government
Game fishing	All States and the Northern Territory
Recreational Angling	All States and the Northern Territory
Indigenous fishing	Australian Government; All States/Northern Territory
Non-Target	
South East Trawl Fishery[1]	Australian Government
South East Non-trawl Fishery[1]	Australian Government
Victorian Inshore Trawl Fishery	Australian Government
Great Australian Bight Trawl Fishery	Australian Government
Northern Prawn Fishery	Australian Government
Western Deepwater Trawl Fishery	Australian Government
Northwest-Slope Trawl Fishery	Australian Government
Eastern Tuna and Billfish Fishery	Australian Government
Southern and Western Tuna and Billfish Fishery	Australian Government

(Table 3 continued...)

(...Table 3 continued)

Non-Target (continued...)	
Southern Bluefin Tuna Fishery	Australian Government
Heard Island and McDonald Island Fisheries	Australian Government
South Tasman Rise Trawl Fishery	Australian Government
Northern Finfish Trawl Fishery	Australian Government
East Coast Deepwater Trawl Fishery	Australian Government
Macquarie Island Fishery	Australian Government
Queensland East Coast Trawl Fishery	Queensland
Queensland Line Fisheries	Queensland
Gulf of Carpentaria (to 7nm)	Queensland
Torres Strait Prawn Fishery	Joint Authority (Australian Government/Queensland)
Other Western Australian fisheries[2]	Western Australia
Other Northern Territory fisheries[3]	Northern Territory
New South Wales Fish Trawl	New South Wales
New South Wales Ocean Trap and Line	New South Wales
New South Wales Ocean Prawn Trawl	New South Wales
New South Wales Ocean Haul	New South Wales
New South Wales Estuaries	New South Wales
Victorian Bay and Inlet Fisheries	Victoria
Victorian Ocean (general)	Victoria
Tasmanian Rock Lobster Fishery	Tasmania
South Australian Marine Scalefish Fishery	South Australia

[1] The South East Trawl, South East Non-Trawl, Great Australian Bight and Southern Shark Fishery have merged to become the Southern and Eastern Scalefish and Shark Fishery (SESSF). The Southern Shark Fishery is now encompassed within the Gillnet Hook and Trap Fishery of the SESSF.

[2] Under the *Fisheries Management Act 1991* (FMA 1991) charter (game) fishing is regarded as commercial fishing and hence comes under the Australian Fisheries Management Authority's (AFMA) management responsibility. To date AFMA has not implemented management arrangements for charter fishing. The Australian Government and the States/Northern Territory are currently investigating options for resource allocation for the recreational fishing sector (which includes charter fishing). Recreational catch will be taken into account in the management plans being developed for the Commonwealth tuna fisheries.

[3] See Appendix H

Source: Rose and SAG 2001

Shark management

Across the target shark fisheries the main management measures include individual transferable quotas (ITQs), individual transferable effort, limited entry and gear restrictions. In the non-target shark fisheries various management measures have a direct impact on shark catch. These include minimum size limits for some shark species, trip limits for shark byproduct, bans on finning (that is, the removal of the fins from a shark and the torso discarded to the sea), bans on the retention of shark products and bans on the use of wire traces and long shanked hooks. Other measures, such as the use of bycatch reduction devices (BRDs) and turtle excluder devices (TEDs) and bans on the use of monofilament gillnets may have an indirect impact on shark catch. Of these measures only minimum size limits and some trip limits are specific to particular shark species[7].

The Shark Assessment Report indicates that management of sharks in target shark fisheries in Australia is generally sound, although there remains room for improvement. A major effort is underway to rebuild the school shark stock in the Australian Government managed Gillnet Hook and Trap fishery, which is considered overfished. Whiskery shark in the Western Australian target shark fishery is also considered overfished. For the relatively small number of shark species targeted in these fisheries there exists monitoring and stock assessment regimes and scientific knowledge is generally regarded as adequate. However, for the bulk of the shark species found and caught in Australian waters, largely as bycatch or byproduct, there is a lack of biological and catch data and the level of resolution at which data are collected is variable, and generally, not fine enough. Apart from specific protection afforded to nine shark species under Commonwealth and/or State/Northern Territory legislation (see Appendix F) there are few species-specific management measures for bycatch and byproduct shark species.

7 Further information about management arrangements in Australian Government managed fisheries may be obtained from the Strategic Assessment Reports for these fisheries available at http://www.afma.gov.au/

Shark catch

Value of Shark catch

The value of Australia's shark catch in 1999/00, 2000/01 and 2001/02 is outlined in Table 4. In 2001/02 the estimated value was $32m.

Table 4 Value of Australia's commercial shark catch, $'000

Fishery/State	1999/00	2000/01	2001/02	2002/03
Southern Shark Fishery*	9435	13 233	15 157	
South East Non-trawl* Fishery	40	45	347	15 645 (now combined with the GHAT)*
South East Trawl Fishery*	1797	1956	2587	2782
Other Australian Government fisheries	1000	1045	1500	1523
New South Wales	1313	1301	1460	1223
Victoria	190	200	222	222
Tasmania	802	472	325	289
South Australia	na	na	na	na
Western Australia	3 609	4 122	4479	4730**
Northern Territory	2 213	2 401	2 250	6191
Queensland	5 679	9354	9752	9630

na: not available.

* Southern Shark and South East non trawl combined management – now the Gillnet Hook and Trap Fishery

** does not include value for shark fins

Source: ABARE 2003

Commercial catch levels

The reported Australian shark catch is dominated by shark landed in the commercial target shark fisheries and to a lesser extent by shark retained as byproduct in other commercial fisheries. Bycatch of shark remains largely unidentified and unquantified. Data on reported commercial landings of shark over the period 1996/97 to 2000/01 are provided in Table 5. This data does not reflect total shark mortality from commercial fishing since they exclude some of the catch of shark retained as byproduct in some Australian Government fisheries, unrecorded bycatch in Australian Government and state fisheries and cryptic fishing mortality (see Rose and SAG 2001 pp. 12-14 for further detail).

* The Southern Shark, South East Trawl and South East Non-Trawl fisheries are now managed as part of the larger Southern and Eastern Scalefish and Shark Fishery.

Table 5 Recorded commercial landings of shark (tonnes, whole weight) 1996/97 - 2000/01[1]

Fisheries	Nature of catch	1996/97	1997/98	1998/99	1999/00	2000/01
Southern Shark Fishery*	Target	3675	3327	3459	3059	3054
WA Shark Fisheries[2]	Target	1478	1616	1579	1360	1510
NT Shark Fishery	Target	643	481	315	372	415
Queensland	Target & non-target	657	767	840	1137	1122
New South Wales	Non-target	554	411	371	369	360
Victoria	Non-target	98	134	183	125	90
Tasmania	Target & non-target	194	155	134	150	110
South Australia	Target & non-target	438	501	604	306	198
Western Australia[2]	Non-target	151	144	129	96	105
Northern Territory	Non-target	39	65	39	80	69
South East Trawl Fishery	Non-target	1722	1911	1709	1562	1574
Great Australian Bight Trawl Fishery	Non-target	300	286	239	219	216
Total		**9949**	**9798**	**9601**	**8835**	**8823**

1: Figures for 1996/97-1998/99 revised since the release of the Shark Assessment Report (Rose and SAG 2001)
2. Preliminary figures for 1999/00 and estimates for 2000/01

Source: Rose and SAG 2001

Other catch

Where data on shark catch from Indigenous and recreational fishing and shark control programs are available, they are by number of shark taken rather than by weight. It is therefore not possible to aggregate commercial and non-commercial shark catch data accurately.

* The Southern Shark Fishery has been amalgamated into the large Southern and Eastern Scalefish and Shark Fishery

The National Recreational and Indigenous Fishing Survey (NRIFS) (Henry and Lyle 2003) was undertaken during 2000 and 2001. The survey estimates that the total shark/rays catch (numbers only) by recreational fishers in Australia is 1,252,728. Shark/rays had the highest release/discard rate out of all key fish species surveyed in the NRIFS. 81% of shark/rays were released/discarded, which is equivalent to 1,024,408 shark/rays. The high release/discard rate could be attributed to a perception that shark/rays were poor eating. As a result of the release/discard rate, the actual harvest rate was 228,230 shark/rays. While the NRIFS does not differentiate between sharks, rays, specific species, or the percentage that was released alive, it is the first national survey undertaken in Australia to collect this data. It is hoped that further studies will be conducted to provide more detailed information about shark catch by recreational fishers.

The Shark-plan acknowledges that Indigenous people have a close, interdependent relationship with the aquatic biodiversity of Australia through traditional fishing practices over tens of thousands of years. Shark is important, traditionally, to Indigenous communities as a source of food and is also spiritually and culturally significant. The spiritual connection to shark varies regionally. The NRIFS estimates that 18,294 shark/rays were harvested by Indigenous communities in northern Australia during the survey period. The NFRIS estimate does not differentiate between sharks and rays and therefore further studies may be necessary to determine this figure.

Shark mortality in shark control programs is well reported and total catch is small in comparison to commercial catch levels. However this does not preclude these programs having an impact on particular species in localised areas. Recreational fishing data, like commercial fishing data, fails to account for cryptic fishing mortality and as a result total mortality incurred by recreational and game fishers is likely to be higher than the available catch data suggest.

While the total shark catch from these sources may be low in comparison to the commercial catch, these resource users have the potential to have a significant impact on particular species or local populations since the impact is a function of both the quantity taken and the vulnerability of the species. The catch of shark taken by these non-commercial sectors can have an impact on the effectiveness of management arrangements for commercial fisheries if it is not reflected in these arrangements. Likewise, the impact of management measures for the commercial sector on the operations of Indigenous and recreational fishers needs to be taken into account.

Species caught

While 178 species of chondrichthyans have been reported as taken in Australian waters two-thirds of the reported commercial Australian shark catch in 1998/99 was comprised of 15 species or groups of sharks (Table 6). Twenty seven per cent of the recorded shark catch in 1998/99 was unidentified. The shark species taken by recreational/charter operators include gummy shark, elephant fish, school shark, blue shark, shortfin mako, fox shark and bronze whaler (Walker, 1999). Species such as whaler sharks, tiger sharks, hammerhead sharks and white sharks are taken in shark control programs (QDPI, 2001).

Table 6 **Percentage of commercial reported shark catch (tonnes whole weight) by species 1998/99.**
Source Rose and SAG 2001

Species	%
Gummy shark (*Mustelus antarcticus*)	27.7
School shark (*Galeorhinus galeus*)	8.9
Dusky shark (*Carcharhinus obscurus*)	4.5
Sawsharks (*Family Pristiophoridae*)	4.5
Dogfish (*Family Squalidae*)	4.1
Sandbar shark (*C. plumbeus*)	3.3
Unidentified blacktip sharks (*Family Carcharinidae*)	2.4
Whiskery shark *(Furgaleus macki*)	2.4
Black shark (*Dalatias licha*)	2.0
Wobbegongs (*Family Orectolobidae)*	1.6
Australian black tip shark *(C. tilstoni*)	1.5
Hammerhead shark (*Family Sphyrnidae*)	1.5
Australian angel Shark (*Squatina australis*)	1.5
Fiddler rays (*Family Rhinobatidae*)	1.3
Elephant fish (*Family Callorhinchidae*)	1.3
Other shark species (27 species)	4.9
Shark unidentified	26.6

Issues in the conservation and management of sharks

A brief discussion of each issue follows and includes a reference to the relevant actions proposed by the Shark-plan to address each issue. Where relevant, recent initiatives (introduced since the Shark Assessment Report was prepared), which support the new actions proposed by the Shark-plan, are also listed.

Issue 1. The need to improve identification of shark species by all resource users

An unknown proportion of the recorded catch of shark in Australian fisheries is incorrectly identified and 27% is recorded as "shark" or "other shark". The collection of accurate shark species data is difficult since shark species are inherently more difficult to identify than most of the bony fishes. This situation is exacerbated by the inadequate provision in some logbooks and catch returns for the recording of species information, particularly for non-target species, poor shark species identification by skippers, crew and other resource users and, in some instances, a failure to comply with logbook requirements.

As the significance of the impact of target fishing on non-target species has become recognised logbooks are being revised to provide for recording of non-target shark species. Alternative data collection and validation programs are also being implemented. Bans on finning (that is bans on the removal of the fins from a shark and the torso discarded to the sea) have also been introduced in many fisheries with one of their objectives being to improve shark species identification since identification from fins alone can be very difficult. However, recent progress on the development of identification kits may soon remove this barrier. In the absence of adequate monitoring there is some concern as to the effectiveness of finning bans as a means of improving shark species identification (finning is discussed further under Issue 7).

There are a number of shark species guides available or under development in Australia. However the information contained in these guides is not always in a form appropriate for use on vessels and is often not region- or fishery-specific. To be effective such guides need to cover all chondrichthyan target, byproduct and bycatch species in a region and, where appropriate, include Indigenous species names.

Shark-plan actions to address Issue 1 **Action Nos 5, 18, 37, 38**

Recent initiatives consistent with this issue:

1(a) AFMA and Fisheries Research and Development Corporation (FRDC) project to develop a field guide for sharks and rays caught in Australian fisheries (CSIRO – released July 2002);

1(b) FRDC project "Biology and stock assessment of the thickskin (sandbar) shark, *Carcharhinus plumbeus*, in Western Australia and further refinement of the dusky shark, *Carcharhinus obscurus*, stock assessment" has produced a shark species guide for fishers of tropical shark species and is developing a technique for identification of shark species from dried fin sample. (Western Australian Fisheries (WAF);

1(c) Identification posters for the grey nurse shark (*Carcharias taurus*), a protected species, have been produced and distributed to scuba diving clubs and shops in New South Wales (NSW) and Queensland;

1(d) The following actions have been undertaken as part of the implementation of Bycatch Action Plans (BAPs) in Australian Government fisheries:

- A pamphlet detailing common sawsharks and dogfishes has been distributed by AFMA to operators in the Great Australian Bight Trawl Fishery (GABTF) and the South East Trawl Fishery (SETF);

(continued...)

(...continued)

- Logbooks in the Southern Squid Jig Fishery (SSJF) now allow for the recording of protected shark species;
- Existing species identification guides have been disseminated to operators in the Southern Shark Fishery (SSF) and the South East Non-trawl Fishery (SENTF). Guides are being developed on protected species; and
- An education program for operators in the tuna fisheries has been established, including the distribution of shark species identification information, to encourage more thorough logbook completion.

1(e) FRDC project "Northern Australian sharks and rays: the sustainability of target and bycatch fisheries" has established pilot observer programs to determine shark catch (CSIRO/Queensland Department of Primary Industries (DPI)/Northern Territory Department of Primary Industry and Fisheries (NTDPIF)/WAF/Bureau of Rural Sciences (BRS);

1(f) A total ban on take of all elasmobranchs was introduced in the NPF in February 2001. Finning bans were introduced in the Australian Government Eastern, and Southern and Western, Tuna Fisheries in October 2000 and then in all Australian Government fisheries where shark is taken as bycatch. Similar bans on shark finning exist in the States of Western Australia, New South Wales, Queensland, Tasmania and Victoria; and

1(g) FRDC project "Rapid assessment of sustainability for ecological risk of shark and other chondrichthyan bycatch species taken in the SSF, SENTF, SETF and GABTF" will address taxonomic uncertainties in southern chondrichthyan fauna. (Marine and Freshwater Fisheries Research Institute (MAFRI)/CSIRO – due 2004/05)

Issue 2. The need for 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

Work is underway in some jurisdictions to improve data collection on sharks. However most of the shark data currently collected do not provide an accurate basis for quantification of total shark mortality due to:

- the difficulty in identifying and hence quantifying the catch of individual species (see issue 1);
- the failure to record all discards of shark (target, bycatch and sharks discarded after finning);
- the difficulty of converting, accurately, numbers of shark taken into weights in the absence of length at capture data;
- double counting where data on the same fishery is collected by more than one jurisdiction;
- variations across jurisdictions and fisheries in the form in which shark is landed[9]; and
- cryptic fishing mortality (unaccounted mortality).

[9] Catches are variously reported as carcass weight with fins on, carcass weight with fins off and whole weight. Fishers land catches in either of the two carcass forms, often in both forms in the one fishery without specifying the carcass form. In a few cases the carcasses are filleted at sea, but they are never (or rarely) landed whole.

The lack of standardisation, quantification and validation of shark catches in many Australian fisheries is a prime concern. Lack of standardisation of commercial shark catch and effort data across jurisdictions and fisheries is a significant impediment to data analysis. Logbooks collect different information, in different formats using different spatial (area and depth) and temporal (month, day and shot) resolutions. The accuracy of the data also varies. The credibility of stock assessments is compromised where data cannot be aggregated across fisheries/jurisdictions, where data are not available from some fisheries/jurisdictions or where the quality of the data is suspect. These issues are particularly significant where the same species is taken in more than one jurisdiction. There is a need to improve official statistics by avoiding double reporting of catch in some jurisdictions and by standardising the form for landed weights.

Cryptic fishing mortality of sharks can arise from fishing by all resources users. The major causes include:

- predation mortality (shark caught but not identified as being caught because it is preyed upon before being brought on board and shark that are brought on board but are so severely damaged by prey or lice that they are discarded without being recorded);
- gear drop out (shark killed but dropped out of gear prior to the catch being brought on board);
- ghost fishing (shark killed by lost gear and waste from fishing vessels (eg bait bands);
- discards of shark that are by regulations (eg size, bycatch or quota limits) not allowed to be landed and not recorded;
- discards of shark for which there is no market or for the purposes of high grading, that are not recorded;
- deliberate killing of sharks in response, for example, to sharks taking scalefish during landing; and
- post release mortality (live catch that is returned to the sea but fails to survive).

Of these causes it is possible to estimate damaged catch that is subsequently discarded, discards of fish that are not permitted to be landed, discards of fish for high grading and deliberate killing of sharks. However accurate records of these mortalities are unlikely to be provided in logbooks. The most appropriate approach is likely to be the use of targeted on-board monitoring exercises to provide reliable estimates of these aspects of cryptic fishing mortality that can then be incorporated in stock assessments and risk assessments. The remaining causes, including post-release mortality, unsighted predation mortality, drop out mortality and ghost fishing are much more difficult, if not impossible, to quantify.
A suggested approach to the nature and methods of collection of shark data in commercial fisheries is provided in Appendix D. The Shark-plan seeks to ensure:

- routine monitoring of:
  - relative abundance of target, byproduct and bycatch species from, ideally, fishery independent survey or from fishery dependent indices;
  - catch, landings, discards, length-frequency composition, and, for target and valuable byproduct species, age-frequency composition; and

- determination of:
  - spatial distribution and critical habitats of each species;
  - availability, catchability, and selectivity for each type of fishing gear encountered by each species (semi-quantitative estimates for bycatch species);
  - the proportion of population breeding and fecundity as they relate to length and, for target and byproduct species, age for each species;
  - growth rates for each target and bycatch species and maximum age for each bycatch species; and
  - trophic and predator-prey relationships though quantitative feeding studies.

The accuracy and lack of standardisation of shark catch data from other resource users (recreational, game and Indigenous fishers, shark control programs, illegal foreign fishers and foreign fishers fishing shared stocks on the high seas or in their EEZs (for example, Indonesia, East Timor and Papua New Guinea) is also of concern. Data from these users are either not collected at all or vary in nature, resolution, reliability and frequency and have not been used in stock assessments or risk assessments to date. There is, for example, no data available on foreign fisheries for straddling shark stocks in northern Australia and the development of adequate data collection processes in these fisheries will be a lengthy process.

Shark-plan actions to address Issue 2	Action Nos 19, 20, 21, 22, 23, 24, 25, 28, 41

Recent initiatives consistent with this issue:

2(a) Ongoing fixed station surveys are underway in the Gillnet Hook and Trap Fishery to collect information on the status of shark stocks and bycatch species.

2(b) The following initiatives under the Australian Government BAPs have improved the collection of shark catch data:
- a pamphlet on common sawsharks and dogfishes has been distributed to operators in the SESSF;
- logbooks in the SSJF now allow for the recording of protected shark species;
- existing species identification guides have been disseminated to operators in the SESSF; and
- an education program for operators in the tuna fisheries has been established, including the distribution of shark species identification information, to encourage more thorough logbook completion.

2(c) Logbooks for charter boat operators have been introduced in NSW, Western Australia and Northern Territory.

2(d) The results of the NRIFS were released in 2003.

1(e) Catch and effort data available on northern shark fisheries has been collated, and conversion ratios for shark fin to whole animal are being determined, in the FRDC project "Northern Australian sharks and rays: the sustainability of target and bycatch fisheries" (CSIRO/QDPI/NTDPIF/WAF/BRS)

2(f) FRDC projects "Rapid assessment of sustainability for ecological risk of shark and other chondrichthyan bycatch species taken in the SSF, SENTF, SETF and GABTF"; and "Northern Australian sharks and rays: the sustainability of target and bycatch species, Phase 2" (2002/03-2004/05) will collect data for ecological risk assessment of chondrichthyan species in southern and northern Australia and ensure data compatibility and accessibility.

Issue 3. The need for full utilisation of dead sharks and an improved understanding of the markets for and trade in shark products

The domestic and international markets for Australian shark products are poorly understood. A better understanding of the relationship between demand and supply of shark products and trends in market demand may help to predict future changes in fishing patterns and facilitate proactive management responses. Utilisation of shark products could also be enhanced by a better understanding of the nature of the market for shark products that are generally discarded, such as unmarketable flesh, shark cartilage, liver oil, bile, stomach bags, skin, fins, livers and embryos. However, attempts to increase utilisation of shark must be consistent with ecological sustainability of the species in question and with legislative requirements regarding threatened shark species.

International trade conventions such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) can supplement traditional fisheries management tools. For example, Australia has listed the great white shark (*Carcharodon carcharias*) on Appendix III of CITES and is proposing its listing be upgraded to Appendix I. The listing requires Australia to issue CITES export permits for great white shark to allow trade of specimens originating from Australia. Countries wishing to import specimens of great white shark originating from Australia shall require the prior presentation of an export permit or a certificate of origin (if being re-exported from a State/country that does not include that species in Appendix III). Any individual countries that are a party to CITES may, at any time, include their populations of a species on Appendix III, for the purpose of seeking the assistance of other countries to control cross-border trade. An export permit is required from the country that listed the species and other countries wishing to trade in these species need to issue a certificate of origin.

Australia also has an interest in the source of its imports of shark products. This interest derives from our responsibility to promote ecologically sustainable fisheries management in other countries and the recognition that many of the shark species taken in Australian waters are from stocks shared with other countries. The import of shark products from fisheries that are not sustainably managed may compromise the effectiveness of Australia's efforts to manage its fisheries sustainably.

Monitoring of international trade flows in fisheries products can be a useful adjunct to fisheries management. However, Australia's trade codes for shark products fall well short of the product specifications recommended by FAO (2000) and CITES[10] (2002) and constrain meaningful analysis of trade data.

Shark-plan actions to address Issue 3	Action Nos 26, 29

Recent initiatives consistent with this issue:

3(a) Australia listed the Great White Shark on Appendix III of CITES in October 2001 and in November 2002 supported the successful listing of the Whale Shark and Basking Shark on Appendix II of CITES. Australia is currently considering proposing that the Great White Shark be listed on Appendix I of CITES; and

3(b) Australia listed the Great White Shark on the Convention on Migratory Species.

[10] Decision 11.151 of CITES instructs the CITES secretariat to "continue to liaise with the World Customs Organisation to promote the establishment and use of specific headings within the standard tariff classifications of the Harmonised System to discriminate between shark meat, fins, leather, cartilage and other products."

Issue 4. The need for coordination of shark research

The large number of fisheries in which sharks are taken and the multi-jurisdictional management arrangements in Australia have resulted in a largely uncoordinated approach to shark research. While various Australian Government and State research plans include shark and while there is an effective cooperative shark research effort between the Northern Territory, Western Australia and Queensland, there is no overarching plan. The need for greater coordination of shark research has been recognised by the SAG and by the FRDC. This is reflected in the FRDC's recognition, in agreeing to fund the southern and northern ecological risk assessments of chondrichthyan species, of the need for greater integration and broader monitoring and oversight of these projects.

Identification of national research priorities would assist the funding application process and ensure a consistent approach to shark research. The following research needs have been identified in the process of developing the Shark-plan:

- rapid risk assessments for all shark species, particularly bycatch and byproduct species including assessments of all impacts on these species;
- research on threatened species (for example, research identified in recovery plans);
- accurate identification and quantification of target, byproduct and bycatch shark species;
- determination of relative productivities, catchabilities and gear selectivities for shark species for the purposes of refining risk assessments;
- research into bycatch reduction techniques, including research into gear modifications to minimise interactions;
- improved stock assessments for target shark species;
- mapping of shark species' distributions, biological productivity and migration patterns and determination of the availability of species to existing fisheries for the purposes of improving risk assessments;
- mapping of critical habitats, which for some species includes nursery areas and aggregation sites for feeding, mating and pupping;
- the impact of shark management and conservation measures on ecosystem structure and function;
- the impact of changes to the marine environment, including seismic surveys, the introduction of electromagnetic fields and ecotourism, on shark populations;
- the impact of natural environmental variations on shark populations;
- catch of shark by non-commercial sectors including traditional Indigenous fishing and recreational/charter fishing;
- the cultural significance of sharks to Indigenous people;
- the sustainability of fisheries from which Australia imports shark products, particularly fisheries for shared/straddling stocks; and
- market research.

Some of these needs are at least partially addressed by current projects including:

- FRDC project "Northern Australian sharks and rays: the sustainability of target and bycatch fisheries" (CSIRO/QDPI/NTDPIF/WAF/BRS);
- FRDC project "Biology and stock assessment of the thickskin (sandbar) shark, *Carcharhinus plumbeus*, in Western Australia and further refinement of the dusky shark, *Carcharhinus obscurus*, stock assessment";
- Australian Council for International Agricultural Research (ACIAR) project "Artisanal shark and ray fisheries in eastern Indonesia: their socioeconomic and fisheries characteristics and relationship to Australian resources" (CSIRO/Murdoch University/Indonesian Agencies);
- FRDC program "Tropical resource assessment program: Phase 2: model application and validation" FRDC project "National application of sustainability indicators for Australian Fisheries" (WAF);
- AFMA project "Ecological risk assessments for Australian Government fisheries" (CSIRO/MAFRI/BRS);
- AFMA project "Rapid assessment of blue shark stocks" (CSIRO);
- FRDC project "Shark and other chondrichthyan byproduct and bycatch estimation in the SEF Trawl and Non-trawl Sectors" (MAFRI);
- FRDC project "Rapid assessment of sustainability for ecological risk of shark and other chondrichthyan bycatch species taken in the SSF, SENTF, SETF, and GABTF" (MAFRI/CSIRO); and
- AFMA project "Southern Shark Monitoring" (MAFRI).

Shark-plan actions to address Issue 4 **Action No. 39**

Issue 5. The need for continued effort to maintain and improve the standard of stock assessments for target shark species in dedicated shark fisheries

Stock assessments have been conducted for the main species/groups of shark caught in the target shark fisheries. These assessments are considered to be as good as current science and available data allow and there is a need for them to be continually updated. The level of uncertainty is high for many of the assessments and there is a need to improve the robustness and reliability of all assessments and to maintain or increase research and monitoring. For example, the main indicator of stock abundance in existing shark stock assessments continues to be catch per unit effort (CPUE) data from logbooks and catch returns. CPUE is not necessarily an accurate measure of stock abundance. Increased effort needs to be devoted to the collection of an appropriate balance of fishery dependent and fishery-independent data that will allow the development of more appropriate abundance indices.

Shark-plan actions to address Issue 5 — **Action Nos 11, 15, 34**

Recent initiatives consistent with this issue:

5(a) A process for ongoing fixed station monitoring has been designed and agreed for the SSF. This process will provide abundance indices of target species and for catch length and age composition and breeding condition of target species and valuable byproduct species; and

5(b) FRDC project "Biology and stock assessment of the thickskin (sandbar) shark, *Carcharhinus plumbeus*, in Western Australia and further refinement of the dusky shark, *Carcharhinus obscurus*, stock assessment" (WAF).

Issue 6. The need for reliable assessments for bycatch and byproduct shark species

Some catch data exist for byproduct shark species however catch is often poorly quantified and inaccurate. Little is known about catch levels of shark bycatch. Total removals of each shark species must be known if overfishing of these species is to be averted.

While improving the identification and quantification of byproduct and bycatch species (see Issues 1 and 2) is an important prerequisite to a better understanding of ecologically sustainable catch levels of these species the quantity of the species taken will not in itself provide a basis for effective management. An indication of the vulnerability of these species to fishing operations in terms of their own biological productivity and the nature of the fishing operation itself is required. The nature of the appropriate and feasible assessment of these species will vary and may range from qualitative or quantitative risk assessments to full-scale stock assessments. Given that little information is currently available on these species the focus initially will be on risk assessments to determine the vulnerability of these species to fishing operations and other impacts (see Issue 12).

Shark-plan actions to address Issue 6 — **Action Nos 14, 27, 28, 34**

Recent initiatives consistent with this issue:

6(a) FRDC project "Shark and other chondrichthyan byproduct and bycatch estimation in the SEF Trawl and Non-trawl Sectors" (MAFRI);

6(b) FRDC project "Northern Australian sharks and rays: the sustainability of target and bycatch fisheries" (CSIRO/QDPI/NTDPIF/WAF/BRS);

6(c) AFMA project "Ecological risk assessments for Australian Government fisheries" (CSIRO/MAFRI/BRS);

6(d) Risk assessments of Western Australian shark fisheries;

6(e) AFMA project "Rapid assessment of blue shark stocks" (CSIRO); and

6(f) FRDC project "Rapid assessment of sustainability for ecological risk of shark and other chondrichthyan bycatch species taken in the SSF, SENTF, SETF, and GABTF" (MAFRI/CSIRO - due 2004/05).

Issue 7. The need for assessment of the adequacy of management for all shark species and more innovative approaches to dealing with identified shark management issues

Fisheries management arrangements in Australia have developed, historically, on the basis of fishing methods used to take target species. This, together with the State/Australian Government jurisdictional arrangements has inevitably resulted in a number of shark species being taken in more than one fishery under the same jurisdiction and/or in fisheries under different jurisdictions. The OCS arrangement between the States/Northern Territory and the Australian Government has attempted to address this issue.

Regional agreements for complementary management of shared and highly migratory species have been agreed for much of Australia, other than for northern Australia. Shark stocks fished by Australian operators are shared with other nations, for example, Indonesia in the North, or are fished on the high seas by other nations. In these circumstances there is a need for bilateral and regional fisheries management arrangements to ensure all shark stocks are managed adequately. Stock assessments will require the sharing of data, hence standardisation of data collections both domestically and internationally within various regions (see Issue 2).

The adoption of the concepts of ESD and ecosystem-based fisheries management has dictated the need for increased cooperation: between fisheries in which the same species of shark is taken; between jurisdictions (domestic and international) having management responsibility for the same species; and between fisheries management and environmental agencies/groups.

Three of the key management issues facing shark management in Australia are:

- ecologically sustainable management of fisheries that take species of different productivity. For example differences in productivity between school and gummy sharks, between whiskery and dusky sharks and between target finfish and generally less productive, lower economic value, and sometimes protected or threatened, shark species;

- ecologically sustainable management of species taken in two or more fisheries. The lack of coordination of data collection, assessment and research and consistent and complementary management arrangements across fisheries, jurisdictions and resource users pose significant risks to sustainable management of shark species. These issues can be particularly significant where the fisheries involved extend across international boundaries; and

- effective measures to reduce shark bycatch and remove incentives to target sharks only for their fins. A management measure for shark that has been applied in the past to vessels fishing under bilateral agreements in the Australian Fishing Zone (AFZ) and more recently to many Australian domestic fisheries is the banning of shark finning. The adequacy of this management measure, which generally allow fins to be landed only when attached to or accompanied by the trunk, needs to be assessed against the objectives being pursued. These can include any or all of the following:
  - to ensure that the species from which the fins were derived can be identified so as to improve overall shark species identification and/or to monitor compliance with prohibitions on the take of protected species and bycatch limits;
  - to ensure that any shark products sold are taken from sharks that comply with legal minimum lengths and any upper size limits such as those imposed to support the Australian food standard for maximum mercury levels;
  - to preclude the practice of finning of live sharks;
  - to provide a disincentive for targeting sharks only for their fins; and
  - to encourage full use of discarded shark trunks.

The extent to which the bans are contributing to these objectives has not been subject to any rigorous assessment and there are concerns as to the bans' effectiveness in meeting the various objectives. There remains concern, for example, that the bans may not be effective in reducing overall shark mortality since sharks may still be caught but discarded whole.

The adequacy of Australia's management of the above issues, and shark species generally, is assessed by the following processes that seek to ensure that fisheries are managed sustainably.

- Australian Government/State/Northern Territory fisheries agencies are accountable against legislation that seeks to ensure that a precautionary approach to fisheries management is adopted and that ESD is pursued.

- The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires that all Australian Government fisheries be strategically assessed. These assessments are made against the Guidelines for the Ecologically Sustainable Management of Fisheries.

- The EPBC Act (Part 13A) also requires that each fishery (Australian Government and State) that exports product be required to undergo an ecological sustainability assessment.

- A framework for self-assessment of fisheries against ESD criteria has been developed by the then Standing Committee on Fisheries and Aquaculture.

- Fisheries that are not captured by these processes, for example, State fisheries that service only the domestic market, are increasingly, although not comprehensively, covered by State requirements to undergo environmental assessments. For example, under NSW legislation management strategies and environmental impact statements are required for all fisheries.

Shark-plan actions to address Issue 7 — **Action Nos 1, 2, 3, 5, 6, 10, 11, 16, 40, 42, 43**

Recent initiatives consistent with this issue:

7(a) The risk assessment component of the following projects will highlight those species most in need of specific management and enable an assessment of the adequacy of management arrangements for those species:
- FRDC project "Northern Australian sharks and rays: the sustainability of target and bycatch fisheries" (CSIRO/QDPI/NTDPIF/WAF/BRS - Phase 1 2002; Phase 2 due 2004/05); and
- AFMA project "Ecological risk assessments for Commonwealth fisheries" (CSIRO/MAFRI/BRS);

7(b) Fisheries management strategies and environmental impact statements are now required for each major commercial fishery, recreational fishery, recreational charter fishery, fish stocking programs and shark control program in NSW;

7(c) Management arrangements for byproduct species such as dogfish *(Centrophorous harrisonni, C. uyato and C. moluccensis*), which are considered to be at risk, are being reviewed by AFMA;

7(d) FRDC project "Rapid assessment of sustainability for ecological risk of shark and other chondrichthyan bycatch species taken in the SSF, SENTF, SETF, and GABTF" (MAFRI/CSIRO - due 2004/05);

7(e) DEH released a national recovery plan for grey nurse shark in 2002. Queensland prepared an information paper on protecting the grey nurse shark in 2003. NSW released a recovery plan for grey nurse shark in May 2002 and a further discussion paper in July 2003;

7(f) DEH prepared a Great White Shark national recovery plan in September 2002;

7(g) Management of shark taken as an incidental catch in Northern Territory fisheries targeting other species is the subject of a review that is expected to be completed by early 2003;

(continued...)

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7(h) Management of the Western Australian Demersal Gillnet and Demersal Longline Fishery is under review. Revised arrangements are expected to be in place by 2005;

7(i) AFMA agreed in October 2001 that the SSF, SETF, SENTF, Victorian Inshore Trawl Fishery and GABTF will be managed under a common plan, the Southern and Eastern Scalefish and Shark Fishery Management Plan, to be determined in 2003;

7(j) Australia has listed the great white shark, and supports listing of whale shark, on Appendix III of CITES;

7(k) ACIAR project "Artisanal shark and ray fisheries in eastern Indonesia: their socioeconomic and fisheries characteristics and relationship to Australian resources" (CSIRO/Murdoch University/Indonesian Agencies – due June 2003); and

7(l) All Australian export fisheries (around 100) must be environmentally assessed by 1 December 2005 as required under the EPBC Act.

Issue 8. The need for improved understanding of the impacts of and, where required, implementation of better management for, recreational and game fishing

Management of recreational anglers and charter boat operations varies across the States and the Northern Territory. Some States require recreational fishing licences and impose catch limits on shark species and some have introduced licences and logbooks for charter boat operators.

The best estimates available suggest that the overall catch of shark by recreational and game fishing are relatively insignificant in comparison to commercial catches. In the absence of reliable data on shark species taken, the data available may, however, disguise impacts on specific species. For example, there is concern about the possible level of catch of protected species such as grey nurse sharks by recreational fishers. In addition the sublethal effects of tag and release programs are not reflected in estimates of catch by the game fishing sector.

Shark-plan actions to address Issue 8 — **Action Nos 8, 20, 37**

Recent initiatives consistent with this issue:

8(a) The National Recreational and Indigenous Fishing Survey was released in August 2003;

8(b) The Amateur Fishermen's Association of the Northern Territory and Primary Industry and Fisheries, Northern Territory hosted the third World Recreational Fishing Conference in May 2002. The Conference covered ESD, management, research, value, development and Indigenous fishing;

8(c) Identification posters for the grey nurse shark (*Carcharias taurus*), a protected species, have been produced and distributed over the last 12 months to scuba diving clubs and shops in NSW and Queensland;

8(d) WAF has conducted regional recreational surveys on the west coast, Gascoyne, Pilbara/West Kimberely and plans to survey the south coast. The surveys will determine retained and released/discarded catch of sharks;

8(e) RecFish Australia released "The national research and development plan for the recreational sector", an FRDC project in April 2001; and

8(f) An FRDC funded workshop in October 2002 considered principles for rights-based management for the recreational fishing sector that are compatible with the frameworks applying to other fishing sectors.

Issue 9. The need to reduce cryptic fishing mortality of shark species

The definition of bycatch used in this Shark-plan (all discarded catch and catch that is not landed but that is killed as a result of interaction with fishing gear) includes all forms of cryptic fishing mortality, that is, mortality that is unaccounted for in quantifying removals from shark stocks.

As well as accounting for cryptic fishing mortality by quantifying it wherever possible (see Issue 2) it is also necessary to minimise the mortality arising from the sources of cryptic fishing mortality. There is scope to reduce mortality arising from ghost fishing, discards of dead undersized sharks, or catch in excess of byproduct or quota limits, discards of dead fish for high grading purposes and discards of live shark, through changes to management measures (for example, seasonal closures or permanent area closures, gear modification) and education programs.

Shark-plan actions to address Issue 9	Action Nos 25, 37

Recent initiatives consistent with this issue:

9(a) The National Strategy for the Survival of Released Line Caught Fish is an initiative of the Fisheries Research and Development Corporation (FRDC) in conjunction with the Australian National Sportfishing Association (ANSA) and Recfish Australia. The strategy aims to improve the understanding of and increase the survival rates of released line caught fish. As part of this strategy, the 'Gently does it' campaign was launched in 2003 to show recreational fishers how to release fish to improve their chances of survival.

Issue 10. The need for an assessment of shark handling practices for the conservation and management of sharks

Australia places a high value on animal welfare. In line with Australia's general approach to animal welfare, there is a need to undertake an assessment of the harvesting and handling practices in all fisheries where shark is caught. An assessment could cover:

- the "chase" of the shark common in game fishing;
- the issue of finning of live sharks;
- the issue of towing live sharks back to shore; and
- the keeping of live shark in aquaria either for display or for restaurant use.

Shark-plan actions to address Issue 10	Action Nos 5, 36

Recent initiatives consistent with this issue:

10(a) A total ban on take of all elasmobranchs was introduced in the NPF in February 2001. Finning bans were introduced in the Eastern, and Southern and Western, Tuna Fisheries in October 2000 and then in all Australian Government fisheries where shark is taken as bycatch. Similar bans on shark finning exist in the States of Western Australia, New South Wales, Queensland, Tasmania and Victoria.

Issue 11. The need for a better understanding and, where necessary, recognition in management arrangements, of shark fishing by Indigenous people

The development of fisheries management arrangements, including those for shark fisheries, has to date failed to take into account both the impact of fishing by Indigenous people on shark stocks and the impact of management of commercial and other fisheries on traditional Indigenous uses of, and cultural values attached to, sharks.

Indigenous fishers can provide valuable information on the identification, protection and removal of threats to habitat for a range of species including shark. However, customary protocols and issues surrounding intellectual property rights must be considered when seeking this information.

The impact of management of commercial and other shark fisheries on Indigenous uses of shark resources can be addressed by:

- increased representation of Indigenous people in decision-making processes together with capacity building of the communities and the representatives selected on decision-making bodies;
- improved understanding of Indigenous fisheries as fisheries distinct from commercial and recreational fisheries;
- improved understanding of the rights of Indigenous people to customary use of biodiversity as spelt out in Article 10(c) of the Convention on Biological Diversity; and
- better understanding of the Indigenous aspirations to share equitably from the benefits derived through commercial exploitation of Australia's aquatic biodiversity.

It is recognised that resolution of this issue will not occur quickly since:

- many Indigenous communities face a range of high priority issues and shark management and conservation is unlikely to be at the top end of those priorities;
- the demands on the time of Indigenous representatives are high; and
- the application of routine methods of data collection in Indigenous communities is unlikely to be effective and development of innovative, appropriate methods of data collection will be required.

Shark-plan actions to address Issue 11	Action Nos 9, 20, 32, 33, 40, 43

Recent initiatives consistent with this issue:

11(a) WAF is preparing an Aboriginal Fishing Strategy to consider how to gain information and advice on customary fishing catches in a culturally appropriate manner and to establish appropriate consultative mechanisms;

11(b) An Indigenous Fisheries Strategy is being developed in NSW in consultation with Aboriginal communities, NSW Department of Aboriginal Affairs and the NSW Aboriginal Land Council. NSW has included Indigenous representation on all of their management advisory committees (MACs) as well as the Fisheries Resource Conservation and Assessment Council that advises the Minister;

11(c) AFMA has been actively encouraging Indigenous participation on MACs where an Australian Government managed fishery interacts with traditional fishing rights;

(continued...)

(...continued)

11(d) A National Heritage Trust (NHT) funded study to describe Aboriginal fisheries of NSW is being conducted by the Centre for Indigenous Fisheries, School of Environmental Science, Southern Cross University;

11(e) The Aboriginal and Torres Strait Islander commission (ATSIC), the Australian Seafood Industry Council (ASIC) and AFMA are collaborating to develop indigenous commercial fishing interests;

11(f) ATSIC released a discussion paper "Offshore Water Rights Discussion Booklet" in February 2002; and

11(g) Aboriginal Consultative Committees have been formed in the Northern Territory to recognise specific cultural needs and aspirations of indigenous stakeholders by providing a forum within which these stakeholders can participate.

Issue 12. The need for risk assessments for all shark species from all impacts on those species

Little is known about the biology and catch vulnerability of the wide variety of shark species taken as bycatch in shark target fisheries and in other fisheries. Appendix F identifies that the conservation status of a number of species is of concern. The determination of the risk status of those species is a priority and will be addressed through the risk assessments of sharks committed to under this Shark-plan.

Ecological risk assessments being conducted for Australian Government fisheries will provide an evaluation of risk assessment methodologies and, where sufficient data exist, an initial application of these to species including shark species. They will address target, byproduct, bycatch and broader ecological impacts of each fishery. The assessments will categorise species into high, medium or low risk profiles based on their susceptibility to capture by various fishing methods and the ability of the species to recover. The initial assessments will be based on existing data and will identify gaps and deficiencies in the data.

The studies being undertaken on northern and southern shark species will provide the data to implement the most appropriate methodology. These risk assessments will evaluate shark species on the basis of relative biological productivity, relative abundance (rarity) and catch vulnerability (that is, catchability by availability by selectivity).

Shark-plan actions to address Issue 12 — **Action Nos 22, 27, 28, 40**

Recent initiatives consistent with this issue:

12(a) The following species are listed on the threatened species list under the EPBC Act:
- The grey nurse shark (East Coast population) and the speartooth shark (*Glyphis Sp. A*) have been added to the list of Critically Endangered species;
- The northern river shark (*Glyphis sp. C*) has been added to the list of Endangered species; and
- The grey nurse shark (West Coast population), the freshwater sawfish (*Pristis microdon*) and the whale shark *(Rhincodon typus*) have been added to the list of Vulnerable species;

12(b) The southern dogfish (*Centrophorous uyato*), Colclough's shark (*Brachaelurus colcloughi*) and the endeavour dogfish (*Centrophorous moluccensis*) are under consideration for inclusion on the threatened species list under the EPBC Act;

12(c) A 'Conservation Overview and Action Plan for Australian Threatened and Potentially Threatened Marine and Estuarine Fishes' has been prepared by Pogonoski et al. (2002) for DEH;

(continued...)

(...continued)

12(d) Australia has listed the great white shark on Appendix III of CITES and in 2004, is proposing that the Great White Shark lisiting be upgraded to Appendix I of CITES. DEH also supports the listing of whale shark on Appendix III. Australia has also advocated a role for the CITES Animals Committee and for CITES Parties in identifying shark species for possible listing on CITES' Appendices;

12(e) AFMA project "Ecological risk assessments for Commonwealth fisheries" (CSIRO/MAFRI/BRS);

12(f) FRDC project "Rapid assessment of sustainability for ecological risk of shark & other chondrichthyan bycatch species taken in the SSF, SENTF, SETF, and GABTF" (MAFRI/CSIRO - due 2004/05); and

12(g) FRDC project "Northern Australian sharks and rays: the sustainability of target and bycatch species, Phase 2" (CSIRO/MAFRI – due 2004/05).

Issue 13. Where necessary develop strategies for the recovery of shark species and populations

Legislation in some States and the Australian Government provides for the listing of threatened species and the development of recovery plans for threatened species. Such legislation may need to be invoked for some species found to be severely depleted or at high risk, although the lack of consistent national legislation may constrain the effectiveness of such actions. Recovery plans, for the species listed as threatened under Commonwealth and State legislation, are being developed.

Management action is being taken in respect of the school shark in the Gillnet Hook and Trap Fishery, which is considered to be overfished, and the range of species of deepwater dogfish and deepwater chimaeras in south-east Australian waters which are considered to be at high risk from trawl fisheries because of their low biological productivity and their concentration on the continental slopes. It is unclear whether these measures will allow rehabilitation. Western Australia is considering revision to the management strategy for whiskery shark to replace the current limit reference point of 40% of virgin biomass by 2010.

Shark-plan actions to address Issue 13 — **Action Nos 13, 35**

Recent initiatives consistent with this issue:

13(a) NSW Fisheries and DEH, in consultation with the dive industry, have developed a code of conduct for diving with grey nurse shark[12];

13(b) Habitat critical to the survival of the grey nurse shark has been identified on the East Coast of Australia in the Australian Government Recovery Plan for grey nurse shark.

13(c) The draft recovery plan for grey nurse shark released by NSW Fisheries in May 2002 proposes the listing, under the *Fisheries Management Act 1994*, of 13 critical habitats for grey nurse shark in NSW waters. NSW Fisheries released a further discussion paper on protecting the grey nurse shark in July 2003;

13(d) Fishing restrictions came into effect on 19 December 2003 at four aggregation sites in south-east Queensland to protect the endangered grey nurse shark. Diving restrictions came into effect on the same day at three of the QLD sites;

13(e) DEH prepared a Recovery Plan for the Great White Shark which was adopted in September 2002;

13(f) Australia has listed the great white shark on Appendix III of CITES and supported the successful listing of the whale and basking shark on Appendix II of CITES in November 2002;

(continued...)

[12] The code can be found at http://www.deh.gov.au/coasts/species/sharks/greynurse-code.html

(...continued)

13(g) NHT project "Status of freshwater elasmobranchs in Northern Australia" (CSIRO);

13(h) NHT project "Designing protected areas for grey nurse sharks off eastern Australia" (CSIRO);

13(i) NHT project "Site fidelity, residence times and home range patterns of white sharks around pinniped colonies" (CSIRO);

13(j) Woodside Energy funded project "Movements and feeding ecology of whale sharks at Ningaloo Reef, Western Australia" (Australian Institute of Marine Science/CSIRO); and

13(k) The national recovery plan for grey nurse and great white sharks include the following actions:

- develop a population dynamics model for the grey nurse shark and white shark to assist understanding of population status, rates of recovery and population structure and distribution; and
- relevant States to develop appropriate mechanisms to conserve sites identified as habitat critical to the survival of threatened shark species and associated foraging areas in their respective jurisdictions. These mechanisms would include establishment of effective marine protected areas (such as 'no take' sanctuary zones) and/or seasonal or permanent closures of sites to commercial and recreational fishing.

Issue 14. The need to reduce or, where necessary, eliminate shark bycatch

The National Bycatch Policy (MCFFA 1999) provides a policy mandate to all Australian fishingagencies to manage the impact of fishing on non-target species and in particular to address the level of bycatch in many fisheries. In response the Australian Government has adopted a policy on bycatch (Commonwealth of Australia 2000). A key component of the Australian Government policy is the development of BAPs for the main Australian Government Fisheries.

Shark-plan actions to address Issue 14	Action Nos 3, 7, 17

Recent initiatives consistent with this issue:

14(a) AFMA have banned wire traces in the SWTBF;

14(b) Industry in the SETF has supported field trials of various bycatch reduction technologies and this has resulted in voluntary uptake of gear modifications by some SETF fishers;

14(c) Draft codes of practice to increase survival rates of released bycatch have been developed in the SWTBF and the ETBF;

14(d) Western Australia has announced that regulations to prevent the use of "pot hooks" attached to rock lobster pots and similar unusual fishing methods such as attaching hooks to nets, mooring lines and anchor ropes;

14(e) The compulsory use of TEDs[13] and BRDs was introduced in the NPF in April 2002 and the compulsory use of TEDs was introduced in the Torres Strait Prawn Fishery in March 2002;

14(f) WAF has announced the phase in of compulsory use of TEDs and BRDs in the Broome and Kimberley Prawn fisheries from July 2002 with BRDs being compulsory for all nets by 2003; and

14(g) Queensland developed a BAP for the Gulf of Carpentaria set net fishery in 2002.

[13] The effectiveness of TEDs as shark bycatch reduction devices remains unclear.

Issue 15. The need for a better understanding of the effects of shark fishing, control programs for bather protection and management practices on ecosystem structure and function

There is very little known about the effects of commercial shark fishing or shark management and conservation measures on ecosystem structure and function. Fishing for shark species has impacts on the ecosystem from which those sharks are removed. Target shark fisheries also take bycatch of other species (including threatened species or species at risk). Some of this catch is accounted for while some is not (cryptic fishing mortality of non-shark species).

Management and conservation measures for sharks also have differential impacts on the ecosystem. For example, shark control programs not only kill shark species that can harm humans but also result in the mortality of benign shark species and other marine species. Some management arrangements recognise this and include measures to minimise the ecosystem wide impacts of fishing (for example limits on the retention of non-target species).

The impact of the protection and subsequent increase in the population of apex predators, such as sharks, on ecosystem structure is largely unknown and warrants further investigation. The trophic impacts of management are a component of the strategic assessments and ecological sustainability assessments of fisheries to be conducted under the EPBC Act (see section 2.3.2 of the Guidelines for the Ecological Sustainable Management of Fisheries (EA 2001)[14].

Shark-plan actions to address Issue 15	Action Nos 4, 7, 29, 31, 34

Recent initiatives consistent with this issue:

15(a) In accordance with requirements of the EPBC Act and the *Western Australian Fish Resources Management Act 1994* WAF commenced ESD assessment and reporting in the Western Australian gillnet and longline fisheries that target sharks in April 2002; and

15(b) Strategic assessment of Australian Government fisheries and approval of all Australian export fisheries under the EPBC Act include ecosystem reporting and assessment. The assessment of the Southern and Eastern Scalefish and Shark Fishery is soon to be finalised.

Issue 16. The need to reduce the impact of environmental degradation on sharks

The maintenance of habitats used by sharks for feeding or as nursery areas can be a critical factor in determining the survival of shark species. Freshwater sharks are particularly vulnerable to environmental degradation since their habitats are usually more accessible to sources of habitat degradation and they inhabit a less stable and proportionally smaller habitat than those in the broader marine environment. Nursery areas for some marine species occur in shallow inshore areas, which are also vulnerable to habitat modification associated with land-based human activity. A further source of environmental degradation relates to the disposal of heavy metals such as mercury into freshwater and marine waterways increasing the accumulation of these metals in higher order predators such as sharks. Coastal development and other sources of marine pollution and ecotourism activities, such as the feeding of sharks for diving, may also lead to degradation of marine habitats.

[14] The Guidelines can be found at http://www.deh.gov.au/coasts/fisheries/assessment/guidelines.html

Shark-plan actions to address Issue 16	Action No 12

Recent initiatives consistent with this issue:

16(a) A habitat study of eastern Bass Strait, an important part of the Gillnet Hook and Trap Fishery, is being undertaken by CSIRO;

16(b) Habitat critical to the survival of grey nurse sharks has been established in waters off Queensland and NSW;

16(c) The significance of certain areas to the survival of great white sharks is under investigation in the NHT project "Site fidelity, residence times and home range patterns of white sharks around pinniped colonies" (CSIRO); and

16(d) National recovery plans will be developed for *Glyphis sp. A* and *Glyphis sp. C* by 2005 and for whale shark by 2007.

Issue 17. The need for more information on the impact on sharks of sound waves in the marine environment

There is concern that high energy, low frequency sound waves produced by air guns used in seismic surveys could cause mortality or sublethal injury to marine organisms, or might modify the feeding or mating activity of marine mammals, fish and other organisms. The impact of seismic surveys on the marine environment is largely unquantified and a precautionary approach needs to be taken until such time as research is conducted to determine the likely impacts.

Studies have shown that noise associated with air guns can influence the behaviour of some species of mammals, fishes and squid. Further, damage to hearing organs has been reported for some species of fishes while mortality has been reported for planktonic organisms, usually at very close range to the source of the noise (DISR 2001).

Shark-plan actions to address Issue 17	Action No 28

Recent initiatives consistent with this issue:

17(a) The Australian Government Department of Industry, Tourism and Resources (DITR) is currently undertaking a Strategic Environmental Impact Assessment of Offshore Petroleum Exploration and Appraisal Activities in Australian Government Waters under the EPBC Act.

Issue 18. The need for more information on the impact on sharks of electromagnetic fields, for example, high voltage electric cables and shark protection devices

Chondrichthyan species have acute electroreception and magnetoreception making them particularly vulnerable to electromagnetic fields. The introduction of electromagnetic fields into the marine environment can potentially have a significant impact on shark populations. For example, the proposal to lay high voltage direct current sub-sea cables for linking electricity grids across Bass Strait (Basslink) raised concerns about the potential impact on shark populations in the SSF. Similarly the possible impact on sharks of the increasing use of personal protection devices by divers may be of concern.

Changes made in April 2002 to the BassLink proposal, which will see the adoption of a 'two-cable configuration' to replace the monopole cable originally proposed, appear to have largely addressed the concerns that were held for the impact on movement rates of shark species. However there is a need for fundamental research to be undertaken so that credible information is available to inform the debate surrounding any future proposals of this type.

The impact on sharks of the use of personal protection devices by divers also warrants further investigation. These devices generate an electrical field that, it is believed, is detected by the shark through its sensory receptors known as Ampullae of Lorenzini, found on the snouts of all sharks. Once detected by the shark's sensors the field causes muscular spasms that result in the shark being repelled from the area. It is possible that these devices could have a significant impact on the endangered grey nurse shark that is found to aggregate in certain areas. The use of these devices in habitat critical to the survival of the grey nurse shark could have a significant impact on the shark's behaviour and biology. Given the depleted nature of the stocks of this species consideration should be given to prohibiting the use of such devices in areas of critical habitat to the grey nurse shark.

Shark-plan actions to address Issue 18	Action Nos 12, 28, 30

APPENDIX A The International Plan of Action for the Conservation and Management of Sharks

Introduction

1. For centuries artisanal fishermen have conducted fishing for sharks sustainably in coastal waters, and some still do. However, during recent decades, modern technology in combination with access to distant markets have caused an increase in effort and yield of shark catches, as well as an expansion of the areas fished.

2. There is concern over the increase of shark catches and the consequences which this has for the populations of some shark species in several areas of the world's oceans. This is because sharks often have a close stock-recruitment relationship, long recovery times in response to over-fishing (low biological productivity because of late sexual maturity; few off-spring, albeit with low natural mortality) and complex spatial structures (size/sex segregation and seasonal migration).

3. The current state of knowledge of sharks and the practices employed in shark fisheries cause problems in the conservation and management of sharks due to lack of available catch, effort, landings and trade data, as well as limited information on the biological parameters of many species and their identification. In order to improve knowledge on the state of shark stocks and facilitate the collection of the necessary information, adequate funds are required for research and management.

4. The prevailing view is that it is necessary to better manage directed shark catches and certain multispecies fisheries in which sharks constitute a significant bycatch. In some cases the need for management may be urgent.

5. A few countries have specific management plans for their shark catches and their plans include control of access, technical measures including strategies for reduction of shark bycatches and support for full use of sharks. However, given the wide-ranging distribution of sharks, including on the high seas, and the long migration of many species, it is increasingly important to have international cooperation and coordination of shark management plans. At the present time there are few international management mechanisms effectively addressing the capture of sharks.

6. The Inter-American Tropical Tuna Commission, the International Council for the Exploration of the Sea, the International Commission for the Conservation of Atlantic Tunas, the Northwest Atlantic Fisheries Organization, the Sub-regional Fisheries Commission of West African States, the Latin American Organization for Fishery Development, the Indian Ocean Tuna Commission, the Commission for the Conservation of Southern Bluefin Tuna and the Oceanic Fisheries Programme of the Pacific Community have initiated efforts encouraging member countries to collect information about sharks, and in some cases developed regional databases for the purpose of stock assessment.

7. Noting the increased concern about the expanding catches of sharks and their potential negative impacts on shark populations, a proposal was made at the Twenty-second Session of the FAO Committee on Fisheries (COFI) in March 1997 that FAO organise an expert consultation, using extra-budgetary funds, to develop Guidelines leading to a Plan of Action to be submitted at the next Session of the Committee aimed at improved conservation and management of sharks.

8. This International Plan of Action for Conservation and Management of Sharks (IPOA-Sharks) has been developed through the meeting of the Technical Working Group on the Conservation and Management of Sharks in Tokyo from 23 to 27 April 1998[1] and the Consultation on Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries held in Rome from 26 to 30 October 1998 and its preparatory meeting held in Rome from 22 to 24 July 1998[2].

9. The IPOA-Sharks consists of the nature and scope, principles, objective and procedures for implementation (including attachments) specified in this document.

Nature and Scope

10. The IPOA-Sharks is voluntary. It has been elaborated within the framework of the Code of Conduct for Responsible Fisheries as envisaged by Article 2(d). The provisions of Article 3 of the Code of Conduct apply to the interpretation and application of this document and its relationship with other international instruments. All concerned States[3] are encouraged to implement it.

11. For the purposes of this document, the term "shark" is taken to include all species of sharks, skates, rays and chimaeras (Class *Chondrichtyes*), and the term "shark catch" is taken to include directed, bycatch, commercial, recreational and other forms of taking sharks.

12. The IPOA-Sharks encompasses both target and non-target catches.

Guiding principles

13. *Participation*. States that contribute to fishing mortality on a species or stock should participate in its management.

14. *Sustaining stocks*. Management and conservation strategies should aim to keep total fishing mortality for each stock within sustainable levels by applying the precautionary approach.

15. *Nutritional and socio-economic considerations*. Management and conservation objectives and strategies should recognise that in some low-income food-deficit regions and/or countries, shark catches are a traditional and important source of food, employment and/or income. Such catches should be managed on a sustainable basis to provide a continued source of food, employment and income to local communities.

Objective

16. The objective of the IPOA-Sharks is to ensure the conservation and management of sharks and their long-term sustainable use.

Implementation

17. The IPOA-Sharks applies to States in the waters of which sharks are caught by their own or foreign vessels and to States the vessels of which catch sharks on the high seas.

18. States should adopt a national plan of action for conservation and management of shark stocks (*Shark-plan*) if their vessels conduct directed fisheries for sharks or if their vessels regularly catch sharks in non-directed fisheries. Suggested contents of the *Shark-plan* are found in Appendix A. When developing a *Shark-plan*, experience of subregional and regional fisheries management organizations should be taken into account, as appropriate.

19. Each State is responsible for developing, implementing and monitoring its *Shark-plan*.

20. States should strive to have a *Shark-plan* by the COFI Session in 2001.

21. States should carry out a regular assessment of the status of shark stocks subject to fishing so as to determine if there is a need for development of a shark plan. This assessment should be guided by article 6.13 of the Code of Conduct for Responsible Fisheries. The assessment should be reported as a part of each relevant State's *Shark-plan*. Suggested contents of a shark assessment report are found in Appendix B. The assessment would necessitate consistent collection of data, including *inter alia* commercial data and data leading to improved species identification and, ultimately, the establishment of abundance indices. Data collected by States should, where appropriate, be made available to, and discussed within the framework of, relevant subregional and regional fisheries organisations and FAO. International collaboration on data collection and data sharing systems for stock assessments is particularly important in relation to transboundary, straddling, highly migratory and high seas shark stocks.

22. The *Shark-plan* should aim to:

- 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 co-ordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States;
- minimise unutilized 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; and
- facilitate the identification and reporting of species-specific biological and trade data.

23. States which implement the *Shark-plan* should regularly, at least every four years, assess its implementation for the purpose of identifying cost-effective strategies for increasing its effectiveness.

24. States which determine that a *Shark-plan* is not necessary should review that decision on a regular basis taking into account changes in their fisheries, but as a minimum, data on catches, landings and trade should be collected.

25. States, within the framework of their respective competencies and consistent with international law, should strive to cooperate through regional and subregional fisheries organisations or arrangements, and other forms of cooperation, with a view to ensuring the sustainability of shark stocks, including, where appropriate, the development of subregional or regional shark plans.

26. Where transboundary, straddling, highly migratory and high seas stocks of sharks are exploited by two or more States, the States concerned should strive to ensure effective conservation and management of the stocks.

27. States should strive to collaborate through FAO and through international arrangements in research, training and the production of information and educational material.

28. States should report on the progress of the assessment, development and implementation of their *Shark-plans* as part of their biennial reporting to FAO on the Code of Conduct for Responsible Fisheries.

Role of FAO

29. FAO will, as and to the extent directed by its Conference, and as part of its Regular Programme activities, support States in the implementation of the IPOA-Sharks, including the preparation of *Shark-plans*.

30. FAO will, as and to the extent directed by its Conference, support development and implementation of *Shark-plan*s through specific, in-country technical assistance projects with Regular Programme funds and by use of extra-budgetary funds made available to the Organization for this purpose. FAO will provide a list of experts and a mechanism of technical assistance to countries in connection with development of *Shark-plan*s.

31. FAO will, through COFI, report biennially on the state of progress in the implementation of the IPOA-Sharks.

Appendix A
Suggested Contents of a *Shark-plan*

I Background

When managing fisheries for sharks, it is important to consider that the state of knowledge of sharks and the practices employed in shark catches may cause problems in the conservation and management of sharks, in particular:

- Taxonomic problems;
- Inadequate available data on catches, effort and landings for sharks;
- Difficulties in identifying species after landing;
- Insufficient biological and environmental data;
- Lack of funds for research and management of sharks;
- Little coordination on the collection of information on transboundary, straddling, highly;
- Migratory and high seas stocks of sharks; and
- Difficulty in achieving shark management goals in multispecies fisheries in which sharks are caught.

II Content of the Shark-plan

The Technical Guidelines on the Conservation and Management of Sharks, under development by FAO, provide detailed technical guidance, both on the development and the implementation of the *Shark-plan*. Guidance will be provided on:

- Monitoring;
- Data collection and analysis;
- Research;
- Building of human capacity; and
- Implementation of management measures.

The *Shark-plan* should contain:

A. Description of the prevailing state of:
   - Shark stocks, populations;
   - Associated fisheries; and
   - Management framework and its enforcement.

B. The objective of the *Shark-plan*.

C. Strategies for achieving objectives. The following are illustrative examples of what could be included:
   - Ascertain control over access of fishing vessels to shark stocks;
   - Decrease fishing effort in any shark where catch is unsustainable;
   - Improve the utilization of sharks caught;
   - Improve data collection and monitoring of shark fisheries;
   - Train all concerned in identification of shark species;
   - Facilitate and encourage research on little known shark species; and
   - Obtain utilization and trade data on shark species.

Appendix B
Suggested contents of a shark assessment report

A shark assessment report should *inter alia* contain the following information:

- Past and present trends for:
  - Effort: directed and non-directed fisheries; all types of fisheries;
  - Yield: physical and economic; and
  - Status of stocks.
- Existing management measures:
  - Control of access to fishing grounds; and
  - Technical measures (including by-catch reduction measures, the existence of sanctuaries and closed seasons).
- Others
  - Monitoring, control and surveillance;
  - Effectiveness of management measures; and
  - Possible modifications of management measures.

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1 See: "Report of the FAO Technical Working Group on the Conservation and Management of Sharks". Tokyo, Japan, 23-27 April 1998. FAO Fisheries Report No.583

2 See report: "Preparatory Meeting for the Consultation on the Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries". Rome, 22-24 July, 1998. FAO Fisheries Report No.584.

3 In this document the term "State" includes Members and non-members of FAO and applies *mutatis mutandis* also to "fishing entities" other than States.

APPENDIX B Acknowledgements

DAFF is grateful to the following individuals and organisations who assisted in the drafting of this Shark-plan.

Names	Organisation	Names	Organisation
Allen Broadhurst	Oceanwatch	**Katrina Maguire**	AFMA
Andrew McNee	AFMA	**Kerry Truelove**	DEH
Anna Willock	TRAFFIC Oceania	**Kevin McLoughlin**	BRS
Astrida Mednis	DEH	**Liz Foster**	DAFF
Brian Jeffriess	Fishing Industry	**Mark Armstrong**	DEH
Brian Johnston	DAFF	**Mark Elmer**	QDPI
Craig Bohm	Marine and Coastal Community Network	**Mike Drynan**	DAFF
Crispian Ashby	FRDC	**Natalie Cole**	WA Fisheries
Dave Walters	DEH	**Nathan Evans**	
David Galeano	ABARE	**Neil MacDonald**	South Australian Fishing Industry Council
David Harasti	NSW Fisheries	**Nick Otway**	NSW Fisheries
Dennis Witt	Tasmanian Fisheries	**Nicola Beynon**	Humane Society International
Dianna Watkins	NSW Fisheries	**Paul Murphy**	AFMA
Fran Trippett	QPPI	**Peter Dundas-Smith**	FRDC
		Peter Millington	WA Fisheries (SAG Chair)
Gary Henry	NSW Fisheries	**Ray Clarke**	NT Fisheries
Geoff Diver	Fishing industry	**Rebecca Brand**	HSI
Glenn Sant	TRAFFIC Oceania	**Ricky Chan**	University of NSW
Graeme Williams	Game Fishermen's Association of Australia	**Rod Lenanton**	WA Fisheries
		Rodney Dillon	ATSIC
Hans Jusseit	Fishing industry/ASIC	**Russ Neal**	ASIC
Ilona Stobutzki	CSIRO	**Sara Williams**	DEH
Ingrid Holliday	AFMA	**Sarah Scott**	DAFF
Jennifer Hoy	DAFF	**Sean Riley**	Tasmanian Fisheries
Jim Gillespie	QDPI	**Sonya Errington**	NSW Fisheries
Joanna Fisher	AFMA	**Stan Jarzynski**	DAFF
John Diplock	NSW Fisheries	**Steve Schnierer**	Southern Cross University
John Harrison	Amateur Fishermen's Association of NT	**Steve Shanks**	SA Fisheries
		Terry Moran	Fishing Industry/ASIC
John Smythe	WADNHMAC	**Terry Walker**	MAFRI
John Stevens	CSIRO	**Tony Bigwood**	DEH
Jonathon Barrington	DAFF	**Vanessa Atkinson**	Greenpeace
Katherine Short	WWF		

APPENDIX C Submissions received on the draft Shark-plan

1. Shark Focus Group, Mackay QLD
2. RB Lowden Pty Ltd
3. TRAFFIC Oceania
4. QLD Fisheries Service and QLD Environment Protection Agency
5. Humane Society International
6. Peter Kyne, University of QLD
7. WA Fisheries
8. NT Fisheries
9. Australian Fisheries Management Authority
10. West Australian Seafood Industry Council
11. Trezise Fishing Pty Ltd
13. RECFISHWEST
14. Bureau of Rural Sciences
15. Great Barrier Reef Marine Park Authority
16. Will Robbins, James Cook University
17. Tasmanian Fisheries
18. Wayne Chadwick (fishermen)
19. NT Seafood Council
20. Australian Government Department of Environment and Heritage
21. East Coast Tuna Boat Owners Association
22. WA Demersal Net and Hook Fisheries Management Advisory Committee
23. Bob Lamason, fishermen
24. ECOFISH TEN Ltd
25. Pogonoski
26. Steve Schnierer, Southern Cross University
27. Australian Seafood Industry Council

APPENDIX D Links between the IPOA-Sharks and the Australian Shark-plan

IPOA-Sharks Objectives	Issues in the Conservation and Management of Sharks in Australia	Relevant Actions in Australian Shark-plan
i. ensure that shark catches from target and non-target fisheries are sustainable;	5. The need for continued effort to maintain and improve the standard of stock assessments for target shark species in dedicated shark fisheries	11, 15, 38
	6. The need for reliable assessments for bycatch and byproduct shark species	14, 27, 28, 38
	7. The need for assessment of the adequacy of management for all shark species and more innovative approaches to dealing with identified shark management issues	1, 2, 3, 5, 6, 10, 11, 16, 41, 42, 43
ii. 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;	6. The need for reliable assessments for bycatch and byproduct shark species	14, 27, 28, 37
	7. The need for assessment of the adequacy of management for all shark species and more innovative approaches to dealing with identified shark management issues	1, 2, 3, 5, 6, 10, 11, 16, 41, 42, 43
	10. The need for an assessment of shark harvesting and handling practices	5, 36
	12. The need for risk assessments for all shark species from all impacts on those species	22, 27, 28, 40
	16. The need to reduce the impact of environmental degradation on sharks	12
	17. The need for more information on the impact on sharks of sound waves in the marine environment	28
	18. The need for more information on the impact on sharks of electromagnetic fields, for example, high voltage electric cables and shark protection devices	12, 28, 30

(continued...)

(...continued)

IPOA-Sharks Objectives	Issues in the Conservation and Management of Sharks in Australia	Relevant Actions in Australian Shark-plan
iii. identify and provide special attention, in particular to vulnerable or threatened sharks;	12. The need for risk assessments for all shark species from all impacts on those species	22, 27, 28, 40
	13. Where necessary develop strategies for the recovery of shark species and populations	13, 35
iv. improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States;	4. The need for coordination of shark research	39
	8. The need for improved understanding of the impacts of and, where required, implementation of better management for recreational and game fishing	8, 20, 37
	11. The need for a better understanding and, where necessary, recognition in management arrangements, of shark fishing by Indigenous people	9, 20, 32, 33, 40, 41
v. minimise unutilised incidental catches of sharks;	9. The need to reduce cryptic fishing mortality of shark species	25
	14. The need to reduce or, where necessary, eliminate shark bycatch	3, 7, 17
vi. contribute to the protection of biodiversity and ecosystem structure and function;	12. The need for risk assessments for all shark species from all impacts on those species	22, 27, 28, 40
	15. The need for a better understanding of the effects of shark fishing, control programs for bather protection and shark management practices on ecosystem structure and function	4, 7, 25, 28, 31, 33
	16. The need to reduce the impact of environmental degradation on sharks	12

(continued...)

(...continued)

IPOA-Sharks Objectives	Issues in the Conservation and Management of Sharks in Australia	Relevant Actions in Australian Shark-plan
	17. The need for more information on the impact on sharks of sound waves in the marine environment	28
	18. The need for more information on the impact on sharks of electromagnetic fields, for example high voltage electric cables and shark protection devices	30
vii. minimise waste and discards from shark catches in accordance with article 7.2.2. (g) of the Code of Conduct for Responsible Fishing (FAO, 1995);	3. The need for full utilisation of dead sharks and an improved understanding of markets for and trade in shark products	7, 22, 26, 28
	9. The need to reduce cryptic fishing mortality of shark species	25, 36
	14. The need to reduce or, where necessary, eliminate shark bycatch	3, 7, 17
viii. encourage full use of dead sharks;	3. The need for an improved understanding of markets for and trade in shark products	7, 22, 26, 27, 28
ix. facilitate improved species-specific catch and landings data and monitoring of shark catches; and	1. The need to improve identification of shark species by all resource users	5, 18, 37, 38
	2. The need for secure, accessible and validated data sets that record all catch and are consistent over time with compatible resolution between jurisdictions over the full range of each species from all resource users	19, 20, 21, 22, 23, 24, 25, 28, 41
x. facilitate the identification and reporting of species-specific biological and trade data.	1. The need to improve identification of shark species by all resource users	5, 18, 37, 38
	3. The need for full utilisation of dead sharks and an improved understanding of markets for and trade in shark products	7, 26, 27, 28

APPENDIX E Suggested minimum data set for shark species in fisheries

Data	Recommended method of collection: Target shark fisheries	Recommended method of collection: Other shark fisheries
Species composition of catch		
• target species (determined by historical catch)	Logbooks	
• byproduct	On-board monitoring[1]	On-board monitoring
• bycatch	On-board monitoring	On-board monitoring
• listed threatened species		
Quantity of retained catch		
• by target species		
• weight	Logbooks	
• numbers	Logbooks	
• Byproduct by species		
• weight	Logbooks	On-board monitoring
• numbers	Logbooks	On-board monitoring
• Total Byproduct		
• weight		Logbooks
• numbers		Logbooks
Quantity of discarded catch		
• by target species		
• weight	On-board monitoring	
• numbers	On-board monitoring	
• reasons for discard	On-board monitoring	
• Bycatch by species		
• weight	On-board monitoring	On-board monitoring
• numbers	On-board monitoring	On-board monitoring
• reasons for discard	On-board monitoring	On-board monitoring
• life status	On-board monitoring	On-board monitoring
• Total bycatch		
• weight	Logbooks	Logbooks
• numbers	Logbooks	Logbooks
• threatened species		
Product Form[2]		
• target species	Logbooks	
• whole		
• headed/gutted fins on		
• headed/gutted fins off		
• fillets	Logbooks	On-board monitoring
• fins		
• Byproduct		
• whole		
• headed/gutted fins on		
• headed/gutted fins off		
• fillets		
• fins		
Cryptic fishing mortality	On-board monitoring Specific research programs	On-board monitoring Specific research programs
Index of abundance[3]	Fishery independent survey of fish density	Fishery independent survey of fish density
Species targeted	On-board monitoring	On-board monitoring

Age data	Collection of vertebrae or dorsal spines by on-board monitoring	On-board monitoring
Sex	On-board monitoring	On-board monitoring
Length	On-board monitoring	On-board monitoring
Location: Lat/Longs	Logbooks	Logbooks
Date	Logbooks	Logbooks
Scale: Shot by shot	Logbooks	Logbooks
Fishing effort	Logbooks	Logbooks
Net length and soak time	Logbooks	Logbooks
Gear specifications[4]	Logbooks	
Vessel specs. inc. storage capacity	Logbooks	Logbooks

1 the form of on-board monitoring program appropriate will vary from one-off data collection exercises, monitoring conducted as part of a specific research program to ongoing programs such as the SETF's Integrated Scientific Monitoring Program.

2 See discussion on product form below.

3 For those species for which stock assessments are required.

4 See discussion on gear specifications below.

Product Form

Ideally the form of catch data needs to be standardised across all jurisdictions. Where this is impracticable standard conversion factors should be applied.

The following basis for standardisation is suggested for consideration under Action 19:

- Fishers should be required to report shark weights for the form in which they are landed and where practical all sharks be landed in the carcass form where a carcass is defined as a beheaded and gutted shark with all fins and, for males, the claspers attached. Leaving the claspers in tact enables monitoring the sex of sharks after landing ashore. The practice of removing claspers varies throughout industry and some industry members have recently begun arguing that leaving the claspers on mature animals degrades the product.

- Fishers should be required to report chimaera weights for the form in which they are landed and where practical all chimaeras be landed in the carcass form where a carcass is defined as a beheaded and gutted chimaera with all fins and, for males, the claspers attached, except for the pectoral fins and belly flaps which are removed.

- The issue of standard reporting of skates and rays needs to be addressed. There is a growing practice of retaining the outer margins of the discs (pectoral fins) of the animal and discarding the rest of the animal for several large-sized species. This involves removing a relatively small proportion of the animal and might be regarded as wasteful and analogous to finning. Official statistics of catch weights should be published as standard shark carcass weights and, where shark weights are reported by fishers in a different form, the weights are converted to the standard carcass form for publication purposes.

Gear specifications should include, as appropriate to fishing method:

- mesh size;
- number of meshes deep;
- filament thickness for gillnets, hook-size for longlines;
- mesh-sizes;
- dimensions of wings and codends of trawl nets;
- length of foot rope;
- height of headrope; and
- wing spread, and door spread.

APPENDIX F The Risk Management Framework

One of the key constraints to developing effective management measures for many of the shark species taken in Australia is the lack of information about the species and their catch. There are a number of projects underway (as described in part B) and others recommended in this Shark-plan that will redress this lack of information. They include projects to collate and collect additional information and projects to undertake risk assessments of shark species based on information that is available. These initial risk assessments will provide a basis for managers to decide whether management is warranted, taking into account the need for a precautionary approach where information is lacking. Over time, as additional data becomes available the risk assessments and management measures will be reviewed.

The Shark-plan supports a common national approach to risk assessment of shark species and gives the adoption of an agreed framework for management of risk associated with exploitation of these species a high priority. Such an approach will ensure that species are assessed, as far as possible, across their distribution on a consistent and holistic basis rather than within jurisdictional or fishery boundaries. This national approach will provide a strong basis for effective management of the risks associated with managing a large number of byproduct and bycatch species about which little information is currently available. An integral part of the Shark-plan is therefore a risk management framework that provides for the ongoing assessment and determination of appropriate management measures for these species as increased information becomes available and risk assessment procedures are applied. The broad outline of this risk management framework is described in Box 2.

Box 2 Risk Management Framework

STEP 1 Assess Risk

- Adopt a national approach to risk assessment using current and recent developments:
  - identifies, as far as possible, all threats to (ie impacts on) each species;
  - prioritises species based on these threats;
  - prioritises threats to those species (eg commercial fishing, recreation fishing environmental degradation); and
  - includes stakeholder involvement.

- The risk assessment process should allow for:
  - the overall risk level of species to be related to the relative biological productivity, abundance and catch vulnerability (availability, vulnerability and selectivity); and
  - the threats to that species to be identified and ranked (so that the main causes for a species at high risk are known).

STEP 2 Develop management response

- The information arising from STEP 1 allows the overall risk and the reasons behind that risk level to be assessed.
- Managers can then deal with the high risk species and causal factors particularly those impacting on more than one species.
- The appropriate management response will depend on the level of risk and cause;
- Based on this information the actions outlined in the Shark-plan should be reviewed and prioritised accordingly.
- Management actions detailed in the Shark-plan should then be updated.

STEP 3 Review management action to address risks

- Assess effectiveness of management actions and refine as necessary.
- Reassess risk if necessary.

APPENDIX G Shark species for which conservation status has been assessed

Speartooth Shark	*Glyphis sp. A*	**CR/P**	Crocodile Shark	*Pseudocarcharias kamoharai*	**LR/lc**
Freshwater Sawfish	*P. microdon*	**CR/P**	White-Spotted Spurdog	*Squalus acanthias*	**LR/lc**
			Pencil Shark	*Hypogaleus hyugaensis*	**LR/lc**
Dwarf Sawfish	*Pristis clavata*	**EN**	Grey Reef Shark	*C. amblyrhynchos*	**LR/lc**
Harrissons dogfish	*Centrophorous harrissoni*	**EN (1)**	Spinner Shark	*C. brevipinna*	**LR/lc**
Maugean Skate	*Raja sp. L*	**EN (1)**	Bull Shark	*C. leucas*	**LR/lc**
Green Sawfish	*P. zijsron*	**EN/A (1)**	Silkyshark	*C. falciformis*	**LR/lc**
Grey Nurse Shark	*Carcharias taurus*	**EN/P**	Tiger Shark	*Galeocerdo cuvier*	**LR/lc**
Northern River Shark	*Glyphis sp. C*	**EN/P (1)**	Whitetip Reef Shark	*Triaenodon obesus*	**LR/lc**
			Scalloped Hammerhead	*Sphyrna lewini*	**LR/lc**
Freshwater Whipray	*Himantura chaophraya*	**VU**	Great Hammerhead	*S. mokarran*	**LR/lc**
Southern dogfish	*Centrophorous uyato*	**VU (1)**	Smooth Hammerhead	*S. zygaena*	**LR/lc**
Colcloughs Shark	*Brachaelurus colcloughi*	**VU (1)**	White-spotted Guitarfish	*Rhynchobatus djiddensis*	**LR/lc**
Narrow Sawfish	*Anoxypristis cuspidata*	**VU/A**	Bluespotted ribbontail ray	*Taeniura lymma*	**LR/lc**
White Shark	*Carcharodon carcharias*	**VU/P**	White-spotted Eagle Ray	*Aetobatus narinari*	**LR/lc**
			Manta Ray	*Manta birostris*	**LR/lc/A**
Bronze Whaler	*C. brachyurus*	**A**	Shortfin Mako	*Isurus oxyrinchus*	**LR/lc/A**
F. Squatinidae		**A**	Porbeagle	*Lamna nasus*	**LR/lc/A**
F. Rajidae		**A**	Gummy Shark	*Mustelus antarcticus*	**LR/lc/A**
F. Dasyatididae		**A**	Blue Shark	*Prionace glauca*	
Elephant Fish	*Callorhinchus milii*	**A**			
Ogilby's Ghostshark	*Hydrolagus ogilbyi*	**A**	Gulper Shark	*Centrophorus granulosus*	**DD**
F. Squalidae		**A**	Spotted wobbegong	*Orectolobus maculatus*	**DD**
F. Pristiophoridae		**A**	Banded wobbegong	*Orectolobus ornatus*	**DD**
			Pigeye Shark	*C. amboinensis*	**DD**
Graceful Shark	*Carcharhinus amblyrhynchoides*	**LR/nt**	Common Blacktip Shark	*C. limbatus*	**DD**
Oceanic Whitetip Shark	*C. longimanus*	**LR/nt**	Wide Sawfish	*P. pectinata*	**DD**
Blacktip Reef Shark	*C. melanopterus*	**LR/nt**	Broadnose Sevengill Shark	*Notorynchus cepedianus*	**DD/A**
Dusky Shark	*C. obscurus*	**LR/nt**	Black Shark	*Dalatias licha*	**DD/A**
Porcupine Ray	*Urogymnus asperrimus*	**LR/nt**	Thresher Shark	*Alopias vulpinus*	**DD/A**
Estuary stingray	*Dasyatis fluviorum*	**LR/nt**	Whale Shark	*Rhincodon typus*	**DD/P**
Sandbar Shark	*C. plumbeus*	**LR/nt/A**	Megamouth Shark	*Megachasma pelagios*	**DD/P**
Sand Tiger Shark	*Odontaspis ferox*	**LR/nt/P**	Basking Shark	*Cetorhinus maximus*	**DD/P**
Common Sawshark	*Pristiophorus cirratus*	**LR/cd**			
Whiskery Shark	*Furgaleus macki*	**LR/cd**			
School Shark	*Galeorhinus galeus*	**LR/cd**			

KEY
IUCN categories:
CR = critically endangered **EN** = endangered **VU** = vulnerable **LR** = lower risk
nt = near threatened **cd** = conservation dependent **lc** = least concern **DD** = data deficient

A = potentially of concern given consistently high catch rates in non-target fisheries
P = protected in some State/Territory and/or Australian Government waters
(1) = being considered for listing under the EPBC Act

Sources: Rose and SAG 2001; Pogonoski et al. 2002

APPENDIX H Minor shark bycatch fisheries

Western Australia	Northern Territory
Open West Coast (general) Licence	Coastal line
Pilbara Fish Trawl Fishery	Restricted bait
Exmouth Gulf Beach Seine	Barramundi
Exmouth Gulf Prawn Trawl	Coastal net
Kimberley Gillnet and Barramundi Fishery	Developmental coastal net
Northern Demersal Scalefish fishery	Finfish trawl
Abroholos Island Trawl Fishery	Spanish mackerel
Cockburn Sound Fish Net Fishery	Demersal
Cockburn Line and Pot Fishery	Bait net
General Fish Trapping	Aquarium fish display
Inner Shark Bay Line Fishery	
Kimberley Demersal Trap Fishery	
Kimberley Prawn Trawl	
Nickol Bay Prawn Fishery	
Onslow Prawn Fishery	
Pilbara Trap Fishery	
Shark Bay Seine Mesh Net Fishery	
Shark Bay Prawn Trawl Fishery	
Shark Bay Pink Snapper Fishery	
Shark Bay Scallop Trawl Fishery	
South Coast Salmon Fishery	
Southern Rock Lobster Fishery	
South West Salmon Fishery	
South West Inshore Trawl Fishery	
West Coast Rock Lobster Fishery	
Windy Harbour Rock Lobster Fishery	
South Coast Estuarine Fisheries	
South Coast Trawl Endorsement	
South West Coast Estuarine Fisheries	
Leatherjacket Trap Fishery	
Ningaloo Fish Trawl Fishery	
West Coast Purse Seine Fisheries	

Source: Rose and SAG 2001

Glossary[15]

Associated and/or dependent species: species associated with or dependent upon harvested species, for example species that are predator or prey of the harvested species (EA 2001)

Availability: the fraction of a fish population that lives in regions where it is susceptible to fishing during a given fishing season (FAO 2002)

Biological diversity, biodiversity: the variability among living organisms from all sources (including marine and other aquatic ecosystems and the ecological complexes of which they are part). Includes 1) diversity within species and between species; and 2) diversity of ecosystems (EA 2001)

Biodiversity maintenance: Biodiversity is the variety of living organisms in all their forms and defined in terms of genetic diversity, species diversity and ecosystem diversity and the interrelations between genes, species and ecosystems. The number of species and within-species genetic variability of shark and other chondrichthyan species is naturally low compared with those of many other taxonomic groups. The loss of species, the loss of individual populations within a species, or loss of genetic variation within a species or population, and consequential loss of ecological processes reduce biodiversity and benefits to human kind. Loss of biodiversity can be caused by increased mortality, loss or degradation of habitat, change of environment, and changes in competition with other species, resulting from the introduction of exotic or genetically altered species or from other ecological changes (FAO 2000)

Bycatch: species that are discarded from the catch or retained for scientific purposes, and that part of the "catch" that is not landed but is killed as a result of interaction with fishing gear. This may include discards of commercially valuable species because of possession laws or because the animals are not fit for human consumption or discards for the purposes of high grading (based on EA 2001)

Byproduct: species that are not the target species, but are retained because they are commercially valuable (EA 2001)

Catchability: fraction of a fish stock which is caught by a defined unit of fishing effort (FAO 2002)

Charter boat fishing: where a boat is used exclusively for recreational fishing in the course of an arrangement under which money or some other consideration is provided for the right to fish from the boat

Critical habitat: habitat that is identified in the register of critical habitat (established under subsection 207A of the EPBC Act) as being critical to the survival of a listed threatened species or listed threatened ecological community (EPBC Act)

Cryptic fishing mortality: mortality that is unaccounted for in quantifying removals from shark stocks

Discards: that part of a fisher's catch which is returned to the sea either because it has no commercial value, or because regulations preclude it being retained (MCFFA 1999)

15 Wherever possible definitions used in respected and well accepted Australian and international sources have been adopted.

Ecologically sustainable: use of natural resources within their capacity to sustain natural processes while maintaining the life-support systems of nature and ensuring that the benefit of the use to the present generation does not diminish the potential to meet the needs and aspirations of future generations (EA 2001)

Ecologically sustainable development: using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased. (Australia's National Strategy for Ecologically Sustainable Development, Commonwealth of Australia, 1992)

Ecosystem: the biotic (living) community and its abiotic (non-living) environment (EA 2001)

Elasmobranch: the taxanomic subgroup of cartilaginous fishes containing sharks and rays

Finning: the practice of removing the fins from a shark and discarding the torso to the sea (BRS 2001)

Fishery-independent data: information gathered independently of the fishing sector. Intended to avoid the biases inherent to fishery-related data (FAO 2002)

Game fishing: recreational fishing that specifically targets large game fish species (eg tuna and billfish) and may involve significant levels of catch/tag and release of fish

Gillnet: a net used to tangle or snare fish

Habitat critical to the survival: habitat deemed to be crucial at some phase of the life-history of a particular species (Pogonoski et al 2002), eg nursery, pupping and mating areas or migration lanes

Habitat protection: Anthropogenic activity such as fishing, aquaculture, ecotourism, dredging, mining, catchment area clearing, dumping, nutrient enrichment, pollution, or introduction of exotic organisms can lead to broad-scale degradation of a species habitat range or loss of critical habitat such as nursery, pupping and mating areas or migration lanes of a species. Special habitat protection or habitat restoration programmes might be required where a species abundance or range has been reduced as a result of habitat loss (FAO 2000)

High grading: the discarding of a portion of a vessel's legal catch that could have been sold to have a higher or larger grade of fish that brings higher prices. It may occur in quota and nonquota fisheries (FAO 2002)

Live finning: The removal of the fins from the torso of a live shark and the torso discarded to the sea

Management for sustainable use: Sustainable use requires an understanding of the biophysical and ecological systems and requires maintaining stocks at, or restoring to, levels above those capable of producing maximum sustainable yields. The concept of sustainable catch has to be viewed within the constraints that ecosystems are in dynamic equilibrium and shift between different States depending on natural oscillations in the environment such as El Niño, on anthropogenic stress such as fishing and other activities impacting ecosystems, and, possibly, on climate change. Managing shark resources for sustainable use involves controlling fishing mortality through limiting fishing effort and/or catch and through biological controls such as legal minimum lengths, prescribed mesh-sizes or hook sizes of the fishing gear, closed seasons and closed areas (FAO 2000)

Management regime: In this document, refers to the policies, plans, action plans, strategic research plans, and all documentation that relates to the operations and management of the fishery (EA 2001)

Overfishing: can be defined in two ways which can act independently or concurrently: 1) "recruitment overfishing", where fishing activities are causing a reduction in recruitment in succeeding years and cause the mortality of too many fish in total, too many pre-productive fish, or too many fish that have only spawned a few times. The end result is that the stock can no longer replenish itself adequately. 2) "growth overfishing": where fishing activities lead to a reduction in the size of the individuals of a species, as a consequence of which few specimens grow to the size for optimum yield (EA 2001)

Precautionary approach: used to implement the precautionary principle. In the application of the precautionary principle, public and private decisions should be guided by: 1) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and 2) an assessment of the risk-weighted consequences of the various options (EA 2001)

Precautionary principle: the 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 (EA 2001)

Productivity: when applied to fish stocks the term productivity gives an indication of the birth, growth and death rates of a stock (EA 2001)

Recovery Plan: a comprehensive plan that details, schedules and costs all actions including research necessary to support the recovery of a species or ecological community that has been listed as threatened under State or Federal legislation (Pogonoski et al 2002)

Recreational fishing: is fishing, where the fish captured are not for sale or for monetary gain. It is predominately a leisure activity for sport, wellbeing, sustenance and social reasons. Recreational fishing may be undertaken individually or in groups, be organised through clubs, or be supplied by charter or guiding services

Reference point: an indicator level of fishing (or stock size) to be used as a benchmark for assessment or decision making (EA 2001)

Rehabilitation: the rebuilding of a significantly depleted species or ecological community

Species conservation: Some species of shark need 'special protection' (or 'special management'). This is because some species of shark have particularly low productivity, naturally small populations (rare), a spatially small distribution range, or a distribution range within regions of high anthropogenic impact where they might be threatened or have their populations severely depleted. Such species may need special protection through management action such as prohibition of their capture, prohibition of specific fishing gears, or closed areas to their capture or use of specific fishing gears (FAO 2000)

Stock: in the strict sense, a distinct, reproductively isolated population. In practice, a group of individuals of a species in a defined spatial range that is regarded as having a relatively low rate of exchange with others of the species (EA 2001)

Threatened species: species listed under the EPBC Act or under fisheries management or wildlife conservation legislation in place in the States/Northern Territory

Virgin biomass: the average biomass of a stock that has not yet been fished (in an equilibrium sense) (FAO 2002)

Abbreviations

ACIAR Australian Council for International Agricultural Research

AFMA Australian Fisheries Management Authority

AFZ Australian Fishing Zone

ASIC Australian Seafood Industry Council

ATSIC Aboriginal and Torres Strait Islander Commission

AQIS Australian Quarantine Inspection Service

BAP Bycatch Action Plan

BRD Bycatch Reduction Device

BRS Bureau of Rural Sciences

CITES Convention on the International Trade in Endangered Species of Wild Fauna and Flora

CPUE Catch Per Unit Effort

CSIRO Commonwealth Scientific and Industrial Research Organisation

DAFF Australian Government Department of Agriculture, Fisheries and Forestry

DEH Australian Government Department of Environment and Heritage

DITR Australian Government Department of Industry, Tourism and Resources

EEZ Exclusive Economic Zone

EPBC Act *Environment Protection and Biodiversity Conservation Act* 1999

ESD Ecologically Sustainable Development

ETBF Eastern Tuna and Billfish Fishery

FAO Food and Agriculture Organisation of the United Nations

FRDC Fisheries Research and Development Corporation

GABTF Great Australian Bight Trawl Fishery

GBRMPA Great Barrier Reef Marine Park Authority

HIMI Heard Island and McDonald Island

HSI Humane Society International

IPOA-Sharks International Plan of Action for the Conservation and Management of Sharks

ITQ Individual Transferable Quota

IUCN International Union for Conservation of Nature and Natural Resources

MAC Management Advisory Committee

MAFRI Marine and Freshwater Research Institute

MCFFA Ministerial Council on Forestry, Fisheries and Aquaculture

NAFM Northern Australian Fisheries Managers

NGO Non-Government Organisation

NHT Natural Heritage Trust

NPF Northern Prawn Fishery

Shark-plan National Plan of Action for the Conservation and Management of Sharks

NRIFS National Recreational and Indigenous Fishing Survey

NSF Northern Shark Fishery

NTDBIRD Northern Territory Department of Business, Industry and Resource Development

PIRSA Primary Industry and Resources South Australia

OCS Offshore Constitutional Settlement

QDPI Queensland Department of Primary Industries

RFMO Regional Fisheries Management Organisation

SAG Shark Advisory Group

SDRS Sustainable Development Reference System

SENTF South East Non-trawl Fishery

SETF South East Trawl Fishery

SSF Southern Shark Fishery

SWTBF Southern and Western Tuna and Billfish Fishery

TED Turtle Excluder Device

WAF Western Australian Fisheries

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Australian Government

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Government of Western Australia

Department of Primary Industries

Queensland Government

Department of Primary Industries and Fisheries

Northern Territory Government

Department of Business, Industry & Resource Development