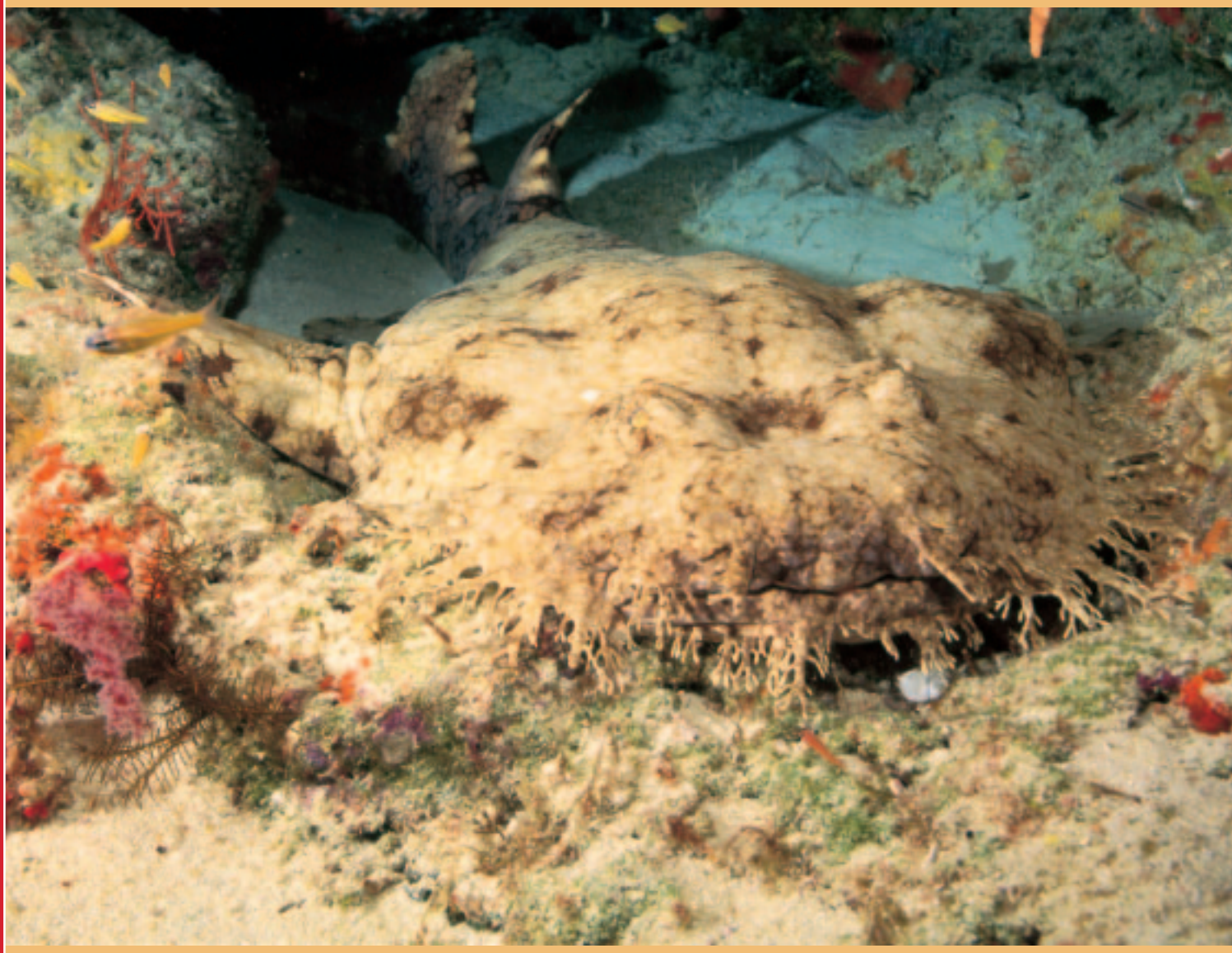
The Conservation Status of Australasian Chondrichthyans

Report of the IUCN Shark Specialist Group
Australia and Oceania Regional Red List Workshop
Queensland, Australia, 7–9 March 2003



Compiled and edited by
Rachel D. Cavanagh, Peter M. Kyne, Sarah L. Fowler,
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Cover photo: Tasselled Wobbegong *Eucrossorhinus dasypogon* © Jeremy Stafford-Deitsch.

Illustrations: Page 7: Harrisson's Dogfish *Centrophorus harrissoni* and Colclough's Shark *Heteroscyllium colcloughi*
Page 129: Banded Eagle Ray *Aetomylaeus nichofii* and Elephant Fish *Callorhinchus milii* © Christopher Glenn.

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Contents

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Editors Notes

The assessments in this report were compiled by 26 experts during a 3-day Workshop. As much standardisation as practicable in the short time available was undertaken when compiling this publication. However, we have chosen to present assessments more or less as written at the Workshop, thus inevitable inconsistencies in writing style and content will be apparent. The main aim of this report is to make the Workshop outcomes available as soon as possible. These assessments form a baseline for future work in the region, some of which is urgent.

The Red List assessments presented here will continually be updated as new information is obtained. For this reason, readers are urged always to consult the current Red List (www.redlist.org), which is updated every year, to obtain the most up to date assessments.

There are several key points to note before reading this report:

Assessment content

The species assessments in this report have been submitted to IUCN for inclusion in the 2003 *IUCN Red List of Threatened Species*™ (with the exception of those discussed under *Global Assessments* below), using the standard Red List assessment questionnaire format (see Introduction). Each assessment has been edited for the purpose of this report, to include only the main information. For example, in this report full details are given for the regional distribution of each species, however for more widespread species, a list of all other countries are not provided here (although all the FAO Fisheries Areas within which the species occur are given). Full details as documented in the standard questionnaires will be made available via the Shark Specialist Group (SSG) website (http://www.flmnh.ufl.edu/fish/organizations/ssg/ssg.htm). All sources of information used by the assessors are included in this report for reference purposes, even if not cited in the text. It should also be noted that some aspects of an assessment rationale are repeated in other sections. This is inevitable as each rationale will 'stand alone' on the Red List (http://www.redlist.org), summarising the justification for each assessment.

Regional assessments

If a species is endemic to the region, then the 'regional' assessment is considered the 'global assessment', and will be displayed as such on the Red List and in this report. For more widespread species where the global assessment differs from the regional assessment, although only the global assessment will be displayed on the Red List, the regional assessment will be documented on the SSG website (in addition to this report). In this report the global assessment is noted first, followed by a regional assessment where appropriate. It should be noted that regional assessments are not always for the entire Australia and Oceania (AO) region (as defined in the Introduction), for example, sometimes they are specific to Australia, New Zealand or New Guinea, and this is documented in each case.

Global assessments

The limited time available at the Workshop, where expertise was focused primarily on the AO region, meant that it was not possible to achieve global assessments of some of the more wide-ranging species such as *Odontaspis ferox*, *Alopias pelagicus, A. superciliosus, Isurus paucus* and some of the carcharhinids, despite discussions with the wider SSG network via email after the Workshop. Thus, the species marked '**' have been temporarily assigned the Data Deficient category, pending urgent review of their global status. These species will not be submitted to the Red List until this review has been undertaken.

2000 Red List Assessments

Most of the chondrichthyan assessments in the 2000 Red List appear unchanged in this report. Full documentation is presented in Fowler *et al*. (in press) thus only the rationales are included for these species (with the exception of ten species which were updated at the Workshop to take account of new information). Unless stated to the contrary, the 2000 assessments were based on the old Red List criteria (1994). In particular, it should be noted that the 'Conservation Dependent' category no longer exists (see Introduction).

Classification

The classification system used in this report follows Compagno (2001). All batoids, including the electric rays of all families, are included in the single order Rajiformes. Common names are based on names presented in Last & Stevens (1994) or official FAO names, with the exception of some endemics where the most commonly used regional name is used in this report.

Taxonomic issues

There are unresolved taxonomic issues with some of the species assessed at the Workshop. This has been noted in the individual assessments, for example, the undescribed *Apristurus* species, and some of the *Squalus* and *Centrophorus* species. In the case of *Squalus megalops*, *S. mitsukurii*, *Centrophorus moluccensis* and *C. uyato,* all of which occur (or may occur) beyond the AO region, taxonomic uncertainties made it impossible to assess their threatened status on a global basis. Assessments for the AO region have been documented here for each of these species, and they have been temporarily noted as Data Deficient globally, and marked '*'. These species will be re-assessed on a global basis once the taxonomic problems have been resolved.

Nominal records

A small number of species included in this report, (for example, *Chiloscyllium griseum, C. indicum* and *Carcharhinus hemiodon*) are known only from nominal records from the AO region. Their occurrence here cannot be confirmed at the present time. However, it was decided to include these as future survey work within the region should note that these species may occur here and there is a need for survey and appraisal of their status.

Glossary and Acronyms

Mainly modified from Compagno (2001); Kelleher (1999); Last and Stevens (1994); Pogonoski *et al.* (2002); and, http://www.fao.org/fi/glossary/ with IUCN Red List Category and criteria definitions from IUCN (2001). Refer to http://www.redlist.org and the IUCN Red List Categories and Criteria for definitions specific to the Red List which may be more detailed than the general definitions included here.

Abyssal plain – the extensive, flat, gently sloping or nearly level region of the ocean floor from about 2,000m to 6,000m depth.

ACIAR – Australian Centre for International Agricultural Research.

Adelphophagy – a mode of **aplacental viviparity** employing **uterine cannibalism**, whereby early foetuses deplete their yolksacs early, then subsist by first feeding on their smaller siblings and then on eggs produced by the mother (see **oophagy**).

AO region – Australia and Oceania region of the **SSG**. This region includes the **EEZ**s and adjacent waters of Australia, New Zealand, New Guinea (Papua New Guinea and Indonesian Irian Jaya) and many other smaller Pacific nations. (See map at http://www.flmnh.ufl.edu/fish/organizations/ssg/ssg.htm).

Aplacental viviparity – a reproductive mode where the maternal adult gives birth to live young which do not have a yolksac placenta.

Aplacental yolksac viviparity – a reproductive mode where the maternal adult gives birth to live young which are primarily nourished by the yolk in their yolksac. The yolk is gradually depleted and the yolksac reabsorbed until the young are ready to be born. Often referred to as **ovoviviparity**.

Area of occupancy – the area within its **extent of occurrence** which is occupied by a taxon, excluding cases of vagrancy. This reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases the area of occupancy is the smallest area essential at any stage of the life cycle to the survival of existing populations of a taxon.

Artisanal fishery – small-scale traditional fisheries involving fishing households (as opposed to commercial companies) which input a relatively small amount of capital and energy, and catch fish mainly for local consumption, however the catch may be exported. Artisanal fisheries can be **subsistence fisheries** or **commercial fisheries**.

Bathyal – **benthic** habitats from 200m to 4,000m depth.

Bathymetric distribution – the vertical distribution of a marine organism, referring to its depth of occurrence.

Batoid – a **ray** or flat shark, a species of the order Rajiformes: the sawfish, sharkray, wedgefish, guitarfish, thornrays, panrays, electric rays, skates, stingrays, stingarees, butterfly rays, eagle rays, cownose rays and devilrays.

Beach meshing – an active fishing method utilising nets or baited drumlines designed to remove sharks from the local area for the purpose of bather protection. Employed only in Queensland and New South Wales in Australia and KwaZulu-Natal in South Africa.

Benthic – living on the bottom of the ocean; bottom-dwelling.

Biological extinction – the complete disappearance of a species from the Earth.

Biomass – the total weight, volume or quantity of organisms in a given area.

Bycatch – the part of a catch taken incidentally in addition to the target species towards which **fishing effort** is directed. In a broad context, this includes all non-targeted catch including **byproduct**, **discards** and other interactions with gear.

Byproduct – the part of the catch which is retained due to their commercial value, but which is not the primary target species (see **target catch**).

Cartilaginous fishes – species of the **class Chondrichthyes**.

Chimaera – a species of the order Chimaeriformes within the subclass **Holocephali**.

Chondrichthyan – referring to the **class Chondrichthyes**.

Chondrichthyes – the **class** Chondrichthyes; the cartilaginous fishes which include the **elasmobranchs** and the **holocephalans**.

Circumglobal – distributed worldwide.

Circumtropical – distributed throughout the tropical regions worldwide.

CITES – Convention on International Trade in Endangered Species of Fauna and Flora. An international agreement which aims to ensure that international trade in specimens of wild fauna and flora does not threaten the survival of species. Appendix II of CITES includes "species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilisation incompatible with their survival" (http://www.cites.org).

Class – one of the taxonomic groups of organisms, containing related **orders**; related classes are grouped into phlya.

Codend – the end of a fishing net in which the catch collects.

Commercial fishery – a fishery targeting species which are retained and sold for their commercial value.

Common name – the informal vernacular name for an organism, which may vary from location to location.

Continental shelf – the gently sloping, shelf-like part of the seabed adjacent to the coast extending to a depth of about 200m.

Continental slope – the often steep, slope-like part of the seabed extending from the edge of the **continental shelf** to a depth of about 2,000m.

CPUE – Catch-per-unit-effort: a measure of the catch rate of a fish species (or other marine or aquatic species) standardised for the amount of **fishing effort** put into catching that species.

Cryptic – fish species (or other organisms) that live amongst concealing or sheltering cover, or that possess protective colouration.

DELASS – 'Development of Elasmobranch Assessments'. A project funded by the European Union to develop elasmobranch assessments to improve the scientific basis for the regulation of fisheries.

Demersal – occurring or living near or on the bottom of the ocean (cf. **pelagic**).

Discards – the component of a catch returned to the sea, either dead or alive. Primarily made up of the **bycatch** but can include juveniles and damaged or unsuitable individuals of the target species.

Discard/release mortality – the proportion of fish that die as a result of being discarded once captured. Discard mortality is often hard to assess as individuals returned to the sea alive may later die due to the effects of being caught.

Dropline fishing – a method of deepwater fishing using a vertical line bearing rows of baited hooks.

DW – disc width: a standard morphometric measurement for **batoids**, across the pectoral fins or 'disc'.

Dynamite fishing – a destructive fishing method using explosives to kill and collect fish. Often used around coral reefs, causing habitat destruction.

Ecosystem – the living community of different species, interdependent on each other, together with their non-living environment.

EEZ – Exclusive Economic Zone: A zone under national jurisdiction (up to 200-nautical miles wide) declared in line with the provisions of 1982 United Nations Convention of the Law of the Sea, within which the coastal State has the right to explore and exploit, and the responsibility to conserve and manage, the living and non-living resources.

Elasmobranch – referring to the subclass **Elasmobranchii**.

Elasmobranchii – the subclass Elasmobranchii, a major subdivision of the **class Chondrichthyes**, containing the living nonbatoid **sharks**, **batoids** and their fossil relatives.

Endemic – native and restricted to a defined region or area.

Epipelagic – the upper part of the **oceanic** zone from the surface to depths of about 200m.

Extent of occurrence – the area contained within the shortest continuous boundary which encompasses all known, inferred and projected sites of present occurrence of a taxon, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g., large areas of obviously unsuitable habitat).

Family – one of the taxonomic groups of organisms, containing related **genera**; related families are grouped into **orders**.

FAO – United Nations Fish and Agricultural Organization.

Fauna – the community of animals peculiar to a region, area, specified environment or period.

Fecundity – a measure of the capacity of the maternal adult to produce young.

Filter-feeding – a form of feeding whereby suspended food particles are extracted from the water using the gill rakers.

Finning – the practice of slicing off a shark's valuable fins and discarding the body at sea.

Fishery independent survey – an experimental or scientific survey of the **fauna** or catch within a fishery or area, conducted independently of the fishing industry.

Fishing effort – the amount of fishing taking place; usually described in terms of the gear type and the frequency or period which it is in use.

Fishing mortality – the proportion of fish that die due to fishing; often expressed as a percentage of the total **population** caught each year.

FL – fork length: a standard morphometric measurement used for sharks, from the tip of the snout to the fork of the caudal fin.

FRDC – Fisheries Research and Development Corporation.

GABTF – Great Australia Bight Trawl Fishery: Commonwealth managed trawl fishery operating in the Great Australia Bight off SA and WA targeting various finfish species under a **QMS**.

Generation – measured as the average age of parents of newborn individuals within the **population**. Where generation length varies under threat, the more natural, i.e. pre-disturbance, generation length should be used.

Genus (plural: genera) – one of the taxonomic groups of organisms, containing related **species**; related genera are grouped into **families**.

Gestation period – the period between conception and birth in live-bearing animals.

Gillnet – a type of fishing net designed to entangle or ensnare fish.

Habitat – the locality or environment in which an animal lives.

Holocephalan – referring to the subclass **Holocephali**.

Holocephali – the subclass Holocephali, a major subdivision of the **class Chondrichthyes**, containing the living **chimaeras** (elephant fishes, chimaeras, ghost sharks, silver sharks, ratfishes, spookfishes) and their fossil relatives.

Holotype – a single specimen cited in the original description of a species which becomes the 'name-bearer' of the species. The Holotype is used to validate the species and its accompanying **scientific name** by anchoring it to a single specimen.

ICES – International Council for the Exploration of the Seas.

Incidental catch – see **bycatch**

Intrinsic rate of increase – a value that quantifies how much a **population** can increase between successive time periods; plays an important role in evaluating the sustainability of different harvest levels and the capacity to recover after depletion.

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

ITQ – Individual Transferable Quota: a catch limit or quota (a part of the **Total Allowable Catch**) allocated to an individual fisher or vessel owner which can either be harvested or sold to others.

IUCN – The World Conservation Union. A union of sovereign states, government agencies and non-governmental organisations.

K-selected species – species selected for its superiority in a stable environment; a species typified by slow growth, relatively large size, low natural mortality and low fecundity (cf. **r-selected species**).

Limited entry fishery – a management arrangement to control the amount of **fishing effort** in a fishery where the number of operators (and size of vessels) is restricted through license limitation or quota systems.

Local extinction – when there is no doubt that the last individual of a particular species has died from a particular region or area.

Longevity – the maximum expected age, on average, for a species or **population** in the absence of human-induced or **fishing mortality**.

Longline fishing – a fishing method using short lines bearing hooks attached at regular intervals to a longer main line. Longlines can be laid on the bottom (**demersal**) or suspended (**pelagic**) horizontally at a predetermined depth with the assistance of surface floats. May be as long as 150km with several thousand hooks.

Mesh-size – the size of openings in a fishing net. Limits are often set on mesh size to protect the young of target species, allowing them to reach maturity or optimal size for capture (minimum mesh size); or to protect larger breeding individuals (maximum mesh size).

Mesopelagic – the intermediate part of the **oceanic** zone from 200m to 1,000m depth.

Migratory – the systematic (as opposed to random) movement of individuals from one place to another, often related to season and breeding or feeding. Knowledge of migratory patterns helps to manage shared **stocks** and to target aggregations of fish.

MPA – Marine Protected Area: Any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment.

MSY – maximum sustainable yield: the largest theoretical average catch or yield that can continuously be taken from a stock under existing environmental conditions without significantly affecting the reproductive process.

Natural mortality – the proportion of fish that die other than due to fishing, i.e. that proportion due to ageing, predation, cannibalism and disease; often expressed as a percentage of the total population dying each year.

nm – Nautical Miles.

Non-target species – species which are not the subject of directed fishing effort (cf. **target catch**), including the **bycatch** and **byproduct**.

Oceanic – living in the open ocean, mainly beyond the edge of the **continental shelf**.

Oceanic seamount – a large isolated elevation in the open ocean, characteristically of conical form; often a productive area for deepwater fisheries.

Oophagy – a mode of **aplacental viviparity** employing uterine cannibalism, whereby early foetuses deplete their yolksacs early, then subsist by feeding on eggs produced by the mother.

Order – one of the taxonomic groups of organisms, containing related **families**; related orders are grouped into **classes**.

Oviparity – a reproductive mode where the maternal adult deposits eggs enclosed in egg-cases on the seafloor which later hatch to produce young.

Ovoviviparity – see **aplacental yolksac viviparity**.

Pelagic – occurring or living in open waters or near the surface with little contact with or dependency on the bottom (cf. **demersal**).

Placental viviparity – a reproductive mode where the maternal adult gives birth to live young which had developed a yolksac placenta.

Population – a group of individuals of a species living in a particular area. (This is defined by IUCN (2001) as the total number of mature individuals of the taxon, with subpopulations defined as geographically or otherwise distinct groups in the

population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less).)

Precautionary principle – a principle which states that lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental damage to habitats or species when there is a threat of serious or irreversible environmental degradation.

Productivity – relates to the birth, growth and mortality rates of a fish **stock**. Highly productive **stocks** are characterised by high birth, growth and mortality rates and can usually sustain higher exploitation rates and, if depleted, could recover more rapidly than comparatively less productive **stocks**.

QMS – Quota Management System: a fishery management arrangement to manage the shares of the **Total Allowable Catch** allocated to individual operating units (fishers, vessels, countries, companies). Quotas may or may not be transferable, inheritable, or tradable.

r-selected species – a species selected for its superiority in variable or unpredictable environments; a species typified by rapid growth rates, small size, high natural mortality and high fecundity (cf. **K-selected biology**).

Ray – see **batoid**.

Red List of Threatened Species – listing of the conservation status of the world's flora and fauna administered by **IUCN**.

Rebound potential – a measure of the ability of a **species** or **population** to recover from exploitation.

Recruitment – the number of fish added to an exploitable **stock** in a fishing area each year, through the processes of growth (a fish grows to a size where it becomes catchable) or migration (a fish moves into the fishing area).

Scientific name – the formal binomial name of a particular organism, consisting of the **genus** and specific names; a **species** only has one valid scientific name.

Seine netting – a fishing method using nets to surround an area of water where the ends of the nets are drawn together to encircle the fish (includes purse seine and Danish seine netting).

SETF – South East Trawl Fishery: Commonwealth managed trawl fishery in Southeast Australia operating from SA to NSW, including VIC and TAS targeting various finfish species under a **QMS**.

Shark – a term generally used for the **cartilaginous fishes** other than the **batoids** and the **chimaeras**. However, the term can be used more broadly to include these groups as suggested by Compagno (2001).

Species – a group of interbreeding individuals with common characteristics that produce fertile (capable of reproducing) offspring and which are not able to interbreed with other such groups, that is, a **population** that is reproductively isolated from others; related species are grouped into **genera**.

Squalene – a long-chain hydrocarbon found in the liver oil of some **cartilaginous fishes**, and harvested from some deepwater species for medicinal, industrial and cosmetic uses.

SSC – Species Survival Commission. One of six volunteer commissions of **IUCN**.

SSF – Southern Shark Fishery: Commonwealth managed fishery in Southeast Australia targeting gummy and school shark under a **QMS**, now merged with the South East Non-trawl Fishery to become the Gillnet, Hook and Trap Fishery (GHATF).

SSG – Shark Specialist Group (part of the **IUCN** Species Survival Commission network).

Statutary Fishing Rights – a fishing permit or licence giving an operator the right to operate in a fishery according to the terms established by the authority regulating the fishery.

Stock – a group of individuals in a **species**, which are under consideration from the point of view of actual or potential utilisation, and which occupy a well defined geographical range independent of other stocks of the same species. A stock is often regarded as an entity for management and assessment purposes.

STRTF – South Tasman Rise Trawl Fishery: Commonwealth managed fishery targeting orange roughy and oreos in an area straddling the Australian Fishing Zone due South of Tasmania and managed through a precautionary **TAC**.

Subpopulation – geographically or otherwise distinct groups in a **population** between which there is little exchange.

Subsistence fishery – a fishery where the fish landed are shared and consumed by the families and kin of the fishers instead of being sold on to the next larger market.

Sympatric – different **species** which inhabit the same or overlapping geographic areas.

TAC – Total Allowable Catch: the total catch allowed to be taken from a resource within a specified time period (usually a year) by all operators; designated by the regulatory authority. Usually allocated in the form of quotas.

Target catch – the catch which is the subject of directed **fishing effort** within a fishery; the catch consisting of the **species** primarily sought by fishers.

Taxon (plural: taxa) – a formal taxonomic unit or category at any level in a classification (**family**, **genus**, **species**, etc.).

Taxonomy – the science of classification of flora and **fauna**.

TED – Turtle Exclusion Device: a modification to a trawl net designed to exclude turtles and other large organisms (large **sharks** and **rays**, sponges etc.) before they reach the **codend**, while maintaining the catch of the target species.

TL – total length: a standard morphometric measurement for **sharks** and some **batoids**, from the tip of snout or rostrum to the end of the upper lobe of the caudal fin.

Trawling (trawl netting) – a fishing method utilising a towed net consisting of a cone or funnel shaped net body, closed by a **codend** and extended at the openings by wings. Can be used on the bottom (**demersal** trawl) or in midwater (**pelagic** trawl).

Undescribed species – an organism not yet formally described by science and so does not yet a have a formal binomial **scientific name**. Usually assigned a letter or number designation after the generic name, for example, *Squatina* sp. A is an undescribed species of angel shark belonging to the **genus** *Squatina*.

Uterine cannibalism – see **adelphophagy** and **oophagy**.

Viviparity – a reproductive mode where the maternal adult gives birth to live young. Encompasses **aplacental viviparity** and **placental viviparity**.

World Conservation Union – see **IUCN**.

Australian states and territories

NSW – New South Wales, **NT** – Northern Territory, **QLD** – Queensland, **SA** – South Australia, **TAS** – Tasmania, **VIC** – Victoria, **WA** – Western Australia.

FAO Fisheries Areas

(Refer to ftp://ftp.fao.org/fi/maps/Default.htm#CURRENT accompanying map – ftp://ftp.fao.org/fi/maps/world_2003.gif)

01 Africa – Inland Waters
02 North America – Inland Waters
03 South America – Inland Waters
04 Asia – Inland Waters
05 Europe – Inland Waters
06 Oceania – Inland Waters
08 Antarctica – Inland Waters
18 Arctic Seas
21 Northwest Atlantic
27 Northeast Atlantic
34 Eastern Central Atlantic
37 Mediterranean and Black Seas
41 Southwest Atlantic
47 Southeast Atlantic
48 Antarctic Atlantic
51 Western Indian
57 Eastern Indian
58 Antarctic Indian
61 Northwest Pacific
67 Northeast Pacific
71 Western Central Pacific
77 Eastern Central Pacific
81 Southwest Pacific
87 Southeast Pacific
88 Antarctic Pacific

Introduction

IUCN Shark Specialist Group

IUCN – the World Conservation Union, is the umbrella body for the world's conservation agencies and institutions. Its members comprise sovereign states, government agencies and non-governmental organisations. The Species Survival Commission (SSC) is a volunteer network within IUCN, comprised of nearly 7,000 scientists, field researchers, government officials and conservation leaders from almost every country in the world, and is an unmatched source of information on biological diversity and its conservation. As such, SSC members provide technical and scientific counsel for conservation projects throughout the world and serve as resources to governments, international conventions and conservation organisations.

In response to growing awareness and concern of the severe impact of fisheries on elasmobranch populations around the world, the SSC established the IUCN Shark Specialist Group (SSG) in 1991; it is now one of the largest and most active specialist groups within the SSC. The SSG provides leadership for the conservation of threatened species and populations of all chondrichthyan fishes. It aims to promote the long-term conservation of the world's sharks and related species (the skates, rays and chimaeras), effective management of their fisheries and habitats and, where necessary, the recovery of their populations.

Chondrichthyans are an evolutionarily-conservative group that has functioned successfully in diverse ecosystems for 400 million years. Despite their evolutionary success, some chondrichthyans may now be threatened with extinction as a result of human activities and the very conservative life-history traits of this group of fishes (Musick in press). Many, if not most, chondrichthyans grow slowly, mature at relatively late ages, have a small number of young and low natural mortality. These characteristics result in very low rates of potential population increase with little capacity to recover from overfishing (either direct or indirect) and other human impacts, including pollution and habitat destruction. However, knowledge of the population status of most of the known species of chondrichthyan fishes is seriously limited.

There are 130 SSG members around the world, all of whom are actively involved in chondrichthyan research and fisheries management, marine conservation or policy formulation. The SSG is divided into nine ocean-region subgroups, led by an Executive Committee of Regional, Deputy and Co-Chairs. A full time Programme Officer works with the Executive Committee to coordinate the work of the group, but the majority of its members provide their time and input voluntarily.

Further information: http://www.flmnh.ufl.edu/fish/organizations/ssg/ssg.htm

IUCN Red List Assessments

One of the roles central to the SSG mission is the preparation of species assessments for the *IUCN Red List of Threatened Species™*. The IUCN Red List is widely recognised as the most comprehensive source of information on the global conservation status of plant and animal species and, in the context of the SSG, can be used as a tool for measuring and monitoring changes in the status of chondrichthyan biodiversity and our knowledge of the taxa. Red Lists are among the most widely used tools available to conservationists worldwide for focusing attention on species of conservation concern, and are an essential basis to enable management priorities to be targeted, and for monitoring the long-term success of management and conservation initiatives. The assessments evaluate the conservation status of individual species, identify threatening processes affecting them and, if necessary, propose recovery objectives for their populations.

Prior to this Workshop, the SSG had assessed, through detailed consultation and consensus, the threatened status of over 100 chondrichthyan species for the IUCN 2001 Red List (http://www.redlist.org and Fowler *et al*. in press). The SSG has recently embarked upon a programme to complete assessments for all chondrichthyan species (totalling >1,000 species, worldwide). Sharks are the priority for 2003, in order to aim for at least one of the taxonomic subgroups completely assessed by the end of the year. Batoid (skate and ray) and holocephalan (chimaera, elephant fish and spookfish) assessments will also be undertaken in the near future, with the aim to have the threatened status of all chondrichthyan species assessed by the end of 2004. This process is being undertaken through a series of regional workshops in order to facilitate detailed discussions and pooling of resources.

Australia and Oceania (AO) Regional Red List Workshop

The first regional SSG Red List Workshop was held by the AO Regional SSG on 7–9 March 2003 at the University of Queensland's Moreton Bay Research Station on North Stradbroke Island, Australia. This group is responsible for the largest geographical SSG area, encompassing the Western Central Pacific, Southwest Pacific and Eastern Indian Oceans. This area includes the EEZs and adjacent waters of Australia, New Zealand, New Guinea (Papua New Guinea and Indonesian Irian Jaya) and many smaller Pacific island nations (see SSG map at http://www.flmnh.ufl.edu/fish/organizations/ssg/ssg.htm). The chondrichthyan fauna of this area is particularly diverse, with ~350 (approximately one third) of all known species occurring in this region. More than half of Australia's chondrichthyan fauna is endemic (Last and Stevens 1994) and within New Zealand waters, Cox and Francis (1997) reported a total of 95 species, with approximately 20% endemic. The fauna from other parts of the region is less well documented.

Participants

Nineteen SSG members attended the Workshop: from the AO regional group, together with members from the USA, UK and South Africa, including the SSG Co-Chairs, Programme Officer and three members of the Executive Committee. Other (non-SSG) participants included experts from the Australian Museum and CSIRO Marine Research, students from the University of Queensland and observers from Environment Australia and the Marine and Coastal Community Network (SA). See Annex I for the list of participants.

Methodology

Each participant selected species to assess prior to the Workshop and much of the research and preparatory work was carried out in advance, thus enabling the aims of the Workshop to be achieved during the short time period available. Fifty-one species of chondrichthyans occurring

within the AO region, including 42 sharks, had already been assessed for the 2000 Red List. The priority here was to assess all previously unassessed sharks from AO waters on a regional basis, and globally where possible. However, sufficient time was available at the Workshop to also enable a small number of batoids and chimaeras to be assessed. Finally, the revision of some of the 2000 Red List assessments was undertaken, in cases where more information was available.

The first part of the Workshop comprised an introduction to the Red List process (using the new criteria, Version 3.1 (http://www.redlist.org)), overviews of the conservation status of the regional fauna, and worked examples of Red List assessments of a selection of species (see agenda in Annex II). The remainder of the Workshop was taken up by individuals and small working groups discussing and undertaking species assessments. Very little information is documented in the published literature for some of the species from the AO region and, as a result, many of these had not been selected for assessment by participants. In such cases, George Burgess (SSG Executive Committee), Leonard Compagno (SSG Regional Vice-Chair for Subequatorial Africa) and John Musick (SSG Co-Chair), reviewed the species and assigned preliminary assessments. Other participants later compiled all available documentation on these species, and as a result these preliminary assessments were revised where necessary. The whole group met at regular intervals for discussion sessions and to reach consensus on completed assessments.

Application of the Red List Categories and Criteria (Version 3.1)

Red List Categories and Criteria

The Red List categories and criteria have undergone several revisions (Fowler *et al*. in press). The latest version – the result of a review undertaken between 1997–2000 (Mace 2000) – is Version 3.1 which came into force in 2001 (IUCN 2001). It should be noted that the chondrichthyan assessments published in the 2000 Red List and those presented in Pogonoski *et al*. (2002) (see below) used the 1994 criteria, some of which incorporated the marine fish caveat from the 1996 Red List (Baillie and Groombridge 1996; Hilton-Taylor 2000) (see below). See Table 1 for definitions of the categories and Annex III for a summary of the criteria.

Geographically distinct populations

An important consideration is the application of the criteria to geographically distinct populations. Many marine species have a markedly disjunct distribution, where there is clearly no possible opportunity for exchange between populations. There may also be no evidence for interchange among well-studied populations which breed on different sides of an ocean basin, even though the species carries out extensive migrations. Finally, many species do not migrate at all, but remain close to their place of birth throughout their life cycle. In these conditions there is minimal interchange between stocks, even when there is apparently little spatial separation. The IUCN Red Listing process allows assessment of geographically distinct populations separately. Some of the chondrichthyan assessments in this report have been made on a regional basis, or even a country-wide basis. A global assessment of extinction risk was not possible for some of the species in this report, due to the paucity of available data or other issues, including taxonomic problems.

Marine fishes and the population decline criteria

The population decline criterion, 'A', is the most powerful of the criteria. The decline may have taken place in the past, or be projected into the future (for example where the decline is likely to take place if current mortality rates are not altered), or be a combination of the two. Since it is difficult to quantify precisely the size of populations of many species, changes in indexes of abundance (such as CPUE) may be used to make inferences. The key statistic for population decline is related to the generation period of a species. The criteria also require the precautionary principle to be used. Thus, where a population decline is known to have taken place, but no management has been applied, the decline is assumed to be likely to continue in the future.

Table 1. Red List Categories (Version 3.1, IUCN 2001).

Category	Definition
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Annex III), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Annex III), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Annex III), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

If fisheries are known to be under way, but no information is available on changes in CPUE, data from similar fisheries elsewhere may be used by informed specialists to extrapolate likely population trends. Additionally, where no life history data are available, the demographics of a very closely related species may be used to estimate biological parameters, for example, age at maturity.

Although criterion 'A' can readily be applied to a range of population data derived from catch rates and fisheries independent field research, this criterion (in particular) does not always lead to equally robust assessments of extinction risk. There is a distinction between actual biological extinction risk, and economic extinction (fishery collapse). Thus the 1996 Red List applied the following caveat to certain marine fish listings: '*The criteria (A–D) provide relative assessments of trends in the population status of species across many life forms. However, it is recognised that these criteria do not always lead to equally robust assessments of extinction risk, which depend upon the life history of the species. The quantitative criterion (A1a, b, d) for the threatened categories may not be appropriate for some species, particularly those with high reproductive potential, fast growth and broad geographic ranges. Many of these species have high potential for population maintenance under high levels of mortality, and such species might form the basis for fisheries.*'

The 2000 revision of the categories and criteria increased the quantitative threshold decline rates for Criterion A, taking account of concerns that the original thresholds (especially for Vulnerable) were too low, and that rates of declines did not take account of highly productive species, managed populations that are being harvested down to levels at which a higher yield may be attained, or dramatic declines in the past that are now halted or even reversed. The difficult issue of how to assess productive and/or harvested species using Criterion 'A' remains unresolved (Mace 2000), however because the chondrichthyan fishes are not generally productive species this is not as major an issue for the SSG. For further discussion of these issues see Musick (1999a), Pogonoski *et al*. (2002) and Fowler *et al*. (in press).

Conservation Dependent

The Conservation Dependent category, previously used for depleted species under fisheries management that should prevent further depletion and allow recovery, is no longer in use (note: some of the assessments from 2000 included in this report may refer to this category). IUCN's decision to remove this category was taken because it was impossible to distinguish within it between those species that had undergone such serious declines that they might otherwise have been categorised as Critically Endangered, and those for which declines were far less serious and therefore much less of a concern. Some participants expressed regrets over the loss of this category, although it has been replaced by a new decline criterion, A1, with a significantly higher qualifying level of decline, which has precisely the same role as Conservation Dependent while simultaneously enabling the level of depletion to be conveyed in the assessment.

Use of Red List Categories at the Workshop

The Red List criteria are applied with some discretion by the SSG. The reasoning is detailed in the individual assessments and group consensus was reached in each case. This was sometimes because of concern (despite the 'marine fish caveat' and revisions described above) about the way in which the population decline criterion 'A' can still sometimes over-estimate biological extinction risk, particularly for many of the more common and wide-ranging chondrichthyans. Some species that would have qualified for a threatened species assessment if the recommended precautionary approach had been strictly applied were not, therefore, listed in such a high category of risk by the SSG. This approach was taken when there was doubt whether the estimated population decline was actually operating at a global level, or when, despite a well-documented decline, knowledge of fisheries population dynamics demonstrated that risk of biological extinction was negligible, if not virtually non-existent in the foreseeable future. On the other hand, many of the assessments have highlighted concern for species caught as bycatch. Continued research on the bycatch of elasmobranchs in non-target fisheries is important to provide accurate estimates of the impacts of all fisheries on stocks. In a mixed-species fishery where all species are subjected to the same fishery mortality rate, less-abundant species could be driven to extinction while numerically dominant, more resilient species still continue to support the fishery (Musick 1999b). A species is particularly likely to be threatened where taken as bycatch in fisheries which are not economically reliant on it (Musick 1999b), and when the entire population is exposed to exploitation at some stage in the life cycle.

The SSG recognises that, regardless of the exact quantitative criteria used, those fishes which exhibit any combination of the following characters may be susceptible to extinction:

- restricted distribution;
- very late maturation;
- very low fecundity and reproductive potential;
- particular vulnerability to fisheries because of their ecological or behavioural characteristics (including their susceptibility to gear); and,
- dependence on threatened habitats.

Consensus process

The SSG is the Red List Authority for chondrichthyan assessments (appointed by the IUCN Species Survival Commission through SSG Co-Chairs Sarah Fowler and Jack Musick) and considers full and open consultation with its membership, through workshops and correspondence, to be essential for the preparation of accurate Red List assessments (Fowler 1996). The assessment and documentation for each species agreed by the group at the AO Workshop was therefore circulated to the entire SSG membership for comments. This process of consultation with all members has led to a consensus agreement being reached on each Red List assessment published here.

Documentation

A standard IUCN Red List assessment questionnaire was completed for each species, collating detailed information on the status of each species (so far as current knowledge permits). Each species was documented as follows:

- Species name
- Red List Category and Criteria
- Countries and FAO Fisheries Areas in which the species occurs
- Map showing the geographic distribution
- Rationale for the assessment
- Current population trends
- Habitat preferences
- Threats
- Conservation measures in place
- Information on any changes in previous assigned Red List status
- Data sources

- Consultation process (including the names of the evaluators and the assessors).

These details are submitted in full to the IUCN Red List, but have been edited for inclusion in this publication.

Results

Overview

As a result of the AO Workshop; 175 species (149 sharks, 22 batoids and four holocephalans) were assessed (including ten sharks for which Red List 2000 assessments were updated) and their status agreed by consensus. This includes all 94 shark species known to be endemic to this region, and 14 endemic batoids. A number of additional batoid assessments were also drafted and will be finalised at an SSG 'Batoid Red List Workshop' in early 2004 (see below). Further to those species assessed at the Workshop, this report also includes 30 sharks and 11 batoids occurring in this region, two of which are regional endemics, that were assessed in 2000 and not revised during the Workshop. Regional and, where possible, global assessments were produced for all of these. (Note: For those species that occur only within the AO region, the 'regional assessment' is considered to be the 'global assessment' since these species do not occur elsewhere). For some species, regional assessments were also produced for the adjacent South East Asia region.

Globally, 34 species have been classified as threatened: four Critically Endangered, six Endangered and 24 Vulnerable, together with 52 Near Threatened, 71 Least Concern and 59 Data Deficient. (Note: these totals include the 2000 assessments). An additional seven species were classified regionally as threatened in Australia (or parts of Australia): two Critically Endangered, two Endangered and three Vulnerable. A further five species were classified regionally as threatened in South East Asia: two Critically Endangered, one Endangered and two Vulnerable.

Global assessments were often difficult, either because of the lack of information from outside the AO region, or due to taxonomic uncertainties. In these cases, the wider SSG network will review the situation over the coming months and reconsider some of the global assessments as more information is made available. For the purposes of this report these species have been classified as Data Deficient globally, pending urgent review (see below). See Annex IV for a summary table of all the assessments.

Threatened Species

The status of all the species assigned to a threatened category must be monitored closely, and research must be conducted without delay to better understand their biology, threats and conservation needs, and to implement management and recovery plans where necessary. Chondrichthyans identified as Critically Endangered (the most severe threatened or 'at risk' category, indicating that a species is "facing an extremely high risk of extinction") are two species of deepwater sharks, Harrisson's dogfish *Centrophorus harrissoni,* a regional endemic, and the southern dogfish *Centrophorus uyato* (assessed as Critically Endangered in Australia, but currently Data Deficient globally due to taxonomic uncertainty). These species have undergone drastic declines of over 99% and 95% respectively in recent years due to commercial fishing activities. Indeed, this report clearly highlights the plight of several deepwater shark species, which are highly vulnerable to over-exploitation, even more so than coastal and epipelagic species. This is due to their slower growth and reproductive rates, lower biomasses compared to shelf species, and the limited productivity and geographic constraints of cold, deepsea environments. Few marine animals have lower international fisheries management priority than deepsea chondrichthyans, yet commercial development of new deepsea fisheries is increasing as pelagic and inshore demersal stocks decline and fleets move further offshore and into deeper water. It is possible that deepsea fisheries could drive some bathyal chondrichthyans (particularly endemics) to extinction before management can be implemented, and possibly even before the species have been seen and described by researchers (Compagno and Musick, in press).

Other Critically Endangered species include the Bizant river shark *Glyphis* sp. A and the northern river shark *Glyphis* sp. C. These rare species are predominantly confined to freshwater and brackish water systems, and their apparently small populations are threatened by fishing activities (as bycatch) and possible habitat degradation. The rare Pondicherry shark *Carcharhinus hemiodon* has not been recorded for over 20 years despite surveys in much of its range, and is now considered to be Critically Endangered. The grey nurse shark *Carcharias taurus*, whilst considered a globally Vulnerable species, is Critically Endangered on the east coast of Australia where severe declines in abundance have been documented. Numbers of grey nurse sharks in New South Wales are now very low, probably numbering less than 500 and possibly as low as 300 individuals. Isolated populations of such species with discrete geographical boundaries can be threatened with extinction at the population level, despite being less threatened on an overall global basis.

Species identified as Endangered (meaning the species is "facing a very high risk of extinction") include two species of deepwater sharks, the Endeavour dogfish *Centrophorus moluccensis* and the shortspine spurdog *Squalus mitsukurii*. These assessments are for the Australian populations of these species, where dramatic declines have been documented in parts of their ranges due to commercial fishing activities. However, due to taxonomic complexities, these species are Data Deficient on a global basis, pending further review. The five sawfish species occurring in the AO region were already listed as Endangered globally on the 2000 Red List, as was the endemic Maugean skate *Raja* sp. L.

Vulnerable species (those considered to be "facing a high risk of extinction") include the Papuan epaulette shark *Hemiscyllium hallstromi* and the hooded carpet shark *H. strahani*: carpet sharks with very restricted ranges in New Guinea, facing increasing pressure in their coral reef habitats which are being heavily impacted by pollution and destructive fishing. The spotted wobbegong *Orectolobus maculatus* and banded wobbegong *O. ornatus,* two endemic species caught in commercial and recreational fisheries, both as target and bycatch, have declined by >60% (the two species combined) between 1990–2000 off the east coast of Australia (New South Wales), and have been assessed as Vulnerable in this area (and Near Threatened Australia-wide). The shark ray *Rhina ancyclostoma*, white-spotted guitarfish *Rhynchobatus australiae*, smoothnose wedgefish *R. laevis* and giant shovelnose ray *Rhinobatos typus* have all been listed as Vulnerable globally due to significant population depletions. They are threatened by fisheries, both as target species (their fins are of exceptionally high value, and their flesh is marketed in Asia) and as bycatch, and by habitat destruction. They are considered Near Threatened in Australia where there are no target fisheries, however the situation must be closely monitored given their vulnerability. The regional endemic estuary stingray *Dasyatis fluviorum* has also been classified as Vulnerable on the basis of a significant range contraction

and decline in abundance off New South Wales and southern Queensland where it was once extremely common. This is thought to be due to a combination of inshore human activities due to the species' reliance on shallow tidal and mangrove habitats, particularly within estuaries and rivers.

Near Threatened Species
Many of the species assessed currently fall into the Near Threatened category (see Annex IV for the summary list). This reflects sufficient concern that they are close to qualifying for, or are likely to qualify for a threatened category in the near future. For example, there is concern for several species in this category that are taken as bycatch by commercial fisheries, yet may be unable to withstand continued exploitation pressure. These include the sharpnose sevengill shark *Heptranchias perlo*, eastern sawshark *Pristiophorus* sp. A., whitish catshark *Apristurus albisoma*, whitefin swell shark *Cephaloscyllim* sp. A., blackspot shark *Carcharhinus sealei* and the Kapala stinagaree *Urolophus* sp. A. In many of the cases in this category there is insufficient evidence of fishing activity at levels that would lead to a significant decline in range, habitat quality or number of individuals. However, it is essential that these species are monitored closely, and where possible action should be taken to avoid their movement into threatened categories.

Data Deficient Species
Although efforts were made to avoid this category by utilising all data available at the time of the Workshop, more than 25% of the species (regional and global) were classified as currently Data Deficient, with inadequate information available on their distribution and/or abundance to make a direct or indirect assessment of their extinction risk. However, as noted by Pogonoski *et al.* (2002), in some instances Data Deficient species are in need of relatively urgent action. It is important to direct research efforts and funding towards these species as well as those in the threatened categories. This is particularly important when there is a threat that has been identified yet where there are virtually no available data on population sizes or biological parameters. Several deepwater species posed a particular dilemma at the Workshop – are they rare, or just rarely caught and documented? For many of these, the category Data Deficient was assigned, regionally and globally, despite concerns that deepwater sharks appear to be among the most vulnerable of species to depletion as a result of fisheries exploitation, even if only taken as bycatch. Others that were listed as Data Deficient on a global basis at this Workshop include some wide-ranging and relatively common species, with a well-understood biology and some regional fisheries data (such as some of the carcharhinids). In these cases it was the wide-ranging nature of these species and lack of data from significant areas of their range that prevented the group from reaching a global assessment; additional regional workshops should be able to resolve these issues. Species with unresolved taxonomic problems may also have been assessed as Data Deficient, regionally and/or globally, particularly where there is uncertainty regarding a species' occurrence within a particular region.

Least Concern Species
This category includes all species not considered to be under any threat of extinction now or in the foreseeable future. Species may of course benefit from conservation and management action even if listed as Least Concern. Over a third of the species assessed were considered to be Least Concern (regional and global). Many of these species are generally abundant and/or widespread, occur primarily in protected areas or areas with limited fishing pressure (e.g. some of the lantern sharks), are not particularly susceptible to fisheries (e.g. some of the small carpet sharks) or are taken primarily by well-managed fisheries. It is worthy of note that some of the species are Least Concern in Australia and New Zealand, but threatened or Near Threatened in South East Asia or globally, due to differing threats and pressures affecting their populations.

Regional threatened species lists and management

The *Conservation Overview and Action Plan for Australian Threatened and Potentially Threatened Marine and Estuarine Fishes*, commissioned by Environment Australia (Pogonoski *et al.* 2002), provides a national overview of threatened and potentially threatened marine and estuarine fishes, including the assessment of selected taxa using the IUCN Red List Categories and Criteria (note: the 1994 system was used), the identification of threats to these taxa, and recommended conservation actions. In terms of chondrichthyan species, the *Conservation Overview* built on the IUCN SSG assessments published in the 2000 Red List (detailed accounts are in the IUCN SSG *Global Status Report for Chondrichthyan Fishes*, Fowler *et al.* in press), plus some endemic Australian species. The *Conservation Overview* included 52 sharks and rays, with detailed species assessments for 33 of these. It highlighted 13 species as being threatened (Critically Endangered, Endangered or Vulnerable) and therefore of conservation concern. Thus, this regional Red List Workshop has served as a useful follow up to the information presented in the *Conservation Overview* by adding to the knowledge of those species addressed in it and in the above-mentioned *Status Report*. Table 2 provides a comparison between species assessed at the Workshop which differ from those in the *Conservation Overview.* This Workshop report includes more recent information, together with the assessment of many regional endemics that were not considered in the *Conservation Overview* and the *Status Report*. In the context of the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* and threatened species listings, this report aims to contribute to the recovery of species of conservation concern.

This report also complements and expands on New Zealand Department of Conservation efforts to determine the threatened species status of plants and animals (Hitchmough 2002; Molloy *et al.* 2002). The New Zealand threat classification system listed 65 shark, 21 batoid and 12 chimaeroid taxa. Of the sharks, two species (the white shark *Carcharodon carcharias* and the basking shark *Cetorhinus maximus*) were listed as "gradual decline", 13 as "sparse", 15 as "data deficient", 30 as "not threatened", four as "migrants" and one as "vagrant". For the batoids, seven were assessed as "data deficient", 13 as "not threatened" and one as "migrant". Two chimaeroids were assessed as "data deficient", and the remaining ten as "not threatened" (C. Duffy, pers. comm.).

Compared with most other countries, some of Australia and New Zealand's shark populations are among the best-managed and well-studied in the world. There are established research and monitoring programmes in some shark fisheries with regular stock assessments. Several of the fisheries are managed using individual transferable quotas (ITQs) and/or effort controls. Australia is one of the few nations with a Shark Assessment Report (SAR) (Rose and SAG 2001) and a National Plan of Action for Sharks

Table 2. Comparison between species assessments in the *Conservation Overview and Action Plan* (Pogonoski *et al.* 2002) and those undertaken at the AO Red List Workshop.

Species	Pogonoski *et al.* 2002 (Australia only)	AO Red List Workshop 2003 (Global* assessment unless stated)
Carcharias taurus	EN	VU (Australia): CR (NSW), NT (WA)
Glyphis sp. C	EN	CR
Centrophorus harrissoni	EN	CR
Centrophorus uyato	VU	CR (Australia), DD (global)
Furgaleus macki	CD	LC
Galeorhinus galeus	CD	VU (Australia), NT (New Zealand)
Pristiophorus cirratus	CD	LC
Odontaspis ferox	NT	VU (Australia), DD (global)
*Rhynchobatus djiddensis***	LC	*R. australiae*: NT (Australia), VU (global), *R. laevis*: NT (Australia), VU (global)
Orectolobus ornatus	DD	VU (NSW), NT (global)
Orectolobus maculatus	DD	VU (NSW), NT (global)
Dasyatis fluviorum	NT	VU

Note: This table only includes species assessed at the AO Red List Workshop which differ from the assessments in Pogonoski *et al.* (2002). It does not include those previously assessed for the 2000 Red List (with the exception of those updated at the Workshop), which are discussed in Pogonoski *et al.* (2002).

The differences between categories assigned to species by Pogonoski *et al.* (2002) and those assigned at the AO Workshop are the result of additional available data and increased knowledge on particular species, recent changes to the Red List categories and criteria (Version 3.1) and/or the resolution of taxonomic issues.

*For endemic species, the assessment for Australia is considered the 'global' assessment (see Editors' Notes).

**The species previously referred to as the wide-ranging *Rhynchobatus djiddensis* is a species complex of at least four species (L.J.V. Compagno, pers. comm.), two of which are presently known from the AO region, *R. australiae* and *R. laevis*.

(NPOA) (Shellack and SAG in press) under the guidelines of the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). Several species that are of considerable conservation concern elsewhere in their range are assessed as 'Least Concern' in the regional assessments presented here. It is also evident from this report, however, that even this level of management effort has not prevented some serious stock depletions among both bycatch and target species, the latter including stocks that have been the focus of some of the longest-running management programmes in the world. The research and management of fisheries in other nations in this region is, in contrast, extremely limited. Many of the island nations in the Pacific have traditional fisheries that capture sharks and the increased demand for fins in Asian markets has resulted in increased exploitation in many of these areas. Widespread degradation from pollution and destructive fishing methods is apparent throughout some areas of the region's extensive coral reef environments. Large-scale pelagic fisheries also exist in both the Pacific and Indian Ocean segments of this region. Some nations such as Fiji have expressed intent to implement the IPOA-Sharks, although most nations have not yet indicated a willingness to develop management plans for their chondrichthyan fauna (IUCN SSG/TRAFFIC 2002a, 2002b, Fowler and Cavanagh in press).

Future work

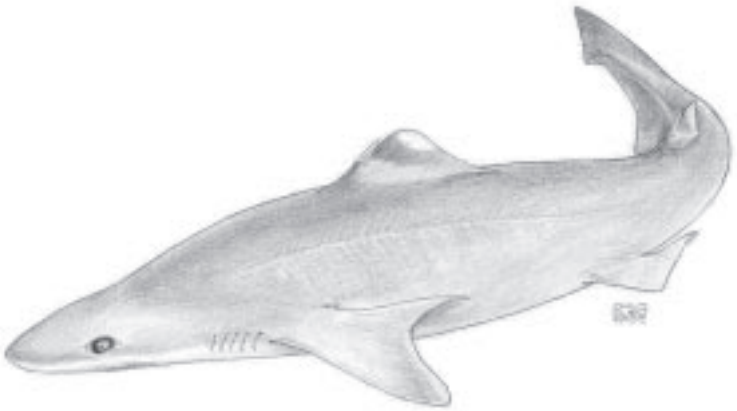
This report presents the latest information available at the time of printing, for the conservation assessment of all regional endemic shark species, together with many widespread shark species and regional batoid and chimaera species. Despite these efforts, it is apparent that our knowledge of the status of most of the known species of chondrichthyan fishes is still seriously limited. In addition, most of the global assessments are awaiting further input and are subject to change in the near future. The ultimate aim of this report is to make the outcomes of this Workshop, the first in the current series, readily and quickly available, as many of these assessments form the baseline for future work in the AO region, some of which is urgent.

Future regional SSG workshops that will take place in 2003 in South America (Brazil), southern Africa (South Africa) and Europe (San Marino) will continue to work on the standardisation and clarification of the global assessments presented here, in addition to adding new regional species. Additionally, deepwater chondrichthyans will be assessed during the joint FAO/SSG meeting on the 'Conservation and Management of Deepsea Chondrichthyan Fishes', in conjunction with Deepsea 2003 in New Zealand, and batoids will be assessed at an SSG 'Batoid Red List Workshop' planned for early 2004. The Red List assessments presented here will, therefore, continually be updated as new information is obtained. All additions and revisions will be incorporated in the regularly updated Red List database held at the World Centre for Conservation Monitoring, Cambridge, UK. For this reason, readers are urged always to consult the current Red List (http://www.redlist.org), which is updated every year, to obtain the most up to date assessments.

Comprehensive assessment and regular re-assessment of all chondrichthyan fishes using IUCN's Red List Categories is one of the SSG's most important tasks. It is so important because it will, for the first time, establish a baseline against which to monitor future changes in the global and regional status of chondrichthyan fishes and improvements in our scientific knowledge of this group. This information will be a powerful tool with which to promote improvements in the management of these biologically-vulnerable species and the research necessary to deliver successful management.

Literature

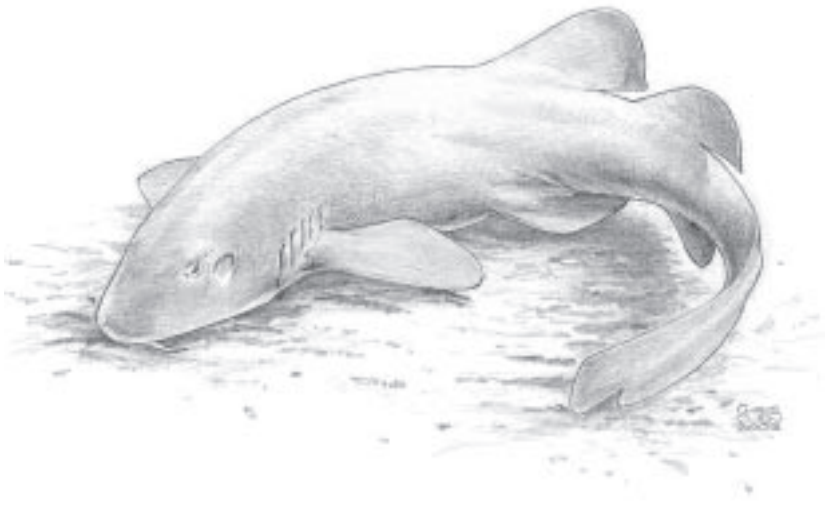
Baillie and Groombridge (1996); Compagno and Musick (in press); Cox and Francis (1997); Fowler (1996); Fowler and Cavanagh (in press); Fowler *et al.* (in press); Hilton-Taylor (2000); Hitchmough (2002); IUCN (2001); IUCN SSG/TRAFFIC (2002a, 2002b); Last and Stevens (1994); Mace (2000); Molloy *et al.* (2002); Musick (1999a, 1999b; in press); Pogonoski *et al.* (2002); Rose and SAG (2001); Shellack and SAG (in press).



Part 1

Red List Assessments

Sharks



ORDER **HEXANCHIFORMES**

FAMILY **CHLAMYDOSELACHIDAE**

Frilled Shark

Chlamydoselachus anguineus Garman, 1884

Larry J. Paul and Sarah L. Fowler

Red List assessment **Global: Near Threatened**

Rationale A generally rare to uncommon deepwater species, with a few localities where it is taken more commonly as bycatch in several fisheries. Not an important target species, but a regular though small bycatch in many bottom trawl, midwater trawl, deep-set longline, and deep-set gillnet fisheries. As bycatch, this species is variously used for meat, fishmeal, or discarded. Occasionally kept in aquaria (Japan). There is some concern that expansion of deepwater fishing effort (geographically and in depth range) will increase the levels of bycatch. Although little is known of its life history, this deepwater species is likely to have very little resilience to depletion as a result of even non-targeted exploitation. It is classified as Near Threatened due to concern that it may meet the Vulnerable A2d+3d+4d criteria.

Distribution **Regional: Australia (NSW and TAS) and New Zealand.**
Global: Wide-ranging in most tropical and temperate oceans, but apparently with a patchy distribution. Generally rare, only a few localities where it is more common.
FAO Areas 27, 31, 34, 47, 51, 61, 77, 81 and 87.

Habitat and ecology Marine, demersal or benthopelagic, reported as occasionally pelagic on the upper and middle continental slope, 100–1,500m, usually 500–1,000m. Maximum size ~196cm TL (female), size at maturity 97–117cm TL (male), 135–150cm TL (female). Ovoviviparous with 6–12 pups per litter, size at birth 40–60cm TL, possibly a long gestation period but life cycle basically unknown.

Threats Not a targeted fisheries species, but taken as bycatch in bottom and midwater trawls, deep-set longlines, and in deep-set gillnets. No population baseline or trends available. Some concern that increased deepwater fishing effort (geographically and in depth range) may increase levels of bycatch. The bycatch is sometimes utilised for fishmeal and for meat. Occasionally kept in aquaria (Japan).

Conservation measures None.

Literature Bass (1979); Compagno (1984a); Gudger and Smith (1933); Kubota *et al.* (1991); Last and Stevens (1994); Nakaya and Bass (1978); Roedel and Ripley (1950); Stewart (2000); Tanaka *et al.* (1990); Tumokhin (1980); Uyeno *et al.* (1983).

FAMILY **HEXANCHIDAE**

Sharpnose Sevengill Shark

Heptranchias perlo (Bonnaterre, 1788)

Larry J. Paul and Sarah L. Fowler

Red List assessment **Global: Near Threatened**

Rationale A wide ranging, but relatively uncommon species where it occurs. Its centres of abundance may be at outer shelf, slope, and oceanic seamounts where commercial fisheries for other target species are likely to develop. It is likely to have a low intrinsic rate of increase, and poor resilience to depletion. This species is of minor commercial importance, but bycatch in bottom trawl and longline fisheries may have caused population declines where deepwater fisheries have been underway for several decades. Increased deepwater fishing effort in many regions is likely to affect populations in the future. The species is assessed as Near Threatened due to concern that it may meet the Vulnerable A2d+3d+4d criteria.

Distribution

Regional: Australia (from Cairns, QLD around the southern coast to Ashmore Reef, WA) and New Zealand.
Global: Wide-ranging but somewhat patchy distribution in tropical and temperate seas except Eastern North Pacific.
FAO Areas 27, 31, 34, 37, 41, 47, 51, 57, 61, 71 and 81.

Habitat and ecology

Marine, demersal to semi-pelagic, probably ranging well into midwater, on the upper continental slope, most commonly taken in 300–600m, sometimes deeper, recorded to 1,000m. Possibly aggregated near seamounts. Occasional reports from shallow water are possible misidentifications. Maximum size ~140cm TL, size at maturity 75–85cm TL (male), 90–105cm TL (female). Ovoviviparous, 6–20 pups/litter, size at birth 25cm TL. May breed year-round, but gestation time and reproductive periodicity unknown. Otherwise, there is virtually no information on its biology.

Threats

Caught in small to moderate numbers as a bycatch of fisheries utilising bottom or midwater trawls, or as part of deepwater fisheries using bottom longlines to catch sharks or tilefish (Gulf of Mexico), but of minor commercial importance. Used for human consumption and presumably for fishmeal. Occasionally kept in captivity in Japan. Even if not retained is likely to be killed. Population status uncertain, but it is suspected that declines may have occurred in places where deepwater demersal trawl fisheries for shrimp and bony fishes have been operational over the past few decades (such as southern Mozambique). This shark is wide-ranging but relatively uncommon in most places where it occurs, and is taken by a wide variety of demersal fisheries. There are no data available on current and past catches, and species-specific catch data are needed.

Conservation measures

None.

Literature

Bass *et al.* (1975b); Capapé (1980); Compagno (1984a); Cortés (1999); Garrick and Paul (1971a); Halstead *et al.* (1990); Last and Stevens (1994); Sierra *et al.* (1994); Stewart (2002); Tanaka and Mizue (1977); Uiblein *et al.* (1999).

Bluntnose Sixgill Shark

Hexanchus griseus (Bonnaterre, 1788)

Sid F. Cook and Leonard J.V. Compagno

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

A valuable food and sports fish, the species seems unable to sustain target fisheries and is taken as bycatch (e.g. in *Centrophorus* liver oil fisheries now underway over large areas of the Indo-Pacific). Fisheries activity in parts of its range, including the Northeast Pacific, have led to the depletion of regional populations, some of which may be Vulnerable (A1bd+2bd). However, because population and fisheries data are lacking from many regions, a worldwide population depletion of over 20% is not proven for this widespread species.

Literature

Cook and Compagno (In: Fowler *et al.* in press).

Bluntnose Sevengill Shark

Notorynchus cepedianus (Péron, 1807)

Leonard J.V. Compagno

Red List assessment

2000 Red List assessment:
Global: Data Deficient
Eastern Pacific: Near Threatened

Rationale

Although wide-ranging and moderately common (where not heavily exploited), this shark is restricted to a limited inshore depth range in heavily fished temperate waters and is exposed to intensive inshore fisheries over most of its range. The central California stock in the San Francisco Bay area is thought to have been depleted in the early 1980s, but lack of fisheries data elsewhere makes it impossible to determine whether this pattern of depletion occurs throughout its range.

Bramble Shark

Echinorhinus brucus (Bonnaterre, 1788)

Larry J. Paul

Red List assessment **Global: Data Deficient**

Rationale An apparently rare deepwater shark, recorded sporadically and usually singly at widely dispersed localities. It may be present at greater depths than are commercially fished, but this is only speculative. It reaches a large size and, although very little is known of its life history, it is likely to be a slow-growing, late-maturing species of low overall productivity. In the Northeast Atlantic there is published qualitative information on a decline in this species over recent decades. At present there is inadequate information to assess the conservation status of this species, however, since it is a known (albeit infrequent) component of fisheries bycatch with probable limiting life history characteristics and likely rare status, the species may well meet the criteria for a threatened category as more information becomes available.

Distribution **Regional: Australia (VIC and the Great Australian Bight); New Zealand.**
Global: Wide-ranging but apparently patchy distribution, in temperate and some tropical waters. Apparently absent from the Eastern Pacific.
FAO Areas 21, 27, 31, 34, 41, 47, 51, 61, 71 and 81. Possibly 51 and 71.

Habitat and ecology This species lives on or near the seafloor, on the upper and middle continental slope, mainly in 400–900m (based on relatively few captures) but has also been taken in shallower water. Maximum size ~310cm TL, size at maturity ~160cm TL (males), ~200cm TL (females). Ovoviviparous with 15–25 pups/litter, size at birth 30–90cm TL, gestation period and reproductive cycle unknown. Otherwise, almost nothing is known of the species' biology.

Threats Although rarely encountered, almost certainly an unreported bycatch in several deepwater trawl and line fisheries. Reportedly only used for fishmeal, but the liver oil has been used medicinally in at least South Africa. No population baseline or trends available, apart from a reported reduction in numbers in the Northeast Atlantic (Quero and Emmonnet 1993; Quero and Cendrero 1996; Quero 1998).

Conservation measures None.

Literature Barcellos and Pinedo (1980); Compagno (1984a); Garrick (1960a); Last and Stevens (1994); Musick and McEachran (1969); Quero (1998); Quero and Cendrero (1996); Quero and Emonnet (1993); Silas and Selvaraj (1972); Stewart (2001).

Prickly Shark

Echinorhinus cookei Pietschmann, 1928

Larry J. Paul

Red List assessment **Global: Near Threatened**

Rationale A rare deepwater shark, known only from the Pacific Ocean. It may be present and more widely dispersed at greater depths than are presently fished, but this is only speculative. It appears to be vulnerable to deepwater trawling and line fishing and, as these fishing activities increase, there is potential for ongoing reduction of what may be a small fragmented population with low resilience to fisheries.

Distribution **Regional: Australia, where it is known only from VIC (Last and Stevens 1994) and a recent record off North QLD (M. Cappo, pers. comm.) and New Zealand.**
Global: Known from several widely separated localities in tropical and temperate waters of the Pacific Ocean. Apparently absent from the Atlantic and Indian Oceans.
FAO Areas 57, 61, 71, 77 and 81.

Habitat and ecology This demersal species occurs on the upper and middle continental slope, at depths of 10–400m, possibly to 1,500m. Recent QLD specimen was captured at about 500m. The shallow records are from submarine canyons, in particular Monterey Canyon (California), where there is a notable, and possibly unique, localised abundance. Maximum size ~400cm TL, size at maturity180–200cm TL (male), 250–300cm TL (female). Ovoviviparous, up to 114 pups per litter have been recorded, size at birth 40–45cm TL. Gestation period and reproductive cycle unknown. Life history generally very poorly known.

Threats A bycatch in some deepwater line and trawl fisheries which will continue as these expand in geographic area and depth range.

Conservation measures None.

Literature Aguirre *et al.* (2002); Chavez-Ramos and Castro-Aguirre (1974); Compagno (1984a); Crane and Hein (1992); Crow *et al.* (1996); Garrick (1960a); Garrick and Moreland (1968); Golovan' and Pakhorukov (1986); Last and Stevens (1994); Melendez and Meneses (1986); Miller and Lea (1972); Stewart (2001); Taniuchi and Yanagisawa (1983); Varoujean (1972).

FAMILY **SQUALIDAE**

Mandarin Shark

Cirrhigaleus barbifer Tanaka, 1912

William T. White

Red List assessment **Global: Near Threatened**

Rationale *Cirrhigaleus barbifer* is found in Japan, Torres Island (Vanuatu), Indonesia, New Zealand and TAS and NSW in Australia, and appears to be locally rare (which may be a natural characteristic of this species). Very little is known about the biology of this species, however its productivity is presumably low. The long dorsal-fin spines and probable slow moving lifestyle of this species make it highly vulnerable to fishing activities involving nets and trawls within its known range and habitat. *Cirrhigaleus barbifer* has a wide distribution, but the extent of occurrence appears to be highly fragmented with extremely low numbers of mature individuals. This species may meet Vulnerable criterion B2a and possibly even C1, however, there is no direct evidence to suggest that populations of this species are in decline due to the low numbers observed within its range and its apparent absence from deepwater fisheries in some areas. Further investigation into populations and range of this species is necessary.

Distribution **Regional: Torres Island in Vanuatu, New Zealand and Australia (TAS and NSW).**
Note: *Cirrhigaleus barbifer* appears to be locally rare which may be a natural characteristic of this species. For example, only three specimens have been recorded off New Zealand (the Bay of Plenty and Gisborne) despite a large deepwater trawl fishery (scampi and fish) occurring throughout New Zealand waters (Garrick and Paul 1971).
Global: Patchy distribution in the western Pacific Ocean.
FAO Areas 61, 71 and 81.

Habitat and ecology *Cirrhigaleus barbifer* is demersal on the uppermost continental and insular slopes, and probably the outer continental-insular shelves at depths of 146–640m (Compagno and Niem 1998a). This stout-bodied species is reported to attain 126cm TL; matures at ~85cm TL (males) and ~110cm TL (females) (Last and Stevens 1994). However, one 99cm TL female observed in Lombok (eastern Indonesia) was pregnant with late-term embryos (W. White, pers. obs.). Ovoviviparous, with one female specimen caught in New Zealand possessing 10 embryos (five per uterus), ~8.5cm TL. There is no available information on reproductive biology, age and growth or natural mortality of this species.

Threats The two long dorsal-fin spines make this species particularly vulnerable to nets and trawls. The very stout body of this species also most likely reflects a slow moving lifestyle thus making net and trawl evasion more difficult. This would make this species particularly vulnerable in areas where such fishing activities are common, e.g. in eastern

Indonesia and New Zealand. Although not utilised commercially at present, the liver is high in squalene oil and is often of high value particularly to artisanal fisherman. The apparent low numbers of this species within its known range may be a result of the above factors, however, this species may have naturally low populations and more data are necessary.

Conservation measures None.

Literature Compagno (1984a); Compagno and Niem (1998a); Cox and Francis (1997); Garrick and Paul (1971b); Japan International Cooperation Agency (1987); Last and Stevens (1994); Shen (1993).

Bartail Spurdog

Squalus sp. A [Last & Stevens, 1994]

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale This undescribed dogfish is likely to be rare or uncommon. Its current known distribution is off northeastern Australia where it is known from only a few specimens. This area has minimal fisheries although future expansion of fisheries here could pose a threat to the species. The biology is poorly known, though it is likely to have the limiting life history characteristics similar to other deepwater shark species. At present there is inadequate information to assess the conservation status of this species.

Distribution **Regional endemic: Northeastern Australia, off QLD, between Cairns and Rockhampton.**
FAO Area 71.

Habitat and ecology This species is known only from a few specimens collected off QLD from a depth range of 220–450m. The largest specimen caught was a 62cm TL male. Biology is virtually unknown. This species may be rare or uncommon.

Threats Any future development of deepsea trawl fisheries off the northeast coast of Australia could pose a threat to this species as it would be susceptible to being caught as bycatch.

Conservation measures None.

Literature Compagno (in prep. a); Last and Stevens (1994).

Eastern Highfin Spurdog

Squalus sp. B [Last & Stevens, 1994]

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale This undescribed dogfish occurs in eastern Australian waters. Its main known range is in an area with minimal fisheries although future expansion of deepsea trawl fisheries could pose a threat. The biology is virtually unknown though it is likely to have the limiting life history characteristics similar to other deepwater shark species. At present there is inadequate information to assess the conservation status of this species.

Distribution **Regional endemic: Eastern Australia (from the upper continental slope between the Queensland Plateau off Cairns, QLD to Bermagui area, NSW).**
FAO Areas 71 and 81.

Habitat and ecology Found on the upper continental slope at depths from 240–450m. Range is currently uncertain. This species may be rare or uncommon, and its biology is virtually unknown. It attains at least 65cm TL; the smallest mature male examined was 62cm TL.

Threats This species is not thought to be abundant off central and southern NSW, and their occasional capture in the NSW trawl fishery is unlikely to have much impact on the

main population (presumably to the north) (K. Graham, pers. comm.). Future development of deepsea trawl fisheries in this area could pose a threat.

Conservation measures None.

Literature Compagno (in prep. a); Graham *et al.* (1997); Last and Stevens (1994).

Western Highfin Spurdog

Squalus sp. C [Last & Stevens, 1994]

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment **Global: Data Deficient**

Rationale Virtually nothing is known of the biology of this undescribed dogfish, though it is likely to have the limiting life history characteristics similar to other deepwater shark species, thus will not be sufficiently fecund to withstand high levels of exploitation. It occurs on the continental slope off WA with a known depth range of 220–510m. This area is subject to the North West Slope Trawl and Western Deepwater Trawl fisheries. Although there has been no assessment of the effect on the non-target bycatch species of these fisheries, which will likely include *Squalus* sp. C, fishing effort is small with only a few boats in operation. The lack of data on the species biology, extent of occurrence, population size, or any indicator of population trend warrants a Data Deficient assessment at this time.

Distribution **Regional endemic: Australia, continental slope off WA (from off Rottnest Island to North West Cape).**
FAO Area 57.

Habitat and ecology The biology of this dogfish is essentially unknown. It occurs at depths of 220–510m, and often aggregates by sex. Maximum size at least 78cm TL, with males maturing at ~56cm TL.

Threats Likely to be caught as bycatch of the North West Slope Trawl and Western Deepwater Trawl fisheries, but these fisheries are small with only a few boats in operation. Although details on bycatch are currently unavailable, given the low fishing effort it is unlikely the impact is cause for concern for this species at the present time.

Conservation measures None.

Literature Compagno (in prep. a); Harris and Ward (1999); Last and Stevens (1994).

Fatspine Spurdog

Squalus sp. D [Last & Stevens, 1994]

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment **Global: Data Deficient**

Rationale Very little is known of the biology of this undescribed dogfish, which occurs on the upper continental slope off northwestern Australia with a known depth range of 180–210m. At depths below 200m this area is fished by the North West Slope Trawl and Western Deepwater Trawl fisheries. Based on its known depth range, *Squalus* sp. D is unlikely to be a significant component of the bycatch of these deepwater fisheries, although information is sparse and it is highly likely that the distribution and range of this species is wider than current knowledge suggests. In addition, fishing effort is small with only a few boats operating in these fisheries, and it is unlikely the impact is cause for concern for this species at the present time. The current known range of this species is an area <10,000km^2, thus it may qualify for Vulnerable under B1, but the lack of data on the species' biology (though it is likely to have the limiting life history characteristics similar to other deepwater shark species), details on its extent of occurrence, population size, or any indicator of population trend warrants a Data Deficient assessment at this time.

Distribution **Regional endemic: Upper continental slope off northwestern Australia (from Port Hedland to North West Cape, WA).**
FAO Area 57.

Habitat and ecology Known to occur on the upper continental slope at depths of 180–210m. The biology of this medium-sized dogfish is essentially unknown. Maximum size ~56cm TL, with males maturing at ~44cm TL.

Threats On the basis of its known depth range, this species is unlikely to be a significant component of the bycatch of the North West Slope Trawl and Western Deepwater Trawl fisheries since they operate at depths below 200m. However, although it is likely that the distribution and range of this species is wider than is currently known, and it may occur well within the depth range of these fisheries, fishing effort is small with only a few boats in operation, and it is unlikely the impact is cause for concern for this species at the present time.

Conservation measures None.

Literature Compagno (in prep. a); Harris and Ward (1999); Last and Stevens (1994).

Western Longnose Spurdog

Squalus sp. E [Last & Stevens, 1994]

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment **Global: Data Deficient**

Rationale Little is known of the biology of this undescribed dogfish though it is likely to have the limiting life history characteristics similar to other deepwater shark species, thus will not be sufficiently fecund to withstand high levels of exploitation. It occurs on the continental slope off WA with a depth range of 300–510m. This area is subject to the North West Slope Trawl and Western Deepwater Trawl fisheries. Although there has been no assessment of the effect on the non-target bycatch species of these fisheries, which will likely include *Squalus* sp. E, fishing effort is small with only a few boats in operation. The lack of data on the species' biology, extent of occurrence, population size, or any indicator of population trend warrants a Data Deficient assessment at this time.

Distribution **Regional endemic: Australia, continental slope off WA, from the Scott Reef to Perth.**
FAO Area 57.

Habitat and ecology Known to occur on the continental slope at depths of 300–510m. The biology of this dogfish is essentially unknown. Unlike most spurdogs, which occur in schools, it appears to be solitary. It reaches at least 56cm TL, with males maturing at ~50cm TL.

Threats The area and depth range at which this species is known to occur falls within the areas of the North West Slope Trawl and Western Deepwater Trawl fisheries. However, fishing effort is small with only a few boats in operation, and although details on bycatch are currently unavailable, given the low fishing effort, it is unlikely the impact is cause for concern for this species at the present time.

Conservation measures None.

Literature Compagno (in prep. a); Harris and Ward (1999); Last and Stevens (1994).

Eastern Longnose Spurdog

Squalus sp. F [Last & Stevens, 1994]

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment **Global: Near Threatened**

Rationale This undescribed deepwater dogfish would qualify for Critically Endangered based on application of the criteria to part of its range studied off NSW, Australia with documented

declines of as much as 97% between 1976–77 and 1996–97. Indeed, almost all trawlable ground on the continental slope off central and southern NSW is regularly fished and is likely to be maintaining continual local pressure on this species. However, this area represents less than 20% of its known range, with the rest to the north where fishery threats are non-existent or minor. Thus *Squalus* sp. F is assessed as Near Threatened, reflecting its wider distribution outside the heavily fished area. However, if specimens are found to occur in other areas exploited by fisheries, and if it is found to have the life history characteristics (low fecundity, slow growth and high longevity) typical of better known squalids, the situation must be re-evaluated.

Distribution

Regional endemic: Continental slope off northeastern Australia, between Cape York and Rockhampton, QLD (Last and Stevens 1994). Also occurs off NSW (Graham *et al*. 2001).
FAO Areas 71 and 81.

Habitat and ecology

The biology of this dogfish is essentially unknown. It occurs at depths of 120–500m. Maximum size ~64cm TL (males), 73cm TL (females). Size at maturity is ~52cm TL (males), and 63cm TL (females). Size at birth possibly ~22cm TL. Litter sizes are usually between 3–5 pups (K. Graham, pers. comm.).

Threats

Almost all trawlable ground on the slope off central and southern NSW is regularly fished maintaining continual fishing pressure on species including *Squalus* sp. F. A documented decline of approximately 97% of 'greeneye dogsharks' (comprising *Squalus mitsukurii* and *Squalus* sp. F) between 1976–77 and 1996–97 between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC) was reported from a fishery independent survey (Graham *et al*. 2001). Total catches in the abovementioned areas in 220–605m (i.e. much of the known depth range of the two species) declined from a mean of 44.8kg h^{-1} in 1976–77 to a mean of 1.2kg h^{-1} in 1996–97. In 1976–77 the two species were caught in approximately equal numbers off Sydney and Ulladulla, thus it is a fair assumption that the decline was roughly equal for both species in these areas. The 1976–77 Eden data suggested 75% or more of the greeneye dogshark catch in the southern area comprised *S. mitsukurii* and thus a relatively small proportion of *Squalus* sp. F. However, in 1996–97 no *Squalus* sp. F were caught off Eden-Gabo Island suggesting that trawling to the north may be preventing recruitment of the species into southern NSW. More than half of the known distribution of this species falls within the area of The Coral Sea Fishery (a Commonwealth managed fishery). This is a very small fishery, with only two operators in the trawl sector with extremely low effort, thus threats to this species from fishing activity in this area are thought to be minimal.

Conservation measures

None.

Literature

Compagno (in prep. a); Graham *et al.* (2001); Last and Stevens (1994).

Piked (Spiny) Dogfish

Squalus acanthias Linnaeus, 1758

Sonja V. Fordham

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

This important and wide-ranging commercial species is particularly vulnerable to overfishing because of its late maturity, low reproductive capacity and longevity. Fished populations in the North Atlantic have a well-documented history of over-exploitation followed by near-collapse, suggesting that Vulnerable might be an appropriate assessment for some regions. However, the species is still landed commercially in significant numbers from target fisheries (some of which are managed) in many parts of the world and is of high value in international trade.

Literature

Fordham (In: Fowler *et al*. in press).

Shortnose Spurdog

Squalus megalops (Macleay, 1881)

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment

Global: Data Deficient*
Australia: Least Concern

Rationale

A common to abundant small dogfish of temperate and tropical seas, this species is of considerable interest to fisheries. It is taken in significant quantities in bottom trawls and also caught with lines and mesh nets. *Squalus megalops* is one of the most abundant chondrichthyan species on the outer continental shelf and upper slope of southern Australia. Its distribution includes some heavily fished areas, for example, off southeast Australia, although significant declines have not been documented to date. It is a minor component of the demersal gillnet fisheries through Bass Strait, off SA and WA. However, *S. megalops* is too small to be readily captured by gillnets, particularly the 6–6.5-inch mesh of shark nets, and there has been no detectable changes in catch rates of this species by commercial shark gillnets in Bass Strait since the 1970s. There are large regions around southern Australia where *S. megalops* is not greatly impacted by fishing, including a large area off the northern west coast which is closed to shark fishing. Consequently, the species is assessed as Least Concern in Australia, but the situation should be monitored because there are recent indications that fishing pressure may be affecting the local abundance of the species in some areas e.g. off Ulladulla, NSW. It should be noted that although currently considered a wide-ranging single species, *S. megalops*, as assessed here, may in fact be an Australian endemic pending further taxonomic studies.

Due to taxonomic uncertainty, the global assessment is Data Deficient pending further study.

Distribution

Regional: Due to unresolved taxonomic problems with this species, *S. megalops* considered in this assessment may in fact be an Australian endemic, occurring in SA, VIC, TAS, WA, NSW and QLD.
Global: Pending a revision of the *S. megalops* complex worldwide, the various nominal records of *S. megalops* and likely synonyms are considered as a single wide-ranging species of temperate and tropical seas, which spans the Eastern Atlantic and Indo-West Pacific.
FAO Areas 27, 37, 47, 51, 57, 61 and 71.

Habitat and ecology

A common to abundant dogfish, found on the inner and outer continental shelves and upper slopes generally on or near the bottom from close inshore down to 732m. Much of the biological information is from South African specimens. Ovoviviparous (aplacental viviparous), with 1–6 pups/litter, but generally two or three. The gestation period is estimated as two years. Adult females are apparently continuously reproductive. Maximum size ~77cm TL, with most smaller than 65cm TL. Size at birth is ~23–25cm TL; size at maturity is ~34–51cm TL (males), 37–62cm TL (females). Age at maturity has been estimated at 22 years (females) and 15 years (males) in the South Africa population (Watson and Smale 1999).

Threats

This species is of considerable interest to fisheries, taken in demersal trawls but also on lines and nets. In Australia, *S. megalops* was shown to be a major component of the catch by a fishery independent trawl survey (Graham *et al.* 2001) between 1976–77 and 1996–97 between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC). However, this species did not follow the general pattern of decline shown by other species of deepwater dogfish, and it appears that the present level of trawling is not adversely affecting *S. megalops*. This could be due to recruitment from the lightly fished outer-shelf areas helping to maintain its overall biomass. Despite this, the situation needs to be monitored due to indications that the relatively heavy fishing pressure off Ulladulla (NSW) is beginning to affect local abundance of this species (athough this is unlikely to markedly affect the entire population). Due to its relatively small size, *S. megalops* has historically not been targeted by trawlers off southeastern Australia, but as catch rates of more traditional species decline, greater exploitation of this species is likely to occur. Along the south coast of Australia, trawl grounds are mainly away from the areas inhabited by this species, and selectivity data indicate that comparatively low numbers are captured in the commercial shark gillnets of 6–6.5-inch mesh-size. There has been no detectable

* This species has been noted as Data Deficient globally on a temporary basis and will be re-assessed when the current taxonomic problems have been resolved.

change in catch rates with 6-inch mesh-size between 1973–76 and 1998–01 in Bass Strait (Walker *et al.* in press). *Squalus megalops* is a very minor component of the temperate WA demersal gillnet fishery (probably <1t/year) and possibly the Commonwealth managed trawl fisheries. The gillnet fishery only operates to the inshore limit of the species' range (i.e. to ~100m depth) and there is a large area off the northern west coast that is closed to shark fishing. Catches are hard to ascertain as dogfish are generally not retained and not identified to species level in either fishery. There is no evidence to suggest a population decline (R. McAuley, pers. comm.).

It is utilised for human consumption in Australia being sold as fresh fillets. Significant quantities of 'greeneye' dogfish, comprising about 80% *S. megalops*, are sold annually through the Sydney Fish Market but sales have declined in recent years (Daley *et al.* 2002). Quantities sold in other Australian markets are small.

Conservation measures None.

Literature Compagno (in prep. a); Daley *et al.* (2002); Graham *et al.* (2001); Last and Stevens (1994); Walker *et al.* (in press); Watson and Smale (1999).

Blacktailed Spurdog

Squalus melanurus Fourmanoir, 1979

Sarah L. Fowler and Bernard Séret

Red List assessment **Global: Least Concern**

Rationale This species is common all around New Caledonia, off the Loyalty Islands, the Chesterfield Archipelago, on the Norfolk Ridge and off Vanuatu. It has been reported from a wide depth range (34–480m) and there is very limited occurrence of deepsea fisheries within much of its range.

Distribution **Regional endemic: Western South Pacific: Common all around New Caledonia, also found off the Loyalty Islands, the Chesterfield Archipelago, on the Norfolk Ridge and off Vanuatu.**
FAO Areas 71 and 81.

Habitat and ecology Occurs on upper insular slopes from 34–480m. A small shark (maximum size ~80cm TL) that bears live young (at least three pups/litter). Biology poorly known. Like better-known members of the genus, it is probably slow to reach maturity with a low intrinsic rate of population increase and resilience to fisheries (this is particularly the case for deepwater species).

Threats Not targeted by deepwater fisheries, but may be taken as bycatch, although deepsea fisheries are very limited in New Caledonia.

Conservation measures None.

Literature Compagno (in prep. a).

Shortspine (Greeneye) Spurdog

Squalus mitsukurii Jordan & Snyder, in Jordan & Fowler, 1903

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment **Global: Data Deficient***
Australia: Endangered A2bd+3d+4bd
New Zealand: Near Threatened

Rationale Due to taxonomic uncertainty the current assessment for *Squalus mitsukurii* considers only the Australasian populations of this species.

Squalus mitsukurii has suffered documented declines of as much as 97% between 1976–77 and 1996–97 in a heavily trawled area off NSW, Australia. However, the category of Endangered (A2bd+3d+4bd) for this species in Australia has been assigned.

* This species has been noted as Data Deficient globally on a temporary basis and will be re-assessed when the current taxonomic problems have been resolved.

This reflects varying levels of fishing pressure on much of the trawlable ground throughout the species' range on the continental slope of southern Australia (from WA to Northern QLD). Fishing pressure is intensive on trawl grounds around south-east Australia, and lower in WA where *S. mitsukurii* was taken as bycatch in a small, short-lived demersal gillnet fishery for *Centrophorus uyato* in the mid-1990s, which ceased due to rapid catch declines; there may be some continuing bycatch in the Commonwealth-managed trawl fishery.

In New Zealand, *S. mitsukurii* has a relatively restricted, disjunct distribution and is fished throughout its range by trawl, set net and longline fisheries, and there are currently no management measures. Research trawl surveys off the west coast of South Island show no trends in relative biomass between 1992 and 2000, but the survey may not be adequately monitoring abundance. *Squalus mitsukurii* is classified as Near Threatened in New Zealand, coming near to (if not actually) meeting Vulnerable criterion A2 and possibly also A3+A4.

Due to taxonomic uncertainty (and lack of quantitative data from elsewhere), this species is currently Data Deficient globally. However, deepwater demersal trawl fisheries are expanding in other parts of its possible range, and with the observed declines described above, together with the knowledge that its biology is similar to other deepwater shark species, this, and related species are not sufficiently fecund to withstand continued exploitation pressure.

Distribution

Regional: Known from Shark Bay (WA) to Townsville (QLD) on the continental slope of southern Australia, off New Zealand and surrounding submarine ridges and seamounts. An apparently separate, small population occurs around the Chatham Islands (Anderson *et al*. 1998).

Global: Range uncertain due to taxonomic uncertainty and erroneous identification. *FAO Areas 57, 71 and 81. Possibly 27, 31, 34, 37, 41, 47, 51, 61 and 77.*

Habitat and ecology

Found near or on the bottom on the continental and insular shelves and upper slopes and on submarine ridges and seamounts at depths of 4–954m, mostly between 100–700m. It is common to abundant where it occurs, often in large aggregations or schools. The wide ranges for the data on biological characteristics available for *S. mitsukurii* strongly suggests a mix of data from a number of species or at least isolated breeding populations. There are considerable differences in size at maturity and in size differences between adult males and females in populations of nominal *S. mitsukurii* in different localities, as well as considerable variation within presumed populations. The specimens from SE Australia mature at ~65–70cm TL (males), 80–82cm TL (females), and have between 7–10 pups/litter (K. Graham, pers. comm.). Maximum size ~81cm TL (males) and 96cm TL (females). The species is ovoviviparous with size at birth ~25cm TL. Across all populations the gestation period may be up to two years. Maximum ages recorded from counting bands on dorsal fin spines (assuming annual bands) were 18 years (males) and 27 years (females). It reaches a maximum size of at least 96cm TL (males) and ~125cm TL (females) and size at birth is ~21–30cm TL.

Threats

Documented declines of approximately 97% of 'greeneye dogsharks' (comprising *Squalus mitsukurii* and *Squalus* sp. F) between 1976–77 and 1996–97 between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC) were reported from a fishery independent survey (Graham *et al*. 2001). Total catches in the abovementioned areas in 220–605m (i.e. most of the known depth range of the two species) declined from a mean of 44.8kg h^{-1} in 1976–77 to a mean of 1.2kg h^{-1} in 1996–97. In 1976–77 the two species were caught in approximately equal numbers off Sydney and Ulladulla, while more than 75% of the Eden catch comprised *S. mitsukurii*. In 1996–97, over 80% (by number) of the much reduced catch of 'greeneye dogsharks' off Sydney and Ulladulla comprised *Squalus* sp. F, suggesting that *S. mitsukurii* was the worse affected of the two species in those areas. In the Eden-Gabo Island area, only a single *S. mitsukurii* was caught in 1996–97 (and no *Squalus* sp. F).

A small number of vessels targeted dogfish (mainly *Centrophorus uyato* with a significant bycatch of *Squalus mitsukurii*) out of Esperance, WA during the mid-1990s for squalene (Daley *et al.* 2002). This fishery was short-lived, due to dramatic declines in catch rates after 2–3 years, and had all but ceased by 1999 (R. McAuley, pers. comm.). Catches were not reported to species level thus precise trends in *S. mitsukurii* catch rates cannot be determined. However, given the fate of the target stock and the similar life-history characteristics of *S. mitsukurii*, it is likely that the stock was impacted to some degree. There is currently a negligible catch of *S. mitsukurii* in the WA demersal gillnet fisheries, as its range is outside that of the fleet. There may be some continuing bycatch in the Commonwealth-managed trawl fishery (small quantities are sold in Australia under the marketing name of 'greeneye dogfish').

In New Zealand, *S. mitsukurii* has a relatively restricted, disjunct distribution and is fished throughout its range by trawl, set net and longline fisheries, and there are currently no management measures. Research trawl surveys off the west coast of South Island show no trends in relative biomass between 1992 and 2000, but the survey may not be adequately monitoring abundance.

Conservation measures None.

Literature Compagno (in prep. a); Graham *et al.* (2001); Last *et al.* (1983); Last and Stevens (1994); Wilson and Seki (1994).

Cyrano Spurdog

Squalus rancureli Fourmanoir, 1978

Sarah L. Fowler

Red List assessment **Global: Near Threatened**

Rationale This species appears to be a Vanuatu endemic with an extremely restricted geographic range near Éfate. Furthermore, all specimens were obtained from a relatively narrow depth band (320–400m). This species fails to meet the 'B' criterion for a threatened category, however, because there is no evidence that its deepwater habitat is threatened or fished heavily, hence no reason to suspect a decline in range, habitat quality or number of individuals.

Distribution **Regional endemic: Range apparently very limited, only known from the vicinity of Éfate, Vanuatu where several specimens have been collected.**
FAO Area 71.

Habitat and ecology Insular slopes, 320–400m depth. Young born at ~24cm TL, three pups/litter. Females mature at ~65cm TL and reach a maximum size ~77cm TL.

Threats Currently of no interest to fisheries. May be taken as bycatch in deepwater trawl fisheries.

Conservation measures None.

Literature Compagno (in prep. a).

FAMILY CENTROPHORIDAE

Gulper Shark

Centrophorus granulosus (Bloch & Schneider, 1801)

Sid F. Cook

Red List assessment *2000 Red List assessment:*
Global: Vulnerable A1abd+A2d

Rationale This widespread species is being heavily fished in deepwater fisheries in the Northeast Atlantic, Northwest Pacific and other regions. Its life history makes it highly vulnerable to over-exploitation and population depletion. The Vulnerable assessment for the gulper shark may well be applicable to most other poorly known deepsea species that are now being exploited by unmanaged expanding fisheries. Studies are required to determine their life history characteristics and other parameters necessary for management.

Literature Cook (In: Fowler *et al.* in press).

Harrisson's Dogfish

Centrophorus harrissoni McCulloch, 1915

John J. Pogonoski and David A. Pollard

Red List assessment

Global: Critically Endangered A2bd+3d+4bd

Rationale

Documented declines of over 99% between 1976–77 and 1996–97 between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC) by a fishery independent trawl research survey. The relatively narrow continental slope habitat of this species (which is fished throughout its entire depth range) suggests that it may now only be present in significant numbers in areas that are non-trawlable. However, as dropline fishers also harvest this species off NSW (under NSW jurisdiction), further pressure may be placed on it in such areas. As with other deepwater sharks, particularly this genus, the low fecundity (1–2 pups maximum, every 1–2 years), high longevity (closely related species live for at least 46 years according to preliminary ageing studies) and probable late age at first maturity of this species not only result in extremely rapid population depletion in fisheries, but also prevent it from quick recovery after such depletion.

Distribution

Regional endemic: Australia (NSW, VIC and TAS). Recorded from off the Clarence River (NSW) southwards to off Maria Island (eastern TAS) (Last and Stevens 1994). Although Last and Stevens (1994) reported *C. harrissoni* from both the east and west coasts of Australia, the west coast form is thought to be a separate taxon (P. Last, pers. comm.). Hence, the known distributional range has been reduced.
FAO Areas 57 and 81.

Habitat and ecology

Demersal on the upper to middle continental slope, mainly in depths of 220–790m (Last and Stevens 1994), although catches have been made as deep as 1,050m (Daley *et al.* 2002). The species has low fecundity (1–2 pups maximum, every 1–2 years), high longevity (closely related species live for at least 46 years according to preliminary ageing studies by Fenton (2001)) and probable late age at first maturity.

Threats

Demersal trawling (SETF) and droplining (NSW Fisheries jurisdiction) along the continental slope within its range. Documented declines in catches of this species of over 99% between 1976–77 (mean catch of 28.8kg h^{-1}) and 1996–97 (mean catch of 0.1kg h^{-1}, a total of only five specimens) between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC) by a fishery independent trawl survey (Andrew *et al.* 1997; Graham *et al.* 1997; Graham *et al.* 2001) in 220–605m (i.e. most of the preferred depth range of this species). *Centrophorus* dogfishes are marketed for their flesh and liver oil (squalene) (Daley *et al.* 2002).

Conservation measures

Recent (January 2003) management changes to the SETF by the Australian Fisheries Management Authority limit the catch of *C. harrissoni* to a maximum of 30kg trunked weight per trip. In addition, livers of *Centrophorus* are not to be retained unless the individual carcasses from which they were obtained are also landed (J. Stevens, pers. comm.). *Centrophorus harrissoni* has also been nominated for listing as an Endangered species on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). If listed as Endangered, the EPBC Act requires that a Recovery Plan be put in place within a three-year period (S. Williams, pers. comm.).

Literature

Andrew *et al.* (1997); Daley *et al.* (2002); Fenton (2001); Graham *et al.* (1997); Graham *et al.* (2001); Last and Stevens (1994).

Endeavour Dogfish

Centrophorus moluccensis Bleeker, 1860

John J. Pogonoski and David A. Pollard

Red List assessment

Global: Data Deficient*
Australia: Endangered A2bd+3d+4bd

* This species has been noted as Data Deficient globally on a temporary basis and will be re-assessed when the current taxonomic problems have been resolved.

Rationale

A fishery-independent trawl survey of the Australian population documented declines of over 95% between 1976–77 and 1996–97 between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC). However, populations of this species in WA waters have not been overfished like those along the east coast of Australia and are therefore not threatened with extinction. Overall population declines in Australian waters have resulted in an Endangered assessment in Australia. The relatively narrow continental slope habitat of this species (which is fished throughout its entire depth range on the east coast of Australia) suggests that it may now only be present in significant numbers in east coast areas that are non-trawlable. However, as dropline fishers also harvest this species off NSW (under NSW jurisdiction), further pressure may be placed on it in such areas. As with other deepwater sharks, particularly this genus, the low fecundity (1–2 pups maximum, every 1–2 years), high longevity (closely related species live for at least 46 years according to preliminary ageing studies) and probable late age at first maturity of this species not only result in extremely rapid population depletion in fisheries, but also prevent it from quick recovery after such depletion.

It is still to be determined whether *Centrophorus moluccensis* may be a different (related) species outside the Australasia region, thus this species is currently Data Deficient globally pending further study. However, deepwater demersal trawl fisheries are expanding in other parts of its potential range, and with the observed declines described above, together with the knowledge that its biology is similar to other deepwater sharks, this, and related species warrant urgent conservation attention globally.

Distribution

Regional: Australia (QLD, NSW, VIC, WA) and New Caledonia.
Global: It is still to be determined whether *C. moluccensis* from outside the Australasia region is in fact a different (related) species.
FAO Areas 51, 57, 61, 71 and 81.

Habitat and ecology

Demersal on the outer continental and insular shelves and upper slopes in 125–820m, but in Australian waters most common in 300–500m (Last and Stevens 1994). Ovoviviparous, mostly with litters of two pups (Last and Stevens 1994). Resilience is very low, minimum population doubling time is more than 14 years (Froese and Pauly 2002). Size at maturity is 69–73cm TL (males) and ~88cm TL (females). Maximum size attained is 86cm TL (males) and 98cm TL (females) (Compagno 1984a; Daley *et al.* 2002). Size at birth is ~31–37cm TL (Daley *et al.* 2002). The species has low fecundity, high longevity (closely related species live for at least 46 years according to preliminary ageing studies by Fenton (2001)) and probable late age at first maturity.

Threats

The species is fished throughout its entire depth range on the east coast of Australia by: (1) Demersal trawling (SETF) in NSW, eastern VIC and SA (Daley *et al.* 2002); (2) Droplining off NSW (NSW Fisheries jurisdiction); and (3) Southeast Non-Trawl Fishery. Documented declines in catches of this species of over 95% between 1976–77 (mean catch 12.3kg h^{-1}) and 1996–97 (mean catch 0.2kg h^{-1}) between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC) by a fishery independent trawl research survey (Andrew *et al.* 1997; Graham *et al.* 1997; Graham *et al.* 2001) in 220–605m (i.e. most of the preferred depth range of this species). The populations of this species in WA waters have not been overfished like those along the east coast of Australia. *Centrophorus* dogfishes are marketed for their flesh and liver oil (squalene) (Daley *et al.* 2002).

Conservation measures

Recent (January 2003) management changes to the SETF by the Australian Fisheries Management Authority limit the combined catch of *Centrophorus* dogfishes to a maximum of 150kg trunked weight per trip. In addition, livers of *Centrophorus* are not to be retained unless the individual carcasses from which they were obtained are also landed (J. Stevens, pers. comm.). *Centrophorus moluccensis* has also been nominated for listing as a Vulnerable species on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). If listed as Vulnerable, the EPBC Act requires that a Recovery Plan be put in place within a five-year period (S. Williams, pers. comm.).

Literature

Andrew *et al.* (1997); Compagno (1984a); Daley *et al.* (2002); Fenton (2001); Froese and Pauly (2002); Graham *et al.* (1997); Graham *et al.* (2001); Last and Stevens (1994).

Taiwan Gulper Shark

Centrophorus niaukang Teng, 1959

Sarah L. Fowler

Red List assessment

Global: Near Threatened

Rationale

Deepwater gulper sharks are highly vulnerable to population depletion through fisheries bycatch because of their highly K-selected biology. This species is very widely, but patchily distributed worldwide. Records are sparse and it is probably not abundant. The virtually complete absence of data on extent of occurrence, population size, or any indicator of population trend might be considered to warrant a Data Deficient assessment, but a Near Threatened assessment reflects widespread concern that bycatch of this biologically highly-vulnerable species has been occurring and will continue to occur in deepwater fisheries, possibly through a significant proportion of this species' range.

Distribution

Regional: Australia and possibly off Papua New Guinea.
Global: Wide, if sporadic, range in the Atlantic and Indo-West Pacific.
FAO Areas 21, 34, 47, 51, 61 and 71.

Habitat and ecology

Occurs on or near the seabed on outer continental shelves and upper slopes at 98–1,000m. Ovoviviparous (aplacental viviparous) with 1–6 (mostly 4–6) pups/litter, size at birth 30–45cm TL. Matures at ~110cm TL (males) to 140cm TL (females) with maximum size ~170cm TL. Although there is limited information on the biology of this species, gulper sharks are considered to have very low rates of population increase.

Threats

Targeted widely (Northeast Atlantic, southern Africa, the Maldives, Australia, China, Taiwan and probably elsewhere) by line and trawl fisheries for its liver oil, which is rich in squalene, and meat for human consumption. Also a bycatch of mixed species deepwater trawl fisheries. Identification problems are compounded by an absence of routine data collection at species level in most of these fisheries. There are no available data on trends in CPUE in most of these fisheries, but where such data are available significant declines have been recorded. Gulper sharks are considered to be very vulnerable to over-exploitation by fisheries. For example, Graham *et al.* (1997) report documented declines of 99.5% in abundance of *Centrophorus* species off southern NSW, Australia, where this species is known to occur in small numbers.

Conservation measures

None.

Literature

Compagno (in prep. a); Daley *et al.* (2002); Graham *et al.* (1997); Last and Stevens (1994).

Leafscale Gulper Shark

Centrophorus squamosus (Bonnaterre, 1788)

William T. White

Red List assessment

Global: Vulnerable A2bd+3bd+4bd
Australia and Oceania: Data Deficient

Rationale

Centrophorus squamosus is an important component of deepwater fisheries (longline and trawl) off Ireland, Spain, Portugal and France. Quantitative CPUE data available for autoline catches in three ICES areas (Northeast Atlantic) show an 80–90% decline in three years, a 67–77% decline in four years and a 20–69% decline in one year. Although these data are for *C. squamosus* and *Centroscymnus coelolepis* combined, these declines together with the acute vulnerability to exploitation of *Centrophorus* species as shown from NSW fishery independent surveys, and the knowledge that *C. squamosus* is the more vulnerable of these two species in terms of life history, leads to this species being assessed as Vulnerable. A stock analysis will be available shortly from the 'DELASS' project in the Northeast Atlantic and more detailed CPUE data throughout its range are required. The flesh and liver are marketed from this species in many areas, e.g. eastern Atlantic and eastern Indonesia. In the latter region *C. squamosus* is landed frequently, but in relatively low numbers and in a very limited artisanal fishery.

The catches of this species in Australia and Oceania are relatively low and do not represent a significant component of the squaloid catches in either southeastern Australia

or New Zealand; but at present there is not enough information to assess it beyond Data Deficient in this region.

Distribution

Regional: Australia (TAS, VIC and NSW) and New Zealand. The distribution for this species is considered to be more widespread in Australia than records suggest (Last and Stevens 1994).
Global: Wide but patchy distribution in the Atlantic, Indian and Pacific Oceans.
FAO Areas 27, 34, 47, 51, 57, 61, 71 and 81.

Habitat and ecology

Centrophorus squamosus is demersal on the continental slopes at depths of 230–2,400m, also pelagic in the upper 1,250m of oceanic water in depths to 4,000m (Compagno and Niem 1998a). This species attains a maximum size ~160cm TL (Compagno and Niem 1998a). Maturity is attained at ~100cm TL (males) and at ~125cm TL (females) (Girard and Du Buit 1999; Clarke *et al.* 2001). *Centrophorus squamosus* is ovoviviparous with 5–8 young born at 35–43cm TL (Last and Stevens 1994; Cox and Francis 1997). There is no apparent seasonal reproductive cycle in males (Girard *et al.* 2000). A study of the age and growth of this species off the Atlantic Slope (off Ireland) provided age estimates of 21–70 years (Clarke *et al.* 2002a), however, the validation of whether the rings were formed annually was not undertaken. This species presumably attains maturity at a relatively late age.

Threats

Centrophorus squamosus is an important component of deepwater fisheries in certain areas within its range. This shark has been exploited commercially for many years. In Japan exploitation peaked during World War II because of the high percentage of squalene in its liver, but quickly declined due to decreasing numbers caught. Deepwater fisheries (longline and trawl) which catch large quantities of this species are found in the eastern Atlantic, e.g. off Ireland, Spain, Portugal and France (Iglesias and Paz 1995; Girard and De Buit 1999; Clarke *et al.* 2001). For example, this species is targeted heavily by the Portuguese deepwater longline fishery for which exploitation peaked in 1986 (600t), and has been steadily declining since then (Correia and Smith in prep.). The catches of the mixed trawl fishery off Rockall Trough and Porcupine Bank in the eastern Atlantic, which consist predominantly of this species and *C. coelolepis,* increased from 302t in 1991 to 3,284t in 1996, and then declined to 1,939t in 1999 (ICES 2000). Although this suggests that the population is declining, these data cannot be directly related to fishing effort and it is therefore possible that fishing effort declined between 1996 and 1999. The French bottom trawl fishery has shown rapidly increasing landings of these species, i.e. 322t in 1990 and 2,939t in 1996 (Girard and De Buit 1999). Quantitative CPUE is available for autoline catches in: ICES Area VI, showing an 80–90% decline in three years; Area VII, 67–77% decline in four years; Area XII, 20–69% decline in one year (SGRST 2002). Although this data are for *C. squamosus* and *C. coelolepis* combined, the acute vulnerability to exploitation of *Centrophorus* species has been shown from NSW fishery independent surveys (Graham *et al.* 2001), and *C. squamosus* is the more vulnerable of these two species in terms of life history. Artisanal deepwater longline fisheries in eastern Indonesia, e.g. Java and Bali, also commonly land this species, but often in low numbers (W. White unpublished data). The catches of this species in Australia and Oceania are relatively low and do not represent a significant component of the squaloid catch in both southeastern Australia and New Zealand, however more data are required. The flesh and liver are marketed from this species in many areas throughout its range.

Conservation measures

None.

Literature

Brito (1991); Clarke *et al.* (2001); Clarke *et al.* (2002a); Compagno and Niem (1998a); Correia and Smith (in prep.); Cox and Francis (1997); Ebert *et al.* (1992); Girard and De Buit (1999); Girard *et al.* (2000); Graham *et al.* 2001; ICES (2000); Last and Stevens (1994); SGRST. (2002).

Southern Dogfish

Centrophorus uyato (Rafinesque, 1810)

John J. Pogonoski and David A. Pollard

Red List assessment

Global: Data Deficient*
Australia: Critically Endangered A2bd+3d+4bd

Rationale

This assessment for *Centrophorus uyato* is for Australia only (the Australian population may be taxonomically distinct from those elsewhere).

Declines of over 99% between 1976–77 and 1996–97 between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC) have been documented by a fishery independent trawl survey. The relatively narrow continental slope habitat of this species (which is fished throughout its entire depth range) suggests that it may now only be present in significant numbers in areas that are non-trawlable. However, as dropline fishers also harvest this species off NSW (under NSW jurisdiction), further pressure may be placed on it in such areas. There was a small, short-lived fishery out of Esperance, WA for *C. uyato* in the mid-1990s, which ceased due to rapid catch declines and there may be some bycatch in the WA Commonwealth-managed trawl fishery. As with other deepwater sharks, particularly this genus, the low fecundity, high longevity and probable late age at first maturity of this species not only result in extremely rapid population depletion in fisheries, but also prevent it from quick recovery after such depletion.

This species is currently Data Deficient globally due to the taxonomic problems. However, deepwater demersal trawl fisheries are expanding in other parts of its potential range, and with the observed declines described above, together with the knowledge that its biology is similar to other deepwater shark species, this, and related species warrant urgent conservation attention globally.

Distribution

Regional: Australia (WA, SA, NSW, VIC, TAS). Documented from Esperance to Geraldton (WA) and Fowlers Bay (SA) to Port Stephens (NSW), including TAS (Last and Stevens 1994), but further study of this distribution is necessary given the taxonomic problems in this genus (Daley *et al*. 2003; J. Stevens, pers. comm.).
Note: the Australian populations may be taxonomically distinct from those elsewhere (see below).
Global: Widespread but somewhat patchy distribution in the Atlantic, Indian and western Pacific Oceans.
FAO Areas 27, 31, 34, 37, 47, 51, 57 and 81.

Habitat and ecology

Demersal on the continental shelf and upper-middle continental slope in depths of 50–1,400m. In Australia, main depth range is 400–650m (Last and Stevens 1994), but has been recorded from 220–740m (Graham *et al*. 1997). The species has low fecundity, high longevity and probable late age at first maturity. Ovoviviparous, usually producing one pup. Length at first maturity is 80cm TL (males) (Last and Stevens 1994) and 100cm TL (females) (Daley *et al*. 2002). Size at birth is 35–45cm TL (Last and Stevens 1994; Daley *et al*. 2002). Preliminary ageing studies by Fenton (2001) suggest that *C. uyato* lives to at least 46 years of age (n=8).

Threats

Centrophorus uyato has been impacted by various fishing activities in Australian waters: (1) Targeted fishing using deep set gillnets off SA and eastern VIC in the SSF. This targeting had all but ceased by 1995 because of declining catches (Daley *et al*. 2002); (2) Demersal trawling (SETF) in NSW and eastern VIC (Daley *et al*. 2002). Declines of over 99% have been documented between the years 1976–77 and 1996–97 between the Sydney area (central NSW) and the Eden-Gabo Island area (southern NSW/northern VIC) by a fishery independent trawl research survey (Andrew *et al*. 1997; Graham *et al*. 1997; Graham *et al*. 2001). Catches in the abovementioned areas in 220–605m (i.e. most of the preferred depth range of this species) declined from a mean of 106.9kg h^{-1} in 1976–77 to a mean of 0.3kg h^{-1} (a total of only 14 specimens) in 1996–97; (3) Droplining (under NSW Fisheries jurisdiction) along the continental slope within its range (although catches are relatively minor); and (4) Previously targeted by gillnetting in WA shark fishery (1996–1999). This fishery has since ceased and according to fishers, catch rates began to decline dramatically after 2–3 years (R. McAuley, pers. comm.).

Centrophorus dogfishes are marketed for their flesh and liver oil (squalene) (Daley *et al*. 2002).

* This species has been noted as Data Deficient globally on a temporary basis and will be re-assessed when the current taxonomic problems have been resolved.

Conservation measures Recent (January 2003) management changes to the SETF by the Australian Fisheries Management Authority limit the combined catch of *Centrophorus* dogfishes to a maximum of 150kg trunked weight per trip. In addition, livers of *Centrophorus* are not to be retained unless the individual carcasses from which they were obtained are also landed (J. Stevens, pers. comm.). *Centrophorus uyato* has also been nominated for listing as a Vulnerable species on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). If listed as Vulnerable, the EPBC Act requires that a Recovery Plan be put in place within a five-year period (S. Williams, pers. comm.).

Literature Andrew *et al.* (1997); Daley *et al.* (2002); Fenton (2001); Graham *et al.* (1997); Graham *et al.* (2001); Last and Stevens (1994).

Brier Shark

Deania calcea (Lowe, 1839)

John D. Stevens

Red List assessment **Global: Least Concern**

Rationale Mainly a bycatch species taken by trawl and hook, although with some limited targeting, for its flesh and oil. Catches in Australia have been increasing in the last few years due to the relaxation of mercury laws and fishers looking for non-quota species in the SETF. The quality of the catch data has improved recently but there are as yet no species-specific trends in abundance or biomass available. Biomass estimates in New Zealand over a ten-year period show no evidence of a declining trend, although there may be problems of effort standardisation. Research surveys on the NSW slope over a 20-year period have shown a decline from 15.7kg h^{-1} to 1.4kg h^{-1} for the related longsnout dogfish, *Deania quadrispinosa*. While there are currently no quantitative data on population trends, the species has low productivity and increased targeting should be viewed with concern. However, the species is currently still abundant and a Near Threatened assessment cannot be justified. The situation should be monitored carefully.

Distribution **Regional: Southern Australia (between Coffs Harbour, NSW and Green Head, southern WA, including TAS) and New Zealand.**
Global: A wide but patchy distribution in the eastern Atlantic and Pacific.
FAO Areas 27, 34, 47, 51, 57, 61, 81 and 87.

Habitat and ecology One of the more abundant mid slope species of deepwater dogfish this species is found on or near the bottom of the continental slope and abyssal plain in depths from 70–1,450m, usually in depths between 400–900m (Last and Stevens 1994; Long 1997). In Australia, catch rates are highest in the 600–1,100m zone (Daley *et al.* 2002). There appears to be some size and sex segregation by depth. Pregnant females are rare in catches from most areas (0.8% of mature females in NSW and TAS). Population parameters in Australia are as follows (Daley *et al.* 2002): size at birth 30cm TL, maximum size ~120cm TL, size at maturity 80cm TL (males) and 90cm TL (females), litter size 1–17 pups/litter (average seven), gestation period is unknown and the breeding cycle is not continuous. Size at 50% maturity in the Northeast Atlantic 85cm TL (males) and 106cm TL (females) (Clarke *et al.* 2002b). Ageing work from the North Atlantic suggests maturity at 17 years (males) and 25 years (females) and longevity of 35 years (Clarke *et al.* 2002b).

Threats Taken by trawl, hook and gillnet both as a target and bycatch species for its liver oil and flesh. The livers are high in squalene comprising about 70% by weight (Bakes and Nichols 1995). Catch rates of up to 500kg h^{-1} have been reported from Australia. Catches in Australia have been increasing in the last few years due to the relaxation of mercury laws and fishers looking for non-quota species in the SETF. Research surveys on the NSW slope over a 20-year period have shown a decline from 15.7kg h^{-1} to 1.4kg h^{-1} for the related longsnout dogfish, *Deania quadrispinosa* (Graham *et al.* 1997).

Conservation measures Regulations introduced into the SETF in Australia prohibit the landings of livers unless the accompanying carcass is also landed.

Literature Bakes and Nichols (1995); Clark *et al.* (2000); Clarke *et al.* (2002b); Daley *et al.* (2002); Ebert *et al.* (1991); Long (1997); Mauchline and Gordon (1983); Yano (1991).

Bareskin Dogfish

Centroscyllium kamoharai Abe, 1966

Sarah L. Fowler

Red List assessment **Global: Data Deficient**

Rationale A little-known deepwater dogfish likely to be highly vulnerable to population depletion through fisheries bycatch because of its highly K-selected biology. Fairly broad but patchy occurrence through the Western Pacific, but records are sparse and the species is not abundant in bycatch in any deepwater fishery. The lack of data on extent of occurrence, population size, or any indicator of population trend is considered to warrant a Data Deficient assessment, despite concerns that bycatch has been occurring and will continue to occur in deepwater fisheries, possibly through most of the species' range.

Distribution **Regional: Australia (eastern Australia from Port Macquarie, NSW to southern TAS, and western Australia from North West Cape to Bunbury, WA; possibly throughout the Great Australian Bight).**
Global: Fairly broadly distributed in deep water in the western Pacific.
FAO Areas 57, 61, 71 and 81.

Habitat and ecology Lives on or near the bottom on continental and insular slopes and seamounts, restricted to a depth range of 500–1,200m with possibly only limited exchange between sub-populations. Size at maturity 40–45cm TL, maximum size ~60cm TL, 3–22 pups/litter (average 12). No seasonal reproductive cycle, no information on annual fecundity, gestation period, age at maturity or longevity. Like other deepwater dogfishes, this species likely has a very low resilience to depletion and a low intrinsic rate of population increase, hence highly vulnerable to bycatch in deepwater fisheries.

Threats Bycatch in deep trawl fisheries, but no data on catches and trends.

Conservation measures None.

Literature Compagno (in prep. a); Daley *et al.* 2002.

Baxter's Dogfish

Etmopterus baxteri Garrick, 1957

Larry J. Paul

Red List assessment **Global: Least Concern**

Rationale A moderately common deepwater shark within its known geographic range (Southern Australia and New Zealand), and which may extend deeper than is currently recognised. Although captured in some quantity in some deepwater trawl fisheries, it is taken only as bycatch, and only over part of its known range. However, if the population is mobile and migrates into exploited fishing grounds from other parts of its range, and if it proves to have the life history characteristics (low fecundity, slow growth and high longevity) typical of better known squaloids, the assessment may have to move into a higher threat category.

Distribution **Regional endemic: Southern Australia (southern NSW, VIC, TAS, and seamounts to the south) and New Zealand. There is no information on whether the population off southeastern Australia is linked to the New Zealand population via seamounts and submarine ridges in the Lord Howe Rise in the Tasman Sea.**
Note: Possibly occurs off southern Africa. A record from Sierra Leone (Pakhurov 1999) requires verification.
FAO Areas 57 and 81. Possibly 47 and 51.

Habitat and ecology A demersal species, inhabiting the upper and middle continental slope at depths of 250–1,500m, usually 700–1,400m. One of the most common deepwater sharks in this depth range. Maximum size ~88cm TL, size at maturity 55–60cm TL (males), 64–

69cm TL (females). Ovoviviparous with 6–16 pups/litter, size at birth ~20cm TL. Gestation period and reproductive cycle unknown.

Threats A moderate bycatch in some deepwater fisheries. Its depth range coincides (in part) with that of some commercially important teleosts (especially orange roughy, oreos), although it extends deeper.

Conservation measures None.

Literature Bakes and Nichols (1995); Compagno (1984a); Compagno *et al.* (1989); Compagno and Niem (1998a); Davenport and Deprez (1989); Deprez *et al.* (1990); Garrick (1957); Garrick (1960b); Last and Stevens (1994); Pakhorukov (1999); Summers and Wong (1992); Tachikawa *et al.* (1989); Wetherbee (1996); Wetherbee (2000).

Tailspot Lantern Shark

Etmopterus caudistigmus Last, Burgess & Séret, 2002

Sarah L. Fowler and Bernard Séret

Red List assessment **Global: Least Concern**

Rationale This small deepwater shark has been recorded in small numbers from only a restricted area and relatively narrow depth band (638–793m) off New Caledonia. Additional surveys will probably demonstrate that it is more widely distributed on the island slope, but it is still likely to be a New Caledonian endemic, particularly if (like related taxa) it is restricted to a relatively narrow depth band on the insular slope. There is very limited deepwater fishing within its range, the species is not targeted but discarded if occasionally caught on the unsuitable large hooks of commercial gear. There is no reason to suspect a decline in range, habitat quality or number of individuals.

Distribution **Regional endemic: New Caledonia (North-West Lifou).**
FAO Area 71.

Habitat and ecology Known from three specimens, caught on longline at a depth of 638–793m, on the insular slopes of New Caledonia. A male was mature at 31cm TL. The largest was a 34cm TL female. No information available on biology, but the capture of three at one location suggests that this may, like some other lantern sharks, be a social species.

Threats Deepwater fisheries are very uncommon around New Caledonia. This species is not targeted, discarded if caught, and unlikely to be caught frequently on large commercial fishing hooks.

Conservation measures None.

Literature Compagno (in prep. a); Last *et al.* (2002).

Pink Lantern Shark

Etmopterus dianthus Last, Burgess and Séret, 2002

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Least Concern**

Rationale This deepwater lantern shark is currently recorded only from the continental slope of the central QLD Plateau off Australia and off New Caledonia. Although the species is known only from two small areas and a narrow bathymetric range, further exploratory trawls may indicate a wider distribution. There are presently no major fishing activities in the known area of occurrence, and if captured it is likely discarded due to its small size and lack of commercial value. Survival rates after discarding, however, are not known. Given the global expansion of deepwater trawl fisheries, future pressure may be placed on this small species and any increase in fishing activities within its range should monitor the catch of this and other etmopterid species closely. At present, there is no reason to suspect a decline in range, habitat quality or number of mature individuals.

Distribution **Regional endemic: Recorded from the continental slope of the central Queensland Plateau (northeastern Australia) and from off New Caledonia.** *FAO Area 71.*

Habitat and ecology Recorded from near the bottom on the continental slope in depths of 708–880m. Maximum size at least 41cm TL. A male specimen of 33.8cm TL was adolescent. An embryonic specimen was 0.95cm TL. Nothing else known of its biology.

Threats Presently no major fishing activity in its area of occurrence. The species is not targeted in any commercial fisheries. It is unlikely to be captured frequently on longline gear due to its small size. If captured, it is likely discarded (survival rates are unknown but are likely to be moderate from longline capture and low from trawl capture).

Conservation measures None.

Literature Last and Stevens (1994); Last *et al.* (2002).

Lined Lantern Shark

Etmopterus dislineatus Last, Burgess and Séret, 2002

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Least Concern**

Rationale This deepwater lantern shark is currently recorded only from the central Coral Sea off Australia on the continental slope. Although the species is known only from a small area and a narrow bathymetric range, further exploratory trawls may indicate a wider distribution. There are presently no major fishing activities in the known area of occurrence, and if captured it is likely discarded due to its small size and lack of commercial value. Survival rates after discarding, however, are not known. Given the global expansion of deepwater trawl fisheries, future pressure may be placed on this small species and any increase in fishing activities within its range should monitor the catch of this and other etmopterid species closely. At present, however, there is no reason to suspect a decline in range, habitat quality or number of mature individuals.

Distribution **Regional endemic: Currently known only from the central Coral Sea, off the Saumarez and Queensland Plateaus (northeastern Australia).** *FAO Area 71.*

Habitat and ecology Found on or near the bottom of the continental slope in depths of 590–700m. Maximum size at least 45cm TL. Smallest observed mature male 33.5cm TL; 33cm TL male adolescent. Nothing else known of its biology.

Threats Presently no major fishing activity in its area of occurrence. The species is not targeted in any commercial fisheries. It is unlikely to be captured frequently on any longline gear due to its small size. If captured, it is likely discarded (survival rates are unknown but are likely to be moderate from longline capture and low from trawl capture).

Conservation measures None.

Literature Last and Stevens (1994); Last *et al.* (2002).

Blackmouth Lantern Shark

Etmopterus evansi Last, Burgess and Séret, 2002

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Least Concern**

Rationale A small deepwater lantern shark currently recorded from off northwestern WA and the Arafura Sea (Indonesia) on the continental slope. Although the species is known only from a few small localities and has a narrow bathymetric range, further exploratory trawls may indicate a wider distribution. Deepwater trawl fisheries are expanding globally, including in Indonesian waters. These activities may place future pressure on this small species. At present *Etmopterus evansi* is unlikely to be captured frequently

as most of the trawl activity is not within its known depth range, and if captured it is likely discarded due to its small size and low commercial value. However, survival rates from trawl discards are likely to be low. There is currently no evidence of a decline in range, habitat quality or number of mature individuals, although any expansion of fishing throughout its range, especially in Indonesian waters should be closely monitored.

Distribution

Regional endemic: Recorded from localised records off northwestern WA and from the Arafura Sea, Indonesia.
FAO Area 57.

Habitat and ecology

Recorded from the continental slope in 430–550m. Maximum size at least 30cm TL. A male of 26.2cm TL was mature. Nothing else known of its biology.

Threats

Presently only minor fishing activity in area of occurrence off WA (Commonwealth managed North West Slope Trawl Fishery). The Arafura Sea and Indonesian waters may be subject to some trawling effort by Indonesian vessels (although at present this is mostly in less than 200m depth).

Conservation measures

None.

Literature

Last and Stevens (1994); Last *et al.* (2002).

Pygmy Lantern Shark

Etmopterus fusus Last, Burgess and Séret, 2002

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment

Global: Least Concern

Rationale

A small lantern shark currently recorded from off northwestern WA on the continental slope, with the possibility of occurrence off Java, Indonesia. Although the species is known only from a few small localities, further exploratory trawls may indicate a wider distribution. *Etmopterus fusus* is assessed as Least Concern because there is little fishing in its known area of occurrence off WA. However, deepwater trawl fisheries are expanding globally, including in Indonesian waters where its potential area of occurrence and depth range are heavily fished. These activities may place future pressure on this small species and if it is verified from the waters off Java, a higher category (of at least Near Threatened) should be considered.

Distribution

Regional endemic: Recorded from the Eastern Indian Ocean off northern WA. Also possibility of occurrence off Java, Indonesia.
FAO Area 57.

Habitat and ecology

Recorded from the continental slope in 430–550m off Australia and possibly in 120–200m off Indonesia (if it occurs off Java). Maximum size at least 30cm TL. Observed males of 25.1–25.8cm TL are mature. Nothing else known of its biology.

Threats

Presently only minor fishing activity in area of occurrence off WA (Commonwealth managed North West Slope Trawl Fishery). The species is not targeted off WA, and if captured is likely discarded (although survival rates are unknown and likely to be low from trawl captures). If the species occurs off Java, Indonesia, that area is likely to be subject to heavy trawling effort by Indonesian vessels (generally operating in less than 200m depth which overlaps with the suspected depth range of the species off Java of 120–200m). Quantitative data on Indonesian fisheries is required to assess its status in these waters if it is confirmed to be present there.

Conservation measures

None.

Literature

Last and Stevens (1994); Last *et al.* (2002).

False Pygmy Shark

Etmopterus pseudosqualiolus Last, Burgess & Séret, 2002

Sarah L. Fowler and Bernard Séret

Red List assessment **Global: Least Concern**

Rationale This small lantern shark has been recorded from only a small area and relatively narrow depth band on oceanic ridges near New Caledonia. There is very limited deepwater fishing within its range. The species is not targeted, but discarded if occasionally caught on the large hooks of commercial gear. There is no reason to suspect a decline in range, habitat quality or number of individuals. It may also prove not to be restricted to such a small area if additional surveys are undertaken.

Distribution **Regional endemic: Currently known only from oceanic ridges near New Caledonia (Norfolk and Lord Howe Ridges), but could be wider ranging.**
FAO Areas 71 and 81.

Habitat and ecology Known from only a few specimens, caught on the bottom at 1,043–1,102m on oceanic ridges. Possibly semi-oceanic. Biology is unknown. All specimens taken were 40–45cm TL, all males were mature.

Threats Deepwater fisheries are very uncommon around New Caledonia. This species is not targeted, discarded if caught, and unlikely to be caught frequently on large commercial fishing hooks.

Conservation measures None.

Literature Compagno (in prep. a); Last *et al.* (2002).

FAMILY **SOMNIOSIDAE**

Portuguese Dogfish

Centroscymnus coelolepis Bocage & Capello, 1864

John D. Stevens and João P.S. Correia

Red List assessment **Global: Near Threatened**

Rationale Mainly a bycatch species taken by trawl and hook, although with some limited targeting, for its flesh and oil. Catches in Australia have been increasing in the last few years due to the relaxation of mercury laws and fishers looking for non-quota species in the SETF. However, appropriate data on biomass or trends in abundance are lacking. The productivity of this species is likely to be low (although age estimates and annual fecundity are currently unknown) and further increases in catches should be viewed with concern. This species is of much lower abundance than *Deania calcea* or *C. crepidater* and, although the quantitative data on populations are lacking, its lower abundance, demersal habits (not appearing to range into midwater) and suspected low productivity warrant a Near Threatened assessment.

Distribution **Regional: New Zealand and southern Australia (from Cape Hawke, NSW to Beachport, SA, including TAS).**
Global: A wide but patchy distribution in the Atlantic and western Pacific.
FAO Areas 21, 27, 34, 47, 57, 61 and 81.

Habitat and ecology Occurs on or near the bottom of the continental slope and abyssal plain in depths from 270–3,700m; locally in 770–1,400m (Last and Stevens 1994). In Australia, catch rates are generally highest in depths greater than 1,000m (Daley *et al.* 2002). Surveys conducted in Portugal never found this species in depths shallower than 800m. There appears to be sex and size segregation by depth. Population parameters in Australia are as follows (Daley *et al.* 2002): size at birth 30cm TL, maximum size ~120cm TL, size at maturity 75cm TL (males) and 95cm TL (females), litter size 8–19 pups/litter (average 12). Gestation period is unknown but is non-seasonal and the breeding cycle is non-continuous. Maturity in Japan and in the Northeast Atlantic is

reported at between 70–86cm TL (males) and ~100cm TL (females) (Yano and Tanaka 1988; Girard and Du Buit 1999), with maximum size attained at 158cm TL. There is evidence of size segregation by depth with smaller specimens at greater depths and pregnant females at shallower depths (Yano and Tanaka 1988; Girard and Du Buit 1999).

Threats

This shark has been exploited commercially for a long time. In Japan exploitation peaked during World War II (because the livers are rich in squalene: 22–49% by weight), but quickly declined due to decreasing numbers caught. Taken by trawl, hook and gillnet both as a target and bycatch species for its liver oil and flesh. Important fisheries for this species exist in Suruga Bay (Japan) and Portugal where it is targeted by a deepwater longline fishery. Between 1986 and 1999 catches in Portugal varied between about 300–900t with an increasing trend. The price of landed wet weight in Portugal has also been increasing since 1986 (US$1.5/kg in 1986 to US$3.5/kg in 1999), which suggests that demand is driving the fishing industry to continue exploitation. However, CPUE data were lacking and it is not currently possible to assess changes in abundance and biomass from any areas.

Conservation measures

Regulations introduced in 2002 in the SETF in Australia prohibits the landings of livers unless the accompanying carcass is also landed.

Literature

Clark *et al.* (2000); Clo *et al.* (2002); Correia and Smith (in prep.); Daley *et al.* (2002); Girard and Du Buit (1999); Hernandez-Perez *et al.* (2002); Last and Stevens (1994); Mauchline and Gordon (1983); Yano and Tanaka (1988).

Golden Dogfish

Centroscymnus crepidater (Bocage & Capello, 1864)

John D. Stevens

Red List assessment

Global: Least Concern

Rationale

Mainly a bycatch species taken by trawl and hook, although with some limited targeting, for its flesh and oil. Catches in Australia have been increasing in the last few years due to the relaxation of mercury laws and fishers looking for non-quota species in the SETF. Biomass surveys extending over 10 years in New Zealand show an increasing trend, but may be confounded by the use of different vessels. The productivity of this species appears to be low, with age at maturity in Australia of 15 years (males) and 22 years (females), and longevity of around 60 years, thus further increases in catches should be viewed with concern. However, the species is currently still abundant and a Near Threatened assessment cannot be justified at this time, although the situation should be monitored carefully.

Distribution

Regional: Locally common around New Zealand and southern Australia (from off Sydney, NSW to Perth, WA, including TAS and the southern seamounts).
Global: A fairly common but poorly studied species with a wide but patchy distribution in the eastern Atlantic and Indo-Pacific.
FAO Areas 27, 34, 47, 51, 57, 81 and 87.

Habitat and ecology

Demersal on the slope in depths of 270–1,300m. Off Australia the species is most common in 780–1,100m (Last and Stevens 1994). Maximum size ~105cm TL (Last and Stevens 1994). The lack of a seasonal pattern to reproduction, with females breeding throughout the year, means that the gestation period is currently unknown. Litter size 3–9 pups/litter (average six). Annual fecundity is unknown.

Threats

The species is coming under increased fishing pressure with the extension of deepwater trawl grounds and restricted access to more desirable deepwater teleosts such as orange roughy. Mainly a bycatch species but some targeting both for its oil and flesh. The livers are rich in squalene containing 61–73% by weight (Bakes and Nichols 1995). Fillets can retail for up to AUS$12/kg in Australia. Regionally it is taken off New Zealand and southern Australia in deepwater trawl and hook and line fisheries. Catches off TAS have been increasing in recent years; biomass surveys off New Zealand show an increase over the last 10 years but these data should be treated with caution due to problems with standardisation of fishing effort (Clark *et al.* 2000). The average catch rate on the Chatham Rise off New Zealand in 1990 and 1993 was 126kg/km^2 (Wetherbee 2000).

Conservation measures Regulations introduced in 2002 in the SETF in Australia prohibit the landings of livers unless the accompanying carcass is also landed.

Literature Bakes and Nichols (1995); Bigelow and Schroeder (1954); Clark *et al.* (2000); Daley *et al.* (2002); Garrick (1959); Last and Stevens (1994); Mauchline and Gordon (1983); Wetherbee (2000).

Owston's Dogfish

Centroscymnus owstoni Garman, 1906

Larry J. Paul

Red List assessment **Global: Least Concern**

Rationale A moderately common deepwater shark within its known geographic range, and which may extend deeper than is currently recognised. Although captured in some quantity in some deepwater trawl fisheries, it is taken mainly as bycatch, and presumably from only part of its known range. However, if the population is mobile and migrates into exploited fishing grounds from other parts of its range, if (as with other deepwater sharks) it becomes more frequently targeted, and if it proves to have the life history characteristics (low fecundity, slow growth and high longevity) typical of better known squaloids, the assessment may have to move into a higher category. However, the species is currently still moderately common over its wide southern Australian and New Zealand range and a Near Threatened assessment is not justified at this time.

Distribution **Regional: New Zealand and southern Australia (from off Cape Hawke, NSW to Shark Bay, WA, including TAS and the southern seamounts).**
Global: Southern Japan, and in the northern Gulf of Mexico.
FAO Areas 31, 57, 61 and 81.

Habitat and ecology A demersal species occurring on the upper and middle continental slope, 250–1,500m, usually 500–1,500m. Life history is not well known, but a typical deepwater shark, sometimes occurring in schools segregated by size and sex. Maximum size ~120cm TL, size at maturity 70–79cm TL (males), 82–105cm TL (females), size at birth 25–30cm TL. Some incomplete information on reproduction is presented by Yano and Tanaka (1987; 1988) and Daley *et al.* (2002), but the gestation period and reproductive cycle are not well known.

Threats A moderate bycatch in some deepwater trawl and line fisheries. Its depth range coincides (in part) with that of some commercially important teleosts (especially orange roughy, oreos), although it extends somewhat deeper.

Conservation measures None.

Literature Bass (1979); Compagno (1984a); Daley *et al.* 2002; Davenport and Deprez (1989); Deprez *et al.* (1990); Garrick (1959); Last and Stevens (1994); Summers (1987); Summers and Wong (1992); Turoczy *et al.* (2000); Wetherbee (2000); Yano and Tanaka (1983); Yano and Tanaka (1984); Yano and Tanaka (1987); Yano and Tanaka (1988).

Plunket's Shark

Centroscymnus plunketi (Waite, 1910)

Larry J. Paul

Red List assessment **Global: Near Threatened**

Rationale A relatively uncommon deepwater shark within its known geographic range (parts of Australasia, perhaps now extended to southern Africa), although it may extend deeper than is currently recognised. Captured as bycatch in small but erratic quantities in some deepwater line and trawl fisheries, although presumably from only part of its known range. This species is of much lower abundance than the sympatric *C. owstoni* and its larger size and aggregating behaviour make it more susceptible to capture. The species appears to be of low productivity and if the population is mobile and migrates into and/or aggregates on exploited fishing grounds from other parts of its

potentially small range, any increases in catches from increasing deepwater–fisheries should be viewed with concern. These factors warrant a Near Threatened assessment.

Distribution

Regional: Occurs mainly around central and southern New Zealand, and also off Southeastern Australia (from off Portland, VIC to Port Macquarie, NSW, including TAS and the southern seamounts).
Global: Recently found in the Indian Ocean (SE South Africa/Mozambique).
FAO Areas 57 and 81.

Habitat and ecology

A demersal species which occurs on the upper and middle continental slope at depths of 200–1,500m, usually 500–1,000m. There is a trend for fish size to increase with depth, with the largest females in deepest water. It is probable that the species extends to greater depths than those sampled. Trawl surveys off southeastern Australia yielded infrequent but large catches of *C. plunketi*, suggesting aggregations. Maximum size ~170cm TL, size at maturity 100–120cm TL (males), 130–145cm TL (females). Ovoviviparous with up to 36 pups/litter, size at birth ~35cm TL. Gestation period and reproductive cycle unknown.

Threats

A small bycatch in some deepwater line and trawl fisheries. Its aggregating behaviour makes it susceptible to localised depletion. There is some danger that because its geographic and depth range coincides with that for some important teleost fisheries its relatively low (apparent) population will continue to decline with continuing and/or expanding fisheries.

Conservation measures

None.

Literature

Anderson *et al.* (1998); Bakes and Nichols (1995); Compagno (1984a); Daley *et al.* (2001); Garrick (1959); Last and Stevens (1994).

Whitetail Dogfish

Scymnodalatias albicauda Taniuchi & Garrick, 1986

Clinton A. J. Duffy

Red List assessment

Global: Data Deficient

Rationale

This species appears to be widespread in the Southern Ocean but is known from very few specimens. It is naturally rare and there is insufficient information on its biology, distribution and exploitation to assess it beyond Data Deficient.

Distribution

Regional: Australia (TAS, Southern Ocean off WA) and New Zealand.
Global: South Atlantic at 43°54′S, 07°45′E.
FAO Areas 47, 57 and 81.

Habitat and ecology

Depth range: 150–500m. Upper slope (Pukaki Rise, New Zealand), possibly mesopelagic. Reaches at least 111cm TL. Size at maturity is unknown. The smallest mature female reported was 74cm TL. This species appears to be highly fecund (litter size >59) however the gestation period and pupping interval are unknown as are size at birth, age and growth, and diet.

Threats

Infrequently taken in deepwater trawl and tuna longline fisheries.

Conservation measures

None.

Literature

Last and Stevens (1994); Nakaya and Nakano (1995); Taniuchi and Garrick (1986).

Sherwood Dogfish

Scymnodalatias sherwoodi (Archey, 1921)

Clinton A. J. Duffy

Red List assessment

Global: Data Deficient

Rationale

A very poorly known species known from a few specimens trawled off the east coast of South Island, New Zealand between 400–500m depth. May also occur off Australia.

Nothing is known of the species ecology, and there is insufficient information to assess it beyond Data Deficient.

Distribution **Regional endemic: New Zealand. Recorded off the east coast of South Island, from Bank's Peninsula to Pukaki Rise.**
FAO Area 81.

Habitat and ecology Depth range: 400–500m. Reaches at least 80cm TL. An 80cm TL male was mature.

Threats Infrequently taken in deepwater trawl fisheries.

Conservation measures None.

Literature Garrick (1956); Taniuchi and Garrick (1986).

Southern Sleeper Shark

Somniosus antarcticus Whitley, 1939

John D. Stevens

Red List assessment **Global: Data Deficient**

Rationale A large dogfish species which is taken as bycatch in the orange roughy, Patagonian toothfish and other deepwater fisheries. It is only in the last five years or so that this species has started to be reported; although not very rare, little is known of catch rates and nothing about population numbers.

Distribution **Regional: Southern Ocean from southern Australia (the seamounts east and south of TAS), New Zealand (with the possible exception of the far north), Macquarie, Heard and Kerguelen Islands. This species may be more widely distributed in the Southern Ocean than current records suggest.**
Global: South Africa and Patagonia (Last and Stevens 1994; Yano *et al.* in prep.).
FAO Areas 57, 58, 81 and 87. Possibly 88.

Habitat and ecology Occurs on or near the bottom with current records from 400–1,100m. Ovoviviparous with size at birth ~40cm TL. Litter size, gestation, reproductive periodicity, age and growth are unknown.

Threats The spread of deepwater fisheries in cool temperate and sub-Antarctic waters will increasingly impact on this species which is taken as bycatch in trawl and hook fisheries, such as those currently exploiting orange roughy and Patagonian toothfish. About 44 specimens were captured in the Macquarie Island toothfish fishery between 1996 and 2000 (van Wijk *et al.* 2001).

Conservation measures Specimens caught in the Australian toothfish fishery are released, however, survival rates are unknown.

Literature Last and Stevens (1994); van Wijk *et al.* (2001); Yano *et al.* (in prep.).

FAMILY **OXYNOTIDAE**

Prickly Dogfish

Oxynotus bruniensis (Ogilby, 1893)

Malcolm P. Francis

Red List assessment **Global: Data Deficient**

Rationale Widespread in southern Australia and throughout New Zealand, but uncommon and only occasionally caught. No information available on catches by commercial vessels, no directed fisheries, but likely to be taken as trawl bycatch. Biology poorly known but fecundity is low (probably 7–8 pups/litter).

Distribution

Regional endemic: Australia (from Newcastle, NSW to the western Great Australian Bight) and New Zealand (throughout mainland and Stewart Island – Snares Island Shelf, Chatham Rise and Chatham Islands, scattered records from Challenger Plateau and Campbell Plateau). Most New Zealand records from Chatham Rise.
FAO Areas 57 and 81.

Habitat and ecology

Habitat poorly known, but occasionally caught by demersal trawlers. Possibly also occurs over foul ground. Depth range 45–650m in Australia and 126–1,067m in New Zealand. Most common at 300–600m in New Zealand. Little is known of the biology of prickly dogfish. They are ovoviviparous, and fecundity is low: one female contained seven embryos and 7–8 large ovarian eggs have been recorded in two New Zealand females. Maximum size ~72cm TL, size at maturity ~55–60cm TL (males) and at or before 67cm TL (females). Size at birth ~24cm TL.

Threats

Taken as bycatch in bottom trawl fisheries, but extent of mortality unknown.

Conservation measures

None.

Literature

Anderson *et al.* (1998); Compagno (1984a); Cox and Francis (1997); Garrick (1960b); Last and Stevens (1994).

FAMILY **DALATIIDAE**

Kitefin Shark

Dalatias licha (Bonnaterre, 1788)

Leonard J.V. Compagno and Sid F. Cook

Red List assessment

2000 Red List assessment:
Global: Data Deficient
Northeast Atlantic: Near Threatened

Rationale

Records of yields from the Portuguese/Azores kitefin shark fishery suggest that targeted fisheries are capable of reducing populations quite rapidly. The life history of this species is expected to result in a slow recovery after depletion. An increasing trend for fisheries to move into deeper water on continental shelves and slopes suggests that fishing pressure on this species will likely increase over the next decade or more. However, because the kitefin shark is widely distributed and data on fisheries and populations are lacking from most of its range, it is not possible to reach a global assessment.

Literature

Compagno and Cook (In: Fowler *et al.* in press).

Cookie-cutter Shark

Isistius brasiliensis (Quoy & Gaimard, 1824)

John D. Stevens

Red List assessment

Global: Least Concern

Rationale

Isistius brasiliensis is widespread but with patchy distribution records. It is too small (up to about 50cm TL) to be regularly taken by fisheries and although it is occasionally caught by pelagic longlines, and sometimes in midwater trawls and plankton nets there are no significant threats to this species.

Distribution

Regional: Australia (from isolated localities off QLD, NSW, TAS, WA), New Zealand and various localities throughout the South Pacific (including Fiji and the Cook Islands).
Global: Widespread oceanic in temperate and tropical regions.
FAO Areas 31, 34, 41, 47, 51, 57, 61, 67, 71, 77, 81 and 87.

Habitat and ecology

Oceanic waters; makes diurnal vertical migrations from below 1,000m in the day, to near the surface at night. Maximum size ~50cm TL, size at maturity ~38cm TL (males) and ~40cm TL (females).

Threats Because of its small size, it is only occasionally taken by fisheries.

Conservation measures None.

Literature Last and Stevens (1994).

Smalleye Pygmy Shark

Squaliolus aliae Teng, 1959

Michelle R. Heupel

Red List assessment **Global: Least Concern**

Rationale *Squaliolus aliae* has a patchy, but wide distribution throughout the Indo-West Pacific. Possibly the smallest known living shark, its size means it is irregularly taken in fisheries. Based on this and its wide range this species is classified as Least Concern.

Distribution **Regional: Australia (isolated records off WA, NSW and QLD) (Kyne *et al.* in prep.; Last and Stevens 1994).**
Global: Indo-West Pacific, restricted to separate regions in Australia, the Philippines and Japan.
FAO Areas 57, 61, 71 and 81.

Habitat and ecology *Squaliolus aliae* is epipelagic or mesopelagic near land masses. It is thought to use a depth range from 200–2,000m. Individuals are thought to make daily migrations from shallow depths at night to deeper waters during the day. This is possibly the smallest living shark attaining a size of ~22cm TL with males maturing at 15cm TL. Females are ovoviviparous but litter sizes are unknown. The biology of this species is almost entirely unknown.

Threats There are currently no fisheries threats identified for this species.

Conservation measures None.

Literature Kyne *et al.* (in prep.); Last and Stevens (1994).

Eastern Sawshark

Pristiophorus sp. A [Last & Stevens, 1994]

Michelle R. Heupel

Red List assessment **Global: Near Threatened**

Rationale *Pristiophorus* sp. A is an endemic species found only in a small region off the east coast of Australia on the continental shelf and upper slope. The depth range and distribution of the species overlaps with heavily fished areas. Due to its restricted range and susceptibility to capture in commercial fisheries, which may rapidly lead to population depletion, this species is classified as Near Threatened.

Distribution **Regional endemic: Southeastern Australia. Restricted to a confined region between Lakes Entrance (VIC) and Coffs Harbour (NSW).**
FAO Area 81.

Habitat and ecology *Pristiophorus* sp. A is found in depths ranging from 100–630m. Females grow to at least 107cm TL; no males have been examined to date. The biology of this species is almost entirely unknown.

Threats This species may be collected as bycatch in commercial fisheries. Its toothed snout makes it particularly susceptible to netting and trawling activities.

Conservation measures None.

Literature Last and Stevens (1994).

Tropical Sawshark

Pristiophorus sp. B [Last & Stevens, 1994]

Michelle R. Heupel

Red List assessment **Global: Least Concern**

Rationale *Pristiophorus* sp. B is an endemic species known only from off northeastern Australia. Little is known of its biology, other than small size at maturity which may indicate that it is a relatively productive species. Its area of occurrence receives little fishing effort. There are no identifiable threats to the species and, therefore it is classified as Least Concern.

Distribution **Regional endemic: Northeastern Australia. Restricted to a confined region off the coast of QLD between Rockhampton and Cairns.**
FAO Area 71.

Habitat and ecology *Pristiophorus* sp. B is found in depths ranging from 300–400m. This species grows to ~84cm TL, with males maturing at ~62cm TL. The biology of this species is almost entirely unknown.

Threats This species is unlikely to be collected as bycatch in commercial fisheries since its distribution is outside fished areas.

Conservation measures None.

Literature Last and Stevens (1994).

Common Sawshark

Pristiophorus cirratus (Latham, 1794)

Terence I. Walker and Colin A. Simpfendorfer

Red List assessment

2000 Red List assessment:
Global: Near Threatened

2000 Red List rationale:
This common benthic shark is endemic to southern Australia. There are no useful biological data available for this species, and no assessment of the impact of commercial fishing. Although they are caught only as bycatch, the fisheries are large and have the potential to impact on the populations. Further research is needed to fully determine the status of this species, but at present there appears to be no significant extinction risk.

Update:
Global: Least Concern

Rationale

The 2000 Red List Assessment classed this species as Near Threatened. The current assessment lowers the classification to Least Concern due to new information, including a comprehensive study of age, growth and reproduction. The revised assessment is also based on a 25-year time series of catch and effort data from the Southern Shark Fishery and 12 years of monitoring data from an onboard observer programme on trawlers. *Pristiophorus cirratus* is a moderately abundant endemic species on the continental shelf and, to a lesser extent, the continental slope of southern Australia. The species is harvested over its entire range, but most of the catch is taken from Bass Strait in gillnets of mesh-size ranging 6–6.5 inches or from NSW and off eastern VIC by the SETF. Current exploitation rates are considered sustainable. Classification of this species is based mainly on six pieces of evidence: (1) Stable commercial catch rates for the combined catch of *P. nudipinnis* and *P. cirratus* during the past 20 years, following an earlier decline; (2) Fishery independent survey data over the past 25-year period indicates the number of animals caught declined to 67%; the change is not statistically significant; (3) Fishing effort has been reducing and a combined TAC has been implemented for *P. nudipinnis* and *P. cirratus*; (4) Relatively high biological productivity; maximum age is 15 years with 6–19 offspring produced biennially; (5) No contraction of range or fragmentation of the population, and; (6) The 3nm closure of all VIC waters to shark fishing provides a large refuge for the species.

Distribution

Regional endemic: temperate waters of southern Australia's outer continental shelf from about Geraldton, WA to Port Stephens, NSW, including the waters of TAS.
FAO Areas 57 and 81.

Habitat and ecology

The recorded depth distribution is 40–310m (Last and Stevens 1994). The highest concentrations are in Bass Strait, VIC (Walker *et al*. 2002). Maximum size and maximum total body mass are higher for females (149cm TL, 8.5kg) than for males (132cm TL, 3.5kg). Ageing studies indicate that the species has a maximum life span of 15 years and hence has comparatively high productivity among chondrichthyans. The species exhibits aplacental viviparity and produces 6–19 offspring biennially, and the size at birth is ~38cm TL. Size at which 50% of females are mature is 107cm TL.

Threats

There is negligible targeting of *P. cirratus*; most of the catch of this species is taken as byproduct to targeting *Mustelus antarcticus*. One threat is their capture from targeting *M. antarcticus* with gillnets of 6–6.5-inch mesh-size off SA (Walker 1999b), VIC and TAS. During 1970–01 the catch of *P. cirratus* and *P. nudipinnis* combined from the SSF varied between 43–301t (carcass weight), 7% of the total catch of all shark species (Walker *et al*. 2002). Another threat is their capture as byproduct in the SETF, which targets a range of quota teleost species with demersal trawl nets off NSW, eastern VIC and eastern TAS. The sawshark catch from this sector was 106t during 2002. In addition, small quantities of *P. cirratus* are taken by the GABTF. The catch from this sector was 28t during 2002. Minor threats include gillnets in the shark fishery of WA and fishing with longlines and other methods.

In Bass Strait, observed catch rates from research vessels during 1973–76 and from scientific observations on-board commercial vessels during 1998–01 indicate that the number of animals per thousand km-hours in bottom-set gillnets of 6-inch mesh-size declined from 381 to 292. This is a decline to 67% of former levels over a 25-year period. (Walker *et al*. in press). CPUE reported by commercial fishers over

this same period declined from 15.32 to 7.71kg per km-lift for *P. nudipinnis* and *P. cirratus* combined; i.e., a decline to 50% of former levels. The decline in the commercial catch rate for these species occurred during 1974–82 and catch rates subsequently stabilised during 1983–01. A steady decline in fishing effort since the mid-1980s and adoption of a TAC during 2002 for *P. cirratus* and *P. nudipinnis* jointly are expected to help secure the stocks of these species.

Conservation measures

Management measures in the SSF include limited entry for the use of gillnets and longlines (since 1984) and, for all fishing sectors, TAC (for *P. cirratus* and *P. nudipinnis* combined) (since 2002). Input controls include limits on length of net (since 1988), various 4–6 week closed seasons to protect pregnant animals of *Galeorhinus galeus* during October–December (1953–67 and 1993–94), and a legal minimum mesh-size of six inches for gillnets (since 1975) for most of the fished area. During 2002, the TAC for *P. cirratus* and *P. nudipinnis* was 191t for the SSF, 124t for the SETF, and 31t for the GABTF. The 3nm closure of all VIC waters to shark fishing provides a large refuge for the species.

Literature

Compagno (1984a); Last and Stevens (1994); Simpfendorfer (In: Fowler *et al*. in press); Walker (1999b); Walker *et al*. (2002); Walker *et al*. (in press).

Southern Sawshark

Pristiophorus nudipinnis Günther, 1870

Terence I. Walker

Red List assessment

Global: Least Concern

Rationale

Pristiophorus nudipinnis is a moderately abundant endemic species and is harvested over its entire range on the continental shelf of southern Australia. Most of the catch is taken from Bass Strait in gillnets of mesh-size ranging 6–6.5 inches. Current exploitation rates are considered sustainable, based mainly on six pieces of evidence: (1) Stable commercial catch rates in the combined catch of *P. nudipinnis* and *P. cirratus* during the past 20 years, following an earlier decline; (2) Fishery independent surveys over the past 25-year period indicates the number of animals caught declined to 45%, however, the change is not statistically significant; (3) Fishing effort has been reducing while a TAC has been implemented for the two pristiophorid species; (4) Relatively high biological productivity; maximum age is nine years with 7–14 offspring produced biennially; (5) No contraction of range or fragmentation of the population, and; (6) The 3nm closure of all VIC waters to shark fishing provides a large refuge for the species.

Distribution

Regional endemic: temperate waters of southern Australia's inner continental shelf from the head of the Great Australia Bight to about Cape Howe in VIC, including TAS.
FAO Area 57.

Habitat and ecology

Occurs from the inner continental shelf down to 70m (Last and Stevens 1994). Maximum size and maximum total body mass are higher for females (124cm TL, 4.3kg) than for males (110cm TL, 2.2kg). Ageing studies indicate that the species has a maximum life span of nine years. This suggests the species has relatively high biological productivity. The species exhibits aplacental viviparity and produces 7–14 offspring biennially, and the size at birth is ~35cm TL.

Threats

There is negligible targeting of *P. nudipinnis*; most of the catch of these species is taken as byproduct to targeting *Mustelus antarcticus*. One threat to the population of *P. nudipinnis* is their capture from targeting *M. antarcticus* with gillnets of 6–6.5-inch mesh-size off SA, VIC and TAS. Most of the catch is taken from Bass Strait (Walker 1999b). During 1970–01 the catch of *P. cirratus* and *P. nudipinnis* combined from the SSF varied between 43–301t (carcass weight), 7% of the total catch of all shark species (Walker *et al*. 2002). Another threat is their capture as byproduct in the SETF, which targets a range of quota teleost species with demersal trawl nets off eastern VIC and eastern TAS. The sawshark catch from this sector was 106t during 2002. Minor threats include fishing with longlines, trawls, and other methods.

In Bass Strait, observed catch rates from research vessels during 1973–76 and from scientific observations on-board commercial vessels during 1998–01 indicate that the number of animals per thousand km-hours in bottom-set gillnets of 6-inch mesh-size declined from 151 to 68. This is a decline to 45% of former levels over a

25-year period, however, the change is not statistically significant (Walker *et al*. in press). CPUE reported by commercial fishers over this same period declined from 15.32 to 7.71kg per km-lift for *P. nudipinnis* and *P. cirratus* combined; i.e. a decline to 50% of former levels. The decline in the commercial catch rate for these species occurred during 1974–82 and catch rates subsequently stabilised during 1983–2001. A steady decline in fishing effort since the mid-1980s and adoption of a TAC during 2002 for *P. cirratus* and *P. nudipinnis* jointly are expected to help secure the stocks of these species.

Conservation measures

Management measures in the SSF include limited entry for the use of gillnets and longlines (since 1984) and, for all fishing sectors, TAC (for *P. cirratus* and *P. nudipinnis* combined) (since 2002). Input controls include limits on length of net (since 1988), various 4–6 week closed seasons to protect pregnant animals of *Galeorhinus galeus* during October–December (1953–67 and 1993–94), and a legal minimum mesh-size of six inches for gillnets (since 1975) for most of the fished area. During 2002, the TAC for *P. cirratus* and *P. nudipinnis* combined was 191t for the SSF, 124t for the SETF, and 31t for the GABTF. The 3nm closure of all VIC waters to shark fishing provides a large refuge for the species.

Literature

Compagno (1984a); Last and Stevens (1994); Walker (1999b); Walker *et al.* (2002); Walker *et al.* (in press).

Eastern Angel Shark

Squatina sp. A [Last & Stevens, 1994]

John J. Pogonoski and David A. Pollard

Red List assessment

Global: Vulnerable A2bd

Rationale

An endemic species of the outer shelf and upper slope of eastern Australia. Generation period inferred to be >10 years. Heavily fished (utilised trawl bycatch) in the southern half of its range. A 96% documented decline in CPUE and a reduction in the mean size of large individuals reported by fishery independent trawl surveys between 1976–77 and 1996–97 in fished areas near the centre of the range. This represents only a quarter of the total range of this endemic, with large areas of its northern range (where the species' abundance is suspected to be lower than in the central and southern parts of its range) remaining untrawled.

Distribution

Regional endemic: Australia from off Cairns, QLD to Lakes Entrance, VIC.
FAO Areas 57, 71 and 81.

Habitat and ecology

Last and Stevens (1994) reported the habitat as outer continental shelf and upper slope in 130–315m depth, but occasionally this species enters waters as shallow as 60m depth (Graham *et al.* 1995, Australian Museum Collection Records identified by J.J. Pogonoski, Feb. 2003). Although Last and Stevens (1994) reported maximum size ~63cm TL, Graham *et al.* (1995) and Graham (1999) reported maximum female size ~130cm TL and 20kg. Males attain a maximum of at least 110cm TL (Graham *et al.* 1997) and 8kg (Graham 1999). Size at maturity is approxomately 107cm TL (females) and 91cm TL (males) (K. Graham, pers. comm.). The minimum size of specimens collected in research vessel trawls off NSW was 30cm TL (Graham *et al.* 1996). Size at birth is probably ~30cm TL. Like *S. australis,* this species is presumably ovoviviparous with litters of up to 20 pups (Michael 2001), although there are no known specific data on litter sizes in the literature. Gestation period unknown but a similar species (*S. californica*) has a gestation period of 10 months (Michael 2001).

Threats

Angel sharks are not very susceptible to line or mesh netting techniques, but are susceptible to trawling as they lay on the bottom (T.I. Walker, pers. comm.). Demersal trawling (SETF) in southeastern Australia between northern VIC and central NSW continues to threaten its populations in the southern part of its range where it is thought to be more abundant. Graham *et al.* (1997) documented a 96% decline (32.6kg h^{-1} in 1976–77 to 1.3kg h^{-1} in 1996–97) in catches across all areas in fishery independent trawl surveys from the Sydney area (central NSW) to the Eden-Gabo Island area (southern NSW/VIC border). In addition, significant reductions in the mean sizes of large *Squatina* sp. A were observed (Graham *et al.* 1997). This area only represents about a quarter of the total range of this species. The species is not (or rarely) harvested in the northern half of its range. Graham *et al.* (2001) noted that the present levels of trawling in the SETF and NSW Ocean Prawn Trawl Fishery were sufficient to keep the numbers of *Squatina* sp. A comparatively low. The flesh of angel sharks is excellent eating and is marketed as angel shark, boneless fillets and monkfish (Last and Stevens 1994).

Conservation measures

No conservation measures are in place for this species. However, there are large areas that are not trawled in the northern part of its range.

Literature

Compagno (1984a); Graham (1999); Graham *et al.* (1995); Graham *et al.* (1996); Graham *et al.* (1997); Graham *et al.* (2001); Last and Stevens (1994); Michael (2001).

Western Angel Shark

Squatina sp. B [Last and Stevens, 1994]

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale A poorly known, undescribed, angel shark endemic to the WA continental shelf and upper slope (150–310m). Nothing is known of its biology, but all those members of this genus for which biological data are available are known to be extremely vulnerable to fishing pressure because of their life history characteristics, morphology, limited dispersion and recolonisation potential, and habitat preferences. Serious declines have been documented for many better-known *Squatina* species with a wider distribution, but no population data or trend data are available for this endemic. The species is presently of no commercial value and is not recorded in WA state fisheries. It is likely to be encountered in the commonwealth Western Trawl Fisheries, but effort in that fishery is very low. Bycatch data should be collected and the life history characteristics of this species elucidated. Any future expansion of fisheries within its area of occurrence would need to closely monitor catches of this species.

Distribution **Regional endemic: Australia, from off Broome to Shark Bay, WA.** *FAO Area 57.*

Habitat and ecology Demersal on the continental shelf and upper slope at depths of 150–310m. Maximum size at least 64cm TL. Nothing known of its biology. This species presumably displays aplacental yolksac viviparity, as do other *Squatina* species. Litter size, gestation period, reproductive periodicity and age and growth parameters are unknown. However, other squatinid species have a long gestation period, for example 6–12 months in *S. tergocellata* (Bridge *et al.* 1998) and 10 months in *S. californica* (Natanson and Cailliet 1986). Parturition may be biennial as in *S. tergocellata* (Bridge *et al.* 1998).

Threats *Squatina* sp. B is presently of no commercial value. Angel sharks are generally not susceptible to line or mesh fishing, but are highly susceptible to trawling (T.I. Walker, pers. comm.). Western Australian state fisheries occurring off northwestern WA (north coast shark fishery, Pilbara Fish Trawl Fishery) do not encounter this species as they generally fish at depths of <100m (R. McAuley, pers. comm.). The Australian Commonwealth managed Western Trawl Fisheries operate at depths >200m and is likely to encounter *Squatina* sp. B. However, this fishery is small (presently about four boats) and so is unlikely to impact upon the species. Given the apparent 'slow' life history of angel sharks together with documented declines of other species (Holts 1988; Graham *et al.* 2001) any catches (including discards) of *Squatina* sp. B should be monitored in the future to ensure any increased fishing effort does not adversely affect the species.

Conservation measures None.

Literature Bridge *et al.* (1998); Graham *et al.* (2001); Holts (1988); Last and Stevens (1994); Natanson and Cailliet (1986).

Australian Angel Shark

Squatina australis Regan, 1906

John J. Pogonoski and David A. Pollard

Red List assessment **Global: Least Concern**

Rationale A relatively abundant angel shark, endemic to the continental shelf (0–130m) of southern Australia (central NSW to southern WA). Valuable in fisheries and vulnerable to demersal trawls. Large areas of its range are untrawled, and observer data in the SETF (Sydney, NSW to Great Australian Bight, SA) show no significant decline in abundance of *Squatina australis* from 1992–2001. The species is assessed as Least Concern, but there is a need to continue to monitor catch rates (standardised for effort), particularly in the SETF, to ensure they remain stable.

Distribution **Regional endemic: Southern Australia. Recorded from central NSW (around Newcastle) to southern WA (Rottnest Island), including TAS.**

It is common in Bass Strait and off surf beaches along the eastern seaboard (Last and Stevens 1994).
FAO Areas 57 and 81.

Habitat and ecology

Last and Stevens (1994) reported the habitat of this demersal species as continental shelf waters down to 130m. It inhabits sand and mud bottoms, often in seagrass beds or adjacent to rocky reefs (Michael 2001). Males attain ~105cm TL and are mature by 90cm TL; females attain at least 115cm TL and are mature by 97cm TL (Graham 1999). Maximum size ~152cm TL (Compagno 1984a) and ~15kg (Graham 1999), but specimens over 115cm TL were rare off NSW between 1976–77 and 1996–97 (Graham 1999). Ovoviviparous (Compagno 1984a), with litters of up to 20 pups (Michael 2001), although there is little data on litter sizes. Gestation period unknown but a similar species (*S. californica*) has a gestation period of 10 months and gives birth in the autumn months (Michael 2001).

Threats

Angel sharks are susceptible to trawling as they lay on the bottom (T.I. Walker, pers. comm.). The main threat to this species is demersal trawling in the SETF. In the SETF Observer Program (between 1992–2001), most catches of this species were in late autumn to winter months and CPUE was highest between eastern TAS and central NSW (T.I. Walker, pers. comm.). These sharks are not very susceptible to line or mesh netting techniques, and gillnetting in the SSF in waters less than 75m depth resulted in total catches of 12t of this species (carcass weight) in VIC and TAS between 1994/95–2000/01 (Walker *et al.* 2002). The flesh of angel sharks is excellent eating and is marketed as angel shark, boneless fillets and monkfish (Last and Stevens 1994).

Conservation measures

None. However, there are large areas that are not trawled within its range.

Literature

Compagno (1984a); Graham (1999); Last and Stevens (1994); Michael (2001); Walker *et al.* (2002).

Ornate Angel Shark

Squatina tergocellata McCulloch, 1914

Peter M. Kyne and Michael B. Bennett

Red List assessment

Global: Least Concern

Rationale

Squatina tergocellata is endemic to southern Australia, demersal on the continental shelf and upper slope in depths of 130–400m (most common about 300m). The species matures at a large size (relative to maximum size), produces litters of 2–9 young (average 4.5) probably biennially, after a gestation period of 6–12 months. It is taken in the GABTF (shelf/upper slope component) where catches appear to be stable. This component of the fishery operates mostly in 120–180m, therefore a large portion of the species depth range is not trawled. Furthermore, the fishery receives relatively low effort (the fishery is managed by limited entry with only 10 Statutory Fishing Rights) and a large portion of the species range receives minimal fishing effort. The species is assessed as Least Concern. However, given documented declines in other angel shark species together with their 'slow' life history characteristics, any future expansion of fisheries within its area of occurrence would need to closely monitor catches of this species.

Distribution

Regional endemic: Southern Australia from off Geraldton, WA to off Port Lincoln, SA.
FAO Area 57.

Habitat and ecology

Squatina tergocellata is demersal on the continental shelf and upper slope in 130–400m, but most common in about 300m (Last and Stevens 1994). The species may display spatial segregation of age classes, with older age classes more common in deeper waters (Bridge *et al.* 1998). Maximum size ~140cm TL (females) and 103cm TL (males) (Bridge *et al.* 1998). Size at maturity is 115–125cm TL (females) and 81–91cm TL (males). Gravid females with near-term embryos were observed during January and February. Fecundity ranges from 2–9 pups/litter (average 4.5). Minimum gestation period of 6–12 months with parturition probably occurring biennially (Bridge *et al.* 1998). Information on age and growth is not available.

Threats

Squatina tergocellata is commonly taken and marketed in the Australian Commonwealth managed GABTF. The species is taken in the shelf/upper slope

component of the fishery which fishes mostly in 120–180m and therefore, only a portion of the species bathymetric range is fished (furthermore, as the species is most common in about 300m most of the population would not be impacted by fishing). Additionally, the fishery receives relatively low effort (the fishery is managed by limited entry with only 10 Statutory Fishing Rights) and a large portion of the species range, particularly in the west, receives minimal fishing effort (Caton 2002). The fishery mostly takes immature individuals (Bridge *et al.* 1998). Reported landings from this fishery are as follows: 1988–1992 (five-year period), 234t; 1995, 97t; 1996, 95t; 1997, 140t; 1999, 109t; 2000, 69t; 2001, 88t; and, 2002, 84t (McLoughlin *et al.* 1994; McLoughlin *et al.* 1995; Caton *et al.* 1997; McLoughlin *et al.* 1997; Caton *et al.* 1999; Caton 2002; P. Sahlqvist, pers. comm.). The decline in catch in 2000 corresponds with a decrease in fishing effort. Overall, the stock appears stable in the Great Australian Bight. Furthermore, while catches were variable, no trend has been observed in catch rates of *S. tergocellata* in the SETF Observer Program (sampling at the eastern extent of the species range) over the ten-year period, 1992–2002 (T.I. Walker, pers. comm.).

Conservation measures

There are currently no quotas in place for catches of the species in the GABTF. The species is likely to occur in the Commonwealth managed Great Australian Bight Marine Park Benthic Protection Area, a 20nm strip extending out from the coast to 200nm offshore where demersal trawling is prohibited.

Literature

Bridge *et al.* (1998); Caton (2002); Caton *et al.* (1997); Caton *et al.* (1999); Graham *et al.* (2001); Holts (1988); Last and Stevens (1994); McLoughlin *et al.* (1994); McLoughlin *et al.* (1995); McLoughlin *et al.* (1997).

Crested Horn Shark

Heterodontus galeatus (Günther, 1870)

Peter M. Kyne and Michael B. Bennett

Red List assessment

Global: Least Concern

Rationale

An uncommon heterodontid shark restricted to relatively shallow water (0–93m) and endemic to the eastern Australian states of QLD and NSW. It is considered rare, particularly when compared with the sympatric *Heterodontus portusjacksoni*. Little information is available on its life history. The species is not targeted commercially, and incidental capture, recreational fishing and protective beach meshing programmes are not significantly impacting the species. Post-capture survivorship appears high. Although rare there are no current threats to the species. However, given this apparent rarity, further research and close monitoring of catches is necessary.

Distribution

Regional endemic: Australia, from Cape Moreton, southern QLD south to Batemans Bay, NSW (Last and Stevens 1994; Johnson 1999). Whitley (1940) reports an egg case from Moa Island in the Torres Strait, but this northern QLD record is doubtful (J. Johnson, pers. comm.).
FAO Areas 71 and 81.

Habitat and ecology

This species is recorded from the intertidal zone to 93m on the continental shelf (Whitley 1940; Michael 1993; Last and Stevens 1994). Maximum size ~120cm TL, but may be up to 152cm TL (Whitley 1940; Michael 1993; Last and Stevens 1994; Froese and Pauly 2002; D. Powter, pers. comm.). Size at maturity 54–60cm TL (males) and 70cm TL (females) (Last and Stevens 1994; P. Kyne unpublished data). Oviparous, but reproductive biology is poorly known. Fecundity may be 10–16 eggs per year (McLaughlin 1969). Oviposition has been reported during July and August but may take place all year around (McLaughlin 1969; Michael 1993; Last and Stevens 1994). Young are reported to hatch at 17–22cm TL (Jacups 1943; Whitley 1950; Last and Stevens 1994). Whitley (1940) suggested a gestation period of at least five months while others (Jacups 1943; Whitley 1950; Last and Stevens 1994) report a longer period of 8–9 months. It is thought that the species is relatively long-lived given an apparently protracted immaturity (Whitley 1950).

Threats

Commercial and recreational fishing have little impact upon this species (Last and Stevens 1994, N. Otway, pers. comm.). The species is taken as bycatch in demersal prawn trawl fisheries in NSW and QLD and in the NSW Ocean Trap and Line Fishery, however it is usually released alive. Numbers taken as bycatch are not known since *H. galeatus* and *H. portusjacksoni* are recorded together in fisheries statistics. *Heterodontus* species are usually released alive from the NSW Protective Beach Meshing Program (Reid and Krogh 1992).

Conservation measures

Heterodontus galeatus is listed as a Declared Animal in Schedule 3 of the Queensland *Marine Parks (Moreton Bay) Zoning Plan 1997*. This schedule declares species that could be affected by over-exploitation and limits the collecting of *H. galeatus* in the Moreton Bay Marine Park, a MPA of ~306,000 hectares. However, records of the species inside Moreton Bay, and therefore in the majority of the area of the MPA, are rare (Johnson 1999), the species usually occurring in offshore regions. The species is also likely to occur in a number of MPAs in NSW waters (including the Solitary Islands Marine Park, the Jervis Bay Marine Park and numerous smaller aquatic reserves), however recreational line and spear fishing are permitted in many of these.

Literature

Froese and Pauly (2002); Jacups (1943); Johnson (1999); Krogh (1994); Kuiter (1993); Last and Stevens (1994); McLaughlin (1969); McLaughlin and O'Gower (1971); Michael (1993); Reid and Krogh (1992); Waite (1896); Whitley (1940); Whitley (1950).

Port Jackson Shark

Heterodontus portusjacksoni (Meyer, 1793)

Colin A. Simpfendorfer

Red List assessment

2000 Red List assessment:
Global: Least Concern

Rationale

This abundant shark is endemic to Australian waters. There is currently no evidence to suggest that Port Jackson shark populations are at risk from human impacts. Although caught in commercial fisheries in substantial quantities, most are returned to the water alive. Sports fishers and the aquarium trade also take small numbers. Habitat modification and other environmental factors do not appear to be a threat to the health of populations.

Literature

Simpfendorfer (In: Fowler *et al.* in press).

Zebra Horn Shark

Heterodontus zebra (Gray, 1831)

Plaxy J. Barratt and Rachel D. Cavanagh

Red List assessment

Global: Least Concern

Rationale

A wide-ranging and apparently common shallow-water Western Pacific species. Although of little interest to commercial fisheries, *Heterondontus zebra* is caught as bycatch of demersal trawlers and possibly other fisheries, and could be under some threat from destructive fishing practices and habitat degradation in Indonesia. However, this species is common within its range, is probably relatively fecund (an oviparous species) and is assessed as Least Concern because there seem to be no major threats to its populations at the present time.

Distribution

Regional: (Northwestern WA).
Global: Western Pacific (Japan south to Indonesia).
FAO Areas 57 and 71.

Habitat and ecology

A common but little-known bottom-dwelling shark of continental and insular shelves. It is mostly found in depths shallower than 50m, although recorded recently from the continental shelf of northern WA in 150–200m. Maximum size ~122cm TL and size at maturity is 64–84cm TL (males). Hatchlings are at least 15cm TL. *Heterodontus zebra* is oviparous but details of reproduction are not known.

Threats

Heterodontus zebra is caught as bycatch by commercial trawlers and possibly other fisheries in its range. It may also be under threat from destructive fishing practices within its range in Indonesia such as cyanide and dynamite fishing, and habitat destruction. Utilisation in the aquarium trade is not recorded, but the species is an obvious candidate because of its attractive colour pattern.

Conservation measures

None.

Literature

Compagno (2001); Last and Stevens (1994); Michael (2001).

Collared Carpet Shark

Parascyllium collare Ramsay & Ogilby, 1888

Michelle R. Heupel

Red List assessment **Global: Least Concern**

Rationale *Parascyllium collare* is a little-known small shark endemic to the subtropical to temperate coast of eastern Australia. Although not targeted by fisheries, this hard bottom-living species is commonly taken as bycatch and resides in areas of heavy trawling effort where many commercial species have declined significantly. An assessment of Least Concern is appropriate as this species is not commercially targeted, is typically discarded and is believed to have high survival rates. However, further information should be collected concerning the status of this species as bycatch in trawl fisheries.

Distribution **Regional endemic: Eastern coast of Australia, from Mooloolaba, southern QLD to Gabo Island, VIC.**
FAO Areas 71 and 81.

Habitat and ecology This species resides on hard bottom areas in temperate waters along the continental shelf in depths of 20–160m. It reaches a maximum size ~87cm TL and is oviparous. Little else is known about the biology of this species.

Threats This species is not commercially targeted, is typically discarded and is believed to have high survival rates. Further information should be collected on its presence in trawl fishery bycatch.

Conservation measures None.

Literature Compagno (2002); Last and Stevens (1994).

Rusty Carpet Shark

Parascyllium ferrugineum McCulloch, 1911

Michelle R. Heupel

Red List assessment **Global: Least Concern**

Rationale *Parascyllium ferrugineum* is a southern Australia endemic with a reasonably wide geographic and bathymetric distribution. Although little is known of this species, it is not targeted by fisheries. Due to its size and depth range, it is unlikely to be largely impacted as a bycatch species in the trawl and gillnet fisheries in this area.

Distribution **Regional endemic: Southern coast of Australia, from Albany, WA to Gabo Island, VIC, including TAS.**
FAO Area 57.

Habitat and ecology This species resides in temperate waters along the continental shelf in depths of 5–150m. It reaches a maximum size ~80cm TL, matures by 60cm TL (males) and is oviparous. Little else is known about the biology of this species.

Threats Due to the size and depth range of this species it is not commonly collected as bycatch in commercial fisheries.

Conservation measures None.

Literature Compagno (2002); Last and Stevens (1994).

Ginger Carpet Shark

Parascyllium sparsimaculatum Goto & Last, 2002

Michelle R. Heupel

Red List assessment **Global: Data Deficient**

Rationale A little known species, endemic to a very small area in the southeastern Indian Ocean off the coast of WA. This species is recorded from only three specimens and its biology is unknown. Further data are required to assess this population fully. Due to its limited distribution and apparently small population size this species may be threatened, but current data do not provide conclusive evidence of the conservation status of *Parascyllium sparsimaculatum*.

Distribution **Regional endemic: Only known to occur off the coast of WA (between Bunbury and Lancelin). This species is known only from three specimens.**
FAO Area 57.

Habitat and ecology This species is small (up to 79cm TL), but its biology is unknown. It has been found on the upper continental slope (245–435m) in only one location off the coast of WA. Beyond the initial description, no scientific data are available for this species.

Threats Currently unlikely to be under threat due to the lack of fishing effort in the region. Potential threat from deepwater trawl fishing on the upper continental shelf if fishing effort increases.

Conservation measures None.

Literature Compagno (2002); Goto and Last (2002); Last and Stevens (1994).

Varied Carpet Shark

Parascyllium variolatum (Duméril, 1853)

Michelle R. Heupel

Red List assessment **Global: Least Concern**

Rationale *Parascyllium variolatum* is a southern Australia endemic with a reasonably wide geographic and bathymetric distribution. Although little is known of this species, it is not targeted by fisheries. Due to its size and depth range, it is unlikely to be largely impacted as a bycatch species in the trawl and gillnet fisheries in this area.

Distribution **Regional endemic: Southern coast of Australia, from Dongara, WA to Lakes Entrance, VIC, including TAS.**
FAO Area 57.

Habitat and ecology This species resides in temperate waters along the continental shelf in depths to 180m. It reaches a maximum size ~90cm TL and is oviparous. *Parascyllium variolatum* has been collected in a variety of benthic habitats including sandy, rocky and seagrass regions, is nocturnal and commonly found under rocks during daylight hours. Little else is known about the biology of this species.

Threats Due to the size and depth range of this species it is not commonly collected as bycatch in commercial fisheries.

Conservation measures None.

Literature Compagno (2002); Last and Stevens (1994).

Blind Shark

Brachaelurus waddi (Bloch & Schneider, 1801)

Peter M. Kyne and Michael B. Bennett

Red List assessment

Global: Least Concern

Rationale

Brachaelurus waddi is endemic to the east coast of Australia. No detailed information is available on current population trends, however, it is a relatively common species. It is not targeted commercially or recreationally, and is likely to be only a minor component of fisheries bycatch. There is little information available on its biology or ecology but it appears to be a hardy species, capable of surviving out of water for extended periods; thus post-capture survivorship may be high. It is popular in the marine aquarium trade although current levels of exploitation are unknown. More research is needed, but since there are currently no significant threats to its viability it is assessed as Least Concern.

Distribution

Regional endemic: East coast of Australia, from Mooloolaba, southern QLD to Jervis Bay, NSW (Last and Stevens 1994; Johnson 1999). There are no confirmed reports from either WA (B. Hutchins, pers. comm.) or from the NT (H. Larson, pers. comm.) and it is probable that the grey carpetshark, *Chiloscyllium punctatum*, may have been mistaken for *B. waddi* in these areas (Last and Stevens 1994; B. Hutchins, pers. comm.). *FAO Areas 71 and 81.*

Habitat and ecology

Brachaelurus waddi is a nocturnal benthic shark inhabiting rocky shorelines and reefs, and nearby seagrass beds over the continental shelf from the intertidal zone to 140m depth (Last and Stevens 1994). Juveniles often occupy ledges, crevices and seagrass beds in high-energy surge zones (Kuiter 1993; Michael 1993). Maximum size ~120cm TL, however, is normally much smaller. Matures at 60cm TL (males) and 66cm TL (females). Aplacental yolksac viviparous with 7–8 pups/litter (Whitley 1940; Last and Stevens 1994). Parturition occurs around November, based on observations off Sydney, NSW (Whitley 1940; Last and Stevens 1994). Young are born at 17cm TL (Last and Stevens 1994). Reproductive periodicity is assumed to be annual. Nothing else known of its biology.

Threats

This species is not targeted or marketed commercially (Last and Stevens 1994). The flesh is reported to be unpalatable (Grant 1978) and recreational fishing is thought to have little impact. The species is likely to be taken as bycatch in demersal prawn trawl fisheries in NSW and in QLD. The NSW Ocean Trap and Line Fishery is also likely to occasionally capture this species, however numbers taken as bycatch are not known as there are no statistics available (N. Otway, pers. comm.). Blind sharks are reported to be able to remain out of water for up to 18 hours (Michael 1993; Last and Stevens 1994) indicating that the species could survive trawl capture more readily than most other species if discarded. Blind sharks are exploited at low levels for the marine aquarium trade and are reported to be hardy and well suited to aquarium display (Michael 2001).

Conservation measures

A number of MPAs (Solitary Islands Marine Park, Jervis Bay Marine Park and numerous smaller aquatic reserves in NSW and Moreton Bay Marine Park in QLD) occur within the known range of *B. waddi*, however the zoning plans for these parks are complex and fishing activities are permitted in many of them, resulting in only a small area of fully protected sanctuaries.

Literature

Dudley and Gribble (1999); Grant (1978); Johnson (1999); Kuiter (1993); Last and Stevens (1994); Michael (1993); Michael (2001); Whitley (1940).

Colclough's Shark

Heteroscyllium colcloughi (Ogilby, 1907)

Leonard J.V. Compagno, Peter R. Last and John D. Stevens

Red List assessment

2000 Red List assessment:
Global: Vulnerable C2b

Rationale Fewer than twenty specimens of this small, attractive but poorly known little shark are recorded, mostly from inshore waters of Moreton Bay. This shark seems to be unabundant as far as is known despite survey coverage of available habitat. As presently known it has an extremely limited geographic and bathymetric range off Queensland and occurs in waters that are heavily utilised by people and subjected to intensive fisheries.

Literature Compagno, Last and Stevens (In: Fowler *et al*. in press).

FAMILY **ORECTOLOBIDAE**

Tasselled Wobbegong

Eucrossorhinus dasypogon (Bleeker, 1867)

Richard D. Pillans

Red List assessment **Global: Near Threatened**
Australia: Least Concern

Rationale A little known, but possibly common reef wobbegong with a wide distribution across northern Australia, Indonesia and Papua New Guinea. In Australia this species is Least Concern, there are no targeted fisheries and it does not appear in commercial shark or trawl fisheries. A considerable section of its habitat is protected in the Great Barrier Reef Marine Park. However, throughout the rest of its range this species is threatened by extensive coral reef habitat destruction (pollution and dynamite fishing), as well as expanding fisheries. This wobbegong is assessed as Near Threatened globally due to suspected significant population declines having occurred and predicted to continue within a large proportion of its range.

Distribution **Regional: Indonesia (Waigeo), Papua New Guinea and northern Australia from Barrow Island, WA to Bundaberg, QLD.**
Global: Also known from Aru in Indonesia which falls just outside the SSG AO region. *FAO Areas 57 and 71.*

Habitat and ecology A tropical inshore and offshore bottom dwelling shark. Found on coral reefs, where it is commonly seen on coral heads and in reef channels and faces (Compagno 2001). Commonly seen on the Great Barrier Reef. This primarily nocturnal shark is thought to have a small home range with several retreats within the area (Compagno 2001). Little is known about the biology of this species, although it is thought to be ovoviviparous. Size at birth is 20cm TL, maximum size at least 125cm TL and a 117cm TL male was mature (Last and Stevens 1994).

Threats Threats within Australia are likely to be minimal, no target fisheries and this species is not reported in bycatch. Outside of Australian waters it will be threatened by habitat destruction as well as overfishing. For example, the threats in Papua will include extensive dynamite fishing (especially in Biak) and heavy fishing pressures. There is also a possibility that coral removal for building material may impact on available habitat for this species (W. White, pers. comm.).

Conservation measures None.

Literature Compagno (2001); Last and Stevens (1994).

Western Wobbegong

Orectolobus sp. A [Last and Stevens, 1994]

Colin A. Simpfendorfer and Rory B. McAuley

Red List assessment **Global: Least Concern**

Rationale This species is endemic to approximately 1,550km of the WA coastline, with a relatively small range compared to other species of wobbegongs. However, it is common within this area and is regularly caught in demersal gillnets and rock lobster pots. In both fisheries it is typically discarded alive. As a result there appears to be no impact on the population and it is assessed as Least Concern.

Distribution

Regional endemic: WA continental shelf (from Cape Leeuwin north to Coral Bay) (R. McAuley unpublished data).
FAO Area 57.

Habitat and ecology

This species is a common inhabitant of rocky reef and weedy areas. Depths unreported, but probably in water from the intertidal to less than 100m. Size at birth is ~22cm TL, size at maturity is ~105cm TL, and a maximum size of ~200cm TL is reached. Growth appears to be relatively slow, although traditional ageing techniques appear to be of limited use (Chidlow 2003). Mature females produce litters of 18–27 pups (average 22) after a gestation period of 9–11 months.

Threats

This species is captured in WA demersal gillnet fisheries as a bycatch species. It is a hardy species with no commercial value and is typically discarded alive. Fisheries monitoring data from 1994–2003 indicate that there has been no change in abundance of this species (R. McAuley unpublished data). It is also caught in rock lobster pots, but is discarded alive and this fishery is unlikely to have an impact on the population.

Conservation measures

There are no conservation measures in place for this species, but the gillnet fishery in which it is caught is effort limited and well managed.

Literature

Chidlow (2003); Last and Stevens (1994).

Spotted Wobbegong

Orectolobus maculatus (Bonnaterre, 1788)

David A. Pollard, Ian Gordon, Anthony A. Flaherty and John J. Pogonoski

Red List assessment

Global: Near Threatened
New South Wales, Australia: Vulnerable A2b

Rationale

Probably an Australian endemic (other locality records unconfirmed, pending taxonomic review). A biologically vulnerable low-fecundity species, apparently territorial (site-attached) within its shallow bathymetric range. Caught in commercial and recreational fisheries, as a target species and as bycatch. Historic catch data are aggregated with *Orectolobus ornatus*, but serious declines (>60% between 1990 and 2000) for these two species combined are documented for the east coast (NSW), where the population has been assessed as Vulnerable, and where there is still no management plan implemented. Catch levels appear to be low and stable in southern and western Australia, however, given the declines on the east coast due to its vulnerability to exploitation, this species is assessed as Near Threatened throughout the rest of its range. More information is needed on population structure, life history and ecology in order to develop management policies and re-assess conservation status.

Distribution

Regional endemic (probable): Southern Australia, from around Fremantle, WA to Moreton Island, southern QLD.
Note: WA populations of *O. maculatus* appear to include at least two species (R. McAuley, pers. comm.).
Global: Unconfirmed records from Japan and the South China Sea are probably invalid. Tasmanian records are also probably invalid (Last and Stevens 1994).
Note: Because of taxonomic difficulties with this genus and the probable invalid nature of non-Australian records, this species should currently be treated as an Australian endemic (L.J.V. Compagno, pers comm.).
FAO Areas 57, 71 and 81.

Habitat and ecology

An abundant, temperate to tropical, inshore to offshore bottom-dwelling shark of continental shelves, occurring from the intertidal zone down to at least 110m (Pogonoski *et al*. 2002 report the species down to 176m), commonly on coral and rocky reefs, in coastal bays, estuaries, seagrass beds, under piers, and on sandy bottoms (Compagno 2001). Nocturnal, often found in caves, under overhangs on rocky reefs, in channels, and in shipwrecks during the day. There is evidence for site-attachment. Juveniles occur in estuaries and are occasionally found over seagrass beds. Maximum size is ~320cm TL, but most individuals caught are smaller: up to 150–180cm TL. Size at birth is ~21cm TL. Size at maturity is ~60cm TL (Compagno 2001). Reproduction is ovoviviparous usually with ~20 pups/litter (Last and Stevens 1994), but up to 37 pups have been recorded (Grant 1978).

Threats

Wobbegong sharks are commonly caught in trawls, beach seines, gillnets, lobster pots and traps, by hook and line, and also by spearfishing. The flesh is now highly regarded

as food, although in the past was generally of only limited commercial value. The attractive skin is used as a decorative leather (Last and Stevens 1994). These sharks are taken as bycatch (often retained) by commercial fisheries throughout their range (Pogonoski *et al.* 2002). There appear to be relatively low and apparently stable catch levels in southern and western coastal fisheries, and low levels of utilisation in WA. However, serious declines have been observed in NSW, demonstrating the vulnerability of this species to exploitation. Generally, declines of up to two thirds have been observed in NSW Fisheries aggregated catches of wobbegong sharks (consisting of *O. maculatus* and *O. ornatus*) between 1990 and 2000. Assessment and management is complicated by the aggregation of the catch data (NSW Fisheries 2001). Based on the future possibility of segregated data for *O. maculatus* and *O. ornatus* becoming available in some regions due to improved fisheries data collection, and clarification of the taxonomy of these species, future separate national assessments would be warranted. Commercial and recreational fishing is probably the main cause of the decline of these species in eastern Australia.

Commercial fishing by a variety of methods is potentially threatening wobbegong species in southern Australian waters. Wobbegongs are taken in the GABTF, SETF and SSF (AFMA logbook data, unpublished, cited by Pogonoski *et al.* 2002). Most of the above fisheries take these species as bycatch and they are often utilised. Wobbegongs, mostly less than 2m long, are part of the bycatch in WA temperate shark fisheries, but are discarded because there is no market for them (Simpfendorfer 1999a). In WA, a Fisheries Department survey conducted in 1996–1997 between Augusta and Kalbarri, reported that up to 1,000 wobbegongs were caught and kept by recreational fishers during that period (Sumner and Williamson 1999). Wobbegongs are also known to be taken by recreational fishers in SA, with no bag or size limits in these states. There is evidence of site-attachment for wobbegongs, making them particularly susceptible to fishing pressure, although further work is necessary in this area (Pogonoski *et al.* 2002). This species may be susceptible to impacts on inshore coastal habitats. Estuaries and seagrass beds may be important nursery areas for juvenile spotted wobbegong sharks (Pogonoski *et al.* 2002). As such, juveniles may be subject to impacts on estuarine and seagrass environments.

Conservation measures

A discussion paper in relation to the management of wobbegong sharks has been prepared for NSW waters (NSW Fisheries 2001), but no management plan is yet in place. There appear to be no other species-specific management arrangements in other Australian states. Some protection may be offered by those protected areas already being implemented for grey nurse sharks *Carcharias taurus* in NSW. This species also occurs in some MPAs in NSW: Julian Rocks Aquatic Reserve, Solitary Islands Marine Park, Fly Point-Halifax Park Aquatic Reserve and Jervis Bay Marine Park. Spotted wobbegongs possibly also occur in the following areas: Shark Bay Marine Park, WA and Hamelin Pool Marine Nature Reserve, WA. The species also occurs in some MPAs in QLD. Recently, an in-possession limit of two wobbegong sharks per person was introduced for recreational fishers in NSW. This new regulation may help to alleviate any adverse affects caused by recreational fishing practices (Pogonoski *et al.* 2002).

Literature

Compagno (1984a) ; Compagno (2001); Last and Stevens (1994); NSW Fisheries (2001); Pogonoski *et al.* (2002); Simpfendorfer (1999a); Sumner and Williamson (1999).

Banded Wobbegong

Orectolobus ornatus (de Vis, 1883)

David A. Pollard, Ian Gordon, Anthony A. Flaherty and John J. Pogonoski

Red List assessment

Global: Near Threatened
New South Wales, Australia: Vulnerable A2b

Rationale

Probably an Australian endemic (other locality records unconfirmed, pending taxonomic review). A biologically vulnerable low-fecundity species, apparently territorial (site-attached) within its shallow bathymetric range. Caught in commercial and recreational fisheries, as a target species and as bycatch. Historic catch data are aggregated with *Orectolobus maculatus*, but serious declines (>60% between 1990 and 2000) for these two species combined are documented for the east coast (NSW), where the population has been assessed as Vulnerable, and where there is still no management plan implemented. Catch levels appear to be low and stable in southern and western Australia, however, given the declines on the east coast due to its vulnerability to exploitation, this species is assessed as Near Threatened throughout the rest of its range. More

information is needed on population structure, life history and ecology in order to develop management policies and re-assess conservation status.

Distribution

Regional endemic (probable): tropical eastern Australia, southwards to Flinders Island in Bass Strait (Last and Stevens 1994) and west and north-westwards to Shark Bay in WA (Hutchins 1990).
Global: Unconfirmed records from Indonesia, Papua New Guinea (PNG) and Japan. Because of taxonomic difficulties with this genus in the previously presumed northern part of its range, this species should currently be treated as an Australian endemic (L.J.V. Compagno, pers comm.).
FAO Areas 57, 71 and 81.

Habitat and ecology

A common inshore bottom-dwelling shark of continental shelves, found on algal-covered rocky reef areas and coral reefs (Compagno 1984a), occurring to at least 117m depth (Last and Stevens 1994; Pogonoski *et al.* 2002) and is also known from around offshore islands. *Orectolobus ornatus* occurs as solitary individuals or in aggregations. This nocturnal shark rests on the bottom during the day in caves, under ledges on reefs, and in trenches (Compagno 2001). Maximum size is ~288cm TL. Size at birth is ~20cm TL. Size at maturity is usually about 175cm TL, but a Queensland male was mature at 63cm TL (suggesting the possibility of more than one species being included under this taxon). The biology of this species is poorly known, but others in the family are ovoviviparous often with between 12–20 pups/litter (Last and Stevens 1994; Compagno 2001).

Threats

Wobbegong sharks are commonly caught in trawls, beach seines, gillnets, lobster pots and traps, by hook and line, and also by spearfishing. The flesh is now highly regarded as food, although in the past was generally of only limited commercial value. The attractive skin is used as a decorative leather (Last and Stevens 1994). These sharks are taken as bycatch (often retained) by commercial fisheries throughout their range (Pogonoski *et al.* 2002). There appear to be relatively low and apparently stable catch levels in southern and western coastal fisheries, and low levels of utilisation in WA. However, serious declines have been observed in NSW, demonstrating the vulnerability of this species to exploitation. Generally, declines of up to two thirds have been observed in NSW Fisheries aggregated catches of wobbegong sharks (consisting of *O. maculatus* and *O. ornatus*) between 1990 and 2000. Assessment and management is complicated by the aggregation of the catch data (NSW Fisheries 2001). Based on the future possibility of segregated data for *O. maculatus* and *O. ornatus* becoming available in some regions due to improved fisheries data collection, and clarification of the taxonomy of these species, future separate national assessments would be warranted. Commercial and recreational fishing is probably the main cause of the decline of these species in eastern Australia.

Commercial fishing by a variety of methods is potentially threatening wobbegong species in southern Australian waters. Wobbegongs are taken in the GABTF, SETF, SSF and the South East Non-Trawl Fishery (AFMA logbook data, unpublished, cited by Pogonoski *et al.* 2002). Most of the above fisheries take these species as bycatch and they are often utilised. This species is also taken in nets in the Western Australian Shark Fishery (WASF) and on hooks in the New South Wales Dropline Fishery (NSWDF), and is sometimes marketed (Daley *et al.* 2002). Wobbegongs, mostly less than 2m long, are part of the bycatch in WA temperate shark fisheries, but are discarded because there is no market for them (Simpfendorfer 1999a). In WA, a Fisheries Department survey conducted in 1996–1997 between Augusta and Kalbarri, reported that up to 1,000 wobbegongs were caught and kept by recreational fishers during that period (Sumner and Williamson 1999). Wobbegongs are also known to be taken by recreational fishers in SA, with no bag or size limits in these states. There is evidence of site-attachment for wobbegongs, making them particularly susceptible to fishing pressure, although further work is necessary in this area (Pogonoski *et al.* 2002). This species may also be susceptible to impacts on inshore coastal habitat, particularly juveniles which often utilise such areas.

Conservation measures

A discussion paper in relation to the management of wobbegong sharks has been prepared for NSW waters (NSW Fisheries 2001), but no management plan is yet in place. There appear to be no other species-specific management arrangements in other Australian states. Some protection may be offered by those protected areas already being implemented for grey nurse sharks *Carcharias taurus* in NSW. These species also occur in some MPAs in NSW: Julian Rocks Aquatic Reserve and Solitary Islands Marine Park, and possibly in Shark Bay Marine Park, WA and Hamelin Pool Marine Nature Reserve, WA. The species also occurs in some MPAs in QLD. Recently, an in-possession limit of two wobbegong sharks per person was introduced for recreational fishers in NSW. This new regulation may help to alleviate any adverse affects caused by recreational fishing practices (Pogonoski *et al.* 2002).

Literature Compagno (1984a); Compagno (2001); Daley *et al.* 2002; Last and Stevens (1994); NSW Fisheries (2001); Pogonoski *et al.* (2002); Simpfendorfer (1999a); Sumner and Williamson (1999).

Northern Wobbegong

Orectolobus wardi Whitley 1939

Richard D. Pillans

Red List assessment **Global: Least Concern**

Rationale A small endemic wobbegong with a wide distribution in shallow water across northern Australia. Little is known of its biology. There are no fisheries for this species and it does not appear in commercial shark or trawl fisheries in northern Australia.

Distribution **Regional endemic: Northern Australia from Fraser Island, QLD to Onslow, WA. (Last and Stevens 1994; Compagno 2001).**
FAO Areas 57 and 71.

Habitat and ecology A little known but possibly common tropical demersal shark, occurring inshore on the continental shelf. Found in shallow water, often in turbid areas. Thought to be reef associated. Little is known about the biology of this species, although it is thought to be ovoviviparous. Maximum size at least 63cm TL, possibly 100cm TL, and a male animal was mature at 45cm TL (Last and Stevens 1994).

Threats Threats within its range are likely to be minimal. There are no target fisheries and it is not reported in bycatch.

Conservation measures None.

Literature Compagno (2001); Last and Stevens (1994).

Cobbler Wobbegong

Sutorectus tentaculatus (Peters, 1864)

Colin A. Simpfendorfer

Red List assessment **Global: Least Concern**

Rationale *Sutorectus tentaculatus* is a common southwestern Australian endemic species occurring in inshore waters around rocky reefs and in weedy areas. It is caught occasionally by demersal gillnet fishers throughout its range in WA, but is normally discarded alive. It is also taken by recreational anglers fishing around reefs for teleost species. At present there appears to have been no significant impact on the population.

Distribution **Regional endemic: Abrolhos Islands, WA, southeast to Adelaide, SA.**
FAO Area 57.

Habitat and ecology Occurs in rocky reef and weedy areas on the continental shelf. Little is known of its ecology, but like other wobbegong sharks it is unlikely to move large distances, spending most of its time lying on the bottom. A small species growing to less than a metre (92cm TL), with size at maturity ~65cm TL (males). Ovoviviparous, with size at birth ~22cm TL. Chidlow (2003) reported only one pregnant female which contained 12 developing embryos with a sex ratio strongly biased towards males.

Threats Occasionally caught in demersal gillnets throughout its range in WA. However, its small size makes it of limited commercial value and it is normally discarded alive. It is not been recorded in the catches from demersal gillnets or trawls in SA (T.I. Walker, pers. comm.). Recreational anglers in southwestern WA occasionally catch this species when fishing for teleosts around rocky reefs.

Conservation measures The gillnet fisheries in which it is caught are managed, but there are no conservation measures specifically aimed at this species.

Literature Chidlow (2003); Compagno (1984a); Last and Stevens (1994).

Grey Bamboo Shark

Chilosyllium griseum Müller & Henle, 1838

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Near Threatened**

Rationale The reproductive and population biology of this small inshore species is poorly known, and it fails to meet any of the criteria for Vulnerable due to insufficient data. However, this species is assessed as Near Threatened as it is regularly taken in fisheries off Pakistan, India and Thailand, and is likely to be threatened by population decline resulting from overfishing, destructive fishing practices and habitat modification, including the damage and destruction of coral reefs. Such threats are likely to increase in the future; there is a need for survey and appraisal of the status of this species.

Distribution **Regional: Papua New Guinea (nominal, see below).**
Global: Indo-West Pacific including nominal records from Indonesia, China, Japan, Philippines, and Papua New Guinea (but possibly based in part on *C. hasselti*, Compagno 2001).
FAO Areas 51, 57 and 71. Possibly 61.

Habitat and ecology A common, sluggish inshore bottom dweller, found on sandy and muddy bottoms, on rocks and in coral lagoons at depths from 5–80m. Oviparous, deposits eggs in small oval eggcases on the bottom. Maximum size at least 77cm TL. Free-living individuals have been found at sizes of at least 12.2cm TL, size at hatching uncertain; size at maturity is 45–55cm TL (males).

Threats Regularly taken in inshore fisheries off Pakistan, India and Thailand, and utilised for food, and is likely to be threatened by overfishing, destructive fishing practices and habitat modification, including the damage and destruction of coral reefs throughout much of its range. This species is kept in public aquaria in the United States (Compagno 2001) but is apparently rare in the aquarium trade (Michael 2001).

Conservation measures None.

Literature Compagno (2001); Michael (2001).

Slender Bamboo Shark

Chiloscyllium indicum (Gmelin, 1789)

Plaxy J. Barratt, Rachel D. Cavanagh and Peter M. Kyne

Red List assessment **Global: Near Threatened**

Rationale *Chiloscyllium indicum* is likely to be threatened by overfishing, destructive fishing practices and habitat modification, including the damage and destruction of coral reefs throughout much of its range. This species is regularly taken in inshore fisheries in India, Sri Lanka and Thailand where it is utilised for food. Virtually nothing is known of the biology of this small, sluggish, bottom dwelling shark. However, although common within parts of its range, it is assessed as Near Threatened, reflecting concern that it may meet the Vulnerable criteria due to the significant impact that considerable fishing pressure is likely having on this species in much of its range, and that will continue in future. There is a need for survey and appraisal of the status of this species.

Distribution **Regional: Possibly New Guinea and the Solomon Islands. Presently unconfirmed from the region, but may also occur in Australian waters east and west of Cape York Peninsula.**
Global: Indo-West Pacific: Much of its range is uncertain. Also possibly Arabian Sea.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology A common but little-known inshore sluggish bottom shark. It may possibly occur in fresh water in the lower reaches of the Perak River in peninsular Malaysia. Virtually nothing is known of the biology of this species. Maximum size ~65cm TL, with size at

maturity 39–42cm TL (males), and 43cm TL (females). *Chiloscyllium indicum* is oviparous.

Threats *Chiloscyllium indicum* is of considerable interest to fisheries in some areas and is regularly taken in inshore fisheries in India, Sri Lanka and Thailand and utilised fresh for food. It is caught in demersal trawls, demersal gillnets and occasionally pelagic gillnets and is likely to be threatened by overfishing, destructive fishing practices and habitat modification, including the damage and destruction of coral reefs throughout much of its range.

Conservation measures None.

Literature Compagno (2001).

Brown-banded Bamboo Shark

Chiloscyllium punctatum Müller & Henle, 1838

Michael B. Bennett and Peter M. Kyne

Red List assessment **Global: Near Threatened**
Australia: Least Concern

Rationale *Chiloscyllium punctatum* is a widely distributed and probably fecund (oviparous) tropical species occurring in a variety of habitats throughout its range. Within Australia the species is assessed as Least Concern as a portion of its habitat is protected in marine parks and it is not a target species, except perhaps for the aquarium trade. It is an extremely hardy species that would presumably survive as a discard in any trawl bycatch. However, throughout much of the rest of its range, the species is likely to be threatened by overfishing for human consumption, habitat loss due to destructive fishing methods on coral reefs, and collection for the aquarium trade.

It fails to meet the criteria for Vulnerable due to insufficient data, but is assessed as Near Threatened globally because of concern over the significant impact that these practices must be having on this species in much of its range.

Distribution **Regional: Irian Jaya, southern coast of Papua New Guinea to the northern coast of Australia (from Shark Bay, WA, to Moreton Bay, QLD, including the NT).**
Global: Indo-West Pacific.
FAO Areas 57, 61 and 71.

Habitat and ecology Found inshore to depths of at least 85m on the continental shelf. Occurs on soft sand/mud substrates and on coral reefs. The species is extremely hardy and can tolerate severe environmental hypoxia, a trait that allows it to occupy and survive in environments that undergo cyclical hypoxic conditions (e.g. coral reef flats). Oviparous species. Hatches at 13–17cm TL and attains a maximum size of ~118cm TL (M.B. Bennett, pers. obs.). Size at maturity 68–76cm TL (males), 63cm TL (females) (Compagno 2001).

Threats Widespread collection for human consumption in artisanal and commercial fisheries and habitat damage over much of its range (not Australia) are the major threats to this species. Collection for the aquarium trade is a minor threat, especially as the species is hardy and will breed prolifically in captivity. Inshore seine-netting, trap fishing and bait fishing are probably the primary modes of collection. Damage and destruction of coral reef habitat from dynamite fishing, other destructive fishing practices and pollution are known to be widespread in large parts of its range.

Conservation measures The species is protected in a significant proportion of its range on the east coast of Australia in the Great Barrier Reef Marine Park and the Moreton Bay Marine Park. While fishing is still allowed in most areas of the parks, the species is not targeted and is likely to survive capture as bycatch.

Literature Blaber *et al.* (1994); Compagno (2001).

Indonesian Speckled Carpet Shark

Hemiscyllium freycineti (Quoy & Gaimard, 1824)

Peter M. Kyne and Michelle R. Heupel

Red List assessment **Global: Near Threatened**

Rationale A largely unknown endemic species from New Guinea. It is apparently common in parts of its range although the shallow water habitat where it occurs is subject to expanding fisheries, including trawling and dynamite fisheries as well as high pollutant loads. This species may also be subject to exploitation by the aquarium industry. *Hemiscyllium freycineti* requires scientific examination to define its conservation status. Due to its limited range, the high degree of habitat destruction and heavy fishing pressure within the region, there is concern that it may soon become Vulnerable (A3cde).

Distribution **Regional endemic: Occurs in the Western South Pacific from Indonesia (Irian Jaya, Waigeo) and Papua New Guinea (Trobriand Islands from Kuia Island, Milne Bay and east of Oro Bay).**
FAO Area 71.

Habitat and ecology This species occurs in shallow waters on coral reefs, sandy and grassy substrates. Reaches a maximum size of 72cm TL with the smallest free-living individual recorded at 19cm TL. Males mature at 37–62cm TL. The biology of this species is almost entirely unknown.

Threats It is unknown if this species is utilised by the aquarium industry. However, this is a very attractive and hardy species that may be sought after for public and private aquaria. This species is very susceptible to habitat destruction via high pollutant levels and dynamite fishing practices. In addition, regions of the Arafura Sea, where *H. freycineti* occurs, are subject to heavy trawling, and high pollutant loads into the Gulf of Papua via the Fly River and others are causing large-scale habitat destruction.

Conservation measures None.

Literature Compagno (2001); Michael (1993).

Papuan Epaulette Shark

Hemiscyllium hallstromi Whitley 1967

Michelle R. Heupel and Peter M. Kyne

Red List assessment **Global: Vulnerable B1ab(iii)**

Rationale A largely unknown species endemic to the Gulf of Papua (Papua New Guinea), a limited distribution subject to a high degree of habitat destruction (high pollutant loads and dynamite fishing practices). Gold mining in the Fly River catchment contributes a large pollutant load that drains directly into the Gulf of Papua causing habitat damage. *Hemiscyllium hallstromi* may also be dependent on coral reef habitats, which are being heavily impacted by pollution and destructive fishing. This species may be subject to exploitation by the aquarium industry, but the extent is unknown.

Distribution **Regional endemic: Occurs exclusively in Papua New Guinea (Gulf of Papua).**
FAO Area 71.

Habitat and ecology This species resides in coastal tropical waters possibly on coral reefs. Reaches a maximum size of 77cm TL. Males mature at 48–64cm TL. The biology of this species is almost entirely unknown.

Threats It is unknown if this species is utilised by the aquarium industry. However, this is a very attractive and hardy species that may be sought after for public and private aquaria. This small population is very susceptible to habitat destruction via high pollutant levels and dynamite fishing practices.

Conservation measures None.

Literature Compagno (2001).

Epaulette Shark

Hemiscyllium ocellatum (Bonnaterre, 1788)

Michael B. Bennett and Peter M. Kyne

Red List assessment

Global: Least Concern
New Guinea: Near Threatened

Rationale

Hemiscyllium ocellatum is widely dispersed across Australia and around New Guinea with a primary habitat of shallow inshore waters and reef systems. In Australian waters, marine parks protect much of the critical habitat on the east coast where it is abundant on some reefs. There are no identifiable important fishing pressures in Australia, although a small aquarium trade may target this species. In New Guinea this shark may be collected as part of a subsistence/artisanal fishery and severe degradation of its habitat occurs in parts of its range through destructive fishing practices and high pollutant loads. The species is listed as Least Concern globally, but Near Threatened (due to concern that it could meet the criterion A3cde for Vulnerable) around New Guinea, highlighting the pressures facing the species in that region.

Distribution

Regional endemic: Occurs in northern coastal waters of Australia, from Shark Bay, WA to Port Macquarie, NSW, including waters of the NT and QLD and New Guinea. Range may extend westwards of New Guinea to Malaysia, and eastwards to the Solomon Islands, but this is not currently verified.
FAO Areas 57, 71 and 81.

Habitat and ecology

This species is commonly found in shallow coastal waters, particularly on coral reefs, from water <1m to at least 40m. The degree of interchange of individuals between reefs is unknown and subpopulations may exist if emigration/immigration is minimal. This is a small, slender shark of up to ~100cm TL. It is more active at low water and, although epaulette sharks can be found actively hunting during daylight hours, it is more active after dark and particularly around dawn or dusk. An oviparous species with size at maturity 54–62cm TL (both sexes). Mating probably occurs between July and November, with females carrying eggcases found between August and December, although in captivity they have been noted to breed continuously (West and Carter 1990). A pair of egg capsules may be produced every 14 days, resulting in up to ~20 potential offspring per female per annum. Eggs hatch after ~120 days with young at 14–16cm TL. Subsequent growth is initially slow, but reaches ~5cm $year^{-1}$ after about three months (West and Carter 1990). The species is hypoxia tolerant and is able to survive in anoxic waters. This trait is important as this shark is often found in shallow (c. 0.15m deep), warm (c. 30°C) waters that become severely hypoxic during the night. This trait may enable this species to survive in areas of poor water quality, such as mining run-off in New Guinea.

Threats

Collection for aquarium trade and bycatch from fishing activities in Australian waters place only minimal pressure on this species. However, around New Guinea the species is likely to be threatened by overfishing, destructive fishing practices and habitat modification, including the damage and destruction of coral reefs from dynamite fishing and pollution. These processes are likely causing declines in all hemiscyllid species occurring around New Guinea, however quantitative data are not available. The status of the species requires close monitoring.

Conservation measures

The species in protected in parts of the Great Barrier Reef Marine Park, QLD.

Literature

Heupel and Bennett (1998); Heupel *et al.* (1999); Last and Stevens (1994); Peach (2002); West and Carter (1990).

Hooded Carpet Shark

Hemiscyllium strahani Whitley, 1967

Michelle R. Heupel and Peter M. Kyne

Red List assessment

Global: Vulnerable B1ab(iii)

Rationale

A largely unknown species endemic to the northern and southern coast along the eastern extent of New Guinea. Its range is limited and somewhat fragmented with a high degree

of habitat destruction (high pollutant loads and dynamite fishing practices). This species may also be subject to an unknown level of exploitation by the aquarium industry.

Distribution **Regional endemic: Papua New Guinea (Port Moresby area and Massas Island).**
FAO Area 71.

Habitat and ecology This species resides in tropical waters on coral reefs typically observed in 3–18m depth. Reaches a maximum size of ~80cm TL. This species is nocturnal and individuals are commonly found in crevices and under coral heads during the day. Known to prefer areas of abundant high coral. Size at maturity is ~60cm TL (males). The biology of this species is almost entirely unknown.

Threats It is unknown if this species is utilised by the aquarium industry. However, this is a very attractive and hardy species that may be sought after for public and private aquaria. This small population is very susceptible to habitat destruction via high pollutant levels and dynamite fishing practices.

Conservation measures None.

Literature Compagno (2001); Michael (1993).

Speckled Carpet Shark

Hemiscyllium trispeculare Richardson, 1843

Michelle R. Heupel

Red List assessment **Global: Least Concern**

Rationale This little-known species is possibly an Australian endemic (although it may also occur in Indonesia). It is not targeted by fisheries and is distributed over a reasonably large coastal range. These small sharks are unlikely to be significantly impacted as a bycatch species and at least a portion of the species' range is protected from fishing. This species may be utilised by the aquarium industry, but the extent of exploitation is unknown.

Distribution **Regional endemic: Northern Australia from Rockhampton, northern QLD to Ningaloo, northern WA. It may also occur in Indonesia (Moluccas).**
FAO Areas 57 and 71.

Habitat and ecology This species resides in shallow tropical waters along the coast and on coral reefs. Reaches a maximum size of ~79cm TL and is oviparous. Individuals are commonly observed under coral structures. Little else is known about the biology of this species.

Threats This species may be taken as bycatch by commercial vessels and may be used in the aquarium trade.

Conservation measures This species is protected in part of its range via closed fishing areas and protected reserves in the Great Barrier Reef Marine Park, QLD.

Literature Compagno (2001); Last and Stevens (1994); Michael (1993).

FAMILY GINGLYMOSTOMATIDAE

Tawny Nurse Shark

Nebrius ferrugineus (Lesson, 1830)

Richard D. Pillans

Red List assessment **Global: Vulnerable A2abcd+3cd+4abcd**
Australia: Least Concern

Rationale A widely distributed continental and insular shelf species of the Indian, West and Central Pacific Oceans. Restricted to a narrow band of shallow water habitat (5–30m,

occasionally to 70m) that is heavily fished throughout all its range except Australia. Taken in inshore fisheries (demersal trawls, floating and fixed bottom gillnets and baited hooks) in Indonesia, Thailand, Philippines, Pakistan and India. Although there are limited data on population declines in these areas, reports of local extinctions in India and Thailand, combined with its narrow habitat range, apparently limited dispersion and low fecundity, indicate that the species is highly susceptible to local inshore fisheries and has declined in a large proportion of its range.

Within Australia it is assessed as Least Concern because it is widely distributed and abundant, captured only in very small numbers in gillnets and beach meshing.

Distribution

Regional: Indonesia (Irian Jaya), Papua New Guinea, northern Australia (WA, NT, QLD), New Caledonia, Samoa, Palau, Marshall Islands and Tahiti (Compagno 2001).
Global: Indo-West and Central Pacific.
FAO Areas 51, 57, 61, 71, 77 and 81.

Habitat and ecology

Found on continental and insular shelves, often in the intertidal zone and from the surf line down to a depth of 70m but more commonly between 5–30m. It occurs on or near the bottom in lagoons, in channels or along outer edges of coral and rocky reefs, seagrass and sandy areas near reefs and off sandy beaches. Often found in crevices and caves during the day. Young prefer crevices in shallow lagoons, but adults are more wide ranging. An ovoviviparous (aplacental viviparity) species with uterine cannibalism in the form of oophagy. Pregnant females from Okinawa had one or two foetuses per uterus (29.7–59.5cm TL) with the yolksac reabsorbed and a greatly expanded stomach filled with yolky material in the larger foetuses, and also had eggcases in the uterus (Teshima *et al.* 1995). It appears as though this species practices oophagy on relatively large, cased nutritive eggs (unlike lamnoids which have very small nutritive eggs) and is the first orectoloboid known to have uterine canabalism. It is not known if the foetuses eat each other (adelphophagy) as with the grey nurse shark *Carcharias taurus*. Litter size is uncertain, possibly one or two per uterus, or even one per female (Compagno 2001). Size at birth is 40–80cm TL. Size at maturity is 250cm TL (males) and 230–290cm TL (females). Maximum size is at least 320cm TL.

Threats

Threats within Australia are likely to be minimal; there are no target fisheries, although it is taken in inshore fisheries throughout much of the rest of its range. In the Gulf of Thailand, it was historically more abundant and may have been adversely affected by the use of explosives and poisons on reefs in the Indian Ocean and western Pacific, particularly Indonesia and the Philippines (Compagno 2001). *Nebrius ferrugineus* often form small aggregations (2–6 individuals) during the day and have a limited home range, with individuals returning to the same area every day after foraging. This behaviour together with its small litter size, large size at maturity and inshore habitat suggest that it is vulnerable to local population depletion in areas of heavy fishing pressure. Furthermore, its docility and habit of resting in caves and crevices during the day make it susceptible to capture and harassment by divers, and reef destruction.

Conservation measures

None.

Literature

Compagno (2001); Last and Stevens (1994); Teshima *et al.* (1995)

FAMILY **STEGOSTOMATIDAE**

Zebra Shark

Stegostoma fasciatum (Hermann, 1783)

Richard D. Pillans and Colin A. Simpfendorfer

Red List assessment

Global: Vulnerable A2abcd+3cd+4abcd
Australia: Least Concern

Rationale

A broadly distributed continental and insular shelf species of the Indian, West and Central Pacific Oceans. Usually found within a narrow band of shallow coral reef habitat and soft bottom (to 62m) that is heavily fished throughout all its range except Australia. Taken in inshore fisheries (demersal trawls, floating and fixed bottom gillnets and baited hooks) and seen in fish markets in Indonesia, Thailand, Malaysia, Philippines, Pakistan, India, Taiwan and elsewhere. There are limited data on population declines in these areas, with the exception of the Gulf of

Thailand, but the species is susceptible to local inshore fisheries and coral reef habitat loss and damage because of its habitat preferences and limited dispersion.

In Australia, where this species is abundant, has a wide distribution and is captured only in very small numbers in prawn trawls, it is assessed as Least Concern.

Distribution

Regional: Indonesia (Irian Jaya), Papua New Guinea, northern Australia (WA, NT, QLD, NSW), New Caledonia and Palau (Compagno 2001).
Global: Indo-West Pacific.
FAO Areas 51, 57, 61, 71 and 81.

Habitat and ecology

Occurs in tropical, shallow inshore and offshore waters of the continental and insular shelves near the bottom; often found on and around coral reefs and on sandy plateaus near coral, at depths down to at least 62m. Often found in large aggregations (20–50 individuals) over sand near broken or continuous reef. An oviparous species, the size at birth is 20–36cm TL. Size at maturity is 147–183cm TL (males) and 169–171cm TL (females). The maximum size attained is at least 235cm TL. All other life history characteristics are currently unknown.

Threats

Threats within Australia are likely to be minimal, no target fisheries. Potentially susceptible to capture by prawn trawls, however very few are reported in the Northern Prawn Fishery (M. Tonks, pers. comm.). Although there is no direct evidence of population decline in the Indo-West Pacific, market surveys suggest this species is much less common than it used to be (L.J.V. Compagno, W. White, pers. comm.). In the Gulf of Thailand, it was historically more abundant and it may have been adversely affected by the use of explosives and poisons on reefs in the Indian Ocean and western Pacific (Compagno 2001). Apart from baited hooks, *S. fasciatum* is susceptible to capture in a wide range of inshore fisheries. This, in combination with a narrow habitat range, limited dispersal and tendency to form large aggregations makes this species vulnerable to population decline.

Conservation measures

None.

Literature

Compagno (2001).

FAMILY **RHINCODONTIDAE**

Whale Shark

Rhincodon typus (Smith, 1828)

Brad Norman

Red List assessment

2000 Red List assessment:
Global: Vulnerable A1bd+2d

Rationale

The life history of this relatively scarce but cosmopolitan tropical and warm temperate species is poorly understood, but it may be relatively fecund and migrates extremely large distances. Catches have declined and populations apparently been depleted by harpoon fisheries in several countries targeting localised concentrations of this huge, slow-moving and behaviourally-vulnerable species, and there is incidental capture in other fisheries. Directed fisheries, high value in international trade, a K-selected life history, highly migratory nature, and low abundance make this species vulnerable to exploitation. In recent years dive tourism involving this species has developed in a number of locations around the world.

Literature

Norman (In: Fowler *et al.* in press).

Grey Nurse Shark (Sand Tiger Shark, or Spotted Ragged Tooth Shark)

Carcharias taurus Rafinesque, 1810

David A. Pollard, Ian Gordon, Sara Williams, Anthony A. Flaherty and Rory B. McAuley

Red List assessment

2000 Red List assessment:
Global: Vulnerable A1ab+2d

2000 Red List rationale:
This large coastal shark has a disjunct distribution, occurring in most subtropical and warm temperate oceans, except for the Eastern Pacific. It has a strongly K-selected life history, producing only two pups/litter every second year. As a result, annual rates of population increase are very low, greatly reducing its ability to sustain fishing pressure. Populations in several locations have been severely depleted by commercial fishing, spearfishing and protective beach meshing, requiring the introduction of specific management measures. See Pollard and Smith (In: Fowler *et al*. in press).

Update (Australia only):
Australia: Vulnerable A1abcd
NSW: Critically Endangered A2abcd+3cd+4abcd
WA: Near Threatened

Rationale

Australia
The Australia-wide assessment of Vulnerable for this species was derived from a combination of a severe depletion of the east coast population since the 1950s and an apparently larger and more stable population on the west coast. Despite State and Commonwealth protection, grey nurse sharks are still subject to mortality from commercial and recreational fishing activities and disturbance by recreational divers at inshore aggregation sites. Australia's two subpopulations are assessed separately as follows:

East coast
Numbers of *Carcharias taurus* in inshore waters of NSW and southern QLD declined dramatically throughout the 1960s and 1970s due to the combined effects of targeted spearfishing, incidental capture by commercial and recreational fishing, and beach protective shark meshing. Numbers in NSW are very low, probably numbering less than 500 and possibly as low as 300. The Critically Endangered assessment is assigned due to observed declines in the numbers of sharks at aggregation sites, a reduction in the number of known aggregation sites, and dramatic declines in catch rates in beach protective meshing programmes. Although protected in NSW since 1984, they are still subject to incidental capture and there appears to be little or no recruitment at sites where populations have become locally extinct.

West coast
Grey nurse sharks have never been targeted in WA. The only significant source of mortality has been from incidental capture by a demersal gillnet fishery. Based on data from this fishery, the west coast population of *C. taurus* is assessed as Near Threatened because mean annual catches of 77 sharks, in conjunction with a stable CPUE, indicate that the population is larger and more stable than the eastern population, and aggregation sites are not known within the range of this fishery. However, these data are only available for 1989–1997, when the species was protected under the *Endangered Species Protection Act* and commercial reporting ceased. Due to the loss of this established index of abundance, the limited reproductive capacity of *C. taurus* and the precarious status of the eastern population, it is recognised that the western population still has the potential to become Vulnerable in the future. Even low levels of bycatch may lead to population declines in a species with such a low intrinsic rate of increase. There is a need to develop the means to monitor the abundance of these sharks in WA and conduct further research into their ecology.

Distribution

Regional: Australia, from Mooloolaba, southern QLD southwards to the VIC border in eastern Australia, and from Cocklebiddy, southern

WA northwards to North West Cape (Hutchins and Swainston, 1986; R. McAuley, pers. comm.). Records and sightings have also been confirmed from the North West Shelf, WA and Arafura Sea, NT (J. Stevens, pers. comm.). Occasional records northwards to Cairns on the northeast coast of QLD (B. Lane, pers. comm.), limited records from northern VIC (T.I. Walker, pers. comm.) and possible records from SA.

Note: Because *C. taurus* is extremely rare in the NT and SA, there is likely to be almost no genetic exchange between sharks on the east and west coasts and, for the purposes of this assessment, the Australian population is considered to consist of two subpopulations.

Global: Primarily in warm-temperate (from subtropical to cool-temperate) inshore waters around the main continental landmasses, except in the eastern Pacific Ocean off North and South America (Pollard *et al.* 1996; Otway and Parker, 1999).

FAO Areas 21, 27, 31, 34, 41, 47, 51, 57, 61, 71 and 81.

Habitat and ecology

The grey nurse shark generally occurs in warm-temperate and subtropical waters, ranging from the surf zone and shallow bays to approximately 200m depth. Usually found on or near the bottom in reef areas, but may occasionally occur in midwater or at the surface (Compagno 1984a). This is a migratory species known to move between particular sites along the east coast of Australia. When not migrating, these sharks aggregate in or near deep sandy-bottomed gutters or in rocky caves around inshore rocky reefs and islands at depths of 15–40m (Pollard *et al.* 1996; Otway and Parker 2000), although these sharks are no longer found at many of the sites that they were known to use previously. No aggregation sites have been confirmed on the west coast, although one site has been reported to exist off Perth. WA Department of Fisheries research data suggest that grey nurse sharks are more dispersed throughout temperate continental shelf waters than they are in eastern Australian waters.

Adelphophagy occurs in this species and only two large pups are produced per litter every second year. As a result, annual rates of population increase are very low, greatly reducing its ability to sustain fishing pressure. Maximum size attained is 220–270cm TL (males) and 300–320cm TL (females). Age at maturity is 6–7 years (males) and 9–10 years (females) (Goldman 2002).

Threats

Currently the main threatening processes in Australian waters appear to be commercial and recreational fishing (including shark control programmes in NSW and QLD), in which this species is taken as bycatch. It has also been suggested that shark diving may also have the potential to adversely impact upon its populations. Refer to the *Recovery Plan for the Grey Nurse Shark (Carcharias taurus) in Australia* (Environment Australia 2002) for further details of the threats facing grey nurse sharks in Australian waters. See also http://www.ea.gov.au/coasts/species/sharks/greynurse/plan/index.html

East coast

Grey nurse sharks are no longer found in significant numbers at several sites on the East Coast in NSW where they used to be dominant during the 1950s and 1960s. A recent diver survey, coordinated by NSW Fisheries, found that numbers in NSW were very low, probably less than 500 and possibly as low as 300. There is concern that the east coast population is suffering from depensation having fallen to such critically low numbers that some individual animals may now be failing to find mates. During the early 1950s up to 36 grey nurse sharks yr^{-1} were captured by shark control nets in NSW. By the 1980s this had decreased to three or less yr^{-1}, and from 1990–2000 only three were caught, despite increased meshing effort over this period. A similar trend was observed in data from the QLD Program, where grey nurse shark captures decreased from an average of nine sharks yr^{-1} between 1962–1972, to slightly over two sharks yr^{-1} by the late 1980s (Reid and Krogh, 1992). Although grey nurse sharks have been protected in NSW since 1984, they are still subject to incidental capture by commercial and recreational fishers and in the beach meshing programmes. In particular, vessels targeting wobbegong sharks (*Orectolobus* spp.) in the NSW Ocean Trap and Line Fishery have a significant bycatch of this species (Fletcher and McVea 2000). In the 1998–2001 NSW diver survey, between 5–7% of observed grey nurse sharks had wobbegong setline and other line fishing hooks embedded in their jaws (Otway and Parker 2000). There also appears to be little or no recruitment into sites where populations have become locally extinct (D. Pollard, I. Gordon, pers. obs.). Illegal finning, eco-tourism and trade for aquaria may pose additional threats to the recovery of grey nurse sharks in NSW and QLD.

West coast

Unlike NSW and QLD, grey nurse sharks have never been subjected to targeted fishing in WA. The only significant source of mortality has been from incidental capture by

the demersal gillnet fishery that operates between Steep Point and the SA border. Catch and catch rate data from this fishery have been independently verified by estimating the fishery's total catch from the CPUE recorded by scientific observers (McAuley and Simpfendorfer draft report). Catches of between 70–105 sharks yr^{-1} (R. McAuley unpublished data) indicate that grey nurse sharks were relatively abundant on the lower west coast of WA between 1989–1997 and CPUE of grey nurse sharks in the demersal gillnet fishery increased between 1989–1993 and then remained level until 1997, indicating that the population was stable. However, data are only available for July 1989 to December 1997, when the species was protected under the *Endangered Species Protection Act* and commercial reporting ceased. These data cover the eight-year period immediately after the historical peak in demersal gillnet fishing effort and the period during which direct management adjustment reduced effort to 42% of its maximum level.

WA Department of Fisheries research records do not suggest that aggregation sites occur within the functional area of the WA demersal gillnet fishery. If such sites do occur within the fishery's geographic boundaries, they are likely to be in areas of heavy reef, where gillnet vessels do not operate due to the risk of net entanglement. Additionally, there are several records of grey nurse shark occurrence in two significant regions outside of the fishery's operational range, between Steep Point (26° 30' S) and NW Cape (22° S), which has been closed to shark fishing since 1993, and, in deeper coastal waters (>100m), where demersal gillnet vessels do not operate due to their generally small size and the amount of expected damage to gear and catch caused by currents and predation. Both areas are thought to offer significant refugia to this species. However, there is also some concern regarding anecdotal reports that grey nurse sharks were more abundant in the 1960s and 1970s and that there may have been inshore aggregation sites that are no longer in existence. Archival tagging of grey nurse sharks to provide data on distribution and migratory behaviour in Western Australia is expected to be undertaken in the next 12 months.

This species may well be reassessed over the coming year, as well as undergoing routine reassessments in the future.

Note: The species was listed as Endangered in Pogonoski *et al.* (2002), using the earlier (1994) IUCN Red List system. When using the new system (version 3.1), Vulnerable A1 is equivalent to the previous Endangered category, both have a threshold of 50% population size reduction.

Conservation measures

Protection Status in Australia

- Protected Species in Commonwealth waters under the *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999*: East Coast Population – *Critically Endangered (2002)*, West Coast Population – *Vulnerable* (since 1997).
- Listed as a *Vulnerable* Species in NSW waters under the *Fisheries Management Act 1994* (since 1999).
- Protected Species in NSW waters under the *Fisheries Management Act 1994* (since November 1984).
- Listed as a *Vulnerable* Species in Victorian waters under the *Fisheries Act 1995.*
- Protected Species in Tasmanian waters under the *Fisheries Regulations 1996* (since 1998).
- Protected Species in Queensland waters under the *Fisheries Act 1994* (Fisheries Regulation, 1995) (since 1997).
- Protected Species in Western Australian waters under the *Wildlife Conservation Act 1950* (since December 1999).

Recovery Plans

A National Recovery Plan for the grey nurse shark in Australia was adopted for implementation by the Minister for Environment and Heritage in June 2002. The overall conservation objective is to increase grey nurse shark numbers in Australian waters to a level that will see the species removed from the IUCN Red List. A draft Recovery Plan for the grey nurse shark has also been developed for NSW.

Other conservation measures

Management measures have been developed for the critical habitat site identified at Pimpernel Rock in northern NSW. See http://www.mpa.nsw.gov.au/simp/simp.htm.

Literature

Compagno (1984a); Environment Australia (2002); Fletcher and McVea (2000); Goldman (2002); Last and Stevens (1994); McAuley and Simpfendorfer draft report; Otway and Parker (1999); Otway and Parker (2000); Pogonoski *et al.* (2002); Pollard *et al.* (1996); Pollard and Smith (In: Fowler *et al.* in press); Reid and Krogh (1992).

Herbst's Nurse Shark (Small-toothed Sand Tiger)

Odontaspis ferox (Risso, 1910)

David A. Pollard, Ian Gordon, Sara Williams, Anthony A. Flaherty and Ian K. Fergusson

Red List assessment

Global: Data Deficient**
Australia: Vulnerable A2abd+3ad+4abd

Rationale

Despite its worldwide distribution, *Odontaspis ferox* populations and occurrences are fragmented and the species may be naturally rare. Recent evidence of shallow water aggregations in a number of areas (Mediterranean Sea and eastern Pacific Ocean) suggests that the species may be more vulnerable to fishing pressure than previously assumed, and potentially susceptible to coastal habitat impacts as well as to over-exploitation because of its presumed very low reproductive capacity. Increased demersal trawl fisheries in Australia and New Zealand are now operating in areas of possible and known occurrence. Fishery independent surveys indicate an observed decline of over 50% in catches off the east coast of Australia (hence the Vulnerable assessment in these waters), probably the result of commercial fishing operations off NSW; similar declines are presumed to have occurred in many other parts of its range impacted by fisheries.

In addition, the decline of *O. ferox* in the Mediterranean Sea likely matches or even exceeds that in Australia, although data are lacking. More study is needed to accurately determine the distributional range, abundance and biology of this species, and it is assessed as Data Deficient globally pending an urgent review.

Distribution

Regional: Australia (NSW, VIC, WA), New Zealand (Last and Stevens 1994) and the Kermadec Islands (Francis 1993). It is probably more widespread in Australian waters than voucher specimens would indicate (P. Last, pers. comm.). Important sites in Australia occur off NSW on the shelf and upper slope off the south coast.
Global: This species has a very disjunct distribution throughout most of the world's oceans.
FAO Areas 27, 31, 34, 37, 51, 57, 61, 77 and 81.

Habitat and ecology

Odontaspis ferox is an active-swimming offshore shark, caught and seen as individuals and in small groups (Compagno 2001). It lives on or closely associated with the bottom in deep water along continental and insular shelves and upper slopes (Last and Stevens 1994) to depths of about 850m (K. Graham, pers. comm.). It is occasionally found in shallower water (Last and Stevens 1994; B. Hutchins, pers. comm.). There are at least three records from pelagic zones in open waters of the Indian Ocean (Bonfil 1995). Little is known of the biology of this shark. Its reproduction is presumably similar to that of the grey nurse shark, *Carcharias taurus*. Compagno (2001) cites an observation which suggests the species practices uterine cannibalism in the form of oophagy. Size at birth is >105cm TL (Compagno 1984a). Compagno (2001) cites maximum size of at least 410cm TL and possibly larger; size at maturity 275cm TL (males), 364cm TL (females). In Australian waters, size at birth is >100cm TL and attains at least 360cm TL, but the size at maturity is unknown (Last and Stevens 1994). A 270cm TL female specimen caught off the Sydney area was judged to be immature, as there was no sign of ovarian development (K. Graham, pers. comm.).

Threats

Incidental capture from commercial fishing on the outer continental shelf and continental slope is a potential threat to its survival in southeastern Australian waters. From the available information, *O. ferox* was never abundant off NSW, but there is strong evidence that numbers seriously declined between 1972 and 1997. Of the 35 specimens caught by the NSW Fisheries Research Vessel *Kapala*, 33 were caught between 1975 and 1981 (from 500 slope trawl tows), but only two were taken from about 250 trawl tows made between 1982 and 1997 (K. Graham, pers. comm; cited in Pogonoski *at al*. 2002). The NSW upper slope trawl grounds were again surveyed in 1996–97 and the results compared to those from an initial survey made in 1976–77 (Graham *et al*. 1997). Twelve captures (14 sharks) were made during 246 tows in 1976–77, but only a single juvenile was caught during 165 tows made in 1996–97.

** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

Although considered in Pogonoski *et al.* (2002) as Near Threatened, based on available NSW catch data, reassessment as Vulnerable is warranted for Australia.

In the Mediterranean, dedicated efforts to detail captures and other indices of the abundance of this species only began in the past ten years, and in particular since 1995. Data concerning historical captures is patchy and lacking in detail, so longer-term trends in its abundance are unknown. Moreover, fisheries records are sometimes confused by the widespread use of similar common names for different Mediterranean species. In recent years, the discovery of at least one apparent aggregation area for these sharks off Lebanon (Fergusson *et al*. in prep.) clearly indicates the vulnerability of these large and generally slow-moving sharks to human interference or directed fisheries. Coastal development for tourism, coupled to uncontrolled spearfishing, unregulated coastal fisheries, pollution and increased human aquatic leisure activities may all seriously impact these sharks whilst inhabiting areas outside their deepwater environment (Fergusson *et al*. 2002).

There has been limited take for aquarium display (Kelly Tarlton's Aquarium at Auckland NZ) but this species was not successfully kept in captivity.

There is now more evidence that coastal locations are frequented by mature *O. ferox* on a repetitive seasonal basis, possibly for reproduction. Where identified, these sites deserve stringent protection where possible. Community-based dive observations or monitoring may be of use in obtaining information on its biology and knowledge of important habitats in shallow waters.

Conservation measures In Australia, this has been a Protected Species in NSW waters since 1984.

Literature Bonfil (1995); Compagno (1984a); Compagno (2001); Fergusson *et al*. (2002); Fergusson *et al.* (in prep.); Last and Stevens (1994); Pogonoski *et al.* (2002).

FAMILY **PSEUDOCARCHARIIDAE**

Crocodile Shark

Pseudocarcharias kamoharai (Matsubara, 1936)

Leonard J.V. Compagno and John A. Musick

Red List assessment *2000 Red List assessment:*
Global: Near Threatened

Rationale This small, uncommon, pelagic, oceanic shark is circumtropical in distribution. Because of its small litter size and probable life history demography, it is likely vulnerable as bycatch in expanding pelagic high-seas longline fisheries. No catch per unit effort records are available to indicate trends in population size, but a population decline from bycatch is considered probable and is predicted to continue or increase as existing massive pelagic longlining fishing effort increases worldwide.

Literature Compagno and Musick (In: Fowler *et al.* in press).

FAMILY **MEGACHASMIDAE**

Megamouth Shark

Megachasma pelagios Taylor, Compagno & Struhsaker, 1983

Leonard J.V. Compagno

Red List assessment *2000 Red List assessment:*
Global: Data Deficient

Rationale A large, mainly deepwater filter-feeding species that is known from only a few bycaught or stranded specimens and is apparently very rare throughout its range. It could increasingly be taken as bycatch in deepwater fisheries.

Literature Compagno and Cavanagh (In: Fowler *et al.* in press).

Pelagic Thresher

Alopias pelagicus Nakamura, 1935

Matt B. Reardon

Red List assessment

Global: Data Deficient**

Rationale

Alopias pelagicus is a wide-ranging Indian and Pacific Ocean pelagic shark, apparently highly migratory, with low fecundity (2 pups/litter) and low potential annual rate of population increase (between 2–4%). This species is especially vulnerable to fisheries exploitation (target and bycatch) as its epipelagic habitat occurs within the range of many gillnet and longline fisheries in which it is readily caught. Although this species appears to be relatively common in some coastal localities, fishing pressure in some areas appears already to be unsustainable at current levels of exploitation, because of its low rebound potential, and is likely to continue, if not increase. This animal requires careful monitoring because of its limiting life-history traits and evidence of declines in parts of its range, although available data are currently insufficient to assess the status of this species.

Distribution

Regional: Australia (northwest WA) and New Caledonia.
Global: Oceanic and wide-ranging.
FAO Areas 51, 57, 61, 71, 77 and 87.

Habitat and ecology

Little is known of this species, it is probably highly migratory and is epipelagic from the surface to at least 152m depth (Compagno 2001). It is aplacental viviparous with oophagy, and a litter size of only two pups. Size at birth is 158–190cm TL. There is no definite breeding season. Size at maturity is ~267–276cm TL (males) and ~264–330cm TL (females). Corresponding age at maturity has been estimated at 6–9 years (males) and 8–9 years (females) (Gilmore 1993; Liu *et al.* 1999; Compagno 2001). Its potential annual rate of population increase under sustainable fishing is thought to be very low and has been estimated at 2–4% (S. Smith, pers. comm.), as opposed to *A. vulpinus* which is between 4–7% (Smith *et al.* 1998).

Threats

Chondrichthyan species have been fished heavily in the Indian Ocean and significant reductions are thought to have occurred as a result of intensive pelagic fishing effort (L.J.V. Compagno, pers. comm.). The area of these fishing operations included known pelagic thresher ranges, and this species is especially vulnerable to fisheries exploitation as it is readily caught in gillnets and on longlines, even getting its tail caught in the nets or on hooks. In Indonesia, and probably elsewhere in South East Asia, *A. pelagicus* are caught in very high numbers by tuna longliners throughout the region, especially south Java where they fish in or close to Australian waters (W. White, pers. comm.). There are no data available on capture rates, but due to their low fecundity and slow growth this is not likely to be sustainable. The species was formerly exploited by the longline fishery in the northwestern Indian Ocean, is also fished in the Central Pacific and is currently an important catch off Taiwan with about 222t landed annually. It is caught by shark fishermen in large numbers in the Gulf of California, the Pacific coast of Mexico, the Gulf of California, the Red Sea and the Gulf of Aden. When *A. pelagicus* occurs off the West coast of the USA during El Nino years, females comprise 83% of the catch, of which 41% are pregnant. This aggregating of females may possibly make them additionally vulnerable to entangling gear such as gillnets (S. Smith, pers. comm.). Analysis of longline data from the EEZ of Mexico's Pacific coast (from 1986–2001) shows *A. pelagicus* as the most important species in the fishery (by numbers) although recently the fleet (now with fewer longliners) has moved towards the west coast of Baja California and blue shark is currently the most important species caught. There was a decline in the *A. pelagicus* stock, but there is no information on the scale of this decline (F. Marquez, pers. comm.). The species is utilised for its meat, liver oil, hides for leather and fins for shark-fin soup.

Conservation measures

None.

Literature

Cailliet and Bedford (1983); Compagno (2001); Gilmore (1993); Liu *et al.* (1999); Moteki *et al.* (2001); Smith, *et al.* (1998).

** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

Bigeye Thresher

Alopias superciliosus (Lowe, 1839)

Matt B. Reardon

Red List assessment

Global: Data Deficient**

Rationale

Alopias superciliosus is an apparently highly migratory, oceanic and coastal species found virtually circumglobally in tropical and temperate seas. It has low fecundity (2–4 pups/litter) and a very low potential annual rate of population increase (between 2–3%). *Alopias superciliosus* is especially vulnerable to fisheries exploitation (target and bycatch) as its epipelagic habitat occurs within the range of many gillnet and longline fisheries in which it is readily caught. This species has been fished throughout its range. Although population trend data are lacking in most areas, significant reductions in thresher (*A. superciliosus* and *A. vulpinus*) CPUE have been reported in the Northwest Atlantic pelagic longline fishery, and suspected declines have occurred elsewhere. Although insufficient data are available on a global level on catch rates and abundance, it is evident that this vulnerable species with such low productivity faces major threats in many parts of its range where it is affected by longline and gillnet fisheries that are unlikely to cease or decrease anytime in the immediate future.

Distribution

Regional: Australia (northwestern coast), New Zealand and New Caledonia.
Global: Oceanic and coastal, virtually circumglobal in tropical and temperate seas. *FAO Areas 21, 27, 31, 34, 41, 47, 51, 57, 61, 71, 77, 81 and 87.*

Habitat and ecology

The bigeye thresher is epipelagic, neritic, epibenthic (Compagno 2001) and also inhabits the mesopelagic zone (S. Smith, pers. comm.). The species is aplacental viviparous with oophagy and usually with two embryos (Gruber and Compagno 1981), sometimes three or four (Compagno 2001). Ages at maturity were estimated to be 9–10 years (males) and 12.3–13.4 years (females) at 332–334cm TL, off northeastern Taiwan (Liu *et al*. 1998), and 3.5 years (males), 4.5 years (females) at 356cm TL in the Atantic Ocean. Of the thresher sharks, the bigeye has the lowest annual rate of increase, estimated at 2–3% under sustainable exploitation (S. Smith, pers. comm.).

Threats

This species has been fished throughout its range (L.J.V. Compagno, pers. comm.). An 80% reduction between 1986–2000 in *A. superciliosus* and *A. vulpinus* (combined) has been reported in the Northwest Atlantic pelagic longline fishery, encompassing the entire range of this regional population (Baum *et al*. 2003). Chondrichthyan species have been fished in the Indian Ocean and significant reductions are thought to have occurred as a result of intensive pelagic fishing effort (L.J.V. Compagno, pers. comm.). The bigeye thresher is especially vulnerable to fisheries as its epipelagic habitat occurs within the range of commercial gillnet and longline fisheries in which it is readily caught, even getting its tail caught in the nets or on hooks. In some areas, aggregating females may possibly make them additionally vulnerable to entangling gear such as gillnets, although distributional data are not currently available (S. Smith, pers. comm.). It is, and has been, caught in the oceanic longline fisheries operated by the former USSR, Japan, Taiwan, Spain, Brazil, Uruguay, Mexico, Cuba and the USA and is caught as a bycatch in gillnets, trawls, and rarely in anti-shark nets in South Africa off KwaZulu-Natal. It is targeted by sport fishers in the USA, South Africa and New Zealand (Compagno 2001). It is possible that catches in the Pacific in recent years may have increased with increased targeting of bigeye tuna in deeper waters. However, since thresher sharks are not separated by species in international longline fleet log records, there is no information currently available on trends (S. Smith, pers. comm.). However, from a recent preliminary study *A. superciliosus* has been shown to be slightly overexploited in the northwestern Pacific (K.M. Liu, pers. comm.). Analysis of longline data from the EEZ of Mexico's Pacific coast (1986–2001) shows that this species was recorded at a low frequency in the catches (F. Marquez, pers. comm.). The species represented almost 100% of alopiids caught by Brazilian longliners during the period 1974–1997, with 1t landed between 1971–1972, 119t in 1989 and 10t in 1996 (Amorim *et al*. 1998). It comprised a small percentage (0.35%) in a fishery independent survey in the western North Atlantic between 1977 and 1994 (Simpfendorfer *et al*. 2002). In Indonesian waters *A. superciliosus* is caught in consistent albeit low numbers, although it is not known whether this is due to them occurring naturally in lower numbers or due to population depletion (W. White, pers.

** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

comm.). It is also caught in relatively small numbers by recreational fishers in northeast North Island in New Zealand (C. Duffy, pers. comm.). The meat of the bigeye thresher is utilised fresh, smoked or dried-salted for human consumption. The liver oil, skin and fins are also utilised.

Conservation measures None.

Literature Amorim *et al.* (1998); Baum *et al.* (2003); Cailliet and Bedford (1983); Compagno (2001); Gruber and Compagno (1981); Liu *et al.* (1998); Simpfendorfer *et al.* (2002); Smith *et al.* (1998); Stillwell and Casey (1976).

Thresher Shark

Alopias vulpinus (Bonnaterre, 1788)

Kenneth J. Goldman

Red List assessment *2000 Red List assessment (updated in 2001):*
Global: Data Deficient
California: Near Threatened

Rationale The thresher shark is a widely distributed continental shelf species, which lives in a wide range of water temperature regimes. It is an important economic species in many areas and has been taken in large numbers as a targeted and bycatch species. The California drift gillnet fishery for *Alopias vulpinus* has provided strong evidence that this species is highly vulnerable to overfishing in a short period of time. A lack of catch and landings data from other locations, knowledge on stock structures, and uncertainty in current estimates of life history parameters, make it impossible to accurately access the status of most populations. Bycatch is potentially a large problem for *A. vulpinus* populations. It is well documented in California waters, but undocumented for other geographic regions.

Literature Goldman (In: Fowler *et al.* in press).

FAMILY CETORHINIDAE

Basking Shark

Cetorhinus maximus (Gunnerus, 1765)

Sarah L. Fowler

Red List assessment *2000 Red List assessment (updated in 2003 with new criteria):*
Global: Vulnerable A2bd
Northeast Atlantic and Northwest Pacific populations: Endangered A2bd

Rationale A very large filter-feeding cold-water pelagic species, widely distributed but only regularly seen in a few favoured coastal locations and probably never very abundant. Documented fisheries in several regions have usually been characterised by rapidly declining local populations as a result of short-term fisheries exploitation, followed by very slow or no recorded population recovery. There is likely potential for similar population declines to occur in the future from directed and bycatch fisheries, driven at least in part by the demand for fins in international trade. Basking sharks are now legally protected in some territorial waters. Compagno (1984a) considers the basking shark "to be extremely vulnerable to overfishing, perhaps more so than most sharks ... ascribed to its slow growth rate, lengthy maturation time, long gestation period, probably low fecundity and probable small size of existing populations (belied by the immense size of individuals in their small schools)."

Literature Fowler (In: Fowler *et al.* in press).

White Shark

Carcharodon carcharias (Linnaeus, 1758)

Ian K. Fergusson, Leonard J.V. Compagno and Mark Marks

Red List assessment

2000 Red List assessment:
Global: Vulnerable A1cd+2cd

Rationale

The white shark is a widely but sparsely distributed top predator with a very low reproductive potential (late maturity and small litter size) and high vulnerability to target and bycatch fisheries (commercial and recreational), some of which supply products (fins, jaws and teeth) for international trade. Where detailed population data are available, these indicate that the abundance and average size of white sharks have declined. The species is now effectively protected in some parts of its range, where it may be Lower Risk (conservation dependent). A global status of Endangered (A1cd+2cd) may be proven accurate for this shark as further data are collated.

Literature

Fergusson, Compagno and Marks (In: Fowler *et al.* in press).

Shortfin Mako

Isurus oxyrinchus Rafinesque, 1810

John D. Stevens

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

A wide-ranging oceanic and pelagic shark with high value meat, the shortfin mako is subject to significant bycatch and targeted fisheries in some areas. Most catches are inadequately or un-recorded, and its relatively low reproductive capacity makes it very susceptible to depletion by these fisheries. However, the species is very wide-ranging and has a relatively fast growth rate. There is no evidence to suggest that its global population has been sufficiently depleted for it to warrant 'Vulnerable' status at the present time.

Literature

Stevens (In: Fowler *et al.* in press).

Longfin Mako

Isurus paucus Guitart Manday, 1966

Matt B. Reardon

Red List assessment

Global: Data Deficient**

Rationale

The longfin mako is a widely distributed but rarely encountered oceanic tropical (possibly circumtropical) shark. Larger and less fecund than the shortfin mako, it is often caught in the same fishing gear but at rates as low as 5% of the latter, which has undergone moderate documented declines in the Northwest Atlantic, and faces very high fishing pressures in its epipelagic habitat from commercial fleets. Longfin mako populations are considered likely to have declined and to continue to decline, due to their susceptibility to fisheries capture, low fecundity, and the fisheries operating throughout its range. However, data are currently insufficient to assess the status of this wide-ranging species.

Distribution

Regional: Australia (QLD and northern NSW).
Global: Oceanic and tropical, possibly circumtropical but records are sporadic so this is not confirmed.
FAO Areas 21, 27, 31, 34, 41, 57, 61, 71, 77 and 81. Possibly 47 and 87.

** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

Habitat and ecology Very little is known of the biology of *I. paucus*. It is aplacental viviparous with possible intrauterine cannibalism, and a pregnant female may have 2–8 embryos at one time. Size at birth is recorded between 92–120cm TL and reported size at maturity is 245cm TL (females) (Gilmore 1993, Compagno 2001).

Threats This species is often caught in the same fishing gear as that of the shortfin mako, which has declined moderately in the Northwest Atlantic (Baum *et al.* 2003). Probably taken regularly as bycatch in tropical pelagic longline fisheries for tuna and swordfish and other fisheries which operate throughout its range. Analysis of longline data from the EEZ of Mexico's Pacific coast (from 1986–2001) shows that this species was recorded at a low frequency in the catches (F. Marquez, pers. comm.). Similarly, this species is caught in low numbers by longliners in Indonesian waters, and given the high level of exploitation in this area, if longfin makos were abundant here, this would likely be reflected in the fisheries catch (W. White, pers. comm.). Between 1971–1972 it accounted for about a sixth of the total weight of sharks caught off the north coast of Cuba, but was infrequently caught between 1974–1997 by longliners off southern Brazil, with only a few samples taken. The meat is of low quality and it is often finned and discarded at sea. It is also caught with hook and line and anchored gillnets (Amorim *et al.* 1998, Compagno 2001).

Conservation measures None.

Literature Amorim *et al.* (1998); Baum *et al.* (2003); Compagno (2001); Gilmore (1993).

Porbeagle Shark

Lamna nasus (Bonnaterre, 1788)

John D. Stevens

Red List assessment

2000 Red List assessment:
Global: Near Threatened
Northeast Atlantic: Vulnerable A1bd
Northwest Atlantic: Conservation Dependent

Rationale A very wide-ranging species (albeit with apparently little exchange between neighbouring populations), but with a low reproductive capacity and high commercial value. Taken both in target and incidental fisheries. Global populations are not proven to have been depleted to a level where they qualify for a Vulnerable status. However, North Atlantic populations have been seriously over-exploited in longline fisheries, although the introduction of management for US and Canadian shark fisheries should reverse the serious decline in this stock. The apparent lack of exchange between populations on each side of the North Atlantic has resulted in separate assessments for the western and eastern stocks.

Literature Stevens (In: Fowler *et al.* in press).

Freckled Catshark

Apristurus sp. A [Last & Stevens, 1994]

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale This undescribed endemic belongs to a genus of poorly known deepwater catsharks. Very little is known of the biology. This species is known to occur in deep water (940–1,290m) off southeastern Australia and WA. There is some concern for this species as its distribution includes heavily fished areas, particularly off southeastern Australia. Deepwater demersal trawl fisheries are expanding in the region, and assuming its biology is like other deepwater shark species, it may not be sufficiently fecund to withstand increasing exploitation pressure.

Distribution **Regional endemic: Southeastern Australia (from Newcastle, NSW to Beachport, SA), and WA (North West Cape to Busselton and off Ashmore Reef). Possibly more widespread – may occur off New Zealand (Last and Stevens 1994).**
Note: The current known range may be inaccurate due to misidentification and further taxonomic work is necessary to resolve problems in this genus.
FAO Areas 57 and 81.

Habitat and ecology Occurs at depths of 940–1,290m. This species attains at least 74cm TL, with size at maturity 51–64cm TL (males). Biology is virtually unknown.

Threats The known distribution of this species includes heavily fished areas, particularly off southeastern Australia by the SETF and STRTF, and to a lesser extent off WA. This is the only species from this genus to appear in the data from the SETF Observer Program, and preliminary unpublished analysis for this species suggests abundance is fairly stable. However, observers in the SETF may have mis-identified species due to their similarity, identifying all specimens from the genus as *Apristurus* sp. A. These catsharks may be quite rare, as not many have been recorded in the SETF surveys (T.I. Walker, pers. comm.). Deepwater demersal trawl fisheries are expanding in the region.

Conservation measures None.

Literature Last and Stevens (1994).

Bigfin Catshark

Apristurus sp. B [Last & Stevens, 1994]

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale This undescribed endemic belongs to a genus of poorly known deepwater catsharks. Very little is known of its biology. This species is known to occur in eastern Australian waters and a smaller area off WA. A significant portion of its range is outside fished areas. Where fisheries do occur, the effects on this species are unknown but thought to be insignificant, although it is occasionally taken as trawl bycatch. Future expansion of deepwater trawl fisheries within its range could pose a threat.

Distribution **Regional endemic: Warm temperate and tropical Australia (in the east from Ingham, QLD to Sydney, NSW, and off Geraldton, WA).**
Note: A closely related form has also been collected from New Caledonia and the current known range may be inaccurate due to misidentification and further taxonomic work is necessary to resolve problems in this genus.
FAO Areas 57, 71 and 81.

Habitat and ecology This deepwater catshark is found on continental slopes from 730–1,000m. It is known to attain at least 67cm TL, with size at maturity 53–57cm TL (males). Biology is virtually unknown.

Threats *Apristurus* sp. B is known to be taken occasionally as bycatch in trawl fisheries, however at the present time the effects of the fisheries operating in its known distribution area and depth are unknown, though not thought to be significant. Future expansion of deepsea trawl fisheries within its range could pose a threat.

Conservation measures None.

Literature Last and Stevens (1994).

Fleshynose Catshark

Apristurus sp. C [Last & Stevens, 1994]

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale This undescribed endemic belongs to a genus of poorly known deepwater catsharks. Very little is known of its biology. This species is known to occur in deep water (900–1,150m) off southern Australia and New Zealand. There is some concern for this species as its distribution includes some heavily fished areas, particularly off southern Australia. Deepwater demersal trawl fisheries are expanding in the region, and assuming its biology is like other deepwater shark species, it may not be sufficiently fecund to withstand the exploitation pressure.

Distribution **Regional endemic: Around southern Australia (from Eucla, WA to Broken Bay, NSW) and New Zealand.**
Note: This species belongs to a complex thought to be related to *Apristurus brunneus* from the western North Pacific. Further research is required to resolve taxonomic problems.
FAO Areas 57 and 81.

Habitat and ecology This deepwater catshark is found in depths of 900–1,150m, and attains at least 71cm TL, with size at maturity ~67cm TL (males). Its biology is virtually unknown.

Threats The known distribution of this species includes some heavily fished areas, particularly off southern Australia by the SETF, STRTF and the GABTF. This species has not been recorded from the SETF, but this may be due to the similarity of members of this genus, resulting in all specimens being identified as *Apristurus* sp. A. These catsharks are possibly quite rare (T.I. Walker, pers. comm.). Off New Zealand, it is likely subject to trawl fisheries in part of its range, and although there is relatively little deepwater trawling effort in the northern part of its New Zealand distribution, this may change as some fishing companies have conducted exploratory deepwater trips off northeast North Island.

Conservation measures None.

Literature Last and Stevens (1994).

Roughskin Catshark

Apristurus sp. D [Last & Stevens, 1994]

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment **Global: Data Deficient**

Rationale This undescribed endemic belongs to a genus of poorly known deepwater catsharks. Very little is known of its biology. This species is known to occur in deep water (840–1,380m) off New Zealand, sporadic sites around Tasmania and a small area of WA. There is some concern for this species as its distribution includes some heavily fished areas. Deepwater demersal trawl fisheries are expanding in the region, and assuming its biology is like other deepwater shark species, it may not be sufficiently fecund to withstand the exploitation pressure.

Distribution **Regional endemic: Australia, from sporadic sites around TAS, the South Tasman Rise, and off Busselton (WA) and continental slope around New Zealand.**
Note: The current known range may be inaccurate due to misidentification and further taxonomic work is necessary to resolve problems in this genus.
FAO Areas 57 and 81.

Habitat and ecology This deepwater catshark is the largest member of the genus found in Australia, recorded at depths of 840–1,380m and appears to extend further down the continental slope than most other *Apristurus* species. It reaches at least 86cm TL, size at maturity ~67cm TL (males). Biology is virtually unknown.

Threats The known distribution of this species includes some heavily fished areas, particularly off southern Australia. This species has not been recorded from the SETF, but this may be due to the similarity of members of this genus, resulting in all specimens being identified as *Apristurus* sp. A. These catsharks are possibly quite rare (T.I. Walker, pers. comm.). Off New Zealand, it is also likely to be affected by trawl fisheries, although as relatively little fishing occurs below 1,200m some of the population occurs beyond fishing depths.

Conservation measures None.

Literature Last and Stevens (1994).

Bulldog Catshark

Apristurus sp. E [Last & Stevens, 1994]

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale This undescribed endemic belongs to a genus of poorly known deepwater catsharks. Very little is known of its biology. This species is known to occur in deep water (1,020–1,500m) off southeastern Australia. There is some concern for this species as its distribution includes heavily fished areas. Deepwater demersal trawl fisheries are expanding in the region, and assuming its biology is like other deepwater shark species, it may not be sufficiently fecund to withstand increasing exploitation pressure.

Distribution **Regional endemic: Southeastern Australia between Beachport, SA and Broken Bay, NSW.**
Note: The current known range may be inaccurate due to misidentification and further taxonomic work is necessary to resolve problems in this genus.
FAO Areas 57 and 81.

Habitat and ecology This deepwater catshark occurs on the continental slope at depths of 1,020–1,500m and attains 63cm TL, with size at maturity ~50cm TL (males). Its biology is virtually unknown.

Threats The known distribution of this species includes heavily fished areas, particularly off southeastern Australia by the SETF and STRTF. This species has not been recorded from the SETF, but this may be due to the similarity of members of this genus, resulting in all specimens being identified as *Apristurus* sp. A. These catsharks are possibly quite rare (T.I. Walker, pers. comm.). Deepwater demersal trawl fisheries are expanding in the region.

Conservation measures None.

Literature Last and Stevens (1994).

Bighead Catshark

Apristurus sp. F [Last & Stevens, 1994]

Tom J. Lisney and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale This undescribed endemic belongs to a genus of poorly known deepwater catsharks and is recorded from only three specimens taken off Perth, WA. This species could be rare or uncommon, and the effects of fisheries are unknown, though if its biology is like other deepwater shark species, it may not be sufficiently fecund to withstand exploitation pressure.

Distribution **Regional endemic: Australia, known from only three specimens collected off Perth, WA.**
FAO Area 57.

Habitat and ecology The three known specimens were taken in 1,030–1,050m depth. This deepwater catshark attains at least 73cm TL.

Threats At the present time the effects of the fisheries operating in its very limited distribution area and depth are unknown.

Conservation measures None.

Literature Last and Stevens (1994).

Pinocchio Catshark

Apristurus sp. G [Last & Stevens, 1994]

Rachel D. Cavanagh and Tom J. Lisney

Red List assessment **Global: Data Deficient**

Rationale This undescribed endemic belongs to a genus of poorly known deepwater catsharks. Very little is known of its biology. Possibly a widely distributed deepwater catshark found along the Australian continental slope at depths of 590–1,000m, this consists of several distinct populations which may be separate species. Although part of the distribution includes heavily fished areas, particularly off southeastern Australia, much of its range is in unfished areas. Given the taxonomic uncertainty of the separate populations it is not possible to assess the conservation status of this species at this time. However, deepwater demersal trawl fisheries are expanding in the region, and the situation should be reassessed following taxonomic clarification.

Distribution **Regional endemic: Southern, eastern and western Australia (from Shark Bay, WA to Cairns, QLD). This distribution includes seamounts to the south of TAS but this species has not been recorded from much of the Great Australia Bight.**
Note: The populations around Australia are distinct from each other and may be separate species. A similar, if not conspecific species is found off New Zealand.
FAO Areas 57 and 81.

Habitat and ecology This deepwater catshark is found along the Australian continental slope at depths of 590–1,000m, and attains at least 61cm TL, with size at maturity of ~51cm TL (males). Biology is virtually unknown.

Threats The wide distribution of this species includes some heavily fished areas, particularly off southeastern Australia by the SETF and STRTF, possibly the GABTF, and to a lesser extent off WA. This species has not been recorded from the SETF, but this may be due to the similarity of members of this genus, resulting in all specimens being identified as *Apristurus* sp. A. These catsharks are possibly quite rare (T.I. Walker, pers. comm.). Deepwater demersal trawl fisheries are expanding in the region. However, a significant proportion of its range receives only minor or no fishing pressure.

Conservation measures None.

Literature Last and Stevens (1994).

Whitish Catshark

Apristurus albisoma Nakaya & Séret, 1999

Sarah L. Fowler

Red List assessment **Global: Near Threatened**

Rationale The area of occupancy of this small benthic endemic shark is presumed very limited (<2,000km^2), being restricted to a narrow depth band on insular and seamount slopes. It has only been reported from a few locations. There is concern that this species may be taken as unutilised bycatch by deepwater trawl fisheries and that, like other deepwater species, it may not be sufficiently fecund to withstand exploitation pressure in these fisheries. It fails to meet the criteria for Vulnerable (B2), however, because there is insufficient evidence of fishing activity at levels that would lead to a decline in range, habitat quality or number of individuals.

Distribution **Regional endemic: Endemic to the island slopes of New Caledonia and adjacent seamounts (Norfolk and Lord Howe Ridges).**
FAO Areas 71 and 81.

Habitat and ecology This deepwater catshark is known from depths of 935–1,564m, matures at 40–50cm TL, reaches a maximum size of ~60cm TL and is likely to have a low intrinsic rate of population increase. Probably a poor swimmer with limited ability to recolonise depleted areas.

Threats Possibly a bycatch of deepwater fisheries, but of no value and would be discarded.

Conservation measures None.

Literature Compagno (in prep. b).

Pale Catshark

Apristurus exsanguis Sato, Nakaya & Stewart, 1999

Clinton A. J. Duffy

Red List assessment **Global: Least Concern**

Rationale Although this is an endemic species, collection records indicate it is widespread and probably continuously distributed over the mid to lower slope around New Zealand. The biology of all *Apristurus* species within the New Zealand EEZ is very poorly known due to the uncertain taxonomy of the group. They appear to be most abundant below 1,000m, and are the only sharks regularly taken in research trawls below 1,200m on the Chatham Rise. As relatively little fishing occurs below 1,200m a large part of these species' populations may be effectively beyond fishing depths. Although the maximum recorded depth of *A. exsanguis* is 1,200m there have been relatively few research trawls below this depth and it is possible that they occur deeper than this. There is also relatively little deepwater trawling effort in the northern part of the species distribution. This situation may change however, as some fishing companies have conducted exploratory deepwater trips off northeast North Island.

Distribution **Regional endemic: New Zealand (off Three Kings Islands, North and South Islands, southern Lord Howe Rise, Challenger Plateau, Hikurangi Trough, Chatham Rise and Campbell Plateau to about 54°S).**
FAO Area 81.

Habitat and ecology A widespread mid to lower slope species, probably bottom-living, occurring at depths of 573–1,200m. Although its maximum recorded depth is 1,200m there have been relatively few research trawls below this depth and it is possible that they occur deeper than this (Francis *et al.* 2002). Size at maturity is 65–70cm TL (both sexes). Reproduction is oviparous. Fecundity is unknown.

Threats Deepwater demersal trawling. As relatively little fishing occurs below 1,200m and the species may occur in deeper water than this, a part of its population may be beyond current fishing depth (Anderson *et al.* 1998, Wetherbee 2000). There is relatively little deepwater trawling effort in the northern part of the species distribution. This situation may change as deepwater fisheries expand.

Conservation measures None.

Literature Anderson *et al.* (1998); Francis *et al.* (2002); Last and Stevens (1994); Nakaya and Sato (1999); Paulin *et al.* (1989); Sato *et al.* (1999); Wetherbee (2000).

Grey Spotted Catshark

Asymbolus analis (Ogilby, 1885)

Peter M. Kyne and Michael B. Bennett

Red List assessment **Global: Data Deficient**

Rationale *Asymbolus analis* is an uncommon catshark endemic to southeastern Australia. It is demersal on the continental shelf, and very little is known of its biology. It is not targeted commercially, but captured as bycatch in demersal trawl fisheries, where it may be retained in small quantities. Given its endemism and the fact that it is uncommon, bycatch levels need to be monitored and future research directed at its life history.

Distribution **Regional endemic: Eastern Australia, ranging from southeastern QLD to Lakes Entrance, VIC, including NSW (Kyne *et al.* in prep.; A. Graham, pers. comm.).**
FAO Areas 57, 71 and 81.

Habitat and ecology *Asymbolus analis* is demersal on the continental shelf and is reported in depths of 40–159m (Last and Stevens 1994; Kyne *et al.* in prep.). It attains at least 60cm TL with size at maturity 46cm TL (both sexes) (Kyne *et al.* in prep.). Oviparous. Mature females with large ripe ovarian ova have been observed during the months of March, September and October (Kyne *et al.* in prep.), suggesting that the species may not have a well-defined reproductive season, similar to the situation with other scyliorhinid sharks. There is no available information on age and growth, natural mortality or behavioural ecology.

Threats *Asymbolus analis* is considered to be less common than other closely related *Asymbolus* species (Last and Stevens 1994). The species is not targeted commercially, however it is captured as bycatch in demersal trawl fisheries (Last and Stevens 1994). It is reported to be retained in the SETF although the quantity is unknown (Rose and SAG 2001). It is an uncommon component of the bycatch of the deepwater component of the eastern king prawn sector of the QLD East Coast Trawl Fishery (P. Kyne unpublished data). It is also likely to occur as bycatch in the NSW Ocean Prawn Trawl Fishery.

Conservation measures None.

Literature Kyne *et al.* (in prep.); Last and Stevens (1994); Rose and SAG (2001).

Blotched Catshark

Asymbolus funebris Compagno, Stevens & Last, 1999

Colin A. Simpfendorfer and Michelle R. Heupel

Red List assessment **Global: Data Deficient**

Rationale *Asymbolus funebris* is known from a single 44cm TL female specimen collected off the southwestern coast of Australia at a depth of 195m. It is likely to be of limited vulnerability to commercial fisheries because of its small size.

Distribution **Regional endemic: A single specimen known from Southern Australia (near the Recherche Archipelago off the coast of WA).**
FAO Area 57.

Habitat and ecology The one specimen of *A. funebris* was found at approximately 195m depth. It was a 44cm TL female.

Threats This species is unlikely to be caught in any fisheries in this area due to its small size.

Conservation measures None.

Literature Last and Stevens (1994).

Western Spotted Catshark

Asymbolus occiduus Last, Gomon & Gledhill, 1999

Michelle R. Heupel and Colin A. Simpfendorfer

Red List assessment **Global: Least Concern**

Rationale *Asymbolus occiduus* is a little known temperate catshark endemic to southern Australia. Due to its reasonably large distribution, habitat use, small size and limited fishing in its area of occurrence, this species is unlikely to be impacted by commercial fisheries.

Distribution **Regional endemic: Southern and western coasts of Australia from Fowlers Bay, SA to Perth, WA.**
FAO Area 57.

Habitat and ecology *Asymbolus occiduus* is found in depths from 98–250m and is most abundant on the outer continental shelf. This species attains at least 60cm TL and at maturity is 58cm TL (males). Its biology is almost entirely unknown.

Threats This species is unlikely to be caught in any fisheries due to its small size and limited fisheries in the region.

Conservation measures None.

Literature Last and Stevens (1994).

Pale Spotted Catshark

Asymbolus pallidus Last, Gomon & Gledhill, 1999

Michelle R. Heupel and Colin A. Simpfendorfer

Red List assessment **Global: Least Concern**

Rationale *Asymbolus pallidus* is a little known small tropical catshark endemic to an area of continental shelf almost 1,000km long off the coast of northeastern Australia. Due to its distribution, small size and limited fishing activity in its area of occurrence, this species is unlikely to be impacted by commercial fisheries.

Distribution **Regional endemic: Northeastern Australia, from Swain Reefs to Cairns, QLD.**
FAO Area 71.

Habitat and ecology This is a small tropical species found in depths from 270–400m. It reaches at least 46cm TL with young hatching at 19cm TL and size at maturity 32cm TL (males). Its biology is almost entirely unknown.

Threats This species is unlikely to be collected as bycatch in commercial fisheries.

Conservation measures None.

Literature Last and Stevens (1994).

Dwarf Catshark

Asymbolus parvus Compagno, Stevens & Last, 1999

Michelle R. Heupel

Red List assessment **Global: Least Concern**

Rationale This small endemic catshark is recorded from a small area off the northwestern coast of Australia with a depth range of 59–252m. Its very small size means that it is unlikely to be significantly impacted by the trawl fisheries in the area. In addition it is probably discarded when caught due to its size and low commercial value, and is believed to have a high survival rate.

Distribution **Regional endemic: Northwestern Australia, between Dampier and the Buccaneer Archipelago, WA.**
FAO Area 57.

Habitat and ecology *Asymbolus parvus* is found most commonly on the outer continental shelf in depths ranging from 59–252m. This species attains ~33cm TL, with size at maturity ~28cm TL (males). Its biology is almost entirely unknown.

Threats This species may be collected as bycatch in commercial fisheries, e.g. the Pilbara Trawl Fishery.

Conservation measures None.

Literature Last and Stevens (1994).

Orange Spotted Catshark

Asymbolus rubiginosus Last, Gomon & Gledhill, 1999

Peter M. Kyne and Michael B. Bennett

Red List assessment **Global: Least Concern**

Rationale *Asymbolus rubiginosus* is a little known catshark endemic to southeastern Australia. It is demersal on the continental shelf and upper slope with a wide bathymetric range. Little is known of its biology. It is of no interest to fisheries, but is caught as bycatch in some demersal trawl fisheries. The species may have a continuous egg-laying cycle leading to high productivity, resulting in resilience to the effects of trawling.

Distribution **Regional endemic: Eastern Australia, from Moreton Island, southeastern QLD to Port Arthur, TAS, including VIC (Last and Stevens 1994; Last 1999).**
FAO Areas 57, 71 and 81.

Habitat and ecology *Asymbolus rubiginosus* is demersal on the continental shelf and upper slope and is reported in depths of 25–540m (Last 1999), although it is uncommon in shallower waters. It reaches at least 54.9cm TL with size at maturity ~34.4cm TL (males) (Last 1999). The species is oviparous with one functional ovary in females. Ovulated females generally contain two eggcases, one in each oviduct. Ovulated females have been observed during the months of July, August and October (P. Kyne unpublished data). The species may not have a well-defined reproductive season, similar to the situation with other scyliorhinid sharks and evidence suggests it may be a productive species. There is no available information on age and growth, natural mortality or behavioural ecology.

Threats *Asymbolus rubiginosus* is presently of no commercial value (Last and Stevens 1994). It is recorded as discarded bycatch in the SETF (Rose and SAG 2001) and in the eastern king prawn sector, deepwater component of the QLD East Coast Trawl Fishery (P. Kyne unpublished data). It is probable that the species is also a component of the bycatch of other demersal trawl fisheries operating in its distribution.

Conservation measures None.

Literature Last (1999); Last and Stevens (1994); Rose and SAG (2001).

Variegated Catshark

Asymbolus submaculatus Compagno, Stevens & Last, 1999

Michelle R. Heupel and Colin A. Simpfendorfer

Red List assessment **Global: Least Concern**

Rationale *Asymbolus submaculatus* is restricted to a relatively small area of southwestern Australia. Due to its habitat use (caves and ledges), nocturnal behaviour patterns and small size, this species is unlikely to be impacted by commercial fisheries.

Distribution **Regional endemic: Southwestern Australia from Recherche Archipelago to Cape Naturaliste off the coast of southern WA.**
FAO Area 57.

Habitat and ecology *Asymbolus submaculatus* is found in depths of up to 150m and is reported to be nocturnal inhabiting caves and ledges. This species grows to at least 43cm TL. Its biology is almost entirely unknown.

Threats This species is unlikely to be caught in any fisheries in this area due to its small size and habitat use.

Conservation measures None.

Literature Last and Stevens (1994).

Gulf Catshark

Asymbolus vincenti (Zietz, 1908)

Michelle R. Heupel and Colin A. Simpfendorfer

Red List assessment **Global: Least Concern**

Rationale This endemic species is widely distributed across southern Australia. It appears to be most common in the Great Australian Bight, where there is only limited demersal trawling within its depth range.

Distribution **Regional endemic: Southern Australia from Bass Strait, VIC to Cape Leeuwin, WA, including TAS and SA. Appears to be most common in the Great Australian Bight.**
FAO Area 57.

Habitat and ecology *Asymbolus vincenti* is found in depths from 130–220m in the Great Australian Bight. Off western TAS and Bass Strait, it is found mostly at depths less than 100m and is frequently found in seagrass beds near the coast in this area. This species attains at least 56cm TL and size at maturity is 38cm TL (males). Its biology is almost entirely unknown.

Threats This species is caught in trawl fisheries in southern Australia. There is no available detailed information on bycatch of this species, but it is likely to be caught only irregularly.

Conservation measures None.

Literature Last and Stevens (1994).

Banded Catshark

Atelomycterus fasciatus Compagno & Stevens, 1993

William T. White

Red List assessment **Global: Least Concern**

Rationale The extent of occurrence of this common shallow water endemic species is quite small and partly fragmented (probably <20,000km^2 with a depth range of 27–122m, mostly <60m). Little is known of its biology. Species composition data from fisheries are necessary, however, due to very limited fishing activity within its known range it is unlikely that populations of this species are declining or under any immediate threat.

Distribution **Regional endemic: Australia: WA between Exmouth and off the southern end of Eighty Mile Beach, and known from a few specimens from the Arafura Sea, NT, and from the Gulf of Carpentaria and Torres Strait, QLD (Compagno and Stevens 1993a). Further information on the extent of this species off the NT and QLD are required to ascertain the full distribution of this species.**
FAO Areas 57 and 71.

Habitat and ecology *Atelomycterus fasciatus* is reported from sand and shelly sand bottoms on the continental shelf in depths of 27–122m with the vast majority recorded shallower than 60m. Reported to attain a maximum size of ~45.1cm TL (females) and 40.2cm TL (males), with the smallest mature individuals being 35.3cm TL (females) and 32.9cm TL (males). This species is oviparous.

Threats Although very little is known about this species, it is of little or no commercial value and it is unlikely that populations of this species are under any direct threat. The only fishery in its distribution and depth range is a small trawl fishery (only very few boats) and if it is caught as bycatch the amount is expected to be very small (if any).

Conservation measures None.

Literature Compagno (1984); Compagno and Stevens (1993a); Last and Stevens (1994); McKay (1966).

Marbled Catshark

Atelomycterus macleayi Whitley, 1939

William T. White

Red List assessment **Global: Least Concern**

Rationale A small catshark endemic to northern Australia and restricted to very shallow water habitats (0.5–3.5m). Although little is known about the biology of this species, there is unlikely to be any fishing pressure upon it. *Atelomycterus macleayi* is of no commercial value, and it is unlikely that populations of this species are under any direct threats.

Distribution **Regional endemic: Tropical Australia between Port Hedland, WA and Melville Island, NT and possibly into QLD (Whitley 1940; Springer 1979; Compagno 1988; Paxton *et al.* 1989; Last and Stevens 1994).**
FAO Areas 57 and 71.

Habitat and ecology *Atelomycterus macleayi* is reported from shallow, inshore regions on both sandy and rocky bottoms 0.5–3.5m in depth (Springer 1979; Last and Stevens 1994; Compagno and Niem 1998b). This species is reported to attain a maximum size of 60cm TL, size at maturity 48cm TL (males), 51cm TL (females) and hatching at ~10cm TL (Last and Stevens 1994; Compagno and Niem 1998). This species is oviparous.

Threats Although very little is known about this species, it is of little or no commercial value and is unlikely to be caught in any fisheries due to its apparent habitat range. Species composition data from the fisheries operating near the range of this species are required.

Conservation measures None.

Literature Compagno (1988); Compagno and Niem (1998b); Compagno and Stevens (1993a); Last and Stevens (1994); McKay (1966); Paxton *et al.* (1989); Springer (1979); Whitley (1940).

Coral Catshark

Atelomycterus marmoratus (Bennett, 1830)

William T. White

Red List assessment **Global: Near Threatened**

Rationale Little is known of the biology of this widespread and common inshore Indo-West Pacific coral reef species. This species represents a minor catch in artisanal fisheries in several eastern Indonesian localities, e.g. Central Java, Bali and Lombok, and it is probable that this species is also caught in such fisheries in West Papua and other parts of its range, north to Taiwan. Increasing fishing pressure and habitat destruction (e.g. dynamite fishing, pollution and coral mining) are likely to represent significant threats to this species. Although data are not available to quantify these impacts, there is concern this species could meet the criteria for Vulnerable due to the high level of exploitation. Further investigation of the population structure and range of this species is required, to refine this assessment of its status.

Distribution **Regional: New Guinea (Papua New Guinea and Indonesian Irian Jaya).**
Global: A wide range in the tropical regions of the Indo-West Pacific.
FAO Areas 51, 57, 61, 71 and 81.

Habitat and ecology Little is known about this common inshore species. Found on coral reefs and thought to inhabit crevices and holes on reefs (Compagno 1984). *Atelomycterus marmoratus* is reported to attain a size of 70cm TL, size at maturity 47–62cm TL (males), 49–57cm TL (females) (Compagno 1984). There is no available information on the reproductive biology or age and growth.

Threats Although *A. marmoratus* is widespread through the Indo-West Pacific, habitat destruction within its range, and increasing fishing pressure are likely to represent significant threats. This species may be under threat from habitat destruction by dynamite fishing, especially in eastern Indonesia, e.g. Tanjung Luar in Lombok (W. White, pers. obs.), and possibly also by coral removal in some parts of the region for use as building materials, e.g. Candi Dasa in Bali. Fisheries catches appear to be only minor throughout this species distribution, for example, it represents a minor catch in artisanal fisheries in several eastern Indonesian localities (W. White pers. obs.), and although it is probably caught in fisheries in West Papua and other parts of its range, information is very sparse. The collection of species composition data from fisheries within the range of this species is necessary.

Conservation measures None.

Literature Compagno (1984); Compagno and Niem (1998b); Compagno and Stevens (1993a); Fowler (1941); Last and Stevens (1994); McKay (1966); Springer (1979); Yamakawa *et al.* (1995).

New Caledonia Catshark

Aulohalaelurus kanakorum Séret, 1990

Sarah L. Fowler and Tom J. Lisney

Red List assessment **Global: Vulnerable B1ab(iii)**

Rationale This species is known from only one specimen and two photographs within an area that is well surveyed for its fish fauna. It is very likely a New Caledonian endemic and uncommon within its range. It is presumed, like similar taxa, to be a benthic species and a weak swimmer, restricted to a narrow depth band of moderately deep external coral reef habitat, hence having a small extent of occurrence. This restricted range and fragile nature of the coral reef habitat makes the species vulnerable to depletion through bycatch in mixed species fisheries and to habitat deterioration and loss as a result of run-off from mining operations and coral reef bleaching.

Distribution

Regional endemic: New Caledonia.
FAO Area 71.

Habitat and ecology

Holotype (and only known specimen, 79cm TL) was collected from coral bottom in the pass of an islet on the external coral reef of a southwestern New Caledonian lagoon, at a depth of 49m. There are also underwater photographs of two specimens. The fish fauna of New Caledonia has been well surveyed, suggesting that this species is rare. It is, however, presumably present at similar depths and in similar habitat elsewhere around the island. New Caledonia has ~8,000km^2 of coral reef habitat surrounding a lagoon of 24,000km^2. Much of this habitat is significantly shallower than the type locality, implying that the total extent of occurrence of this species around the island will be <20,000km^2, even if the species is very widespread (which appears not to be the case).

Threats

This small, attractively patterned catshark is likely to be taken as bycatch in mixed-species, artisanal fisheries and to be susceptible to habitat deterioration and loss. New Caledonian coral reefs are in generally good condition, but large areas (particularly in the east) are affected by run-off arising from nickel mining operations and resultant deforestation, erosion and water pollution. The problem is exacerbated by destruction of mangroves. The incidence of coral reef bleaching is also rising in the region.

Conservation measures

None.

Literature

Compagno (in prep. b). Habitat information: www.greens.org.au/bobbround/etuc.htm; www.univ-perp.fr/ephe/acorweb/anglais/caledonie.html; www.reefbase.org

Black-spotted Catshark

Aulohalaelurus labiosus (Waite, 1905)

Tom J. Lisney and William T. White

Red List assessment

Global: Least Concern

Rationale

The biology of this endemic species is poorly known but it is reported to be common. Although it has a limited distribution in southwestern Australian coastal waters, it is not subjected to any significant fishing pressure due to its reef-dwelling habit and is of no commercial value to fisheries (although there is evidence that this catshark enters the marine aquarium trade).

Distribution

Regional endemic: Australia: WA, from the Recherche Archipelago to the Houtman Abrolhos (Last and Stevens 1994).
FAO Area 57.

Habitat and ecology

A common endemic inshore catshark on the temperate WA continental shelf, found in shallow coastal habitats and on offshore reefs at a depth of at least 4m (Last and Stevens 1994). The biology of *A. labiosus* is virtually unknown. Oviparous, and attains at least 67cm TL, with adult males mature at ~54cm TL (Last and Stevens 1994; W. White unpublished data). There is no published information on the age and growth of this species.

Threats

There is very little fishing pressure within the habitat range of this species in southwestern Australia and it is also of little or no commercial value. There is evidence that this small, attractively spotted catshark enters the marine aquarium trade with several having been observed in aquarium retailers in WA and it is possible that this may extend to elswhere (Compagno in prep. b; W. White, pers. obs.). Species composition data from fisheries and from collectors for the aquarium trade in southwestern Australia are required.

Conservation measures

None.

Literature

Compagno (in prep. b); Last and Stevens (1994).

Whitefin Swell Shark

Cephaloscyllium sp. A [Last & Stevens, 1994]

Plaxy J. Barratt and Peter M. Kyne

Red List assessment **Global: Near Threatened**

Rationale *Cephaloscyllium* sp. A is endemic to southeastern Australia on the upper continental slope in depths of 240–550m. Very little is known about the biology of this species, and the extent of its distribution is uncertain. It is susceptible to trawling and is known to be a common component of bycatch in southern Australia. Declines of >30% have been observed for catch rates off NSW over a twenty-year period. However, these declines are documented only over about one third of its known range. There is also evidence of a slight downward trend in population size in the SETF Observer Program off southern Australia. Given the intensity of trawling over its area of occurrence, which may lead to a continued population decline, catches of this species need to be monitored.

Distribution **Regional endemic: Southeastern Australia from Port Stephens, NSW to at least Port Lincoln, SA, including TAS. Possibly found to the western Great Australian Bight.**
FAO Areas 57 and 81.

Habitat and ecology *Cephaloscyllium* sp. A is a large stocky benthic catshark found on the upper continental slope in 240–550m. It attains at least 94cm TL, and males mature by 70cm TL. This species is oviparous. Very little is known of its biology.

Threats This benthic shark is susceptible to capture by trawling and is a common component of trawl bycatch off southern Australia. This area is subject to intensive fishing effort and without adequate knowledge of the biology of *Cephaloscyllium* sp. A it is not possible to determine accurately how this pressure is affecting populations. In fishery independent surveys of the NSW upper slope trawl fishery (Graham *et al.* 2001) the 1996–97 catch rate of this species was 68% of the 1976–77 rate, indicating a reduction in population size greater than 30%. However, this observed decline is only over about one third of the species known range. There is also evidence of a slight downward trend in population size in the SETF Observer Program off southern Australia (T.I. Walker, pers. comm.).

Conservation measures None.

Literature Graham *et al.* (2001); Last and Stevens (1994).

Saddled Swell Shark

Cephaloscyllium sp. B [Last & Stevens, 1994]

Plaxy J. Barratt and Peter M. Kyne

Red List assessment **Global: Data Deficient**

Rationale There are virtually no data for the biology of this undescribed species endemic to eastern Australia. The distribution of *Cephaloscyllium* sp. B is uncertain, but thought to be quite restricted. It is likely to be quite rare in this area. Current fishing effort in its area of occurrence is small, however any future expansion of trawling effort may pose a threat to this benthic species, which requires further study to determine its status.

Distribution **Regional endemic: Northeastern Australia between Townsville and the Saumarez Reef, QLD. Possibly also on the Britannia Seamount (off Brisbane).**
FAO Area 71. Possibly 81.

Habitat and ecology *Cephaloscyllium* sp. B is a medium-sized elongate catshark found on the continental slope in 380–590m. It attains at least 70cm TL, size at maturity is ~55cm TL (males). This species is oviparous. Very little is known of its biology and more specimens are required for research (Last and Stevens 1994).

Threats The distribution and range for *Cepahaloscyllium* sp. B is uncertain but appears to be confined to a small area, in which it is likely to be quite rare. Trawl fishing effort in its

known distribution is minimal. However, any increase in trawl effort off the east coast of Australia in the future could pose a threat to this endemic species, as it is susceptible to being caught as trawl bycatch.

Conservation measures None.

Literature Last and Stevens (1994).

Northern Draughtboard Shark

Cephaloscyllium sp. C [Last & Stevens, 1994]

Plaxy J. Barratt and Peter M. Kyne

Red List assessment **Global: Near Threatened**

Rationale *Cephaloscyllium* sp. C is restricted to the east coast of Australia between southern QLD and central NSW. It is known to be rare within this area, as intensive trawling has revealed only a few specimens. This area receives high trawling effort from QLD and NSW prawn trawl fisheries. There are virtually no data on the biology of this endemic species. Given its apparent rarity, restricted distribution and bathymetric range, and the intensive trawling effort in its area of occurrence, the species is considered likely to be close to Vulnerable (A4, B1ab, and/or C1). Research is required to determine population size and, therefore, more accurately assess its conservation status.

Distribution **Regional endemic: East coast of Australia from Noosa, QLD to Woolongong, NSW.**
FAO Areas 71 and 81.

Habitat and ecology Only a few specimens have been collected, although juvenile specimens and two eggcases collected from NSW are likely to belong to this species (Last and Stevens 1994). Very little is known about the habitat and ecology of this medium-sized, slender catshark found in depths of 90–140m. It is oviparous and attains a size of at least 65cm TL. There is virtually no biological information for this species.

Threats Limited range and a lack of specimens indicate that this catshark is relatively rare, as the area and depth at which the specimens were collected is subject to intensive trawling by the Ocean Prawn Trawl Fishery (NSW) and the East Coast Trawl Fishery (QLD).

Conservation measures None.

Literature Last and Stevens (1994).

Narrowbar Swell Shark

Cephaloscyllium sp. D [Last & Stevens, 1994]

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale Known only from a few specimens trawled at 440m off Flinders Reef, QLD. May be more widely distributed on the northeastern Australian continental slope. Nothing known of its biology. Presently, low fishing effort in its area of occurrence. Distribution and status needs to be better defined.

Distribution **Regional endemic: Australia. Known from only a few specimens taken near Flinders Reef, QLD. May be more widely distributed along the continental slope off northeastern Australia.**
FAO Area 71.

Habitat and ecology Recorded from a depth of 440m on the continental slope, but may be more widely distributed. Maximum size at least 43cm TL. Nothing known of its biology.

Threats The area where the few known specimens were collected receives little fishing effort. May be naturally rare, but no threats are apparent at present.

Conservation measures None.

Literature Last and Stevens (1994).

Speckled Swell Shark

Cephaloscyllium sp. E [Last & Stevens, 1994]

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale Known only from a few specimens trawled in 390–440m off northwestern Australia and in 600–700m off northeastern Australia. May be more widely distributed on the northern Australian continental slope. Nothing known of its biology. Presently, low fishing effort in area of occurrence. Distribution and status needs to be better defined.

Distribution **Regional endemic: Australia. Known only from a few specimens taken off the Rowley Shoals, WA and near Lihou Reef off Innisfail, QLD. May be more widely distributed along the continental slope off northern Australia.**
FAO Areas 57 and 71.

Habitat and ecology Presently recorded from only a few specimens trawled on the continental slope off northwestern Australia in 390–440m and off northeastern Australia in 600–700m. Maximum size at least 68cm TL with size at maturity ~64cm TL (males). Nothing else known of its biology.

Threats Areas where few known specimens were collected receive little fishing effort. Species may be naturally rare, but no threats are apparent at present.

Conservation measures None.

Literature Last and Stevens (1994).

Reticulate Swell Shark

Cephaloscyllium fasciatum Chan, 1966

Tom J. Lisney and Peter M. Kyne

Red List assessment **Global: Data Deficient**
Australia: Least Concern

Rationale A small tropical swellshark recorded from the Indo-West Pacific on the continental slope at depths of 219–450m. Little is known of the biology of the species. Known from two populations, one off Vietnam and China (Hainan Island) and one off northwestern Australia. Little fishing occurs in the species' area of occurrence off Australia, and with no threats evident towards that population, it is assessed as Least Concern.

Outside Australia the species is Data Deficient, with no information on its population status, and although it is a known component of demersal trawl bycatch, no details are available.

Distribution **Regional: Northwestern Australia, from Geraldton to Broome, WA.**
Global: Western Pacific around Vietnam and China (Hainan Island).
Note: Asian and Australian populations distinct. Differences exist between these populations and their relationship needs assessment.
FAO Areas 57, 61 and 71.

Habitat and ecology This tropical swellshark is found on muddy substrates on or near the bottom on the outer continental shelf and uppermost slope, at depths of 219–450m. Oviparous; the hatchlings are ~12cm TL. Maximum size at least 42cm TL (adolescent or adult female); size at maturity ~36cm TL (males).

Threats Of minor interest to fisheries where it is caught by commercial demersal trawlers as bycatch and possibly utilised for fishmeal in Asia. Actual level of exploitation in Asia

unknown. Area of occurrence off WA only subject to low fishing effort (Commonwealth managed Western Trawl Fisheries).

Conservation measures None.

Literature Compagno (in prep. b); Last and Stevens (1994).

Draughtboard Shark

Cephaloscyllium isabellum (Bonnaterre, 1788)

Malcolm P. Francis

Red List assessment **Global: Least Concern**

Rationale Endemic to New Zealand, from 0–673m, mostly <400m, soft substrates and rocky reefs. Commonly caught as bycatch in trawl and rock lobster fisheries, and probably also in some set net fisheries. Reported annual commercial catches were 74–540t between 1988 and 1991 when a shark liver fishery was operating, but catches declined rapidly when this industry stopped. Since then, reported catches have been less than 5t per year, and most sharks are probably discarded. They are very hardy and able to survive removal from the water for long periods, so survival of sharks returned to the sea is probably high. Widespread and common throughout its range.

Distribution **Regional endemic: Throughout mainland New Zealand, and the Stewart Island – Snares Island Shelf, Chatham Rise and Chatham Islands.**
FAO Area 81.

Habitat and ecology Depth ranges from the shore to 673m, but most occur shallower than 400m. Trawled over open, soft substrates, and also found on rocky reefs. Nocturnally active; usually resting during the day. Young hatch at ~16cm TL. Size at maturity ~60cm TL (males) and 80cm TL (females). Maximum size is reported to be >150cm TL, but individuals >100cm TL are rare. Females grow larger than males.

Threats Frequently caught as bycatch in trawl and rock lobster fisheries. However there is no indication that these fisheries are impacting the population, though abundance data are lacking.

Conservation measures None.

Literature Anderson *et al.* (1998); Compagno (1984); Cox and Francis (1997); Francis (1998); Francis (2001); Last and Stevens (1994).

Australian Swell Shark

Cephaloscyllium laticeps (Duméril, 1853)

William T. White

Red List assessment **Global: Least Concern**

Rationale *Cephaloscyllium laticeps* is a common, shallow water (to at least 60m) southern Australian endemic that forms a significant component of the southeastern Australia shark gillnet fishery. Although catches of *C. laticeps* in this fishery were shown to drop between 1973–76 and 1998–2001, i.e. 660 to 305 animals caught per 1,000km-hours of 6-inch gillnet, this species is typically released as it is of little commercial value. There is also limited fishing activity in the western part of its range. Mortality is also probably low because this species is extremely resilient and can survive for a considerable length of time out of water. Therefore, *C. laticeps* appears to be of low risk in the well managed fishery in southeastern Australia and indeed throughout its range.

Distribution **Regional endemic: Southern Australia, from the Recherche Archipelago, WA to Jervis Bay, NSW, including SA, VIC and TAS.**
FAO Areas 51 and 81.

Habitat and ecology *Cephaloscyllium laticeps* occurs inshore on the continental shelf to at least 60m in depth and is probably the most common catshark in this region. This species reaches

at least 100cm TL (possibly 150cm TL) with size at maturity ~82cm TL (males). Oviparous with the young hatching at ~14cm TL (Last and Stevens 1994).

Threats *Cephaloscyllium laticeps* forms a significant component of the southeastern Australia shark gillnet fishery (Walker *et al.* in press) but there is little fishing pressure further to the west. This species is usually returned to the water and fishing mortality appears to be low due to its resilience: it can survive for a considerable length of time out of the water (T.I. Walker, pers. comm.). Although this species is of little commercial value, it has recently been marketed in some areas (J. Stevens, pers. comm.).

Conservation measures None.

Literature Last and Stevens (1994); Walker *et al.* (in press).

Northern Sawtail Shark

Galeus sp. B [Last & Stevens, 1994]

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale An undescribed, little-known catshark recorded from a narrow distributional and bathymetric range off northeastern Australia (QLD). There is nothing known of its biology and little fishing effort in its area of occurrence. No information is available to assess the species beyond Data Deficient.

Distribution **Regional endemic: Northeastern Australia between Rockhampton and Townsville, QLD. Distribution little understood, may be more widely distributed off northeastern Australia.**
FAO Area 71.

Habitat and ecology Demersal on the continental slope in depths of 310–420m. Maximum size at least 41cm TL. Size at maturity 38cm TL (males). Nothing else is known of its biology.

Threats Little fishing effort in its area of occurrence. No threats currently apparent.

Conservation measures None.

Literature Last and Stevens (1994).

Sawtail Shark

Galeus boardmani (Whitley, 1928)

Peter M. Kyne and Michael B. Bennett

Red List assessment **Global: Least Concern**

Rationale *Galeus boardmani* is a small, apparently common, but little known catshark endemic to southern Australian waters between southeastern QLD and WA. It is demersal on the outer continental shelf and upper slope. Little is known of its biology. It is of only minor importance to fisheries, but is regularly taken as bycatch in various demersal trawl fisheries. The species is widespread in southern Australian waters with a wide bathymetric range and there appear to be no major threats to this species at present.

Distribution **Regional endemic: Southern Australia, from Noosa, southeastern QLD to Carnarvon, WA, including NSW, VIC, TAS and SA (Last and Stevens 1994; Compagno and Niem 1998b).**
FAO Areas 57, 71 and 81.

Habitat and ecology *Galeus boardmani* is demersal on the outer continental shelf and upper slope and is reported in depths of 128–823m (Last and Stevens 1994; Compagno and Niem 1998b) however, it has been trawled from shallower waters (85m) off southeastern QLD (P. Kyne, pers. obs.). It attains 61cm TL, with size at maturity ~40cm TL (males) and ~40–43cm TL (females) (Last and Stevens 1994; P. Kyne unpublished data). Oviparous. Little is known about its biology, except that it appears to sometimes aggregate by sex

(Last and Stevens 1994). The species may not have a well-defined reproductive season, similar to other scyliorhinid sharks.

Threats *Galeus boardmani* appears to be widespread and common, is not targeted by commercial fisheries and is only of minor importance to fisheries at present through retention as bycatch (Last and Stevens 1994; Compagno and Niem 1998b). The species is reported to be retained in the Western Deepwater Trawl Fishery, although the quantity is unknown (Rose and SAG 2001). It is, however, a frequent component of bycatch in demersal trawl fisheries (Last and Stevens 1994). It is discarded in the SETF (Rose and SAG 2001), where catch rates from an observer program have been stable over the last 10 years (T.I. Walker, pers. comm.). It is a minor component of the bycatch in the eastern king prawn sector, deepwater component of the QLD East Coast Trawl Fishery, where survivorship from trawling is high (P. Kyne unpublished data). Post-release survivorship is unknown. It is probable that the species is also a component of bycatch of other demersal trawl fisheries operating in its distribution.

Conservation measures None. Due to its bathymetric distribution it is unlikely to occur inside any MPAs, with the exception of the Commonwealth managed Great Australian Bight Marine Park.

Literature Compagno and Niem (1998b); Last and Stevens (1994); Rose and SAG (2001).

Slender Sawtail Shark

Galeus gracilis Compagno and Stevens, 1993

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale A small, little-known catshark reported from isolated records from northern Australia. Found on the continental slope in depths of 290–470m. *Galeus gracilis* appears to be rare and nothing is known of its biology. Limited trawl fisheries operate in its area of occurrence, and while the species is of no commercial interest, bycatch levels are unknown. No information is available to assess the species beyond Data Deficient.

Distribution **Regional endemic: Australia. Isolated records from the northwestern continental slope off WA and the NT, and east of Cape York, QLD (Compagno and Stevens 1993b; Last and Stevens 1994). The isolated records may represent different populations or may be part of a continuous range.**
FAO Areas 57 and 71.

Habitat and ecology Demersal on the continental slope in depths of 290–470m. Maximum size at least 34cm TL. Nothing known of its biology.

Threats Area of occurrence off northwestern Australia subject to minor trawl effort from the Commonwealth managed Western Trawl Fisheries. While it is appears to be a rare species, it is of no commercial value and therefore unlikely be to subjected to any directed fishing pressure. Bycatch levels are unknown.

Conservation measures None.

Literature Compagno and Stevens (1993b); Last and Stevens (1994).

Dusky Catshark

Halaelurus sp. A [Last & Stevens, 1994]

William T. White

Red List assessment **Global: Data Deficient**

Rationale Known only from one 44cm TL immature male specimen caught on the continental slope off Ashmore Reef, northwestern Australia, in 900m depth. It is unlikely to be caught by any fishery at this depth.

Distribution **Regional endemic: Known from only one specimen caught off Ashmore Reef, northwestern Australia (Last and Stevens 1994).**
FAO Area 57.

Habitat and ecology The single known specimen was caught on the continental slope at 900m, and was an immature male of 44cm TL, thus this species appears to attain a larger size than other members of the genus *Halaelurus*.

Threats Data deficient. Probably minimal threats due to the depth they presumably occur in.

Conservation measures None.

Literature Last and Stevens (1994)

cf. Speckled Catshark

Halaelurus sp. 1 (cf. *boesemani* Springer and D'Aubrey, 1972)

William T. White

Red List assessment **Global: Least Concern**

Rationale The Australian *Halaelurus* sp. 1 (cf. *boesemani*) is known only from the continental shelf off WA in depths of 110–250m. Although there is a small trawl fishery in this area, such small scyliorhinids are of little or no commercial value and are thus presumably discarded. This species is unlikely to be incidentally caught by recreational fishers. The extent of occurrence of this species appears to be quite small and probably <20,000km^2, thus could come under a significant threat if fishing pressure was to increase within its range. However, there is no evidence or reason to suspect that the population is in decline or that the population is fragmented.

Distribution **Regional (possible endemic): The Australian *Halaelurus* sp. 1 (cf. *boesemani*) is known only from the continental shelf off Gantheaume Bay to the Rowley Shoals, WA and may be endemic to this region.**
Note: *Halaelurus boesemani*, which has previously been recorded in subtropical and tropical regions off the Arabian Sea, Somalia, Vietnam, Philippines, Indonesia and northwestern Australia (Springer and D'Aubrey 1972; Sainsbury *et al.* 1985; Last and Stevens 1994), is likely to be a species complex (including the Australian *Halaelurus* sp. 1). The Indonesian *Halaelurus boesemani* is known from Maluku and Bali in eastern Indonesia (Compagno and Niem 1998b; W. White unpublished data) although it is likely that this form also extends into northwestern Irian Jaya and thus into the Australia and Oceania region.
FAO Area 57.

Habitat and ecology Demersal on the continental shelf at 110–250m depth. Attains 42cm TL with size at maturity 35cm TL (males) (Last and Stevens 1994). There is no published information on the biology of the species.

Threats A small trawl fishery based off the northwest shelf of Australia is the only fishery likely to catch this species, however, since small scyliorhinids are of little or no commercial value they would presumably be discarded (R. McAuley, pers. comm.). There is no evidence to suggest that this species is under threat from overfishing or by any other means. This species is not utilised commercially and would most likely not be incidentally caught by recreational fishers.

Conservation measures None.

Literature Compagno and Niem (1998b); Last and Stevens (1994); Sainsbury *et al.* (1985); Springer and D'Aubrey (1972).

Dawson's Catshark

Halaelurus dawsoni Springer, 1971

Malcolm P. Francis

Red List assessment **Global: Data Deficient**

Rationale There is no information on the population abundance or catches of this New Zealand endemic. It has a small distributional range – most of the population occurs in an area of about 722,000km^2 – and it is uncommon. Research trawl tows in the habitat area usually catch no sharks, and tows that do catch them usually take only a few individuals. The only known threat is fishing by deepwater demersal trawlers, but the small size of the shark probably ensures a large proportion escape through the codend meshes, which are a minimum of 100mm over much of the habitat range.

Distribution **Regional endemic: New Zealand, between 38°S and 54°S, but most records are from southeastern New Zealand (Chatham Rise and Campbell Plateau) at 43–54°S.**
FAO Area 81.

Habitat and ecology Occurs over a depth range of 50–790m, but is most abundant in 300–700m. All known records have been obtained by demersal trawlers over soft sediment, however it is possible that the species also occurs over foul, untrawlable seabed. Size at maturity 35–36cm TL (males) and 37–38cm TL (females) (M. Francis unpublished data). Maximum known size is 41.5cm TL. Males and females grow to similar maximum lengths. Oviparous. Size at hatching is unknown but the smallest observed free-living individual was 11.3cm TL.

Threats Probably caught occasionally as trawl bycatch, but their small size means that escapement from trawl nets would be high.

Conservation measures None, apart from a restriction on the mesh size of trawl nets to 100mm or greater at latitudes north of 50°S.

Literature Anderson *et al.* (1998); Compagno (1984); Cox and Francis (1997); Springer (1971).

Short-tail Catshark

Parmaturus sp. A [Last & Stevens, 1994]

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Data Deficient**

Rationale A catshark known only from a single specimen captured on the Saumarez Plateau off northeastern Australia (QLD) at a depth of 590m. May be a rare endemic with a restricted range. Further specimens and research is required.

Distribution **Regional endemic: Known only from a single specimen collected from the Saumerez Plateau off northeastern Australia (QLD).**
FAO Area 71.

Habitat and ecology The single record from 590m depth was a 71cm TL mature female with an eggcase (therefore species is oviparous). Nothing else is known of its biology.

Threats Species may be rare and localised. Little fishing activity in area where the single specimen was captured.

Conservation measures None.

Literature Last and Stevens (1994).

McMillan's Catshark

Parmaturus macmillani Hardy, 1985

Larry J. Paul

Red List assessment **Global: Data Deficient**

Rationale Known only from two New Zealand specimens, and three off southeastern Africa, in about 1,000m. This may be a rare species within the 1,000–1,500m depth range currently being fished, or the captures at 1,000m may simply be at the shallow end of a much greater depth range.

Distribution **Regional: Northern New Zealand.**
Global: Southern Mozambique.
FAO Areas 51 and 81.

Habitat and ecology Known only from a few specimens captured during exploratory trawl surveys from two Indo-Pacific localities. A demersal species on the middle continental slope, 1,000m and probably deeper. There is no available life history information.

Threats A potential bycatch in some deepwater trawl fisheries for teleosts such as orange roughy as these continue to expand their geographic range and depth.

Conservation measures None.

Literature Compagno (in prep. b); Hardy (1985).

FAMILY PSEUDOTRIAKIDAE

Slender Smoothhound

Gollum attenuatus (Garrick, 1954)

Malcolm P. Francis

Red List assessment **Global: Least Concern**

Rationale *Gollum attenuatus* is endemic to New Zealand and adjacent oceanic ridges, and taken as bycatch in demersal trawl fisheries. Fecundity is extremely low (two pups/litter), but there is no information on population size or status. However, large parts of the species' range (Norfolk and Three Kings Ridges) are outside fished areas, suggesting that there is a relatively unfished reservoir. Should these areas become fished in future, the status could move quickly towards a threatened category.

Distribution **Regional endemic: New Zealand and ridges to the north (Norfolk Ridge, Three Kings Ridge).**
FAO Area 81.

Habitat and ecology Found on flat plateaus to steep slopes on the upper to mid continental slope. Trawled over open, soft seabed, but may also occur over rocky habitats. Depth range 129–724m, with greatest abundance in 300–600m. Size at maturity 70cm TL (both sexes), and maximum size attained is 110cm TL. Usually two pups/litter, which are born at ~40cm TL.

Threats Caught as bycatch by demersal trawlers and demersal longliners in New Zealand waters. Fishing effort on the ridges north of New Zealand is probably low, and catches therefore minimal.

Conservation measures None.

Literature Anderson *et al.* (1998); Compagno (1984); Compagno and Niem (1998c); Cox and Francis (1997); Yano (1993a; b).

Whiskery Shark

Furgaleus macki (Whitley, 1943)

Colin A. Simpfendorfer and Rory B. McAuley

Red List assessment

2000 Red List assessment:
Global: Conservation Dependent

2000 Red List rationale:
This common, moderately-sized triakid shark is endemic to the continental shelf waters of southern and western Australia. Its biomass level has been reduced significantly by commercial fishing in southwestern Australia. However, a management plan to ensure the survival of the species, and the long-term economic viability of the fishery, has been implemented. Given the high level of research and management in this fishery it is likely that there is no extinction risk for this species in the foreseeable future. (See: Simpfendorfer (In: Fowler *et al.* in press).

Update:
Global: Least Concern

Rationale

This species is endemic to southern and western Australia, with the greatest abundance in southwestern WA where it is a target species in a demersal gillnet fishery. The population has decreased to approximately 26% of virgin levels, but has been relatively stable since the mid-1980s. The fishery is tightly managed and regular assessments of *Furgaleus macki* are undertaken. Since the population has been stable for about three generations and the gillnet fishery is managed this species is assessed as Least Concern.

Distribution

Regional endemic: Australia, from North West Cape, WA, south and east to central VIC and northern TAS. It is found in greatest abundance in southwestern Australia from Albany to Kalbarri.
FAO Area 57.

Habitat and ecology

The whiskery shark is most commonly found in rocky reef seagrass areas on the continental shelf. Mature females produce 4–29 pups/litter (average 19) every second year (Simpfendorfer and Unsworth 1998). Size at birth is 25cm TL, size at maturity is ~110cm TL (both sexes), and maximum size attained is 150cm TL. The age at maturity is 4.5 years (males) and 6.5 years (females) (Simpfendorfer *et al.* 2000a). Maximum age is probably 15 years.

Threats

Whiskery sharks have been caught in commercial fisheries in WA since the 1940s (Simpfendorfer and Donohue 1998). Early longline fisheries captured small numbers in the 1940s and 1950s, but the introduction of multifilament gillnets in the 1960s increased catches. Concerns about mercury in sharks in the mid-1970s saw a reduction in catches for a few years. However, once these concerns were addressed and dedicated well-equipped shark fishing vessels entered the fishery, levels of fishing effort and catch rose dramatically. The late 1970s and early 1980s saw the whiskery shark population reduced to less than 30% of virgin levels (Simpfendorfer *et al.* 2000b). In the mid-1980s WA introduced management to the gillnet fishery, restricting effort levels and other management measures. Since then whiskery shark abundance has remained relatively stable at 25–30% of virgin levels over a period of 20 years. Whilst management has not yet rebuilt the stock to the 40% of virgin biomass target, the final phase of effort reductions in the target fishery was not implemented until 2000/01. Early indications are that there have been significant and steady increases in CPUE in the centre of the species' range (and an overall increase) for the last 4–5 years and that a 'pulse' of young adult whiskery sharks are currently recruiting into the fishery. Continued management of the fishery, including several effort reductions, has maintained whiskery shark abundance at this lower level and should do so for the foreseeable future. In addition to catches in WA this species is also caught in the SSF. Catches in this fishery, however appear to be low and pose no threat to the population.

Conservation measures

Management measures in the WA gillnet fishery are in part targeted at conservation of whiskery sharks. These measures include effort controls and mesh size restrictions. At present there are no other conservation measures in place.

Literature Last and Stevens (1994); Simpfendorfer and Donohue (1998); Simpfendorfer and Unsworth (1998); Simpfendorfer *et al*. (2000a; b); Simpfendorfer *et al.* (2001); Simpfendorfer (In: Fowler *et al*. in press).

School Shark

Galeorhinus galeus (Linnaeus, 1758)

Terence I. Walker, John D. Stevens and Larry J. Paul

Red List assessment

2000 Red List assessment:
Global: Vulnerable A1bd+2d
Australasia: Conservation Dependent

2000 Red List rationale:
A widespread mainly coastal and bottom associated shark of temperate areas which has been fished in all parts of its distribution. Because of the species' low productivity and its history of stock collapse (e.g. the Californian fishery) it is considered that the global population will have been reduced by over 20% in the past 60–75 years (the three generation period). However, the populations in Australia and New Zealand have been fished commercially for more than 50 years and management plans are currently in place to rebuild the populations. Stock assessment of the Australian population suggests that current biomass is between 20–59% of the total virgin biomass, or between 19–43% of mature virgin biomass. Consequently, the species is assessed as Lower Risk (conservation dependent) in these areas. See Stevens (In: Fowler *et al*. in press).

Update (Australasia only):
Australia: Vulnerable A1bcd
New Zealand: Near Threatened

Rationale A widespread mainly coastal and bottom associated shark of temperate areas which has been fished in all parts of its distribution. In the *2000 Red List*, *Galeorhinus galeus* was listed as Vulnerable globally and Conservation Dependent in Australia. This updated regional assessment details the classification of Vulnerable for Australia, and Near Threatened for New Zealand. The former is based mainly on two pieces of evidence: (1) In southern Australia the current mature biomass has been estimated from age-based model outputs to be below 20% of the level before commercial target fishing began in the 1920s, and; (2) Very low biological productivity; maximum age is potentially 60 years, age at maturity in females exceeds 10 years. In New Zealand, the stock has been managed for 17 years, and landings have been stable for the past decade. However, commercial TACs introduced following some CPUE declines have been regularly exceeded. Fisheries for the species are managed by ITQs in both New Zealand and Australia that should allow stocks to begin to rebuild, but the sustainable catch level in New Zealand remains unknown.

Distribution **Regional: Southern Australia (from Perth, WA to Moreton Bay, QLD including Lord Howe Island [uncertain] and TAS) and New Zealand.**
Global: Widespread in temperate waters.
Note: The present assessment is on the basis of separate isolated genetic stocks between Australia and New Zealand (Ward and Gardner 1997). Whilst available tag data indicate mixing between the Australian and New Zealand stocks (Hurst *et al*. 1999, Brown *et al*. 2000), genetic data indicate nil or very little interbreeding between these populations (Ward and Gardner 1997).
FAO Areas 27, 34, 37, 41, 47, 57, 71, 77 and 81.

Habitat and ecology *Galeorhinus galeus* occurs over the continental shelf from shallow, inshore bays (mainly juveniles) to about 800m depth on the continental slope. At least in some areas (Northeast Atlantic, Tasman Sea) they also extend offshore up to 1,610km from the coast (Fitzmaurice 1979; Brown *et al*. 2000). The species is primarily found near the bottom but ranges through the water column even into the pelagic zone. It appears to have fairly discrete pupping and nursery areas, which are often in shallow, protected bays and estuaries (Olsen 1954).

The species attains a maximum size of ~200cm TL, but is somewhat smaller in the South West Atlantic (155cm TL). Size at maturity is 125–135cm TL (males) and 134–140cm TL (females), (although males mature at 107cm TL and females at 118cm TL in the South West Atlantic) (Ripley 1946; Olsen 1954; Capapé and Mellinger 1988; Peres and Vooren 1991). Reproduction is aplacental viviparity with an average of 20–35 pups/litter (up to 54) produced in spring or early summer after a gestation period of

~12 months; size at birth is ~30–35cm TL (Last and Stevens 1994). Males appear to breed every year but individual females have been reported to breed every year in the Mediterranean, every second year in Australia, and every third year in Brazil (Olsen 1954, Capapé and Mellinger 1988, Peres and Vooren 1991). These may reflect real differences or may be due to the difficulties of sampling a species which shows marked temporal and spatial sexual and size segregation, and which makes extensive movements. These animals are estimated to live for 60 years. In Australia, tags have been returned from animals at liberty for more than 40 years. Age at maturity is 8–10 years (males) and 10–12 years (females) (Olsen 1954; Walker 1999a).

The species makes extensive migrations, with animals tagged in the UK being recaptured as far as the north of Iceland (2,461km), Canary Islands (2,526km) and the Azores (1,610km off the coast of Portugal) (Fitzmaurice 1979; Holden and Horrod 1979; Stevens 1990). In Australia, tagging has shown mixing across most of the southern half of the continent (with movements of up to 1,260km) and a number of animals have moved across the Tasman Sea between Australia and New Zealand (Olsen 1984; Brown *et al.* 2000).

Threats

The main threat to the various populations of *G. galeus* is from targeting widely with gillnets and longlines. Minor threats include fishing with trawls and other methods. There is accidental capture of pups on nursery grounds in gillnets of small mesh-size and recreational fishers operating in inshore shallow-water areas. Studies have reported declines in juveniles in nursery areas, thought to be due to fishing pressure on pregnant females during their pupping migration and intensified fishing of juveniles in some areas (Olsen 1959, 1984; Stevens and West 1997). The nursery areas are also vulnerable to the effects of habitat destruction (such as loss of seagrass) and pollution from the increased human population pressures often associated with these areas. Other threats are habitat degradation by the effects of trawling through disturbance of substrates (Walker 1998) and installation of high voltage direct current sub-sea cables with induced magnetic and electric fields across their migration lanes (Walker 2001).

Galeorhinus galeus has a long history of exploitation in target fisheries in most parts of its range where they have been in demand for their liver-oil, meat and fins. In southeastern Australia, the harvest of *G. galeus* began in the mid-1920s, but increased markedly during the war years with the market for shark liver oil. Catches levelled off at about 2,000t live weight during 1949–57 with the decline of the liver market and as the fishery spread from inshore to offshore waters (Olsen 1959). With the establishment of the shark meat market and the introduction of gillnets in 1964, production rose rapidly to peak during 1969 at 3,158t. Following a ban on the sale of large school sharks in 1972 because of high mercury levels, catches declined for about 10 years. With the relaxation of the mercury laws catches again increased, reaching 3,060t during 1986. Since 1986, the total annual catch from the SSF had declined to 172t by 2001 (Walker 1999a, Walker *et al.* 2002). The mature biomass has been estimated from age-based model outputs to be below 20% of the level before commercial target fishing began (Punt *et al.* 2000)

In New Zealand, *G. galeus* have been exploited since the mid-1940s. With the demise of the liver oil fishery in the 1950s, a market for the meat developed (some is exported to Australia) and catches peaked at 5,000t live weight in 1984 (Francis 1998, Paul and Sanders 2001). Catch levels have been ~3,000t for the past decade, but it is not known if this, or the current commercial TACs (TACCs) (3,107t), are sustainable, or if they are at levels that will allow the stock to move towards a size that will support the maximum sustainable yield.

Conservation measures

Management measures in the fishery of southern Australia where the stock is most depleted include limited entry for the use of gillnets and longlines (since 1984) and, for all fishing sectors, TAC (since 2000). Input controls include limits on length of net (since 1988), various 4–6 week closed seasons to protect pregnant animals of *G. galeus* during October–December (1953–67 and 1993–94), and a legal minimum mesh-size of six inches for gillnets (since 1975) for most of the fished area. Closed areas to commercial gillnetting in inshore waters of TAS have been variously implemented since 1954 to protect newborn, juvenile and pregnant *G. galeus* on nursery areas. A more extensive closed area was adopted during 1988 when all VIC proclaimed waters (inside 3nm limit) were closed to the use of shark gillnets and longlines. Legal minimum lengths were phased in by the States and Commonwealth during 1949 and the early 1950s and remain current. During 2002, the TAC for *G. galeus* was 269t for the SSF, 33t for the SETF, and 2t for the GABTF.

In New Zealand, minimum mesh-sizes of 125mm and 150mm apply for *G. galeus* in northern New Zealand and southern New Zealand, respectively. Numerous general restrictions apply to the use of commercial and recreational gillnets and longlines, including limits on the length of gillnets, number of hooks per longline, number of longlines, soak time, the amount of an estuary or bay that can be blocked by a gillnet,

and areas that can be fished. The restrictions vary regionally and are designed to reduce the number of nets lost and the amount of fish wasted to sea lice and decay because of excessively long sets, and to minimise conflict with other users of inshore waters. Also, *G. galeus* is covered by the mixed species daily bag limits for recreational fishers of 20 and 30 fish for the northern and central regions and southern region of New Zealand, respectively. In October 1986, the TACC was set at 2,590t, but this had increased to 3,107t by 1995–96 (as a consequence of quota appeals, not stock assessment) and was current in 2003. The TACC was exceeded by up to 10% in the late 1990s.

Literature Brown *et al.* (2000); Capapé and Mellinger (1988); Compagno (1984); Francis (1998); Hurst *et al.* (1999); Kroese *et al.* (1995); Olsen (1954); Olsen (1959); Olsen (1984); Paul and Sanders (2001); Peres and Vooren (1991); Punt *et al.* (2000); Punt and Walker (1998); Ripley (1946); Stevens (In: Fowler *et al.* in press); Stevens and West (1997); Walker (1998); Walker (1999a); Walker (2001); Walker *et al.* (2002); Walker and Punt (1998); Ward and Gardner (1997).

Sailback Hound Shark

Gogolia filewoodi Compagno, 1973

Sarah L. Fowler

Red List assessment **Global: Data Deficient**

Rationale Known from only one pregnant female (carrying two near-term pups, suggesting a low intrinsic rate of population increase), collected off a river mouth in water 73m deep. Presumably an endemic of the New Guinea continental shelf. The known extent of occurrence of this species is likely small (<20,000km^2), but there is no evidence of major threats to the habitat or significant fishing pressure (this very distinctive species has not been reported from landing sites or markets).

Distribution **Regional endemic: Northern New Guinea.**
FAO Area 71.

Habitat and ecology Only one specimen has been recorded, thus this species is probably an uncommon endemic; it is very distinctive in appearance and should have been recorded more frequently if common, although the area is not well-surveyed. Known specimen was taken on a hand line off the continental shelf, off a river mouth, probably on or close to the bottom. It was a pregnant female of 74cm TL, with two near-term foetuses (24cm TL). This is an ovoviviparous species with the observed fecundity indicating a low intrinsic rate of population increase.

Threats Bycatch in shallow continental shelf fisheries.

Conservation measures None.

Literature Compagno (in prep. b).

Darksnout Hound Shark

Hemitriakis abdita Compagno & Stevens, 1993

William T. White

Red List assessment **Global: Data Deficient**

Rationale Very few specimens of *Hemitriakis abdita* have been recorded and since, at least off Queensland, it occurs in waters 225–400m deep, it is unlikely to be caught in fisheries within its range.

Distribution **Regional endemic: Australia, from the Coral Sea, QLD and New Caledonia (Compagno and Niem 1998d).**
Note: Several specimens of a similar *Hemitriakis* species have been recorded from Bali and Lombok in eastern Indonesia but this is probably a distinct species (W. White unpublished data).
FAO Area 71.

Habitat and ecology *Hemitriakis abdita* occurs on the upper continental slope at depths of 225–400m. Attains at least 80cm TL, size at maturity is 65cm TL and size at birth is 20–25cm TL (Last and Stevens 1994). Very little is known about its biology and only a limited number are in museum collections.

Threats Unlikely to be caught in fisheries off QLD due to lack of fisheries in the depths it is found.

Conservation measures None.

Literature Compagno (1998); Compagno and Niem (1998d); Compagno and Stevens (1993c); Last and Stevens (1994).

Sicklefin Hound Shark

Hemitriakis falcata Compagno & Stevens, 1993

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Least Concern**

Rationale A rare Australian endemic with a restricted distributional and bathymetric range (146–197m) on the outer continental slope off northwestern WA. Fisheries operate both inshore (<100m) and offshore (>200m) from its known depth range, while the area in between receives little fishing effort. *Hemitriakis falcata* does not meet the B criterion for threatened status, as while its range is limited, there is currently no evidence of heavy fishing, and therefore no evidence of a decline in range, habitat quality or number of mature individuals. However, given its rarity and occurrence within only a narrow range, any future expansion of fishing in the area could impact upon the viability of the species (at present this looks unlikely as interest in the North West Slope Trawl Fishery is declining, but the situation should be monitored).

Distribution **Regional endemic: Australia, from a small area off northwestern WA (from northwest of Dampier to northwest of Broome). Species may be more widespread than presently known.**
FAO Area 57.

Habitat and ecology Recorded from the outer continental shelf at depths of 146–197m. Maximum size attained at least 80cm TL (Last and Stevens 1994) (largest reported by Compagno and Stevens (1993c) was 77.3cm TL). Size at birth ~20–25cm TL. Males 69.5cm TL and larger are mature, however, no males have been observed from 38–69.5cm TL, therefore maturity may occur at a smaller size. Nothing else is known of its biology.

Threats There is likely to be only minor fishing effort in its known area of occurrence. The Australian Commonwealth managed North West Slope Trawl Fishery (NWSTF) is a small fishery operating >200m depth while WA state fisheries operating in this area (north coast shark fishery, Pilbara Fish Trawl Fishery) generally fish at depths of <100m. Therefore, current fishing pressure on the species may be low. Future expansion of fishing in the area could impact upon the viability of the species although at present this looks unlikely as interest in the NWSTF is declining.

Conservation measures None.

Literature Compagno and Stevens (1993c); Harris and Ward (1999); Last and Stevens (1994).

Pencil Shark

Hypogaleus hyugaensis (Miyosi, 1939)

Colin A. Simpfendorfer and Leonard J.V. Compagno

Red List assessment *2000 Red List assessment:*
Global: Near Threatened

Rationale This small triakid shark has a patchy distribution in the Indo-West Pacific. Given the minor nature of this species in fisheries, it is unlikely that it faces an immediate threat of extinction. However, its patchy distribution and relatively low abundance

throughout its range increases the potential for future fishing pressure to cause problems.

Literature Simpfendorfer and Compagno (In: Fowler *et al.* in press).

Longnose Hound Shark

Iago garricki Fourmanoir, 1979

Peter M. Kyne and Rachel D. Cavanagh

Red List assessment **Global: Least Concern**

Rationale A small houndshark reported from northwestern WA, QLD and Vanuatu. Recorded from the continental slope at depths of 250–475m. The species produces small litters of 4–5 young, but little else is known of its biology. It is of minor interest to fisheries although it is likely to be taken as bycatch in the small Australian Commonwealth managed Western Trawl Fisheries. More information is needed on its biology and abundance, particularly as it seems to be naturally rare.

Distribution **Regional endemic: Australia (northwestern Australia from Shark Bay, WA to Darwin, NT, and tropical QLD between Townsville and Cairns) and Vanuatu.**
FAO Areas 57 and 71.

Habitat and ecology Recorded in tropical waters on the continental slope at depths of 250–475m. Maximum size attained at least 75cm TL. Size at birth ~25cm TL and size at maturity ~45cm TL (males). The species is viviparous with a yolksac placenta and 4–5 pups/litter (Last and Stevens 1994).

Threats *Iago garricki* is of minor interest to fisheries (Compagno and Niem 1998d). It is likely to be taken as bycatch in the Australian Commonwealth managed North West Slope Trawl Fishery which operates at depths of >200m off northwestern WA. This fishery is small and no actual data on bycatch levels are available (Harris and Ward 1999).

Conservation measures None.

Literature Compagno and Niem (1998d); Harris and Ward (1999); Last and Stevens (1994).

Grey Gummy Shark

Mustelus sp. A [Last & Stevens, 1994]

Rory B. McAuley

Red List assessment **Global: Least Concern**

Rationale This Australian endemic is widespread in deep coastal waters (100–300m). Limited biological data suggest it is a relatively productive species. It occurs within the outer depth ranges of the WA West Coast Demersal Gillnet and Demersal Longline Fishery, in which it is a known component of the bycatch. Catches are small (probably <4t yr^{-1}). The species is most common in deeper coastal waters, outside the principal operational areas of the demersal gillnet fishery. Its range also includes a large area (~10,000km^2) where shark fishing is prohibited. The species has not been recorded from the Pilbara Fish Trawl (PFT) fishery despite extensive sampling, but is an irregular bycatch species in the QLD East Coast Trawl Fishery.

Distribution **Regional endemic: Australia: Western and northwestern WA (Last and Stevens 1994; R. McAuley unpublished data), Northern Australia and southeastern QLD (P. Kyne, pers. comm.).**
FAO Areas 57 and 71.

Habitat and ecology This species is known to occur between 100–300m depth. Very little information about the life history characteristics of this species is available in the published literature. Unpublished research data show that size at maturity is 83cm FL (females) and maximum size attained is at least 101cm FL. These data indicate that this is likely to be a fairly productive species, with 6–24 pups/litter (average 18).

Threats Minor component of the bycatch in the WA West Coast Demersal Gillnet and Demersal Longline Fishery (R. McAuley unpublished data). Not targeted in WA. This species has not been recorded from the Pilbara Fish Trawl (PFT) fishery despite extensive sampling (Stephenson and Chidlow draft report). An irregular bycatch species in the QLD East Coast Trawl Fishery (P. Kyne, pers. comm.).

Conservation measures The only known source of exploitation of *Mustelus* sp. A. is the WA West Coast Demersal Gillnet and Demersal Longline Fishery. This is a limited entry fishery, where fishing effort is regulated by the use of unitised time-gear access. Shark fishing was prohibited north of Steep Point (26°30'S) in 1993. This is thought to offer a significant refuge for this species.

Literature Last and Stevens (1994); Stephenson and Chidlow (draft report).

White-spotted Gummy Shark

Mustelus sp. B [Last & Stevens, 1994]

Rory B. McAuley

Red List assessment **Global: Least Concern**

Rationale This Australian endemic is possibly widespread in deep coastal waters (120–400m). Limited biological data suggest it is a relatively productive species. It occurs at the northern extent of the WA West Coast Demersal Gillnet and Demersal Longline Fishery. It was a negligible component of this fishery's bycatch before the prohibition on shark fishing north of 26°S in 1993. Since then, it is unclear whether *Mustelus* sp. B still occurs as bycatch and the large 'closed' area (~10,000km^2) probably offers a significant refuge. It has not been recorded from the Pilbara Fish Trawl (PFT) fishery despite extensive sampling, but is an irregular bycatch species in the QLD East Coast Trawl Fishery. The species is most common in deeper coastal waters, outside the principal operational areas of most commercial fisheries within its range.

Distribution **Regional endemic: Western and northwestern WA and QLD (Last and Stevens 1994; R. McAuley unpublished data).**
FAO Areas 57 and 71.

Habitat and ecology This species is known to occur at 120–400m depth. Little is known about the life history characteristics, however size at maturity is ~60cm TL (females) and maximum size attained is at least 103cm TL in WA. The QLD form attains 117cm TL and size at maturity is possibly >70cm TL. Limited data indicate that this is likely to be a fairly productive species, with 4–17 pups/litter.

Threats Was a negligible component of the bycatch in the WA West Coast Demersal Gillnet and Demersal Longline Fishery (R. McAuley unpublished data) but bycatch is likely to have reduced since shark fishing was prohibited north of Steep Point (26°30'S) and may no longer be caught by this fishery. Not targeted in WA. It has not been recorded from the Pilbara Fish Trawl (PFT) fishery despite extensive sampling (Stephenson and Chidlow draft report). An irregular bycatch species in the QLD East Coast Trawl Fishery (P. Kyne, pers. comm.).

Conservation measures The only known source of exploitation of *Mustelus* sp. B is the WA West Coast Demersal Gillnet and Demersal Longline Fishery. This is a limited entry fishery, where fishing effort is regulated by the use of unitised time-gear access. Shark fishing was prohibited north of Steep Point in 1993. This is thought to offer a significant refuge for this species.

Literature Last and Stevens (1994); Stephenson and Chidlow (draft report).

Gummy Shark

Mustelus antarcticus Günther, 1870

Terence I. Walker

Red List assessment

2000 Red List assessment:
Global: Conservation Dependent

2000 Red List rationale:
Gummy sharks are endemic to Southern Australia, occurring mainly on the continental shelf. This is a highly productive shark species in terms of the maximum sustainable yield rate (defined as the maximum sustainable yield divided by the biomass at equilibrium required to provide that yield), which is about 12% for gummy shark. The Red List Assessment is based on the following considerations: (a) the productivity of the species is relatively high, (b) current biomass is estimated as being close to half the biomass before fishing began, and (c) the fishery is managed with firm controls implemented. See Walker (In: Fowler *et al.* in press).

Update:
Global: Least Concern

Rationale

Mustelus antarcticus is a highly abundant southern Australian endemic with relatively high productivity (longevity 16 years, low age at maturity, eight-year generation period, and up to 38 pups per litter). It is harvested over its entire range, but about two-thirds of the catch is taken from Bass Strait. There is no population fragmentation. Mandatory adoption of middle-sized mesh-sizes in the fishery and the large area closure of all Victorian waters to shark fishing provide effective protection of large breeding females. Age-based fishery assessment models indicate that current catch levels are sustainable and that, while the number of births is closely related to the number of maternal animals, recruitment to the fishery at age two years is remarkably stable for a wide range of population sizes. In Bass Strait, SA and WA, stock assessments indicate that biomass has been 40–55% of initial biomass for most of the past two decades, with <20% change in population size over the three generation period. A steady decline in fishing effort since the mid-1980s and adoption of a TAC during 2000 has led to a steady increase in abundance of mature and maternal animals in the population. Biomass is above the level required to provide the maximum sustainable yield. This species is therefore updated from the 2000 assessment of Conservation Dependent to Least Concern.

Distribution

Regional endemic: Temperate waters of Australia, from about Geraldton, WA (28°S) to Port Stephens, NSW (32°S).
Note: This assessment is for the genetic stock known to range from Bunbury, WA, in the west to Bermagui, NSW. Shark fisheries mainly harvest animals from this stock. A second is located off NSW in the region from Newcastle to the Clarence River, and a third is located off QLD near Townsville. The much smaller second and third genetic stocks are not assessed directly.
FAO Areas 57, 71 and 81.

Habitat and ecology

The species is demersal, occurring mainly on the continental shelf from the shore to about 80m depth, but also on the upper slope down to 350m. Female *M. antarcticus* reach a greater maximum size (185cm TL) than males (148cm TL) (T.I. Walker unpublished data), and reach a maximum weight of 24.8kg (Walker 1983). Tagging and ageing studies indicate that the species has a maximum life span of ~16 years (Moulton *et al*. 1992). The species exhibits aplacental viviparity with uterine compartments. Ovulation occurs October–mid-December in Bass Strait and off SA (Walker 1996) and November–February off WA (Lenanton *et al*. 1990). Pregnant sharks carry 1–38 young, and large mothers carry more embryos than smaller ones. The size at first maturity and the proportion of sharks longer than this length found to be pregnant increases from east to west (Walker 1996). In Bass Strait about half of the population of large female sharks breed each year whereas off SA (Walker 1994a) and WA (Lenanton *et al*. 1990) most breed each year. The sex ratio of embryos is 1:1 and mean size at birth is ~33cm TL (Walker 1983). The young are usually born in shallow coastal areas. These animals do not exhibit well-defined migration patterns, but tag data indicate that some large females leave Bass Strait and move to waters off SA and WA. Movement rates from SA to Bass Strait are much lower (Walker *et al*. 2000).

Threats

In the SSF, *M. antarcticus* and *Galeorhinus galeus* have been targeted in oceanic waters since the mid-1920s and possibly earlier in inshore areas. Baited hooks attached

to bottom-set longlines was the principal fishing method until the early 1970s when the method was replaced by bottom-set gillnets. Today the main threat to populations of *M. antarcticus* is from targeting widely across southern Australia with gillnets of 6–6.5-inch mesh-size off SA, VIC and TAS, and of 6.5–7-inch mesh-size off WA. In Bass Strait (Walker 1994b; 1998), SA (Walker 1994b), and WA (Simpfendorfer 1999a), stock assessment indicates that the level of biomass was 40–55% of initial biomass for most of the past two decades. A steady decline in fishing effort since the mid-1980s and adoption of a TAC during 2000 led to a steady increase in abundance. There is negligible targeting for *M. antarcticus* off NSW and south of Bass Strait off TAS. In accordance with the FAO Code of Conduct for Responsible Fishing, the biomass is above the level required to provide the maximum sustainable yield.

Application of age-based fishery assessment models, allowing for age- and density-dependent natural mortality and incorporating information on growth and reproduction of the species and on selectivity of gillnets, indicates that current catch levels are sustainable and shows that while the number of births is closely related to the number of maternal animals, recruitment to the fishery at age two years is remarkably stable for a wide range of population sizes (Walker 1992; 1994a,b; 1998). For this species, there are advantages in harvesting the middle-sized sharks and in protecting the large older sharks for breeding purposes and for protecting the young animals to improve the yield from growth. This is achieved by gillnets of mesh-size ranging 6–6.5 inches (Walker 1998, 1999b). Minor threats include fishing with longlines, trawls and other methods.

Conservation measures

Management measures in this fishery include limited entry for the use of gillnets and longlines (since 1984) and, for all fishing sectors, TAC (since 2000) and various input controls. Limits apply to length of net (since 1988) (initially 6,000m but subsequently reduced to 4,200m) and depth of net (20-meshes). Various 4–6 week closed seasons have been in place to protect pregnant animals of *Galeorhinus galeus* during October–December (1953–67 and 1993–94). There is a legal minimum mesh-size of 6 inches (since 1975) and a legal maximum length of 6.5 inches (since 1997) for gillnets for most of the fished area. Closed areas to commercial gillnetting in inshore waters of TAS have been variously implemented since 1954 to protect newborn, juvenile and pregnant *G. galeus* on nursery areas. A more extensive closed area was adopted during 1988 when all Victorian proclaimed waters (inside 3nm limit) were closed to the use of shark gillnets and longlines. Legal minimum lengths were phased in by the States and Commonwealth during 1949 and the early 1950s and remain current. During 2002, the TAC for *M. antarcticus* was 1,750t for the SSF, 86t for the SETF, and 28t for the Great Australia Bight Trawl Fishery.

Literature

Gardner and Ward (1998); Lenanton *et al.* (1990); MacDonald (1988); Simpfendorfer (1999a); Walker (1983); Walker (1992); Walker (1994a; b); Walker (1996); Walker (1998); Walker (1999b); Walker *et al.* (2000); Walker *et al.* (2002); Walker (In: Fowler *et al.* in press).

Rig

Mustelus lenticulatus Phillipps, 1932

Malcolm P. Francis

Red List assessment

2000 Red List assessment:
Global: Conservation Dependent

2000 Red List rationale:
This abundant, small, coastal shark is endemic to New Zealand, where it is commercially fished. Catches have been constrained by Individual Transferable Quotas (ITQs) following the identification of at least some of the five stocks as severely overfished. Rig are fast growing, at least up to maturity, and there is anecdotal evidence that heavily depleted stocks have rebuilt rapidly since the introduction of ITQs in 1986. This is one of the most resilient commercially fished species of shark, capable of recovering from serious depletion. See Francis (In: Fowler *et al.* in press).

Update:
Global: Least Concern

Rationale

Rig is an abundant endemic distributed throughout New Zealand. Annual commercial catches of 1,600–1,900t are constrained by ITQs. Rig are fast growing, and mature at moderate ages (females 7–8 years). Depleted stocks have rebuilt under the QMS that has been in place since 1986, when some stocks had been identified as severely

overfished. Of five management stocks, one now has increasing CPUE, three are stable and one is declining. This species assessment has been updated from Conservation Dependent to Least Concern.

Distribution

Regional endemic: Mainland New Zealand and the Stewart Island – Snares Island Shelf. Absent from Chatham Islands and sub-Antarctic islands.
FAO Area 81.

Habitat and ecology

Female rig attain a larger maximum size (151cm TL) than males (126cm TL). Size at maturity varies among stocks, but females mature at larger sizes than males. Growth studies indicate that rig grow rapidly, reaching maturity at 5–8 years depending on the sex and stock. They live to at least 15 years. Natural mortality (M) is estimated to be in the range 0.2–0.3. The Maximum Constant Yield (Annala *et al*. 2002) for rig populations is estimated to be about 3–7% of virgin biomass. Rig are ovoviviparous, the gestation period is ~11 months, and size at birth is 20–32cm TL. Fecundity increases with the length of the mother, and ranges from 2–37 embryos (average 11). Most mature females probably breed every year, with only a short resting period (1–2 months) between pregnancies. Parturition, ovulation and mating occur mainly during spring and early summer. The young are either born in, or make their way to, shallow coastal areas including harbours, bays and sheltered coastlines. They remain there for the summer and autumn before migrating into deeper water.

Threats

Commercial fisheries (mainly set net and bottom trawl) take 1,600–1,900t per year. Recent analyses indicate that one fishstock (management area) has increasing CPUE, several have stable CPUE, and one has declining CPUE. These varying trends reflect the differing knowledge of stock status, and the ability to set appropriate TACs, when ITQs were introduced in 1986. Overall, the rig population has probably remained stable for 17 years.

Conservation measures

Managed under a QMS.

Literature

Annala *et al.* (2002); Francis (1988); Francis (1989); Francis (1997a); Francis (In: Fowler *et al.* in press); Francis and Ó Maolagáin (2000); Last and Stevens (1994).

FAMILY **HEMIGALEIDAE**

Weasel Shark

Hemigaleus microstoma Bleeker, 1852

Colin A. Simpfendorfer

Red List assessment

Global: Least Concern
South East Asia: Near Threatened

Rationale

This species occurs on continental shelves out to 170m throughout its disjunct range in the Indo-West Pacific. In northern Australia it is commonly taken in trawl fisheries, including those for prawns and fish and is also taken in gillnet and longline fisheries, but not in large numbers. In other countries data are lacking, but it appears not to be abundant. This small species has relatively high productivity – it produces large litters (up to 19 pups) after a six-month gestation period, probably grows fast, and matures at an early age. These life history parameters are likely to enable it to sustain reasonable levels of fishing pressure and it is assessed as Least Concern globally.

However, it is fished in high numbers in South East Asia, and despite its relatively high productivity, there is enough concern to warrant a Near Threatened assessment in this region (where it may meet the criteria for Vulnerable A2d).

Distribution

Regional: Northern Australia (from the Abrolhos Islands, WA north and east to Brunswick Heads, NSW) and Papua New Guinea.
Global: Disjunct Indo-West Pacific distribution.
FAO Areas 57, 61, 71 and 81.

Habitat and ecology

This species has an apparently disjunct distribution and occurs on the continental shelf out to approximately 170m. Compagno (1984) reports that it is not extremely abundant throughout its range. Biological data are only available from Australian waters. It is viviparous, producing 1–19 pups/litter after a six-month gestation period.

Size at birth is ~30cm TL, size at maturity is 60cm TL (males) and 65cm TL (females), with a maximum size of 110cm TL. There are no age and growth data, but they are assumed to be relatively fast growing and early maturing. This life history is relatively productive for an elasmobranch and should enable it to withstand a reasonable level of fishing pressure.

Threats This species is caught in trawl fisheries throughout its range. In northern Australia it is commonly taken in trawl fisheries, including those for prawns (including the Shark Bay, Exmouth Gulf, Gulf of Carpentaria and QLD east coast fisheries) and fish (including the Pilbara Trawl Fishery) (Last and Stevens 1994; Simpfendorfer *et al.* 1999). In northern Australia it is also taken in gillnet and longline fisheries, but not in large numbers. In other countries data are lacking, however, it is caught in high numbers in South East Asia (e.g. Indonesia) and more information is needed on its status and threats throughout this region.

Conservation measures None.

Literature Compagno (1984); Last and Stevens (1994); Simpfendorfer *et al.* (1999).

Fossil Shark

Hemipristis elongatus (Klunzinger, 1871)

William T. White

Red List assessment **Global: Vulnerable A2bd+3bd+4bd**
Australia: Least Concern

Rationale *Hemipristis elongatus* is commonly landed in coastal fisheries throughout its shallow (to 130m) tropical Indo-West Pacific range (to a lesser extent in Australia) since the flesh is considered of very high quality, as are the fins and liver. The intensive and largely unmanaged net and trawl fisheries that occur throughout its range (with the exception of Australia) fish heavily in its known habitat and are likely to catch this species if present. Many shark fisheries and stocks in the region are known to be over-exploited, with catches declining, and market surveys indicate that this species has declined in areas where it was once considered common. This trend is likely to continue in future in the absence of management and because of continued, if not increasing fishing effort.

Australia is the exception to this pattern; the species is only a minor component of northern Australian trawl fisheries and is of little commercial value so is considered Least Concern here.

Distribution **Regional: Northern Australia (Bunbury, WA to Lizard Island, QLD).**
Global: Indo-West Pacific.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology *Hemipristis elongatus* is a rare to common tropical coastal species occurring at depths down to 130m (Compagno 1998). This species attains a maximum size of 240cm TL, with size at maturity ~120cm TL (females) and 110cm TL (males). They are viviparous and have a seasonal reproductive cycle with 2–11 pups/litter (average six), with size at birth 45–52cm TL (Compagno 1984; Last and Stevens 1994). Mating appears to take place around June, ovulation in September and birth in about April, with a gestation period of ~7–8 months. The pregnancy rate among mature females off Australia is about 30%, which suggests that individual females may breed every other year (Stevens and McLoughlin 1991). There is no information on the age at maturity and growth of this species.

Threats *Hemipristis elongatus* forms a minor component of the northern Australian gillnet and trawl (prawn and fish) fisheries (Last and Stevens 1994; Stobutzki *et al.* 2002; R. McAuley, pers. comm.) and is also landed in gillnet and trawl fisheries in Indonesia (W. White unpublished data) and presumably in other countries within its range.

Gillnet and trawl fisheries in Indonesia (especially the Java Sea) are very extensive and as a result, many shark species are highly exploited. Catches of sharks in South East Asia are very high but are declining and fishers are travelling much further from the ports in order to increase catches (Chen 1996). Trawl and gillnet fisheries are also moving further away, e.g. in Jakarta the gillnet fishery at Muara Baru travels to waters around Kalimantan due to the decline in local shark populations (W. White unpublished data). In the Gulf of Thailand this species was once considered common, however,

surveys in recent years have observed very few specimens (L.J.V. Compagno, pers. comm.). In India, the fins and oil are utilised and the flesh is considered of extremely high quality (Last and Stevens 1994).

Conservation measures None.

Literature Chen (1996); Compagno (1984); Compagno (1998); Last and Stevens (1994); Setna and Sarangdhar (1977); Stevens and McLoughlin (1991); Stobutzki *et al.* (2002).

FAMILY **CARCHARHINIDAE**

Silvertip Shark

Carcharhinus albimarginatus (Rüppell, 1837)

Richard D. Pillans

Red List assessment **Global: Data Deficient****
Australia: Least Concern

Rationale *Carcharhinus albimarginatus* has a wide but fragmented distribution throughout the tropical Indo-Pacific. It is a large, slow-growing whaler species, which appears to be relatively site-specific, possibly with limited dispersion. It is not exploited commercially in Australian waters, where it is assessed as Least Concern, but elsewhere is presumably caught in artisanal fisheries and commercial line fisheries (target and bycatch). Although there is no evidence that this species is captured in significant numbers throughout its range and no population or trend data, its localised behaviour, fragmented populations and life history characteristics indicate that even remote populations are highly vulnerable to target shark fisheries (for meat or fins); more information is needed on the status of populations throughout its range.

Distribution **Regional: Northern Australia (from Carnarvon, WA to Bundaberg, QLD) with the exception of the Gulf of Carpentaria and Arafura Sea. Also Papua New Guinea and the Solomon Islands.**
Global: Wide but fragmented distribution throughout the tropical Indo-Pacific.
FAO Areas 51, 57, 61, 71, 77, 81 and 87.

Habitat and ecology Occurs over or adjacent to continental or insular shelves and offshore banks, from close inshore to well offshore (but not mid oceanic), throughout the water column from the surface to depths of about 800m (Last and Stevens 1994; Compagno and Niem 1998e). The maximum size attained is 275cm TL, with size at maturity 170cm TL (males) and 195cm TL (females). Females give birth every two years with 1–11 pups/litter (average six) and size at birth is 55–80cm TL. Gestation period is unknown (Stevens 1984b; Last and Stevens 1994; Compagno and Niem 1998e). A tagging study of immature animals showed very localised movements, with nearly 70% of sharks recaptured within 2km of the tagging site. The greatest distance travelled was 7km and 34% of those tagged were recaptured (Stevens 1984b).

Threats Not fished commercially in Australia, however is presumably caught in artisanal fisheries and commercial line fisheries (target and bycatch) elsewhere in its range. It has been recorded in markets in Indonesia in small numbers (W. White, pers. comm.). The catches of this species are largely unknown, however the small movement patterns (Stevens 1984b) suggest that it could be susceptible to local depletion in target fisheries.

Conservation measures None.

Literature Compagno and Niem (1998e); Last and Stevens (1994); Stevens (1984b).

** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

Bignose Shark

Carcharhinus altimus (Springer, 1950)

Richard D. Pillans

Red List assessment

Global: Data Deficient**
Australia: Least Concern

Rationale

Carcharhinus altimus is a deepwater, diurnally migrating (30–430m) whaler shark which probably has a circumglobal distribution on the continental shelf edge in tropical and warm seas, although records are patchy. There are no target fisheries for this species, although it is taken as bycatch in deep set pelagic longlines including widespread tuna longline fisheries, and occasionally in bottom trawls. Reported catches are small, but shark bycatch in longline fisheries is not reported fully throughout the species' range and cannot be used to assess mortality or population trends.

This species is not commercially fished in Australia, where it is assessed as Least Concern; elsewhere there is a need for further information on fisheries catches and population status.

Distribution

Regional: Australia, currently recorded from the Northwest Shelf and off Rottnest Island, WA, Northern NSW and Northern QLD.
Global: Circumglobal with patchy records in tropical and warm seas.
FAO Areas 31, 34, 37, 51, 57, 61, 71, 77, 81 and 87.

Habitat and ecology

This species occurs mainly on the edge of continental shelves in deep water (30–430m), and is more common between 80–220m with very occasional captures in shallow water (Tester 1969). Is thought to display diurnal vertical migrations, moving near the surface over deep water at night (Anderson and Stevens 1996). The maximum size attained is 300cm TL, with size at maturity 190cm TL (males) and 225cm TL (females). Females give birth every two years with 1–13 pups/litter (average nine) and size at birth is 60cm TL. Gestation period is unknown (Last and Stevens 1994; J. Stevens, pers. comm.).

Threats

Not commercially harvested in Australia. Globally, it is taken in pelagic longline fisheries in deep water (200–1,000m) (Anderson and Stevens 1996) and is therefore susceptible to capture in widespread tuna longline fisheries. The species is occasionally caught in bottom trawls.

Conservation measures

None.

Literature

Anderson and Stevens (1996); Compagno and Niem (1998e); Last and Stevens (1994); Tester (1969).

Graceful Shark

Carcharhinus amblyrhynchoides (Whitley, 1934)

Colin A. Simpfendorfer

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

A little studied coastal Indo-West Pacific continental shelf species impacted throughout its range by incidental capture in commercial fisheries. Although not targeted by directed fisheries, it is widely landed. Further life history research is required.

Literature

Simpfendorfer (In: Fowler *et al.* in press).

** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

Grey Reef Shark

Carcharhinus amblyrhynchos (Bleeker, 1856)

Malcolm J. Smale

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

This widespread social species was formerly common in clear tropical coastal waters and oceanic atolls. Its restricted habitat choice, site fidelity, inshore distribution, small litter size, relatively late age at maturity and increasing unmanaged fishing pressure suggests that this species may be under threat. More fisheries data are required. Although caught in tropical multi-species fisheries, it has considerably greater value if protected for dive tourism.

Literature

Smale (In: Fowler *et al.* in press).

Pigeye Shark

Carcharhinus amboinensis (Müller & Henle, 1839)

Geremy Cliff

Red List assessment

2000 Red List assessment:
Global: Data Deficient
Southwest Indian Ocean: Near Threatened

Rationale

Carcharhinus amboinensis is sporadically distributed in the Indo-West Pacific, which may, in part, be due to an inability to distinguish it from other members of the genus *Carcharhinus*. Where fisheries data are available, this species constitutes a very small component of the catch, suggesting that it may not be common. Natal Sharks Board data demonstrate a significant declining trend in catches from 1978–98, with evidence of localised stock depletion, and a decrease in mean length in the southwest Indian Ocean. This shark's apparently sporadic distribution and low abundance suggests that it may be unable to sustain heavy, localised fishing pressure, and shark fisheries are intensifying in the Indo-Pacific.

Literature

Cliff (In: Fowler *et al.* in press).

Bronze Whaler

Carcharhinus brachyurus (Günther, 1870)

Clinton A.J. Duffy and Ian Gordon

Red List assessment

Global: Near Threatened
East Asia: Vulnerable A2d+3d+4d
Eastern Pacific: Data Deficient
Australia, New Zealand, Southern Africa: Least Concern

Rationale

Carcharhinus brachyurus is a large coastal shark with low productivity. Although widespread, regional populations appear to be discrete, movement of individuals between them is thought infrequent or absent, and it does not appear to be naturally abundant anywhere. *Carcharhinus brachyurus* is assessed as Vulnerable in East Asia due to intensive fisheries and the apparent widespread collapse of fisheries for large coastal sharks. Coastal multispecies fisheries in the region are likely to continue to depress the population by taking pregnant females and juveniles. Coastal nursery areas in this region are also at risk from development and pollution.

Catches appear to be stable in Australia. In New Zealand, although there may have been some reduction in population size due to fishing, *C. brachyurus* is apparently still common throughout its range. Management of this species in New Zealand, Australia and South Africa is simplified by having most, if not all of the population resident within each nation's EEZ, and the species is assessed as Least Concern in these regions.

However, it is assessed as Data Deficient in the East Pacific, where there is no information and it appears to be uncommon or rare.

Throughout its range, it is known to be exploited by fisheries, but landings are grouped together with other *Carcharhinus* species, meaning any population declines are likely to go unnoticed, and its coastal nursery areas are potentially vulnerable to development and pollution. This, together with life history characteristics that make it especially vulnerable to overfishing has led to the global assessment of *C. brachyurus* as Near Threatened. The situation must be monitored as this species could soon qualify for a threatened category, on the basis of population declines due to fisheries exploitation in some areas.

Distribution

Regional: Southern Australia (NSW to southern WA) and New Zealand (North Island and Cook Strait).
Global: Widespread, but with discrete populations.
Note: The range (and biology) of *C. brachyurus* is poorly known due to confusion with other large *Carcharhinus* species, particularly *C. obscurus* which often replaces it in subtropical waters.
FAO Areas 27, 34, 37, 41, 47, 51, 57, 61, 77, 81 and 87.

Habitat and ecology

Carcharhinus brachyurus is an essentially warm temperate and subtropical species (Garrick 1982; Compagno 1984b; Muñoz-Chápuli 1984; Smale 1991; Cappo 1992; Cliff and Dudley 1992; Chiaramonte 1998b). It is a widespread but patchily distributed coastal and shelf species, occasionally reported from oceanic areas close to the continental shelf (Amorim *et al*. 1998; Marín *et al*. 1998; Bagley *et al*. 2000). It enters shallow water (Ayling and Cox 1982; Cappo 1992; Last and Stevens 1994) and also occurs in brackish or freshwater in the lower reaches of large rivers and estuarine bays (Last 2002). Maximum reported depth is 100m but it is likely to range deeper (Compagno 1984b; Smale 1991; Last and Stevens 1994). Nursery areas tend to be large and ill defined but include shallow banks, large shallow bays, inlets and harbours as well as the open coast (Muñoz-Chápuli 1984; Smale 1991; Cappo 1992; Fergusson and Compagno 1995; Chiaramonte 1998b). The mean distance travelled by tagged *C. brachyurus* in South Africa is 163km during 162 days at liberty, the maximum distance travelled was 1,320km (Cliff and Dudley 1992). In South Australia tagged adults have been resighted at their tagging location after a year at liberty suggesting this species, like other carcharhinids, is philopatric (I. Gordon, pers. obs.). Movement between New Zealand and Australia, or other regional populations has not been documented. *Carcharhinus brachyurus* occur singly and in loose schools sometimes numbering hundreds of individuals (Smale 1991; Cappo 1992; Cliff and Dudley 1992; C. Duffy unpublished data).

Reproductive periodicity is probably biennial like most other large carcharhinids (Castro *et al*. 1999). Reproduction is viviparous, with a yolksac placenta. Litters range from 7–24 pups (average 15 reported from South Africa) (Garrick 1982; Smale 1991; Cliff and Dudley 1992; Chiaramonte 1998b). Size at birth is ~60cm TL (range 55–67cm TL) (Garrick 1982; Smale 1991; Cliff and Dudley 1992). Cliff and Dudley (1992) estimated gestation lasts ~12 months, but could be 15–21 months. Size at maturity is between 206–235cm TL (males), and 227–244cm TL (females). Age at maturity in South Africa is estimated at 13–19 years (males), and 19–20 years (females) (Walter and Ebert 1991). Maximum size attained is at least 295cm TL, and it is reported to reach 350cm TL (Ayling and Cox 1982; Compagno 1984b; Last and Stevens 1994). Maximum age is unknown. Productivity is estimated to be low to very low, with a minimum population doubling time of more than 14yrs (K=0.04) (Froese and Pauly 2002).

Threats

The life history of this large carcharhinid makes it vulnerable to overfishing by directed fisheries and as bycatch in fisheries targeted at more productive species (Walker 1998; Castro *et al*. 1999; Vidthayanon 2002). *Carcharhinus brachyurus* is mainly taken as bycatch in gillnet and bottom longline fisheries for bony fishes and other sharks, particularly *Mustelus* spp. and *Galeorhinus galeus* (Compagno *et al*. 1989; Cappo 1992; Bentley In: Rose 1996; Chiaramonte 1998a, b). It also forms a minor component of bottom trawl and pelagic longline fisheries (Compagno *et al*. 1989; Parry-Jones 1996; Amorim *et al*. 1998; Marín *et al*. 1998; Bagley *et al*. 2000).

Carcharhinus brachyurus is fished commercially in New Zealand (Francis 1998; Bagley *et al*. 2000, Ministry of Fisheries, catch effort data), Australia (Cappo 1992); South Africa (Compagno *et al*. 1989); Brazil (Amorim *et al*. 1998); Uruguay (Marín *et al*. 1998); Argentina (Chiaramonte 1998a, b); Mexico (Appelgate *et al*. 1993) and China (Parry-Jones 1996). In the Mediterranean it is taken in net fisheries and is usually grouped with other carcharhinids (e.g. *C. plumbeus*) when landed (Fergusson and Compagno 1995). Little data are available for these fisheries. In WA the "bronze whaler fishery" actually targets juvenile dusky sharks *C. obscurus* (Heald 1987; Simpfendorfer 2001) and *C. brachyurus* only constitutes about 3% of total reported landings in this fishery (R. McAuley, pers. comm.). *Carcharhinus* spp. are also taken as bycatch in the

SSF. The bulk of this is landed in SA, where landings increased from less than 20t a year in the early 1980s to 60–70t a year between 1988–1990 (Stevens In: Castro *et al.* 1999). During the 1990s the landed catch has remained stable at around 70t a year (T.I. Walker, pers. comm.). In New Zealand reported annual commercial landings have declined steadily since the mid-1990s from about 48t to about 20t (Ministry of Fisheries, catch effort data), however, CPUE analysis has not been performed so it is uncertain if this represents a decline in abundance or a change in fishing practice. Although no fishery data are available for *C. brachyurus* in East Asia, directed shark fisheries have operated in the region since at least the 1950s, and sharks are a component of multi-species fisheries for more highly valued species such as tuna and swordfish (Parry-Jones and others In: Phipps 1996). All directed fisheries for large coastal sharks in this region appear to have ceased during the 1970s due to declining catches and a shift in effort into offshore fisheries for tuna and salmon (Parry-Jones, and Kiyono In: Phipps 1996). The Gulf of California represents one of the major fishing grounds in the Pacific and supports directed fisheries for *Carcharhinus* spp. including *C. brachyurus,* although this species is not listed as being heavily fished (Appelgate *et al.* 1993; Bonfil 1994). However, as it is vulnerable to the same types of gear and may be naturally less abundant than those *Carcharhinus* spp. that dominate the landings, the effects of fishing on *C. brachyurus* may be more serious than its representation in the catch suggests.

Sport fisheries taking *Carcharhinus* spp. occur in New Zealand, Australia, South Africa, Argentina, Mexico and California (Stevens 1984a; Compagno *et al.* 1989; Cappo 1992; Pepperell 1992; Appelgate *et al.* 1993, Chiaramonte 1998a, b; Francis 1998). In New Zealand *C. brachyurus* is the most commonly landed *Carcharhinus* species. Most of the sharks taken in a small summer sport fishery for *C. brachyurus* in the northern North Island are pregnant and post-partum females, and are tagged and released. *Carcharhinus brachyurus* is a minor component of sport fishing catches in southern NSW but is likely to dominate "bronze whaler" catches in VIC and SA (Stevens 1984a; Cappo 1992). In South Africa this species is regularly taken by shore-based fishers in the Eastern Cape. These fishers take mainly neonates and juveniles less than 200cm TL (Smale 1991). There is also a land-based tag and release fishery for adult *C. brachyurus* in Namibia (S. Fowler, pers. comm.).

Carcharhinus brachyurus is commonly taken in protective shark control programmes off KwaZulu-Natal, South Africa and presumably Australia (NSW), although catches of *Carcharhinus* spp. are not identified to species in Australia (Cliff and Dudley 1992; Reid and Krogh 1992; Dudley 1997; Dudley *et al.* 1998). Catches in shark nets in South Africa did not exhibit any trend over a 12-year period however these catches are unlikely to be representative of the stock. *Carcharhinus brachyurus* is also killed as a pest species in and around fish farms, notably southern bluefin tuna pens in SA (I. Gordon, pers. obs.). The shallow coastal nursery areas of *C. brachyurus* are potentially vulnerable to habitat loss and pollution arising from coastal development. The effects of this are likely to be greatest in parts of the Mediterranean Sea and East Asia. Expansion of marine aquaculture in New Zealand also potentially threatens nursery areas of *C. brachyurus*.

Castro *et al.* (1999) listed this species as Category 3 (i.e. a species that is exploited by directed fisheries or bycatch, and has a limited reproductive potential, and/or life history characteristics that makes it especially vulnerable to overfishing). Vidthayanon (2002) listed it as Vulnerable in Thailand.

Conservation measures

Australia:

A prohibition on taking school and gummy sharks in shark nursery areas in TAS, and bans on gillnetting in some of these, may indirectly benefit some *C. brachyurus* but most of these areas are outside the main part of the species range (Williams and Schaap 1992; Last and Stevens 1994). VIC coastal waters out to 3nm are almost completely closed to commercial shark fishing (Stevens 2002).

New Zealand:

Carcharhinus brachyurus may not be target fished in Quota Management Areas 1, 3, 4, 5, 6 and 9. Management measures that are likely to indirectly benefit this species include closure of most harbours and semi-enclosed bays in northern New Zealand to trawling and Danish seining, and a permanent ban on gillnetting out to five nautical miles from shore off the northwest North Island (Fisheries statistical areas 41 and 42) to protect endangered North Island Hector's dolphin.

Literature

Amorim *et al.* (1998); Applegate *et al.* (1993); Ayling and Cox (1982); Bagley *et al.* (2000); Bonfil (1994); Castro e*t al.* (1999); Castillo-Génez *et al.* (1998); Chen *et al.* (2002); Chiaramonte (1998a, b); Cliff and Dudley (1992); Compagno (1984a); Compagno *et al.* (1989); Cox and Francis (1997); Dudley (1997); Dudley *et al.* (1998); Fergusson and Compagno (1995); Francis (1998); Francis (2001); Froese and Pauly

(2002); Garrick (1982); Hanson (1999); Heald (1987); Illingworth (1961); Last (2002); Last and Stevens (1994); Marín *et al.* (1998); Masuda *et al.* (1984); Muñoz-Chápuli (1984); Parry-Jones (1996); Pepperell (1992); Phipps (1996); Reid and Krogh (1992); Rose (1996); Russell (1993); Simpfendorfer (2001); Smale (1991); Stevens (1984a); Stevens (2002); Vidthayanon (2002); Walker (1998); Walter and Ebert (1991); Whitley (1940); Williams and Schaap (1992).

Spinner Shark

Carcharhinus brevipinna (Müller & Henle, 1839)

George H. Burgess and Steven Branstetter

Red List assessment

2000 Red List assessment:
Global: Near Threatened
Northwest Atlantic: Vulnerable A1bd+2d

Rationale

The spinner shark is cosmopolitan in near and offshore warm-temperate, subtropical and tropical continental and insular shelf waters. It is frequently captured in recreational and commercial fisheries. Its meat is valuable and fins are marketable. It frequents nearshore waters as adults and has inshore nursery areas, making it highly vulnerable to fishing pressure and human-induced habitat alteration.

Literature

Burgess and Branstetter (In: Fowler *et al.* in press).

Nervous Shark

Carcharhinus cautus (Whitley, 1945)

Michael B. Bennett and Peter M. Kyne

Red List assessment

Global: Data Deficient
Australia: Least Concern

Rationale

This species is apparently common in shallow warm coastal waters and embayments within its range (northern Australia, Papua New Guinea and the Solomon Islands). Females mature at 5–6 years and reach maximum size at 16 years. Litters of 2–6 are produced at two-year intervals. Relatively little is known about its population structure and dynamics. It occurs in areas of northern Australia that are targeted by a moderate level of prawn trawling and coastal/estuarine gillnetting. This species is probably taken as a bycatch in both fisheries, but with a greater likelihood of being caught in the inshore gillnet fishery. Discard/release mortality is probably significant but these fisheries are not thought to be detrimental to the Australian population (where this species is assessed as Least Concern). It will also be taken (and presumably not discarded) in shallow coastal gillnet and line fisheries elsewhere in its range, where no data are available.

Distribution

Regional endemic: Solomon Islands, Papua New Guinea (Arafura sea coast and Gulf of Papua) and tropical Australia, (from Carnarvon, WA to Moreton Bay, southeast QLD, including the waters of the NT). It seems likely that this species may also be found in the intervening waters around east PNG.
FAO Areas 57 and 71.

Habitat and ecology

Occurs on continental and insular shelves in shallow water in subtropical and tropical waters (including large embayments) within its range. It is the most common carcharhinid in Darwin Harbour (NT), which lies at the centre of this species' range. It is also common on the eastern side of the Gulf of Carpentaria (QLD) and in Shark Bay (WA). This species is reported to attain a maximum size of 150cm TL (Last and Stevens 1994) although other data suggest ~120cm TL (males) and 140cm TL (females) (White *et al.* 2002). Size at maturity is ~79–84cm TL (males) and ~91cm TL (females) from Darwin, NT (Lyle 1987), but 91cm TL (males) and 101cm TL (females) from Shark Bay, WA (White *et al.* 2002). Gestation period is 10 months with 2–6 pups/litter produced every other year. Size at birth is 33–39cm TL. Age at maturity is 4–5 years (males), reaching maximum size by ~12 years; and, 6–7 years (females), reaching maximum size at ~16 years.

Threats

This species is threatened primarily by inshore gillnet fisheries throughout its range. In Australia the barramundi *Lates calcarifer* fishery poses the greatest threat. Smaller

individuals may also be taken as bycatch in the prawn trawl fisheries to the north of Australia. It will also be taken in shallow coastal gillnet and line fisheries elsewhere in its range, where no data are available.

Conservation measures None.

Literature Kyne *et al.* (in prep.); Last and Stevens (1994); Lyle (1987); Lyle and Timms (1987); Salini *et al.* (1992); White *et al.* (2002).

Whitecheek Shark

Carcharhinus dussumieri (Valenciennes, in Müller & Henle, 1839)

Michael B. Bennett and Peter M. Kyne

Red List assessment

Global: Near Threatened
Australia: Least Concern

Rationale *Carcharhinus dussumieri* has a wide tropical Indo-West Pacific distribution in coastal waters down to 170m, and locally is one of the most common whaler sharks of northern Australia. This small species is particularly vulnerable to inshore fisheries, being caught commonly as bycatch in commercial trawling, artisanal fishing, hook and line fishing and gillnetting throughout its range. It has a low reproductive capacity, with a normal litter size of two, making it vulnerable to over-exploitation. It also enters the shark fin trade. Globally, this species fails to qualify for Vulnerable A2acd, as while declines have been observed throughout part of its range, quantitative data are not available.

In Australia this species is classified as Least Concern, as regional fishing pressure appears sustainable. However, continued fishing pressures throughout its range will result in further declines and populations require monitoring.

Distribution

Regional: Recorded across northern Australia (Cape Naturaliste, WA to Fraser Island, QLD, including the waters of the NT) and from southern and eastern New Guinea.
Global: Tropical Indo-West Pacific.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology Widespread in coastal waters down to ~170m depth. This species is sometime confused with *Carcharhinus sealei*. It is a small species with a maximum size of 100cm TL, although specimens of up to ~90cm TL are more common (Stevens and McLoughlin 1991). Size at maturity is ~64–74cm TL (males) and 67–71cm TL (females) (Garrick 1982; Stevens and McLoughlin 1991). There are no data on the age at maturity or longevity of this species. Usually two pups/litter (rarely four), with size at birth ~40cm TL. There does not appear to be a distinct seasonal reproductive cycle, with pregnant females recorded at all times of the year. As almost all mature females are reported to be pregnant or spent at any one time, there appears to be a continuous reproductive cycle. There are no data on the gestation period, and it seems likely that, on average, only two offspring will be produced annually.

Threats The major threat to this species is from fisheries in relatively shallow shelf and inshore waters throughout the whole of its range. Due to its size it is caught by gillnetting, hook and line fishing and trawling. In northern Australia it commonly comprises about 2–3% of trawl catch by biomass (Russell and Houston 1989). While the population in northern Australia appears fairly robust, there is evidence of severe depletions, including local extirpations, of this species in coastal waters throughout parts of its range in Asia (L.J.V. Compagno, pers. comm.).

Conservation measures None.

Literature Garrick (1982); Last and Stevens (1994); Russell and Houston (1989); Salini *et al.* (1994); Simpfendorfer and Milward (1993); Stevens and McLoughlin (1991).

Silky Shark

Carcharhinus falciformis (Bibron, in Müller & Henle, 1839)

Ramon Bonfil

Red List assessment

2000 Red List assessment:
Global: Least Concern
Northern Indian, Tropical Pacific and Western North Atlantic Oceans: Data Deficient

Rationale

A common, large, semi-pelagic coastal and oceanic shark of continental shelf and slope waters, discontinuously distributed in all tropical ocean basins. Caught in large numbers as bycatch in oceanic fisheries, but often unreported or misidentified. Landed for meat and fins by multi-species shark fisheries. Reproductive capacity limited (annual rate of population increase estimated as 4%). Despite a lack of population size estimates, observations of trends, or indices of abundance for any stock (studies of fisheries impacts are a high priority), the silky shark is considered to be susceptible to over-exploitation by analogy with better known carcharhinids.

Literature

Bonfil (In: Fowler *et al.* in press).

Creek Whaler

Carcharhinus fitzroyensis (Whitley, 1943)

Michael B. Bennett and Peter M. Kyne

Red List assessment

Global: Least Concern

Rationale

This species is endemic to northern Australia with a broad distribution across tropical seas from the intertidal zone to at least 40m. The creek whaler is relatively productive for a viviparous shark species and can tolerate the current and projected level of pressure in the northern Australian fisheries.

Distribution

Regional endemic: Tropical Australia, from Cape Cuvier, WA to Gladstone, QLD, including the waters of the NT.
FAO Areas 57 and 71.

Habitat and ecology

Carcharhinus fitzroyensis ranges from the intertidal zone to a depth of at least 40m (Last and Stevens 1994). This species attains a maximum size of ~135cm TL (Lyle 1987), with no sexual dimorphism apparent. There is no information about age at maturity for either sex, but size at maturity is ~83–88cm TL (males) and ~90–100cm TL (females) (Lyle 1987). There is an annual reproductive cycle with litter sizes ranging from 1–7 pups and size at birth ~45–55cm TL (Simpfendorfer and Milward 1993; Last and Stevens 1994). Mating apparently takes place between May and July (Darwin Harbour, NT) with birth occurring the following year after a gestation period of 7–9 months (Lyle 1987). Simpfendorfer and Milward (1993) report juvenile sharks occupying a nursery area (Cleveland Bay, QLD) primarily during February, which is consistent with the observations from further north.

Threats

Small numbers of this species are caught in northern inshore gillnet fisheries. Juveniles that use embayments as nursery areas are at potential risk of gillnetting, which could depress populations locally. However, the species is relatively fecund and populations should prove resilient.

Conservation measures

None.

Literature

Last and Stevens (1994); Lyle (1987); Salini *et al.* (1992); Simpfendorfer and Milward (1993).

Galapagos Shark

Carcharhinus galapagensis (Snodgrass & Heller, 1905)

Michael B. Bennett, Ian Gordon and Peter M. Kyne

Red List assessment

Global: Near Threatened
Australia and Oceania: Data Deficient

Rationale

Carcharhinus galapagensis has a widespread, but patchy distribution, occurring at many widely separated island and some coastal sites in the Pacific, Atlantic and Indian Oceans. It is classified globally as Near Threatened (just failing to meet Vulnerable A2acd, and likely to be A3d+4d in the near future) because populations at many of these sites may be subject to high levels of fishing pressure (tuna longline fisheries, targeted dropline fishing, recreational/tourism-based angling). There is considerable potential to cause severe local declines in the number of mature individuals. Evidence of such reductions/extirpations exists for this species around Central America (Pacific and Atlantic Oceans). As the species has a limited intrinsic rebound potential, and there are no data on recruitment to isolated sites, such local depletions could lead to loss of populations at specific localities. Continued fishing pressures throughout its range will result in further declines and populations require monitoring.

The species is classified as Data Deficient in Australia and Oceania: although it is not considered to be under threat off Lord Howe Island (Australia) and off the Kermadec Islands (New Zealand) where a marine reserve encompasses the species' range, there is currently no information on these populations.

Distribution

Regional: Lord Howe Island (Australia), American Samoa, Western Samoa, Cook Islands, French Polynesia, and the Kermadec Islands (New Zealand).
Global: Circumglobal distribution in warm and temperate waters, but essentially limited to oceanic islands.
FAO Areas 31, 34, 47, 51, 71, 77, 81 and 87. Possibly 21 and 27.

Habitat and ecology

Carcharhinus galapagensis is most commonly found over rugged, rocky terrain in clear water. Isolated rocky islets serve as congregation sites (Edwards and Lubbock 1982; Brum and Azevedo 1995), suggesting that underwater pinnacles may also be suitable habitat, giving this species a more extensive range of sites than currently understood. Occurs from surface waters to depths of >280m, with some suggestion of segregation on the basis of size. Vertical distribution patterns appear to be site specific and vary considerably between geographical areas/habitat types. In some regions juveniles are found in shallow water (<1m) whereas in others they prefer deeper water (c. 40m) (Wetherbee *et al.* 1996). This species is reputed to attain a maximum size of ~350cm TL, although specific records suggest that 300cm TL appears more likely. Size at maturity is ~215–250cm TL (females), and ~205–250cm TL (males) (Bass *et al.* 1973; Last and Stevens 1994; Wetherbee *et al.* 1996). Estimated age at maturity is 6–8 years (males) and 6.5–9 years (females) (De Crosta *et al.* 1984). Litter size ranges from 4–16 pups, size at birth 60–81cm TL. Reproductive life histories are not well known. Females probably breed every two (or three) years with mating likely to occur in winter/spring. The species has a limited intrinsic rebound potential (Smith *et al.* 1998).

Threats

The major threat comes from longlining and other bait-fishing activities around islands and seamounts throughout its range. The aggressive nature of this common species together with the occupation of inshore habitats may result in pressures to extirpate local populations. Evidence of such reductions/extirpations exists for this species around Central America (Pacific and Atlantic Oceans) (L.J.V. Compagno, pers. comm.). The interrupted geographical distribution and unknown level of immigration to these isolated populations could place subpopulations at significant risk from overfishing. It should also be noted that uncontrolled legal and illegal shark fin fishing takes place at sites in the Pacific, including the Galápagos Marine Resources Reserve where a significant population of this species is known to occur (Bonfil *et al.* in press).

Conservation measures

The population at the Kermadec Islands is protected by a 12nm marine reserve which extends in places to cover depths of over 3,000m.

Literature

Bass *et al.* (1973); Beeb and Tee-Van (1941); Bonfil *et al.* (in press); Brum and Azevedo (1995); Cortés (1999); De Crosta *et al.* (1984); Edwards and Lubbock (1982); Last and Stevens (1994); Schwartz (1998); Smith *et al.* (1998); Wetherbee *et al.* (1996).

Pondicherry Shark

Carcharhinus hemiodon (Valenciennes, in Müller and Henle, 1839)

Leonard J.V. Compagno, William T. White and Sarah L. Fowler

Red List assessment

2000 Red List assessment:
Vulnerable C2a

2000 Red List rationale:
This is a rarely recorded and poorly known inshore Indo-Pacific shark, represented by fewer than 20 specimens in museum collections from areas impacted by major fisheries. Only one specimen reported during an extensive survey of market landings in Karachi, Pakistan, in 1974. Another specimen was caught off Tahy, India in 1979. Not recorded during a survey of fishing camps in southern India in 1982, nor during the 1996/97 IUCN Shark Specialist Group and Sabah Fisheries Department survey of marine sharks in markets in Sabah, Borneo (Malaysia), nor surveys in 1999/2000 in the Philippines. (See Compagno In: Fowler *et al.* in press).

Update:
Global: Critically Endangered A2acd; C2a(i)

Rationale

This very rare Indo-West Pacific species is known from about 20 specimens in museums, obtained from widely separated sites all of which are subject to large, expanding and unregulated artisanal and commercial 'catch all' fisheries. Last recorded in 1979, the species has not been reported since, despite market surveys in much of its range in recent years. Given that it has not be observed in over 20 years, that most known specimens were captured before 1900, and that its previously known habitat and area of occurrence face expanding unregulated fisheries, this species is listed as Critically Endangered. Future survey work should attempt to locate the species.

Distribution

Regional: Nominal records from New Guinea and Australia.
Note: There are only nominal records of *Carcharhinus hemiodon* from the Australia and Oceania region, for example, Munro (1958) notes it from the New Guinea region, with a record from Waigeu Island off the northwestern tip of New Guinea. These records cannot be confirmed. The species is included in this report as any future survey work around New Guinea and across northern Australia should be aware that this species may occur in this region.
Global: Indo-West Pacific (Most records are from India).
FAO Areas 51, 57, 61 and 71.

Habitat and ecology

This Indo-West Pacific species has only been recorded from a small number of widely separated sites (most of them in India) and is represented by fewer than 20 specimens in museum collections, most of which were captured before 1900. The last record was in 1979 in India; it has not been seen since anywhere, despite detailed surveys in Borneo, Philippines and Indonesia. It is considered to be extremely rare globally (possibly even extinct). Occurs inshore on continental and insular shelves. No information available on the biology or life history parameters of this rarely recorded and poorly known inshore shark.

Threats

This apparently rare shark occurs (or occurred) in inshore localities and habitats subject to large, expanding, and unregulated artisanal and commercial fisheries. If still extant, it is probably caught and utilised as bycatch of other fisheries, although market surveys have failed to locate it. Its populations are thought to have been severely depleted as a result of this exploitation.

Conservation measures

None.

Literature

Compagno (in prep. b); Compagno (In: Fowler *et al.* in press); Munro (1958).

Bull Shark

Carcharhinus leucas (Valenciennes, in Müller & Henle, 1839)

Colin A. Simpfendorfer and George H. Burgess

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale This common tropical and subtropical species occurs in marine, estuarine and freshwater, and can penetrate long distances up large rivers. It is caught in fisheries throughout its range, but is rarely a target species. Its occurrence in estuaries and freshwater makes it very vulnerable to human impacts and habitat modification. Given this species' habitat requirements in areas that are currently heavily impacted by human activity, its life history, and target and bycatch in many inshore fisheries, there is some concern that bull sharks may be threatened. Average length of bull sharks caught by the Natal Sharks Board have declined significantly.

Literature Simpfendorfer and Burgess (In: Fowler *et al.* in press).

Blacktip Shark

Carcharhinus limbatus (Valenciennes, in Müller & Henle, 1839)

George H. Burgess and Steve Branstetter

Red List assessment *2000 Red List assessment:*
Global: Near Threatened
Northwest Atlantic: Vulnerable A1bcd+2cd

Rationale A modest-sized shark widespread in warm-temperate, subtropical and tropical waters worldwide. It frequents inshore waters as adults and has inshore nursery areas, making it highly vulnerable to fishing pressure and human-induced habitat alteration. Frequently captured in commercial and recreational fisheries, its meat is valuable and fins highly marketable.

Literature Burgess and Branstetter (In: Fowler *et al.* in press).

Oceanic Whitetip Shark

Carcharhinus longimanus (Poey, 1861)

Malcolm J. Smale

Red List assessment *2000 Red List assessment:*
Global: Near Threatened

Rationale This species is a widespread and common large pelagic shark of warm oceanic waters. It presumably has a low reproductive capacity, but is extremely abundant and wide-ranging and is subject to fishery pressure as a common bycatch species with tuna and other pelagic species. This bycatch is either inadequately reported or unrecorded. The fins are highly prized in trade although the carcass is often discarded. Fishery pressure is likely to persist, if not increase, and the impact of this fishing pressure is presently unknown.

Literature Smale (In: Fowler *et al.* in press).

Hardnose Shark

Carcharhinus macloti (Müller & Henle, 1839)

Colin A. Simpfendorfer and John D. Stevens

Red List assessment **Global: Near Threatened**
Australia: Least Concern

Rationale A widespread continental shelf species throughout the Indo-West Pacific region. Throughout its range it is caught in subsistence, artisanal and commercial fisheries that utilise gillnets, longlines and trawls. Highest levels of exploitation probably occur in Pakistan, India, Sri Lanka and China. It is also reported in catches from Australia and Indonesia. Although of small size, its life history may not be as productive as that of other small carcharhinids (e.g. *Rhizoprionodon* spp.), making it more susceptible to fishing pressure. It is assessed as Near Threatened because continuing fishing pressure may reduce the population to a level where it may meet the criteria for Vulnerable.

In Australian waters fishing does not appear to have had a significant impact and its status is assessed regionally as Least Concern.

Distribution

Regional: Northern Australia (Carnarvon, WA to Bundaberg, QLD), and Papua New Guinea, Indonesian Irian Jaya.
Global: Indo-West Pacific.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology

This species occurs in continental shelf waters. A small species of carcharhinid shark that attains a maximum size of 110cm TL, although size at birth is relatively large (45cm TL). Size at maturity is 70–75cm TL (Last and Stevens 1994). Mature females probably have a two-year reproductive cycle, with only two pups/litter (Stevens and McLoughlin 1991). Limited age and growth data are available, but a single tag return from an animal (that was mature when tagged) was made after 10 years, indicating that they may live at least 15–20 years. Based on these life history parameters it is likely to have a much lower level of productivity than other small species of carcharhinid sharks (e.g. *Rhizoprionodon* spp.) and so is more susceptible to fishing pressure.

Threats

This species is caught in inshore subsistence, artisanal and commercial fisheries throughout its range. Highest catches appear to have been taken in southern Asian countries (Pakistan, India, Sri Lanka and southern China) (Compagno 1984). Catches in Indonesia during 2002 were rare (W. White, pers. comm.) and may indicate the population in this area has been overfished. Further data needs to be collected in this area to investigate this possibility. In northern Australia this species is an important component of the gillnet (13.6%) and longline (4.0%) fisheries, but this does not appear to be having a significant impact on the population.

Conservation measures

None.

Literature

Compagno (1984); Last and Stevens (1994); Stevens (1999); Stevens and McLoughlin (1991).

Blacktip Reef Shark

Carcharhinus melanopterus (Quoy & Gaimard, 1824)

Michelle R. Heupel

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

A common and wide-ranging species of the Indo-West Pacific and Central Pacific. Commonly found in shallow waters on and near coral reefs and occasionally in brackish waters. Regularly caught by inshore fisheries and vulnerable to depletion because of its small litter sizes and long gestation periods.

Literature

Heupel (In: Fowler *et al.* in press).

Dusky Shark

Carcharhinus obscurus (LeSueur, 1818)

Merry Camhi, John A. Musick and Colin A. Simpfendorfer

Red List assessment

2000 Red List assessment:
Global: Near Threatened
Northwest Atlantic and Gulf of Mexico: Vulnerable A1abd

Rationale

A large, wide-ranging, coastal and pelagic warm water species. Among the slowest-growing, latest-maturing of known sharks, bearing small litters after a long gestation, and one of the most vulnerable of vertebrates to depletion by man because of its very low intrinsic rate of increase. Difficult to manage or protect because it is taken with other more productive sharks in mixed species fisheries, and has a high mortality rate when taken as bycatch. Catch rates for dusky shark in the western Atlantic have declined markedly. The population in the northwestern Atlantic and Gulf of Mexico is now probably at 15–20% of its mid-1970s abundance. In other regions the impact of fishing has not been as great, but still requires close monitoring.

Literature

Camhi, Musick and Simpfendorfer (In: Fowler *et al.* in press).

Sandbar Shark

Carcharhinus plumbeus (Nardo, 1827)

John A. Musick

Red List assessment

2000 Red List assessment:
Global: Near Threatened
Northwest Atlantic: Vulnerable A1abd+2d

Rationale

A large, slow-growing, late-maturing and low-fecundity coastal species, common and widespread in subtropical and warm temperate waters worldwide. An important component of shark fisheries in most areas where it occurs, although catch data are sparse. Severely overfished in the western North Atlantic, although the stock still contains over 100,000 individuals and supports an active and now tightly managed fishery. A management plan in US waters implemented in 1993 has led to stock stabilisation and the beginning of recovery.

Literature

Musick (In: Fowler *et al.* in press).

Blackspot Shark

Carcharhinus sealei (Pietschmann, 1916)

William T. White

Red List assessment

Global: Near Threatened

Rationale

Carcharhinus sealei is likely to be caught in relatively large quantities by artisanal fisheries and small-scale commercial fisheries within its range, particularly in South East Asia, since it is most commonly found in shallow waters where such fishing activities are intensive. Short-lived (mature at one year and longevity five years), this species produces only 1–2 pups per year. Although recorded in Indonesia previously, this species was not recorded in a recent survey of markets within this region. There is concern that *C. sealei* may meet the Vulnerable criteria A2bd+3bd+4bd due to the high level of exploitation and its apparent population decline in some areas, but detailed species composition data are lacking and it is therefore considered Near Threatened.

Distribution

Regional: Northern Australia, Papua New Guinea and Indonesian Irian Jaya (Compagno and Niem 1998e).
Global: Indo-Pacific.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology

Carcharhinus sealei is a coastal shark on the continental and insular shelves from the surf line to depths of 40m, but usually in shallow water, and not adjacent to river mouths (Compagno and Niem 1998e). It attains a maximum size of at least 95cm TL and size at maturity is 70–80cm TL. Viviparous with one or two pups/litter, size at birth is 33–45cm after a gestation of ~9 months (Compagno and Niem 1998e). Van der Elst (1981) recorded age and growth data for this species, with age at maturity at ~1year and maximum age of ~5 years.

Threats

Carcharhinus sealei is a common catch in artisanal fisheries and small-scale commercial fisheries, as well as by recreational anglers (Compagno and Niem 1998e). This species occurs in shallow waters where fishing activities such as longlines and gillnets are often very intensive, e.g. in Indonesia, and therefore would be highly susceptible to overfishing. Although recorded in Indonesia previously, this species was not recorded in a recent survey of markets within this region (W. White unpublished data). The flesh is utilised for human consumption.

Conservation measures

None.

Literature

Compagno and Niem (1998e); Last and Stevens (1994); Van der Elst (1981).

Spot-tail Shark

Carcharhinus sorrah (Valenciennes, in Müller & Henle, 1839)

Richard D. Pillans and John D. Stevens

Red List assessment

Global: Data Deficient**
Australia: Least Concern
South East Asia: Near Threatened

Rationale

A tropical Indo-Pacific species, recorded patchily from South Africa to southern China, and common on continental and insular shelves close inshore (20–50m) and occurring out to 140m. CPUE data for sharks caught in the Taiwanese gillnet fishery off northern Australia (now closed), of which *Carcharhinus sorrah* comprised about 20%, together with fast growth rates, early maturity and relatively high fecundity, suggest that this species is more resilient to exploitation than most other shark species. Currently, annual landings of sharks in northern Australia (mainly *C. tilstoni* and *C. sorrah*) are significantly smaller than historical catches. Although there is a need to monitor catches in these fisheries, current catch rates are highly unlikely to threaten the Australian population of *C. sorrah*, and the species is assessed as Least Concern in these waters.

Intensive unmanaged coastal commercial and artisanal fisheries are, however, taking this and other carcharhinids in other parts of its range (certainly in Indonesia, other areas of South East Asia and likely elsewhere), where similar population declines to those previously observed in Australian waters have probably occurred and are likely to continue unchecked. Tagging data from Australia suggest that stocks of *C. sorrah* in areas of intensive fishing are susceptible to local population decline. *Carcharhinus sorrah* is thus assessed as Near Threatened in South East Asia. The probability of shared stocks between Australia and Indonesia is currently being investigated and it is recommended that the status of *C. sorrah* stocks be reassessed in the near future.

Information is lacking from elsewhere and the species is currently assessed as Data Deficient globally.

Distribution

Regional: Northern Australian, from Point Quobba, WA to Moreton Bay, QLD.
Global: Tropical Indo-West Pacific.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology

A common inshore shark, on continental and insular shelves found from close inshore to a depth of at least 140m (Compagno and Niem 1998e). Common over mud and sand bottom in depths between 20–50m but also occurs near coral reefs. Occurs throughout the water column but mainly in midwater or near the surface (Last and Stevens 1994). Maximum size attained is 160cm TL, with size at maturity 90cm TL (males) and 95cm TL (females). Age at maturity is 2–3 years. *Carcharhinus sorrah* is viviparous with a gestation period of 10 months and a reproductive periodicity of one year. Litter size ranges from 1–8 pups/litter (average three), with size at birth 50cm TL. Growth rate of juveniles are 20cm/year for the first year, declining to 5cm/year when the sharks are about five years old (Stevens and Wiley 1986; Davenport and Stevens 1988).

Threats

Genetic evidence suggested that this species forms one population in Australian waters (Lavery and Shacklee 1989). Tagging studies off Northern Australia have shown that 49% of sharks were recaptured within 50km of the tagging site, however one shark was captured 1,116km away (Stevens *et al.* 2000). These authors also showed that most animals moved along the coastline. Data from this study suggests that although there was sufficient movement to prevent stock differentiation, the degree of movement was not great enough to prevent a reduction in local populations as a result of heavy fishing pressure. This conclusion contradicts those of Lavery and Shacklee (1989) who had concluded that local populations would be well buffered by immigration of sharks from other areas and that under high fishing pressure, total population size rather than local population size was likely to be the limiting factor affecting production.

Carcharhinus sorrah is captured as both a target species and as bycatch in northern Australian shark, finfish and prawn fisheries although current catch rates are highly unlikely to threaten the population. Historically, *C. sorrah* contributed about 20% by number to the Taiwanese gillnet fishery that operated in Australian waters between 1979 and 1986 (Stevens and Davenport 1991). This fishery's annual catch was about 7,000t processed weight of shark, tuna and mackerel. Sharks comprised about 80% of

** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

the total catch with *C. sorrah* and *C. tilstoni* accounting for about 60% (20% and 40% respectively). CPUE of sharks declined from 11kg/km in 1979 to 3kg/km in 1984 and then increased to about 6kg/km in 1986, (Stevens and Davenport 1991).

There is some concern regarding the possibility of shared stocks of *C. sorrah* between Australia and Indonesia. *Carcharhinus sorrah* apparently occur in small but consistent numbers (<20 sharks per day) in the Indonesian artisanal markets. Although this suggests a relatively low catch rate, there is no data on CPUE and it is therefore not possible to determine whether the low catches are due to small population size caused by overfishing. Considering the fishing methods used (longlines and gillnets), it seems highly unlikely that *C. sorrah* is not targeted and the low catches may represent decreased stock size of *C. sorrah*. Although actual catch statistics are unknown (W. White, pers. comm.), these Indonesian fisheries are currently being investigated by an ACIAR funded research project, while the Australian fishery and the probability of shared stocks with Indonesia is being investigated by a FRDC funded study involving state and commonwealth organisations. Data should be available in 2004. Data is needed from elsewhere in its range.

Conservation measures None.

Literature Compagno and Niem (1998e); Davenport and Stevens (1988); Last and Stevens (1994); Lavery and Shacklee (1989); Stevens and Davenport (1991); Stevens and Wiley (1986); Stevens *et al.* (2000).

Australian Blacktip Shark

Carcharhinus tilstoni (Whitley, 1950)

Richard D. Pillans and John D. Stevens

Red List assessment **Global: Least Concern**

Rationale A northern Australian continental shelf endemic occurring from close inshore to about 150m. CPUE data for sharks in the Taiwanese gillnet fishery (now closed) of which *Carcharhinus tilstoni* comprised about 40%, together with this species' fast growth rates, early maturity and relatively high fecundity suggests that it is more resilient to exploitation than many other shark species, and will already have recovered from depletion by this fishery in the 1980s. Currently, annual landings of sharks in northern Australia (mainly *C. tilstoni and C. sorrah*) are significantly smaller than historical catches. Although there is a need to monitor catches in these fisheries, current catch rates are highly unlikely to threaten the population.

Distribution **Regional endemic: Tropical Australia.**
FAO Areas 57 and 71.

Habitat and ecology Occurs on the continental shelf from close inshore to a depth of about 150m and is found throughout the water column but mainly in midwater or near the surface. Often occurs in large aggregations. Size shows a sharp increase with increasing depth (Lyle 1987). Maximum size attained is 200cm TL, with size at maturity 110cm TL (males) and 115cm TL (females). Age at maturity is 3–4 years. Average size of *C. tilstoni* captured in the Timor Sea were much smaller than from other areas, suggesting that the species utilises the inshore areas there as a nursery area. *Carcharhinus tilstoni* is viviparous with a gestation period of 10 months and a reproductive periodicity of one year. Litter size ranges from 1–6 pups/litter (average three), with size at birth 60cm TL. Growth rate of juveniles are 17cm/year for the first year, declining to 8–10cm/year when the sharks are about five years old (Stevens and Wiley 1986; Davenport and Stevens 1988; Last and Stevens 1994).

Threats Genetic evidence suggested that this species forms one population in Australian waters (Lavery and Shacklee 1989). Tagging studies off Northern Australia have shown that 60% of sharks were recaptured within 50km of the tagging site, however one shark was captured 1,113km away (Stevens *et al.* 2000). These authors also showed that most animals moved along the coastline. Data from this study suggests that although there was sufficient movement to prevent stock differentiation, the degree of movement was not great enough to prevent a reduction in local population as a result of heavy fishing pressure. This conclusion contradicts those of Lavery and Shacklee (1989) who concluded that local populations would be well buffered by immigration of sharks from other areas and that under high fishing pressure, total population size rather than local population size was likely to be the limiting factor affecting production.

Historically, *C. tilstoni* contributed to the Taiwanese gillnet fishery that operated in Australian waters between 1979 and 1986 (Stevens and Davenport 1991). This fishery's annual catch was about 7,000t processed weight of shark, tuna and mackerel. Sharks comprised about 80% of the total catch with *C. sorrah* and *C. tilstoni* accounting for about 60% (20% and 40% respectively). CPUE of sharks declined from 11kg/km in 1979 to 3kg/km in 1984 then increased to about 6kg/km in 1986 (the year this fishery ceased) (Stevens and Davenport 1991). There was an apparent decrease in the number of mature male and female *C. tilstoni* from 1981–1986 (Stevens and Davenport 1991). Data from this fishery between 1975–1978 showed the highest catches were in North QLD, Torres Strait, Gulf of Papua, Gulf of Carpentaria and Inshore Arafura Sea.

Together with *C. sorrah*, this species is an important component of the northern Australian commercial shark fishery. *Carcharhinus tilstoni* is captured as both a target species and as bycatch in northern Australian shark, finfish and prawn fisheries. Annual landings of sharks in northern Australia (mainly *C. tilstoni* and *C. sorrah*) are estimated at between 100–900t live weight and these catch rates are highly unlikely to threaten the population.

Conservation measures None.

Literature Davenport and Stevens (1988); Last and Stevens (1994); Lavery and Shacklee (1989); Stevens *et al.* (2000).

Tiger Shark

Galeocerdo cuvier (Peron & LeSueur, in LeSueur, 1822)

Colin A. Simpfendorfer

Red List assessment *2000 Red List assessment:*
Global: Near Threatened

Rationale This large omnivorous shark is common worldwide in tropical and warm-temperate coastal waters. It is a relatively fast growing and fecund species, caught regularly in target and non-target fisheries. There is evidence of declines for several populations where they have been heavily fished. Continued demand, especially for the valuable fins, may result in further declines in the future, but this species can withstand a higher level of fishing activity than many other species of shark. Additionally, juvenile survivorship increases where adult tiger shark populations have been depleted by fisheries and predation of young is lessened.

Literature Simpfendorfer (In: Fowler *et al.* in press).

Bizant River Shark

Glyphis sp. A [Last & Stevens, 1994]

John J. Pogonoski and David A. Pollard

Red List assessment **Global: Critically Endangered C2a(i)**

Rationale Based on the very few specimens collected to date from just two rivers, this undescribed fresh to brackish water species is possibly a northern Australian endemic and is presumably very rare. Surveys targeting freshwater and estuarine elasmobranchs in northern Australia (WA, NT, QLD) in mid-late 2002 collected no *Glyphis* specimens, despite sampling in 136 sites in 38 rivers. It is inferred that the population contains fewer than 250 mature individuals and that no subpopulation contains more than 50 mature individuals, further that it is presumably threatened by bycatch in commercial and recreational fishing activities and by possible habitat degradation. Future sampling in northern Australian rivers may yet reveal this species to be more abundant than currently known. However, until a time when its abundance can be proven to be greater than current levels, the species is classified as Critically Endangered.

Distribution **Regional endemic: Australia (NT and QLD). This species is based on two specimens collected in 2m of water in the Bizant River in northern QLD in 1982 (Last and Stevens 1994; Fowler 1997). Additional specimens were collected in the Adelaide River, NT in 1999.**
FAO Area 06.

Habitat and ecology The population size is unknown, but is suspected to be small based on current knowledge and their apparent rarity. This species may be largely restricted to the freshwater and brackish reaches of rivers, but further research is required on its habitat preferences. The ecology (i.e. critical habitat, salinity tolerances) and life history parameters (age and size at maturity, litter sizes, longevity) of this species need further investigation.

Threats As with other species of the genus, *Glyphis* sp. A may be largely restricted to freshwater and brackish reaches of rivers. Some of the most threatened chondrichthyan species are those restricted to such habitats, and with naturally very small populations. In addition to all the biological constraints of the marine chondrichthyans, freshwater/brackish species are more seriously limited by threats (such as fisheries and habitat degradation) affecting their restricted populations than are more widely ranging marine species (Compagno 2002). *Glyphis* sp. A is likely to be threatened by both commercial and recreational fishing, and possible habitat degradation. Commercial fishing may be in the form of gillnetting (legal or illegal) or longlining. Recreational fishing may be in the form of illegal gillnetting or hook and line fishing (using bait and/or lures). The potential impacts of fishing operations on this species need further investigation.

Conservation measures This species is listed as Critically Endangered on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. A Recovery Plan is currently being drafted and will be completed by mid-2003 (S. Williams, pers. comm.). It is also listed as an Endangered species under the NT's *Territory Parks and Wildlife Conservation Act 2000*, but no management programme was in place as of June 2002 (Stirrat and Larson 2002). Kakadu National Park (NT) is probably an important site for this species as it may be afforded more protection here than in other areas.

Literature Compagno (1984); Compagno (2002); Compagno and Niem (1998e); Fowler (1997); Last and Stevens (1994); Pogonoski *et al.* (2002); Stirrat and Larson (2002); Taniuchi *et al.* (1991).

Northern River Shark

Glyphis sp. C [Compagno & Niem, 1998]

John J. Pogonoski and David A. Pollard

Red List assessment **Global: Critically Endangered C2a(i)**

Rationale Based on the very few specimens collected to date from northern Australia (records from Papua New Guinea are not yet confirmed as this species), this undescribed species is presumably very rare. Surveys targeting freshwater and estuarine elasmobranchs in northern Australia (WA, NT, QLD) in mid-late 2002 collected no *Glyphis* specimens despite sampling in 136 sites in 38 rivers. It is inferred that the population contains fewer than 250 mature individuals and no subpopulation contains more than 50 mature individuals, further that it is presumably threatened by bycatch in commercial and recreational fishing activities and by possible habitat degradation. Future sampling in northern Australian and PNG rivers may yet reveal this species to be more abundant than currently known. However, until a time when its abundance can be proven to be greater than current levels, it is classified as Critically Endangered.

Distribution **Regional endemic: Australia (known from the Adelaide and Alligator River systems, NT) and possibly Papua New Guinea (Fly River) where it may be more common (P. Last, pers. comm.). In addition a specimen collected by hook and line from the Fitzroy River near Derby, WA is provisionally assigned to this species (W. White, pers. comm.).**
FAO Area 06.

Habitat and ecology The population size is unknown, but is suspected to be small based on current knowledge and their apparent rarity. This species was thought to be confined to the turbid freshwater and brackish (6–26ppt) reaches of rivers (Larson 2000), but a recent specimen provisionally identified as this species was taken from a salinity of 38ppt in WA (W. White, pers. comm.). Further research is required on its habitat preferences. The ecology (i.e. critical habitat, salinity tolerances) and life history parameters (age and size at maturity, litter sizes, longevity) of this species are little known and need further investigation.

Threats As with other species of the genus, *Glyphis* sp. C may be largely restricted to freshwater and brackish reaches of rivers. Some of the most threatened chondrichthyan species are those restricted to such habitats, and with naturally very small populations. In addition to all the biological constraints of the marine chondrichthyans, freshwater/brackish species are more seriously limited by threats (such as fisheries and habitat degradation) affecting their restricted populations than are more widely ranging marine species (Compagno 2002). *Glyphis* sp. C is likely to be threatened by both commercial and recreational fishing and possible habitat degradation. Commercial fishing may be in the form of gillnetting (legal or illegal) or longlining. Recreational fishing may be in the form of illegal gillnetting or hook and line fishing (using bait and/or lures). The potential impacts of fishing operations on this species need further investigation.

Conservation measures This species is listed as Endangered on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.* A Recovery Plan is currently being drafted and will be completed by mid-2003 (S. Williams, pers. comm.). It is also listed as an Endangered species under the NT's *Territory Parks and Wildlife Conservation Act 2000,* but no management programme was in place as of June 2002 (Stirrat and Larson 2002). Kakadu National Park (NT) is probably an important site for this species as it may be afforded more protection here than in other areas.

Literature Compagno (1984); Compagno (2002); Compagno and Niem (1998e); Fowler (1997); Larson (2000); Last and Stevens (1994); Pogonoski *et al.* (2002); Stirrat and Larson (2002); Taniuchi *et al.* (1991).

Sliteye Shark

Loxodon macrorhinus Müller & Henle, 1839

Colin A. Simpfendorfer and John D. Stevens

Red List assessment **Global: Least Concern**

Rationale This small inshore shark is common throughout the Indo-West Pacific and is commonly caught in artisanal, subsistence and commercial fisheries. There are few data on its biology or trends in abundance. In parts of its range (e.g. South East Asia) its abundance has probably declined due to fishing. However, it is presumably a fast growing species that can sustain a reasonable level of fishing pressure and so is listed globally as Least Concern.

Distribution **Regional: Northern Australia (from North West Cape, WA to Moreton Bay, QLD) and Papua New Guinea.**
Global: Widespread in the Indo-West Pacific.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology *Loxodon macrorhinus* is a small species of shark that appears to be common in inshore waters through most of its range, occurring down to 100m. Size at birth is 40–45cm TL, size at maturity is ~60cm TL, and maximum size attained is 90cm TL. They reproduce annually and usually have a litter size of two. There are no data available on age and growth, but like other closely related small tropical carcharhinid species, they are presumably fast growing and early maturing.

Threats This species is commonly caught in artisanal, subsistence and commercial fisheries throughout their range, but are rarely targeted. In particular they are heavily fished in southern India where their flesh is used for human consumption (Compagno 1984). Manjaji (2002) reported them in the fish markets of Sabah, Malaysia. In Australian waters this species is most commonly caught in fish trawls in northern areas, where it is one of the most common shark species caught (Last and Stevens 1994). Their small size and productive life history make them capable of sustaining reasonable levels of fishing pressure, and so throughout most of their range they are likely to be unaffected by fishing.

Conservation measures None.

Literature Compagno (1984); Last and Stevens (1994); Manjaji (2002).

Sharptooth Lemon Shark

Negaprion acutidens (Rüppell, 1837)

Richard D. Pillans

Red List assessment

Global: Vulnerable A2abcd+3bcd+4abcd
Australia: Least Concern
South East Asia: Endangered A2abcd+3bcd+4abcd

Rationale

A widely distributed tropical Indo-West and Central Pacific inshore species usually associated with coral reefs, lagoons and mangrove estuaries, and which exhibits very limited movement patterns. Within Australian waters, this species is wide-ranging and captured in small numbers in gillnets, beachmeshing and longlines on the east coast and NT. Catches in WA are also small. In Australia, there are likely to be significant areas of unfished habitat outside the operational ranges of these fisheries, thus the population is assessed as Least Concern.

Outside Australia, this species is heavily fished in unregulated and expanding inshore fisheries throughout its range, and this, together with its narrow habitat range and limited potential for recolonisation of heavily fished sites, leads to a global assessment of Vulnerable.

Further, in Indonesia there has been little recent evidence of this species at fish markets although it was historically abundant. Widespread damage and destruction of coral reefs and mangrove habitats in parts of South East Asia are also cause for concern. In addition, there are records of local extinctions in India and Thailand. This species is assessed as Endangered in South East Asia.

Distribution

Regional: Northern Australia (from Abrolhos Islands, WA to Moreton Bay, QLD), Indonesian Irian Jaya, Papua New Guinea and patchily throughout the Central Pacific.
Global: Wide-ranging in the Indian Ocean and Western Central Pacific.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology

Occurs in tropical, shallow inshore and offshore waters near the bottom; often found on and around coral reefs and on sandy plateaus near coral, at depths down to at least 30m (Compagno and Niem 1998e). Often found inside coral lagoons but also on reef flats and reef edges (Stevens 1984b). It is also known to occur around and within mangrove estuaries (W. White, pers. comm.). Size at birth is 60cm TL, size at maturity is 220cm TL (both sexes) and maximum size attained is 300cm TL. The gestation period is 10–11 months, they reproduce biannually and litter size is 6–12 pups. In a tagging study by Stevens (1984b), the average distance moved by individuals was 1.3km, the maximum distance travelled was 5km, and more than half of the recaptured animals were caught at the tagging site.

Threats

In Australia, data from the NT (Lyle *et al.* 1984) indicated that catch rates of *N. acutidens* in gillnet and longline fishing trials were very low. *Negaprion acutidens* is taken in small quantities (~15t yr^{-1}) in the WA northern shark fisheries. These fisheries comprise a very small number of boats (13 licences, seven active and only three fishing for six months or more) operating over a very large length of coast. A smaller quantity of *N. acutidens* are also taken as bycatch in trawl and gillnet fisheries in northern WA waters. There are likely to be significant areas of unfished habitat outside the operational ranges of these fisheries (R. McAuley, pers. comm.).

Threats from inshore fisheries are high outside Australian waters (particularly South East Asia) where these sharks are captured by gillnets and longlines. They are particularly susceptible to local depletion due to their very small habitat range and limited movement patterns (Stevens 1984b). This species is also likely to be affected by habitat destruction, particularly in South East Asia, for example, by extensive coral reef habitat destruction (pollution and dynamite fishing). In addition, this species is known to occur around and within mangrove estuaries, many of which have been deforested or are heavily populated by humans throughout its range. Although they are still recorded, albeit very infrequently within Indonesia (W. White, pers. comm.), evidence suggests *N. acutidens* was historically more abundant, and have not been seen for several years in some areas. Furthermore, evidence of local extinctions in India and Thailand (L.J.V. Compagno, pers. comm.) indicates that this species is extremely susceptible to local inshore fisheries.

Conservation measures

None.

Literature

Compagno and Niem (1998e); Last and Stevens (1994); Lyle *et al.* (1984); Stevens (1984b).

Blue Shark

Prionace glauca (Linnaeus, 1758)

John D. Stevens

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

While blue sharks are among the most abundant, widespread, fecund and faster growing of the elasmobranchs, and a pelagic species that is widely distributed throughout the world's oceans, they are also the most heavily fished sharks in the world. The impact of an annual fisheries mortality (mainly of bycatch) of an estimated 10–20 million individuals is likely to be having an effect on the world population, but monitoring data are inadequate to assess the scale of any population decline. There is concern over the removal of such large numbers of this likely keystone predator from the oceanic ecosystem.

Literature

Stevens (In: Fowler *et al.* in press).

Milk Shark

Rhizoprionodon acutus (Rüppell, 1837)

Colin A. Simpfendorfer

Red List assessment

Global: Least Concern

Rationale

Rhizoprionodon acutus is a common widespread species (the most widespread of this genus) that occurs from West Africa to the western Pacific (southern Japan). It is a coastal species, and as such it is commonly taken in a wide range of artisanal, subsistence and commercial fisheries, and regularly seen in fish markets. Despite its widespread occurrence in fisheries and the limited data available about their impacts on populations, it is assessed as Least Concern due to its wide distribution and relatively productive life history.

Distribution

Regional: Northern Australia (from Shark Bay, WA to Fraser Island, QLD), Papua New Guinea and Indonesia Irian Jaya.
Global: Indo-West Pacific and also along the West African coast (this population is geographically isolated from the remainder of the population).
FAO Areas 34, 47, 51, 57, 61 and 71.

Habitat and ecology

This common continental shelf species is the most widely distributed species of the genus *Rhizoprionodon*. Size at birth is 35–40cm TL (Australia) and 25cm TL (Africa), and size at maturity ~75cm TL. Australian animals attain a maximum size of ~100cm TL, while African animals attain a larger size, possibly as high as 178cm TL (Last and Stevens 1994). They are viviparous, with litter sizes from 1–8 pups (Compagno 1984). The gestation period is ~12 months, and mature females produce young every year. In Australian waters reproduction is asynchronous (Stevens and McLoughlin 1991), but in African and Asian waters reproduction is seasonal (Bass *et al.* 1975a; Devadoss 1988). *Rhizoprionodon acutus* reaches maturity after two or three years and probably lives to a maximum of at least five years (Compagno 1984). These life history parameters suggest a relatively high productivity.

Threats

Rhizoprionodon acutus is an abundant inshore shark that is commonly caught in subsistence, artisanal and commercial fisheries throughout its range. Catches in fisheries are best documented in Australia and India. In northern Australia it is one of the most commonly taken shark species in fish and prawn trawls (Last and Stevens 1994). It also represents 2% of the catch in gillnets and 6% of the catch on longlines (Stevens 1999). Despite these catches the Australian population does not appear to have been adversely affected.

In Indian waters it is commonly taken in gillnet and trawl fisheries (Devadoss *et al.* 1989). There are a number of studies in Indian waters that have assessed the status of the population based on demographic approaches. Krishnamoorthi and Jagadis (1986) estimated that in Madras waters *R. acutus* was being under-exploited. Kasim (1991) estimated that along the Verval coast the species was being fished below its maximum sustainable level, with males fished more heavily than females. The results of these assessments are questionable as they applied simplistic methods designed for teleost

fishes. As such, the results are treated with caution. Since these assessments were undertaken the Indian elasmobranch catch has increased dramatically (Anderson and Simpfendorfer, in press) and this species is likely to have become more heavily exploited. Data from other areas is limited. It is known to be landed in other countries, but there is no other data available on the status of populations or fisheries. The life history parameters of the species suggest a relatively high productivity that would sustain a reasonable level of fishing pressure, although not as high as that sustained by *R. oligolinx* or *R. taylori*.

Conservation measures Australian fisheries which catch this species are managed, but there is no assessment of population status and no species-specific regulations.

Literature Anderson and Simpfendorfer (in press); Bass *et al.* (1975a); Compagno (1984); Devadoss (1988); Devadoss *et al.* (1989); Kasim (1991); Krishnamoorthi and Jagadis (1986); Last and Stevens (1994); Stevens (1999); Stevens and McLoughlin (1991).

Grey Sharpnose Shark

Rhizoprionodon oligolinx Springer, 1964

Colin A. Simpfendorfer

Red List assessment **Global: Least Concern**

Rationale This is an abundant inshore species across southern Asia from the Arabian Gulf at least to northern Australia, possibly southern Japan. It is exploited by artisanal, subsistence and commercial fisheries throughout its range, including gillnet, trawl and longline fisheries. In parts of its range exploitation rates are relatively high. However, it is assumed to have a productive life history, like those of better-known species in this genus, which enables it to sustain relatively high levels of fishing pressure.

Distribution **Regional: Northern Australia (in the Gulf of Carpentaria where it is known only from a limited number of specimens, is probably rare, and may be a stray from Indonesian waters).**
Global: Indo-West Pacific.
FAO Areas 51, 57, 71. Possibly 61.

Habitat and ecology The biology of this species is poorly known. However, it is likely to have a life history very similar to the Australian sharpnose shark *R. taylori* which grows to a similar size and has a similar appearance. *Rhizoprionodon oligolinx* is a small shark, size at birth is 21–26cm TL, size at maturity is 35–40cm TL, and it attains a maximum size of ~70cm TL (Last and Stevens 1994). Mature females produce 3–5 pups/litter, presumably every year (Compagno 1984). Assuming that the life history is similar to that of *R. taylori* it is thought to be a productive species.

Threats This species is probably exploited by inshore artisanal, subsistence and commercial fisheries through most of its range. Manjaji (2002) reported it from fish markets in Sabah, Malaysia. No data are available on the magnitude of catches or the impact of fishing on the populations. Due to its presumed productive life history characteristics based on similar species, it is assumed to be able to sustain relatively high levels of fishing pressure.

Conservation measures None.

Literature Compagno (1984); Last and Stevens (1994); Manjaji (2002).

Australian Sharpnose Shark

Rhizoprionodon taylori (Ogilby, 1915)

Colin A. Simpfendorfer

Red List assessment **Global: Least Concern**

Rationale *Rhizoprionodon taylori* is a small abundant inshore shark restricted to southern Papua New Guinea and northern Australia where it is caught as bycatch in inshore gillnet and trawl fisheries. Catches at times are large, but sporadic. It is not a targeted species

and is one of the most productive species of shark known, growing very rapidly, maturing after one year with females producing up to 10 pups each year. This life history makes them able to sustain considerable fishing pressure, especially when the immature animals are not exploited.

Distribution

Regional endemic: Northern Australia (North West Shelf, WA to southern QLD, including the NT) and Southern Papua New Guinea.
FAO Areas 57 and 71.

Habitat and ecology

This is a very abundant inshore species that occurs across northern Australia and in southern Papua New Guinea (Last and Stevens 1994). The demographics of the population have been investigated by Simpfendorfer (1999b). The size at birth is 25cm TL, size at maturity is ~55cm TL (both sexes), and the maximum size attained is 67cm TL (Last and Stevens 1994). This species has one of the most *r*-selected life histories of any shark species. Simpfendorfer (1992) reported that mature females produce litters of 1–10 pups every year after a gestation period of 11.5 months. Interestingly, this is the only species of shark in which a period of embryonic diapause occurs (7.5 months) during which embryonic development is arrested. *Rhizoprionodon taylori* is a rapidly growing species, reaching maturity after only one year, and living to a maximum of seven years (Simpfendorfer 1993). Estimates of natural mortality rates using catch curve analysis are 0.56 $year^{-1}$ for females and 0.70 $year^{-1}$ for males (Simpfendorfer 1999b). Estimates of the intrinsic rate of population increase are 0.27 which give a population doubling time of 2.55 years. This rate of population increase is amongst the highest for any species of elasmobranch, and means that they are able to sustain relatively high levels of fishing pressure. If all age classes are fished equally the population can withstand an instantaneous fishing mortality rate of 0.18, and if the immature animals are not fished then this increases to 0.67.

Threats

This species of taken as bycatch in inshore gillnet fisheries for mackerel and barramundi along the QLD coast. At times large catches are made, but these events are sporadic and the overall catch is relatively small. In the waters off the NT this species makes up about 0.5% of the catch in gillnet and longline fisheries (Stevens 1999), but its size is considered to be too small for retention (Last and Stevens 1994). Many of the animals discarded in these fisheries are already dead. The life history of this species makes it relatively resilient to the moderate levels of fishing pressure to which it is subjected.

Conservation measures

The fisheries in which *R. taylori* is caught in northern Australia are regulated by either the relevant state government, or the federal government. However, there are no specific regulations that apply to this species.

Literature

Last and Stevens (1994); Simpfendorfer (1992); Simpfendorfer (1993); Simpfendorfer (1998); Simpfendorfer (1999b); Stevens (1999).

Whitetip Reef Shark

Triaenodon obesus (Rüppell, 1837)

Malcolm J. Smale

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

This small shark is widely distributed in warm shallow Indo-Pacific waters and is closely associated with coral reefs. Its restricted habitat, depth range, small litter size and moderately late age at maturity suggest that, with increasing fishing pressure, this species may become threatened.

Literature

Smale (In: Fowler *et al.* in press).

Winghead Shark

Eusphyra blochii (Cuvier, 1817)

Colin A. Simpfendorfer

Red List assessment

Global: Near Threatened
Australia: Least Concern

Rationale

This highly distinctive Indo-West Pacific continental shelf species is fished throughout its range. In southern Asia and Indonesia it is subjected to a range of fisheries and is probably heavily exploited. There are no scientific data on its status, and biological data are incomplete, but based on anecdotal accounts and market surveys the population is assumed to have declined and is assessed as Near Threatened. In the future it may reach a level that would warrant a Vulnerable listing.

In Australia it is only a small component of commercial catches, the population is considered to be relatively healthy and is assessed as Least Concern.

Distribution

Regional: Northern Australia (Broome, WA to Ingham, QLD), Papua New Guinea and Indonesian Irian Jaya.
Global: Wide distribution in the Indo-West Pacific.
FAO Areas 51, 57 and 71.

Habitat and ecology

This unique species of hammerhead occurs on and near the continental shelf in depths to 275m. The size at birth is ~45cm TL, size at maturity is ~110cm TL, and they attain a maximum size of 186cm TL (Stevens and Lyle 1989). Mature females produce litters of 6–11 pups each year after a gestation period of 8–11 months (Compagno 1984). There are no age and growth data available for this species. As a consequence it is difficult to predict the productivity of its life history.

Threats

This species is heavily exploited in some parts of its range, especially in the Gulf of Thailand, India and Indonesia (L.J.V. Compagno, W. White, pers. comm.). Anecdotal reports indicate that in these areas the populations have been impacted by fishing and in the near future may require a listing as Vulnerable based on population decline. Within Australian waters it is only lightly exploited by gillnet and longline fishing.

Conservation measures

None.

Literature

Compagno (1984); Last and Stevens (1994); Stevens and Lyle (1989).

Scalloped Hammerhead

Sphyrna lewini (Griffith & Smith, in Cuvier, Griffith & Smith, 1834)

John D. Stevens, Colin A. Simpfendorfer and Michelle R. Heupel

Red List assessment

2000 Red List assessment:
Global: Near Threatened

2000 Red List rationale:
This common large hammerhead is widely distributed in warm temperate and tropical seas, occurring from the shore and surface over continental and insular shelves to adjacent deep water. Pups occupy shallow coastal nursery grounds, often heavily exploited by inshore fisheries. This widely distributed species is extremely commonly taken in fisheries, both as a target species and as utilised bycatch (fins are highly valued). Lack of data on population trends makes it difficult to assess whether the high level of catches of this species at all life stages is having an effect on stocks, but some declines are reported. See Kotas (In: Fowler *et al.* in press).

Update (Australia only):
Australia: Least Concern

Rationale

Sphyrna lewini is found along the northern coast of Australia in reasonably high numbers. It is a large, viviparous, reasonably fecund species and although this species is taken in commercial fisheries these are well-managed and its

population is not being impacted, thus *S. lewini* is classified as Least Concern in Australian waters.

Distribution

Regional: Northern Australia to about 34°S on both coasts (Geographe Bay, WA to Sydney, NSW), Papua New Guinea and Indonesian Irian Jaya.
Global: Cosmopolitan in tropical and warm temperate seas.
FAO Areas 21, 31, 34, 41, 47, 51, 57, 61, 71, 77, 81 and 87. Possibly 27.

Habitat and ecology

Sphyrna lewini is found in tropical and warm temperate waters occurring over continental and insular shelves and adjacent deep water to depths of at least 275m. Juveniles are commonly found inshore. Size at birth is 45–50cm TL, size at maturity is 140–160cm TL and maximum size attained is ~350cm TL. Females are viviparous giving birth to 13–23 pups between October and January after a gestation period of 9–10 months. Little is known about the movement and migration patterns in Australian waters.

Threats

This species is caught in commercial fisheries, but is not impacted in Australia at this time. *Sphyrna lewini* is not targeted or highly utilised due to its high mercury content.

Conservation measures

None.

Literature

Kotas (In: Fowler *et al.* in press); Last and Stevens (1994).

Great Hammerhead

Sphyrna mokarran (Rüppell, 1837)

John D. Stevens, Colin A. Simpfendorfer and Michelle R. Heupel.

Red List assessment

2000 Red List assessment:
Global: Data Deficient

2000 Red List rationale:
A large widely-distributed tropical water shark, largely restricted to continental shelves. Although not targeted directly by commercial fisheries, this is a probable bycatch species of tropical longline and drift net fisheries, with high value fins. (See Denham In: Fowler *et al.* in press).

Update (Australia only):
Australia: Least Concern

Rationale

Sphyrna mokarran is found along the northern coast of Australia in reasonably high numbers. It is a large, viviparous, reasonably fecund species and although this species is taken in commercial fisheries, these are well managed and it is not being impacted, thus is classified as Least Concern in Australian waters.

Distribution

Regional: Widespread in northern Australia on both coasts (Abrolhos Islands, WA to Sydney, NSW). Also Papua New Guinea, New Caledonia and French Polynesia.
Global: Circumglobal in warm temperate and tropical seas.
FAO Areas 21, 27, 31, 34, 41, 47, 51, 57, 61, 71, 77, 81 and 87.

Habitat and ecology

Sphyrna mokarran is found in tropical and warm temperate waters occurring over continental and insular shelves and adjacent water to depths of at least 80m. Size at birth is 65cm TL, size at maturity is 225cm TL and maximum size attained is 600cm TL (although few are seen over 450cm TL). Females are viviparous giving birth to 6–33 pups in December-January after a gestation period of 11 months. Little is known about the movement and migration patterns in Australian waters.

Threats

This species is caught in commercial fisheries, but is not impacted in Australia at this time. *Sphyrna mokarran* is not targeted or highly utilised due to its high mercury content.

Conservation measures

None.

Literature

Denham (In: Fowler *et al.* in press); Last and Stevens (1994).

Smooth Hammerhead

Sphyrna zygaena (Linnaeus, 1758)

John D. Stevens, Colin A. Simpfendorfer and Michelle R. Heupel

Red List assessment

2000 Red List assessment:
Global: Near Threatened

2000 Red List rationale:
A relatively common and widespread shark, captured in a number of fisheries throughout its range, mostly by gillnet and longline. There is likely to be significant mortality of this species in large-scale longline and driftnet fisheries, although the impact on populations is unknown at present. Fins from hammerhead sharks are prized in Asia and individuals caught as bycatch are unlikely to be released alive. See Simpfendorfer (In: Fowler *et al.* in press).

Update (Australia and New Zealand only):
Australia and New Zealand: Least Concern

Rationale

Regionally, *Sphyrna zygaena* occurs around New Zealand, where it is a prohibited target species, and the most abundant shark species recorded in aerial surveys along the northwest coast. It also occurs along the southern coast of Australia where it is found in reasonably high numbers. It is a large, viviparous, fecund species and although taken in commercial fisheries, it does not appear to be negatively impacted by this fishing pressure, and is classified as Least Concern for this region.

Distribution

Regional: Widespread in southern Australia (from Jurien Bay, WA to Coffs Harbour, NSW) and New Zealand.
Global: Widespread in temperate waters.
FAO Areas 21, 27, 31, 34, 41, 47, 51, 57, 61, 77, 81 and 87.

Habitat and ecology

Sphyrna zygaena occurs over continental and insular shelves to depths of at least 20m. Size at birth is 50–60cm TL, size at maturity is 250cm TL and maximum size attained is 350cm TL. Females are viviparous giving birth to 20–50 pups between January and March after a gestation period of 10–11 months. Little is known about the movement and migration patterns in Australian waters.

Threats

Sphyrna zygaena is an important bycatch species in the WA demersal gillnet fishery, but appears not to be impacted by this fishing pressure. The species is reasonably abundant around the northern North Island of New Zealand, and was the most abundant shark species recorded in aerial surveys along the northwest coast. In New Zealand, neonates and small juveniles are a common bycatch in commercial gillnet fisheries for flatfish, and are also commonly taken by trawlers and Danish seine vessels. They are usually discarded, although juveniles discarded from gillnets are usually dead. Adults are mainly taken by gamefishers as bycatch when targeting marlin with live baits, and consequently the annual catch is small. Many of the sharks taken by game fishers are released alive (C. Duffy, pers. comm.). *Sphyrna zygaena* is abundant in the region, and significant numbers of adults do not appear to be taken in commercial fisheries.

Conservation measures

Sphyrna zygaena is a prohibited target species within New Zealand waters. WA gillnet fisheries are well managed, but there are no regulations for this species.

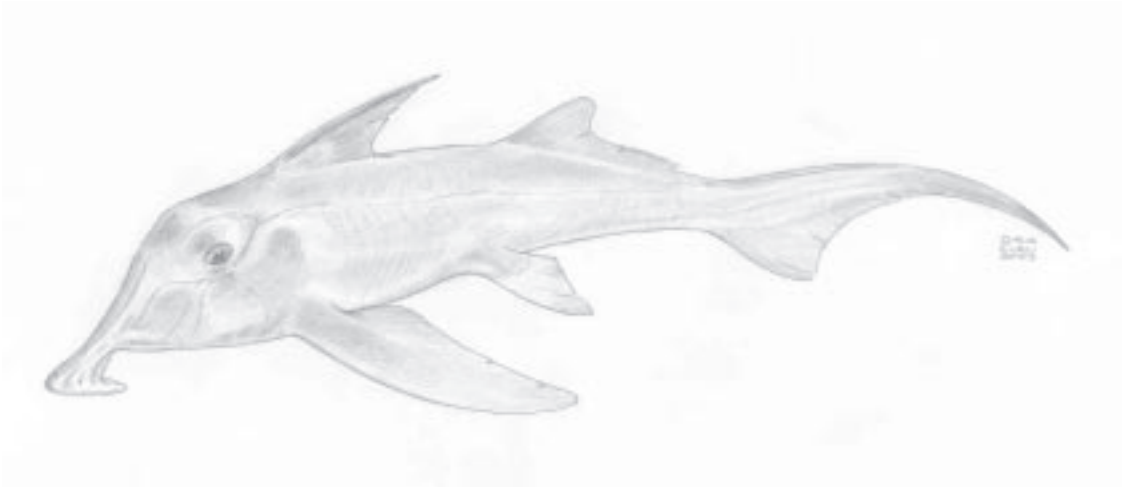
Literature

Last and Stevens (1994); Simpfendorfer (In: Fowler *et al.* in press).

Part 2

Red List Assessments

Batoids and Chimaeras



Narrow Sawfish

Anoxypristis cuspidata (Latham, 1794)

Leonard J.V. Compagno, Sid F. Cook and Madeline I. Oetinger

Red List assessment

2000 Red List assessment:
Global: Endangered A1acde+2cde

Rationale

This large sawfish is distributed through much of the Indo-West Pacific region. It is, like all other pristids, disproportionately subject to continued capture in the net gear widely employed throughout its range. It is also vulnerable to habitat loss and damage as a result of human activities in shallow inshore coastal waters and estuaries. Extensive fishing and this species' K-selected life history have caused substantial reductions in abundance and the virtual disappearance of this species from commercial catches in regions where it was once considered fairly common.

Literature

Compagno, Cook and Oetinger (In: Fowler *et al.* in press).

Dwarf Sawfish

Pristis clavata Garman, 1906

Sid F. Cook, Leonard J.V. Compagno and Peter R. Last

Red List assessment

2000 Red List assessment:
Global: Endangered A1acd+2cd

Rationale

This small species of sawfish is known only from northern Australia, but may also occur through Indonesia and adjacent areas of South East Asia. The population is much reduced as a result of bycatch in commercial gillnet and trawl fisheries throughout its limited confirmed range. Its known distribution may expand with further collections in adjacent waters, but these areas are also fished sufficiently intensively for all species of sawfishes to be commonly bycaught in local fisheries and for populations to be similarly depleted.

Literature

Compagno, Cook and Last (In: Fowler *et al.* in press).

Freshwater Sawfish

Pristis microdon Latham, 1794

Leonard J.V. Compagno and Sid F. Cook

Red List assessment

2000 Red List assessment:
Global: Endangered A1bcde+2bcde
South East Asia: Critically Endangered A1abc+2cd

Rationale

A large species of sawfish that occurs mostly in freshwaters of South East Asia and Australia. It is extremely vulnerable to fisheries and virtually all known populations have experienced very serious declines. It is also threatened by habitat loss and degradation over most of its range from eastern India, through much of South East Asia, to northern Australia.

Literature

Compagno and Cook (In: Fowler *et al.* in press).

Wide Sawfish

Pristis pectinata Latham, 1794

William F. Adams

Red List assessment

2000 Red List assessment:
Global: Endangered A1bcd+2cd
North and Southwest Atlantic: Critically Endangered A1bcd+2cd

Rationale

This large, widely distributed, sawfish has been wholly or nearly extirpated from large areas of its former range in the North Atlantic (Mediterranean, US Atlantic and Gulf of Mexico) and the Southwest Atlantic coast by fishing and habitat modification. Its status elsewhere is uncertain but likely to be similarly reduced. Reports of this species from outside the Atlantic may be misidentifications of other pristids, but these populations are also likely to be similarly affected.

Literature

Adams (In: Fowler *et al.* in press).

Green Sawfish

Pristis zijsron Bleeker, 1851

Leonard J.V. Compagno, Sid F. Cook and Madeline I. Oetinger

Red List assessment

2000 Red List assessment:
Global: Endangered A1bcd+2cd

Rationale

A formerly common Indo-West Pacific sawfish that inhabits marine areas. Intensive exploitation in directed and bycatch fisheries throughout its Australian, South East Asian and Indian Ocean range has resulted in severe population depletions in many, if not most, areas. Records have been extremely infrequent or absent from some parts of its (former?) range during the past 30–40 years.

Literature

Compagno, Cook and Oetinger (In: Fowler *et al.* in press).

FAMILY **RHINIDAE**

Shark Ray

Rhina ancylostoma Bloch & Schneider, 1801

Rory B. McAuley and Leonard J.V. Compagno

Red List assessment

Global: Vulnerable A2bd+3bd+4bd
Australia: Near Threatened

Rationale

Rhina ancylostoma is a widely distributed Indo-West Pacific inshore species taken by multiple artisanal and commercial fisheries throughout its range both as a target species and as bycatch. Flesh is sold for human consumption in Asia and the fins from large animals fetch exceptionally high prices, creating a significant incentive for bycatch to be retained. Very little is known about the biology or population status of this species, but it appears not to be common anywhere. Given its susceptibility to capture by multiple fishing gear types, including trawl nets, gillnets and hooks, and its high value fins, it is probable that numbers have been locally reduced by fishing throughout its range. Local population depletion can be inferred from Indonesia where the target gillnet fishery fleet for rhinids and rhynchobatids has declined significantly, reportedly due to declining catch rates. It is probable that the population will continue to decline, at least, until target fisheries become uneconomical. Habitat destruction is also thought to pose a significant threat to *R. anclyostoma* throughout much of its range. Thus, given its susceptibility to capture, high value fins, inferred and observed declines, and continual fisheries pressure placed across most of its range the species is assessed globally as Vulnerable.

There are no target fisheries for *R. ancylostoma* in Australia but it is a known bycatch of demersal trawl fisheries. The introduction of TEDs in some Australian trawl fisheries and the implementation of various elasmobranch-finning prohibitions, has

probably led to a recent reduction in captures by this sector, hence the Near Threatened classification for this species in Australian waters, although the situation should be monitored due to the vulnerability of this species and the high value placed on its fins.

Distribution

Regional: Northern Australia from Exmouth Gulf, WA to NSW, including the waters of the NT and QLD, and Papua New Guinea.
Global: Indo-West Pacific.
FAO Areas 51, 57, 61, 71 and 81.

Habitat and ecology

Coastal distribution throughout its range, generally occurring close inshore and around coral reefs to ~90m. *Rhina ancylostoma* occurs on or close to the seabed, mainly over sandy or muddy substrates. Very little is known about the life history characteristics of this species. Maximum size at least 270cm TL (Compagno and Last 1999a) and they reproduce ovoviviparously. Further research on the biology and exploitation of this species is required.

Threats

Rhina anclyostoma is one of the target species of South East Asian rhinid and rhynchobatid gillnet fisheries (W. White, pers. comm), which are generally unregulated and catches are thought to be poorly recorded (Chen 1996). The target gillnet fishery fleet in Indonesia declined from 500 boats in 1987 to 100 boats in 1996, reportedly due to declining catch rates (Chen 1996). There are no target fisheries for this species in Australia. It is also taken as bycatch in numerous non-target fisheries due to its vulnerability to multiple gear types, including trawl nets, gillnets and hooks (Stobutzki *et al.* 2002; Stephenson and Chidlow draft report; R. McAuley unpublished data). Flesh is sold for human consumption in Asia and the fins from large animals fetch particularly high prices. Habitat destruction and pollution are thought to pose a significant threat to this species, particularly in southern and South East Asia. Specifically, dynamite fishing, coral bleaching and siltation caused by deforestation may be reducing available habitat.

Conservation measures

The introduction of TEDs in trawl nets of some Australian fisheries, has significantly reduced their capture of large elasmobranchs (Brewer *et al.* 1998), however TEDs are not mandatory in several trawl fisheries in northern Australian and are probably not widely used in other parts of this species' range. The introduction of TEDs in other Australian trawl fisheries is highly recommended for mitigating bycatch of this and other at risk elasmobranchs. Finning of rhinids and rhynchobatids is also prohibited in some parts of Australia but there is thought be a continuing black market trade in their fins (Rose and McLoughlin 2001; R. McAuley unpublished data).

Literature

Brewer *et al.* (1998); Chen (1996); Compagno and Last (1999a); Froese and Pauly (2002); Last and Stevens (1994); Rose and McLoughlin (2001); Stephenson and Chidlow (draft report); Stobutzki *et al.* (2002).

FAMILY **RHYNCHOBATIDAE**

White-spotted Guitarfish

Rhynchobatus australiae Whitley, 1939

William T. White and Rory B. McAuley

Red List assessment

Global: Vulnerable A2bd+3bd+4bd
Australia: Near Threatened

Rationale

Rhynchobatus australiae is taken by multiple artisanal and commercial fisheries throughout its range both as a target species and as bycatch. Flesh is sold for human consumption in Asia and the fins from large animals fetch exceptionally high prices, creating a significant incentive for bycatch to be retained. Very little is known about the biology or population status of this species. Given its susceptibility to capture by multiple fishing gear types, including trawl nets, gillnets and hooks and its high value fins, it is probable that numbers have been locally reduced by fishing throughout its range. Local population depletion can be inferred from Indonesia where the target gillnet fishery fleet for rhinids and rhynchobatids has declined significantly, reportedly due to declining catch rates. Therefore, globally this species meets the criteria of Vulnerable A2bd+3bd+4bd due to the apparent population decline outlined above and the remaining very high level of exploitation in South East Asia. Habitat destruction may also pose a significant threat to this species throughout much of this region.

There are no target fisheries for *R. australiae* in Australia but it is a known bycatch of demersal trawl fisheries in the region. The introduction of TEDs in some Australian trawl fisheries in 2000 and the implementation of various elasmobranch-finning prohibitions, has probably led to a recent reduction in captures by this sector. However, given the population declines throughout South East Asia and the high value placed on fins (even in Australia), the Australian population may meet the criteria of Vulnerable A2d, but more detailed catch data are required and it is thus assessed as Near Threatened in these waters.

Distribution

Regional: Australia (QLD) and Indonesia (Irian Jaya) (Compagno and Last 1999a; W. White, pers. obs.).
Global: Indo-West Pacific.
Note: *Rhynchobatus australiae* probably has a larger range throughout this region, as many records of *R. djiddensis* from the Western Central Pacific and Eastern Indian Ocean cannot be reliably identified to species and may in fact be *R. australiae*. In addition, several different colour morphs of *R. australiae* are present in Indonesia which may be different species (W. White, pers. obs.; P. Last, pers. comm.).
FAO Areas 57 and 71.

Habitat and ecology

Rhynchobatus australiae inhabits inshore waters on the continental shelves. This species attains a maximum size of 223cm TL (female), and probably up to 300cm TL (from Thailand), with size at maturity 131cm TL (males) (Compagno and Last 1999a, W. White unpublished data). Very little is known about the biology and ecology of this species. There is no published information on the age and growth and natural mortality of *R. australiae.*

Threats

Rhynchobatus australiae is one of the most sought after elasmobranchs in South East Asia (particularly Indonesia), with the dorsal fins and upper caudal fin considered to be of premium quality and fetch the highest prices. A set of fins from a single individual has been reported to fetch up to Rp 900,000 or US$396/kg (Chen 1996). The skin and flesh are also of good quality. The Aru Islands rhinid and rhynchobatid gillnet fishery first began in the mid-1970s and rapidly expanded to reach its peak in 1987 with more than 500 boats involved. In future years the catches declined very rapidly with only 100 boats fishing in this area in 1996 (Chen 1996). The demersal gillnet fishery for batoids in Merauke still land large quantities of rhynchobatids. A similar fishery also exists in Merauke (south Papua) with gillnet boats operating in the Arafura Sea, close to Australian waters. One observed catch weighed close to 8t with *Rhynchobatus* spp. constituting more than 30% of the total mass, the largest proportion of the catch (W. White unpublished data). There is also evidence that fisherman in these regions occasionally fish in Australian waters (Chen 1996; W. White unpublished data). *Rhynchobatus djiddensis* (probably *R. australiae*) was found to be one of the four most commonly caught elasmobranchs in the bycatch of the trawl fisheries (prawn and fish) in northern Australia, with approximately 10% of these dying in the trawl net (Stobutzki *et al.* 2002; Stephenson and Chidlow draft report). Rhynchobatids are a common target of recreational anglers in some parts of their range, including northern Australia (Last and Stevens 1994). There is also evidence of finning of large shovelnose rays and guitarfish in northern Australia (R. McAuley unpublished data). Recent catch data for this species in eastern Indonesia and northern Australia, as well as elsewhere in its range, are required to assess to what extent the population decline is occurring. Improved species composition data from all fisheries that take shovelnose rays and guitarfish is necessary.

Conservation measures

Since the introduction of TEDs in some northern Australian trawl fisheries, catches of large elasmobranchs have been reduced and thus *R. australiae* are probably caught in lower numbers. The introduction of TEDs in other Australian trawl fisheries is highly recommended for mitigating bycatch of this and similar species. Finning of rhynchobatids is prohibited in some parts of Australia but there is thought be a continuing black market trade in their fins (Rose and McLoughlin 2001; R. McAuley unpublished data).

Literature

Bentley (1996); Chen (1996); Compagno and Last (1999a); Last and Stevens (1994); Rose and McLoughlin (2001); Stephenson and Chidlow (draft report); Stobutzki *et al.* (2002).

Smoothnose Wedgefish

Rhynchobatus laevis (Bloch & Schneider, 1801)

Rory B. McAuley and Leonard J.V. Compagno

Red List assessment

Global: Vulnerable A2bd+3bd+4bd
Australia: Near Threatened

Rationale

Due to its inshore occurrence off river mouths and shallow bays, *Rhynchobatus laevis* is subject to capture in a variety of fisheries. Flesh is sold for human consumption in Asia and the fins from large animals of this species and other members of its genus fetch exceptionally high prices, creating a significant incentive for bycatch to be retained. Although very little is known about its population status, because of its fragmented and sketchy distribution, unregulated targeted fishing in some areas and high fin value, local populations of *R. laevis* appear to have been significantly depleted throughout its range and are likely to continue to decline, at least until target fisheries become uneconomical. Thus the species is assessed as Vulnerable globally. Habitat destruction is also thought to pose a significant threat to *R. laevis* throughout much of its range.

The range of *R. laevis* is poorly known in northern Australia, due to confusion with *R. australiae* and *R. djiddensis*, and there may be a higher bycatch in demersal trawl fisheries than is currently understood. However, the introduction of TEDs in some Australian trawl fisheries and the implementation of various elasmobranch-finning prohibitions, has probably led to a recent reduction in captures by this sector, hence the Near Threatened classification in Australian waters, although the situation should be monitored due to the vulnerability of this species and the high value of its fins.

Distribution

Regional: Northern Australia (see note below).
Global: Described from India and best known from the Indian Subcontinent (India, Pakistan, Sri Lanka and Bangladesh).
Note: Specimens agreeing closely with this species are also known from Zanzibar (Tanzania), Oman and the Arabian Sea, Japan, China and northern Australia. These are provisionally placed in *R. laevis*.
FAO Areas 51, 57, 61 and 71.

Habitat and ecology

Rhynchobatus laevis has a coastal distribution throughout its range, generally occurring on or close to the seabed, inshore off river mouths and in shallow bays. Very little is known about the life history characteristics of this species, however they grow to at least 147cm TL and possibly to 200cm TL and reproduce ovoviviparously. Further research on the biology and exploitation of this species is urgently required.

Threats

Rhynchobatus laevis is subject to capture in a variety of fisheries throughout its range (Compagno and Last 1999a; W. White, pers. comm.), and is fished heavily by gillnet fisheries, for example, in India. Due to its similarity (in both habitat and habits) with *R. australiae*, it is probably also vulnerable to other gear types, including trawl, nets and hooks. Outside of Australia, elasmobranch fisheries throughout this species' range are generally unregulated (Chen 1996), catches are poorly recorded (Bonfil 1994) and finning is widespread. Flesh is sold for human consumption in Asia and the fins from large animals fetch exceptionally high prices. Given this species' use of semi-enclosed and near-shore habitats, habitat destruction and pollution are thought to pose a significant threat, particularly in southern and South East Asia.

Conservation measures

The introduction of TEDs in trawl nets of some Australian fisheries, has significantly reduced the capture of large elasmobranchs (Brewer *et al.* 1998), however TEDs are not mandatory in several trawl fisheries in northern Australian and are probably not widely used in other parts of this species' range. The introduction of TEDs in other Australian trawl fisheries is highly recommended for mitigating bycatch of this and other at-risk elasmobranchs. Finning of rhynchobatids is prohibited in some parts of Australia but there is thought be a continuing black market trade in their fins (Rose and McLoughlin 2001; R. McAuley unpublished data).

Literature

Bonfil (1994); Brewer *et al.* (1998); Chen (1996); Compagno and Last (1999a); Rose and McLoughlin (2001).

Spotted Shovelnose Ray

Aptychotrema sp. A [Last & Stevens, 1994]

Rory B. McAuley

Red List assessment **Global: Least Concern**

Rationale Endemic to the Timor Sea (northern Australia) and known only from a few specimens taken in about 120m, but possibly with a wider distribution than is currently known. Distributed outside the depth range of the major tropical Australian prawn trawl fishery and too deep for capture by illegal Indonesian fishing vessels. Possibly taken as bycatch in the NT fish trawl fishery but are likely to be of negligible commercial value due to their small, low value fins, low recovery of saleable flesh and lack of markets. Although poorly known, at this stage there are no identifiable threats to the species.

Distribution **Regional endemic: Known from a few specimens collected off northern Australia in the Timor Sea, off Melville Island (NT) in about 120m. Presumably endemic to Australia.**
FAO Area 71.

Habitat and ecology Very little is known about the life history characteristics of this species, however they attain at least 51cm TL and presumably reproduce ovoviviparously.

Threats Occurs in deeper water outside the main commercial trawl fishery in the area. Range is probably larger than currently known. Likely to be of little commercial value and usually discarded alive.

Conservation measures None.

Literature Last and Stevens (1994).

Western Shovelnose Ray

Aptychotrema vincentiana (Haacke, 1885)

Rory B. McAuley

Red List assessment **Global: Least Concern**

Rationale A common inshore endemic shovelnose ray with a wide distribution around southern and western Australia (although less common at the eastern extent of its range). Due to its inshore occurrence, *Aptychotrema vincentiana* is subject to capture in a variety of fisheries throughout its range. However, they are of negligible commercial value due to the small, low value fins, low recovery of saleable flesh and lack of markets, at least in WA. These small shovelnose rays are therefore usually discarded alive.

Distribution **Regional endemic: Southern and western Australia from Bass Strait (VIC) west to Port Hedland (WA), including the waters of SA. Widespread and common around the South West corner of WA, less common on the west and south coasts. There are apparently only limited records from SA and VIC.**
FAO Area 57.

Habitat and ecology In the south of the species range in WA, juvenile *A. vincentiana* are most common close inshore, whereas in the north of WA they occur mainly along the mid-continental shelf. Very little is known about the life history characteristics of this species, however they attain at least 79cm TL and reproduce ovoviviparously with litter sizes of 14–16 (Haacke 1885). Research into the biology of *A. vincentiana* has recently begun.

Threats Due to its inshore occurrence, *A. vincentiana,* is subject to capture in a variety of fisheries throughout its range (R. McAuley unpublished data; W. White, pers. comm.). There is some bycatch in demersal gillnet and small local temperate trawl fisheries in WA, but the species is usually discarded alive. Probably significant habitat outside, or in unfishable areas within, these fisheries.

Conservation measures None.

Literature Haacke (1885); Last and Stevens (1994).

Goldeneye Shovelnose Ray

Rhinobatos sp. A [Last & Stevens, 1994]

Rory B. McAuley

Red List assessment **Global: Least Concern**

Rationale A little known common shovelnose ray endemic to northwestern Australia. Occurs in coastal waters, within the depth range of some small prawn and fish trawl fisheries. It is a known bycatch of the Pilbara Fish Trawl (PFT) Fishery, but is of negligible commercial value due to its small, low value fins, low recovery of saleable flesh and lack of markets. Is known to be discarded alive in the PFT and is likely to have a high survival rate. Possibly has a wider distribution than is currently known.

Distribution **Regional endemic: Australia: North West Shelf and Kimberley regions of WA. Possibly other tropical Australian regions.**
FAO Area 57.

Habitat and ecology Very little is known about the life history characteristics of this species, however they attain at least 56cm TL but size at maturity is about 55cm TL (males), suggesting a larger maximum size. Presumably reproduce ovoviviparously.

Threats Is a known discarded bycatch in the PFT Fishery (Stephenson and Chidlow draft report). Occurs outside the geographic range of the major prawn trawl fishery in the area but its range might overlap if it is distributed further north than currently reported. If so, it is also likely to be discarded as it is of little commercial value.

Conservation measures The use of TEDs in trawl nets is unlikely to prevent capture due to the species' small size.

Literature Last and Stevens (1994); Stephenson and Chidlow (draft report).

Giant Shovelnose Ray

Rhinobatos typus Bennett, 1830

William T. White and Rory B. McAuley

Red List assessment **Global: Vulnerable A2bd+3bd+4bd**
Australia: Near Threatened

Rationale *Rhinobatos typus* is taken by multiple artisanal and commercial fisheries throughout its range both as a target species and as bycatch. Flesh is sold for human consumption in Asia and the fins from large animals fetch particularly high prices, creating a significant incentive for bycatch to be retained. Very little is known about the biology or population status of this species. Given its susceptibility to capture by multiple fishing gear types, including trawl nets, gillnets and hooks and its high value fins, it is probable that numbers have been locally reduced by fishing throughout its range. Local population depletion can be inferred from Indonesia where the target gillnet fishery fleet for rhinids and rhynchobatids has declined significantly, reportedly due to declining catch rates. Therefore, globally this species meets the criteria of Vulnerable A2bd+3bd+4bd due to the apparent population decline outlined above and the remaining very high level of exploitation in South East Asia. Furthermore, destruction of habitat, e.g. mangrove areas, and high level of fishing pressure in areas such as Papua (e.g. Merauke) may be having a deleterious effect on juveniles of this species that utilise such inshore regions.

There are no target fisheries for *R. typus* in Australia but it is a known bycatch of demersal trawl fisheries in the region. The introduction of TEDs in the Australian Northern Prawn Trawl Fishery in 2000 and the implementation of various elasmobranch-finning prohibitions, has probably led to a recent reduction in captures by this sector. However, given the population declines throughout South East Asia and the high value placed on fins (even in Australia) the Australian population may meet the criteria of

Vulnerable A2d, but more detailed catch data are required and it is thus assessed as Near Threatened in Australian waters.

Distribution

Regional: Northern Australia (from Shark Bay, WA to Forster, NSW, including the NT and QLD), New Guinea, and the Solomon Islands.
Global: Widely distributed in the Indo-West Pacific.
FAO Areas 51, 57, 71 and 81.

Habitat and ecology

Juveniles of *R. typus* occur inshore, e.g. mangrove systems and estuaries, and around atolls, whilst adults are found in the deeper waters of the continental shelf to ~100m. This species has also been reported to be able to live and breed permanently in freshwater. *Rhinobatos typus* is reported to attain at least 270cm TL. Although no published information is available on size at maturity and reproductive biology of this species, specimens examined from Shark Bay (WA) showed that size at maturity is between 155–175cm TL (both sexes), and size at birth is ~38–43cm TL (W. White unpublished data). There does not appear to be a distinct seasonal reproductive cycle with newborn young found in most months of the year (W. White unpublished data). Juveniles utilise shallow sand flats as nursery areas and move into mangrove areas and sand flats at high tide to feed (Last and Stevens 1994, W. White unpublished data). There is no published information on the age at maturity, longevity and natural mortality of this species.

Threats

The fins from *R. typus* are widely considered as being amongst the most valuable of elasmobranchs (i.e. 'white-fin') and there is a significant incentive for fishers to remove the fins from large individuals when they are taken as either target catch or bycatch. *Rhinobatos typus* is commonly landed as bycatch in fisheries in Indonesia (Bentley 1996; Chen 1996; W. White, pers. obs.). Fisheries targeting rhynchobatids in eastern Indonesia, e.g. Aru Islands and Merauke (Papua), often catch this species but generally in low numbers. Since juveniles of this species inhabit shallow sand flats and mangrove estuaries, intensive fishing pressures, e.g. gill, trap and seine nets, in such inshore areas throughout Indonesia, e.g. Merauke (Papua), are most likely having a high level of impact on this species. Such threats to this species in the Australia and Oceania region appear to be more confined to eastern Indonesia (e.g. Papua). In northern Australia, this species constitutes a minor component of the catch in the Northern Prawn Trawl Fishery (Stobutzki *et al.* 2002). There is also likely to be only limited fishing pressure on juvenile *R. typus* in inshore regions in northern Australia.

Further research into the population structure, biology and ecology of *R. typus* is required to assess the extent to which fishing pressure, particularly in relation to finning, and habitat destruction is influencing this species within its range. Improved species composition data from all fisheries that take shovelnose rays and guitarfish is necessary.

Conservation measures

Since the introduction of compulsory TEDs in the Northern Prawn Trawl Fishery in the year 2000, the number of large individuals of elasmobranchs retained have been further reduced.

Literature

Bentley (1996); Chen (1996); Compagno and Last (1999b); Last and Stevens (1994); Stephenson and Chidlow (draft report); Stobutzki *et al.* (2002).

Southern Fiddler Ray

Trygonorrhina fasciata Müller and Henle, 1841

Matt B. Reardon

Red List assessment

Global: Least Concern

Rationale

An Australian endemic with a wide range across southern Australia, *Trygonorrhina fasciata* appears to be common throughout its range. Little is known of its biology, but it is probably a relatively productive species. Abundance data for 1992 to 2002 from the SETF operating from NSW to SA including TAS shows no appreciable decline in catch rates. Data from a trawl survey in WA indicates a relatively abundant population in this region. Reasonable areas of its range are subject to little commercial demersal fishing (i.e. in the Great Australian Bight).

Distribution

Regional endemic: Southern Australia from eastern Bass Strait to Lancelin, WA, including the waters of VIC, northern TAS and SA.
FAO Area 57.

Habitat and ecology Recorded from shallow water environments. Little is known of the life history of the southern fiddler ray except that it is aplacental yolksac viviparous (M. Reardon, pers. obs.) and produces 4–6 pups per breeding cycle (Haacke 1885). It is reported to attain a maximum size of 126cm TL. Like other Australian shovelnose rays it inhabits shallow soft substrate habitats and seagrass meadows.

Threats *Trygonorrhina fasciata* is caught as a bycatch in commercial fisheries and also by recreational fishers (Last and Stevens 1994; Hyndes *et al.* 1999; T.I. Walker, pers. comm.). The flesh is of good quality and is sold in small quantities in seafood outlets. Abundance data for 1992 to 2002 from the SETF operating from NSW to SA including TAS shows no appreciable decline in catch rates (T.I. Walker, pers. comm.).

Conservation measures This species occurs in some protected marine parks, reserves and sanctuaries in VIC and SA waters.

Literature Haacke (1885); Hutchins and Swainston (1996); Hyndes *et al.* (1999); Last and Stevens (1994).

FAMILY **NARKIDAE**

Blind Electric Ray

Typhlonarke aysoni (Hamilton, 1902)

and

Oval Electric Ray

Typhlonarke tarakea Phillipps, 1929

Clinton A. J. Duffy

Red List assessment **Global: Data Deficient (both species)**

Rationale *Typhlonarke aysoni* and *T. tarakea* are poorly known electric rays, endemic to New Zealand. They are apparently rare, however their distribution and status is uncertain due to confusion between the two species. *Typhlonarke aysoni* and *T. tarakea* are potentially vulnerable to fisheries activity since their known distribution coincides with major trawl fishery grounds, but insufficient information is available to assess these species beyond Data Deficient at this time.

Distribution **Regional endemics: New Zealand. Exact distribution uncertain due to confusion between the two species. Blind electric rays have been recorded off east coast North Island south of East Cape, South Island, Stewart Island, Chatham Rise (Mernoo Bank and Chatham Islands) and Snares Shelf to 49°S.**
FAO Area 81.

Habitat and ecology Largely unknown. Blind electric rays of both species have been trawled from 46–800m, but are most common between 300–400m. Reproduction is probably ovoviviparous with up to 11 pups/litter. Size at birth is 9–10cm TL. Maximum size is 38cm TL for *T. aysoni* and 35cm TL for *T. tarakea*.

Threats Due to their benthic lifestyle, these electric rays are susceptible to capture by bottom trawling.

Conservation measures None.

Literature Anderson *et al.* (1998); Garrick (1951).

FAMILY **HYPNIDAE**

Coffin Ray

Hypnos monopterygius (Shaw & Nodder, 1795)

Tom J. Lisney

Red List assessment **Global: Least Concern**

Rationale This endemic ray is assessed as Least Concern as it is common and widely distributed in tropical and warm temperate Australian waters. Although it is occasionally taken as bycatch by commercial trawlers, this species is very hardy (it can survive out of water for hours), and is usually returned alive. More information on the biology of this species is required.

Distribution **Regional endemic: Tropical and warm temperate Australia (from St Vincents Gulf, SA to Broome, WA, and from Eden, NSW to at least Caloundra, QLD). A gap exists in the species' range from St Vincents Gulf, SA to Eden, NSW. The species has not been recorded from the waters of VIC or TAS.**
FAO Areas 57, 71 and 81.

Habitat and ecology This slow-moving species is commonly found inshore, buried on sandy and muddy bottoms, but also to depths of 240m. Reported to attain a maximum size of 60cm TL, but rarely exceeds 40cm TL. Size at maturity is ~24cm TL (males). Viviparous, with size at birth ~8–11cm TL. A very hardy animal, it can survive out of water for hours.

Threats Trawl fishery bycatch, although its hardiness means this species is usually returned alive.

Conservation measures None.

Literature Last and Stevens (1994).

FAMILY **TORPEDINIDAE**

New Zealand Torpedo Ray

Torpedo fairchildi Hutton, 1872

Clinton A. J. Duffy

Red List assessment **Global: Data Deficient**

Rationale *Torpedo fairchildi* is an apparently common endemic species with a wide geographic and bathymetric distribution around New Zealand. Further taxonomic research is required to determine if this species occurs elsewhere. Little is known of its biology. It is not targeted commercially but is taken regularly as bycatch in commercial bottom trawl fisheries and occasionally on bottom-set longlines throughout its range. Survival rates of discarded individuals are unknown. Spatial refuges from fishing are unknown but may exist. Its large size (to 200cm TL) and apparently low fecundity indicate that it is potentially vulnerable to overfishing and bycatch rates should be monitored closely.

Distribution **Regional endemic: New Zealand (North, South, Stewart and Chatham Islands, Challenger Plateau, Chatham Rise and Snares Shelf to about 49°S).**
FAO Area 81.
Note: Further research, particularly genetic studies, is required to clarify the status and distribution of Australasian *Torpedo* species. *Torpedo fairchildi* is considered endemic to New Zealand but electric rays observed at Norfolk Island may be this species (Cox and Francis 1997). *Torpedo fairchildi* is very similar to *T. macneilli* from Australia, and an Indian species has been reported under the name *T. fairchildi* (Michael 1993; Last and Stevens 1994). Last and Stevens (1994) reported an undescribed *Torpedo* from northern Australia (longtail torpedo ray, *Torpedo* sp. A), and considered it possible that *T. macneilli* may contain a number of cryptic species.

Habitat and ecology A common inhabitant of the continental shelf and upper slope around New Zealand at depths of 5–1,135m, but most frequently recorded in research trawls between 100–300m (Cox and Francis 1997; Paul and Heath 1997; Anderson *et al.* 1998). *Torpedo fairchildi* usually inhabits sandy or muddy bottoms on the outer continental shelf but is occasionally encountered inshore, including on shallow rocky reefs (C. Duffy, pers. obs.). Maximum size to 200cm TL, commonly to 100–150cm TL (Paul and Heath 1997). Reproduction is ovoviviparous. Litter size reported as eight (four embryos in each uterus) (Hamilton 1883, Graham 1956). Nursery areas are not known. Size at birth and maturity is unknown. The smallest pregnant female reported was 91cm TL.

Threats *Torpedo fairchildi* is commonly taken as bycatch in commercial bottom trawls and occasionally on bottom-set longlines. It has no commercial value and is usually discarded. Survival of discards is unknown but could be high in line fisheries. The species is infrequently taken by recreational line fishers and is usually cut, or struck off the line (Paul and Heath 1997). Old reports suggest that it was formerly common on inshore trawl grounds, whereas these days it appears to be most abundant below 100m, suggesting possible declines in shallow waters.

Conservation measures None.

Literature Anderson *et al.* (1998); Cox and Francis (1997); Graham (1956); Hamilton (1883); Last and Stevens (1994); Michael (1993); Paul and Heath (1997).

FAMILY **RAJIDAE**

New Zealand Smooth Skate

Dipturus innominatus (Garrick & Paul, 1974)

Malcolm P. Francis

Red List assessment **Global: Near Threatened**

Rationale Widespread throughout New Zealand, and frequent in shelf waters around South Island. Long life span (>24 years) and late age at maturity (females, 13 years) result in a long generation period and indicate low productivity. Trawl survey biomass indices in the main abundance area of east coast South Island show no trends, though there is evidence of inter-annual variation in catchability that may invalidate the time series. Expected to be introduced to the QMS in October 2003. On this basis alone, the species would be assessed as Least Concern. However, its low productivity and vulnerability to capture before reaching maturity means that the species could quickly move towards a threatened category if management measures are inadequate to regulate fishing mortality at a sustainable level. It is therefore considered to be Near Threatened until the QMS is operational and CPUE data indicate that the population is stable.

Distribution **Regional endemic: New Zealand (North and South Islands, Stewart Island – Snares Islands Shelf, and Chatham Rise, plus scattered records from the Campbell Plateau).**
FAO Area 81.

Habitat and ecology Soft bottom habitats on the continental shelf and upper slope; most abundant on the mid-outer continental shelf. Depth range from the shore to about 1,200m but rare deeper than 800m. Oviparous, females laying pairs of eggs in leathery cases on the seabed. Embryos hatch at ~10–15cm pelvic length (PL, snout tip to posterior margin of pelvic fins). Size and age at maturity is 93cm PL and five years (males), and 112cm PL and 13 years (females). Females grow larger and probably older than males, and attain a maximum size of at least 158cm PL and 24 years of age.

Threats Commercial catch of around 1,000t per year in bottom trawl and bottom longline fisheries. However, exact quantities are unknown because rough *skates Dipturus nasutus* and smooth skates are frequently grouped in landings statistics. Skates are not targeted, but are retained when caught.

Conservation measures A total competitive quota of 900t for all skates and rays was introduced in 1991–92 for the east coast of South Island, but landings have exceeded the quota every year

since it was introduced. The Ministry of Fisheries proposes to introduce smooth skate into the QMS in October 2003.

Literature Anderson *et al.* (1998); Francis (1997b); Francis (1998); Francis *et al.* (2001).

New Zealand Rough Skate

Dipturus nasutus (Banks in Müller & Henle, 1841)

Malcolm P. Francis

Red List assessment **Global: Least Concern**

Rationale Widespread throughout New Zealand, and common in inner shelf waters around South Island. Moderate life span (>9 years) and age at maturity (females, six years). Trawl survey biomass indices in the main abundance area of east coast South Island show no trends, though there is evidence of inter-annual variation in catchability that may invalidate the time series. Expected to be introduced to the QMS in October 2003.

Distribution **Regional endemic: New Zealand (North and South Islands, and Stewart Island – Snares Islands Shelf, plus scattered records from the Chatham Rise and Campbell Plateau).**
FAO Area 81.

Habitat and ecology Soft bottom habitats on the continental shelf; most abundant on the inner continental shelf. Depth range from the shore to about 1,000m but rare deeper than 600m. Oviparous, females laying pairs of eggs in leathery cases on the seabed. Embryos hatch at ~10–15cm pelvic length (PL; snout tip to posterior margin of pelvic fins). Size and age at maturity is 52cm PL and four years of age (males), and 59cm PL and six years (females). Females grow larger and probably older than males, and reach at least 79cm PL and nine years of age.

Threats Large commercial catch of around 1,500–2,000t per year in bottom trawl fishery. However, exact quantities are unknown because rough and smooth skates *Dipturus innominatus* are frequently grouped in landings statistics. Skates are not targeted, but are retained when caught.

Conservation measures A total competitive quota of 900t for all skates and rays was introduced in 1991–92 for the east coast of South Island, but landings have exceeded the quota every year since it was introduced. The Ministry of Fisheries proposes to introduce rough skate into the QMS in October 2003.

Literature Anderson *et al.* (1998); Francis (1997b); Francis (1998); Francis *et al.* (2001).

Maugean Skate

Raja sp. L [Last & Stevens, 1994]

Daniel Gledhill and Peter R. Last

Red List assessment *2000 Red List assessment:*
Global: Endangered B1+2c

Rationale Very little is known of this primitive skate, which was discovered just over a decade ago. It is only recorded from Bathurst and Macquarie Harbours on the Tasmanian west coast, which may contain two distinct populations. Its range in these estuary systems is not known, but is likely to be small, appearing to favour the shallow upper regions. There are no scientific data relating to the biology, distribution or the environmental requirements of this animal. Based on the few initial studies into this species, it appears that the population is very small.

Literature Gledhill and Last (In: Fowler *et al.* in press).

Argus Skate

Raja polyommata Ogilby, 1910

Peter M. Kyne and Michael B. Bennett

Red List assessment **Global: Data Deficient**

Rationale A poorly known but apparently common small skate endemic to the eastern Australian outer shelf and upper slope. Areas of its range are subject to intensive trawling where surveys have revealed it as the most common elasmobranch bycatch species. Mortality from trawling may be high and needs further investigation. Current research into life history and fisheries interactions in QLD may yield more data on the species. However, at this time the species cannot be assessed beyond Data Deficient.

Distribution **Regional endemic: Australia, from off Townsville, QLD to Byron Bay, NSW.**
FAO Areas 71 and 81.

Habitat and ecology An apparently common skate on the outer continental shelf and upper slope recorded from depths of 140–310m. Maximum size ~36cm TL with size at maturity 26–30cm TL (males). Size at birth ~17cm TL (Last and Stevens 1994). Oviparous. Little else known of its biology.

Threats In surveys of the eastern king prawn sector (deepwater component) of the QLD East Coast Trawl Fishery, *Raja polyommata* was the most common elasmobranch bycatch species comprising 36% of the elasmobranch catch by number. Mortality was high, particularly of juveniles (P. Kyne unpublished data). This fishery operates only in the upper depths of the species distribution (>200m). The species may also be caught in NSW trawl fisheries.

Conservation measures None.

Literature Last and Stevens (1994).

FAMILY UROLOPHIDAE

Kapala Stingaree

Urolophus sp. A [Last & Stevens, 1994]

Peter M. Kyne and Michael B. Bennett

Red List assessment **Global: Near Threatened**

Rationale *Urolophus* sp. A is a small stingaree endemic to the east coast of Australia, where it occupies a relatively narrow bathymetric distribution (18–85m) in heavily trawled areas. Little is known of its biology except that fecundity is usually limited to two young. Females regularly abort embryos when captured. Reported declines in catches of sympatric urolophid species in NSW suggest an inability to withstand fishing pressure. Given its level of endemism, restricted bathymetric range, intense fishing pressure throughout its range, low fecundity and aborting behaviour, together with declines observed in sympatric species, the species is categorised as Near Threatened, nearly meeting criterion A2d for Vulnerable.

Distribution **Regional endemic: East coast of Australia, between southeastern QLD and Jervis Bay, NSW.**
FAO Areas 71 and 81.

Habitat and ecology Inshore demersal species occurring in depths of 18–85m. Maximum size at least 45cm TL, size at maturity ~28cm TL (males). Viviparous, most commonly with one embryo in each uterus (P. Kyne unpublished data). Little else known of its biology.

Threats *Urolophus* sp. A is a common component of the bycatch in the QLD East Coast Trawl Fishery (ECTF) (eastern king prawn sector) where it is often caught in small aggregations (P. Kyne unpublished data). It is also taken in the NSW Ocean Prawn Trawl Fishery. Off the Clarence River and Newcastle, it is more regularly captured in waters between

9–56m than deeper waters where catch rates were considerably lower (Graham and Wood 1997). The implementation of TEDs in the QLD ECTF does not appear to be reducing catches (P. Kyne unpublished data).

Urolophids are often captured in large numbers as bycatch in Australian trawl fisheries (for example, see Graham and Liggins 1995). An overall decline of 66% in the catch of urolophids on the continental slope off NSW between 1976–77 and 1996–97 has been reported, with a decline of 90.5% on one survey ground (Eden) (Graham *et al.* 2001). Catch rates were not divided by species but comprised *U. bucculentus* (common), *U. viridis* (common), *U. sufflavus* and *U. cruciatus* (both less common). These data suggest that this group may be vulnerable to trawling activities.

Conservation measures

The species may occur inside some marine protected in NSW waters, including the Solitary Island Marine Park and the Jervis Bay Marine Park.

Literature

Graham and Liggins (1995); Graham and Wood (1997); Graham *et al.* (2001); Last and Stevens (1994).

FAMILY **DASYATIDAE**

Shorttail (Smooth) Stingray

Dasyatis brevicaudata (Hutton, 1875)

Clinton A. J. Duffy and Larry J. Paul

Red List assessment

Global: Least Concern

Rationale

A widespread temperate Southern Hemisphere species recorded from New Zealand, Australia and southern Africa, which is common to abundant throughout its range. Although taken in a wide variety of fisheries, it is usually released or discarded. It appears to survive capture and release well, and is assessed as Least Concern. In New Zealand, this species is prohibited as a commercial target species in quota management areas encompassing the core of its distribution.

Distribution

Regional: Southern Australia (southern QLD to Shark Bay, WA, including the waters of NSW, VIC, TAS and SA), New Zealand (Kermadec Islands; Three Kings Islands; North and South Islands to Foveaux Strait, Chatham Islands; rare at the Kermadec Islands and uncommon south of Cook Strait).
Global: Southern Africa (South Africa and Mozambique).
FAO Areas 47, 51, 57, 71 and 81.

Habitat and ecology

Poorly known despite its abundance due to confusion with other large *Dasyatis* spp. and lack of research. Occurs in a wide variety of habitats including shallow coastal bays, estuaries, large inlets, coastal rocky reefs, offshore islands, open sea floor and occasionally near the surface over the outer shelf. Common in 180–480m off South Africa where the species is mainly reported from deep offshore banks. Not recorded below 156m in New Zealand and Australia. During summer large midwater aggregations are found at several locations around the Poor Knights Islands, New Zealand. The purpose of these aggregations is unknown but they may be related to mating. Size and age at maturity is unknown. Reproduction is viviparous. Size at birth is ~36cm DW. Litter size and gestation period are unknown. Pupping and nursery areas are also unknown. This is the largest stingray in the world, attaining a maximum size of at least 210cm DW, 430cm TL and 350kg. Individuals exceeding 150cm DW are common in New Zealand waters, and there are reliable but unconfirmed reports of individuals approaching 300cm DW.

Threats

Taken as bycatch in inshore trawl, Danish seine, snapper longline and purse seine fisheries. Usually discarded. Commonly taken by recreational line fishers, either by surfcasting or line fishing from boats. Also taken on set lines, and in drag and set nets. Sometimes speared, or harpooned for sport. Usually released but sometimes retained for their flesh, or for angling competitions. Commercial and recreational fishers regularly amputate stingrays' tails before releasing them to reduce the risk of injury. The relatively large number of shorttail rays seen by divers without tails suggests they survive capture and release well. A small number of rays are caught for exhibition in public aquaria.

Conservation measures In New Zealand prohibited as a commercial target species in quota management areas (QMA) 1, 4 and 9. QMAs 1 and 9 represent the core of the species distribution in New Zealand.

Literature Ayling and Cox (1982); Bagley *et al.* (2000); Compagno *et al.* (1989); Cox and Francis (1997); Francis (1998); Last and Stevens (1994); Michael (1993); Wallace (1967).

Estuary Stingray

Dasyatis fluviorum Ogilby, 1908

Peter M. Kyne, David A. Pollard and Michael B. Bennett

Red List assessment **Global: Vulnerable A2bcd+3cd+4bcd**

Rationale *Dasyatis fluviorum* is recorded from the east and north coasts of Australia and the southern coast of New Guinea. Very little is known of its biology and ecology. Once common, there is considerable anecdotal evidence of a significant range contraction and decline in abundance for this species in the waters of NSW and southern QLD, Australia. Historic accounts report that *D. fluviorum* was an extremely common species in the bays and estuaries of southern QLD and NSW. It has not been reported from Port Jackson and Botany Bay, NSW, where it was once common, since the 1880s and is now uncommon anywhere along the central and northern coast of NSW. The southern limit of the species is uncertain. The species also appears to be declining in the estuaries of southern QLD, where it was also once common. This decline is probably the combined result of a number of threatening processes, including, bycatch in commercial fisheries, persecution by shellfish farmers, destruction of incidental catches by recreational fishers and during some commercial fishing activities, and habitat degradation and loss due to foreshore development. The species appears particularly vulnerable to such human activities due to its reliance on shallow tidal and mangrove habitats, particularly within estuaries and rivers. *Dasyatis fluviorum* is assessed as Vulnerable (A2bcd+3cd+4bcd) given its decline in range and abundance, decline in quality of habitat and continuing threats. Habitat protection, fisher education and research are priorities for its recovery.

Distribution **Regional endemic: Australia, from NSW north to at least the central QLD coast, and west from Cape York, QLD to Darwin, NT and Southern New Guinea, off both Papua New Guinea and Indonesian Irian Jaya.**
Note: Its occurrence north of Proserpine to Cape York, QLD, requires verification (Pogonoski *et al.* 2002; J. Johnson, pers. comm.). Historically, the southern extent of its range in NSW was Botany Bay and Port Jackson, however it has not been reported from these localities since the 1880s (Pogonoski *et al.* 2002). Its southern limit is uncertain but may now be Forster (Last and Stevens 1994). Although Gray *et al.* (1990) report the species from the Hawkesbury River, this report cannot be verified (J. Pogonoski, pers. comm.).
FAO Areas 71 and 81.

Habitat and ecology This species is reported from mangrove-fringed rivers and estuaries, to at least 28m depth, but more commonly in shallow inshore waters (Last and Stevens 1994; Pogonsoki *et al.* 2002). It is also known to ascend rivers to beyond the tidal limit (Whitley 1940). The species appears to be rather habitat specific and common only at a number of suitable inshore locations. Maximum size 120cm DW. Size at birth is 11cm DW (Last and Stevens 1994). Size at maturity is ~45cm DW (males) and 43cm DW (females) (P. Kyne unpublished data). Life history is virtually unknown.

Threats Once common, there is considerable anecdotal evidence of a significant range contraction and decline in abundance for this species in the waters of NSW and southern QLD. A number of threatening processes can be identified as acting on the species, which have, and still are, probably combining to cause the current population trend. *Dasyatis fluviorum* is not utilised commercially, but is taken as bycatch in inshore commercial fisheries, including demersal prawn trawl fisheries in NSW and QLD (P. Kyne, pers. obs.). Incidental capture by recreational fishers is also likely to be a significant threat as fishers often destroy any stingray catches (Pogonoski *et al.* 2002; P. Kyne, pers. obs.). Decline in southern QLD waters is also thought to be a result of the reclamation of large areas of shallow muddy tidal bays and mangroves for the development of urban areas, canal estates and marinas. Relatively shallow mangrove and estuarine areas have been recognised as critical habitat for *D. fluviorum* and protection of these are essential as a recovery objective for the species. This stingray

has been reported to feed voraciously on farmed oysters (Whitley 1940; Last and Stevens 1994), and subsequent persecution by commercial shellfish farmers in NSW and southern QLD estuaries has probably been another factor contributing to the species' apparent decline. Education of commercial fishers, aquaculturists and recreational fishers is also a priority to halt the destruction of incidental catches of the species. No information is available on the species' current status in New Guinean waters although it is likely to face pressure from subsistence fishing activities and the effects of pollution from mining and other land-based activities.

Dasyatis fluviorum was listed as Near Threatened, adopting the 1994 IUCN Red List system in Pogonoski *et al.* (2002). This report emphasised significant concern for this species and stressed the need for close monitoring. This revised assessment shows the species meets the criteria for Vulnerable.

Conservation measures

While *D. fluviorum* is likely to occur in a number of MPAs in NSW and QLD waters, the zoning plans for these MPAs restrict fishing activities in only small areas and do not generally protect sufficient areas of the habitat of this species. The species is still relatively common in some southern QLD estuaries and bays (Hervey Bay, parts of Moreton Bay), and these areas may be important for habitat protection (they are however, also heavily fished both commercially and recreationally and face development pressure).

Literature

Gray *et al.* (1990); Greenwood (1993); Last and Stevens (1994); Marshall (1964); Pogonoski *et al.* (2002); Whitley (1940).

Giant Freshwater Whipray

Himantura chaophraya Monkolprasit & Roberts, 1990

Leonard J.V. Compagno and Sid F. Cook

Red List assessment

2000 Red List assessment:
Global: Vulnerable A1bcde+2ce
Thailand (and probably other localities): Critically Endangered A1bcde+2ce

Rationale

This obligate freshwater species is recorded from several rivers in South East Asia and northern Australia and is probably unrecorded in others. The potential for exchange between these subpopulations is presumably very limited. The species has been and will continue to be adversely affected in much of its range by a complex of factors including directed and bycatch fisheries and habitat alteration or destruction. The possibility of extinction in the wild for some subpopulations is considered extremely high, but the status of those in Australia is probably favourable.

Literature

Compagno and Cook (In: Fowler *et al.* in press).

Blue-spotted Fantail Ray

Taeniura lymma (Forsskål, 1775)

Leonard J. V. Compagno

Red List assessment

2000 Red List assessment:
Global: Near Threatened

Rationale

Although very wide-ranging and common, this species is subject to human-induced problems because of capture in intensive inshore fisheries in most places where it occurs, its attractiveness for the marine aquarium fish trade (small size and brilliant colour pattern), and, especially, by widespread destruction of its reef habitat.

Literature

Compagno (In: Fowler *et al.* in press).

Porcupine Ray

Urogymnus asperrimus (Bloch & Schneider, 1801)

Leonard J. V. Compagno

Red List assessment

2000 Red List assessment:
Global: Vulnerable A1bd+2d

Rationale

Although widespread in the Indian Ocean and Indo-West Pacific, this species does not seem to be regularly recorded, and has certainly significantly decreased in abundance in parts of the centre of its range for which comparative data are available.

Literature

Compagno (In: Fowler *et al.* in press).

FAMILY MYLIOBATIDAE

White-spotted Eagle Ray

Aetobatus narinari (Euphrasen, 1790)

Hajime Ishihara

Red List assessment

2000 Red List assessment:
Global: Data Deficient

Rationale

A very widely distributed, relatively fecund, schooling species. This ray is taken as bycatch in much of its range in tropical and warm temperate seas. No data available on population trends.

Literature

Ishihara (In: Fowler *et al.* in press).

Banded Eagle Ray

Aetomylaeus nichofii (Bloch & Schneider, 1801)

Peter M. Kyne, Leonard J.V. Compagno and Michael B. Bennett

Red List assessment

Global: Vulnerable A2d+3d+4d

Rationale

Aetomylaeus nichofii is a wide-ranging but rare, little known, Indo-Pacific eagle ray. It is marketed throughout its range, except in Australia. South East Asian market catches are low and have declined, and large regions of the species' range have been subject to intensive (and increasing) trawling for a considerable time. Given actual (and increasing) levels of exploitation, rarity, low fecundity and global declines in catches of batoids the species is listed as Vulnerable A2d+3d+4d. Research urgently needs to address biology and levels of abundance.

Distribution

Regional: Tropical waters of Australia, from Bonaparte Archipelago, WA to Hervey Bay, QLD, including waters of the NT.
Global: Indo-West Pacific.
FAO Areas 51, 57, 61, 71 and 81.

Habitat and ecology

Demersal on the continental shelf inshore to at least 70m. Size at birth is ~17cm DW and attains a maximum size of at least 64cm DW. Viviparous with up to four pups/litter (Last and Stevens 1994; Compagno and Last 1999c). Nothing else known of its biology.

Threats

The species is a major commercial eagle ray that is marketed throughout the region, except in northern Australia. It is naturally rare and has declined due to heavy trawling in South East Asia since the 1960s. The species is rarely seen in both Thai and Indonesian market catches, where the Gulf of Thailand and Indonesian waters are subject to increasing trawling. It was previously more common in Thai markets. In Australian waters the species is rare with few museum records and ranges over moderately trawled areas (east coast of QLD, Gulf of Carpentaria). The species may

also be associated with coral reefs, which are under increasing pressure throughout most of its tropical range.

Conservation measures None. The species may be protected in small areas of the Great Barrier Reef Marine Park in Australia, although commercial fishing is still permitted in the majority of the park.

Literature Compagno and Last (1999c); Kyne *et al.* (in prep.); Last and Stevens (1994); Phipps (1996).

New Zealand Eagle Ray

Myliobatis tenuicaudatus Hector, 1877

Clinton A. J. Duffy

Red List assessment **Global: Least Concern**

Rationale A common coastal species, *Myliobatus tenuicaudatus* is endemic to New Zealand. Little is known of its reproductive biology, but it may be relatively productive (one captive female gave birth to 20 pups). Although taken in a wide variety of fisheries this species is usually released or discarded, and appears to survive capture and release well. It is prohibited as a commercial target species in quota management areas encompassing the core of its distribution.

Distribution **Regional endemic: New Zealand (Kermadec Islands, Three Kings Islands, North and South Island to Foveaux Strait [including Fiordland], Chatham Rise [not recorded from Chatham Islands]). Rare at the Kermadec Islands. Uncommon south of Cook Strait and the Marlborough Sounds. Rare on the Chatham Rise.**
Note: May be conspecific with *Myliobatis australis* Macleay 1881 from southern Australia. If so the name *M. tenuicaudatus* has precedence (Last and Stevens 1994).
FAO Area 81.

Habitat and ecology A common coastal species. Found mainly over soft bottoms, including tidal flats in estuaries and harbours, also commonly encountered on shallow rocky reefs. They are present in shallow water all year round but tend to concentrate in water less than ~10m deep during summer and autumn, and move offshore into water deeper than 20m during winter. Only adults and large juveniles are found in shallow water. Occur from low water to 422m but is rare below ~50m. Usually encountered on or near the bottom, eagle rays are occasionally seen swimming at the surface in open water. Reproduction is viviparous. Litter size and size at birth is poorly known. A captive female gave birth to a litter of 20 pups after six months in captivity. Size at birth was reported to be ~8cm DL (disc length). Size at maturity is unknown. Maximum TL is ~200cm.

Threats Mainly taken as bycatch in inshore trawl fisheries around the upper North Island. Usually discarded. Also taken by Danish seine nets. Commonly taken by recreational line fishers, either by surfcasting or line fishing from boats. Also taken on set lines, and in drag and set nets. Sometimes speared, or harpooned for sport. Usually released but sometimes retained for their flesh, or for angling competitions. They probably survive capture and release well. A small number of eagle rays are caught for exhibition in public aquaria.

Conservation measures Prohibited as a commercial target species in quota management areas (QMA) 1, 4 and 9. QMAs 1 and 9 represent the core of the species distribution.

Literature Ayling and Cox (1982); Bagley *et al.* (2000); Cox and Francis (1997); Francis (1998); Last and Stevens (1994).

Manta Ray

Manta birostris (Donndorff, 1798)

Hajime Ishihara

Red List assessment

2000 Red List assessment: (updated in 2001):
Global: Data Deficient
South China Sea, Sulu Sea, Gulf of California and West coast of Mexico: Vulnerable A1b

Rationale

This common and widespread large coastal plankton-feeding ray is very widely distributed in tropical shelf waters and around oceanic islands. Unfished populations are not thought to be threatened, and there are neither target fisheries for, nor bycatch of manta rays in most parts of the range. However, regional populations have been depleted in areas where the species has been fished, including the South China and Sulu Seas, and off the west coast of Mexico. This species is important for diving ecotourism.

Literature

Ishihara (In: Fowler *et al.* in press).

Pygmy Devilray

Mobula eregoodootenkee (Bleeker, 1859)

Simon J. Pierce and Michael B. Bennett

Red List assessment

Global: Near Threatened
Australia: Least Concern

Rationale

Mobula eregoodootenkee is locally common within its wide tropical Indo-West Pacific and northern Indian Ocean distribution. However, little is known about its biology and ecology, although inference from related *Mobula* species suggests this species is likely to have a low reproductive output. *Mobula eregoodootenkee* is likely to be a bycatch component of several fisheries through entanglement in nets, with much of this catch unreported. It is marketed in Thailand and probably elsewhere in South East Asia. Fishing pressure could severely impact this species, and given the lack of quantitative data available it is prudent to assign the species with an assessment of Near Threatened (close to Vulnerable A3d) until its population is otherwise proven to be stable.

This species is of no commercial value in Australia and is not recorded as a catch in any domestic commercial fisheries. At this low level of exploitation its population is likely to be stable, and no immediate threats to its survival are apparent, thus the species is assessed as Least Concern in Australia.

Distribution

Regional: Northern Australia (from Port Hedland, WA to southeastern QLD) and New Guinea.
Global: Widely distributed through the coastal continental waters of the tropical Indo-West Pacific.
FAO Areas 51, 57 and 71.

Habitat and ecology

Mobula eregoodootenkee attains a maximum size of ~100cm DW. The neotype for this species, a male of 96.9cm DW, was sexually mature (Notarbartolo-Di-Sciara 1987). These rays are viviparous, usually producing one offspring per litter. Mating and birthing occur in shallow water, and juveniles remain in these areas.

Threats

This species is caught as bycatch in several fisheries through entanglement in nets. Fishing pressure could potentially impact this species due to its presumed low reproductive rate. It is marketed in Thailand and probably elsewhere in South East Asia.

Conservation measures

None. Although the target fishery for *Manta birostris* was banned in the Philippines in 1998, fisheries continue for other species of mobulid. (Simpfendorfer *et al.* in press).

Literature

Chen (1996); Compagno and Last (1999d); Last and Stevens (1994); Michael (1993); Notarbartolo-Di-Sciara (1987); Rose and SAG (2001); Simpfendorfer *et al.* (in press).

Japanese Devilray

Mobula japanica (Müller & Henle, 1841)

William T. White

Red List assessment

Global: Near Threatened
Australia: Data Deficient

Rationale

Mobula japanica is highly susceptible to gillnets and is a common component of the inshore pelagic tuna gillnet fishery in Indonesia (probably elsewhere also) where the flesh and gill rakers are utilised. Target fisheries for whale sharks and mantas in South East Asia are also likely to be catching a significant number of this species. Due to the high levels of exploitation in some regions, especially South East Asia, this species almost qualifies for the Vulnerable criteria of A2d+3d+4d. However, little species composition data for this region is available so there is no information on the effects of such exploitation. Although devilrays commonly occur near the surface and are thus highly susceptible to surface-set tuna gillnets, the habitat utilised is quite extensive. *Mobula japanica* is assessed as Near Threatened globally but Data Deficient in Australia based on only a limited number of specimens from this country.

Distribution

Regional: Australia (NSW and QLD) and New Zealand.
Global: Probably circumglobal in all temperate and tropical seas.
FAO Areas 34, 51, 57, 61, 71, 77, 81 and 87.
Note: This species needs to be critically compared to *Mobular mobular* in the Mediterranean Sea (Compagno and Last 1999d). A similar but smaller *Mobula* species found in eastern Indonesia also needs to be examined (W. White, pers. obs.).

Habitat and ecology

Mobula japanica occurs inshore, offshore and possibly oceanic, but the utilisation patterns within its range are little known. It is usually caught coastally (Compagno and Last 1999d). *Mobula japanica* attains a maximum size of at least 310cm DW but is usually smaller than 250cm DW. Its biology is little known. It is ovoviviparous and size at birth is ~85cm DW (Compagno and Last 1999d). Size at maturity is between 200–210cm DW (males), and one pregnant female contained a single embryo 50cm DW (W. White unpublished data).

Threats

Mobula japanica is a common catch in the inshore pelagic tuna gillnet fisheries of Indonesia and presumably elsewhere throughout its range, and the gill rakers are of relatively high value in some areas, e.g. Pelabuhanratu in West Java (W. White unpublished data). The flesh is also utilised both for human consumption and as bait and chum for longlines. The species is highly susceptible to gillnets and species composition data from all gillnet fisheries operating throughout the range of this species is necessary.

Conservation measures

None.

Literature

Compagno and Last (1999d); Kyne *et al.* (in prep.); Last and Stevens (1944); Notarbartolo-Di-Sciara (1987); Paulin *et al.* (1982).

Elephant Fish

Callorhinchus milii (Bory de Saint-Vincent, 1823)

Matt B. Reardon, Terry I. Walker and Malcolm P. Francis

Red List assessment

Global: Least Concern

Rationale

The holocephalan *Callorhinchus milii* is relatively abundant and is caught as byproduct in fisheries of Southern Australia and New Zealand. In southern Australia, commercial catch rates have been stable for the past 20 years, while fishing effort is reducing and a TAC was implemented during 2002. Onboard monitoring over the past 25-year period indicates the change in the number of animals caught per unit of fishing effort was not statistically significant. A 3nm closure of all VIC waters to shark fishing provides a large refuge for the species in southern Australia. In New Zealand TACs have been in place since 1986 and the CPUE trend increased during 1989–2001. As a result, the total TAC increased from 619 to 1,040t over this time period. The species is most abundant off the east coast of the South Island. This fishery appears to be stable with populations likely to be above the biomass required to provide the maximum sustainable yield. The species has relatively high biological productivity; maximum age of 15 years, matures relatively early and continues to lay eggs over several weeks each year. No contraction of range or fragmentation of the population has occurred.

Distribution

Regional endemic: Southern Australian (from Esperance, WA to Sydney, NSW, including VIC, TAS and SA) and New Zealand (from East Cape to Stewart Island, but is only abundant around South Island).
Note: This assessment assumes a single genetic stock in southern Australia and a separate single genetic stock in New Zealand.
FAO Areas 57 and 81.

Habitat and ecology

Callorhinchus milii is found on the continental shelf in temperate seas to a depth of at least 200m. In southern Australia, *C. milii* is most abundant in Bass Strait and during the egg-laying period enters large estuaries and bays (Last and Stevens 1994). *Callorhinchus milii* is oviparous, laying eggcases in pairs in shallow water that may take up to 10 months to hatch (Last and Stevens 1994; Smith 2001). It is a seasonal breeder with females moving to shallower habitats to lay eggs (Last and Stevens 1994; Francis 1997c; Smith 2000; Reardon 2001). Eggs are laid over several weeks each year. Juveniles remain in the shallow habitats for up to three years, which may make them vulnerable to trawl capture in New Zealand (Francis 1997c). The species appears to be sexually segregated as males and females are often caught separately by commercial fishermen (T.I. Walker unpublished data). It has relatively high biological productivity. Maturity occurs relatively early at 70cm fork length (FL) for females, and 50cm FL for males. Maximum age has been estimated as nine years from ageing using growth increments in dorsal fin spines (T.I. Walker unpublished data) and 15 years from a tag return (Francis 1997c; Annala *et al.* 2002).

Threats

Callorhinchus milii is caught both commercially and recreationally in southern Australia and New Zealand. The sports fishery in New Zealand is currently recovering (C. Duffy, pers. comm.). The flesh is of good quality and is sold in seafood markets as whitefish fillets (Last and Stevens 1994). It is captured as byproduct from targeting *Mustelus antarcticus* with gillnets of 6–6.5-inch mesh-size off SA, VIC and TAS. During 1970–2001 the catch of *C. milii* from the SSF varied 4–118t (carcass weight), 2% of the total catch of all shark species (Walker *et al.* 2002). There is some targeting of females inshore by recreational fishers during the egg-laying period. Small quantities are taken as byproduct in the SETF. In southern Australia, commercial catch rates have been stable for the past 20 years, while fishing effort is reducing (Walker *et al.* 2002). Onboard monitoring over the past 25-year period indicates the number of animals caught per unit of fishing effort declined to 67%; the change is not statistically significant (Walker *et al.* in press). In New Zealand, the species is most abundant off the east coast of the South Island. The fishery appears to be stable with populations likely to be above the biomass required to provide the maximum sustainable yield (Annala *et al.* 2002).

Conservation measures Australia and New Zealand both have TAC limits in place for the elephant fish. In New Zealand, there is a recreational bag limit of 20 fish per day. Part of its range incorporates areas closed to shark fishing and MPAs. A 3nm closure of all VIC waters to shark fishing provides a large refuge for the species in southern Australia.

Literature Annala *et al.* (2002); Francis (1997c); Coakley (1971); Coakley (1973); Gorman (1963); Last and Stevens (1994); McClatchie and Lester (1994); Reardon (2001); Smith (2001); Walker *et al.* (2002); Walker *et al.* (in press).

FAMILY **CHIMAERIDAE**

Leopard Chimaera

Chimaera panthera Didier, 1998

Clinton A. J. Duffy

Red List assessment **Global: Data Deficient**

Rationale A large chimaeroid endemic to New Zealand waters. Known from very few specimens from three localised areas at depths of 327–1,020m. May have a wider distribution than is presently known. Nothing known of its biology. Vulnerable to bottom longlining and possibly bottom trawling in the upper part of its depth range but there is little fishing effort throughout most of its known distribution. Presently, not enough information available to assess the species beyond Data Deficient.

Distribution **Regional endemic: New Zealand: recorded from only three locations off northern New Zealand (Lord Howe Rise, Kermadec Ridge, Three Kings Ridge). This species may have a wider distribution than is presently known, particularly in waters deeper than 1,000m (Didier 1998).**
FAO Area 81.

Habitat and ecology A large, very poorly known species. Males and females above 100cm TL have been mature. Maximum size at least 129cm TL. Depth of occurrence 327–1,020m.

Threats Vulnerable to bottom longlining and possibly bottom trawling in the upper part of its depth range but there is little fishing effort throughout most of its known distribution.

Conservation measures None.

Literature Didier (1998); Paulin *et al.* (1989).

Pale Ghostshark

Hydrolagus bemisi Didier, 2002

Malcolm P. Francis

Red List assessment **Global: Least Concern**

Rationale An endemic species with a widespread distribution throughout New Zealand. Caught commercially by bottom trawlers (c. 1,700t per year), but managed by ITQs since 1998. Productivity unknown but may be low. Biomass indices relatively stable in 200–800m depth range, but declining in 750–1,500 m depth range, on the Chatham Rise. The 200–800m depth range encompasses the main habitat depth range (500–900m), so the overall population abundance is probably relatively stable.

Distribution **Regional endemic: Widespread throughout New Zealand.**
FAO Area 81.

Habitat and ecology Inhabits upper and mid continental slope over soft sediments. Depth range 86–1,410m; most abundant in 500–900m. Pale ghostsharks lay eggs in hard cases, depositing them in pairs on the seabed. Size at maturity (males) is 60cm caudal length (CL; snout to posterior end of upper caudal fin) and 70cm CL (females). Maximum size ~90cm CL.

Threats Large commercial catch of around 1,700t per year in bottom trawl fishery. Trawl survey indices (1992–2000) from Chatham Rise in 200–800m depth range (the main habitat depth range of this species) show no change, but indices (1984–1994) from the Chatham Rise in 750–1,500m show a decline.

Conservation measures Managed under ITQs since 1998.

Literature Anderson *et al.* (1998); Clark *et al.* (2000); Didier (2002); Francis (1998); Francis *et al.* (1998); Horn (1997); Livingston *et al.* (in press).

Dark Ghostshark

Hydrolagus novaezealandiae (Fowler, 1910)

Malcolm P. Francis

Red List assessment **Global: Least Concern**

Rationale *Hydrolagus novaezealandiae* is an endemic species with a widespread distribution throughout New Zealand, though uncommon around North Island, Challenger Plateau and Campbell Plateau. Productivity unknown but may be low. Caught commercially by bottom trawlers (c. 2,000t per year), but managed by ITQs. Biomass indices are variable, but possibly increasing.

Distribution **Regional endemic: Widespread throughout New Zealand, though uncommon around North Island, Challenger Plateau and Campbell Plateau.**
FAO Area 81.

Habitat and ecology Inhabits outer continental shelf and upper continental slope over soft sediments. Depth range 32 to c. 800m; most abundant in 150–500m. Dark ghostsharks lay eggs in hard cases, depositing them in pairs on the seabed. Size at maturity (males) is 52cm caudal length (CL; snout to posterior end of upper caudal fin) and 62cm CL (females). Maximum length ~80cm CL.

Threats Large commercial catch of around 2,000t per year in bottom trawl fishery. Trawl survey biomass indices (1992–2000) from Chatham Rise in 200–800m depth range are variable, but possibly increasing.

Conservation measures Managed under ITQs since 1998.

Literature Anderson *et al.* (1998); Clark *et al.* (2000); Francis (1998); Francis *et al.* (1998); Horn (1997); Livingston *et al.* (in press).

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AO = Australia and Oceania
NWA = Northwest Atlantic
ANWP = Asia and Northwest Pacific
SEA = Subequatorial Africa

Annex II: Workshop Agenda

Day 1

08:30	**Opening and welcome by local indigenous leaders**
08:40	**Opening address and plan for workshop** } *Rachel Cavanagh*
09:00	**The IUCN Red List**
09:40	**Problems with assessing marine species** *Jack Musick and Sarah Fowler*
10:00	**Discussion**
10:30	*Tea break*
11:00	**Ecological Risk Assessment** *Terry Walker*
11:30	**Conservation overview of Australian elasmobranchs** *Dave Pollard*
12:00	**Protection of Australian elasmobranchs** *Sara Williams*
12:30	*Lunch*
13:30	**Worked example – *Cetorhinus maximus*** *Sarah Fowler*
14:00	**Status of commercial species, worked example: *Mustelus antarcticus*** *Terry Walker*
14:30	**Status of freshwater species, worked examples: *Glyphis glyphis* and *Himantura chaophraya*** *Leonard Compagno*
	Status of Australian freshwater species } *John Stevens*
15:00	**Status of deepwater species (Australia)** }
	Status of deepwater species (New Zealand) *Malcolm Francis*
15:30	**Highlighting of species not selected for assessment** *Peter Kyne*
15:40	*Tea break*
16:00	**Working groups/individuals to work on assessments**
17:30	**Reconvene for discussions**
18:30	*Dinner*
20:00	**Evening session optional**

Day 2

09:00	**Working groups/individuals to work on assessments**
11:00	*Tea break*
11:20	**Reconvene for discussions**
12:30	*Lunch*
13:00	**Working groups/individuals to work on assessments**
15:00	*Tea break*
15:20	**Working groups/individuals to work on assessments**
16:30	**Reconvene for discussions and consensus on completed assessments**
18:30	*Dinner*
20:00	**Evening session optional**

Day 3

09:00	**Working groups/individuals to work on assessments**
11:00	*Tea break*
11:20	**Reconvene for discussions and consensus on completed assessments**
12:30	*Lunch*
13:00	**Working groups/individuals to work on assessments**
15:00	*Tea break*
15:20	**Final debate and finalisation of assessments**
18:30	**Workshop Summary**

Annex III: Summary of the 2001 IUCN Red List Criteria (Ver. 3.1)

A. Reduction in population size

A. Reduction in population size	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
A1. An observed, estimated, inferred or suspected population size reduction of:	≥90%	≥70%	≥50%
over the last 10 years or three generations whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following: a) direct observation b) an index of abundance appropriate for the taxon c) a decline in area of occupancy, extent of occurrence and/or quality of habitat d) actual or potential levels of exploitation e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.			

A. Reduction in population size	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
A2. An observed, estimated, inferred or suspected population size reduction of:	≥80%	≥50%	≥30%
over the last 10 years or three generations, whichever is the longer**,** where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible**,** based on (and specifying) any of the following: a) direct observation b) an index of abundance appropriate for the taxon c) a decline in area of occupancy, extent of occurrence and/or quality of habitat d) actual or potential levels of exploitation e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.			

A. Reduction in population size	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
A3. A population size reduction of:	≥80%	≥50%	≥30%
projected or suspected to be met within the next 10 years or three generations whichever is the longer (up to a maximum of 100 years)**,** based on (and specifying) any of the following: b) an index of abundance appropriate for the taxon c) a decline in area of occupancy, extent of occurrence and/or quality of habitat d) actual or potential levels of exploitation e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.			

A. Reduction in population size	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
A 4. An observed, estimated, inferred, projected or suspected population size reduction of:	≥80%	≥50%	≥30%
over any period of 10 years or three generations whichever is longer (up to a maximum of 100 years), where the time period includes both the past and the future, and where the decline or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of the following: a) direct observation b) an index of abundance appropriate for the taxon c) a decline in area of occupancy, extent of occurrence and/or quality of habitat d) actual or potential levels of exploitation e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.			

Annex III: Summary of the 2001 IUCN Red List Criteria (Ver. 3.1), cont'd.

B. Geographic range

B. Geographic range	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
in the form of either **B1** (extent of occurrence) OR **B2** (area of occupancy) OR both:			
B1. Extent of occurrence estimated to be (km^2), and estimates indicating any two of a–c:	<100	<5,000	<20,000
B2. Area of occupancy estimated to be (km^2), and estimates indicating any two of a–c:	<10	<500	<2,000
a. Severely fragmented or known to exist at:	only 1 location	= 5 locations	= 10 locations
b. Continuing decline, observed, inferred or projected, in any of the following: i) extent of occurrence ii) area of occupancy iii) area, extent and/or quality of habitat iv) number of locations or subpopulations v) number of mature individuals.			
c. Extreme fluctuations in any of the following: i) extent of occurrence ii) area of occupancy iii) number of locations or subpopulations iv) number of mature individuals.			

C. Population size

C. Population size	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
estimated to number fewer than (mature individuals) and either	<250	<2,500	<10,000
C1. An estimated continuing decline of at least	25%	20%	10%
in (years)	3	5	10
or (generations)	1	2	3
whichever is longer (up to a maximum of 100 years in the future) OR			
C2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following: (a–b) a) Population structure in the form of one of:			
i) no subpopulation estimated to contain more than (mature individuals), OR	50	250	1,000
ii) at least (%) of mature individuals are in one subpopulation	90%	95%	All (100%)
b) Extreme fluctuations in number of mature individuals.			

D. Population size

D1. Population size	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
estimated to number fewer than (mature individuals)	<50	<250	<1,000
D2. (VU only) Population with a very restricted area of occupancy (typically less than 20km^2) or number of locations (typically five or less) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.			

E. Quantitative analysis

E. Quantitative analysis	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)
showing the probability of extinction in the wild is at least	50%	20%	10%
within (years)	10	20	100
or (generations)	3	5	–
whichever is the longer (up to a maximum of 100 years).			

Annex IV: Summary Table of Red List Assessments

Species	Red List Assessment
Harrisson's Dogfish *Centrophorus harrissoni*	**CR**
Pondicherry Shark *Carcharhinus hemiodon*	**CR**
Bizant River Shark *Glyphis* sp. A	**CR**
Northern River Shark *Glyphis* sp. C	**CR**
Narrow Sawfish *Anoxypristis cuspidata*	**EN**
Dwarf Sawfish *Pristis clavata*	**EN**
Freshwater Sawfish *Pristis microdon*	**EN** (CR South East Asia)
Wide Sawfish *Pristis pectinata*	**EN** (CR North and Southwest Atlantic)
Green Sawfish *Pristis zijsron*	**EN**
Maugean Skate *Raja* sp. L	**EN**
Gulper Shark *Centrophorus granulosus*	**VU**
Leafscale Gulper Shark *Centrophorus squamosus*	**VU (**DD Australia and Oceania)
Eastern Angel Shark *Squatina* sp. A	**VU**
Colclough's Shark *Heteroscyllium colcloughi*	**VU**
Papuan Epaulette Shark *Hemiscyllium hallstromi*	**VU**
Hooded Carpet Shark *Hemiscyllium strahani*	**VU**
Tawny Nurse Shark *Nebrius ferrugineus*	**VU (**LC Australia)
Zebra Shark *Stegostoma fasciatum*	**VU (**LC Australia)
Whale Shark *Rhincodon typus*	**VU**
Grey Nurse Shark *Carcharias taurus*	**VU (**VU Australia, CR New South Wales, NT Western Australia)
Basking Shark *Cetorhinas maximus*	**VU (**EN Northeast Atlantic and Northwest Pacific)
White Shark *Carcharodon carcharias*	**VU**
New Caledonia Catshark *Aulohalaelurus kanakorum*	**VU**
School Shark *Galeorhinus galeus*	**VU** (VU Australia, NT New Zealand)
Fossil Shark *Hemipristis elongatus*	**VU** (LC Australia)
Lemon Shark *Negaprion acutidens*	**VU** (LC Australia, EN South East Asia)
Shark Ray *Rhina ancylostoma*	**VU** (NT Australia)
White-spotted Guitarfish *Rhynchobatus australiae*	**VU** (NT Australia)
Smoothnose Wedgefish *Rhynchobatus laevis*	**VU** (NT Australia)
Giant Shovelnose Ray *Rhinobatos typus*	**VU** (NT Australia)
Estuary Stingray *Dasyatis fluviorum*	**VU**
Giant Freshwater Whipray *Himantura chaophraya*	**VU** (CR Thailand)
Porcupine Ray *Urogymnus asperrimus*	**VU**
Banded Eagle Ray *Aetomylaeus nichofii*	**VU**
Frilled Shark *Chlamydoselachus anguineus*	**NT**
Sharpnose Sevengill Shark *Heptranchias perlo*	**NT**
Bluntnose Sixgill Shark *Hexanchus griseus*	**NT**
Prickly Shark *Echinorhinus cookei*	**NT**
Mandarin Shark *Cirrhigaleus barbifer*	**NT**
Eastern Longnose Spurdog *Squalus* sp. F	**NT**
Piked (Spiny) Dogfish *Squalus acanthias*	**NT**
Cyrano Spurdog *Squalus rancureli*	**NT**
Taiwan Gulper Shark *Centrophorus niaukang*	**NT**
Portuguese Dogfish *Centroscymnus coelolepis*	**NT**
Plunket's Shark *Centroscymnus plunketi*	**NT**
Eastern Sawshark *Pristiophorus* sp. A	**NT**
Tasselled Wobbegong *Eucrossorhinus dasypogon*	**NT**
Spotted Wobbegong *Orectolobus maculatus*	**NT** (VU New South Wales)
Banded Wobbegong *Orectolobus ornatus*	**NT** (VU New South Wales)
Grey Bamboo Shark *Chiloscyllium griseum*	**NT**
Slender Bamboo Shark *Chiloscyllium indicum*	**NT**
Brown-banded Bamboo Shark *Chiloscyllium punctatum*	**NT** (LC Australia)
Indonesian Speckled Carpet Shark *Hemiscyllium freycineti*	**NT**
Crocodile Shark *Pseudocarcharias kamoharai*	**NT**

Annex IV: Summary Table of Red List Assessments, cont'd.

Species	Red List Assessment
Shortfin Mako *Isurus oxyrinchus*	**NT**
Porbeagle Shark *Lamna nasus*	**NT** (VU Northeast Atlantic, CD Northwest Atlantic)
Whitish Catshark *Apristurus albisoma*	**NT**
Coral Catshark *Atelomycterus marmoratus*	**NT**
Whitefin Swell Shark *Cephaloscyllium* sp. A	**NT**
Northern Draughtboard Shark *Cephaloscyllium* sp. C	**NT**
Pencil Shark *Hypogaleus hyugaensis*	**NT**
Graceful Shark *Carcharhinus amblyrhynchoides*	**NT**
Grey Reef Shark *Carcharhinus amblyrhynchos*	**NT**
Bronze Whaler *Carcharhinus brachyurus*	**NT** (VU East Asia, DD Eastern Pacific, LC Australia, New Zealand and Southern Africa)
Spinner Shark *Carcharhinus brevipinna*	**NT** (VU Northwest Atlantic)
Whitecheek Shark *Carcharhinus dussumieri*	**NT** (LC Australia)
Galapagos Shark *Carcharhinus galapagensis*	**NT** (DD Australia and Oceania)
Bull Shark *Carcharhinus leucas*	**NT**
Blacktip Shark *Carcharhinus limbatus*	**NT** (VU Northwest Atlantic)
Oceanic Whitetip Shark *Carcharhinus longimanus*	**NT**
Hardnose Shark *Carcharhinus macloti*	**NT** (LC Australia)
Blacktip Reef Shark *Carcharhinus melanopterus*	**NT**
Dusky Shark *Carcharhinus obscurus*	**NT** (VU Northwest Atlantic and Gulf of Mexico)
Sandbar Shark *Carcharhinus plumbeus*	**NT** (VU Northwest Atlantic)
Blackspot Shark *Carcharhinus sealei*	**NT**
Tiger Shark *Galeocerdo cuvier*	**NT**
Blue Shark *Prionace glauca*	**NT**
Whitetip Reef Shark *Triaenodon obesus*	**NT**
Winghead Shark *Eusphyra blochii*	**NT** (LC Australia)
Scalloped Hammerhead *Sphyrna lewini*	**NT** (LC Australia)
Smooth Hammerhead *Sphyrna zygaena*	**NT** (LC Australia and New Zealand)
New Zealand Smooth Skate *Dipturus innominatus*	**NT**
Kapala Stingaree *Urolophus* sp. A	**NT**
Blue-spotted Fantail Ray *Taeniura lymma*	**NT**
Pygmy Devilray *Mobula eregoodootenke*	**NT** (LC Australia)
Japanese Devilray *Mobula japanica*	**NT** (DD Australia)
Blacktailed Spurdog *Squalus melanurus*	**LC**
Brier Shark *Deania calcea*	**LC**
Baxter's Dogfish *Etmopterus baxteri*	**LC**
Tailspot Lantern Shark *Etmopterus caudistigmus*	**LC**
Pink Lantern Shark *Etmopterus dianthus*	**LC**
Lined Lantern Shark *Etmopterus dislineatus*	**LC**
Blackmouth Lantern Shark *Etmopterus evansi*	**LC**
Pygmy Lantern Shark *Etmopterus fusus*	**LC**
False Pygmy Shark *Etmopterus pseudosqualiolus*	**LC**
Golden Dogfish *Centroscymnus crepidater*	**LC**
Owston's Dogfish *Centroscymnus owstoni*	**LC**
Cookie-cutter Shark *Isistius brasiliensis*	**LC**
Smalleye Pygmy Shark *Squaliolus aliae*	**LC**
Tropical Sawshark *Pristiophorus* sp. B	**LC**
Common Sawshark *Pristiophorus cirratus*	**LC**
Southern Sawshark *Pristiophorus nudipinnis*	**LC**
Australian Angel Shark *Squatina australis*	**LC**
Ornate Angel Shark *Squatina tergocellata*	**LC**
Crested Horn Shark *Heterodontus galeatus*	**LC**
Port Jackson Shark *Heterodontus portusjacksoni*	**LC**
Zebra Horn Shark *Heterodontus zebra*	**LC**
Collared Carpet Shark *Parascyllium collare*	**LC**
Rusty Carpet Shark *Parascyllium ferrugineum*	**LC**

Annex IV: Summary Table of Red List Assessments, cont'd.

Species	Red List Assessment
Varied Carpet Shark *Parascyllium variolatum*	**LC**
Blind Shark *Brachaelurus waddi*	**LC**
Western Wobbegong *Orectolobus* sp. A	**LC**
Northern Wobbegong *Orectolobus wardi*	**LC**
Cobbler Wobbegong *Sutorectus tentaculatus*	**LC**
Epaulette Shark *Hemiscyllium ocellatum*	**LC** (NT New Guinea)
Speckled Carpet Shark *Hemiscyllium trispeculare*	**LC**
Pale Catshark *Apristurus exsanguis*	**LC**
Western Spotted Catshark *Asymbolus occiduus*	**LC**
Pale Spotted Catshark *Asymbolus pallidus*	**LC**
Dwarf Catshark *Asymbolus parvus*	**LC**
Orange Spotted Catshark *Asymbolus rubiginosus*	**LC**
Variegated Catshark *Asymbolus submaculatus*	**LC**
Gulf Catshark *Asymbolus vincenti*	**LC**
Banded Catshark *Atelomycterus fasciatus*	**LC**
Marbled Catshark *Atelomycterus macleayi*	**LC**
Black-spotted Catshark *Aulohalaelurus labiosus*	**LC**
Draughtboard Shark *Cephaloscyllium isabellum*	**LC**
Australian Swell Shark *Cephaloscyllium laticeps*	**LC**
Sawtail Shark *Galeus boardmani*	**LC**
(cf. Speckled Catshark) *Halaelurus* sp. 1	**LC**
Slender Smoothhound *Gollum attenuatus*	**LC**
Whiskery Shark *Furgaleus macki*	**LC**
Sicklefin Hound Shark *Hemitriakis falcata*	**LC**
Longnose Hound Shark *Iago garricki*	**LC**
Grey Gummy Shark *Mustelus* sp. A	**LC**
White-spotted Gummy Shark *Mustelus* sp. B	**LC**
Gummy Shark *Mustelus antarcticus*	**LC**
Rig *Mustelus lenticulatus*	**LC**
Weasel Shark *Hemigaleus microstoma*	**LC** (NT South East Asia)
Silky Shark *Carcharhinus falciformis*	**LC** (DD Northern Indian, Tropical Pacific and Western North Atlantic)
Creek Whaler *Carcharhinus fitzroyensis*	**LC**
Australian Blacktip Shark *Carcharhinus tilstoni*	**LC**
Sliteye Shark *Loxodon macrorhinus*	**LC**
Milk Shark *Rhizoprionodon acutus*	**LC**
Grey Sharpnose Shark *Rhizoprionodon oligolinx*	**LC**
Australian Sharpnose Shark *Rhizoprionodon taylori*	**LC**
Spotted Shovelnose Ray *Aptychotrema* sp. A	**LC**
Western Shovelnose Ray *Aptychotrema vincentiana*	**LC**
Goldeneye Shovelnose Ray *Rhinobatos* sp. A	**LC**
Southern Fiddler Ray *Trygonorrhina fasciata*	**LC**
Coffin Ray *Hypnos monopterygius*	**LC**
New Zealand Rough Skate *Dipturus nasutus*	**LC**
Shorttail (Smooth) Stingray *Dasyatis brevicaudata*	**LC**
New Zealand Eagle Ray *Myliobatis tenuicaudatus*	**LC**
Elephant Fish *Callorhinchus milii*	**LC**
Pale Ghostshark *Hydrolagus bemisi*	**LC**
Dark Ghostshark *Hydrolagus novaezealandiae*	**LC**
Bluntnose Sevengill Shark *Notorynchus cepedianus*	**DD** (NT Eastern Pacific)
Bramble Shark *Echinorhinus brucus*	**DD**
Bartail Spurdog *Squalus* sp. A	**DD**
Eastern Highfin Spurdog *Squalus* sp. B	**DD**
Western Highfin Spurdog *Squalus* sp. C	**DD**
Fatspine Spurdog *Squalus* sp. D	**DD**
Western Longnose Spurdog *Squalus* sp. E	**DD**

Annex IV: Summary Table of Red List Assessments, cont'd.

Shortnose Spurdog *Squalus megalops*	**DD*** (LC Australia)
Shortspine (Greeneye) Spurdog *Squalus mitsukurii*	**DD*** (EN Australia, NT New Zealand)
Endeavour Dogfish *Centrophorus moluccensis*	**DD*** (EN Australia)
Southern Dogfish *Centrophorus uyato*	**DD*** (CR Australia)
Bareskin Dogfish *Centroscyllium kamoharai*	**DD**
Whitetail Dogfish *Scymnodalatias albicauda*	**DD**
Sherwood Dogfish *Scymnodalatias sherwoodi*	**DD**
Southern Sleeper Shark *Somniosus antarcticus*	**DD**
Prickly Dogfish *Oxynotus bruniensis*	**DD**
Kitefin Shark *Dalatias licha*	**DD** (NT Northeast Atlantic)
Western Angel Shark *Squatina* sp. B	**DD**
Ginger Carpet Shark *Parascyllium sparsimaculatum*	**DD**
Herbst's Nurse Shark *Odontaspis ferox*	**DD**** (VU Australia)
Megamouth Shark *Megachasma pelagios*	**DD**
Pelagic Thresher *Alopias pelagicus*	**DD****
Bigeye Thresher *Alopias superciliosus*	**DD****
Thresher Shark *Alopias vulpinus*	**DD** (NT California)
Longfin Mako *Isurus paucus*	**DD****
Freckled Catshark *Apristurus* sp. A	**DD**
Bigfin Catshark *Apristurus* sp. B	**DD**
Fleshynose Catshark *Apristurus* sp. C	**DD**
Roughskin Catshark *Apristurus* sp. D	**DD**
Bulldog Catshark *Apristurus* sp. E	**DD**
Bighead Catshark *Apristurus* sp. F	**DD**
Pinocchio Catshark *Apristurus* sp. G	**DD**
Grey Spotted Catshark *Asymbolus analis*	**DD**
Blotched Catshark *Asymbolus funebris*	**DD**
Saddled Swell Shark *Cephaloscyllium* sp. B	**DD**
Narrowbar Swell Shark *Cephaloscyllium* sp. D	**DD**
Speckled Swell Shark *Cephaloscyllium* sp. E	**DD**
Reticulate Swell Shark *Cephaloscyllium fasciatum*	**DD**
Northern Sawtail Shark *Galeus* sp. B	**DD**
Slender Sawtail Shark *Galeus gracilis*	**DD**
Dusky Catshark *Halaelurus* sp. A	**DD**
Dawson's Catshark *Halaelurus dawsoni*	**DD**
Short-tail Catshark *Parmaturus* sp. A	**DD**
McMillan's Catshark *Parmaturus macmillani*	**DD**
Sailback Hound Shark *Gogolia filewoodi*	**DD**
Darksnout Hound Shark *Hemitriakis abdita*	**DD**
Silvertip Shark *Carcharhinus albimarginatus*	**DD**** (LC Australia)
Bignose Shark *Carcharhinus altimus*	**DD**** (LC Australia)
Pigeye Shark *Carcharhinus amboinensis*	**DD** (NT Southwest Indian)
Nervous Shark *Carcharhinus cautus*	**DD** (LC Australia)
Spot-tail Shark *Carcharhinus sorrah*	**DD**** (LC Australia, NT South East Asia)
Great Hammerhead *Sphyrna mokarran*	**DD** (LC Australia)
Blind Electric Ray *Typhlonarke aysoni*	**DD**
Oval Electric Ray *Typhlonarke tarakea*	**DD**
New Zealand Torpedo Ray *Torpedo fairchildi*	**DD**
Argus Skate *Raja polyommata*	**DD**
White-spotted Eagle Ray *Aetobatus narinari*	**DD**
Manta Ray *Manta birostris*	**DD** (VU South China Sea, Sulu Sea, Gulf of California and West coast of Mexico)
Leopard Chimaera *Chimaera panthera*	**DD**

* This species has been noted as Data Deficient globally on a temporary basis and will be re-assessed when the current taxonomic problems have been resolved.
** In the time available it was not possible to achieve a global assessment of this species. It has been temporarily assigned the Data Deficient category, pending urgent review of its global status.

The Conservation Status of Australasian Chondrichthyans

Report of the IUCN Shark Specialist Group Australia and Oceania Regional Red List Workshop

Queensland, Australia, 7–9 March 2003

Compiled and edited by
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The IUCN (World Conservation Union) Species Survival Commission Shark Specialist Group (SSG) was established in 1991 to promote the sustainable use, wise management and conservation of the world's chondrichthyan fishes (sharks, rays and chimaeras). There are 130 SSG members around the world, in nine ocean-region subgroups, all of whom are actively involved in chondrichthyan research and fisheries management, conservation or policy formulation.

The SSG held a regional Red List Workshop at the University of Queensland's Moreton Bay Research Station in March 2003. The purpose was to assess the conservation status of the chondrichthyan fauna in the SSG's Australia and Oceania region (encompassing Australia, New Zealand, New Guinea and many smaller Pacific Island nations). The chondrichthyan fauna is extremely diverse, with ~350 (approximately one third) of all known species occurring in this region. A total of 175 species were assessed during the Workshop and their status agreed by consensus throughout the SSG network. This includes all regional endemic shark species together with several endemic rays and chimaeras, and many wider-ranging species. For each species, in addition to the Red List assessment, information is presented on distribution, habitat and ecology, threats and conservation measures. The Workshop outcomes are discussed in the context of the overall regional and global conservation status of chondrichthyan fishes. Summaries of Red List assessments carried out by the SSG network in 2000 of species occurring within this region are also included in this report.

Queensland waters support a rich chondrichthyan diversity from the subequatorial north to the subtropical waters of Moreton Bay in the south. The University of Queensland hosted the SSG Australia and Oceania Red List Workshop at Moreton Bay Research Station – one of its two marine research and teaching facilities (the other being at Heron Island, Great Barrier Reef). Research undertaken at these stations is part of a wider effort involving many interested groups to further the understanding of chondrichthyan biology and the status of species in this region.

IUCN The World Conservation Union
Species Survival Commission
The University Of Queensland
Environment Australia