

Illegal, unreported and unregulated shark catch:

A review of current knowledge and action

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M. Lack and G. Sant





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Blue-spotted fantail ray.

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Scalloped hammerhead.

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Introduction

In recent years there has been growing international concern for the conservation status of sharks, skates, rays and chimaeras (hereafter collectively referred to as sharks). This concern stems from the inherent vulnerability of sharks to overfishing, because they grow slowly, are late to mature and produce relatively few young, combined with strong demand and high prices prevailing for some shark products. The lucrative market, particularly for shark fin, has resulted in increased targeting of sharks and, in some cases this is illegal, unreported or unregulated (IUU) fishing.

Successive updates of the World Conservation Union's (IUCN) *Red List of Threatened Species* continue to paint an ever grimmer picture of the status of shark stocks. Currently, of the 591 shark species assessed globally, more than 20% are considered to be Critically Endangered, Endangered or Vulnerable (IUCN, 2007). A number of additional species have been assessed and will be listed in the 2008 Red List.

The international response to the growing concern for shark species has included:

- a number of resolutions and decisions by parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) concerning the conservation and management of all sharks, commencing with Resolution Conf. 9.17 in 1994, and the convening of a Shark Working Group reporting to the Animals Committee of CITES;
- the listing of some shark species in the Appendices of CITES and of the Convention on Migratory Species (CMS);
- the development of the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) (Food and Agriculture Organization of the United Nations (FAO), 2000);
- the introduction of controls on finning of sharks by some States and by some regional fisheries management organisations (RFMOs); and
- the listing of some shark species in some domestic protected species legislation.

However, most shark species remain unmanaged, and implementation of the IPOA-Sharks has been patchy. As a result, the status of shark stocks continues to deteriorate. Given the role of the market, particularly the market for shark fins in driving exploitation of sharks, members of CITES have a keen interest in assessing the role that the Convention might play in shark conservation. In addition, IUU fishing for sharks is occurring in the waters of many CITES parties. For example, the issue of IUU fishing for sharks is of particular interest to Australia, which has experienced significant problems with illegal fishing in northern waters of the Australian Fishing Zone (AFZ). A number of shark species (see Appendix 3) in that area are listed as protected species under Australia's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The fourteenth Conference of the Parties (CoP14) to CITES, June 2007, decided that:

“The Animals Committee, in consultation with FAO, shall examine and report on linkages between the international trade in shark fins and meat and IUU shark fishing activities, including where possible the main species of sharks taken by IUU fishing, and the relative importance of fins compared to meat in international trade arising from IUU fishing” (Decision 14.117, CITES, 2007a).

The information presented in this paper is intended to inform the CITES Animals Committee’s consideration of the linkages between the trade in shark fins and meat and IUU shark fishing activities.

This paper is structured as follows:

- a **discussion of the concept** of IUU fishing and its application to shark catch;
- a **review of what is known** about the nature and extent, of IUU fishing for sharks based on the available literature and a case study of the issue in Australian waters;
- an **overview of recent and current initiatives** to address IUU shark fishing; and
- a **preliminary examination** of how the information provided in the report might inform the Animals Committees consideration of the issue.

The nature and extent of IUU fishing for sharks

Introduction

An overview of the global catch, management and trade of sharks is provided in Appendix 1. The overview indicates that:

- There is international recognition of the vulnerability of shark species and of the need for management of fisheries exploiting shark stocks.
- Despite this recognition, there is generally little effective management of shark stocks at either national or regional level, and only a small number of shark species are subject to any international conservation measures.
- Where management is in place, especially on a regional basis, it is generic (rather than species-specific), is indirect, operating through controls on finning rather than control on catch or mortality, and is generally poorly enforced.
- Catch and trade of sharks have continued to trend upward reflecting strong market demand for some shark meat and fins together with increased take of shark bycatch as a result of expansion, in particular, of longline fishing for tunas.
- There remains a dearth of species-specific data on catch and trade of shark products in general and shark fins in particular, owing in part to the difficulty in determining the species from which fins originated.
- While many countries catch and/or trade in shark there are a relatively small number (about 20) that account for the bulk (about 80%) of the catch.

These factors largely explain the deteriorating status of shark species. However, despite IUU fishing having emerged over the past decade as a serious threat to various fish stocks worldwide, there has been little, if any, analysis of the role of IUU fishing in the declining status of shark stocks or of the proportion of the global catch and trade that is derived from IUU activities. A discussion of IUU fishing in the context of shark fisheries, a review of the information available on IUU shark fishing, and a specific case study on IUU shark fishing in Australia's northern waters are provided below.

What is IUU fishing?

The *International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing* (the IPOA-IUU Fishing) defines the three components of IUU fishing (see Box 1). Based on that definition of IUU fishing, and in the context of the known catch and management of sharks, some of the broad scenarios in which IUU fishing for sharks could occur are outlined below, noting that fishing can, simultaneously, constitute two or all of the three components of IUU fishing.

Scenario 1: A State/entity has national regulations or conditions relating specifically to the take of shark species and those regulations are not adhered to by national vessels fishing either in national waters or, where the regulations apply to high seas operations, on the high seas (illegal fishing).

Scenario 2: A foreign flagged vessel, authorised to fish in the waters of another State/entity, fails to adhere to conditions relating to shark catch imposed by that State/entity (illegal fishing).

Scenario 3: A foreign flagged vessel fishes, without authorisation, in the waters of another State/ entity and takes sharks either as a target species or as bycatch (illegal fishing).

Scenario 4: In a high seas area to which management measures for sharks established by an RFMO apply, a vessel, flying the flag of a member of that RFMO takes shark in direct contravention of those measures (illegal fishing).

Scenario 5: Where a vessel in any of scenarios 1 to 4 fails to report or misreports its catch of shark (unreported fishing).

Scenario 6: A vessel fails to report or misreports legal catch of shark in contravention of national laws and regulations or in contravention of the reporting requirements of an RFMO (unreported fishing).

Scenario 7: In a high seas area to which management measures, for sharks specifically or for other species, established by an RFMO apply, a vessel, without flag or flying the flag of a non-member of that RFMO, takes shark in direct contravention of those shark specific measures or indirectly (as bycatch) in contravention of measures for other species (unregulated fishing).

Scenario 8: A vessel fishes in an area where there are no applicable conservation or management measures but where such activity is inconsistent with State responsibilities for conservation of living marine resources under international law (e.g. the United Nations Convention on the Law of the Sea of 10 December 1982 (UNCLOS)¹ (Unregulated Fishing).

It is important to recognise that even where fishing is legal, reported and/or regulated, this does not necessarily equate to sound management. For example, a State may issue a permit to its vessels to fish in its zone or on the high seas. Such a permit allows these vessels to fish legally and may require reporting. Fishing conducted under such a permit is regarded as regulated fishing. However such a permit does not necessarily constrain the species taken or the quantity of catch. It is important in assessing the nature and extent of IUU fishing for sharks, that poorly regulated fishing is not construed as IUU fishing. This is illustrated by the following statement from a South African scientist commenting on the impact of increasing demand for shark products on shark stocks in that country:

“Unfortunately, most of the shark fishing that is taking place is not illegal, but rather there are not adequate regulations in place protecting these shark populations effectively at this stage.” (A. Kock cited in Anon, 2008)

Factors that might determine whether or not shark catch is IUU catch include:

- where the catch is taken (in national waters, high seas, in an area of competence of an RFMO);
- whether the species is identified by UNCLOS as a highly migratory species;
- whether the flag State of the catching vessel is a party to UNCLOS and/or the United Nations Fish Stocks Agreement (UNFSA)² and/or to any relevant RFMO;
- whether the flag State of the catching vessel regulates the activities of its vessels in national waters and/or on the high seas;

¹ Article 117 of UNCLOS specifies that “All States have the duty to take, or to cooperate with other States in taking, such measures for their respective nationals as may be necessary for the conservation of the living resources of the high seas.”

² The Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

Box 1 Illegal, unreported and unregulated fishing

3.1 Illegal fishing refers to activities:

3.1.1 conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;

3.1.2 conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organisation but operate in contravention of the conservation and management measures adopted by that organisation and by which the States are bound, or relevant provisions of the applicable international law; or

3.1.3 in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organisation.

3.2 Unreported fishing refers to fishing activities:

3.2.1 that have not been reported, or have been misreported, to the relevant national authority in contravention of national laws and regulations; or

3.2.2 undertaken in the area of competence of a relevant regional fisheries management organisation that have not been reported or have been misreported in contravention of the reporting procedures of that organisation.

3.3 Unregulated fishing refers to fishing activities:

3.3.1 in the area of application of a relevant regional fisheries management organisation that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organisation, or by a fishing entity in a manner that is not consistent with or contravenes the conservation and management measures of that organisation; or

3.3.2 in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law.

3.4 Notwithstanding paragraph 3.3, certain unregulated fishing may take place in a manner that is not in violation of applicable international law, and may not require the application of measures envisaged under the International Plan of Action (IPOA). *Source: FAO (2001).*

- whether a State or RFMO has in place measures to manage sharks; and
- whether an RFMO has the authority to manage shark species³.

Literature Review

The following assessment of IUU fishing for sharks has been compiled from a review of the available literature. The literature review has focused on material relating to the period post-2000, since both the IPOA-Sharks and IPOA-IUU Fishing have come into effect since that time. In addition to a review of the formal literature in this area, media reports over the 18 months to April 2008 (print and electronic) relating to IUU shark fishing have been referenced. These provide useful insights into the nature and

³ Further discussion of the legal and policy basis for management and conservation of sharks can be found in Barreira (2007).

extent of IUU fishing for sharks. The assessment provided does not purport to be a comprehensive review. Further, it does not attempt to use the estimates of IUU catch as a basis for quantifying IUU fishing for sharks, since the basis of many of the estimates cited, particularly those in media reports, is unspecified. It has not been possible, within the scope of this study, to verify the accuracy of the information cited or to confirm whether reported instances of IUU fishing were successfully prosecuted.

The literature includes examples of IUU fishing for sharks, estimates of the level and value of IUU shark catch from specific instances of detected IUU fishing, and estimates of IUU shark catch in particular regions or countries. The information identified is summarised in Appendix 2 and is presented on a region/country basis.

The information might most properly be viewed as indicative of the most prevalent forms of IUU shark fishing and of particular areas and shark species that are most commonly affected by IUU shark fishing. Subject to these qualifications, Appendix 2 suggests that:

- most IUU fishing of sharks is illegal fishing (and as a consequence, most is also unreported);
- illegal shark fishing is occurring globally but the available information suggests ‘hot spots’ are found off Central/South America and in the Western and Central Pacific Ocean. High levels of illegal shark fishing have also been occurring in the northern waters of Australia (see case study in Appendix 3 for an overview of the issue and the Australian Government response);
- most illegal fishing of sharks is carried out in national waters by both foreign and national vessels;
- illegal foreign fishing of sharks in national waters often derives from neighboring countries;
- illegal foreign fishing can result from either unauthorised access or breaches of conditions of access;
- most of the identified illegal fishing involves the retention of fins;
- most of the reported instances and estimates of IUU shark fishing do not specify the species of sharks taken;
- the most frequently cited species taken in illegal fishing are hammerhead sharks *Sphyrna* spp. and silky shark *Carcharhinus falciformis*; and
- longlining and gillnetting are the most frequently cited methods used in illegal shark fishing.

Overall, the available literature provides a broad picture of the nature of IUU fishing for sharks. It does not, however, provide a sound basis on which to make judgements about:

- the quantities taken;
- the relative impact of IUU fishing compared to “legitimate” fishing on shark populations; or
- the relative impact of IUU fishing on different shark species.

This lack of information on a global basis is reinforced by the findings of the case study of IUU shark fishing in Australian waters (Appendix 3). The case study reveals that, while increased monitoring, control and surveillance has apparently reduced the problem in those waters, the impact of IUU fishing on shark populations in the area is unknown, since there are essentially no estimates of the total IUU fishing removals of sharks from the area and very limited information on the species taken (see Appendix 3 for details of relevant research to address this problem). What is clear, however, is that the demand for shark fins is driving the IUU activity in Australian waters.

Regional and global initiatives to address IUU shark fishing

As noted earlier, CITES CoP14 adopted decision 14.117 relating to sharks and IUU fishing that directs the CITES Animals Committee, in consultation with FAO, to examine and report on shark IUU fishing. The CITES Secretariat has confirmed that it has been in contact with FAO, which has provided basic information outlining the list of species traded from its data sets and a qualitative assessment of those species that may be affected by IUU fishing (see Table 1).

The 23rd meeting of the CITES' Animals Committee was held in April 2008. Agenda item 15, Conservation and Management of Sharks, included consideration of:

- reports from Parties on implementation of IPOA-Sharks, opportunities to improve monitoring, verification and reporting of catch, bycatch and discards, and use of commodity codes;
- identification of shark species of concern that require consideration for inclusion in the Appendices if their management and conservation status does not improve; and
- linkages between international trade in shark fins and meat and illegal, unreported and unregulated fishing.

In relation to the last of these issues, the Animals Committee noted that:

1. Australia is preparing a report on IUU fishing for sharks that brings together all the different aspects of IUU fishing and its relevance to shark catch and that the Animals Committee will be able to use this report in implementing Decision 14.117 at its next meeting.
2. FAO will be convening a workshop in November 2008 on 'Status, limitations and opportunities for improving the monitoring of shark fisheries', which will cover topics including: (i) the main problems in the monitoring of shark fisheries and how they can be overcome; (ii) the relative importance of IUU fisheries to the overall fishing mortality of sharks; and (iii) the main problems in reporting of shark catch statistics to FAO and how they can be overcome. The workshop is aimed at countries with extensive shark fishing activities, especially those that have not yet developed NPOAs and the FAO hopes that CITES will participate.
3. The scheduled international expert workshop on CITES Non-detriment Findings to be held in Cancun, Mexico from 17-22, November, 2008.

The Animals Committee encouraged Australia to take into account available sources, including the outcomes of the FAO shark fisheries workshop and the Non-Detriment Findings workshop, when preparing its paper on IUU fishing for sharks, and to present this report to CITES AC24 for further discussion (Earth Negotiations Bulletin, 2008; and S. Zain, *TRAFFIC in litt.* to G. Sant *TRAFFIC*, 24 April 2008).

This report will inform the discussions at the upcoming workshops and provide the basis for subsequent work that draws together the background material provided here and the relevant outcomes of the workshop to be held later in 2008. Together these should provide a sound basis for consideration of the issue at the 24th meeting of the Animals Committee in 2009.

Table 1: Main species groups of shark in trade and preliminary evaluation of relative importance of threats¹

Main species in trade	Main products in trade (in order of importance)	Trade			Threats			
		International	Domestic	Direct fisheries	Bycatch	IUU fishing	Recreational fishing	Environmental change
White Shark <i>Carcharodon carcharias</i>	Fins, jaws, teeth	**	*	*	**	*	*	
Basking Shark <i>Cetorhinus maximus</i>	Fins, liver oil, meat	**	*	**	**	*		
Whale Shark <i>Rhincodon typus</i>	Meat, liver oil, fins	***	*	***	*	*		
Spiny Dogfish <i>Squalus acanthias</i>	Meat and fins	****	**	****	***	*	*	
Porbeagle <i>Lamna nasus</i>	Meat and fins	***	**	***	*	*	*	
Sawfish <i>Pristidae</i>	Fins and rostra	***	**	*	***	**	*	*
Pelagic sharks	Fins and meat	****	***	***	****	**	**	
Gulper sharks <i>Family Centrophoridae</i>	Liver oil, meat and fins	***	**	***	**	*		*
School Shark, Smooth-hounds, angle sharks, skates and rays	Meat and fins	**	****	****	**	*	*	*
Requiem sharks, hammerheads, shovelnose rays, guitarfishes	Fins and meat	****	****	****	****	**	*	*
Freshwater stingrays, Leopard Shark, Grey Nurse Shark and Longtail Carpet Sharks	Ornamental fish trade, meat	**	**	***	**	**	*	***

Source: M. Vasconcellos (FAO) in litt. to G Sant 3 December 2007.

¹ Higher risk is represented by a higher number of asterisks.

A number of other individuals were contacted around the world to ascertain what activities were being undertaken at the regional and global levels. There are a number of general IUU fishing reviews being undertaken, but few shark specific IUU reviews. They include:

- **Regional Plan of Action (RPOA) to Promote Responsible Fishing Practices including combating IUU Fishing in the region:** A joint initiative between most ASEAN States, Australia, Timor Leste and Papua New Guinea to strengthen the overall level of fisheries management in the region. A workshop was held in Thailand in 2007 to discuss implementation issues and another was held in March 2008 to discuss monitoring, control and surveillance issues. While the RPOA is not specifically about shark IUU fishing issues, these will be addressed by the RPOA. RPOA priorities include developing information, monitoring, compliance and surveillance systems to more fully meet coastal State measures, particularly those relating to IUU fishing and related capacity needs.
- **Reauthorisation of the Magnuson-Stevens Fishery Conservation and Management Act:** In respect to traceability and IUU fishing, the 2007 reauthorisation of this legislation has mandated the United States' National Oceanic and Atmospheric Administration (NOAA) to certify that fishery imports coming into the United States are not sourced from IUU fisheries. Actions required under the Moratorium Protection Act include the production of a biennial report (the first report due to Congress in January 2009), which must include information on the status of international living marine resources and a list of nations whose vessels have been identified for engaging in IUU fishing or bycatch or protected living marine resources. Additionally, NOAA must develop identification procedures for IUU fishing and the Commerce Secretary is required to identify: nations whose vessels are engaged or have been engaged during the past two years in IUU fishing; if relevant RFMOs have failed to implement effective measures to end IUU fishing activity; nations that are not party to or do not maintain cooperating status with the relevant RFMO; or if no RFMO regulates the IUU fishing activity in question. Within 60 days after submitting the biennial report to Congress, the Commerce Secretary, acting through Secretary of State, must notify nations of their identification and the Act's requirements to address IUU fishing, initiate consultations, and notify relevant RFMOs of US actions to address IUU fishing⁴.
- **European Union IUU fishing policies:** The European Union (EU) is proposing the adoption of policies to combat IUU fishing, which include a catch documentation scheme through a system of permits to verify that fisheries products imported into the EU have not been sourced from IUU fisheries (European Commission, 2007). Additional measures under these proposed IUU policies include vessels blacklists, trade sanctions, and prohibitions on transshipment at sea, both for EU and non-EU vessels and flag States. These proposals have been put forward by the European Commission as a draft Regulation, which will be considered in June 2008. The EU also plans to encourage the adoption of further strategies to combat IUU fishing and to promote an international strategy against IUU fishing⁴.

⁴ Magnuson-Stevens Fishery Conservation and Management Act. Public Law 94-265 as amended by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (P.L. 109-479).

• **Regional IUU fishing program:** In the Southern African Development Community (SADC) coastal states have initiated a program to address IUU fishing in the region through regional cooperation under the SADC Protocol on Fisheries. The core program components are as follows:

Output 1: Developing the means – through updating knowledge on IUU fishing and associated drivers and exploring the technical and institutional options to take action.

Output 2: Spreading the word – dissemination of information and awareness of IUU fishing issues, impact and solutions.

Output 3: Support to National Plans of Action on IUU – developed and integrated into national policy.

Output 4: Regional policy coherence – created to support actions.

Output 5: A Ministerial Conference and Declaration – to underpin a regional plan against IUU fishing.

These outputs are planned to lead into to a Ministerial Conference and Declaration to be held in 2008 to demonstrate that the countries of Southern Africa are cooperating to combat IUU fishing. The content of the outputs have been crafted based on consultation in the region.

- **Asia-Pacific IUU fishing study:** Asia-Pacific Economic Cooperation (APEC) is funding a Canadian-led study on IUU fishing in the Asia-Pacific region. The purpose of this project is to undertake an assessment of the economic, social and environmental impacts of IUU fishing as well as the challenges and obstacles to implement measures to combat it. While the study is not looking specifically at shark IUU fishing, the issue will be covered by the project, which is expected to be finished by late-2008.
- APEC is funding a US-led project, Improving the Conservation and Management of Sharks in the APEC Region, with the aim of helping APEC economies to build capacity to manage sharks and meet the commitments for conservation measures. Under the auspices of this project, a workshop on the Conservation and Management of Shark Populations in the Eastern Pacific Ocean will be hosted by the IUCN, the US Department of State and the Government of Ecuador, in Ecuador, in July 2008.
- AUSAID has provided funding for a “Study on illegal foreign fishing in waters of mutual interest between Australia and Indonesia”. The project is managed by the Department of Foreign Affairs and Trade and is being conducted by the Australian National Centre for Oceanic Resources and Security (ANCORS) and the Marine Resources Assessment Group Ltd (MRAG). It will examine the nature and extent of the IUU fishing problem, the drivers and impacts of the problem and specifically illegal fish trade. The study will include IUU fishing for sharks and illegal trade in shark products, specifically fins. The project is in its early stages but is expected to be completed in 2008.
- Participants to the Meeting to Identify and Elaborate an Option for International Cooperation on Migratory Sharks under the CMS, 11-13 December 2007, agreed among other things, that the proposed instrument should be global in scope and should focus on whale sharks, basking sharks and white sharks with provision for other species to be added (Earth Negotiations Bulletin, 2007)⁵. A draft CMS Agreement is expected to be available in the first half of 2008.

⁵ Outcomes of the December 2007 meeting can be found at <http://www.cms.int/>.

Main species taken by IUU fishing

The CITES Decision 14.117 directs the Animals Committee of CITES to, where possible, examine and report on the main species of sharks taken by IUU fishing. This report has not been able to identify information that provides clear guidance on those species. However, the information collated here does provide a basis for the Animals Committee's consideration of this issue. Table 2 lists the shark species/groups that have:

- previously been identified by the CITES Animals Committee as “of concern”;
- are known to comprise a significant proportion of trade in shark products (namely fins or meat); or
- have been identified as, or are considered to be, subject to IUU fishing.

In addition, there is evidence that a relatively small number of species make up a large proportion of the market for fins. Clarke, *et al.* (2006a) found that on the world's largest shark fin market, Hong Kong, 34-45% of fins belong to only 14 species. Blue Shark *Prionace glauca* comprises about 17% and other common species in the fin market include hammerhead sharks, shortfin mako sharks *Isurus oxyrinchus*, silky sharks, sandbar sharks *Carcharhinus plumbeus*, bull sharks, *Carcharhinus leuca* and thresher sharks *Alopias* spp..

Trade of IUU catch of shark fins and meat

The CITES Decision 14.117 directs the Animals Committee of CITES to, where possible, examine and report on the relative importance of fins compared to meat in trade arising from IUU fishing. As noted earlier, it is not possible to quantify the proportion of traded shark products that are derived from IUU fishing. Under these circumstances it is clearly not possible to be definitive about the relative contribution of meat and fins to trade of IUU catch of sharks. However, it may be possible to draw some inferences from the information available:

- Shark fin (all forms) accounts for about only 7% of the volume of shark trade, but 40% of the value. Therefore, the per unit value of shark fin is much higher than that of shark meat.
- IUU fishing is focused on high value products in order to justify the risks of detection and prosecution by maximising returns to IUU fishing effort.
- From the available information, IUU fishing for sharks is consistent with a focus on high value products, in this case, shark fins.
- Shark species that are taken predominantly for their meat (for example Spiny Dogfish *Squalus acanthias*, Porbeagle *Lamna nasus*, School Shark *Galeorhinus galeus*) tend to be part of managed (albeit not necessarily well-managed) fisheries in which IUU fishing has not been identified as a serious concern. (For example, the CITES proposals for listing of spiny dogfish and porbeagle in 2007 did not identify IUU fishing as a threat to these species).

Anecdotal evidence (see Appendix 2) suggests that the demand for particular species for sharks fin is not necessarily static. While species such as the blue and silky shark have not traditionally been recognised as high value fin species, the consistency of their supply, largely from tuna fishing operations, has increased their attractiveness on the fin market.

There is also increasing concern that in longline tuna fisheries, shark bycatch is playing a significant role in the economics of fishing operations. In response to increased operating costs, declining catch rates and tighter controls on fishing, the high value of shark fins in particular, but also their meat, makes retention of shark bycatch very attractive to fishers. In many tuna fisheries where sharks are taken as bycatch, legitimate fishers are now required to retain the shark carcass as well as the fins. To the extent that these requirements are being complied with, and the extent to which international markets can be found for the meat, the proportion of fins and meat in trade may also be changing as a result of these measures.

For the same economic reasons IUU operations focused on tuna fishing are also likely to be taking and selling significant quantities of sharks. However, unlike legitimate operations, IUU fishers are unlikely to be complying with requirements to retain the meat, Therefore it could be expected that the proportion of fins and meat from IUU operations might be quite different from those of legitimate fishers.

Table 2: Shark species of concern and species taken in IUU fishing

Species/Group as identified in the reports cited	CITES listed/Animals Committee species of concern	Commonly traded on Hong Kong market	Top 10 international market preferred Australia caught species in fin trade	Fins confiscated from IUU fishers in Australian waters	Species in trade ²			Threat of IUU fishing ³	Species taken in IUU fishing (Literature and media reports)
					Fins	Meat	Other		
Family Alopiidae Thresher Sharks <i>Alopias</i> spp.		✓			✓	✓		✓	
Family Carcharidae Requiem Sharks	✓				✓	✓	✓	✓	
Australian Sharpnose Shark <i>Rhizoprionodon taylori</i>				✓					
Blacktip <i>Carcharhinus</i> spp.			✓						
Blacktip Shark <i>Carcharhinus sorrah</i>				✓					
Blacktip Shark <i>Carcharhinus tilstoni</i>				✓					
Blacktip Shark <i>Carcharhinus limbatus</i>				✓					
Blue shark <i>Prionace glauca</i>		✓	✓					✓	
Bronze whaler (<i>Carcharhinus brachyurus</i> , <i>C. obscurus</i> or <i>C. falciformis</i>)			✓						
Bull shark <i>Carcharhinus leucas</i>		✓		✓					
Dusky Shark <i>Carcharhinus obscurus</i>		✓		✓					
Grey Reef Shark <i>Carcharhinus amblyrhynchos</i>				✓					

Species/Group as identified in the reports cited	CITES listed/Animals Committee species of concern	Commonly traded on Hong Kong market	Top 10 international market preferred Australia caught species in fin trade	Fins confiscated from IUU fishers in Australian waters	Species in trade ²			Threat of IUU fishing ³	Species taken in IUU fishing (Literature and media reports)
					Fins	Meat	Other		
Hardnose Shark <i>Carcharhinus macloiti</i>				✓					
Lemon Shark <i>Negaprion acutidens</i>				✓					
Milk Shark <i>Rhizoprionodon acutus</i>				✓					
Oceanic Whitetip <i>Carcharhinus longimanus</i>		✓	✓						
Pigeye Shark <i>Carcharhinus amboinensis</i>				✓					
Sandbar shark <i>Carcharhinus plumbeus</i>		✓							
Silky Shark <i>Carcharhinus falciformis</i>		✓		✓				✓	
Spinner shark <i>Carcharhinus brevipinna</i>				✓					
Tiger Shark <i>Galeocerdo cuvier</i>		✓	✓	✓					
Whitetip <i>Carcharhinus</i> spp.			✓						
Whitecheek Shark <i>Carcharhinus dussumieri</i>				✓					
Whitetip Reef Shark <i>Triacnodon obesus</i>				✓					
Family Centrophoridae Gulper sharks	✓				✓	✓✓	✓	✓	
Family Lamnidae Mackerel Sharks									
Great White Shark <i>Carcharodon carcharias</i>	Appendix 11				✓		✓	Jaws Teeth	

Species/Group as identified in the reports cited	CITES listed/Animals Committee species of concern	Commonly traded on Hong Kong market	Top 10 international market preferred Australia caught species in fin trade	Fins confiscated from IUU fishers in Australian waters	Species in trade ²			Threat of IUU fishing ³	Species taken in IUU fishing (Literature and media reports)
					Fins	Meat	Other		
Porbeagle Shark <i>Lamna nasus</i>	✓				✓	✓✓		✓	
Shortfin mako <i>Isurus paucus</i>		✓	✓					✓	
Longfin mako <i>Isurus paucus</i>									
Salmon Shark <i>Lamna ditropis</i>									
Family Potamotrygonidae Freshwater stingrays	✓					✓	Aquaria	✓	
Family Pristidae Sawfish	Appendix 1 ¹		✓		✓✓		Rostra	✓✓	
Narrow Sawfish <i>Anoxypristis cuspidate</i>				✓					
Family Rhinobatidae Guitarfishes/shovelnose rays	✓				✓✓	✓		✓	
White-spotted guitarfish <i>Rhynchobatus djiddensis</i>			✓	✓					
Devil rays Family Mobulidae	✓							✓	
Family Sphyrnidae Hammerheads.		✓	✓		✓✓	✓		✓	
Scalloped Hammerhead Shark <i>Sphyrna lewini</i>				✓					
Great Hammerhead <i>Sphyrna mokarran</i>		✓		✓					
Winghead Shark <i>Eusphyrna blochii</i>				✓					
Groups									
Longtail carpet sharks Family Hemiscylliidae						✓	Aquaria	✓✓	

Species/Group as identified in the reports cited	CITES listed/Animals Committee species of concern	Commonly traded on Hong Kong market	Top 10 international market preferred species in fin trade	Fins confiscated from IUU fishers in Australian waters	Species in trade ²			Threat of IUU fishing ³	Species taken in IUU fishing (Literature and media reports)
					Fins	Meat	Other		
Pelagic Sharks					✓✓	✓		✓✓	
Smooth hounds, angel sharks, skates and rays					✓	✓✓		✓	
Species									
Basking Shark <i>Cetorhinus maximus</i>	Appendix 11				✓✓	✓	Liver oil	✓	
Cowtail Stingray <i>Pastinachus sephen</i>				✓					
Grey Nurse Shark <i>Carcharias taurus</i>						✓	Aquaria	✓✓	
Leopard Shark <i>Triakis semifasciata</i>	✓					✓	Aquaria	✓	
Pelagic Stingray <i>Pteroplatytrigon violacea</i>								✓	
Portuguese Dogfish <i>Centroscymnus coelolepis</i>								✓	
School, tope or soupfin shark <i>Galeorhinus galeus</i>	✓				✓	✓✓		✓	
Shark Ray <i>Rhina ancylostoma</i>				✓					
Spiny Dogfish <i>Squalus acanthias</i>	✓				✓	✓✓			
Whale Shark <i>Rhinocodon typus</i>	Appendix 11				✓	✓✓	Liver oil	✓	

Sources: CITES (2008b); Clarke et al. (2006); Rose and McLoughlin (2001); Salini et al. (2007); Vasconcellos in litt. to G. Sant, 3 December 2007.

¹ Except *Pristis microdon* which is listed on Appendix 11

² Where species is traded in both meat and fins two ticks indicates the predominant form.

³ Two ticks suggests a relatively higher IUU threat.

Conclusions

The broad analysis presented in this paper has identified the need to formulate an approach to addressing the current lack of understanding of shark catch and trade and, in particular, to establish a framework within which at least a qualitative and, to the extent possible, quantitative assessment of the impact of IUU fishing on sharks might be made. There is also a need to identify the best ways in which measures can be introduced to allow for the origin of shark products to be traced and to facilitate assessment of whether shark products have been derived from IUU fishing activities.

The following findings of this report may provide useful input to the scheduled 2008 workshops on sharks and ultimately to the Animals Committee's consideration of shark IUU fishing at its 2009 meeting:

- Most shark stocks remain unmanaged.
- Much of the management that does exist, especially on a regional basis, represents itself as 'conservation and management of sharks' but is generic (rather than species-specific); is indirect, operating through controls on finning rather than control on catch or mortality; and is generally poorly enforced.
- The high value of fins relative to meat is clear.
- There are serious deficiencies in the data on catch and trade of sharks including, in particular, under-reporting of catch and trade and a very low proportion of data reported on a species basis.
- As a result, it is not possible to quantify the catch or trade of sharks, or to identify the legal or IUU components of catch or trade.
- The available information confirms that IUU fishing for sharks is occurring and measures are required to minimise the incentives and opportunities for such fishing.
- Given the lack of, or poor management in place in many fisheries in which sharks are taken, there remains scope for unsustainable fishing for sharks to occur that is not considered IUU fishing.
- Concern about the possible impact of IUU fishing on the conservation status of shark species is however, growing. This concern is obvious at both local and international levels. In Australia, there is increasing concern about the very low level of available information about species and quantities of sharks removed from northern Australian waters by illegal foreign fishing, and also about the lack of understanding about the trade in that catch. Significant investment is being made by the Australian Government to improve the level of information available and to find solutions to the problem
- At the international level, concern about the impact of IUU fishing for sharks has been most clearly expressed by the parties to CITES in their 2007 decision that the Animals Committee examine and report on:
 - o linkages between the international trade in shark fins and meat and IUU shark fishing activities, including where possible the main species of sharks taken by IUU fishing; and
 - o the relative importance of fins compared to meat in international trade arising from IUU fishing.

Our understanding of catch and trade in sharks is impeded by ongoing issues with data:

a) Key issues with catch data

- Data on shark catch (landings) are often not collected at all.
- Data on discards of sharks are even less frequently collected.
- Where catch data are collected it is predominantly in generic ‘shark’ categories and species-specific data is lacking.
- There is limited capacity to monitor shark catch in many significant shark catching countries.
- Where shark catch data is collected, it is not always reported to the primary global fisheries data collection facility, the FAO.

b) Key issues with trade data

- Data on shark trade is often not collected at all, largely due to the limited number of shark product categories and, in particular, of species-specific trade codes in place in major trading countries. This situation is linked to the lack of species-specific catch data (if we don’t know what is caught how can we know what is traded?).
- Apart from some trade data collected by some exporting and importing countries for a limited number of species (for example, both the US and the EU record trade in spiny dogfish) and that available on CITES-listed species, there are effectively no species-specific trade data available for sharks. The lack of species-specific trade codes for shark fins is of particular concern.
- There are significant anomalies in the reported global shark fin export and import data and between the trade data and the global reported production data.
- The available trade data for sharks has been shown to substantially understate the catch of sharks (see for example, Clarke, *et al.*, 2006b).

Given the lack of available information, it is impossible at this stage to make an assessment of the impact of IUU fishing on shark species globally. It is proposed that any assessment will, in the first instance, be largely a qualitative assessment informed by whatever catch, management and trade data are available on those species considered to be at highest risk from IUU fishing.

The assessment should provide guidance to those implementing domestic, regional and international management measures on what data collection, monitoring and mitigation measures are required in order to address IUU fishing impacts on high risk shark species in the immediate term but also to provide a sound basis for the ongoing assessment of the nature and extent of the impact of IUU fishing on shark species more generally.

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Media Reports

The following reports can be found at: <http://www.illegal-fishing.info/>.

1. Shark-smuggling pastor catches one year in prison, 21/01/07
2. PNG arrests 33 for allegedly illegally fishing on the border, 27/3/07
3. Vietnamese fisherman arrested by Philippine authorities, 2/4/07
4. Boats with 80 sharks seized near Colombia, 26/04/07
5. Taiwan fishing crew held in New Caledonia, 21/5/07
6. Master of foreign long-liner to face illegal fishing charges, 17/05/07
7. Sea Shepherd Galapagos sting results in seizure of over 18,000 shark fins, 20/06/07
8. Australia promoting seaweed, coral reef cultivation among NTT fishermen, 8/11/07
9. Basking shark found dead in illegal drift net, 11/07/07
10. Asian demand for shark fins threatens Colombian species, 29/7/07
11. Ecuadoran Police confiscate 2 tonnes of shark fins found in fishermen's homes, 3/08/07.
12. Palau charges Taiwanese over illegal shark fishing, 24/08/07
13. Raid in Palau finds Taiwanese fishing company with huge haul of illegal shark fins, 16/09/07
14. Seychelles promises to protect its sharks 13/12/07
15. 30 'finned sharks' washed up on New Zealand beach 10/01/08
16. Philippines raises alarm over shark 'slaughter' 20/03/08
17. NT Fishos blamed for 'shark finning' 09/04/08

Acronyms & Abbreviations

ACIAR	Australian Centre for International Agricultural Research
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AIMS	Australian Institute of Marine Science
ALP	Australian Labor Party
ANCORS	Australian National Centre for Oceanic Resources and Security
APEC	Asia-Pacific Economic Cooperation
AUSAID	Australian Government's Overseas Aid Program
BRUVS	Baited Remote Underwater Video System
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
CoP	Conference of the Parties (to CITES)
CSIRO	Commonwealth Scientific and Industrial Research Organization
DAFF	Department of Agriculture, Fisheries and Forestry (Australia)
DEWHA	Department of the Environment, Water, Heritage and the Arts (Australia)
EEZ	Exclusive Economic Zone
EPBC Act	Environment Protection and Biodiversity Conservation Act, 1999 (Australia)
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
IATTC	Inter-American Tropical Tuna Commission
GFCM	General Fisheries Commission for the Mediterranean
ICCAT	International Commission for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission

IPOA-Sharks	International Plan of Action for the Conservation and Management of Sharks
IPOA-IUU Fishing	International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing
IUU	Illegal, unreported and unregulated (fishing)
MRAG	Marine Resources Assessment Group Ltd
MOU	Memorandum of Understanding
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	Northeast Atlantic Fisheries Commission
NOAA	National Oceanic and Atmospheric Administration (US)
NPOA	National Plan of Action
NPOA-Sharks	National Plan of Action for the Conservation and Management of Sharks
RFMO	Regional Fisheries Management Organization
RPOA	Regional Plan of Action
SADC	Southern African Development Community
SEAFDEC	Southeast Asian Fisheries Development Center
SEAFO	Southeast Atlantic Fisheries Organization
UNCLOS	United Nations Convention on the Law of the Sea of 10 December 1982
UNFSA	United Nations Fish Stocks Agreement
UNGA	United Nations General Assembly
WCPFC	Western and Central Pacific Fisheries Commission

Appendix 1

Shark catch, management and trade

Shark catch

Shark catch results from the following forms of fishing:

- **targeted fishing for sharks** for fins and/or for meat resulting in retention of fins and/or meat but with the possibility of less preferred sharks (on the basis of species or size) being discarded, either dead or alive, and, where fins are the main target, the discard of shark trunks (if permitted); or
- **targeted fishing for other species** that results in an incidental catch of shark which is then either:
 - retained for fins with the trunk discarded (if permitted);
 - retained for fins with the trunk landed (if required or if the meat is of value relative to other catch competing for limited hold capacity); or
 - discarded, dead or alive (Lack and Sant, 2006a).

Target fisheries

Examples of target fisheries for sharks are: the North Atlantic porbeagle *Lamna nasus* fishery; the tope or school shark *Galeorhinus galeus* fisheries off California and Australia; spiny dogfish *Squalus acanthias* fisheries in the North Sea and off British Columbia; and the large coastal shark fishery off the east coast of the United States (Musick and Bonfil, 2004). In the main, these fisheries have developed as shark meat fisheries, although fins are also retained in many cases. All or most of the stocks underlying these fisheries have collapsed or suffered severe depletion owing to lack of, or poor, management.

Bycatch fisheries

Increasingly, shark populations worldwide are threatened by those fisheries where shark is taken as bycatch to directed fishing for more productive, and usually more highly valued, teleost species (Walker, 2004). In these fisheries, the high value of shark fins is one of the key drivers for retention, rather than discard, of sharks. In such fisheries management of shark bycatch has, at best, been very slow to be introduced and in many cases bycatch of shark remains unmanaged.

In addition to those shark fisheries, directed or otherwise, for species that occur wholly within national waters, many species of sharks are considered highly migratory. UNCLOS includes the following species of oceanic sharks in its list of defined highly migratory species:

- bluntnose sixgill shark *Hexanchus griseus*;
- basking shark *Cetorhinus maximus*;
- thresher sharks family alopiidae;
- whale shark *Rhincodon typus*;

- requiem sharks family carcharhinidae;
- hammerhead sharks family sphyrnidae;
- mackerel sharks family isuridae⁶.

As a result, the UNFSA applies directly to management of these species. Thus, parties to the UNFSA, individually and through cooperation in RFMOs, have a responsibility for management of these sharks.

The FAO's Fishstat Capture Production Database (FAO, 2007a) is the most comprehensive compilation of global shark catch data. A summary of reported world catch from 1990-2005 is provided in Table A1.1. Over that period, shark catch (nominal liveweight of landed sharks) has generally trended upwards, peaking in 2003 at 897 000 t, before declining to 758 000 t in 2006.

Trends in reported shark catch are very difficult to interpret since they can reflect changes:

- in stock abundance;
- in fishing practices (for example, in response to changing markets for sharks and other species);
- in the level and or quality of reporting; and/or
- in the way data are recorded.

In addition, the FAO shark catch data is known to under-represent the global catch of sharks since it does not include mortalities incurred through discarding and because of under-reporting of catch. For example, Lack and Sant (2006b) indicate that a number of countries that export shark products are not reporting catch to FAO, and Clarke *et al.* (2006b) have estimated that shark biomass in the fin trade alone is three to four times higher than the total shark catch figures reported to FAO. Other studies, such as that conducted by the Southeast Asian Fisheries Development Center (SEAFDEC), support the concern that there is under-reporting of shark catch at a country level. SEAFDEC found that domestic production levels of shark meat and fins appear to be under-reported in the southeast Asian region, especially in Malaysia and Thailand. The report suggested that this “may be the result of statistical systems which do not differentiate shark products from other fish resources and/or do not count unprocessed shark products such as fresh or frozen meat as production (SEAFDEC, 2006). The usefulness of the FAO data is further limited in that only about 15% of the catch recorded by FAO is on a species basis (Lack and Sant, 2006b).

However, based on the FAO data, about 80% of the annual reported shark catch is taken by 20 countries (see Table A1.2). While the top 20 catching countries varies from year to year, 15 of the top 20 countries in 1990 remained in that list in 2006.

⁶ Family *Isuridae* is now more commonly known as *Lamnidae* (Fowler, 2005)

Table A1.1 Reported shark catch history of top 20 catchers in 2006 (nominal liveweight, t)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indonesia	73 272	76 828	80 159	87 138	92 776	98 098	94 396	95 998	110 788	108 393	113 626	110 311	106 398	117 559	108 944	100 037	98 250
India	51 230	55 925	59 730	76 604	83 689	77 078	132 160	71 991	74 704	76 802	76 057	67 971	66 923	63 771	79 825	61 056	77 821
Taiwan Province of China	75 731	68 632	64 512	56 080	39 457	44 004	41 158	40 089	40 025	42 933	45 923	42 355	44 412	67 432	43 797	45 945	49 375
Argentina	16 687	17 628	19 320	19 364	24 327	25 332	30 163	29 034	33 511	29 485	25 750	31 784	26 251	31 691	32 039	37 161	40 293
Spain	14 163	14 578	9 946	11 572	20 827	24 419	19 062	99 638	67 311	70 800	82 349	77 103	62 996	61 595	51 260	38 630	40 057
Mexico	44 880	41 169	43 267	43 603	42 922	43 470	45 205	35 665	36 532	35 239	35 260	32 718	30 888	34 429	37 540	39 106	39 106
USA	34 576	35 510	54 093	38 074	37 764	37 554	52 043	40 425	44 560	37 559	30 935	22 072	24 076	35 372	30 732	29 793	31 976
Japan	32 103	33 362	38 466	38 539	34 317	31 146	24 206	29 397	33 665	33 034	31 873	27 696	32 879	25 537	23 475	25 930	26 178
Malaysia	17 360	17 161	20 771	20 898	20 889	24 144	24 007	24 765	23 943	25 125	24 521	25 209	24 167	27 948	25 053	25 094	22 240
Thailand	10 950	11 056	7 576	8 312	13 229	15 281	17 753	17 969	16 026	22 397	24 689	24 278	30 208	32 540	27 646	20 745	21 187
Pakistan	40 043	45 098	45 745	46 405	50 177	49 964	51 432	48 429	54 497	54 958	51 170	49 863	49 904	33 248	30 687	22 877	20 127
France	26 310	25 895	24 705	23 064	22 149	21 613	22 447	23 645	21 524	22 941	24 952	25 799	23 136	22 755	21 800	21 477	19 082
Brazil	24 690	23 730	20 500	18 300	15 800	14 881	14 894	14 941	17 269	18 553	21 585	20 406	21 736	20 842	20 041	23 749	18 389
Portugal	26 563	35 675	18 991	18 690	15 733	14 132	13 138	12 577	12 039	11 343	12 783	13 855	14 017	16 999	12 765	15 360	16 934
New Zealand	10 108	9 809	9 617	14 171	12 717	17 766	14 293	22 619	15 840	19 811	17 719	19 796	21 238	18 459	16 647	18 032	16 783
Iran (Islamic Rep. of)	.	.	.	.	.	.	.	15 566	11 661	19 185	12 155	11 635	10 619	15 963	18 318	17 443	15 015
Nigeria	8 402	7 229	8 912	5 849	9 053	6 471	8 388	8 821	13 969	15 373	13 238	14 626	13 449	15 179	13 560	13 882	14 444
Yemen	639	2 749	6 067	6 537	6 455	4 636	4 878	5 100	5 900	6 100	5 080	6 620	8 360	11 220	12 750	13 060	13 060
Venezuela Boliv Rep of	6 762	6 811	7 970	7 849	8 650	9 918	8 791	7 896	6 708	5 260	5 491	4 718	7 619	11 294	11 294	11 294	11 294
Korea, South	15721	21 400	12 250	20 342	17 845	17 938	15 598	15 900	10 305	16 398	15 394	11 130	11 961	12 345	12 265	10 110	10 841
Others	168 810	170 704	184 166	190 079	198 065	194 800	188 730	185 330	185 657	192 024	211 574	212 334	228 883	220 772	206 611	176 676	156 046
Total	699 000	720 949	736 763	751 470	766 841	772 705	822 742	845 795	836 434	863 713	882 124	852 279	860 120	896 950	837 049	767 457	758 498

Source: FAO (2007a).

Table A1.2: Global catch by major catcher, 2006 (nominal weight, t)

Catcher	2006	%
Indonesia	98 250	13.0
India	77 821	10.3
Taiwan Province of China	49 375	6.5
Argentina	40 293	5.3
Spain	40 057	5.3
Mexico	39 106	5.2
USA	31 976	4.2
Japan	26 178	3.5
Malaysia	22 240	2.9
Thailand	21 187	2.8
Pakistan	20 127	2.7
France	19 082	2.5
Brazil	18 389	2.4
Portugal	16 934	2.2
New Zealand	16 783	2.2
Iran (Islamic Rep. of)	15 015	2.0
Nigeria	14 444	1.9
Yemen	13 060	1.7
Venezuela, Boliv Rep of	11 294	1.5
Korea, Republic of	10 841	1.4
Others	156 046	20.6
Global catch	758 498	

Source: FAO (2007a)

Management of sharks

The International Plan of Action

The IPOA-Sharks (FAO, 2000) was developed in response to growing concern for shark species and established principles for effective monitoring and management of sharks. Implementation of the IPOA is voluntary and its uptake to date has been poor.

In 2007, the FAO reported that more than half its members had conducted an assessment to determine whether a NPOA-Sharks was needed, however only one-third of those had developed and implemented an NPOA (FAO Committee on Fisheries, 2007). This means that fewer than 20% of FAO members have developed and implemented the IPOA-Sharks. Only seven of the top 20 catching countries are known to have implemented an NPOA-Sharks (see Table A1.3) and the quality of these plans is variable (IUCN Species Survival Commission's Shark Specialist Group and TRAFFIC, 2002).

Table A1.3: Development of NPOA-Sharks by the top 20 catching countries

Rank/Country	NPOA-Sharks
1. Indonesia	Drafting began in 2004 but is yet to be finalized.
2. India	No (Under development as at October 2004)
3. Taiwan	Yes
4. Argentina	No (Under development as at October 2004)
5. Spain	No (European Union (EU) plan under development ⁷)
6. Mexico	Yes (United Nations General Assembly (UNGA), 2007a)
7. USA	Yes
8. Japan	Yes
9. Malaysia	Yes (UNGA, 2007a)
10. Thailand	Yes (UNGA, 2007a)
11. Pakistan	No (Under development as at October 2004)
12. France	No (EU plan under development)
13. Brazil	No (Under Development as at October 2004)
14. Portugal	No (EU plan under development)
15. New Zealand	No. Plan released for public consultation October 2007.
16. Iran, Islamic Rep. of	Unknown
17. Nigeria	No (As at October 2004)
18. Yemen	Unknown
19. Venezuela	Unknown
20. South Korea	No (in development as at July 2007)

Sources: UNGA (2005); UNGA (2007a); Commission for the Conservation of Southern Bluefin Tuna (CCSBT) (2006); CITES (2004); SEAFDEC (2006); Indian Ocean Tuna Commission (IOTC) (2006).

⁷ In September 2006 the European Parliament called on the European Commission to present to the Parliament by 30 June 2007 a Community Plan of Action for the conservation of sharks. The Commission released a Consultation Paper on its Community Plan of Action in December 2007.

Domestic management

In 2005, 127 countries/entities reported shark catch to the FAO. The general consensus of the literature is that a relatively low proportion of these have shark management in place. Some countries, such as Australia, Canada, the USA, New Zealand, Japan and the United Kingdom have management measures in place for target shark fisheries (WildAid, 2007).

An increasing number of countries have implemented controls on shark finning. Those countries include: American Samoa, Australia, Brazil, Canada, Colombia, Costa Rica, Ecuador, members of the EU, Mexico, Nicaragua, Palau, South Africa and the USA (Watts and Wu, 2005; WildAid, 2007).

Globally, the level of effective management of domestic shark fisheries, particularly those in which shark is taken as bycatch, is very low. More than half the top 20 catching countries identified in Table A1 have no known management measures in place for shark species.

Regional management

The IPOA-Sharks proposes that RFMOs establish regional plans of action where required, however no RFMO has done so. A number of RFMOs have introduced measures to address some aspects of shark fishing. These measures have been reviewed by Lack and Sant (2006a), but in summary:

- Finning regulations are in place in the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tunas (ICCAT), the IOTC, the Northwest Atlantic Fisheries Organisation (NAFO), the General Fisheries Commission of the Mediterranean (GFCM), the Northeast Atlantic Fisheries Commission (NEAFC), the Southeast Atlantic Fisheries Organisation (SEAFO) and the Western and Central Pacific Fisheries Commission (WCPFC).
- The report of the 2007 meeting of the IOTC Working Party on Ecosystems and Bycatch identified a number of inadequacies associated with the IOTC Resolution on conservation of sharks, including its failure to require the collection of data, its failure to clearly signal the expectation of comprehensive assessment of sharks; its failure to ensure that sharks are not finned and its lack of clarity regarding the weight, the fins and the cutting techniques referred to in the application of the fin ratio (IOTC, 2007). The deficiencies identified by the IOTC Working Party generally apply to the shark finning resolutions in place in other RFMOs.
- Several RFMOs have agreed to resolutions encouraging data collection, research and the development of bycatch mitigation measures for sharks, but these are not mandatory.
- The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) has prohibited the targeting of sharks in CCAMLR waters.
- NAFO has imposed quota limits for thorny skate *Amblyraja radiata*
- NEAFC has introduced limits on deep-sea fishing effort which may reduce the bycatch of deep-sea shark species and has introduced an interim conservation measure which prohibits directed fishing for basking shark in 2006 and 2007.
- ICCAT adopted a binding recommendation in 2005 calling for a reduction in fishing mortality of North Atlantic shortfin mako shark *Isurus oxyrinchus*, and in 2007 the members of ICCAT agreed to reduce fishing on shortfin mako shark and porbeagle shark (Shark Alliance, 2007).
- There are no shark management measures in place in the CCSBT, and there remains uncertainty as to whether the CCSBT Convention provides for binding conservation and management measures to be implemented for non-target species such as sharks (CCSBT, 2007).

A number of other regional agreements also apply to conservation and management of sharks:

- The Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean lists great white and basking shark and giant devil ray *Mobula mobular* in Annex II as endangered threatened species and lists shortfin mako, porbeagle, blue shark *Prionace glauca*, angel shark *Squatina squatina* and white skate *Rostroraja alba* in Annex III as species whose exploitation is regulated. Similar listings are in place under the Convention on Conservation of European Wildlife and Natural Habitats (the Bern Convention).
- Under the Pacific Corridor Declaration of 2002, Costa Rica, Panama, Ecuador and Colombia have agreed to conserve and sustain an area of 211m ha encompassing the protected areas of the four participating countries (the area contains a number of endemic marine and terrestrial species). Sharks are one group of species considered to be a potential beneficiary of the Corridor. Most of the shark species taken throughout the Corridor are classified as highly migratory (Watts and Wu, 2005). However, as demonstrated later in this paper, these countries have had difficulty enforcing prohibitions on fishing in marine protected areas.

International Measures

International conventions also provide mechanisms for initiatives to be taken on a global level for the conservation and management of sharks. In particular, CITES and the CMS have included certain species of sharks in their Appendices. Species listed in Appendix I of CITES are considered to be threatened with extinction, and listing essentially prohibits international trade in that species. An Appendix II listing relates to species that are potentially threatened with extinction unless trade is strictly controlled. Basking shark, whale shark and great white shark are listed in Appendix II of CITES⁸. In June 2007, sawfish *Pristidae* spp. were listed in Appendix I of CITES, except for freshwater sawfish *Pristis microdon*, which was listed in Appendix II. In relation to the listing of freshwater sawfish, the CITES listing has been annotated as follows: “for the exclusive purpose of allowing international trade in live animals to appropriate and acceptable aquaria for primarily conservation purposes” (CITES, 2008c). In 2007 proposals to list two additional shark species, porbeagle and spiny dogfish, on Appendix II of CITES were unsuccessful.

A CMS listing is intended to promote the development of either legally binding ‘agreements’ or ‘memoranda of understanding’ (Fordham, 2006). Migratory species that have been categorised as being in danger of extinction throughout all or a significant proportion of their range are listed on Appendix I of the Convention, whereas those that have an unfavorable conservation status or would benefit significantly from international cooperation organised by tailored agreements are listed in Appendix II (CMS, 2007a). Basking shark and great white shark are registered in both Appendix I and Appendix II of the CMS and whale shark is listed on Appendix II⁹.

In 2005 the CMS adopted a resolution on migratory sharks that urges its Parties to strengthen measures to protect migratory shark species, promotes the implementation of the IPOA-Sharks and calls upon its Parties to develop a global migratory shark conservation instrument. Participants to the *Meeting to Identify and Elaborate an Option for International Cooperation on Migratory Sharks* under the CMS, 11-13 December 2007, agreed, that the proposed instrument should be global in scope and it should focus on whale shark, basking shark and white shark with provision for other species to be added (CMS, 2007b).

⁸ Iceland, Indonesia and Norway have taken out a reservation on the listing of basking shark, great white shark and whale shark. While Indonesia and the Republic of Korea have taken out a reservation on the listing of whale shark and basking shark and Palau has taken out a reservation on the listing of whale shark and great white shark. This means that these CITES Parties are treated as non-parties for the purposes of the listing.

⁹ Norway has taken out a reservation in relation to the Appendix I and II listings of the great white shark and the basking shark. Denmark has taken out a reservation in respect of the Appendix I and II listings of the basking shark in the Faeroe Islands and the EU has taken out a reservation in relation to the Appendix I listing of the basking shark.

In 2006 and 2007 the UN General Assembly passed resolutions¹⁰ calling, among other things, for States, individually or through RFMOs:

- to urgently implement the IPOA-Sharks “for directed and non-directed shark fisheries, based on the best available scientific information, through, inter alia, limits on catch or fishing effort, by requiring that vessels flying their flag collect and regularly report data on shark catches, including species-specific data, discards and landings, undertaking, including through international cooperation, comprehensive stock assessments of sharks, reducing shark by-catch and by-catch mortality, and, where scientific information is uncertain or inadequate, not increasing fishing effort in directed shark fisheries until measures have been established to ensure the long-term conservation, management and sustainable use of shark stocks and to prevent further declines of vulnerable or threatened shark stocks”; and
- “to take immediate and concerted action to improve the implementation of and compliance with existing RFMO and national measures that regulate shark fisheries, in particular those measures which prohibit or restrict fisheries conducted solely for the purpose of harvesting shark fins, and, where necessary, to consider taking other measures, as appropriate, such as requiring that all sharks be landed with each fin naturally attached” (UNGA, 2007b).

Trade of shark products

Sharks are landed and sold in domestic markets and contribute to subsistence requirements in some coastal communities. However, international demand for shark meat, and particularly shark fins, is the driving force behind most shark landings. The high prices for some shark meat, for example spiny dogfish and porbeagle, as well as the premium prices paid for shark fins has prompted the increased targeting of some shark species and the increased retention of sharks taken as bycatch (see, for example, Williams, 2007; Lack, 2006; Anon., 2006).

The FAO’s *Commodities Production and Trade 1976-2005* database (FAO, 2007b) is the most comprehensive compilation of trade in shark products. The following discussion is based on those data¹¹. Exports of shark products from 1990 to 2005 are shown in Table A1.4. Trends in the top 10 exporters and importers over the period are shown in Tables A1.5 and A1.6.

¹⁰ UNGA Resolutions A/RES/61/105 and A/RES/62/177.

¹¹ The FAO’s Trade database has been shown to suffer from a number of deficiencies. A discussion of the issues associated with the data is contained in Lack and Sant (2006b).

Table A1.4 Reported global exports of shark products, 1990-2005 (t, product weight)

Product	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fresh, Chilled (exc. Fillets)																
Sharks, fresh or chilled	7609	7428	7953	10578	13195	7556	8617	7232	10077	8514	11499	15620	14942	18242	12482	13537
Dogfish (Squalidae), fresh or chilled	10424	11034	8573	11089	7240	10421	9736	8072	6394	8142	9734	3864	3788	3784	7418	3916
Skates, fresh or chilled	39	40	155	295	440	830	925	927	761	685	1000	961	713	818	878	536
Sharks, rays, skates, fresh or chilled, nei	252	1563	2827	1356	1128	517	296	602	497	573	926	744	33	89	133	341
Sub-total	18324	20065	19508	23318	22003	19324	19574	16833	17729	17914	23159	21189	19476	22933	20911	18330
Frozen (exc. Fillets)																
Sharks, frozen	12386	16526	19938	23950	20516	25406	20457	29911	34176	31163	39031	43948	39635	40490	46470	52958
Skates, frozen	338	490	383	344	326	275	314	324	163	347	240	268	79	208	151	261
Sharks, rays, chimaeras nei, frozen	909	910	157	1	1	3	0	0	0	21	28	119	112	5380	3171	2839
Dogfish (Squalidae), frozen	1715	4408	1962	2395	4086	9868	9584	5869	4186	5486	5567	4358	4737	3419	2095	3612
Sub-total	15348	22334	22440	26690	24929	35552	30355	36104	38525	37017	44866	48693	44563	49497	51887	59670
Fresh, chilled, fillets																
Shark fillets, fresh or chilled	6	37	66	61	28	19	7	59	29	22	9	29	12	15	32	33
Sharks, rays, chimaeras, nei fillets fresh or chilled	2	0	0	0	0	0	1	0	0	1	1	1	0	1	1	4
Sub-total	8	37	66	61	28	19	8	59	29	23	10	30	12	16	33	37
Frozen fillets																
Shark fillets, frozen	3961	3425	3374	2957	2816	2282	2708	2713	3164	3841	3514	3441	3809	3627	4283	5003
Dogfish (Squalidae) and catshark fillets, frozen	0	6	0	1	47	69	4	8	67	2	2	0	37	0	0	0
Sharks, rays, chimaeras, skates, nei fillets frozen	132	300	1160	839	572	750	641	2071	5384	1589	681	2930	3915	3524	4353	5060
Sub-total	4093	3731	4534	3797	3435	3101	3353	4792	8615	5432	4197	6371	7761	7151	8636	10063

Product	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fins																
Shark fins, dried, salted, etc.	2960	1654	3089	3213	3285	2166	3985	3174	3253	3147	3240	2767	3229	3429	4216	2788
Shark fins, dried, unsalted	1099	1069	988	991	1126	1070	1527	1312	1013	1529	2266	1761	2122	2634	2001	2619
Shark fins, frozen	394	165	75	95	2	5	241	299	223	429	1027	664	661	901	786	553
Shark fins, salted and in brine but not dried or smoked	209	135	185	212	164	373	50	64	22	1	2	1	9	0	0	28
Sub-total	4662	3023	4337	4511	4577	3614	5803	4849	4511	5106	6535	5193	6021	6964	7003	5988
Other																
Sharks, rays, etc., dried, salted or in brine	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0
Sharks, dried, salted or in brine	1	17	1	0	0	0	0	5	782	465	170	442	485	480	424	404
Shark oil	7	0	12	5	14	113	89	132	69	55	56	47	57	42	48	50
Shark liver oil	22	214	222	108	52	16	11	5	0	0	0	0	90	51	33	0
Sub-total	30	231	235	113	66	129	100	142	895	520	226	489	632	573	505	454
TOTAL	42465	49421	51120	58490	55038	61739	59193	62779	70304	66012	78993	81965	78465	87134	88975	94542

Source: FAO (2007b).

Table A1.5: Top 10 Shark product exporters (by tonnage)

1990		2003		2005	
Exporter	%	Exporter	%	Exporter	%
1. Norway	15.91	1. Taiwan	20.47	1. Taiwan	21.38
2. UK	11.88	2. Spain	13.36	2. Spain	14.85
3. Japan	10.80	3. Costa Rica	6.7	3. Japan	5.82
4. Canada	7.36	4. Chile	6.29	4. Panama	5.76
5. USA	7.19	5. UK	5.44	5. Costa Rica	5.40
6. Taiwan	6.11	6. Japan	4.98	6. New Zealand	4.06
7. Germany	5.96	7. Canada	4.85	7. UK	3.98
8. New Zealand	4.62	8. Panama	4.40	8. Canada	3.38
9. Denmark	3.99	9. New Zealand	4.04	9. Chile	3.27
10. Chile	3.83	10. USA	4.04	10. Indonesia	2.92

Source: FAO (2007b).

Table A1.6: Top 10 Shark product importers (by tonnage)

1990		2003		2005	
Importer	%	Importer	%	Importer	%
1. Italy	24.38	1. Spain	15.10	1. South Korea	19.29
2. France	17.38	2. South Korea	14.53	2. Spain	13.53
3. Germany	8.22	3. China, Hong Kong	11.57	3. Italy	10.64
4. Denmark	8.20	4. Mexico	10.10	4. China, Hong Kong	8.63
5. China, Hong Kong	7.59	5. Italy	8.81	5. Brazil	8.56
6. UK	6.14	6. China	7.96	6. China	7.28
7. USA	5.83	7. Brazil	5.13	7. Mexico	6.66
8. Spain	4.57	8. France	4.34	8. France	2.79
9. Japan	4.29	9. UK	2.02	9. Portugal	2.00
10. Greece	3.46	10. Singapore	1.92	10. Singapore	1.62

Source: FAO (2007b).

Total export tonnage (net product weight) more than doubled (122%) between 1990 and 2005, peaking at 94 542 t in 2005. Reported imports in the same year were 120 000 t. The FAO data for that period show that:

- frozen shark products (exc. fillets) increased from 36% to 65% of total exports by volume;
- shark, fresh/chilled (exc. fillets) fell from 43% to 19% of total exports by volume;
- exports of fresh/chilled dogfish (*Squalidae*) (exc. fillets) declined from a peak of 11 000 t in 1993 to just under 4000 t in 2005 and frozen dogfish (exc. fillets) declined from a peak of nearly 10 000 t in 1995 to 3600 t in 2005;
- exports of frozen fillets increased from 4000 t in 1990 to 10 000 t in 2005;
- the proportion of shark fin in total export volume declined from 11% in 1990 to 6% in 2005, however, total exports of fins trended upwards over the period, peaking at 7000 t in 2004 before falling back to around 6000 t in 2005¹²;
- Taiwan's share of shark product exports by volume increased from 6% to 21% between 1990 and 2005, making it the leading exporter in 2005;
- Spain was the other major exporter in 2005 accounting for 15% of exports, with Japan, Panama and Costa Rica each accounting for more than 5%; and
- in 2005, the Republic of Korea (South Korea) was the major importer of shark products, accounting for nearly 20% by volume. China, including Hong Kong, accounted for 16% and Spain and Italy accounted for 14% and 11% respectively. Brazil and Mexico are also significant importers accounting for nearly 9% and 7% respectively.

There are significant differences between the contribution of various shark product categories to the volume of trade and the value of that trade. Over the period 2000 to 2005 the reported export value of shark products ranged from US\$237 m in 2002 to US\$310 m in 2005. Over that period shark fin (all forms) accounted for 40% of the reported export value, shark meat (fresh/chilled/frozen) for a further 40% and dogfish for a further 9%. However in the same period shark fin accounted for only 7% of the volume of trade, shark meat 80% and dogfish 11%. The high value of fins relative to meat is clear.

While fin size and quality are key determinants of the price of shark fin, anecdotal advice suggests that continuity and consistency of supply are also key factors. At a meeting between IUCN, TRAFFIC and the fin traders association from Hong Kong in 2002, fin traders indicated that their main concern was for consistent supply of fin product rather than necessarily only those high value fin species, supply of which had become less consistent (Glenn Sant, pers. comm. December 2007). This may have implications for demand for species, such as blue shark and silky shark, which are caught in large numbers in tuna longlining operations. While these may not have traditionally been regarded as high quality fin species, the consistency of supply from tuna operations could be increasing their attractiveness to the fin market.

The main importers of shark products in recent years according to the FAO import data are summarised in Table A1.7. The major markets for shark meat are in Europe, particularly for dogfish, with the major importers of fins being China (including Hong Kong and Macao), Malaysia, Indonesia, Thailand and Taiwan.

¹² It is known that during this period, China changed its Customs coding system, resulting in frozen shark fin imports being combined with frozen shark meat (CITES, 2007b).

Table A1.7: Major importers of key shark products, 2000-2005

Fresh/chilled Shark Meat (not fillets)	Frozen Shark Meat (not fillets)	Fresh/chilled and Frozen Shark Fillets	Fresh/chilled Dogfish	Frozen Dogfish	Fins, dried salted	Fins, other
Spain	Spain	Italy	Denmark	France	China, Hong Kong	China, Hong Kong
US	Italy	Spain	Italy	Italy	China	Indonesia
Italy	Mexico	France	France	UK	China,	Taiwan
Mexico	Brazil	Germany	UK	Spain	Macao	
UK	China	Greece	USA	Germany	Malaysia	
France	South Korea		Spain	Greece	Thailand	
China	Portugal					
Canada	Singapore					
Australia	Greece					
	Japan					

Source: FAO (2007b).

The available trade data for sharks provide virtually no information on trade by species. A limited number of countries have introduced trade codes for a limited number of key species. In particular, there are no species-specific data on fin trade. This reflects in part the difficulty in identifying the species from which fins are derived, once they have been separated from the shark trunk. However, genetic-based techniques are increasingly being used successfully to identify the species origin of fins in trade.

The FAO trade data reflects only those generic categories listed in Table A1.4. In addition, care should be taken when interpreting trade data and with comparing it to catch data, since the trade in shark products, especially fins, is quite complex, and the exporting country, may for example, not reflect the source of catch. Similarly, imports may reflect product imported for processing and re-export rather than for domestic consumption.

For some fish products it is possible to assess the extent of IUU fishing through a comparison of catch and trade (see Willock (2004) for an overview of this technique and Lack and Sant (2001) for an example of its application). However, such analyses require, among other things, that there are rigorous processes in place for catch reporting from legitimate fishing operations together with reliable and species specific trade data. Currently, these pre-requisites are met for very few, if any, shark species.

Appendix 2 Instances and estimates of IUU shark fishing¹³

Waters	Laws, Regulations, Measures contravened	Nationality /Flag State of IUU fisher or vessel	Species taken	Method of fishing	Quantity/Value estimate	Sources
Atlantic/Mediterranean						
Mediterranean	EU Ban on driftnet fishing in EU waters (EU Council Reg. 1239) ICCAT ban on driftnets for large pelagics in the Mediterranean (Rec. 2003-04) GFCM ban on use of driftnets in the Mediterranean Algerian ban on driftnetting	Italy France Morocco Turkey Algeria	Blue Shark <i>Prionace glauca</i> ; Thresher Shark <i>Alopias vulpinus</i> ; Shortfin Mako <i>Isurus paucus</i> ; Porbeagle shark <i>Lamna nasus</i> ; Requiem Shark <i>Carcharhinus spp.</i> ; Basking Shark <i>Cetorhinus maximus</i> ; Hammerhead Shark <i>Sphyrna spp.</i> ; Devil Ray <i>Mobula mobular</i> ; Pelagic Stingray <i>Pteroplatytrigon violacea</i>	Driftnet		Oceana (2006 and 2007) Environmental Justice Foundation (2007)
International waters of the Atlantic Ocean			Leafscale Gulper Shark <i>Centrophorus squamosus</i> ; Portuguese dogfish <i>Centroscymnus coelepis</i>			ICES Working Group on Elasmobranch Fisheries (2007)
Atlantic Ocean (Irish Waters)	EU Ban on Driftnet Fishing		Basking Shark	Driftnet	1 Basking Shark	Media Report (9)
South/Central America						
Colombia (Malpelo marine sanctuary)	Illegal fishing in a protected sanctuary	Colombia	Sharks including hammerheads, silkies, oceanics, white fins, black fins, fox shark and reef shark		Nearly 80 shark (Approx. 2 t of shark meat)	Media report (4 and 10)
Colombia	Unauthorized fishing	Ecuador	Sharks (finning)			Watts and Wu (2005)
Colombia (Malpelo and Gorgona reserves)	Finning banned in the reserves	Local and foreign	Silky sharks	Gillnets		Watts and Wu (2005)

¹³ In many cases the cited sources do not specify the year to which the instances or estimates of IUU fishing relate.

Waters	Laws, Regulations, Measures contravened	Nationality /Flag State of IUU fisher or vessel	Species taken	Method of fishing	Quantity/Value estimate	Sources
Costa Rica (Cocos Island Marine Reserve)	Fishing banned within 12 miles of the Island	Local and foreign (including Ecuador and Colombia)	Mainly great hammerheads and silky sharks (finned and discarded)			Watts (2003) WildAid (2007)
Costa Rica	Unauthorized fishing in national waters	Taiwan	Shark			Watts (2003)
Costa Rica	Illegal to land fins without corresponding carcasses	Foreign vessels	Shark			Watts (2003)
Ecuador	Ban on sale of shark fins (recently relaxed to allow the sale of fins from shark taken as bycatch)	Ecuador	Shark		2 t of fins confiscated in one raid	Media Report (11)
Ecuador (Galapagos Islands)	UNESCO World Heritage site Sharks protected Prohibition on the export of shark fins since 2004	Local boats Foreign boats, mainly from Costa Rica and Colombia	Shark (for fins)		Estimated volume of dried shark fin from the Island of Isabela, is 1500kg/month representing approx. 3000 sharks	WildAid (2007) Watts and Wu (2005)
Ecuador	Illegal exportation and commercialization of shark fins		Shark	Longline	18 673 shark fins, roughly equivalent to 4500 sharks with a street value of USD140 000	Media Report (7)
Guatemala	Unauthorized fishing	Costa Rica	Shark	Longlining		WildAid (2007)
Nicaragua	Unauthorized fishing	Costa Rica	Shark	Longlining		WildAid (2007)
Panama (Coiba National Park)	Illegal fishing	Local and Costa Rica	Shark	Longlines and gillnets		WildAid (2007)
Mexico	National marine reserve legislation		Shark (most finned and discarded)	Driftnetting	2000-4000 sharks	Watts (2003)

Waters	Laws, Regulations, Measures contravened	Nationality /Flag State of IUU fisher or vessel	Species taken	Method of fishing	Quantity/Value estimate	Sources
Africa						
Kenya			Shark		392 t/year US\$0.9m/year	MRAG (2005a) MRAG (2005b)
Mozambique	Fishing in artisanal waters; fishing inside the closed season; using unauthorized gear	Foreign	Includes Giant Guitarfish <i>Rhynchobatus djiddensis</i>	Longlines and gillnets		Anon. (2007a) MRAG (2005a)
Mozambique (Pomene Reserve)	Fishing in declared reserve		Shark		20 sharks per day for fins for export	Anon. (2007b)
Mozambique	Unauthorized fishing	China,	Shark	Longlines		Peterson (2003)
(Bazaruto Archipelago National Park)	Fishing in a prohibited area	Korea or Taiwan				
Seychelles	Illegal take of fins	Taiwan	Shark		169 t/year US\$0.1m/year	MRAG (2005a) MRAG (2005b)
Seychelles			Shark		650kg dried shark fins on board (only 15kg identified as taken in Seychelloise waters)	Media Report (14)
South Africa	False declaration of catch (underreporting)	Taiwan	Shark		8t of shark fins valued at 4m Rand	Watts (2003)
North America						
United States	Taking undersized fish	United States	Leopard sharks		465 sharks	Media report (1) Rogers (2007)
United States	Unauthorized fishing in national waters	Mexico	Shark			
USA (off Texas)		Mexico	Shark (mostly blacktips and hammerheads) and red snapper	Gillnet and longline	Estimated annual take of 9500-28 000 sharks (30-380 t)	Brewster-Geisz and Eytcheson (2005)

Waters	Laws, Regulations, Measures contravened	Nationality /Flag State of IUU fisher or vessel	Species taken	Method of fishing	Quantity/Value estimate	Sources
Western and Central Pacific						
Australia	Illegal fishing	Taiwan	Shark, tuna, swordfish, marlin	Longline	44 t of shark	Media Report (5)
Australia	Illegal fishing	Indonesia	Shark/Stingray/teleosts		320 shark trunks, 100kg shark fin, 10 stingrays and 20 stingray tails.	AFMA (2008)
Australia (see case study)	Unauthorized fishing in national waters	Mainly Indonesia	Shark	Mainly gillnets		MRAG (2005b) Watts (2003)
Australia	Illegal fishing: Removal of fins and return of live shark to the water	Australian (likely)	Reef shark		1 shark	Media report (17)
Guam	Foreign fishing companies in contravention of US Shark finning regulations	Shark			2t of fins	Watts (2003)
Guam/USA	Illegal offloading of shark fins	Japan	Shark			MRAG (2005b)
Marshall Islands	Conditions of access agreement		Reef sharks	Line		Watts (2003)
New Caledonia	Illegal fishing	Taiwan	Shark, tuna, squid		6 t of shark (including fins)	Media Report (6)
New Zealand	Illegal fishing: Removal of fins and return of live shark to the water		Sand sharks		30 sharks	Media Report (15)
Palau	Shark fishing, mutilating sharks, use of steel leaders, maintaining an erroneous fishing log, fishing without a permit, failing to operate the VMS	Taiwan	Sharks		94 shark carcasses 11 shark heads 650 shark fins	Media Report (12)

Waters	Laws, Regulations, Measures contravened	Nationality /Flag State of IUU fisher or vessel	Species taken	Method of fishing	Quantity/Value estimate	Sources
Palau		Taiwanese fishing company	shark		455 kg of shark fins	Media Report (13)
Papua New Guinea	National Shark Fishery Management Plan (Unreported fishing) Unauthorized fishing	Nationals Indonesian	Shark	Longlines Trawling, netting and line fishing	Unreported catch by licensed longliners est. at 2490 t/year Illegal catch est. to be up to 6490 t /year; Estimated value of US\$2.4 m/year	MRAG (2005a) MRAG (2005b)
Papua New Guinea (Western Province)	Illegal fishing	Indonesia	Shark fin		200 kg of fins dumped for health reasons	Media report (2)
Philippines	Illegal fishing Violation of an endangered species law 10 fishers arrested	Vietnamese	Shark		200 kg of dried shark meat	Media report (3)
Philippines	Fishing in a protected area	Philippines	Thresher shark			Media Report (16)
Thailand	In possession of shark fin	Taiwan	Shark		157 fins confiscated	Watts (2003)
Tonga	Conditions of access tuna authorization		Shark			MRAG (2005b)
Western and Central Pacific			Reef-associated sharks	Longline		Swan (2004)
Global						
Global High Seas			Shark	Pelagic longline and gillnets	US\$192 m/year	MRAG (2005a)

Appendix 3 Case Study: IUU fishing for sharks in Australian waters

The northern border of Australia's Exclusive Economic Zone (EEZ) abuts the waters of Indonesia, Papua New Guinea and East Timor. The extent to which fish stocks are shared across these waters remains unclear. However stocks of red snappers *Lutjanus malabaricus* and *L. erythropterus* and migratory species of tunas and sharks are known to be shared (Williams, 2007). Australian and Indonesian scientists have recently compiled all available information on species of sharks and rays, and data on fishing catches and effort, in the Java and Arafura Seas.

Illegal fishing, particularly by Indonesian fishers, but also by small numbers of Taiwanese and Papua New Guinea vessels (AFMA, 2007a) has been a problem in northern Australian waters for many years. A Memorandum of Understanding (MOU) between the governments of Australia and Indonesia allows Indonesian fishers, using traditional fishing methods, access to certain waters in the AFZ known as the MOU Box. However illegal fishing occurs both within, using non-traditional methods, and outside the Box. Illegal Indonesian fishers use a variety of motorised vessels that originate from various ports along the southeastern arc of the Indonesian archipelago from the Island of Roti to Irian Jaya (Fox, 2007). The illegal fishing problem escalated in the early part of the current decade driven by:

- the depleted state of marine resources in Indonesian waters due to overfishing by Indonesian vessels, authorised foreign vessels and IUU fishing by foreign vessels;
- the poor range of alternative employment opportunities for fishers in many parts of Indonesia;
- the longstanding fishing history of some Indonesian fishers in waters that are now part of the AFZ (see for example, Stacey, 2007a);
- the high returns from illegal fishing in comparison to those available to most local villagers in eastern Indonesia; and in particular,
- the high prices for shark fin (see Table A3.1) (Stacey, 2007b; AFMA, 2007a).

Table A3.1: Price of shark fin, Roti/Kupang, 2005

	Indonesian Rp/kg	\$AU\$/kg
Class 1 (Size > 60 cm)	1 200 000	171.00
Class 1I (Size 40-60 cm)	800 000	114.00
Class II1 (Size 40 cm)	200 000	29.00
Base (of Shark Tail)	65 000	9.00

Source: Fox (2005) cited in Australian Labor Party (ALP) (2006).

Small (10-15m long), wooden-hulled vessels from Indonesia make up 97% of illegal fishing vessels in Australian waters (Norwood, 2008a). Illegal Indonesian fishers take a variety of finfish species as well as crayfish, dolphins, turtles and shark species (AFMA, *in litt.* to TRAFFIC, 2007). It is clear, however, that illegal foreign fishers have a specific interest in shark products. For example, in 2005, the Senate Rural and Regional Affairs and Transport Legislation Committee was advised that: “A total of 201 Indonesian foreign fishing vessels have been observed and apprehended in the Australian Fishing Zone to 30 October 2005. A further 249 were subject to forfeiture of catch and/or gear. A total of 217 of these vessels were found to be in possession of shark or shark fin. The species of shark is undetermined. Identification of shark by species is difficult and further complicated as most Illegal, Unreported and Unregulated (IUU) shark catch consists of the fin only” (Commonwealth of Australia, 2005).

In relation to IUU shark fishing by Indonesian vessels, AFMA's Regional Director of Foreign Compliance Operations, Peter Venslovas, commented that:

“There’s not much storage space on these smaller boats, so with the sharks in particular, they keep only the parts of the sharks worth the most – the shark fin. Essentially, they catch the sharks, de-fin them, throw the body back in the water and dry the fins. There are up to 12 fins on a shark, but the dorsal fin is the largest and has the most value. They can get up to \$100/kg for dried shark fin and we’ve apprehended boats with up to 30kg of fins on board. The sheer number of these small fishing boats means that collectively, they can devastate shark populations very quickly.” (Norwood, 2008)

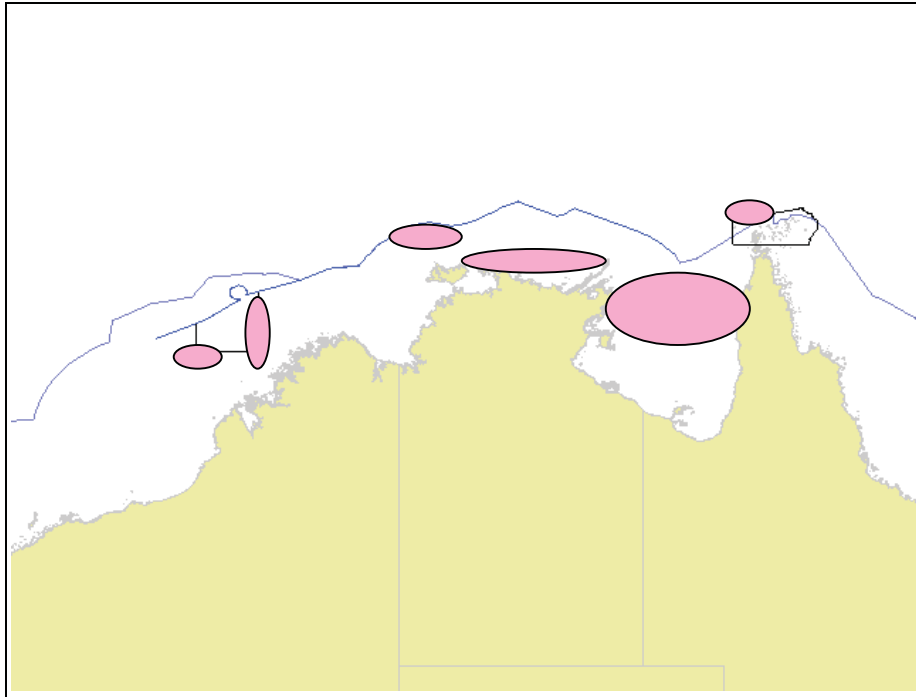
Illegal Indonesian fishers tend to use both longlines and gillnets to target sharks. Both methods are used in the areas in and around the MOU Box but data from the early 1990s suggested gillnets were the predominant fishing method used to catch sharks illegally in waters west of Darwin to Cape York (Rose and McLoughlin, 2001).

Most of the sightings and apprehensions of illegal fishers have occurred in waters north of around 18°S in waters between around 115°W and 142°W (see Figure A3.1). The impact of this illegal fishing on shark populations in Australian waters will depend on the composition and extent of the catch and the relative vulnerability of the species taken.

Figure A3.1. Location of apprehensions of illegal shark vessels, 2004-30 June 2007.

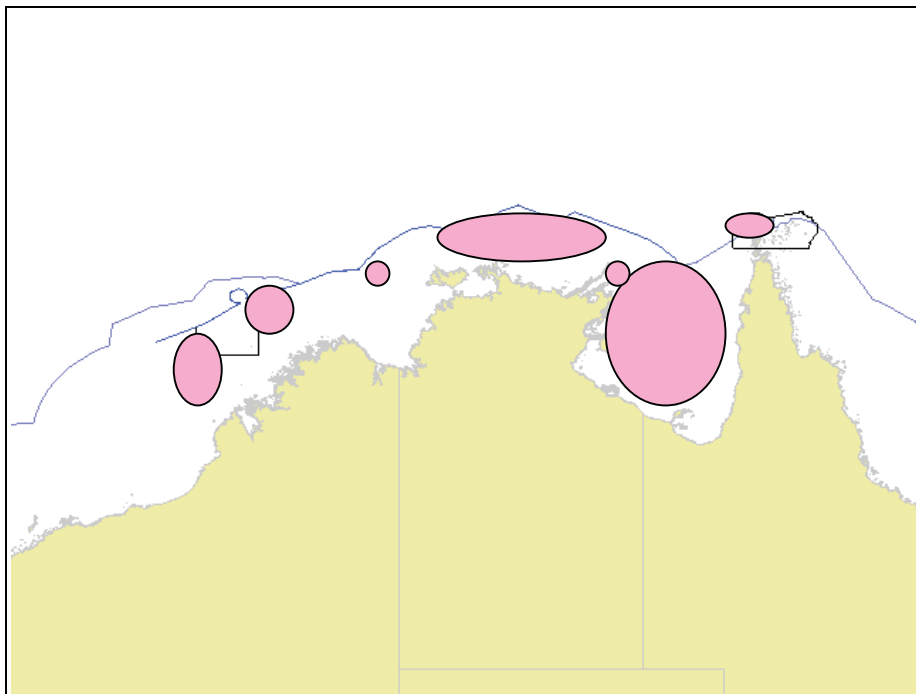
2004: Total boats apprehended targeting shark, 146 of a total of 161 apprehensions

(Source Australian Fisheries Management Authority)



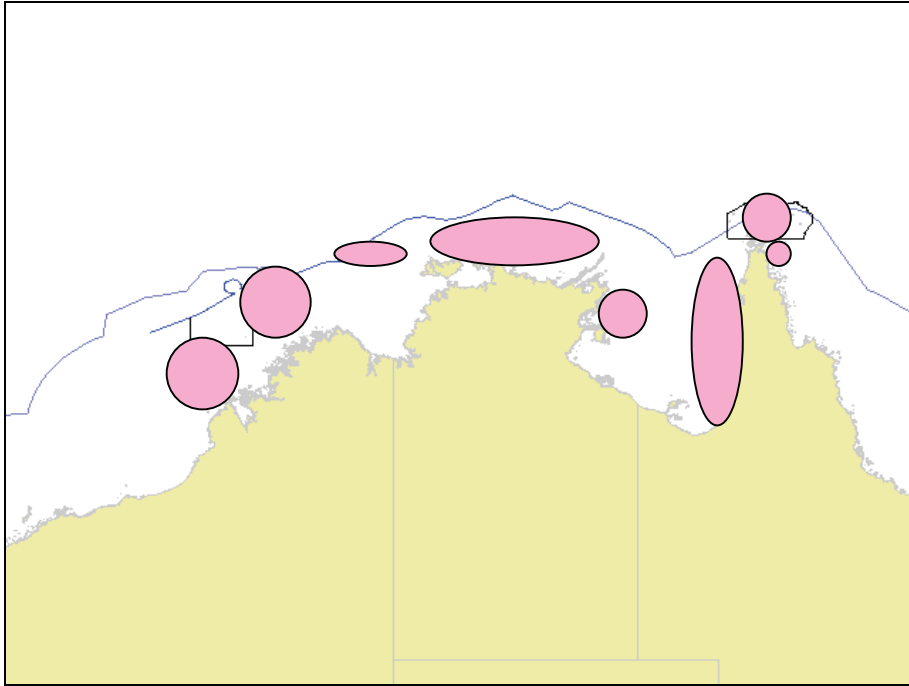
2005: Total boats apprehended targeting shark, 200 of a total of 281 apprehensions

(Source Australian Fisheries Management Authority)



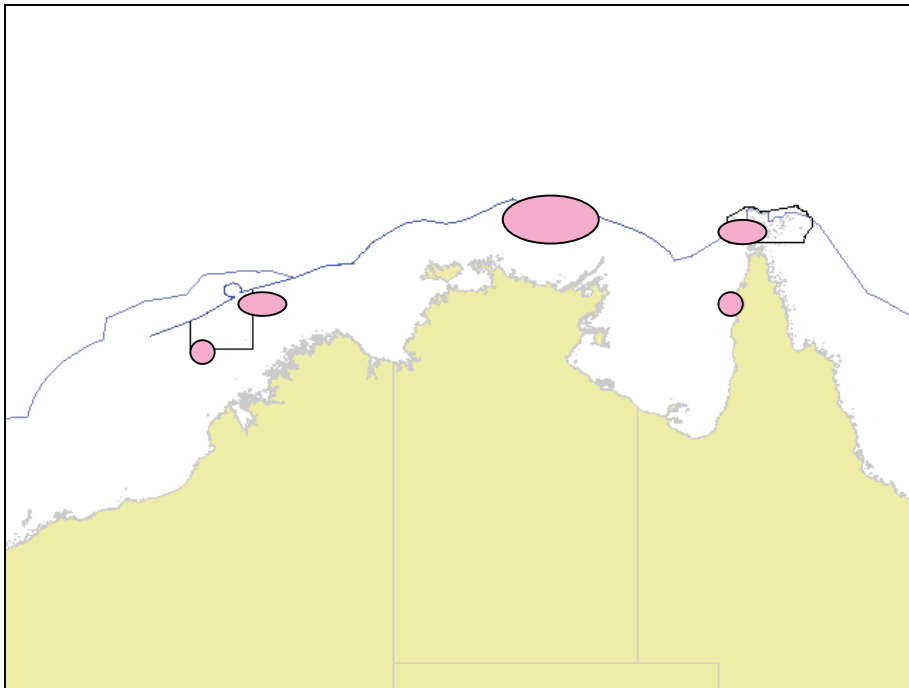
2006: Total boats apprehended targeting shark 314 of a total of 365 apprehensions

(Source Australian Fisheries Management Authority)



2007 (to 30 June 2007): Total boats apprehended targeting shark 33 of a total of 45 apprehensions

(Source Australian Fisheries Management Authority)



Extent of illegal shark catch

As is the case with much IUU fishing, the extent and the species composition of the catch of sharks by illegal fishers in northern Australian waters is not well understood. The limited data available on shark catch have been summarised in Table 2. These data suggest that the shark products retained take a variety of forms including whole, meat, fins, jaws and tails. However, the data are subject to a number of caveats (see notes to Table A3.2), are far from conclusive in terms of quantifying the total illegal shark catch and provide no information on the species taken. In addition to the data in Table 2, in January 2008 an Indonesian vessel was apprehended for illegally fishing in Australian waters and on board were 320 shark trunks, 100kg of shark fin, 10 stingrays and 20 stingray tails. The captain of the vessel was fined AUD\$120,000 (AFMA, 2008).

Table A3.2: Quantities of shark identified on intercepted illegal foreign vessels fishing in the AFZ adjacent to Western Australia, the Northern Territory and Queensland ¹⁻⁵

	2002-2003		2003-2004		2004-2005		2005-2006		2006-2007	
	No.	Kg	No.	Kg	No.	Kg	No.	Kg	No.	Kg
Whole shark	12		45		92	2	35		30	18000 ⁶
Shark cartilage					30		46			
Shark fin	276	245	1365	926	1659	1831	873	4312	350	1600
Shark jaws			5	52	8					
Shark meat		156				137				
Shark tails	2									
Stingray									4	
Sawfish										10 ⁷

Source: AFMA, in litt. to TRAFFIC, May 2007 and January 2008

¹ Number and amounts are exclusive; catch is reported either by number or by kilogram weight.

² The information on catch is collated from the initial boarding at seas (the time of apprehension) that is received via facsimile, email or defence signal. Numbers are estimates only and there is no consistency about how these estimates are made. Catches are not verified by an accurate weighing of the product.

³ These catches do not include any catches reported as 'small amount' or 'small quantity'.

⁴ Catches are from apprehensions and also legislative forfeitures from July 2002 to 30 June 2007.

⁵ Other products that may be derived from sawfish, such as fins, are likely to be recorded under general shark categories.

⁶ One larger Taiwanese boat apprehended off the east coast of Australia in 2006-07 accounted for 17000 kg of whole shark and 800 kg of fins.

⁷ The record of sawfish in 2006-07 refers to 12 dried rostra. It is not known whether these specimens were taken in Australian waters.

The quantity of sharks taken by illegal foreign fishing in northern Australian waters is therefore largely unknown. The level of illegal fishing tends to be reflected by the number of sightings and apprehensions, neither of which provide a true indication of the level of fishing effort or of the level of catch. Sightings of vessels may, for example, include multiple sightings of the same vessel. Since many of the vessels are of similar construction and carry no identification marking it is very difficult to discern individual vessels from the air and it also difficult to determine whether they are actually fishing illegally or legally transiting the AFZ (Commonwealth of Australia, 2005).

This uncertainty has not, however, prevented claims being made about the extent of the catch. For example, in 2005, the Minister for Fisheries in Western Australia was quoted as saying that the “illegal shark catch in Australian waters could be as high as 25,000 tonnes per year or more than one million, sharks” (Ford, 2005). This figure was also cited by the ALP’s Transport and Maritime Security Taskforce (ALP, 2006).

However, CSIRO (Salini *et al.*, 2007) has recently developed a method to estimate foreign fishing vessel effort from Coastwatch surveillance and apprehension data, and this work may eventually allow more accurate estimates of the catch to be made. Based on that model CSIRO estimate, subject to plus or minus 20%, that in September 2005 there was an average number of 60 illegal vessels per day fishing in the EEZ and that this figure had dropped steadily down to 14 per day in June 2006 (Commonwealth of Australia, 2007). According to Border Protection Command, the study confirms that while there have been thousands of sightings per year in the past, “it is clear even from the peak of the problem that the problem is not thousands; it is hundreds [of fishing vessels]. How many hundreds is very difficult to say” (Commonwealth of Australia, 2007)¹⁴.

Despite their shortcomings, data on the number of sightings support the CSIRO’s finding that the trend in illegal foreign fishing is downwards. AFMA reports that there were fewer sightings and apprehensions in 2006/07 compared with 2005/06. In 2006/07 there were 216 apprehensions, four legislative forfeitures of catch and gear conducted and a total of 1391 persons detained. This is in comparison to 368 apprehensions, 291 legislative seizures and 2962 detainees in 2005/06 (AFMA, 2006 and 2007b).

There are a number of factors that could explain the reduction in sightings and apprehension of FFVs in Australia’s northern waters. These include the increased enforcement presence of Australian Border Protection Command in the area, a decline in abundance of sharks and/or reduced fishing effort in response to the increased oil price.

The decline in illegal fishing is also supported by Fox (2007) who claims that at the height of illegal operations there were as many as 400 small motorised boats, known as *bodi*, in the port of Papela on Roti Island in Indonesia, that made several incursions a month into Australian waters to fish for shark, but that by 2007 only around 20 *bodi* continued to fish illegally in Australian waters. However, the apprehension in April 2008 of a 34m, steel-hulled, Indonesian-flagged vessel illegally fishing in Australian waters, raises concerns that while the number of vessels may have declined, more powerful vessels with more sophisticated equipment may be being used. This apprehension represents a vessel nearly three times the size of vessels normally apprehended (Burke, 2008). If this was not an isolated incident, then the current constraint on retention of shark meat, posed by storage space, may be less of a factor in the future and more shark meat may be retained.

Composition of illegal shark catch

In line with the lack of quantification of shark catch, there is little information available on the species composition of shark catch of illegal foreign fishers.

Shark catches by Australian fishers in northern Australian waters may provide some indication of the range of shark species available in those waters. In the Western Australian North Coast Shark Fishery and the Joint Authority Northern Shark Fishery, thickskin shark *Carcharhinus plumbeus* dominates the catch, followed by blacktip sharks (mainly *C. sorrah* and *C. tilstoni*), tiger shark *Galeocerdo cuvier*, hammerhead sharks *Sphyrna* spp. and bronze whaler *C. brachyurus*. Other sharks taken in lesser quantities include tawny nurse shark *Nebrius ferrugineus*, lemon shark *Negaprion acutidens* and skates and rays (McAuley *et al.*, 2000 cited in Rose and Shark Advisory Group, 2001).

¹⁴ Information provided to the Senate Legal and Constitutional Affairs Committee in May 2007 indicated that the CSIRO report contained so much information on operational patterns of surveillance that it could not be released publicly.

In the Northern Territory's target shark fishery the main species taken are black-tip sharks *C. tilstoni* and *C. sorrah*. Other species taken include hammerhead sharks (including scalloped hammerhead *Sphyrna lewini*, winghead shark *Eusphyra blochii* and great hammerhead *S. mokarran*), milk shark *Rhizoprionodon acutus*, whaler sharks *Carcharinids*, sawfishes *Pristidae* spp., shovelnose shark (may be either or both shovel nose rays (rhinobatidae) and sharkfin guitarfishes (rhynchobatidae), the latter having the highly valuable 'white' shark fin), graceful shark *C. amblyrhynchoides*, grey reef shark *C. amblyrhynchos*, pigeye shark *C. amboinensis*, spinner shark *C. brevipinna*, whitecheek shark *C. dussumieri*, creek whaler *C. fitzroyensis*, hardnose shark *C. maclovi*, Australian sharpnose shark *Rhizoprionodon taylori* and tiger shark *G. cuvier* (Rose and Shark Advisory Group, 2001).

While foreign illegal fishers are likely to take at least some of the species taken in domestic fisheries, illegal fishers are thought to be targeting sharks for fins and may therefore target different species than those traditionally targeted in domestic shark fisheries. Wallner and McLoughlin (1996) (cited in Rose and Shark Advisory Group, 2001) found that the composition of shark catch taken by Indonesian fishers was likely to be different to that of the Australian shark catch in northern Australia. In particular, they considered that the main target species of the domestic fishery (*C. tilstoni* and *C. sorrah*) are not a large part of the more offshore catches of the Indonesians.

This is borne out by the limited data available on shark species taken by illegal foreign fishers in northern Australian waters. Using DNA techniques, the CSIRO has identified, from a small collection of shark fins confiscated from illegal foreign fishers, the shark species from which these fins were taken (Salini *et al.*, 2007). While the collection of fins used in the research cannot be considered representative of illegal foreign fishing catch it is the only species specific data available on illegal foreign catch of shark in northern Australian waters (see Table A3.3). These limited data suggest that while there is a lot of commonality in the array of species taken by domestic and foreign fishers there are some significant differences in the proportional composition of the catch. For example, the main target species in the domestic fisheries, *C. sorrah* and *C. tilstoni*, together comprise less than 10% of the sample of confiscated fins.

Vulnerability of species to illegal fishing

In the absence of good data on the species composition of the catch it is virtually impossible to make any assessment of the shark species that are most likely to be vulnerable to illegal fishing in Australia's northern waters. However one group that requires specific consideration is those species protected under Australia's EPBC Act. Those are:

- Grey nurse shark *Carcharias taurus* (East coast population), listed as Critically Endangered
- Grey nurse shark *Carcharias taurus* (West coast population), listed as Vulnerable
- Spartooth shark *Glyphis sp. A*, listed as Critically Endangered
- Northern river shark *Glyphis sp. C*, listed as Endangered
- Great white shark *Carcharodon carcharias*, listed as Vulnerable
- Freshwater sawfish *Pristis microdon*, listed as Vulnerable
- Green sawfish *Pristis zijsron* listed as Vulnerable
- Whale shark *Rhincodon typus*, listed as Vulnerable

Table A3.3: Species composition of confiscated fins

Species	% of confiscated fins
Whitecheek shark <i>Carcharhinus dussumieri</i>	27.9
Scalloped hammerhead shark <i>Sphyrna lewini</i>	8.8
Pigeon shark <i>Carcharhinus amboinensis</i>	7.5
Hardnose shark <i>Carcharhinus macroti</i>	6.9
Whitespotted guitarfish <i>Rhynchobatus australiae</i>	6.9
Blacktip shark <i>Carcharhinus sorrah</i>	4.8
Great hammerhead shark <i>Sphyrna mokarran</i>	4.8
Blacktip shark <i>Carcharhinus tilstoni</i>	4.1
Winghead shark <i>Eusphyrna blochii</i>	4.1
Narrow sawfish <i>Anoxypristis cuspidate</i>	3.4
Spinner shark <i>Carcharhinus brevipinna</i>	3.4
Blacktip shark <i>Carcharhinus limbatus</i>	2.0
Whitetip reef shark <i>Triaenodon obesus</i>	2.0
Grey reef shark <i>Carcharhinus amblyrhynchos</i>	1.4
Bull shark <i>Carcharhinus leucas</i>	1.4
Dusky shark <i>Carcharhinus obscurus</i>	1.4
Shark ray <i>Rhina ancylostoma</i>	1.4
Milk shark <i>Rhizoprionodon acutus</i>	1.4
Australian sharpnose shark <i>Rhizoprionodon taylori</i>	1.4
Unknown species	1.4
Giant catfish <i>Arius thalassinus</i>	0.7
Silky shark <i>Carcharhinus falciformis</i>	0.7
Tiger shark <i>Galeocerdo cuvier</i>	0.7
Likely himantura species	0.7
Lemon shark <i>Negaprion acutidens</i>	0.7
Cowtail stingray <i>Pastinachus sephen</i>	0.7

Source: Salini et al. (2007).

Markets exist for fins of grey nurse, great white, sawfishes and whale shark, for the rostrum of sawfishes and for other body parts of species such as the great white shark (Rose and McLoughlin (2001). However the availability of these species to illegal fishing depends in part on their distribution. The distribution of the East and West Coast populations of grey nurse shark does not extend into the northern waters of the EEZ predominantly subject to illegal foreign fishing. Nor does the recovery plan for grey nurse shark (Anon., 2002a) identify illegal foreign fishing as a threat to this species.

The distribution of the Australian population of great white shark does not extend into the northern waters of the EEZ subject to illegal foreign fishing. While the recovery plan for great white shark (Anon., 2002b) notes that illegal trade in great white shark products (jaws, teeth and fins) may be a threat to the Australian population and may induce active targeting of sharks, it does not identify illegal foreign fishing as a threat to this species.

The northern river shark has been found in only two places in Australia – the Adelaide River and Alligator River, Northern Territory. Similarly, the speartooth shark has been found in only two places in Australia - the Bizant River in northern Queensland and the Alligator River, Northern Territory. These four sites are contained within the broad area subject to illegal foreign fishing however the limited distribution of these species to rivers minimizes the potential for them to be affected by illegal fishing. The information provided to support the listings of these species did not cite illegal foreign fishing as a threat but indicates that the greatest threat comes from Barramundi *Lates calcarifer* fishing and recreational fishing.

Despite its name, freshwater sawfish is a marine/estuarine species that occurs in fresh or weakly saline waters. The species may potentially occur in all large rivers of northern Australia from the Fitzroy River in Western Australia, to the western side of Cape York Peninsula. This distribution is contained within the broad area subject to illegal foreign fishing. However, the material supporting its listing (DEWHA, 2007) does not mention illegal foreign fishing in Australian waters as a threat to the species.

Green sawfish was listed as Vulnerable in March 2008. In listing the species the Minister for the Environment, Heritage and the Arts noted that “The green sawfish faces ongoing threats from accidental catch in fishing nets, from illegal fishing for fins and rostrums – the distinctive saw-toothed snouts – and from habitat degradation through coastal development.” (Garret, 2008). Pogonoski *et al.* (2002) note that green sawfish is widely distributed in the northern Indian Ocean (westwards to South Africa), and off Indonesia and Australia and that locally, it is more commonly encountered in the tropics and was occasionally caught south to Sydney, New South Wales and Broome, Western Australia. The species inhabits muddy bottom habitats, enters estuaries was frequently found in shallow water. Commercial prawn and fish trawling and gillnetting, where it may be taken as a bycatch, have been identified as threats to the survival of this species in Australian waters (Pogonoski *et al.*, 2002).

Whale shark is distributed across the broad area of northern Australian waters subject to illegal foreign fishing. However the recovery plan for whale shark (Anon., 2005) does not mention illegal foreign fishing in Australian waters as a threat to the species. It does, however, note that the main threat to the whale shark occurs outside Australian waters and that it is commercially harvested by a number of other range States.

Overall, the potential for illegal foreign fishing to affect populations of protected species appears relatively low. However the data in Table 2 indicate that 12 sawfish (*Pristidae* spp.) rostra were found on an illegal foreign fishing vessel, although it cannot be certain that these were taken in Australian waters. In 2007 CITES listed all species of *Pristidae*, except *Pristis microdon*, in Appendix I of CITES. Australia successfully proposed *P. microdon* to be listed in Appendix II in order to allow international trade in live animals to appropriate and acceptable aquaria for primarily conservation purposes. Rose and McLoughlin (2001) note that there are a further five *pristidae* species (narrow sawfish *Anoxypristis cuspidate*, dwarf sawfish *pristis clavata*, wide sawfish *pristis pectinata* and green sawfish *pristis zijsron*) that could be taken in northern Australian waters. Trade in any of these species for commercial purposes, regardless of whether they are taken legally or illegally, by members of CITES¹⁵, would be illegal. The narrow sawfish has been identified by the CSIRO as a species confiscated from illegal foreign vessels (see Table 3).

¹⁵ Indonesia is a CITES member.

What we know about illegal fishing for sharks in Australian waters

- Most illegal fishing for shark in northern Australian waters is undertaken by Indonesian fishers.
- The sophistication of the vessels has increased over time and many illegal operators now use modern and well-equipped vessels, often with satellite positioning systems, radar and ice-packed holds (Downer, 2005).
- The level of illegal fishing appears to be declining, however it is thought likely that this decline would be reversed if the level of surveillance was reduced (Fox, 2007; Commonwealth of Australia, 2007).
- The limited data on illegal shark catch (see Table 2) indicate that while small quantities of shark meat are retained by fishers, shark fins comprise the main part of the catch. This is supported by other reports (see, for example, Watts (2003)).
- While the level of impact and the species-specific impact of illegal fishing on shark populations in Australian waters is poorly understood, research has demonstrated a clear difference in the abundance and species diversity of sharks on fished and unfished reefs in the oceanic shoals of northern Australia (where illegal shark fishing is particularly intense). Sharks were found to be anywhere from 4 to 17 times less abundant at fished reefs (AIMS, 2006).

What we don't know about illegal fishing for sharks in Australian waters

- The quantity of sharks taken by illegal fishing is unknown.
- The species composition of illegal shark catch is unconfirmed.
- The impact of illegal fishing on shark populations and ecosystems in northern Australian waters is unknown.
- The impact on protected species of sharks is unknown but the potential impact is thought to be minimised by the distribution of most of these species.

Australian initiatives to address IUU shark fishing

The following information on current/proposed and completed research and initiatives related to IUU fishing for sharks in Australia is based on material provided by DAFF (A. Townley, DAFF *in litt.* to G. Sant, 20 December 2007):

Current/proposed projects

a) Capacity building

- Australia is assisting Indonesia develop a National Plan of Action for the Conservation and Management of Sharks (NPOA-Sharks). CSIRO has drafted a basic document which has been translated into Bahasa Indonesia and discussed at a workshop in Indonesia for initial discussion by industry and other stakeholders.

b) The nature, extent, impact of and drivers for IUU shark fishing

- Indonesian Catch Monitoring, a study conducted jointly by the Australian Centre for International Agricultural Research (ACIAR), AFMA and Professor Jim Fox (Australian National University) will examine landed quantities of catch in the Indonesian market and compare with official landing records to improve knowledge of catch composition and routes of fish product through south-east Asia. Status Unknown.

- An AFMA funded pilot study, involving interviews with illegal Indonesian fishers in detention will obtain information on illegal catches, species, fishing hotspots, ports used. Interviews have commenced and a report will be finalized upon completion of interviews.

Future IUU shark endeavors involving Indonesia could potentially be progressed in concert with the Australia-Indonesia Working Group on Marine Affairs and Fisheries, which is currently progressing a number of bilateral initiatives including a joint surveillance forum, joint management plan for shared red snapper stocks and management of the MOU Box.

c) The nature and status of shark stocks

DEWHA is supporting a number of research projects on the status of shark stocks. These include:

- *Assessing migration patterns and population status of Whale Sharks, *Rhincodon typus**. Australian Institute of Marine Science is undertaking research to identify the migratory cycle of the Ningaloo whale shark population and define its habitat in relation to physical and biological oceanography. It will build linkages with and harness whale shark research activity (including tagging, photo-identification and genetics) in other areas of the Indian Ocean and encourage capacity building with an aim to relating whale shark observations to ocean dynamics to help explain whale shark movements, develop a program of international research, assess population status on both local and regional scales and examine the feasibility of whale shark ecotourism based in Roti, Indonesia.
- *Assessing Traditional Ecological Knowledge of Whale Sharks in eastern Indonesia: A pilot study with fishing communities in Nusa Tenggara Timur*. Charles Darwin University is undertaking research with a focus on Traditional Ecological Knowledge held by Indonesian (Bajo) fishers about the migration and behaviour of whale sharks (*Rhincodon typus*) from the waters off the Western Australian coast into eastern Indonesia. The research will also investigate the potential human threats facing whale sharks at identified aggregation areas in eastern Indonesia. The results of the research will form the basis of recommendations for extending this study to other locations in eastern Indonesia and will contribute towards developing collaborative conservation and management measures for whale shark populations across international borders.
- *Developing non-lethal method for estimating age and habitat use for Australian sawfish populations*. Charles Darwin University is undertaking studies to provide uses non-lethal techniques to obtain information on life history parameters useful for defining extinction risk of sawfish populations.
- *Spatial distribution and habitat utilisation of sawfish (*Pristis* sp.) in relation to fishing in northern Australia*. CSIRO Marine and Atmospheric Research is undertaking research to investigate spatial distribution and habitat utilisation of sawfish (*Pristis* sp.) in relation to fishing in northern Australia. The aim of the project is to obtain data on the long-term habitat utilisation and fine-scale movement patterns of sawfish in Western Australia. This data will be used to examine interactions between sawfish and commercial fishing gear in northern Australia.

Completed projects

a) Nature and status of shark stocks

- *Artisanal shark and ray fisheries in eastern Indonesia – their socioeconomic and fisheries characteristics and relationship with Australian resources / Supplementary Stock Assessment Meeting*, CSIRO Cleveland (2006). ACIAR Project FIS/2003/037. Project includes analysis of shark and ray survey data for the Java Sea and a taxonomic guide/description of the sharks and rays from the project.

- A study conducted by the CSIRO, Northern Australian Sharks and Rays – the sustainability of target and bycatch species – phase II, examines the stock structure of major target species to determine an appropriate management scale and whether stocks are shared across states and territories and with Indonesia. Project completed January 2007 and report finalized.
- Dennis D.M., Milton, D.M, Skewes, T.D., Taranto, T.J, and Haywood, M.D.E (2005). *A Rapid Assessment of the Fin-fish and Shark Resources on the Shallow Reefs in the Timor Sea MOU Box*. Report estimates abundance of shark species on a number of reefs from underwater visual census data.
- Meekan, M., and Cappo, M. (2004), *Non-destructive Techniques for Rapid Assessment of Shark Abundance in Northern Australia*. The study tests Baited Remote Underwater Video Systems (BRUVS) as a suitable technique to estimate shark abundance and samples and compares shark abundance in northern Australia.
- Meekan, M., Cappo, M., Carlton, J., and Marriott, R. (2005), *Surveys of Shark and Fin-fish Abundance on Reefs within the MoU Box and Rowley Shoals using BRUVS*. The study uses BRUVS to sample and compare fish and shark assemblages in reefs inside and outside the MOU Box.
- Salini, J. (2003), *The sustainability of northern Australian sharks and rays* (CSIRO). The project was divided into three strands: biological research on the stocks; socioeconomic research into the fishery and post harvest chain; and sustainability of current catches.
- The Northern Australian Fisheries Committee provides a forum for coordination of fisheries research and management issues across jurisdictions in northern Australia, including IUU shark catches. The Committee has made a new shark assessment in northern waters one of its top two priorities for 2008.

b) The nature, extent and impacts of illegal shark fishing

- Resosudarmo, B.P. Napitupulu, L., and Campbell, D. (2006). *Illegal Fishing in the Arafura Sea*. Paper presented at the Development and Environment Workshop, Australian National University, 8 April 2006. The report examines characteristics of illegal fishing in the Arafura Sea.
- Fox, J.J. (2005). *Report on Illegal Fishermen in Australia Waters: Shark Fishermen from Merauke, Dobo, Saumlaki and Papela*. Unpublished paper. Report on the scope of illegal foreign fishing efforts by Indonesian shark fishers based on surveys of detainees and fishing communities in Indonesia.
- McLoughlin, K. (1996). *Review of Indonesian Fishing in the Australian Fishing Zone*. The study looks at the catch collected from apprehensions and attempts to estimate illegal foreign fishing catch rates and effort.
- CSIRO has submitted a final report on their project *Species identification from shark fins (Phase 1)*. The study involved large scale sampling of shark fin confiscated from foreign fishing vessels and applied identification techniques including DNA imaging. The report identifies, *inter alia*, a method of using fin morphology to identify shark species from their fins.
- Enhanced collection of IUU shark catch and effort data. This AFMA/National Heritage Trust project has been completed and collection of shark data is underway.
- CSIRO has submitted a final report on the project *Estimating reliable foreign fishing vessel effort from Coastwatch surveillance and apprehension data (Phase 2)*. The outcomes of this report are confidential.

- CSIRO has recently begun the project *Calculating recent foreign fishing vessel numbers using established estimators based on Coastwatch surveillance and apprehension data*.
- CSIRO is finalising a report on *The effect of illegal, unregulated and unreported fishing on the ecosystem in the Gulf of Carpentaria: management options and downstream effects of other fisheries*.

c) Drivers of illegal fishing

- Wheeler, C. (2006). *Sources of Indonesian Fishers in Australian Waters*. Report for the Australian Government's overseas aid program (AUSAID), Canberra. The report examines the sources and drivers for illegal Indonesian fishing in the Australian Fishing Zone.

In addition to the government funded/initiated projects identified above by DAFF a number of PhD theses currently being prepared are relevant to IUU shark fishing. For example, students in Australia are:

- investigating the use of morphological techniques to identify sharks to species level from single fins. The methods developed in this project will be used to create identification guides to be used by fisheries managers and AFMA officials for identifying shark species from fins apprehended from foreign fishing vessels.
- examining the DNA of shark products found in South East Asia, particularly shark fin, to ascertain the species and source of the product.

Australia has also undertaken a number of joint initiatives with Indonesia to educate fishers about the impacts and consequences of illegal fishing in Australian waters, for example:

- the printing and distribution of free maps and maritime boundaries printed in Indonesian;
- programs for developing alternative livelihoods in Indonesia. For example Australia has been financially assisting a two-year project to promote seaweed and coral-reef cultivation among fishing communities in Roti Ndao and Kupang districts in East Nusatenggara Province in order to create alternative livelihoods for local fishermen so they do not fish illegally in Australian waters (Media Report 8);
- visits by Australian Fisheries Officers to Indonesian ports to advise on Australian measures and to discourage incursions (AFMA, 2007a); and
- Australia is also maintaining an increased level of surveillance and enforcement activity as a deterrent to illegal fishing and has conducted or initiated a range of research projects to improve the understanding of the impact of illegal shark fishing.