Sharks in Danger:
Global Shark Conservation Status with Reference to Management Plans and Legislation

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1.0 ABSTRACT

This book reviews the current status of, and threats to, shark populations globally with special reference to the basking shark and the great white shark. Sharks are a valuable resource both directly through shark watching trips, medical research and commercial and recreational fisheries, and indirectly through the selection pressure they exert on our teleost fisheries, the part they play in maintaining the ecology of the ocean and their intrinsic scientific value. Identifiable threats to sharks are recreational and commercial overfishing and environmental degradation rendered by man, such as development of nursery and mating zones and disturbance of the marine environment through netting and trawling. Particular threats to sharks worldwide are the exploitative fin and cartilage trades. Information required for the sustainable management of sharks includes: life history episodes such as reproductive rates, vulnerable life stages, population dynamics and spatial and temporal distribution. An in depth analysis of white sharks

and basking sharks reveals similarities in their reproductive strategies such that similar management practices can be applied to both species. In reviewing fishery management practises it was found that sustainable management plans must be based upon reproductive rates and this requires knowledge of life histories. Life history information is also often required for legislative protection and this means that extremely rare species cannot be considered. Protective legislation should be targeted towards individual species and vulnerable life stages, particularly nursery and mating zones. Further legislation should be enacted to improve current knowledge through required data collection.

2.0 INTRODUCTION

Many shark populations are in danger of extinction as a direct result of man's activities. Sharks are generally hated and feared in the Western world but in Malaita in the Solomon Islands people have worshipped sharks as gods for centuries. However, today the lure of high prices for shark fins has created a market even in some of the Solomon Islands (Sant & Hayes 1996). Management to prevent further destruction and to replenish numbers requires a change in attitudes and an elucidation of shark requirements to enable sustainable trade, fishery and sport activity.

This book will outline why sharks are a valuable resource, identify threats to sharks and where they occur and review what we need to know about sharks in order to protect them. Fisheries management procedures are investigated to target areas requiring future research and implementation. Conservation initiatives, legislation, and international agreements are reviewed and future measures suggested. Case histories on the basking shark and the great white shark detail threats specific to these species and identify research and management requirements. For brevity, scientific nomenclature is contained in Annex 1.

3.0 WHAT IS A SHARK?

The Chondrichthyes possess a distinctive cartilaginous skeleton with bone deposits in teeth and parts of the spine and comprise the sharks, chimaerans, rays, skates and sawfishes. Sharks are distinct from the other Chondrichthyes as they have cylindrical forms, (with the exception of the Squatiniformes), with five to seven gill openings on each side of the head.

There are at least 370 shark species worldwide spanning many ecological types (Hall, 1993:3). Sizes range from the whale shark (13.7m maximum measured length) to the 15-18cm dwarf dogfish. Habitats range from the ocean surface to its depths and, in the case of the bull shark and the Ganges shark, freshwater rivers (Stevens 1987:37). Feeding habits range from the filter feeding basking shark to the apex predator tiger shark and activity levels range from the constantly swimming mako species to the bottom lying nurse shark.

4.0 WHY SHOULD WE BE CONCERNED ABOUT SHARK CONSERVATION?

Published data from the Food and Agriculture Organisation of the United Nations (FAO) show that shark catches have been rising steadily since the 1940s (Anon, 1999d). Today drift gill nets alone kill 3,000 sharks daily (Marine Conservation Society leaflet, 2000). Most sharks are K selected: they have large body size, few natural predators, slow rates of growth, late onset of maturity and small numbers of well-developed young so cannot withstand high levels of predation (Gruber, 1990:188).

4.1 Ocean Ecology and Fisheries

Sharks maintain diversity by preventing explosions of single species. An increase in stingrays and jellyfish along the Florida Panhandle has been attributed to decreasing shark numbers. Shark overfishing in Tasmania caused a boom in their main prey, octopus, which crashed the spiny lobster fishery. Predatory sharks assist their prey's evolution by removing diseased and genetically defective individuals which creates a stable, quality fishery supply. Sharks are distributed worldwide such that the impact of their decline will be widespread.

4.2 Important Economic Resource

Sharks play an important role in the economy through directed commercial and recreational fisheries, the control they exert over other fisheries, trade in shark by-products and ecotourism. In 1993 shark diving in the Maldives was estimated to generate $2.3 million per year such that a grey reef shark was worth one hundred times more alive at a dive site than dead on a fishing boat (Anderson and Ahmed, 1993).

4.3 Medical Research

Sharks may further our medical knowledge if we can explain how:

- shark wounds heal within 24 hours without treatment,
- lacerated corneas remain clear, functional and heal rapidly when blindness follows in other species, and
- sharks resist our attempts to induce cancer tumours.

Scientists recently isolated squalamine, an antibiotic effective against bacteria, fungi and protozoa, from dogfish shark liver oil. A cancer tumour growth requires blood vessels to grow towards it in a process called angiogenesis. Squalamine is an angiogenesis inhibitor and has slowed the growth of brain tumours in rats. It is currently in Phase I clinical trials at the University of Texas (San Antonio) and Georgetown Cancer Center, Washington DC (Anon, 2000f).

4.4 Intrinsic Scientific Value

Sharks exhibit many unique life history traits and behaviours. Predatory sharks can detect blood in very high dilutions and the bull and Ganges sharks are able to osmoregulate in both freshwater and marine environments. Navigation is thought to be in response to magnetic and electrical fields, lunar movements, chemical stimuli and geographical topography. Reproduction includes unique forms of nourishment including interuterine cannabalism in the sand tiger shark. Shark physiology and behaviour, such as attack, mating, schooling and use of nursery grounds, are not fully understood.

5.0 WHY ARE SHARKS IN NEED OF PROTECTION?

Shark numbers are depleting through overfishing, fisheries by-catch, destruction of nursery and mating habitats and increased demand for shark products and aquarium species. Countries attract tourists by promoting shark watching activities, unrestricted sport fishing and using anti-shark measures to decrease the possibility of attack. This has led to severe population depletion in some areas. For example, there are concerns that the nurse shark population in New South Wales is failing to find mates due to low numbers (Anon, 2000b).

5.1 Shark Products

Fisheries are overfishing stocks for a variety of products and uses (see Table 5.11). The FAO reports a doubling of world shark exports between 1985 and 1994. Imports to the EU increased from 27,100 million tonnes (mt) in 1980 to 42,000mt in 1994. An estimated 30 per cent of fish and chip shops in southern England serve “rock salmon” (piked dogfish) which requires imports from the USA and Canada to meet demand (WWF 2000).

Table 5.11 Shark uses

sharks	laboratory animals, commercial and domestic aquaria
fins	soup, traditional medicine
jaws and teeth	jewellery, curios
skin	leather, abrasives
entrails	fishmeal
flesh	food, fertilizer
liver	oil - vitamins, haemorrhoid medicine, paint base squalene - cosmetics, pharmaceuticals, perfumery, lubricate fine mechanisms such as aircraft hydraulic systems and electronics
cartilage	burn treatment (Chondroiten - artificial skin) and biochemicals
blood	anticoagulants
eye	corneal implants

Source: Gruber, 1990:115-121.

The shark fin and cartilage industries currently pose the biggest threats to shark populations.

5.11 Shark Fin Industry

Since the second century BC Asian countries have used fin cartilage in shark fin soup. Today shark fin soup is available worldwide through Asian restaurants and food shops. Shark fin soup fetches upwards of $50 a bowl (Russell, 1996:104) and is considered a powerful aphrodisiac.

More than 150 countries trade in shark fin. Hong Kong Customs data show total imports of shark fins rose from 2.7 million kilos in 1980 to 6.1 million in 1995. However, re-exports are not recorded and Hong Kong often exports raw fins to China which are returned after processing for re-export. Hong Kong dealers note that Japan and Spain are major suppliers of blue shark fins, the Philippines and the Middle East of blacktip reef shark fins, Mexico of hammerhead fins and Mexico, Brazil, the Philippines and Venezuela of oceanic whitetip and tiger shark fins (Parry-Jones 1996). Fins from piked dogfish and porbeagle are exported to Asian countries from Norway, Germany and the UK (Traffic 1997). Retail prices in Hong Kong range from US$40 to $564 per kilo (WWF 2000). The value of fins vary according to species, fin type, condition and regional preference. The lower caudal fin is the most valuable owing to its high fin needle content. Fins from larger sharks are sold as fin sets consisting of the first dorsal, pectoral, and lower caudal fins. Value increases with rarity such that fishermen will expend increasing effort on dwindling populations.

Table 5.111 Top exporters and importers of shark fins in 1990

Exporters	Quantity (million tons)	Importers	Quantity (million tons)
Hong Kong	1,609	Hong Kong	3,838
China	809	China	1,335
Singapore	806	Singapore	1,006
Indonesia	558	USA	192
Japan	451	Malaysia	92
Others	1,172	Others	143

Source: FAO Fisheries Statistics (1994:16)

Shark fins are harvested as a highly lucrative by-catch with little directed effort and storage problems. Shark meat has a low value due to its high urea content. Fishermen utilise their refrigerators for more valuable catch and discard the shark once the fins have been cut off. The high value of shark fins has led to the launch of thousands of directed shark fin longlining vessels with Taiwanese, Japanese, South African and Spanish operators extending from Morocco to Ghana (Cook, 1990:6).

From 1991 to 1998 the number of sharks killed solely for their fins in waters off Hawaii increased by 2500%. On 22 June 2000 a state bill was passed to prohibit the landing of any shark fins in the state of Hawaii unless the shark is landed whole. Similar legislation should be

enacted in fisheries where sharks are targeted, or incidentally taken, to reduce this practice and enable catch to be monitored for fisheries management. The shark fin market has expanded rapidly and research is needed to determine the exploitation levels of various species and to assess appropriate conservation measures.

5.12 Shark Cartilage Industry

In 1996 shark cartilage was a $50 million a year industry with between 25-100,000 people using dozens of brands for it's reputed cancer-curing properties (Dold, 1996:53). Today turnover is probably even greater due to supply through high street shops such as Holland & Barrett and increasing usage by European veterinary practices. Cartilage is believed to contain angiogenesis inhibitors. Cartilage can account for up to 6 per cent of shark body weight making them an obvious source for this industry. Twenty seven pounds of shark cartilage produce one pound of extract (Russell,1996:104). One US owned cartilage-extracting plant in Puntarenas, Costa Rica (Corporacion Procesadora Cartilago, SA) exported 131,275kg of cartilage chips between 1 August 1994 (opening of plant) and 30 September 1995. Ninety percent was shipped to US and European markets where capsules sell for over $40 per 100 pills (Russell,1996:104). It is estimated that at least 235,000 large coastal sharks are being processed each month at this plant (Dold, 1996). Four

other plants in Puntarenas also process cartilage. As sharks are becoming more scarce Costa Rican fishermen are fishing off Guatemala and illegally fishing in the Galapagos Marine Reserve (Russell,1996:104). Cartilage production is not restricted to Costa Rica. The New Zealand seafood exporters directory lists 2 companies exporting shark cartilage to the US (Sant & Hayes 1996).

The Journal of Clinical Oncology November 1998 contains the results of a three month study conducted by the Cancer Treatment Research Foundation in Illinois on terminally ill cancer patients which concluded that shark cartilage neither slowed the disease nor improved quality of life.

5.2 Overfishing: Commercial and Incidental

It is important to note that most commercial, incidental and recreational shark catches are unregulated and unmonitored such that available data does not represent a true indication of worldwide landings. (See Annex 2 for explanation of fishery methods).

Virtually all major targeted shark fisheries studied have crashed after 3-5 years (Anon, 1995c). Few regulations exist due to lack of catch data and insufficient research funding which are both necessary for the development of management plans. Similar shark species command

similar prices so fishermen manage multiple shark species as one generic stock. A species can become severely depleted before the fishery is aware of its condition.

Sharks are caught as incidental by-catch in virtually every commercial fishery and are rarely released. They are generally killed either for their economic value, to avoid the dangers of handling a live shark or because it is impractical to release them from a large catch. Greenpeace Australia calculated that in 1988 alone Taiwanese and Korean squid fleets killed over 2.25 million blue sharks in the north Pacific (Dayton, 1991:34-37). Increases in vessel numbers and capability have increased global pressure. China's distant-water fleet has rapidly expanded from 1 vessel in 1976 to 64 vessels in 1996 in the North Pacific, Atlantic and Indian Oceans (Rose, 1996).

Table 5.21 Fisheries where collapses have occurred

Porbeagle fisheries in the Northwest Atlantic (1968-1972)
California Soupfin Shark Fishery (1930-1944)
Australian School Shark Fishery (1927-1956)
Scottish-Norwegian Spiny Dogfish Fishery (1946 - 1986)
British Columbia Spiny Dogfish Fishery (1907-1949)
Basking Shark Fisheries off Northeast Atlantic and Eastern and Western Pacific
Source: Anderson, 1990:473-474