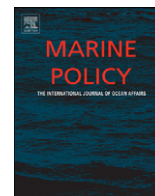




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Keeping the lead: How to strengthen shark conservation and management policies in Canada

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ABSTRACT

Internationally, shark conservation is now being recognized as a major environmental challenge, but management efforts to halt the overexploitation of sharks have lagged behind. This review examines the state of knowledge for shark species in Canadian waters and analyzes the role of existing management and legislation in ensuring shark conservation. Despite Canada's early leadership, the present management framework reveals major shortcomings with regard to legal protection, bycatch and finning regulations. These problems are not unique to Canada but illustrate broader issues pertaining to the global management of endangered fish species. To strengthen the conservation and management of sharks, this paper recommends a set of key policies and management priorities, which exemplify proper precautionary management of endangered shark species in Canada and could serve as a blueprint for improving conservation efforts internationally. A structured approach for grading progress in shark conservation efforts against best practices is also presented and could be used as a goalpost elsewhere.

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1. Introduction

In recent years the management of shark species has emerged as a new priority in marine conservation. Worldwide catches of sharks and other elasmobranchs have increased steadily in the past two decades [1], driven largely by the rising demand for fins on the Asian market and the decline in yields in some traditional fisheries which have resulted in a shift toward species that were formerly discarded [2]. Today, an estimated 26–73 million sharks are traded annually for their fins, a number that exceeds the reported catch by three to four times [3].

Sharks have long been recognized as vulnerable to increased mortality because of their life-history characteristics (relatively slow growth, late age of maturity, long life, and low reproductive rate) [4]. In a number of regions, such as the northwest Atlantic, Gulf of Mexico, and the Mediterranean, numerous species, particularly large coastal and pelagic sharks, have shown severe declines in recent decades, and many are estimated to be less than 10 percent of former abundance [5–8]. According to the IUCN, sharks along with skates and rays are among the most threatened marine vertebrates, most notably pelagic sharks, of which 60 percent are currently threatened with extinction [9–10]. Many of

these species are apex predators and changes in their abundance can have far-reaching consequences for the structure, function and resilience of marine ecosystems; which rises important ecological, socio-economic, and management concerns [11–13].

Canada is not a major shark fishing nation, but is considered one of the leading nations with regard to shark management, as it was one of the first countries in the world to develop and implement a management plan for sharks. The 1995 plan for Atlantic pelagic shark fisheries, established quotas for porbeagle (*Lamna nasus*), blue (*Prionace glauca*) and shortfin mako (*Isurus oxyrinchus*) sharks, limited the number of fishing licenses available, and imposed fishing gear restrictions [14]. Following widespread concern over the increase of shark fishing, its negative consequences on shark populations, and a lack of management, the Food and Agriculture Organization of the United Nations (FAO) developed, in 1999, an International Plan of Action for the Conservation and Management of Sharks (*IPOA-Sharks*) [15]. This plan is a voluntary instrument within the framework of the Code of Conduct for Responsible Fisheries, which encompasses both target and non-target species and is guided by the principle that total fishing mortality for each stock be kept within sustainable levels [15]. Canada is one of only 12 states out of the 130 states reporting shark landings to the FAO that participates in the *IPOA-Sharks*. Although the Canadian National Plan of Action for sharks provides useful details on commercial shark stocks, it does not specify actions to assess or mitigate threats to non-commercial or threatened shark species [16]. This review analyzes

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to what extent the existing management framework protects shark species (Superorder *Selachimorpha*) in Canada. Our goals in this study were to evaluate the current state of knowledge, the role of existing legislation for sharks in Canada, discuss success and limitations, and highlight priorities for the management of sharks in Canada, and internationally.

2. Canadian shark species, conservation status, and the Species at Risk Act

Twenty-eight species of sharks representing 13 families have been reported in Canadian waters (Table 1). Few shark species are the subject of directed commercial fisheries in Canadian waters, whereas the majority are caught as bycatch and then discarded. The species, which are of primary commercial interest, include the spiny dogfish (*Squalus acanthias*), exploited on both coasts, and to a lesser extent the porbeagle and shortfin mako shark in the Atlantic [16].

According to IUCN assessments, close to half of Canadian shark species are considered globally threatened with extinction (i.e. classified as vulnerable, endangered, or critically endangered) (Table 1). In Canada, the *Species at Risk Act* (Bill C-5, or SARA 2002) was created to protect threatened species and their habitats, in order to avoid extirpation. If species are listed as threatened or endangered, no person can kill, harm, harass, capture or take any individual of this species and a recovery strategy must be developed [19]. The Committee on the Status of Endangered

Wildlife in Canada (COSEWIC) provides the scientific assessment on the status of individual species, and after the socio-economic impacts are reviewed, the Minister makes the final decision of which species are to be protected under SARA. To date, 10 shark populations representing 8 species have been evaluated by COSEWIC, 3 of these as endangered, and 1 as threatened (Table 1). So far, only the bluntnose six-gill (*Hexanchus griseus*) and the tope shark (*Galeorhinus galeus*) have been legally listed under SARA (in 2007, as special concern), but their recovery plans are still pending.

All remaining species, with the exception of porbeagle, are currently being considered for listing under SARA. The porbeagle shark for which a small directed fishery exists in Atlantic waters was rejected under SARA in 2006, despite being assessed as endangered [20]. The primary reasons for the rejection were (1) the economic costs to fishers and associated industries (constituting a loss of eight jobs and an economic reduction of 2 percent to a single community), and (2) the loss of biological information from fisheries, which was the only source of information for monitoring population recovery at the time [21,22].

The process of listing endangered species under SARA has been criticized in the past; marine species, especially if commercially harvested, have rarely been afforded legal protection [23]. Currently, the Pacific population of basking sharks and the Atlantic populations of blue, shortfin mako, and great white sharks are being considered for listing under SARA. Blue sharks and shortfin makos may prove contentious, as these sharks are frequently caught in pelagic longlines fisheries directed at tuna

Table 1
List of all shark species occurring in Canadian waters with their conservation status according to the global IUCN red list and Canada's COSEWIC classification with their assessment year.

Family	Species	Common name	CAN	IUCN/COSEWIC status ^a	IUCN/COSEWIC year
Species of commercial interest					
LAMNIDAE	<i>Lamna nasus</i>	Porbeagle Shark	A	VU ^b /EN	2006/2004
LAMNIDAE	<i>Isurus oxyrinchus</i>	Shortfin Mako Shark	A, P	VU/TR (A)	2008/2006
SQUALIDAE	<i>Squalus acanthias</i>	Spiny Dogfish	A, P	VU	2006
Species that are common or occasional bycatch					
ALOPIIDAE	<i>Alopias vulpinus</i>	Thresher Shark	A, P	VU	2008
CARCHARHINIDAE	<i>Prionace glauca</i>	Blue Shark	A, P	NT/SC (A), DD (P)	2000/2006
CARCHARHINIDAE	<i>Galeocerdo cuvie</i>	Tiger Shark	A	NT	2000
CETORHINIDAE	<i>Cetorhinus maximus</i>	Basking Shark	A, P	VU/EN (P)	2000/2006
DALATIIDAE	<i>Somniosus pacificus</i>	Pacific sleeper Shark	P	N/A	–
ETMOPTERIDAE	<i>Centroscyllium fabricii</i>	Black Dogfish	A	LC	2008
HEXANCHIDAE	<i>Notorynchus cepedianus</i>	Broadnose Sevengill shark	P	DD	2000
HEXANCHIDAE	<i>Hexanchus griseus</i>	Bluntnose sixgill shark	P	NT/SC	2000/2007
LAMNIDAE	<i>Lamna ditropis</i>	Salmon Shark	P	LC	2008
SCYLORHINIDAE	<i>Apristurus brunneus</i>	Brown Cat Shark	P	DD/DD	2004/2007
SOMNIOSIDAE	<i>Somniosus microcephalus</i>	Greenland Shark	A, Arc	NT	2006
TRIAKIDAE	<i>Galeorhinus galeus</i>	Tope Shark	P	VU/SC	2006/2007
Species that are rare bycatch					
ALOPIIDAE	<i>Alopias superciliosus</i>	Bigeye Thresher Shark	P	VU	2008
CARCHARHINIDAE	<i>Rhizoprionodon terraenovae</i>	Atlantic sharpnose shark	A	LC	2000
CARCHARHINIDAE	<i>Carcharhinus longimanus</i>	Oceanic Whitetip Shark	A	VU	2006
CARCHARHINIDAE	<i>Carcharhinus obscurus</i>	Dusky Shark	A	VU	2009
ETMOPTERIDAE	<i>Etmopterus spp.</i>	Lanternshark spp ^c	P	–	–
ETMOPTERIDAE	<i>Etmopterus princeps</i>	Great Lanternshark	A	DD	2006
LAMNIDAE	<i>Isurus paucus</i>	Longfin Mako Shark	A	VU	2006
LAMNIDAE	<i>Carcharodon carcharias</i>	White Shark	A, P	VU/EN (A), DD (P)	2000/2006
ODONTASPIDIDAE	<i>Odontaspis Taurus</i>	Sand Tiger Shark	A	VU	2000
SCYLORHINIDAE	<i>Apristurus profundorum</i>	Deepwater catshark	A	DD	2004
SOMNIOSIDAE	<i>Centroscymnus coelolepis</i>	Portuguese Dogfish	A	NT	2003
SPHYRNIDAE	<i>Sphyrna zygaena</i>	Smooth Hammerhead	A	NT	2000
TRIAKIDAE	<i>Mustelus canis</i>	Smooth dogfish	A	NT	2000

CAN: Canadian occurrence, A: Atlantic waters, Arc: Arctic waters, P: Pacific waters; VU: vulnerable, NT: near threatened, LC: least concern, DD: data deficient, TR: threatened, SC: special concern, N/A: not assessed.

^a Designable unit indicated in parentheses for COSEWIC status.

^b Northwest Atlantic population is classified as endangered (2006).

^c Possibly Hawaiian Lanternshark (*E. villosus*) [17].

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