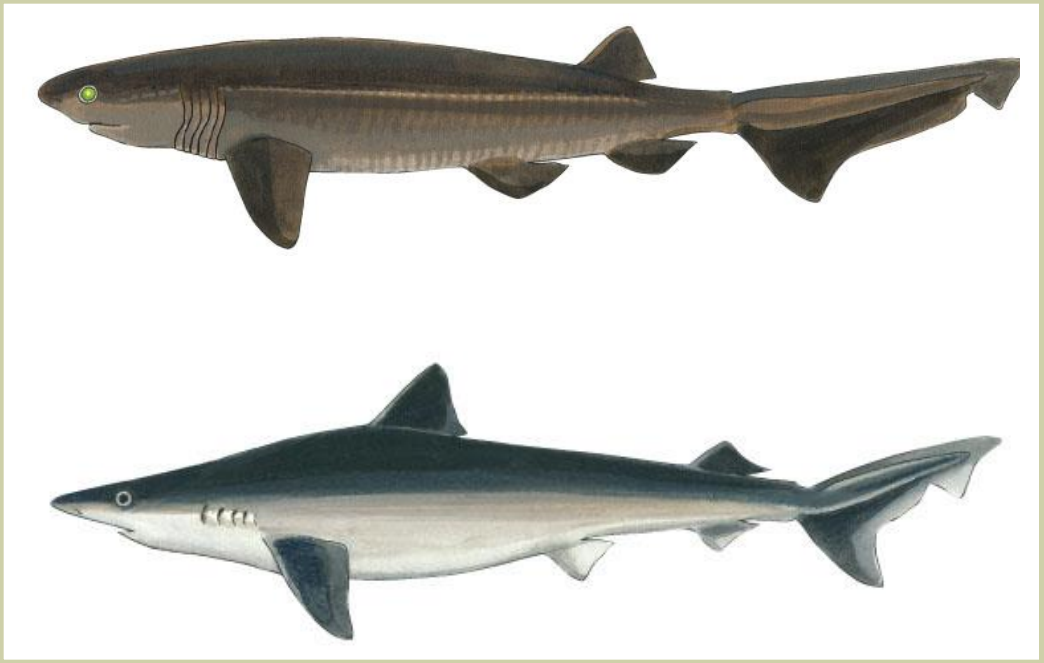
Species at Risk Act
Management Plan Report Series

Report on the Progress of Management Plan Implementation for the Bluntnose Sixgill Shark (*Hexanchus griseus*) and Tope Shark (*Galeorhinus galeus*) in Canada for the Period 2012 to 2017

Bluntnose Sixgill Shark and Tope Shark



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Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for the protection of species at risk throughout Canada. Under section 72 of the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the competent ministers are responsible for reporting on the implementation of the management plan for a species at risk, and on the progress towards meeting its objectives within five years of the date when the management plan was placed on the Species at Risk Public Registry and in every subsequent five-year period, until its objectives have been achieved or the status of the species changes to threatened or endangered under SARA.

Reporting on the progress of management plan implementation requires reporting on the collective efforts of the competent minister(s), provincial and territorial governments and all other parties involved in conducting activities that contribute to the species' conservation. Management plans set goals and objectives for maintaining sustainable population levels of one or more species that are particularly sensitive to environmental factors, but which are not in danger of becoming extinct. Some of the identified strategies and approaches are sequential to the progress or completion of others; and not all may be undertaken or show significant progress during the timeframe of a report on the progress of management plan implementation (progress report).

The Minister of Fisheries and Oceans and the Minister responsible for the Parks Canada Agency (PCA) are the competent ministers under SARA for the Bluntnose Sixgill Shark and Tope Shark. Fisheries and Oceans Canada (DFO) has prepared this progress report with the support of PCA.

As stated in the preamble to SARA, success in the conservation of species at risk depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in the management plan and will not be achieved by DFO, Environment and Climate Change Canada, PCA, or any other jurisdiction alone. The cost of conserving species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing the management plan for the Bluntnose Sixgill Shark and Tope Shark for the benefit of the species and Canadian society as a whole.

Acknowledgments

This progress report was prepared by Rhona Govender (DFO), with input from Heather Brekke (DFO), Paul Grant (DFO), Jackie King (DFO), Tatiana Lee (DFO), and PCA. DFO would like to express its appreciation to all individuals and organizations who have contributed to the conservation of the Bluntnose Sixgill Shark and Tope Shark.

Executive summary

The Bluntnose Sixgill Shark (*Hexanchus griseus*) and Tope Shark (*Galeorhinus galeus*) were listed as a species of special concern under the *Species at Risk Act* (SARA) in 2009. The "Management Plan for the Bluntnose Sixgill Shark (*Hexanchus griseus*) and Tope Shark (*Galeorhinus galeus*) in Canada" was finalized and published on the Species at Risk Public Registry in 2012.

The main threats identified in the management plan for the Bluntnose Sixgill Shark and Tope Shark include: entanglement in fishing gear and aquaculture pens, fisheries bycatch, pollution, habitat loss or degradation, climate and oceanographic change, and harassment from human activities such as SCUBA diving or seismic activity. Historically, the major threats to Bluntnose Sixgill Shark and Tope Shark were directed fisheries and entanglement and bycatch in commercial and recreational fishing activity.

The management goal for the Bluntnose Sixgill Shark and Tope Shark is to maintain their abundance within Canadian Pacific waters at current or higher levels.

The management objectives for the Bluntnose Sixgill Shark and Tope Shark are to:

1. improve scientific knowledge of abundance, biology, ecology, stock structure, and threats to these two species
2. maintain viable populations and prevent a decline to levels at which they would become threatened or endangered
3. maintain the species' current range of occupancy and distribution
4. enhance communication and outreach of the biology, management, monitoring, research, and enforcement activities of these species

This report documents the progress of management plan implementation for the Bluntnose Sixgill Shark and Tope Shark in Canada for the period January 1, 2012 to December 31, 2017. It summarizes progress that Fisheries and Oceans Canada (DFO) and other contributors have made towards achieving the goal and objectives set out in the management plan, including:

- use satellite tagging in the Strait of Georgia to better understand habitat use of sub-adult Bluntnose Sixgill Sharks in Canadian Pacific waters
- publish aerial and boat survey data for pelagic sharks such as Tope Sharks and have contributed to a better understanding of areas of aggregation and seasonal occurrence of this species
- encourage the reporting of sightings through its Shark Sightings network which collates all shark sightings from commercial and recreational users, the general public, and also by SCUBA divers
- implement a standardized set of biological sampling protocols that are available for use by at-sea observers on commercial fishery vessels and by DFO researchers on surveys
- develop code of conduct for shark encounters that outlines suitable handling procedures to reduce mortality during release from bycatch encounters
- require groundfish, tuna, and commercial salmon fisheries to collect and submit bycatch information
- continued collaboration between Parks Canada Agency and DFO when communicating strandings and collecting genetic material for research

While measurable progress has been made towards meeting the goal and objectives of the management plan, more work needs to be completed in order to increase our understanding of the stock structure, habitat, and diet requirements of Bluntnose Sixgill and Tope Sharks to ensure the continued conservation of the species.

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1 Introduction

This progress report covers the period from January 1, 2012 to December 31, 2017. It outlines the progress made towards meeting the goal and objectives listed in the "Management Plan for the Bluntnose Sixgill Shark (*Hexanchus griseus*) and Tope Shark (*Galeorhinus galeus*) in Canada" (DFO 2012). The report should be considered as part of a series of documents for these species that are linked and should be taken into consideration together. These are: the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) "Assessment and Status Report on the Bluntnose Sixgill Shark (*Hexanchus griseus*) in Canada" (COSEWIC 2007), the "COSEWIC Assessment and Status Report on the Tope (*Galeorhinus galeus*) in Canada" (COSEWIC 2007), the management plan (DFO 2012), the "Multi-species Action Plan for Gwaii Haanas National Park Reserve, National Marine Conservation Area Reserve, and Haida Heritage Site" (PCA 2016), and the "Multi-species Action Plan for Pacific Rim National Park Reserve of Canada" (PCA 2017).

Section 2 of this progress report summarizes key information on the threats to the species, management objectives, and actions to meet those objectives. For more details, readers should refer back to the management plan. Section 3 reports the progress of activities identified in the management plan that support achieving the management goal and objectives. Section 4 provides a concluding statement about the progress towards achieving those objectives.

2 Background

2.1 COSEWIC assessment summary

2.1.1 Bluntnose Sixgill Shark COSEWIC assessment summary

The Bluntnose Sixgill Shark was initially assessed and designated as special concern by COSEWIC in 2007 (COSEWIC 2007). The *Species at Risk Act* (SARA) listing of the Bluntnose Sixgill Shark in 2009 led to the development and publication of the management plan in 2012 (DFO 2012), based on the information provided in the COSEWIC status report (COSEWIC 2007). An updated COSEWIC assessment is expected, but the date has not yet been determined.

Assessment summary: April 2007

Common name: Bluntnose Sixgill Shark

Scientific name: *Hexanchus griseus*

Status: Special concern

Reason for designation: This large (maximum reported length 4.8 m), heavy-bodied shark is a benthic species that is widely distributed over continental and insular shelves in temperate and tropical seas throughout the world. In Canadian Pacific waters, it is found in inlets and along the continental shelf and slope typically at depths greater than 91 m (range 0 to 2500 m). In the absence of information about population structure, it is treated as a single population for assessment purposes. The present population size and abundance trends are not known. The only available abundance index (encounter rates with immature

Bluntnose Sixgill Sharks at a shallow site in the Strait of Georgia) has decreased significantly (>90%) in the last five years. This index is not likely representative of the overall abundance trend because only immature Bluntnose Sixgill Sharks are encountered and the site is shallow relative to the preferred depth range. The principal known threat to the species is fishing. The Bluntnose Sixgill Shark has been the focus of at least three directed fisheries in Canadian waters, most recently in the late 1980s and early 1990s. It continues to be caught as bycatch, but survival of released sharks is unknown. Bluntnose Sixgill Sharks observed by divers sometimes show scars from entanglement in fishing gear. Because of its late age of maturity (18 to 35 years for females), it is likely susceptible to overfishing even at low levels of mortality. Little is known about the abundance and movement patterns of this species elsewhere in the world, so the potential for a rescue effect is unknown.

Occurrence: Pacific Ocean

Status history: The Bluntnose Sixgill Shark was designated as special concern in April 2007. An updated assessment is expected based on the development of a new status report by COSEWIC.

2.1.2 Tope Shark COSEWIC assessment summary

The Tope Shark was initially assessed and designated as special concern by COSEWIC in 2007 (COSEWIC 2007). The SARA listing of the Tope Shark in 2009 led to the development and publication of the management plan in 2012 (DFO 2012), based on the information provided in the COSEWIC status report (COSEWIC 2007). COSEWIC re-examined and confirmed the status of the Tope Shark as special concern in 2021 (COSEWIC 2021).

Assessment summary: April 2021

Common name: Tope Shark

Scientific name: *Galeorhinus galeus*

Status: Special concern

Reason for designation: This Pacific coast shark is thought to be highly migratory across its range from Hecate Strait, British Columbia to the Gulf of California. Tope Shark shows no evidence of distinct populations and is therefore considered as a single population for the purposes of this assessment. It feeds primarily on fish and, in Canada, occupies continental shelf waters between western Vancouver Island and Hecate Strait. The Tope Shark's maximum length is less than two metres, maximum age is at least 45 years, maturity occurs between 12 and 17 years, and generation time is 23 years. Tope Shark is noted for its high concentration of vitamin A in the liver, exceeding that of any other northeast Pacific fish species. Demand for vitamin A during World War II led to a large fishery that quickly collapsed due to over-exploitation. More than 800,000 individuals, primarily large adults, were killed for their livers between 1937 and 1949 throughout the species' migratory range. Tope Shark is rarely seen today in Canadian waters. There is no targeted commercial fishery in Canada, but it continues to be caught as fishery bycatch in Canada and the United States (U.S.), and remains the target of small commercial and recreational fisheries in the U.S. The sustainability of current catches cannot be assessed because there is no

population estimate for Tope Shark. The ongoing fishery mortality, the lack of a management plan for Canadian bycatch, and the long generation time and low fecundity of Tope Shark suggest cause for concern.

Occurrence: Pacific Ocean

Status history: The Tope Shark was designated as special concern in April 2007. Status re-examined and confirmed in May 2021.

2.2 Threats to Bluntnose Sixgill Shark and Tope Shark

This section summarizes the information found in the management plan (DFO 2012) regarding threats to the Bluntnose Sixgill Shark and the Tope Shark within Canadian Pacific waters.

2.2.1 Threats to the Bluntnose Sixgill Shark and the Tope Shark

Table 1 summarizes the threats to the Bluntnose Sixgill Shark and the Tope Shark. Please refer to section 1.5 and appendix III of the management plan for more information on these threats.

Table 1. Summary of the threats identified for the Bluntnose Sixgill Shark and the Tope Shark, based on the management plan.

Threat	Level of concern[1]	Description
Entanglement/ bycatch	Medium	Fishing activities are the primary threat to the Bluntnose Sixgill Shark and Tope Shark. No directed fishery currently exists for either species; however, both species are incidentally caught in other fisheries, primarily the groundfish trawl and groundfish hook and line fisheries. The extent of interception in food, social and ceremonial fisheries and aquaculture operations is unknown.
Pollution	Low	The threat of pollution to the Bluntnose Sixgill Shark and Tope Shark could originate from petroleum spills from oil tankers, drill rigs, or ocean-going vessels; waste from ocean-going vessels; or biological contaminants via sewage outflow or industry discharge. Spills are recurrent events along the British Columbia (BC) coast, and the likelihood of accidental spills may increase with high densities of marine traffic or increased shoreline development. The subsequent decrease in water quality from pollutants could result in increased mortality directly and indirectly through a decline in prey availability. Bioaccumulation of contaminants may also be a concern.

[1] Level of concern indicates whether managing the threat is an overall high, medium, or low level of concern for conservation of the species, taking into account the stress, extent, occurrence, frequency, casual certainty, and severity of the specific threat.

Threat	Level of concern[1]	Description
Climate and oceanographic change	Low	Bluntnose Sixgill Shark and Tope Shark are known to feed on a variety of invertebrates and bony fishes which would be impacted by climate change. Impacts of climate change on these sharks may be limited to changes in food resources (for example, abundance and distribution) and temperature, which would manifest themselves through changes in Bluntnose Sixgill Shark and Tope Shark distribution and growth. Due to changing ocean productivity associated with climate change, it is likely these sharks, particularly Tope Shark and juvenile Bluntnose Sixgill Shark, would significantly change their distribution patterns following food resources. A warming climate may induce a major shift in spawning or birthing areas and nursery grounds
Habitat loss or degradation	Low	Urbanization and development of coastal BC may result in physical degradation of habitat that may displace juvenile Bluntnose Sixgill Sharks from their preferred shallower water habitats, affecting their potential to feed, or achieve reproductive success. Tope Sharks rarely occupy nearshore coastal waters in Canadian Pacific waters and, as a result, habitat loss or degradation is likely not a threat for them within Canada.
Harassment	Low	A recreational SCUBA dive industry aimed at diving with the Bluntnose Sixgill Shark has developed in the Strait of Georgia and off the west coast of Vancouver Island during the last few decades. Though the extent is unknown, this may impact normal Bluntnose Sixgill Shark behaviour. Anecdotal reports have noted intentional baiting of Bluntnose Sixgill Sharks to bring them to the surface for viewing, which could make them more susceptible to human impacts, such as encounters with boats and fishing gears. Further, the impacts of underwater noise through seismic activity, explosives, or otherwise on sharks in general has not been well documented.
Historical directed fishing[2]	N/A	The Bluntnose Sixgill Shark was the focus of at least three known directed fisheries in Canadian Pacific waters, with a focus on their skins in the 1920s, livers in 1937 to 1946, and on an experimental basis for juveniles in the late 1980s and again in 1994. An intensive fishery for Tope Shark existed between 1937 and 1949, occurring throughout their migratory range in the northeast Pacific. This depleted the adult biomass, and since that time, the Tope Shark has not received any commercial or research attention. The degree to which the stock has recovered is unknown.

[2] Historical threats are identified due to the impact on the population but have not been included in the ranking system as they currently do not contribute to the level of concern of the present population.

Threat	Level of concern[1]	Description
Historical entanglement/ bycatch	N/A	Little information exists on bycatch of Bluntnose Sixgill Shark and Tope Shark in the historic record because shark bycatch was not broken down by species. Although limited, the information that does exist indicates both species were caught in groundfish longline and, to a lesser extent, trawl fisheries. It is likely, given the lower effort levels in these historical fisheries compared to current fisheries, that bycatch levels would have been very low.

2.3 Management

This section summarizes the information found in the management plan on the management goal and objectives necessary for the conservation of the Bluntnose Sixgill Shark and Tope Shark.

2.3.1 Management goal and objectives

Section 2 of the management plan identified the following management goal and objectives necessary for the conservation of the Bluntnose Sixgill Shark and Tope Shark.

Management goal:

> To maintain their abundance within Canadian Pacific waters at current or higher levels.

Management objectives:

1. Improve scientific knowledge of abundance, biology, ecology, stock structure, and threats to these species
2. Maintain viable populations and prevent a decline to levels at which they would become threatened or endangered
3. Maintain the species' current range of occupancy and distribution
4. Enhance communication and outreach of the biology, management, monitoring, research, and enforcement activities of these species

2.3.2 Performance measures

The management plan does not contain any performance indicators or measures to define and evaluate progress towards achieving the management goal and objectives. Progress will be informed by the advancement of the management plan goal and objectives as described in section 3 below.

3 Progress towards conservation

The management plan for the Bluntnose Sixgill Shark and the Tope Shark divides the management effort into four conservation actions: 1) management; 2) research; 3) monitoring; and 4) outreach and communication. Progress in carrying out these conservation actions is

reported in section 3.1. Section 3.2 summarizes the progress towards undertaking these actions.

3.1 Actions supporting conservation

Table 2 below provides information on the implementation of activities undertaken to address the conservation actions identified in the management plan. Each activity has been assigned one of four statuses:

1) completed: the planned activity has been carried out and concluded
2) in progress: the planned activity is underway and has not concluded
3) not started: the activity has been planned but has yet to start
4) cancelled: the planned activity will not be started or completed

Table 2. Details of activities supporting the conservation of the Bluntnose Sixgill Shark and Tope Shark from 2012 to 2017.

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
Develop Codes of Conduct (CoC) to reduce mortality by both aquaculture entanglement and bycatch of Bluntnose Sixgill Shark and Tope Shark in commercial and recreational fisheries.	Management	2013	Completed	In 2014, Fisheries and Oceans Canada (DFO) developed CoC for shark encounters to reduce the threat of fishery-induced mortality, including incidental capture and entanglement in commercial, aquaculture, and recreational fisheries. The CoC encourage those who encounter sharks in Canadian Pacific waters to document and report all encounters. They also include information on how to limit encounters and provide handling and release guidelines for commercial and recreational fishers, and aquaculture operations in the case of entanglement. The handling guidelines specify different approaches depending on the life stage and	2,4	**DFO**, harvesters, stakeholders

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
				condition of the shark, as well as the gear type used.		
Continue the permitting of scientific activities, with reporting requirements, to address key knowledge gaps and clarify identified threats for Bluntnose Sixgill Shark and Tope Shark in Canadian Pacific waters.	Management	Ongoing	In progress	DFO was issued a scientific licence pursuant to section 52 of the *Fishery (General) Regulations.* This licence is renewed every five years and permits DFO staff to conduct general scientific research, including research on Bluntnose Sixgill and Tope Sharks. No separate scientific research permits were issued from 2012 to 2017 for Bluntnose Sixgill Shark and Tope Shark. Permits for scientific activities that address key knowledge gaps and clarify identified threats will continue to be reviewed as they are requested.	1	**DFO**
Conduct scientific research on the biology, ecology, stock structure and threats to a) determine the range, areas of aggregation and seasonal occurrence; b) analyze the genetic population structure; c) analyze biological	Research	Ongoing	In progress	Eight Bluntnose Sixgill Sharks were satellite tagged to identify the depth and thermal habitats of juveniles in the Strait of Georgia. Results of this study suggest that juvenile Bluntnose Sixgill Sharks remain in the Strait of Georgia until they are mature and then migrate into deeper offshore waters (King and Surry 2017). King et al. (2017b) outlined current and historic shark interactions (including Bluntnose Sixgill Shark and Tope Shark) through directed and incidental	1,2,3	**DFO,** academic community, environmental non-governmental organizations (ENGOs), harvesters, United States National Oceanic and Atmospheric

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
contaminants; d) investigate habitat and diet requirements; e) provide an estimate of life history characteristics; and f) collect size, sex, and age samples, where possible.				fisheries in the Northeast Pacific Ocean, and the present conservation challenges for shark management. Surry and King (2015) published aerial and boat survey information for pelagic sharks, including Tope Shark, on the Pacific coast of Canada. The global scientific community made several contributions to the literature during the time period covered by this progress report. King's book chapter (King et al. (2017b) was a contribution to a two-part book series summarizing all research relating to Northeast Pacific shark biology and conservation (Larson and Lowry 2017a, 2017b). Mitochondrial DNA was used to assess genetic connectivity in Bluntnose Sixgill Sharks (Vella and Vella 2017). Findings show that the largest population subdivisions occur between the Atlantic and Pacific Oceans, and even within oceans. Within the Pacific Ocean, a significant genetic difference was found between the North East Pacific and South West Pacific. This differentiation is consistent with the Bluntnose Sixgill Shark's restricted transoceanic migration patterns.		Association (NOAA)

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
				Harry (2017) reviewed bomb carbon dating and fluorochrome chemical marking age validation studies to show that counting growth zones on calcified shark structures can underestimate age. For Tope Shark, this discrepancy can lead to an apparent age that is underestimated by half of the true age. Chabot (2015) used genetic analyses to show that Tope Shark populations are isolated globally, and recommended that they be managed as independent stocks.		
Develop an index of relative abundance (IRA).	Research	2017	In progress	The feasibility of the development of an IRA was conducted. The majority of abundance data for Bluntnose Sixgill Shark and Tope Shark is obtained from research surveys and commercial groundfish trawl, line, and net fisheries. It was determined that an IRA cannot be developed at this time because of the limited data available for these species.	1,2	**DFO**
Develop a set of protocols for biological sampling of bycatch of Bluntnose Sixgill	Research	2013	Completed	Opportunistic biological shark sampling protocols were developed in 2010; one for at-sea observers on commercial groundfish vessels, and one for DFO researchers on surveys. The protocols include taking photos, recording the	1	**DFO**

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
Shark and Tope Shark.				length and sex, and collecting tissue samples for DNA analyses. Tissue samples for contaminant analyses, vertebrae for age determinations, samples of stomach contents, and liver samples for fat content and stable isotope analyses are all collected in the case of a dead specimen. These sampling protocols could address key knowledge gaps identified in the management plan, including understanding factors that regulate population productivity and the identification of stock structure in British Columbia (BC). The biological sampling protocols were described in key integrated fisheries management plans (IFMPs). Thirty-two DNA samples were obtained from Tope Sharks and one sample from a Bluntnose Sixgill Shark during the 2012 to 2017 reporting period, as per the sampling protocols.		
Continue to collect bycatch information from groundfish fisheries of Bluntnose Sixgill Shark and Tope Shark in Canadian	Monitoring	Ongoing	In progress	The Pacific groundfish trawl fishery has had 100% at-sea observer coverage since 1996. In 2006, an electronic monitoring system was implemented for all groundfish 1) trap fisheries, and 2) hook and line fisheries in Canadian Pacific waters. Ten percent of all sets	1,3	**DFO**, at-sea observers, harvesters

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
Pacific waters; improve bycatch information in all other fisheries.				per trip are randomly selected for review. Bycatch information from all groundfish fisheries is collected on an ongoing basis by DFO from independent service providers. All commercial salmon fishers discard shark bycatch at-sea and are required to report this in their logbooks. There is no independent monitoring of this bycatch at-sea. This information is reported to DFO and included in the Fishery Operations System which is used to collect commercial fishery catch and effort data. There are catch records of 829 Tope and 835 Bluntnose Sixgill Sharks from 2012 to 2017, all from commercial fisheries, primarily directing for groundfish and salmon. There are no reporting measures in place for Bluntnose Sixgill Shark and Tope Shark bycatch in invertebrate fisheries. Reports are submitted voluntarily by fishers. Interactions between invertebrate fisheries occurring in Canadian Pacific waters and Bluntnose Sixgill Shark and Tope Shark are believed to be rare. The shrimp trawl fishery poses the highest		

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
				threat of all invertebrate fisheries; however, it is still believed to be of low concern. There were no reports of Bluntnose Sixgill Shark or Tope Shark bycatch in the shrimp trawl fishery or in research surveys from 2012 to 2017. Reporting of Bluntnose Sixgill Shark and Tope Shark bycatch is not a requirement in any of the herring fisheries in Canadian Pacific waters. All tuna fisheries that are conducted in Canadian Pacific waters are required to record all shark interactions in their shark logbook and ensure that incidentally-caught sharks are released in a manner that causes them the least harm. There is no independent at-sea observing of this activity. There was one report of a Tope Shark intercepted in a tuna fishery between 2012 and 2017. Additionally, three sharks have been reported in the more general "shark" category and may include Bluntnose Sixgill sharks. The accuracy of voluntary reporting of bycatch for Bluntnose Sixgill Shark and Tope Shark is unknown.		
Improve accuracy of species	Monitoring	Ongoing	In progress	Sharks of British Columbia species identification sheets were developed in	1,3	**DFO**, harvesters

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
identification in reporting of bycatch information from all fisheries.				2011 and updated in 2017. These sheets include diagrams of the species and list key anatomical features of 14 shark species found in BC's waters, including Bluntnose Sixgill Shark and Tope Shark. Sampling protocols and identification sheets are provided to at-sea observers. Diagrams showing Bluntnose Sixgill Shark and Tope Shark are included in the CoC (row 1 of this table). The CoC are described and linked to in key IFMPs.		
Encourage the reporting of entanglement in aquaculture gear and sightings by SCUBA divers.	Monitoring	2014	In progress	DFO receives all bycatch reports voluntarily from finfish aquaculture operations. There wereno reports of incidental capture of Bluntnose Sixgill Shark or Tope Shark from 2012 to 2017. The CoC for shark encounters have been distributed to aquaculture operations. Mandatory reporting of incidental drowning at aquaculture sites, and/or a "bulletin" to aquaculture operations requesting entanglement information prior to relicensing may reduce this threat. Divers are encouraged to report Bluntnose Sixgill Shark and Tope Shark sightings to DFO through the reporting website or phone number.	1,3	**DFO**, harvesters (aquaculture)

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
				Beginning in 2007, Rendezvous Dive Adventures began conducting an annual citizen science “shark survey week” in August. Sighting reports include the collection of anatomical, behavioral, and habitat data. Sightings data are reported to DFO and are entered into a database created and maintained by staff at DFO’s Pacific Biological Station.		
Enhance Indigenous group, public, and stakeholder awareness of these species.	Outreach and communication	Ongoing	In progress	Refer to row 7 above for a description of the shark identification sheets that were developed and row 8 above for the shark reporting website. An incentive program was also developed to help encourage the reporting of sightings to DFO through the shark reporting website or phone number. Between 2012 and 2014, PCA delivered several presentations on cartilaginous fish, including the Bluntnose Sixgill Shark. This reached approximately 24,000 people and occurred primarily through the Coastal Naturalist Program delivered on ferries in collaboration with British Columbia Ferry Services Inc. PCA will continue to communicate about these species opportunistically.	4	**DFO**, Indigenous groups, International Union for the Conservation of Nature, PCA, stakeholders

Activity	Type of conservation action	Timeline	Status	Details	Objectives	Participants*
Build intra- and interagency networks, where appropriate, for effective communication regarding strandings, aquaculture entanglement, and bycatch.	Outreach and communication	Ongoing	In progress	Reports of Bluntnose Sixgill and Tope Shark sightings are encouraged through the shark reporting website detailed in row 6 above. Bycatch reports are available within DFO, upon request. One dead Bluntnose Sixgill Shark washed ashore in the Pacific Rim National Park Reserve in 2012. Biological samples were collected for DFO. Although no Bluntnose Sixgill Sharks or Tope Sharks have been found stranded or dead within a national park since then, PCA continues to opportunistically respond to shark strandings.	4	**DFO**, harvesters, PCA
Collaborate with key organizations, agencies, and international efforts of research, monitoring, management, and enforcement activities for the Bluntnose Sixgill and Tope Shark.	Outreach and communication	Ongoing	In progress	Refer to the rows 9 and 10 above for information regarding PCA's collaboration with DFO in Bluntnose Sixgill Shark and Tope Shark research, monitoring, and management. The International Pacific Halibut Commission follows the CoC when conducting surveys in Canadian waters. This includes taking samples of dead Bluntnose Sixgill Sharks which are then sent to the DFO Pacific Biological Station in Nanaimo for analysis.	1,2,3,4	**DFO**, academic community, ENGOs, harvesters, NOAA, PCA

*In the participants column of the table, the lead participant(s) is/are listed on top and in bold; other participants are listed alphabetically. Not all activities have specific participants identified.

3.2 Summary of progress towards conservation

3.2.1 Status of activities

Eleven activities from the management plan are identified in table 2. Of the eleven activities, two (18%) have been completed and nine (82%) are in progress; the latter are incomplete at present, and do not have a specific endpoint.

4 Concluding statement

While the majority of activities are still in progress, many steps have been taken toward meeting the conservation actions outlined in the management plan. Codes of conduct (CoC) were implemented to reduce the threat of fishery-induced mortality, including incidental capture and entanglement in commercial, aquaculture, and recreational fisheries. Several contributions were made to literature by Fisheries and Oceans Canada (DFO) staff that provided a better understanding of Bluntnose Sixgill Shark and Tope Shark habitat use and occurrence in Canadian Pacific waters through satellite tagging and the publication of sightings data through aerial and ship surveys. DFO continues to encourage the reporting of sightings by SCUBA divers through several key dive operations with an active interest in Bluntnose Sixgill Sharks. Further outreach can be conducted with the broader SCUBA diving community to bring more awareness to the shark reporting website.

A standardized set of biological sampling protocols were implemented that can be used in studies that require Bluntnose Sixgill Shark and Tope Shark aging or DNA analyses. Bycatch information is a requirement and continues to be collected in groundfish, tuna, and commercial salmon fisheries. Ongoing work is needed to improve reporting from all other fisheries. Parks Canada Agency continues to work collaboratively with DFO when communicating strandings and collecting genetic material for research.

Ongoing work is needed to determine the accuracy of bycatch reporting in herring and invertebrate commercial fisheries, food, social and ceremonial fisheries, as well as aquaculture operations. Including the CoC and species identification sheets in tuna and invertebrate fishery harvest logbooks may assist in species identification and harm reduction in the case of any interactions. When incidentally caught, the actual mortality of “released live” sharks is unknown. A better understanding of post-release mortality will enable a more accurate assessment of the effects fishing has on Bluntnose Sixgill Shark and Tope Shark populations. Further data collection is necessary before an index of relative abundance can be created that will reflect actual abundance. Increased promotion of the shark reporting website and identification sheets is necessary to increase Indigenous, public, and stakeholder awareness of these species.

All of the activities outlined in the management plan are completed or in progress. Many of these activities are ongoing efforts that will continue to provide further understanding of Bluntnose Sixgill Shark and Tope Shark stock structure, habitat, diet requirements, and threats to these populations into the future.

5 References

Chabot, C.L. 2015. Microsatellite loci confirm a lack of population connectivity among globally distributed populations of the Tope Shark *Galeorhinus galeus* (Triakidae). J. Fish. Biol. 87: 371-385.

COSEWIC. 2007. COSEWIC assessment and status report on the Bluntnose Sixgill Shark *Hexanchus griseus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 33pp.

COSEWIC. 2007. COSEWIC Assessment and status report on the tope *Galeorhinus galeus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 29 pp.

COSEWIC. 2021. COSEWIC assessment and status report on the Tope *Galeorhinus galeus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 49 pp.

DFO. 2012. Management plan for the Bluntnose Sixgill Shark (*Hexanchus griseus*) and Tope Shark (*Galeorhinus galeus*) in Canada. Species at Risk Act Management plan Series. Fisheries and Oceans Canada, Ottawa. iv + 37 pp.

Harry, A.V. 2017. Evidence for systemic age underestimation in shark and ray ageing studies. Fish Fish. 19(2): 185-200.

King, J.R. and Surry, A.M. 2017. Seasonal and daily movements of the Bluntnose Sixgill Shark (*Hexanchus griseus*) in the Strait of Georgia from satellite tag data. Environ. Biol. Fish. 100(12): 1543-1559.

King, J. R., G. A. McFarlane, V. V. Gertseva, J. Gasper, S. E. Matson, and C. A. Tribuzio. 2017. Shark Interactions with Directed and Incidental Fisheries in the Northeast Pacific Ocean: Historic and Current Encounters, and Challenges for Shark Conservation. Adv. Mar. Biol. 78 (Pt. B): 9-44.

Larson, S. and Lowry, D. 2017a. Northeast Pacific shark biology, research, and conservation (Part A). Adv. Mar. Biol. 77: 230 pp.

Larson, S. and Lowry, D. 2017b. Northeast Pacific shark biology, research, and conservation (Part B). Adv. Mar. Biol. 78: 169 pp.

PCA. 2016. Multi-species Action Plan for Gwaii Haanas National Park Reserve, National Marine Conservation Area Reserve, and Haida Heritage Site. Species at Risk Action Plan Series. Parks Canada Agency, Ottawa. vi+ 25 pp.

PCA. 2017. Multi-species Action Plan for Pacific Rim National Park Reserve of Canada. Species at Risk Act Action Plan Series. Parks Canada Agency, Ottawa. v. + 29 pp.

Surry, A.M., and King, J.R. 2015. Surveys for Basking Sharks (*Cetorhinus maximus*) and other pelagic sharks on the Pacific Coast of Canada, 2007 – 2011. Can. Tech. Rep. Fish. Aquat. Sci. 3108: vi + 28 p.

Vella, N. and Vella, A. 2017. Population genetics of the deep-sea Bluntnose Sixgill Shark, *Hexanchus griseus*, revealing spatial genetic heterogeneity. Mar. Genomics. 36: 25-32.