

Action Plan for the Basking Shark (*Cetorhinus maximus*) in Canadian Pacific waters

Basking Shark (Pacific population)



2020

Recommended citation:

Fisheries and Oceans Canada. 2020. Action Plan for the Basking Shark (*Cetorhinus maximus*) in Canadian Pacific waters [Final]. *Species at Risk Act* Action Plan Series. Fisheries and Oceans Canada, Ottawa. iii + 17 pp.

For copies of the action plan, or for additional information on species at risk, including Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports, residence descriptions, recovery strategies, and other related recovery documents, please visit the [Species at Risk Public Registry](#).

Cover illustration: Florian Graner, 2010

Également disponible en français sous le titre
« Plan d'action pour le requin-pèlerin (*Cetorhinus maximus*) dans les eaux canadiennes du Pacifique »

© Her Majesty the Queen in Right of Canada, represented by the Minister of Fisheries and Oceans, 2020. All rights reserved.

ISBN 978-0-660-34199-6

Catalogue no. CW69-21/66-2020E-PDF

Content (excluding the illustrations) may be used without permission, with appropriate credit to the source.

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 effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of action plans for species listed as extirpated, endangered, or threatened for which recovery has been deemed feasible. They are also required to report on progress five years after the publication of the final document on the Species at Risk (SAR) Public Registry.

The Minister of Fisheries and Oceans and the Minister of the Environment and Climate Change, as the Minister responsible for the Parks Canada Agency, are the competent ministers under SARA for the Pacific population of Basking Shark and have prepared this action plan to implement the recovery strategy, as per section 47 of SARA. In preparing this action plan, the competent ministers have considered, as per section 38 of SARA, the commitment of the Government of Canada to conserving biological diversity and to the principle that, if there are threats of serious or irreversible damage to the listed species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for a lack of full scientific certainty. To the extent possible, this action plan has been prepared in cooperation with Parks Canada Agency as per subsection 48(1) of SARA.

As stated in the preamble to SARA, success in the recovery of this species depends on the commitment and cooperation of many different groups that will be involved in implementing the directions and actions set out in this action plan and will not be achieved by Fisheries and Oceans Canada and the Parks Canada Agency or any other jurisdiction alone. The cost of conserving species at risk is shared amongst many groups. All Canadians are invited to join in supporting and implementing this action plan for the benefit of the Pacific population of Basking Shark and Canadian society as a whole.

Under SARA, an action plan provides the detailed recovery planning that supports the strategic direction set out in the recovery strategy for the species. The plan outlines recovery measures to be taken by Fisheries and Oceans Canada and the Parks Canada Agency and other jurisdictions and/or organizations to help achieve the population and distribution objectives identified in the recovery strategy. Implementation of this action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

Acknowledgments

This action plan was prepared by Heather Brekke (DFO). The development of the action plan was the result of collaborative efforts and contributions from many individuals and organizations. The Basking Shark Action Plan Team (appendix B) considered the contributions from team meetings and the Canadian Science Advisory Secretariat's Science Response paper "Evaluation of Information Available to Support the Identification of Habitat Necessary for the Survival and Recovery of Basking Shark in Canadian Pacific Waters" (DFO 2016) for the development of the action plan.

Executive summary

The Pacific population of Basking Shark (*Cetorhinus maximus*) was listed as endangered under SARA in 2010. This action plan is considered one in a series of documents that are linked and should be taken into consideration together, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report, a recovery potential assessment, and the recovery strategy. This document is considered a partial action plan because current best available information is insufficient to identify critical habitat (DFO 2016). Identification of the habitat necessary to support survival and recovery of the population may be addressed in an amendment to the recovery strategy at a later date.

The Basking Shark is the world's second largest fish, reaching a maximum recorded length of 12.2 metres. Basking Sharks exhibit life history characteristics of overall low productivity, namely longevity (~50 years), slow growth and maturation, and low fecundity. They are filter-feeders, feeding primarily on copepod zooplankton.

Canada's Pacific population of Basking Sharks migrates into British Columbia waters in spring and summer, and winters off California (McFarlane et al. 2009). Historically, large aggregations numbering in the hundreds or possibly thousands were seasonally common and widely distributed in Canadian Pacific waters (DFO 2009; Wallace and Gisborne 2006, as cited in COSEWIC 2007). Current abundance in Canadian Pacific waters is unknown, but it is estimated that some proportion up to the full range-wide population (321 to 535 individuals) seasonally utilizes Canadian Pacific waters. At present, there have been only 37 confirmed or reliable sightings from 1996 to 2018 in Canadian Pacific waters (King pers. comm. 2018).

The key factors limiting the recovery and survival of the Pacific population of Basking Shark are their long-life, slow growth and maturation, and low fecundity which lead to overall low productivity. The decline of the Pacific population of Basking Shark is primarily due to human-caused mortality from 1942 to 1969. Current threats to the Basking Shark include entanglement, collision with vessels, harassment from marine based activities, and prey availability.

This action plan outlines measures that provide the best chance of achieving the population and distribution objectives for the species, including the measures to be taken to address the threats and monitor the recovery of the species. The population and distribution objectives for the Pacific population of Basking Shark identified in the recovery strategy are:

- maintain the current abundance of Basking Sharks
- attain positive population growth of Basking Sharks within 15 to 20 years
- attain increase in Basking Shark aggregations (two or more sharks)
- maintain distribution of Basking Sharks

Section 1.2 outlines the measures to be taken under the following broad strategies:

1. communications and outreach
2. scientific research
3. management
4. collaboration

Minor edits have been made to these broad strategies from how they appear in the Basking Shark Recovery Strategy. The changes were made to better align broad strategies with the current understanding of the required recovery measures, based on best available science. An evaluation of the socio-economic costs and benefits of the action plan is provided in section 3.

Table of contents

Preface.....	i
Acknowledgments	i
Executive summary	ii
1. Recovery actions.....	1
1.1 Context and scope of the action plan.....	1
1.2 Measures to be taken to implement the recovery strategy	2
1.2.1 Implementation schedules	4
2. Critical habitat	11
2.1 Identification of the species' critical habitat	11
3. Evaluation of socio-economic costs and of benefits.....	11
3.1 Socio-economic costs of implementing this action plan	12
3.2 Benefits of implementing this action plan	13
4. Measuring progress	13
5. References.....	14
Appendix A: effects on the environment and other species.....	16
Appendix B: record of cooperation and consultation	17

1. Recovery actions

1.1 Context and scope of the action plan

The Pacific population of Basking Shark (*Cetorhinus maximus*) was listed as endangered under the *Species at Risk Act* (SARA) in 2010. This action plan is part of a series of documents regarding the Pacific population of Basking Shark that should be taken into consideration together, including the [COSEWIC status report](#) (COSEWIC 2007), the Science Advisory report from the [recovery potential assessment](#) (RPA) (DFO 2009), and the [recovery strategy](#) (DFO 2011). Under SARA, an action plan provides the detailed recovery planning that supports the strategic direction set out in a recovery strategy for the species. The recovery strategy also provides background information on the species and its threats and critical habitat information. This document is considered a partial action plan because current best available information is insufficient to identify critical habitat (DFO 2016). Identification of the habitat necessary to support survival and recovery of the population may be addressed in an amendment to the recovery strategy at a later date.

The Basking Shark is the world's second largest fish, reaching a maximum recorded length of 12.2 metres. Basking Sharks exhibit life history characteristics of overall low productivity, namely longevity (~50 years), slow growth and maturation, and low fecundity. They are filter-feeders, feeding primarily on copepod zooplankton.

Given their large size and their planktivorous feeding strategy, Basking Sharks require oceanographic conditions that concentrate prey. Based on experience elsewhere, specific geological structures (that is, headlands, banks) that concentrate prey are used regularly by Basking Sharks (Sims and Quayle 1998; McFarlane et al. 2009). In the northeast Atlantic it was calculated that Basking Sharks require a minimum prey density of between 0.55 and 0.74 g·m⁻³ for net energy gain (Sims 1999).

Basking Sharks are found circumglobally in coastal shelf waters. In Canadian Pacific waters, Basking Sharks are considered to be part of a population which migrates into British Columbia waters in spring and summer, and winters off California (McFarlane et al. 2009). Current abundance in Canadian Pacific waters is unknown, but it is estimated that some proportion up to the full range-wide population (321 to 535 individuals) seasonally utilizes Canadian Pacific waters; however, these numbers are highly uncertain. Historically, large aggregations of Basking Sharks numbering in the hundreds or possibly thousands were seasonally common and widely distributed in Canadian Pacific waters (DFO 2009; Wallace and Gisborne 2006, as cited in COSEWIC 2007). At present, Basking Sharks appear infrequently in Canadian Pacific waters with only 37 confirmed or reliable sightings from 1996 to 2018 (King pers. comm. 2018). It is important to note that most of these sightings are of Basking Sharks in surface waters and it is estimated that individuals spend, on average, only 19% of their time near the surface (Westgate et al. 2014).

Research in the north Atlantic has found that Basking Sharks are capable of very large migrations across ocean basins and hemispheres, and spend significant periods well below the surface (Gore et al. 2008; Skomal et al. 2009). Basking Sharks appear to utilize favorable feeding zones that extend over large regions (Gore et al. 2016). They are not dependent on restricted feeding locations, but rather continuously move between areas on spatial scales of tens of kilometres on a timescale of days. Basking Sharks have very low genetic diversity and such little differentiation between ocean basins that it is not possible to designate distinct

populations based on genetic differences (Hoelzel et al. 2006). To date, no genetic analyses have been completed on Basking Sharks in the Northeast Pacific Ocean.

The key factors limiting the recovery and survival of the Pacific population of Basking Shark is their long-life (~50 years), slow growth and maturation, and low fecundity which lead to overall low productivity. Even in the absence of human-induced mortality, Basking Shark populations grow very slowly. The decline of the Pacific population of Basking Shark is primarily due to human-caused mortality which occurred from 1942 to 1969. Current threats to the Basking Shark include entanglement, collision with vessels, harassment from marine based activities, and prey availability.

The recovery strategy defined population and distribution objectives for the Basking Shark as:

- maintain the current abundance of Basking Sharks
- attain positive population growth of Basking Sharks within 15 to 20 years
- attain increase in Basking Shark aggregations (two or more sharks)
- maintain distribution of Basking Sharks

Under section 47 of SARA, the competent minister must prepare one or more action plans based on the recovery strategy. Therefore, action planning for species at risk recovery is an iterative process. The implementation schedule, including the recovery measures, outlined in this action plan may be updated in the future through an amendment to this action plan or development of another action plan, depending on the progression towards recovery.

1.2 Measures to be taken to implement the recovery strategy

Successful recovery of this species is dependent on the actions of many different jurisdictions. It requires the commitment and cooperation of the constituencies that will be involved in implementing the directions and measures set out in this action plan.

This action plan provides a description of the measures that provide the best chance of achieving the population and distribution objectives for the Pacific population of Basking Shark, including measures to be taken to address threats to the species and monitor its recovery, to guide not only activities to be undertaken by Fisheries and Oceans Canada (DFO) and the Parks Canada Agency (PCA), but those for which other jurisdictions, organizations and individuals have a role to play. As new information becomes available, these measures and the priority of these measures may change. DFO and PCA strongly encourage all Canadians to participate in the conservation of the Basking Shark by undertaking measures outlined in this action plan.

Table 1 identifies the measures to be undertaken by DFO to support the recovery of the Pacific population of Basking Shark. Table 2 identifies the measures to be undertaken collaboratively between DFO and its partners, other agencies, organizations or individuals. Implementation of these measures will be dependent on a collaborative approach, in which DFO is a partner in recovery efforts, but cannot implement the measures alone. As all Canadians are invited to join in supporting and implementing this action plan, table 3 identifies the measures that represent opportunities for other jurisdictions, organizations or individuals. If your organization is interested in participating in one of these measures, please contact the Species at Risk Pacific Region office by email at SARA.XPAC@dfo-mpo.gc.ca.

Federal funding programs for species at risk that may provide opportunities to obtain funding to carry out some of the outlined activities include the [Habitat Stewardship Program for Species at Risk](#), the [Aboriginal Fund for Species at Risk Program](#), and the [Interdepartmental Recovery Fund](#).

The actions listed in tables 1, 2, and 3 will support the recovery and survival of the Pacific population of the Basking Shark. As identified in the recovery strategy, it may take many decades before increases in population can be documented in a long-lived species such as the Basking Shark, and even longer before recovery is achieved. It is therefore imperative that the long-term nature of this action plan is recognized in the evaluation of the objectives and supporting recovery plans. Many of these actions are a continuation of activities that started once the species entered the recovery process and thus the timeline is ongoing.

While DFO has already commenced efforts to implement the action plan, the measures included in this plan but not yet implemented by DFO will be subject to the availability of funding and other required resources. As indicated in table 2 below, partnerships with specific organizations will provide expertise and capacity to carry out some of the listed recovery measures. However, the identification of partners is intended to be advice to other jurisdictions and organizations, and carrying out these actions will be subject to each group's priorities and budgetary constraints.

1.2.1 Implementation schedules

Table 1. Measures to be undertaken by Fisheries and Oceans Canada

#	Recovery measures	Broad strategy	Approach	Priority ¹	Threats or objectives addressed	Status and timeline ²
1	Maintain the Basking Shark Sightings Network (BSSN) as well as the community outreach that supports this network.	1. Communications and outreach	Create public education and awareness program to collect information on Basking Sharks in Canadian Pacific waters.	High	Presence, abundance, distribution, habitat identification	Underway/ ongoing
2	Continued revision and communication of Canadian Pacific Shark identification, reporting, and other guides to marine user groups.	1. Communications and outreach	Create public education and awareness program to collect information on Basking Sharks in Canadian Pacific waters.	Medium	Presence, abundance, distribution	Underway/ ongoing

¹ "Priority" reflects the degree to which the measure contributes directly to the recovery of the species or is an essential precursor to a measure that contributes to the recovery of the species:

- "high" priority measures are considered likely to have an immediate and/or direct influence on the recovery of the species
- "medium" priority measures are important but considered to have an indirect or less immediate influence on the recovery of the species
- "low" priority measures are considered important contributions to the knowledge base about the species and mitigation of threats

² "Status and timeline" reflects the status of a recovery measure and the amount of time required for the measure to be completed from the time the action plan is published as final on the SAR Public Registry. The status may be reported as either "New" (that is measures that have not been started yet) or "Underway" (that is measures that were initiated or implemented prior to the development of the action plan, but have not yet been completed). Timelines are reported as time frames (for example, 1 year, 2 years, ongoing).

#	Recovery measures	Broad strategy	Approach	Priority ¹	Threats or objectives addressed	Status and timeline ²
3	Maintain sightings database and use sightings data reported to the BSSN to improve our understanding of Basking Sharks.	2. Scientific research	Improve understanding of population structure, abundance, and seasonal distribution within Canadian Pacific waters.	High	Abundance, distribution, habitat identification	Underway/ ongoing
4	Conduct satellite tagging studies for Basking Sharks.	2. Scientific research	Improve understanding of population structure, abundance, and seasonal distribution within Canadian Pacific waters.	High	Presence, distribution, abundance, habitat identification	Underway/opportunistic
5	Conduct biosampling of live animals as well as carcasses, following the guidance provided in the Basking Shark Biosampling Protocol.	2. Scientific research	Improve understanding of population structure, abundance, and seasonal distribution within Canadian Pacific waters.	High	Presence, distribution, abundance, habitat identification	Underway/opportunistic
6	Annually review, and improve as required, the Basking Shark mitigation and avoidance measures identified as conditions in commercial and Aboriginal fishing licenses, as well as text in integrated fisheries management plans (IFMPs) and integrated management of aquaculture plans (IMAPs).	3. Management	Develop and implement protocols for sightings and entanglements in fishing and aquaculture gear.	High	Entanglement, collision with vessels, harassment	Underway/ongoing

#	Recovery measures	Broad strategy	Approach	Priority ¹	Threats or objectives addressed	Status and timeline ²
7	Maintain and improve communication and reporting on the collisions, entanglement, and incidental catch of Basking Sharks within all commercial fisheries and aquaculture activities.	3. Management	Develop and implement protocols for sightings and entanglements in fishing and aquaculture gear.	High	Entanglement, collision with vessels, harassment	Underway/3 years
8	Support ongoing (for example, annual) training of various DFO, Canadian Coast Guard, and Parks Canada Agency staff who work on the water in Basking Shark identification and reporting requirements.	3. Management	Develop and implement protocols for sightings and entanglements in fishing and aquaculture gear.	Medium	Information sharing, awareness and outreach, research, threat mitigation and assessment	Underway/ongoing
9	Support ongoing (for example, annual) training of at-sea fisheries observers in Basking Shark identification, disentanglement, and data collection.	3. Management	Develop and implement protocols for sightings and entanglements in fishing and aquaculture gear.	Medium	Entanglement, collision with vessels, harassment	Underway/ongoing
10	Assess feasibility of SARA permitting and training requirements to be able to authorize licenced fishers and aquaculture operators to disentangle Basking Shark.	3. Management	Ensure Basking Shark protection, recovery, permitting, and enforcement considerations are integrated into legislative processes (for example, under <i>Species at Risk Act</i> , <i>Fisheries Act</i> , and <i>Canadian</i>	High	Entanglement, collision with vessels, harassment	New/1 year

#	Recovery measures	Broad strategy	Approach	Priority ¹	Threats or objectives addressed	Status and timeline ²
			<i>Environmental Assessment Act).</i>			
11	Assess feasibility of enforcement of Basking Shark avoidance and disentanglement protocols to prevent harm to Basking Sharks as per SARA prohibitions.	3. Management	Ensure Basking Shark protection, recovery, permitting, and enforcement considerations are integrated into legislative processes (for example, under <i>Species at Risk Act</i> , <i>Fisheries Act</i> , and <i>Canadian Environmental Assessment Act</i>).	High	Entanglement, collision with vessels, harassment	New/2 years
12	Review and assess project impacts on Basking Sharks and their prey in Canadian Pacific waters, and provide advice on avoidance and mitigation measures as required.	3. Management	Ensure Basking Shark protection, recovery, permitting, and enforcement considerations are integrated into legislative processes (for example, under <i>Species at Risk Act</i> , <i>Fisheries Act</i> , and <i>Canadian Environmental Assessment Act</i>).	High	Entanglement, collision with vessels, harassment	Underway/ongoing

Table 2. Measures to be undertaken collaboratively between Fisheries and Oceans Canada and its partners

#	Recovery measures	Broad strategy	Approach	Priority	Threats or objectives addressed	Timeline	Partner(s)
13	Expand a Basking Shark education and awareness program for general public, Indigenous communities, fishing and aquatic recreation communities, local municipalities, industry, and aquaculture, including a website, social media, posters, presentations, video, and press releases.	1. Communication and outreach	Create public education and awareness program to collect information on Basking Sharks in Canadian Pacific waters.	Medium	Abundance, distribution	Underway /ongoing	PCA, aquatic user groups (various)
14	Support a series of regional workshops and/or conferences on the Pacific population of Basking Shark that increase species awareness and engagement, research and collaboration with environmental non-governmental organisations (ENGOs), academia and government.	1. Communication and outreach	Create public education and awareness program to collect information on Basking Sharks in Canadian Pacific waters.	Low	Information sharing, awareness and outreach, research, threat mitigation and assessment	Underway / every 5 years	PCA, ENGOs, academia, other government agencies
15	Supplement DFO's survey efforts by working with other aerial surveillance programs to identify and report Basking Sharks within Canadian Pacific Waters.	2. Scientific research	Support collaborative approaches to research of Basking Sharks in Canada to further improve the understanding of Basking Shark population structure, abundance and seasonal distribution.	Medium	Abundance, distribution	Underway /ongoing	Transport Canada, Environment and Climate Change Canada, PCA

#	Recovery measures	Broad strategy	Approach	Priority	Threats or objectives addressed	Timeline	Partner(s)
16	Conduct habitat modelling to determine and characterize high use habitats and identify habitat necessary for the survival and recovery of Basking Sharks in Canadian Pacific waters.	2. Scientific research	Support collaborative approaches to research of Basking Sharks in Canada to further improve the understanding of Basking Shark population structure, abundance and seasonal distribution.	Medium	Critical habitat identification	Underway /ongoing	Academia, ENGOS
17	Maintain Basking Shark tri-national working group (that is with the U.S. and Mexico) to support information sharing, develop collaborative outreach and awareness, research, monitoring, and management throughout the population's Northeast Pacific range.	4. Collaboration	Participate in international efforts to conserve and manage sharks.	Low	Research, information sharing, international management	Underway /ongoing	NOAA, Mexico
18	Make use of bilateral and multilateral funding programs to support collaborative research, training, and awareness, including community participation in recovery activities.	4. Collaboration	Participate in international efforts to conserve and manage sharks.	Medium	Range wide conservation approaches	Underway /ongoing	Other agencies, ENGOS
19	Pursue efforts to collaborate on recovery efforts of Basking Sharks across the Pacific Basin in support of improved cross-Pacific coordination of data.	4. Collaboration	Participate in international efforts to conserve and manage sharks.	Low	Research, information sharing, international management	New/ongoing	RFMOs, ISC shark working group

Table 3. Measures that represent opportunities for other jurisdictions, organizations or individuals to lead

#	Recovery measures	Broad Strategy	Approach	Priority	Threats or objectives addressed	Suggested other jurisdictions or organizations
20	Assess potential effectiveness of existing and innovative fishing gear modifications to reduce entanglement risks.	2. Scientific research	Improve understanding of population structure, abundance, and seasonal distribution within Canadian Pacific waters.	Low	Entanglement harassment	Academia, ENGOS
21	Investigate the potential use of emerging technologies and identify potential collaborations that may support understanding of Basking Sharks in Canadian Pacific waters (for example, eDNA analysis).	2. Scientific research	Improve understanding of population structure, abundance, and seasonal distribution within Canadian Pacific waters.	High	Population structure	Academia, ENGOS, other agencies

2. Critical habitat

2.1 Identification of the species' critical habitat

Critical habitat is defined in SARA as "...the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in a recovery strategy or in an action plan for the species." [subsection 2(1)]

Also, SARA defines habitat for aquatic species as "... spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced." [subsection 2(1)]

The best available information on Canadian Pacific habitat for Basking Sharks is insufficient to support identification of critical habitat of Basking Sharks at this time. The [Evaluation of Information Available to Support the Identification of Habitat Necessary for the Survival and Recovery of Basking Shark in Canadian Pacific Waters](#) (DFO 2016) provides information on studies required to refine knowledge so that critical habitat can be identified in the future. Identification of the habitat necessary to support survival and recovery of the species may be addressed in an amendment to the recovery strategy at a later date. Once critical habitat is identified, effective protections will be put in place to safeguard its features and functions.

Section 7.2 of the Recovery Strategy for the Basking Shark (*Cetorhinus maximus*) in Canadian Pacific Waters provides a schedule of studies necessary to gather further information on the habitat necessary to support survival and recovery.

The [Report on the Progress of Recovery Strategy Implementation for the Basking Shark \(*Cetorhinus maximus*\) in Canadian Pacific Waters for the Period 2011-2016](#) (DFO 2018) outlines measures that have been taken to address knowledge gaps, including those related to critical habitat identification.

3. Evaluation of socio-economic costs and of benefits

SARA requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation (SARA paragraph 49(1)(e), 2003). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective, as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety, recognizing that organizations or agents other than the federal government may be better placed for implementation of certain aspects of the plan. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis. The intent of this evaluation is to inform the public and to guide decision making on implementation of the action plan by partners.

The protection and recovery of species at risk can result in both benefits and costs. SARA recognizes that "wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons" (SARA 2003). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the

preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996; DFO 2008). Furthermore, the conservation of species at risk is an important component of the Government of Canada's commitment to conserving biological diversity under the International Convention on Biological Diversity. The Government of Canada has also made a commitment to protect and recover species at risk through the [Accord for the Protection of Species at Risk](#). The specific costs and benefits associated with this action plan are described below.

3.1 Socio-economic costs of implementing this action plan

The implementation schedule separates recovery measures into three tables. Table 1 includes measures to be undertaken by DFO with the full costs borne by the Government of Canada. Table 2 includes measures to be undertaken collaboratively between DFO and partners; the costs of these measures would be borne jointly by government and partners. The measures in table 3 provide opportunities for other jurisdictions, organizations and individuals to support the recovery of Basking Sharks; these costs would be borne primarily by parties other than the Government of Canada. Government costs would come for existing allocations.

The measures in the plan are related to research and monitoring, compliance promotion as well as engagement and outreach type activities. The majority of the activities in table 1 are long-term, ongoing activities that are already underway and considered low cost. The research and monitoring activities in table 1 are focused around gathering population and distribution information to support understanding of habitat use, critical habitat identification and to reduce threats from fishing interceptions. The remaining actions in table 1 are related to very low cost outreach and compliance promotion type actions that will be maintained over the long-term.

Table 2 actions are mainly focused around engagement, raising awareness and collaborations through workshops with partners in academia, other government departments and international partners. While there may be some low, one-time direct costs, for the most part these actions are likely to result in in-kind costs to partners to attend workshops and to collaborate on research studies.

Costs associated with table 3 activities are also likely low with a focus on collaborating with academia on research to increase knowledge of threats and habitat use of Basking Sharks in Canadian Pacific waters. The costs associated with the research and education measures in table 3 are unknown, but likely very low cost based on similar actions for other species. These measures are anticipated for the duration of the action plan, and most costs would likely be borne by parties other than Government of Canada.

Overall, the direct annual costs of all the measures in table 1 and 2 of the action plan are likely low (that is less than \$50,000/year) for DFO and partners, with some additional ongoing in-kind costs for partners, organizations and individuals for measures in tables 2 and 3. There may also be some yet unknown, but likely low direct costs associated with table 3 actions for partners. The costs will be distributed across the short, medium and long-term.

3.2 Benefits of implementing this action plan

The impacts on the Basking Shark of the recovery measures in this plan are unknown but likely positive. The measures outlined are expected to increase knowledge of and collaboration on Northeast Pacific Basking Sharks. Research and monitoring efforts such as bio-sampling and tagging would support filling knowledge gaps associated with the population (for example, age, sex, DNA, distribution, length of fish) and may assist in threat mitigation to support recovery. As indicated above, Canadians value species for a number of reasons, including non-market benefits (that is existence, bequest and option values).³ Activities that positively affect the recovery of species with non-market benefits may result in positive benefits to Canadians.

The recovery measures may also provide broader benefits to other species. For example, research activities that increase knowledge and collaboration (for example, amongst DFO, academics, international partners (that is NOAA), and stewardship groups) may provide information on species such as other sharks that would be useful in the management of these other species.

4. Measuring progress

Reporting on implementation of the action plan (under section 55 of SARA) will be done by assessing progress towards implementing the broad strategies identified in the recovery strategy. The performance measures presented in the associated recovery strategy provide a way to define and measure progress toward achieving the population and distribution objectives. Reporting on the performance indicators and progress towards recovery in the future are included in reports on the progress towards recovery strategy implementation. The Report on the Progress of Recovery Strategy Implementation for the Basking Shark (*Cetorhinus maximus*) in Canada for the Period 2011-2016 was posted on the Species at Risk (SAR) Public Registry in 2018.

³ Non-market benefits include bequest values (the value placed on conservation for future generations), existence values (the value people place on the existence of a species) and option values (the amount someone is willing to pay to keep open the option of future use of the species).

5. References

- COSEWIC 2007. COSEWIC assessment and status report on the Basking Shark *Cetorhinus maximus* (Pacific population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 34 pp.
- Fisheries and Oceans Canada (DFO). 2008. Estimation of the economic benefits of marine mammal recovery in the St. Lawrence Estuary. Policy and Economics Regional Branch, Quebec.
- Fisheries and Oceans Canada. 2009. Recovery potential assessment for Basking Sharks in Canadian Pacific waters. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/046.
- Fisheries and Oceans Canada. 2011. Recovery Strategy for the Basking Shark (*Cetorhinus maximus*) in Canadian Pacific Waters [Final]. *Species at Risk Act Recovery Strategy Series*. Fisheries and Oceans Canada, Ottawa. v + 25 pp.
- Fisheries and Oceans Canada. 2016. Evaluation of Information Available to Support the Identification of Habitat Necessary for the Survival and Recovery of Basking Shark in Canadian Pacific Waters. DFO Can. Sci. Sec. Sci. Resp. 2016/046.
- Fisheries and Oceans Canada. 2018. Report on the Progress of Recovery Strategy Implementation for the Basking Shark (*Cetorhinus maximus*) in Canada for the Period 2011 – 2016. *Species at Risk Act Recovery Strategy Report Series*.
- Gore, M.A., Rowat, D, Hall, J., Gell, F.R., and Ormond, R.F. 2008. Transatlantic migration and deep mid-ocean diving by Basking Shark. *Biology letters*, 4(4), 395-398. Doi:10.1098/rsbl.2008.0147.
- Gore, M. A., Frey, P. H., Ormond, R. F., Allan, H. and Gilkes, G. 2016. Use of Photo-Identification and Mark-Recapture Methodology to Assess Basking Shark (*Cetorhinus maximus*) Populations. *PLoS one*, 11(3), e0150160.
- Hazen, E. L., Jorgensen, S., Rykaczewski, R. R., Bograd, S. J., Foley, D. G., Jonsen, I. D., ... Block, B. A. 2013. Predicted habitat shifts of Pacific top predators in a changing climate. *Nature Climate Change*, 3(3), 234–238.
- Hoelzel, A.R., M.S. Shivji, J.E. Magnussen and M.P. Francis. 2006. Low worldwide genetic diversity in the Basking Shark (*Cetorhinus maximus*). *Biology Letters*, 2 639–642.
- Loomis, J.B. and D.S. White. 1996. Economic benefits of rare and endangered species: summary and meta-analysis. *Ecological Economics*, 18(3), 197-206.
- McFarlane, G.A, King, J.R., Leask, K. and Christensen, L.B. 2009. Assessment of information used to develop a Recovery Potential Assessment for Basking Shark *Cetorhinus maximus* (Pacific population) in Canada. *Can. Sci. Advis. Sec. Res. Doc.* 2008/071. vi + 98 p.
- Sims, D.W. and V.A. Quayle. 1998. Selective foraging behaviour of Basking Sharks on zooplankton in a small-scale front. *Nature*, 393,460-464.

Sims, D.W. 1999. Threshold foraging behaviour of Basking Sharks on zooplankton: life on an energetic knife-edge? Proceedings of the Royal Society of London. Biological Sciences, 266, 1437-1443.

Skomal, G.B., Zeeman, S.I., Chisholm, J.H., Summers, E.L., Walsh, H.J., McMahon, K. W. and Thorrold, S.R. 2009. Transequatorial migrations by basking sharks in the western Atlantic Ocean. Current Biology, 19(12), 1019-1022.

Westgate, A.J., Koopman, H.N., Siders, Z.A., Wong, S.N.P., Ronconi, R.A. 2014. Population density and abundance of basking sharks (*Cetorhinus maximus*) in the lower Bay of Fundy, Canada. Endanger. Species Res., 23, 177–185.

Appendix A: effects on the environment and other species

In accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#) (2010), SARA recovery planning documents incorporate strategic environmental assessment (SEA) considerations throughout the document. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the [Federal Sustainable Development Strategy](#)'s goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of recovery measures may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the action plan itself, but are also summarized below in this statement.

Many of the activities identified in this action plan will have positive impacts on other marine species in addition to benefiting the Pacific population of Basking Shark. The recovery measures to mitigate threats or increase our understanding of threats are also likely to provide broader benefits as some of the threats to the Pacific population of Basking Shark are common to other marine species. Further, this plan includes support for ongoing programs and activities that are not species-specific (such as aerial surveillance programs). These programs provide assistance to, and information on, numerous species. In particular, other shark species that utilize Canadian Pacific waters may benefit from the management and research activities in this plan.

Appendix B: record of cooperation and consultation

Action plans are to be prepared in cooperation and consultation with other jurisdictions, organizations, affected parties and others as outlined in SARA section 48. DFO has utilized a process of technical iterative document development, interagency involvement, and consultation with interested and affected parties to seek input to the development of this action plan. Information on participation is included below.

Table 4. Recovery team members

Member / attendee	Affiliation	Department / agency
Heather Brekke, Chair	Species at Risk program	Fisheries and Oceans Canada
Jackie King	Science	Fisheries and Oceans Canada
Paul Grant	Science	Fisheries and Oceans Canada
Jennifer Yakimishyn	Resource Conservation	Parks Canada Agency

Input into the development of this action plan was sought in 2017 from academia, other Government agencies, and species experts from USA and Mexico. All input received was addressed and incorporated as appropriate.

An external review on the draft action plan was held December 12, 2017 through January 19, 2018. The external review was targeted for those potentially affected to provide feedback on the draft action plan prior to public consultation. This was sent to wildlife management boards, stakeholders, academia, environmental non-government organizations, as well as to Environment and Climate Change Canada and the Province of BC. No comments were received during this external review period.

The proposed action plan was posted to the DFO website for a public comment period from July 27 through September 27, 2019. No comments were received during this public consultation period.