

Analysis of the Science-Policy Interface in North Atlantic Right Whale (*Eubalaena glacialis* /
Put'p) Conservation

By

Kevin Ryan Allan

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List of Abbreviations

AFN – Assembly of First Nations

AIS – Aquatic Invasive Species

ALWTRP – Atlantic Large Whale Take Reduction Plan

ALWTRT – Atlantic Large Whale Take Reduction Team

AP – Action Plan

ASRG – Atlantic Scientific Review Group

BDC – Business Development Bank of Canada

BOEM – Bureau of Ocean Energy Management

C&P – Conservation and Protection

CBD – Convention on Biological Diversity

CEQ – Council on Environmental Quality

CIRNAC – Crown-Indigenous Relations Canada

CITES – Convention on the International Trade of Endangered Species of Wild Fauna and Flora

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

CSA – Canada Shipping Act

CSA – Canadian Space Agency

CSA – Committee of Scientific Advisors

CSAS – Canadian Science Advisory Secretariat

CWI – Canadian Whale Institute

DFO – Fisheries and Oceans Canada

DHS – United States Department of Homeland Security

DOC – United States Department of Commerce

DOI – United States Department of the Interior

ECCC – Environment and Climate Change Canada

eNGO – Environmental Non-Governmental Organization

EPA – Environmental Protection Agency

ESA – Endangered Species Act

FFHP – Fish and Fish Habitat Protection
F/P/T – Federal, Provincial, and Territorial
GARFO – Greater Atlantic Regional Fisheries Office
GC – Government of Canada
GE³LS – Genomics and its Environmental, Economic, Ethical, Legal, and Social aspects
IMO – International Maritime Organization
IRA – Inflation Reduction Act
Massachusetts DMF – Commonwealth of Massachusetts Division of Marine Fisheries
MMC – Marine Mammal Commission
MMHSRP – Marine Mammal Health and Stranding Response Program
MMPA – Marine Mammal Protection Act
MMR – Marine Mammal Regulations
MPA – Marine Protected Area
MS(FCM)A – Magnuson-Stevens (Fishery Conservation and Management) Act
NARW – North Atlantic Right Whale
NARWC – North Atlantic Right Whale Consortium
NAS – National Academy of Sciences
NEAq – New England Aquarium
NEFSC – Northeast Fisheries Science Center
NEIT – Northeast Implementation Team
NEPA – National Environmental Policy Act
NGO – Non-Governmental Organization
NIST – National Institute of Standards and Technology
NMFS – National Marine Fisheries Service
NMMTB – National Marine Mammal Tissue Bank
NMS – National Marine Sanctuary
NOAA – National Oceanic and Atmospheric Administration
NOS – National Ocean Service

NSERC – National Sciences and Engineering Research Council for Canada

NSF – National Science Foundation

OLE – Office of Law Enforcement

ONMS – Office of National Marine Sanctuaries

OPR – Office of Protected Resources

ORCA – Oceans Research and Conservation Association

OS – Opportunity-Strength

OW – Opportunity-Weakness

PCA – Parks Canada Agency

PET – Population Evaluation Tool

POTUS – President of the United States

PVA – Population Viability Analysis

RS – Recovery Strategy

SAR – Species at Risk

SARA – Species at Risk Act

SEFSC – Southeast Fisheries Science Center

SEIT – Southeast Implementation Team

SERO – Southeast Regional Office

SMA – Seasonal Management Area

SMU – Saint Mary’s University

SPI – Science-Policy Interface

SRG – Scientific Review Group

SWOT – Strengths, Weaknesses, Opportunities, and Threats

TC – Transport Canada

TS – Threat-Strength

TW – Threat-Weakness

UBC – University of British Columbia

UINR – Unama’ki Institute of Natural Resources

UME – Unusual Mortality Event

UNC – University of North Carolina

UNDA – United Nations Declaration on the Rights of Indigenous Peoples Act

UNDRIP – United Nations Declaration on the Rights of Indigenous Peoples

USA – United States Army

USACE – United States Army Corps of Engineers

USCG – United States Coast Guard

(US)DOD – United States Department of Defense

(US)FWS – United States Fish and Wildlife Service

USGS – United States Geological Survey

USN – United States Navy

WCEL – West Coast Environmental Law Association

WHOI – Woods Hole Oceanographic Institution

WWF-Canada – World Wildlife Fund-Canada

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Abstract

The North Atlantic Right Whale (NARW) is a critically endangered species with an estimated ~ 370 total individuals and fewer than 70 reproductive aged females. Major sources of mortality and serious injury include physical strikes from vessels and entanglement in fishing gear. NARW are a transboundary species, present in eastern Canadian and American waters. To help facilitate recovery of the species, management measures have been undertaken to address anthropogenic mortality. Science-policy interface (SPI) studies address how information is, or is not, used to inform policies and regulations including the relationship between actors involved. This study seeks to illustrate the SPI for NARWs. A literature review was conducted to establish the components of the interface, and input from those involved in the NARW network was used to map linkages and potential information flow. Techniques from decision-making theory, network analysis, and SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) were used to assess the SPI. Fisheries and Oceans Canada and Transport Canada are the primary regulatory authorities for NARW in Canada whereas the National Oceanic and Atmospheric Administration is the primary regulatory authority in the US. A strength of the system is its focus on the precautionary approach to management. A notable weakness was a lack of transparency in the system. Opportunities and threats included the potential for further international involvement and lack of Indigenous involvement. This research will also provide clarity to both those inside and outside of this interface to aid in knowledge mobilization and effective decision-making practices for NARW.

Keywords: North Atlantic Right Whale; science-policy interface; decision-making theory; SWOT analysis; knowledge mobilization.

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Chapter 1 – Introduction

In this chapter, the endangered North Atlantic Right Whale is introduced, including its conservation status, range, and known threats. Management actions that have been taken to address these threats and their effectiveness are discussed. The management problem that this study seeks to address and research questions are also outlined.

1.1 The North Atlantic Right Whale

The North Atlantic Right Whale (NARW), *Eubalaena glacialis*, is a critically endangered baleen whale species with an estimated population size between 346 and 363 individuals as of October 2023. There is thought to be less than 70 reproductively active females in the population (National Oceanic and Atmospheric Administration [NOAA], 2024d), and only 17 mother/calf pairs have been observed during the 2023/2024 calving season as of January 2024 (Marine Mammal Commission [MMC], 2024b). An ongoing Unusual Mortality Event (UME) began in 2017, resulting in 40 known deaths and sublethal impacts to 99 individuals. More than one fifth of the population has documented impacts from the UME. These numbers are presumed to be an underestimate of the actual impacts from the UME as research suggests that only ~ 33% of NARW mortalities are ever documented (NOAA, 2024d). NARW are threatened by human activities including strikes from vessels and entanglement in fishing gear. The most common wounds from vessel strikes are blunt force trauma or cuts from propellers (NOAA, 2024c). Non-tended fixed fishing gear, such as lobster and crab traps, are usually suspended in the ocean with ropes. These ropes also provide an entanglement risk to NARW (Woods Hole Oceanographic Institution [WHOI], 2024).

NARW are a quasi-migratory species. The whales are largely found in north Atlantic waters ranging from the Canadian maritime provinces to the northeastern US (MMC, 2024b; NOAA, 2024d). However, they also are found as far south as Georgia and Florida where calving occurs (Figure 1).



Figure 1. Map of estimated North Atlantic Right Whale range and distribution, circa 2024. National Oceanic and Atmospheric Administration, 2024d.

It is thought that the migratory nature of NARW is likely due to the presence of plankton, primarily copepods, which are a key component of the NARW diet (NOAA, 2024d). Climate change has affected the distribution of copepods, which in turn has impacted the range of NARW. Previously used feeding grounds in the Scotian Shelf and Gulf of Maine are increasingly being abandoned by NARW in favour of the Gulf of St. Lawrence region. It has been hypothesized that warming waters in the Scotian Shelf and Gulf of Maine have led to a local decline of copepods, and the NARW are moving to colder feeding grounds where copepod abundance is higher (Meyer-Gutbrod et al., 2021). In the US, NARW feeding primarily occurs in Cape Cod Bay, and the Nantucket Shoals. Pregnant female NARW travel south to waters near South Carolina, Georgia, and Florida to birth and rear their calves. The entire population is not migratory, as many individuals will remain in the northern feeding grounds year-round (MMC, 2024b; NOAA, 2024d).

1.2 Management Actions

As a result of the threats outlined in the previous section, management measures have been devised by Fisheries and Oceans Canada (DFO) and Transport Canada (TC) in Atlantic Canadian waters to minimize risks. These measures have included fishery closures specifically

for lobster, crab (rock, snow, toad), whelk, halibut (Atlantic, Greenland), winter flounder, cod, mackerel, and herring fisheries (DFO, 2024b). Upon the detection of a NARW in dynamic closure zones, either visually or acoustically, a 2 000 km² area around the detection is closed to non-tended fixed gear fishing for 15 days. If NARW are detected again between days 9 and 15, the closure will be extended. In the Bay of Fundy, this extension is for an additional 15 days. In the Gulf of St. Lawrence, the fishery will remain closed until the end of the fishing season (November). Outside of these dynamic closure zones, closure is considered on a case-by-case basis. Closures may also apply to waters shallower than 20 fathoms. Upon detection of a NARW in waters between 10 fathoms and 20 fathoms deep, gear must be moved to depths shallower than 10 fathoms. Should a NARW be detected in depths shallower than 10 fathoms, the area around the detection will be closed to fishing. Visual detection usually occurs via aircraft or boat while acoustic detection occurs through underwater microphones, known as hydrophones, deployed on buoys or gliders (Table 1; Fisheries and Oceans Canada [DFO], 2024a).

Table 1. Comparison of North Atlantic Right Whale management measures in Canada and the United States of America (Fisheries and Oceans Canada, 2024a; National Oceanic and Atmospheric Administration, 2024c; Transport Canada, 2024b).

	Canada	United States
Fishing	Dynamic closure zones Gear relocation Gear marking Ghost gear reporting Whale-vessel contact reporting Whalesafe gear trials	Seasonal closures Gear marking Rope inserts and weak links Trawling up Whalesafe gear trials
Shipping	Static zones Voluntary seasonal slowdown zones Seasonal management areas Areas to avoid	Dynamic management areas Seasonal management zones NARW education reporting

In addition to closures, NARW management measures include mandatory gear marking. In Atlantic Canada and Québec, all non-tended fixed fishing gear must be marked with the region

and fishery. Lobster and crab gear must also identify the fishing area. Fishing license holders, regardless of target species are required to report any lost or “ghost” gear (DFO, 2024a), referring to gear that has been abandoned, lost, or discarded. This gear may pose an entanglement risk to NARW and contributes to pollution. The gear may also decompose into harmful micro-components such as micro-plastics (DFO, 2023b). Fishing license holders are also required to report any contact between a marine mammal and their vessel or gear. DFO is currently engaging with fishers to implement “whalesafe” gear, for example, ropeless and on-demand gear which do not leave fixed lines in the water column throughout the fishing season (Table 1; DFO, 2024a).

NARW protection measures from TC have primarily been implemented to reduce threats from vessel strikes, particularly in the Gulf of St. Lawrence region where vessel traffic is high. In 2024, from April to November, two static zones were in place in the Gulf of St. Lawrence where vessel > 13 m must not exceed speeds of ten knots. A similar voluntary seasonal slowdown zone was in place in the Cabot Strait from April to June, where the same speed restrictions were recommended. In the shipping lanes surrounding Anticosti Island, similar temporary speed restrictions also exist, though these are triggered by NARW detection. Two Seasonal Management Areas (SMAs) have also been in effect. SMAs have the same speed restrictions as the previous management measures but were only in effect from April to June, though NARW detection can re-trigger them temporarily from June to November. Between April and September 2024, a closure was in place at Shediac Bay. Vessels were ordered out of these waters unless otherwise exempted. Exempted vessels were restricted to speeds of eight knots or slower. Outside of the aforementioned areas, it is requested that vessels reduce speed to ten knots if NARW are suspected and to report any sightings to DFO. In waters shallower than 20 fathoms, NARW detection triggers a navigational warning which alerts commercial fishing vessels that they must not exceed ten knots. The Roseway Basin has been deemed an area to avoid by vessels over 300 gross tons from June to December. A voluntary slowdown is also in place in Atlantic Canadian waters outside of TC management zones from November to December. NARW monitoring does not typically actively occur during this time due to inclement weather conditions (Table 1; TC, 2024b).

In the United States of America, the National Oceanic and Atmospheric Administration (NOAA) is the comparable governmental entity to DFO. NOAA is an agency within the United States Department of Commerce (NOAA, 2024b). The National Marine Fisheries Service (NMFS), also known as NOAA Fisheries, is the division of NOAA that oversees marine management measures including those related to NARW. NOAA has implemented measures to reduce NARW entanglements. These include mandated gear marking. Other measures include seasonal closures of fixed gear fisheries in NARW habitat. Gillnet anchors and traps/pots are required to use sinking line rather than floating line. Weak rope and inserts are also required to increase the chance of escape for entangled whales. In addition, NOAA requires fisheries to “trawl up” in areas where NARW aggregate. This refers to the practice of reducing the number of vertical lines and buoys used in traps and pots. Ropeless and on demand gear are also being developed in conjunction with harvesters (Table 1; NOAA, 2024c).

Vessel related management measures have also been implemented by NOAA. Seasonal Management Zones have been created which require most vessels ≥ 65 feet to reduce their speeds to 10 knots at specific times of the year when NARW are expected to be present (NOAA, 2024c). A similar state regulation exists in Cape Code, where the Commonwealth of Massachusetts Division of Marine Fisheries (Massachusetts DMF) requires all vessels to slow down to below 10 knots at certain times of the year (Commonwealth of Massachusetts Division of Marine Fisheries [Massachusetts DMF], 2022). NOAA has also created Right Whale Slow Zones and Dynamic Management Areas where the slowdowns are optional. Slow zones are triggered in the Northeastern region upon acoustic detection of NARW. Dynamic Management Areas are triggered by the detection of three or more NARW in proximity with each other (NOAA, 2024c). Analysis indicates that compliance with voluntary speed reductions is low. A safety zone of 500 yards has also been created where vessels cannot approach NARW. Mandatory reporting exists in NARW calving grounds in the southeast and in NARW feeding grounds in the northeast. In these areas, vessels are required to report to stations on the shore where they are briefed on NARW (Table 1; NOAA, 2024c).

1.3 Management Problem

There is currently a disconnect between the recovery potential of NARW expected through genetic research and actual recovery from management efforts. Even though the

management measures listed above have been enacted, NARW have not successfully recovered from the UME. Research suggests that the NARW genome is not being as negatively affected by the small population size as expected. The species is likely eliminating harmful genes and there is not evidence of genetic depression from inbreeding (Crossman et al., 2023; Crossman et al., 2024). This research suggests that, genetically speaking, NARW are positioned to make a successful recovery. The genetic results bring into question the current management parameters, such as recovery potential estimates, that are being used. If, genetically, NARW are capable of recovering, why have recovery efforts not been successful? Ineffective management and governance of NARW may play a role, but in practice, the nature of this management failure is complex and might take many forms. The management system is highly complex with several applicable acts and multiple jurisdictions. As a result, the management system is not well understood by parties with interest in NARW conservation which limits efforts to assess its effectiveness. To pinpoint the problem, it is necessary to understand the network of research and management organizations working on NARW, including documenting the connections between groups to better understand how information is shared and contributes towards management efforts or conversely is not shared and therefore does not contribute to management efforts. This report takes a preliminary step to address potential issues in management by documenting the network of scientists, managers, and practitioners working at the science-policy interface (SPI) in NARW conservation to better understand the degree of information flow and decision-making processes within this system.

1.3.1 Research Questions

This project is preliminary research on the efficacy of the NARW governance system. This work is framed by an overarching question: Why has NARW recovery not successfully occurred if genomics data suggests recovery should be forthcoming? One hypothesis is that NARW management efforts have not been effective at addressing anthropogenic threats. To test this hypothesis, the NARW governance system must first be delineated and understood. This project seeks to better understand the SPI in NARW governance, providing background to inform future research into the broader overarching question. This background leads to the specific research questions for this project:

1. What is the structure of NARW management in the United States and Canada, in terms of:
 - a. How, where, when, and between whom does information flow, or not flow, within this governance system?
 - b. Who makes NARW management decisions?
 - c. What information is used to inform NARW management decisions?
2. What strengths, weaknesses, opportunities and threats exist in the current management system?

Chapter 2 – Background

In this chapter, background information about SPI framing and the Canadian/American legal structure are introduced. First the SPI is defined and its relevance to a marine management context is discussed. Legislation and regulations relevant for NARW management are introduced in both the Canadian and US context. Introduced legislation includes enabling legislation which gives management jurisdiction to particular departments/agencies, the general legal framework surrounding endangered species/species at risk, specific marine mammal regulations, and legal obligations to Indigenous Peoples.

2.1 Science-Policy Interface

SPI refers to the intersections between information and policy decisions, including the actors involved such as scientists and decision-makers (van den Hove, 2007). Van den Hove (2007) and Saner (2014) note that this interface involves many, sometimes conflicting, perspectives. Science is a descriptive and analytical process, focusing on understanding the world, replicability, and accepting uncertainty as a necessary part of this process. Meanwhile, policymaking is prescriptive, dealing with practicality and making decisions in a value-laden society that may have significant consequences. Due to factors such as these, differences may occur between science that is generated and decisions that are made (van den Hove, 2007; Saner, 2014). Washbourne et al. (2024) similarly note that the intersection between theory and practice is a key element of SPI. The authors suggest that transdisciplinary approaches are necessary to allow for knowledge exchange between the different actors (Washbourne et al., 2024). In order for effective governance decisions to be made, the SPI must function smoothly so that implementable decisions can be made that lead to the desired outcomes of decision-makers.

Karcher et al. (2024) reviewed SPI studies specifically related to ocean and coastal management. The authors emphasize the need for evidence-based decision making to address anthropogenic threats through knowledge exchange. The authors suggest that improved knowledge exchange is necessary for positive policy changes which in turn lead to desired outcomes in marine management (Karcher et al., 2024). For NARW management, SPI literature can provide insights into complicated management systems in which there are multiple levels of jurisdiction, different types of actors, and interplaying issues. SPI literature that assesses the successes and failures of other marine governing systems can be considered in the NARW context to find remedies and avoid issues that have previously arisen in similar contexts.

2.2 Canadian Legal Context

The *Fisheries Act* is one of the oldest acts of Canadian parliament, with the first version enacted in 1868, only one year after Canadian confederation. It is this Act that gives DFO the authority to regulate fishing activity and fishing gear in Canadian waters (Fisheries Act, 1985). Canada's *Marine Mammal Regulations* (MMR) are enabled through the Fisheries Act. The MMR addresses the interaction between humans and marine mammals in Canadian waters. The MMR specifies that vessels must maintain a distance of at least 100 metres from all marine mammals and 400 metres for listed endangered cetaceans in the Gulf of St. Lawrence region (Marine Mammal Regulations, 1993).

The Canadian *Oceans Act* was first enacted in 1996, coming into effect in 1997. This Act is key enabling legislation for DFO, as it outlines statutory powers and responsibilities of the Minister of Fisheries and Oceans. At the time of its passage, it was described as the first holistic, ecosystem-based legislation in the world (West Coast Environmental Law Association [WCEL], 2024). The Act tasks DFO with the creation of a national oceans strategy and integrated management plans to achieve that strategy. Amendments to the Act in 2019 require DFO to use the precautionary approach in management. This means that the absence of scientific certainty cannot be used to justify lack of conservation and management measures (Oceans Act, 1996; WCEL, 2024).

The *Species at Risk Act* (SARA) was enacted in 2002 to protect threatened/endangered species and their habitat, and to prevent species from becoming threatened. This Act is one of the major ways that Canada strives to reach biodiversity commitments from the United Nations Convention on Biological Diversity (CBD) (Environment and Climate Change Canada [ECCC], 2016). The Act outlines the jurisdiction of different entities with respect to Species at Risk (SAR) and creates a process for species assessment (Species at Risk Act, 2002). Prior to the enactment of SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created. COSEWIC was established in 1977 as an official body to evaluate the science for potentially endangered or threatened species.

Originally, COSEWIC was responsible for designating species as being vulnerable to decline. With the passage of SARA, COSEWIC now acts as an advisory body for SAR decisions. NARW were determined by COSEWIC as endangered in 2003. Prior to 2003 NARWs were not

recognized as a separate species from the Southern Right Whale. “Right Whales” were first designated as endangered by COSEWIC in 1980. COSEWIC status reports are working documents that continually reassess the status of species. NARWs were reassessed in 2013 as still endangered (Committee on the Status of Endangered Wildlife in Canada [COSEWIC], 2013). SARA also mandates the creation of recovery strategies (RSs) for species assessed as at risk. Recovery strategies must be developed within two years of the species listing. Sections 37 to 46 describe the specific content of the RSs (Species at Risk Act, 2002). NARWs were listed under SARA in 2005, and the RS was finalized in 2009 (Brown et al., 2009), with a revision having taken place in 2014 (DFO, 2014). Upon the completion of the RS documentation, at least one specific Action Plan (AP) is developed. For NARW, an AP for threats from fisheries was undertaken. In 2018, this AP was rescoped to include all known threats. The final AP was completed in 2021 (DFO, 2021).

The Canada Shipping Act (CSA) was enacted in 2001, replacing pre-existing shipping-related acts. The Act provides enabling legislation for both DFO and TC. The CSA gives the federal government powers to manage registration and operation of marine vessels. The CSA also governs vessel safety/inspection, marine pollution/environmental protection, and vessel-related accidents. The Act allows for the creation of shipping related regulations and penalties for non-compliance (Canada Shipping Act, 2001). Amendments to the Act in 2018 allow the government to further regulate vessel production, creating environmental protection as a factor in vessel specification regulations. These specifications only apply to vessels manufactured in Canada (DFO, 2021).

2.2.1 Treaties and Indigenous Legal Context in Canada

In Canada, Indigenous peoples are rightsholders in the marine space and are therefore important actors within marine management systems. Between 1725 and 1779, treaties were signed between the British Crown and three Indigenous Nations in Atlantic Canada (Mi’kmaq, Wolastoqiyik, and Peskotomuhkati). These treaties are collectively referred to as the Peace and Friendship Treaties. It is important to note that no Peace and Friendship treaty involved the surrender of Indigenous land or rights (Crown-Indigenous Relations and Northern Affairs Canada [CIRNAC], 2015). The first treaty was signed in 1726, ending a three-year conflict between the nations and Britain. In this treaty, the British agreed to not interfere with Indigenous

hunting, fishing, planting, or “other lawful activity.” Subsequent treaties largely reaffirmed the 1726 treaty’s peace due to British-French conflict in the region. The 1752 treaty also formalized a trade relationship between British and the Mi’kmaq, and the 1760 treaty between the British and the Wolastoqiyik. In 1760/1761, a number of treaties were signed with individual Mi’kmaq nations. In the final treaties of 1778 and 1779, Mi’kmaq and Wolastoqiyik delegates agreed not to assist British rebels from the “United Colonies” (future United States of America). It is worth noting that each of these treaties was with specific nations and communities, and not every community is necessarily party to a treaty that their nation signed. Due to this, and the reaffirmations, there is disagreement over which nations and communities are parties to which specific treaties (CIRNAC, 2010).

The *Constitution Act* of 1982 officially enshrined the Canadian Charter of Rights and Freedoms in Section I of the Act. Article 35, within Section II, deals with the rights of Indigenous Peoples in Canada (referred to as Aboriginal in the parlance of the time). Section 35 reaffirmed and codified Aboriginal rights and Indigenous treaty rights in Canada. Prior to this Act, the Canadian legal system considered these rights a matter of common law which could be altered, or extinguished, through legislation (University of Alberta, n.d.; University of British Columbia [UBC], 2009). The Act itself does not explicitly define Aboriginal rights or comment on whether any rights can be considered extinguished (Rights of the Aboriginal Peoples of Canada, 1982; UBC, 2009). Aboriginal rights differ from treaty rights. While treaty rights are derived from agreements such as the aforementioned Peace and Friendship Treaties, Aboriginal rights are the right to engage in specific activities such as hunting and are derived from longstanding residency on and relation to land. Due to Article 35’s placement in Section II, it is not subject to the notwithstanding clause. This position prevents the Government of Canada (GC) from opting out of the rights enshrined in the Act (Canadian Charter of Rights and Freedoms, 1982; Rights of the Aboriginal Peoples of Canada, 1982; University of Alberta, n.d.). Section 52, the supremacy clause, indicates that the Act is the paramount legislation in Canada and all other legislation must be consistent with it unless the notwithstanding clause has been appropriately invoked. This places Aboriginal rights as among the paramount legislation that supersedes other laws (Rights of the Aboriginal Peoples of Canada, 1982).

In the wake of the *Constitution Act*, a number of Supreme Court decisions clarified the Canadian legal system's position on Indigenous rights. Section 35 uses the term existing rights to refer to rights that have not been extinguished. These court decisions clarified whether the Canadian legal system considered a right to be still existing or extinguished (University of Alberta, n.d.). *R. v. Sparrow* [1990] determined that section 35 does not revive an extinguished right. This decision also established a legal test to establish situations where the Canadian legal system has deemed it appropriate to infringe upon Aboriginal or treaty rights (*R. v. Sparrow*, [1990]; University of Alberta, n.d.). One of the first cases to deal with the existence of rights was *Simon v. The Queen* [1985], which upheld the treaty right of Mi'kmaq to hunt and fish freely (*Simon v. the Queen*, [1985]). A case of marine significance was *R. v. Marshall* [1999], leading to two landmark decisions. The first Marshall decision upheld the right of Mi'kmaq, Wolastoqiyik, and Peskotomuhkati to fish, but qualified this right to stipulate that fishing must only be in pursuance of a moderate livelihood. The second decision, issued upon a rehearing, further clarified that this right is only superseded by compelling public objectives such as conservation. Therefore, the Marshall decisions gave the GC the ability to restrict Indigenous fishing if conservations concerns exist for that species (*R. v. Marshall*, [1999]).

The *United Nations Declaration on the Rights of Indigenous Peoples* (UNDRIP) is a non-binding United Nations (UN) resolution concerning standards for Indigenous rights that was passed by the UN in 2007. Canada was not a signatory at the time. The GC argued that UNDRIP was fundamentally incompatible with the Canadian constitution. Canada eventually reversed course in 2016 and UNDRIP was codified into Canadian law in 2021 as the *United Nations Declaration on the Rights of Indigenous Peoples Act* (UNDA). Within UNDRIP there are 46 articles concerning the responsible and ethical treatment of Indigenous peoples and Indigenous sovereignty. The passage of UNDA requires these articles to be followed in Canadian law. UNDRIP makes reference to engaging with Indigenous peoples using the Free, Prior, and Informed Consent (FPIC) principles. This refers to the practices of receiving consent from potentially affected nations before making decisions that may impact them. This consent must be given without manipulation, after the nations are sufficiently informed of the implications of the decision, and prior to the decision being made (United Nations Declaration on the Rights of Indigenous Peoples Act, 2021).

This legal context governs Indigenous participation and rights in fisheries in the Canadian Atlantic and is used to guide the NARW conservation measures that are in place for fisheries. The treaties and Supreme Court decisions govern Canada's ability to regulate Indigenous fisheries for conservation purposes. Canada's commitment to UNDRIP, and the passage of UNDA, also means that the 46 articles within the Act are now the legal basis that governs Indigenous consultation for NARW decision-making.

2.3 United States Legal Context

The Marine Mammal Protection Act (MMPA) was passed by Congress in 1972. The MMPA has the goal of maintaining a healthy ecosystem which sustains optimal populations of marine mammals. This Act prohibits the "take" of marine mammals unless otherwise exempted. Take refers to any activity that harms a marine mammal ranging from harassment to death of the individual. The MMPA is also the enabling legislation for the Marine Mammal Commission (MMC) and lays out the responsibilities of Scientific Review Groups (SRGs). The Act largely tasks NOAA with overseeing marine mammal protection, though some species were placed under the purview of the United States Fish and Wildlife Service (FWS). The MMPA also places the import and export of Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES) listed species as the responsibility of FWS (Marine Mammal Protection Act, [MMPA], 1972).

The Endangered Species Act (ESA) was passed by Congress in 1973 and is the core legislation for conservation. The ESA is the US parallel to SARA. The Act requires federal government entities to ensure that they do not undertake actions that will threaten a listed species or negatively alter its designated critical habitats. The lead agencies for implementing the Act are NOAA for marine species and FWS for terrestrial and freshwater species (Endangered Species Act [ESA], 1973).

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) was passed by Congress in 1976 and empowers NOAA to manage fisheries. The Act manages fisheries which contribute to the entanglement of NARW. In the marine mammal context, the most significant provisions of the MSA call for the reduction and more robust monitoring of bycatch species, such as NARW (Magnuson-Stevens (Fishery Conservation and Management) Act [MS(FCM)A], 1976).

The National Environmental Policy Act (NEPA) passed congress in 1969 and became effective in 1970. NEPA requires federal governmental entities to consider the environmental impacts of their actions and mandates environmental review before an action is enacted. NEPA reviews either result in an environmental impact statement, a concise environmental assessment which may return a finding of nonimpact, or an administrative memorandum determining categorical exclusion from review. NEPA also established the Council on Environmental Quality (CEQ) (National Environmental Policy Act [NEPA], 1969).

The Inflation Reduction Act (IRA) of 2022 included the largest monetary investment in conservation and climate efforts in US history. Approximately \$82 million of this money was earmarked towards NARW conservation and management efforts. The IRA money is being used for monitoring and modeling, vessel strike reduction, on-demand fishing gear, and enforcement (Inflation Reduction Act [IRA], 2022; NOAA, 2023d).

Table 2. Comparison of Canadian and American legislation and regulations relevant to NARW conservation and management.

	Canada	United States
Endangered Species	SARA	ESA
Fisheries Management	Fisheries	MS(CFM)A
Marine Mammal	Fisheries MMR	MMPA
Ocean	Oceans	
Environmental Impacts		NEPA
Shipping	CSA	
Funding		IRA
Indigenous rights	Constitution	
	UNDA	

Chapter 3 – Methods

This study is part of the Conservation Genomics of the Endangered North Atlantic Right Whale Project. That project is introduced in this chapter, and the methodology used in this study is outlined. Methods and information sources for SPI mapping are discussed alongside SWOT analysis and strategy matrices as an analytical framework for evaluating the effectiveness of the management structure.

3.1. Conservation Genomics of the Endangered North Atlantic Right Whale Project

The Conservation Genomics of the Endangered North Atlantic Right Whale Project seeks to understand the factors impacting both births and mortalities in the population, through a genomics lens. The Project's Genomics and its Environmental, Economic, Ethical, Legal, and Social aspects (GE³LS) team specifically seeks to understand the different entities that impact and are impacted by NARW. GE³LS research has the goal of improving conservation outcomes and the governability of the NARW governance system by identifying the strengths and weaknesses of the current system. The present research contributes to objective three of the project: “conduct network analyses of entities involved in and/or impacted by right whale research and conservation to identify gaps so that such relationships can be developed or strengthened.” This research also provides a foundation for future research about objective four: “conduct ethnographic research into these entities to facilitate effective communications and collaborations” (Conservation Genomics of the Endangered North Atlantic Right Whale, 2024).

3.2 Documentation of the Science-Policy Interface

The current project seeks to map the SPI for the Canadian and American governments as it pertains to NARW management and governance. This research employed a literature review and personal communication to identify and understand the entities involved in the governing system. First, a meeting record was reviewed. This meeting featured DFO and NOAA officials outlining the structure of NARW management and decision-making. To further elucidate and corroborate this record, a review of government webpages and legislation was conducted. Specifically, webpages from DFO, TC, and NOAA related to NARW were used as an additional starting point to identify entities relevant to NARW. Presence of organizations at the annual North Atlantic Right Whale Consortium (NARWC) in October 2024 was also used as a means of identifying parties involved in NARW management and conservation. Due to the confidentiality rules of the NARWC, this meeting was primarily used to inform the project rather than provide

explicit data points. Upon assembling the SPI and NARW management/conservation network, the results were member checked with relevant Canadian and American government officials for completeness and accuracy. Revisions were then made based on this ground-truthed feedback. The recorded meeting with DFO and NOAA officials, and subsequent member-checking and ground-truthing, are referenced in the text as personal communications.

3.3 SWOT Analysis

The acronym SWOT refers to Strengths, Weaknesses, Opportunities, and Threats. This is an analytical framework which can be used to assess the effectiveness of a management system. The principles behind SWOT analysis were first described by Stewart et al. (1965), though the acronym was not popularized until the 1970s. The framework has been widely used for business management and organizational strategic planning in the succeeding decades (Puyt et al., 2023). In SWOT analyses, the internal qualities of the management system are evaluated through strengths and weaknesses while external factors are considered through opportunities and threats. The Business Development Bank of Canada (BDC) (Feder, n.d.) and the University of Kansas Community Tool Box (University of Kansas, n.d.) guidelines for SWOT analyses were used to conduct the analysis in this report. The external factors were considered first, as this is recommended practice for SWOT analyses (Minsky & Aron, 2021). A table of analysis results was constructed and used to form a strategy matrix to create Opportunity-Strength (OS), Opportunity-Weakness (OW), Threat-Strength (TS), and Threat-Weakness (TW) strategy recommendations. SWOT analyses are intended to be flexible for application to different organizational situations (Porter et al., 2002). As such, the analysis is not conducted prescriptively through a rigid set of criteria rather sample criteria were selectively applied depending on their relevance to the NARW SPI.

Chapter 4 –Science-Policy Interface Documentation

In Chapter 4, the results of SPI documentation are presented for the Canadian, American, and International NARW network, respectively. Relationships between entities and the organizational structure of key entities involved are discussed alongside their roles in the system, jurisdiction, and mandates.

4.1 North Atlantic Right Whale Management in Canada

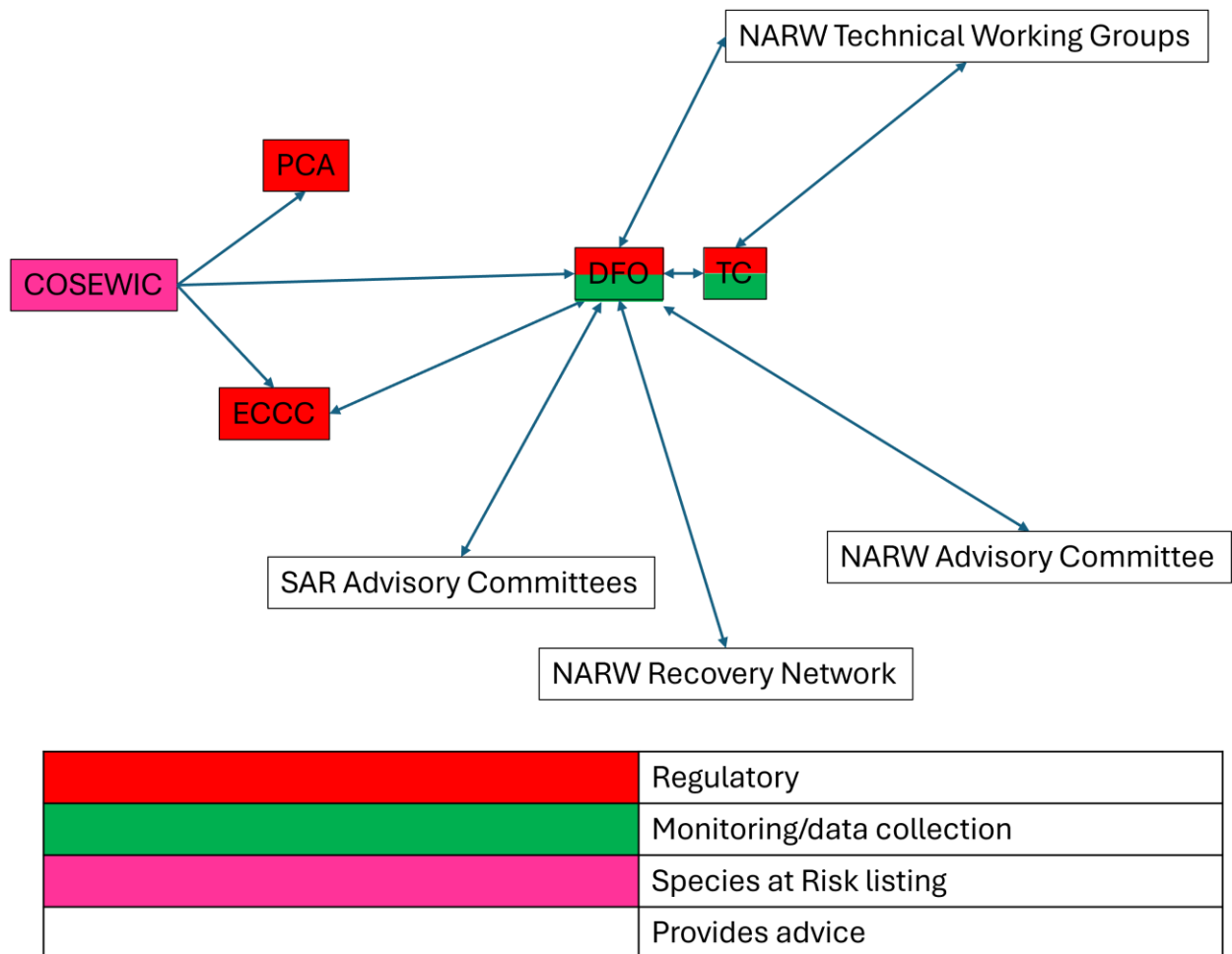


Figure 2. Simplified diagram of the North Atlantic Right Whale science-policy interface and conservation network within Canada demonstrating relationships between entities with arrows denoting expected information flow, and role in the governing system denoted by colour.

Implementation of SARA includes three governmental entities and three corresponding “competent ministers”: DFO, Environment and Climate Change Canada (ECCC), and Parks

Canada Agency (PCA). ECCC is the primary regulatory department for SAR, with DFO holding authority on aquatic species, and PCA holding authority over wildlife that occurs in PCA-managed lands and waters. For these reasons, the responsible department for NARW is DFO (DFO, 2020a). ECCC is generally responsible for coordinating the SAR listing process, including providing response to recommendations (Figure 2; DFO, 2020a).

DFO is organized into seven regions, of which four overlap with the NARW range: Gulf, Maritimes, Newfoundland and Labrador, and Québec. DFO is also divided into branches, headed by an Assistant Deputy Minister, each with a different topic of responsibility. These branches include Ecosystems and Oceans Science (hereafter known as Science), Aquatic Ecosystems, and Fisheries Resource Management (hereafter known as Fisheries Management), alongside administrative branches (DFO, 2024c).

DFO Science does not hold any policy decision-making authority (DFO, personal communication, 2024). Within DFO Science are marine mammal research activities. Several researchers lead teams that collect data on North Atlantic Right Whales (DFO, 2022b; DFO, 2022c). There is a NARW science leads group that meets to help coordinate and disseminate NARW science (DFO, personal communication, 2024). The Whale Science for Tomorrow Initiative is a National Sciences and Engineering Research Council for Canada (NSERC) funded initiative that partners DFO with universities to conduct cetacean research. One of the projects is a partnership between DFO and Dalhousie University to assess NARW monitoring technology (DFO, 2020b). DFO science also undertakes scientific reviews of the effectiveness of management actions and takes advice from Canadian Science Advisory Secretariat (CSAS) reports such as through a NARW scientific review conducted in 2017 (DFO, 2017a), and a CSAS report for the timing of NARW slow down zones conducted in 2017 (Figure 3; DFO, 2017b).

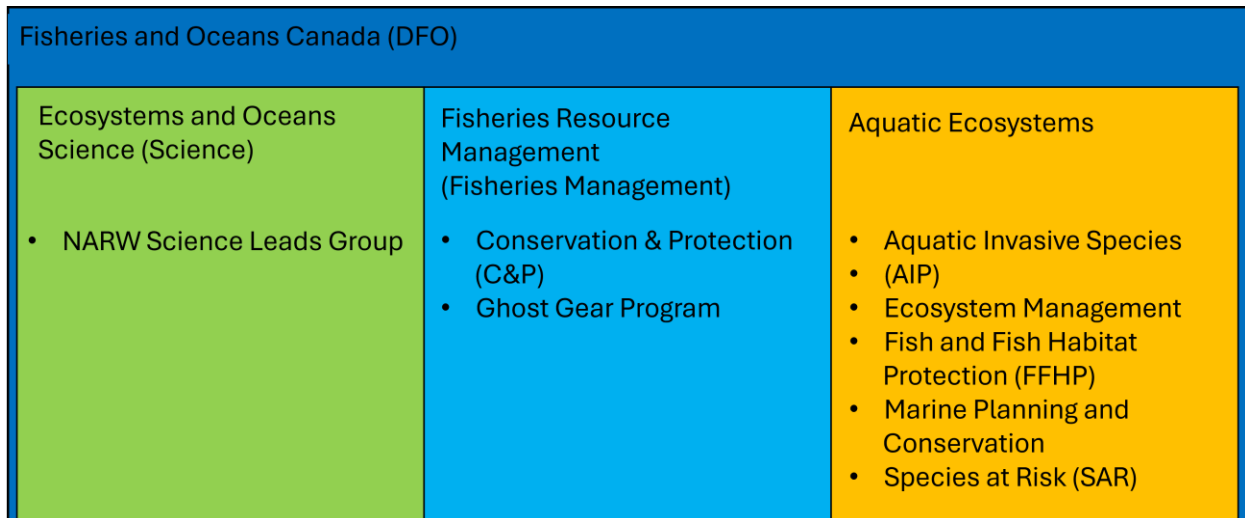


Figure 3. Simplified organization of Fisheries and Oceans Canada for North Atlantic Right Whale Management with colour denoting organization structure.

Fisheries Management is responsible for fisheries management decisions related to the *Fisheries Act* (DFO, 2022a). This mandate includes the management of Total Allowable Catch for fisheries in the Atlantic, opening and closures of fisheries, and the development of fishery management plans. Fisheries Management is therefore responsible for managing fisheries closures in relation to NARW detections, alongside other measures including gear marking (DFO, 2024b). Also within Fisheries Management is the Conservation and Protection Program. Conservation and Protection is responsible for enforcement of fisheries management decisions and fishing-related legislation (DFO, 2019a). The ghost gear removal program is also managed by Fisheries Management (Figure 3; DFO, 2022a).

Within Aquatic Ecosystems is the Species at Risk Program (DFO, 2024d). The SAR program oversees implementation of SARA, including the development of RSs and APs. In 2000, the North Atlantic Right Whale Recovery Implementation Team (right whale recovery team) developed the Canadian North Atlantic Right Whale Recovery Plan for DFO and World Wildlife Fund-Canada (WWF-Canada) (World Wildlife Fund-Canada [WWF-Canada]/DFO, 2000). The right whale recovery team was composed of government officials and representatives of academia, industry, and other stakeholder groups (DFO, 2014). DFO Maritimes led development of the 2009 NARW RS, based on the National Recovery Plan. The RS was drafted by the right whale recovery team with further amendments by DFO (Brown et al., 2009). Minor

updates to the RS in 2014 were conducted by DFO officials. Other parties, including representatives from the DFO capital region; provincial government representatives from Nova Scotia, New Brunswick, Newfoundland and Labrador, and Québec; Indigenous communities; and the general public were also consulted during development of the RSs (DFO, 2014). The 2021 AP was prepared by DFO after consultation, including two workshops, with governmental officials, industry, Indigenous partners, and Non-Governmental Organizations (NGOs) (DFO, 2021). The right whale recovery team was replaced by the North Atlantic Right Whale Recovery Network (right whale recovery network) in 2009. The right whale recovery network includes representatives from federal and provincial government, NOAA, academia, industry, Indigenous partners, and environmental NGOs (eNGOs) (DFO, 2021). A NARW Advisory Committee also meets annually in November to allow for government consultation with stakeholders (DFO, 2023c; DFO, 2024a). There is also a NARW Technical Working Group which is composed of governmental officials, harvesters, and NARW academics that provides advice to DFO (DFO, 2023a). The DFO regions also have a regional internal working groups that work towards recovery of NARW (DFO, personal communication, 2024). Aquatic Invasive Species (AIS) are also managed by Aquatic Ecosystems (DFO, 2022a). AIS have been identified as potential threats to NARW critical habitat through alterations of the food web (DFO, 2009). The Fish and Fish Habitat Protection (FFHP) Program is also housed within Aquatic Ecosystems (DFO, 2022a). The FFHP seeks to conserve, protect, and restore fish and fish habitat. Activities and decisions undertaken by the FFHP program may impact NARW critical habitat and the broader ecosystems that NARW are within (DFO, 2024d). Marine Planning and Conservation oversee Marine Protected Area (MPA) planning and management. MPAs are a tool that can be used to protect NARW, though current MPAs in Atlantic Canada are largely not designated with that specific goal. The Bancs-des-Américains MPA in the Gulf of St. Lawrence lists the protection of whales such as NARW amongst its primary goals (DFO, 2019b). NARW are also occasional visitors to The Gully MPA off the eastern coast of Nova Scotia (Figure 2: DFO, 2017c).

There are also four external committees for engaging stakeholders and Rightsholders on SAR. The Canadian Endangered Species Conservation Council consists of federal, provincial, and territorial (F/P/T) ministers responsible for SAR. The National Aboriginal Council for Species at Risk includes Indigenous community representatives who advise on the implementation and administration of SARA. The First Nations Advisory Committee on Species

at Risk includes regional Assembly of First Nations representatives who provide advice to the three responsible ministers. The Species at Risk Advisory Committee includes representatives from Indigenous groups, NGOs, and industry that advise on SAR and the SARA to assistant deputy ministers related to SAR (Figure 2; SARA, 2002, DFO, 2020a).

The Marine Mammal Response Program is a collection of individuals and organizations involved in responding to marine mammals in distress. The program is led by DFO, supporting DFO's responsibility to assist marine mammals experiencing distress, such as through strandings, vessel strikes, and entanglements. The program provides DFO with data to inform policies and species recovery efforts (DFO, 2022a).

TC is divided into five regions, of which the Atlantic and Québec regions overlap with the NARW range. TC is also divided into groups, of which the Programs and Policy groups are most relevant to NARW (TC, 2024a). The Programs group manages initiatives and funds related to the Oceans Protection Plan. The Policy group provides advice and recommendations on transportation policy, considering factors such as stakeholders, performance, environment, and other transportation issues (TC, 2020). For NARW, this advice is prepared by the East Coast Whale Protection Policy Team (TC, personal communication, 2024). TC manages the vessel traffic related NARW measures in Canada including speed restrictions and lane closures (TC, 2024b). A second NARW Technical Working Group provides advice to TC and includes governmental officials, harvesters, industry representatives, and NARW academics (TC, 2021). The Canadian Space Agency (CSA) is also involved in NARW conservation. Since 2021, the CSA has worked with DFO, TC, and five industry partners to develop smartWhales. This project has produced new methods for NARW satellite monitoring and modelling (Figure 2; Canadian Space Agency [CSA], 2024).

4.2 North Atlantic Right Whale Management in the United States of America

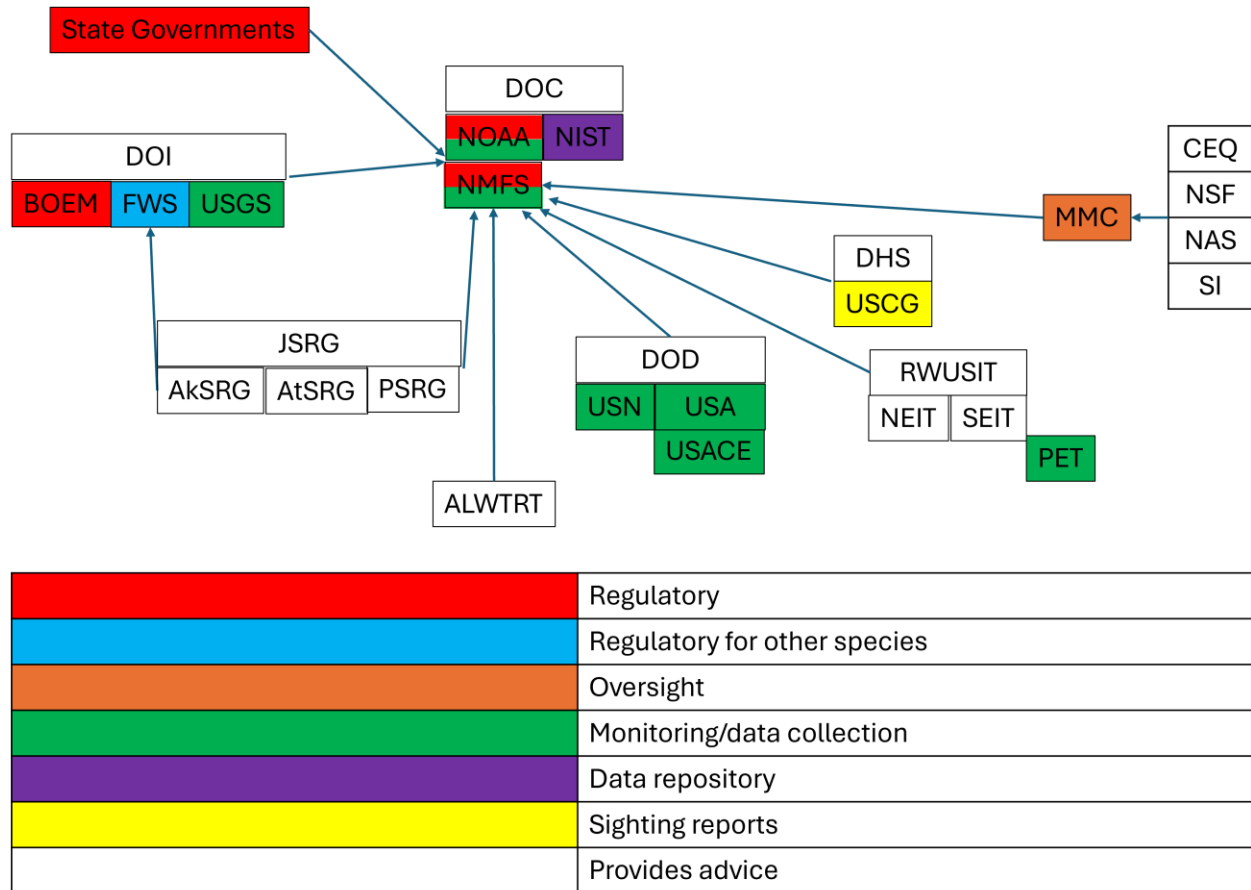


Figure 4. Simplified diagram of the North Atlantic Right Whale science-policy interface and Conservation Network within the United States of America demonstrating relationships between entities with arrows denoting expected information flow, and role in the governing system denoted by colour.

NOAA is a central entity for NARW management in the US, primarily through NMFS (Figure 4). The NMFS divides American waters into regions. Within the NOAA regions are regional offices and regional science centers. There are currently five regional offices (NOAA, n.d.-f) and six corresponding science centers (NOAA, n.d.-g) of which only the Greater Atlantic Regional Fisheries Office (GARFO) and Southeast Regional Office (SERO) are involved with NARW (NOAA, personal communication, 2024). GARFO oversees fisheries management and marine protection in the Greater Atlantic Region. This region is composed of the Atlantic coast

from Maine to Cape Hatteras, North Carolina and the Great Lakes area (NOAA, n.d.-a). The science centers are responsible for data collection and advice to managers in the NOAA region (NOAA, n.d.-b; NOAA, n.d.-h). The corresponding science center is the Northeast Fisheries Science Center (NEFSC) (NOAA, n.d.-f). The NEFSC has five divisions: Ecosystems and Aquaculture; Fishery Monitoring and Research; Population & Ecosystem Monitoring & Analysis; Protected Species; and Resource Evaluation and Assessment (Figure 5; NOAA, n.d.-b).

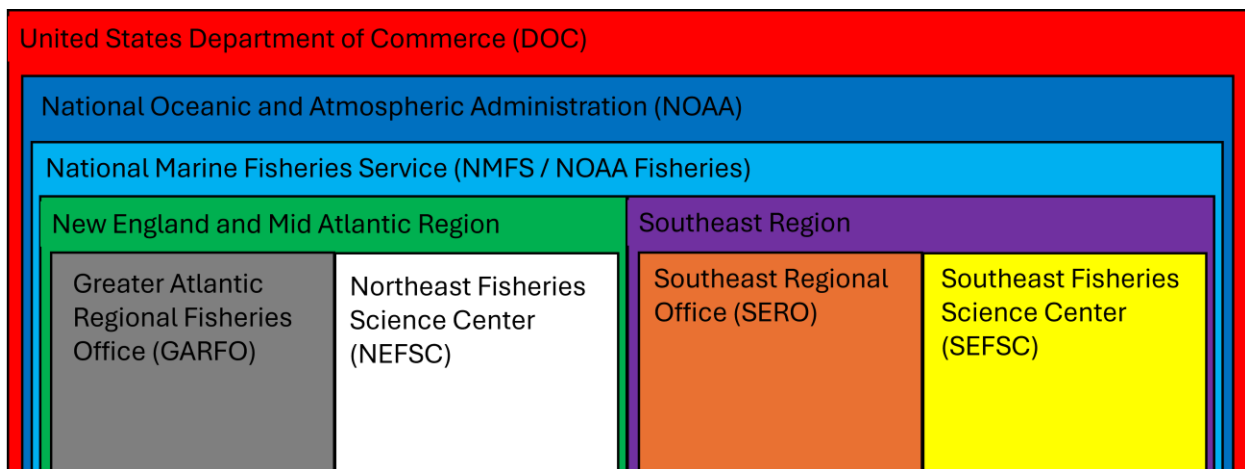


Figure 5. Simplified regional organization of the National Marine Fisheries Service for North Atlantic Right Whale management with colour denoting organizational structure.

The Northeast Implementation Team (NEIT) is the ESA-mandated recovery team that advises NOAA on NARW conservation and helps to inform and execute the NARW recovery plan from Maine to Virginia. The NEIT is composed of 14 members from the US government, state governments, Canadian federal government, US military, and academia (NOAA, 2024a). SERO oversees marine protection and fisheries management in the rest of North Carolina, down the Atlantic coast to Florida, and along the coast to Texas. The office also has jurisdiction over Puerto Rico and the United States Virgin Islands (NOAA, n.d.-i). The corresponding science center is the Southeast Fisheries Science Center (SEFSC) (NOAA, n.d.-h). The SEFSC has six divisions: Fisheries Assessment, Technology, and Engineering Support; Fisheries Statistics; Marine Mammals and Sea Turtles; Operations, Management, and Information; Population and Ecosystem Monitoring; and Sustainable Fisheries (Figure 5; NOAA, n.d.-h). The Southeast

Implementation Team (SEIT) is the equivalent of the NEIT for waters from North Carolina to Florida. This team is composed of 12 members representing the US federal government, state government, US military, academia, and stakeholder groups (NOAA, 2023c). The NEIT and SEIT also collectively meet, forming a coordinating body known as the Right Whale US Implementation Team for issues that span beyond each region’s boundaries. The Right Whale US Implementation Team also has a Population Evaluation Tool (PET) Subgroup which devised an assessment tool for Population Viability Analysis (PVA). PVA models NARW extinction risk based on trends to project benchmarks necessary for a successful recovery. The subgroup released its PVA report in 2023 (Figure 6; NOAA, 2024a).

NMFS is also organized by function: regulatory, scientific, and operational. There are national offices within these three categories relevant to NARW. The Office of Protected Resources (OPR) is the primary national regulatory office involved in NARW conservation. The OPR is generally responsible for ESA listed species including their designation, monitoring, and recovery strategy. For marine mammals specifically, OPR is responsible for conducting stock assessments and for conservation and management activities under the MMPA. OPR is the coordinating body for responding to marine mammals in distress through the Marine Mammal

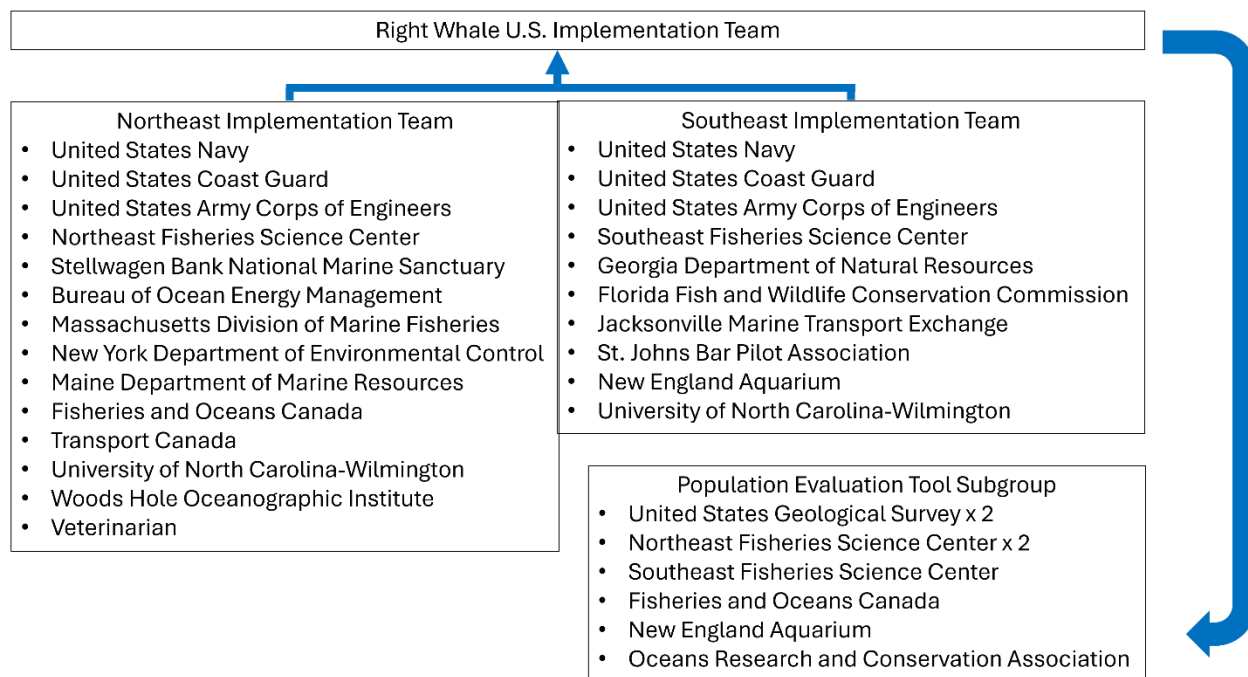


Figure 6. Membership of the Northeast Implementation Team, Southeast Implementation Team, Right Whale US Implementation Team, and Population Evaluation Tool Subgroup as of November 2024.

Health and Stranding Response Program (MMHSRP) and issues take exemption permits (NOAA, n.d.-d). For operational offices, the Office of Law Enforcement (OLE) is involved in NARW management as the body that oversees compliance and enforcement with NOAA regulations (NOAA, n.d.-c). The Office of Science and Technology (OST) is generally responsible for data collection and science coordination within NOAA. This includes for fisheries management, monitoring and assessment, program review, and socioeconomic analysis (Figure 7; NOAA, n.d.-e).

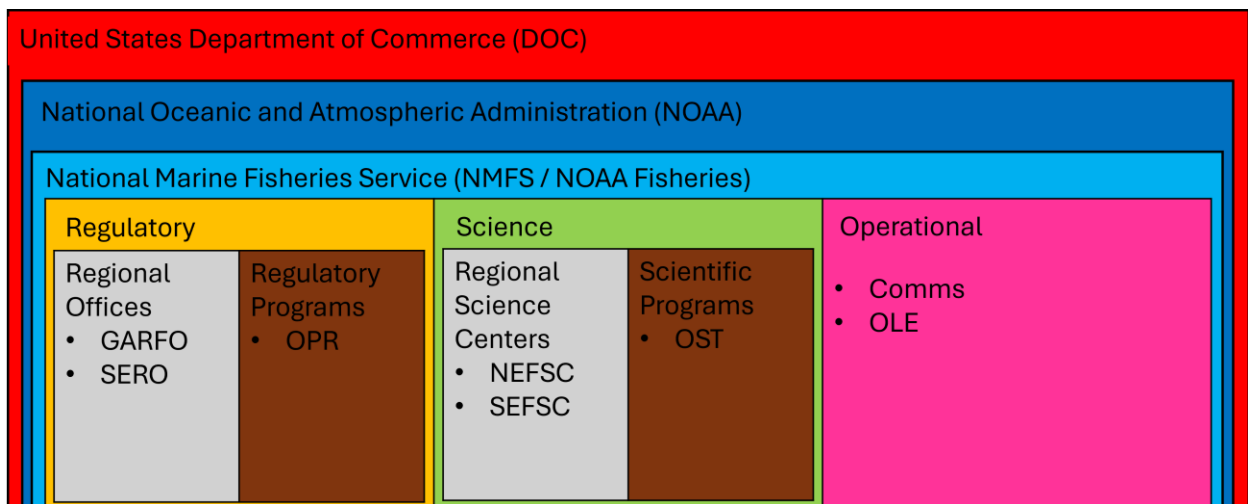


Figure 7. Simplified functional organization of the National Marine Fisheries Service for North Atlantic Right Whale management with colour denoting organizational structure.

NARW decision-making powers in NOAA are held by the Executive Committee. This committee takes advice and recommendations from the NARW Steering Committee. The Steering Committee is composed of representatives from the two regional offices and two regional science centers. There is active two-way communication between these two committees (NOAA, personal communication, 2024). Decisions about external NARW messaging and communications are ultimately approved by the NMFS national Office of Communications. NARW-related officials and teams at the regional level do not directly manage any of the public-facing messaging or narratives about the species (NOAA, personal communication, 2024).

Outside of the NMFS, NOAA's National Ocean Service (NOS) is also involved in NARW conservation. The Office of National Marine Sanctuaries (ONMS) manages the 15

National Marine Sanctuaries (NMSs) in US waters. The Stellwagen Bank National Marine Sanctuary (SBNMS) extends from the Gulf of Maine to Cape Cod and encompasses NARW feeding grounds (NOAA, 2023b) while the Gray's Reef National Marine Sanctuary (GRNMS) includes NARW calving grounds off the coast of Georgia (NOAA, 2014).

Outside of NOAA, there are other governmental and non-governmental entities involved in NARW management and conservation. Within the DOC is the National Institute of Standards and Technology (NIST). NIST contains the National Marine Mammal Tissue Bank (NMMTB). The NMMTB is a biorepository that stores tissue samples as part of the MMHSRP (NOAA, 2023a). The Atlantic Large Whale Take Reduction Team (ALWTRT) develops plans to reduce the impacts of fishing on large whales in the Atlantic Ocean. The ALWTRT is composed of over 50 members representing trap and gillnet fishers' associations, federal and state government officials, conservationists, and scientists (Figure 4; NOAA, 2024e).

The Department of Homeland Security is also involved in NARW management as the United States Coast Guard (USCG) helps NOAA facilitate NARW reporting areas (United States Coast Guard [USCG], 2014; NOAA, 2024c), receives reports of NARW sightings (NOAA, 2024c), and sits on the NEIT and SEIT (NOAA, 2023c; NOAA, 2024a). The Department of Defense (DOD) has a more applied role in NARW management through aerial surveys and monitoring conducted by the United States Navy (USN) and the United States Army Corps of Engineers (USACE) (United States Army Corps of Engineers [USACE], 2022). The Department of the Interior (DOI), with responsibility for parks and wildlife, is also involved in NARW management and conservation efforts. Within the DOI are three agencies which are more tangentially involved in NARW management: The Bureau of Ocean Energy Management (BOEM), the United States Geological Survey (USGS), and the FWS. The BOEM is tasked with managing offshore energy and minerals. The ESA instructs the BOEM to ensure that endangered species and their critical habitat are not harmed by approved projects (Bureau of Ocean Energy Management [BOEM], n.d.). The USGS absorbed responsibility for the National Biological Survey in 1996 and is generally involved in a wide variety of biological and oceanic research including species surveys and mapping (United States Geological Survey [USGS], n.d.). For NARW, the USGS was one of the entities involved in the PET subgroup and PVA research (NOAA, 2024a). With regard to the jurisdictions outlined in the ESA, the FWS is only

responsible for freshwater and non-marine species. As a result, the FWS is not directly involved in NARW management but is involved in the management of some other marine mammals (ESA, 1973). FSW also manages the importation and exportation of CITES-listed species, which included NARW though they are not an actively traded species (Figure 4; MMPA, 1972; Species+, n.d.).

With regard to the MMPA, three SRGs were created to advise NOAA and the FWS on marine mammals: Alaska, Atlantic, and Pacific. Generally, SRGs advise on marine mammal stock assessments, status, abundance, trends, uncertainties, research to address uncertainty and incidental mortality, habitat, habitat change (natural and anthropogenic), and other issues deemed suitable. The SRGs also collectively meet as the Joint SRG. For NARW, the relevant SRG is the Atlantic Scientific Review Group (ASRG). The ASRG is currently composed of 14 members representing the US federal government, Canadian federal government, state governments, academia, and eNGOs. The ASRG specifically focusses on entanglement, pollution/contamination, disturbance/habitat alteration from human development, and marine mammal takes resulting from fisheries (NOAA, 2024f). As the ASRG advises on manatees, which is FWS jurisdiction, FWS is an entity to which the ASRG reports. Since marine mammal stock assessments are often multi-species, a stock assessment of both NARW and manatees reports to both NOAA and FWS (Figure 8; FWS, n.d.; NOAA, 2024f).

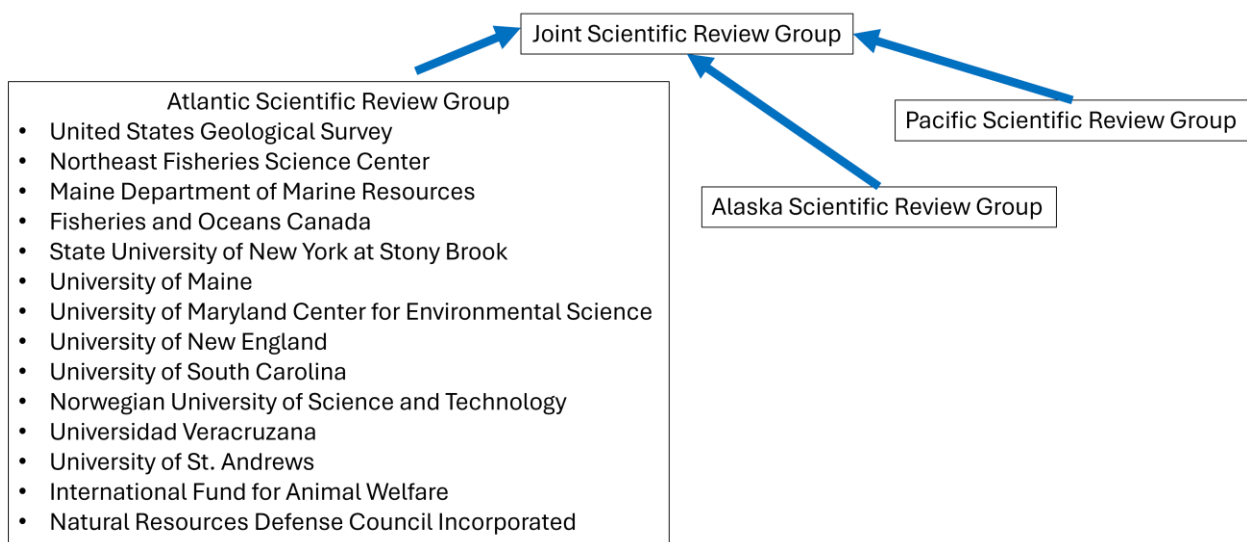
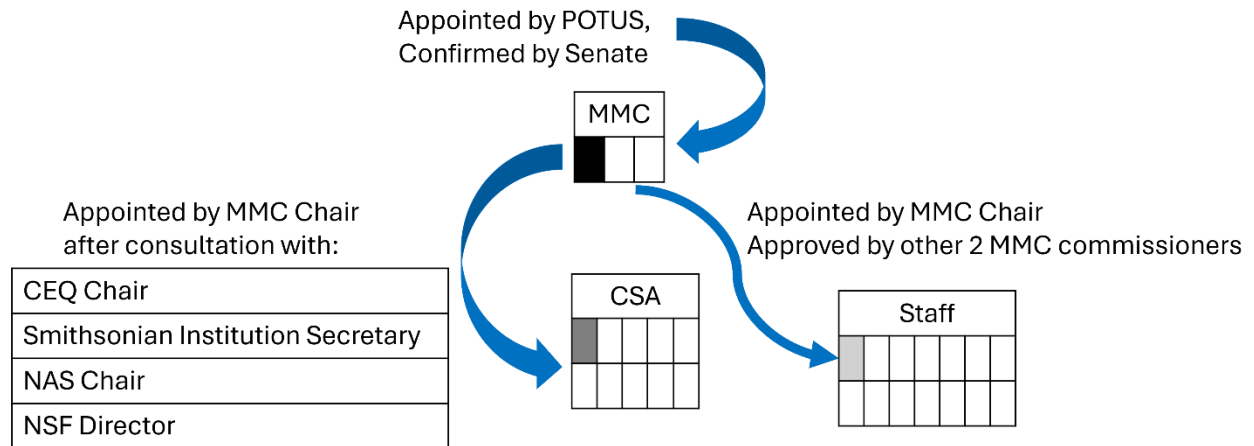


Figure 8. Membership of the Atlantic Scientific Review Group as of November 2024.

The MMPA established the MMC, an independent governmental organization responsible for seven duties involving oversight of science, policy, and management of marine mammals (MMC, 2024c). The MMC is tasked with **1)** evaluating whether American activities are compliant with marine mammal legislation and international conventions; **2)** continuously reviewing the state of marine mammal populations and efforts related to research, conservation, harvest, and display; **3)** facilitating studies related to its duties; **4)** recommending appropriate conservation actions to federal officials; **5)** recommending international marine mammal arrangements to the United States Secretary of State; **6)** recommending revisions to the status of marine mammals on the endangered species list; and **7)** recommending to Congress and other federal officials other measures, such as those to protect “Indians, Eskimos, and Aleuts” whose livelihood may be affected by actions taken (MMPA, 1972; MMC, 2024c). The MMC is composed of three commissioners nominated by the President of the United States (POTUS) and confirmed by the United States Senate (MMC, 2024a). The MMPA stipulates that all commissioners must have a background in marine ecology and resource management and not be individuals who would profit from the “taking” of marine mammals. The commissioners are supported by the Committee of Scientific Advisors (CSA). The CSA is a 10-member group, of which the MMPA requires nine must be scientists knowledgeable in marine ecology and marine mammals. Members are appointed by the Chair of the MMC after consultation with the Chair of the CEQ, the Secretary of the Smithsonian Institution, the Director of the National Science Foundation (NSF), and the Chair of the National Academy of Sciences (NAS) (MMPA, 1972). One of the members is a special advisor for Native Affairs. The MMC has an additional 14 staff members including the Executive Director, who is appointed by the Chair of the MMC with the approval of the other two commissioners (Figure 9; MMC, 2024a).



	Chair of the MMC
	Special Advisor for Native Affairs
	Executive Director of the MMC

Figure 9. Marine Mammal Commission selection and confirmation process.

4.3 International North Atlantic Right Whale Management

There are multiple Canada-US working groups about NARW. The Canada-US Transboundary Resources Steering Committee has a SAR Working Group. The steering committee discusses integrated management in the Gulf of Maine and Georges Bank area with the working group focussing on research and management of transboundary SAR, including NARW (DFO, 2021). There is also a United States and Canada Bilateral Cetacean Working Group, formed in 2017, which helps coordinate cetacean conservation efforts between nations (DFO, 2021; DFO, 2023c). NARWs are the primary focus of the working group (DFO, 2021). As Atlantic Canada shares a maritime border with France (through the overseas territory of Saint Pierre and Miquelon), DFO also coordinates NARW monitoring and recovery efforts with the French government (DFO, 2021). As Canada cannot regulate the construction of non-Canadian vessels which use Canadian waters, the International Maritime Organization (IMO) is involved in the creation of vessel standards that incorporate environmental protection measures targeting whales (DFO, 2021).

Table 3. Summary of Canadian, American, and international organizations/agencies involved in NARW management and conservation and their specific role.

Jurisdiction	Organization/ Agency	Responsibility in NARW management
Canada	Fisheries and Oceans Canada (DFO)	Fisheries management
	Transport Canada (TC)	Shipping management
	Environment and Climate Change Canada (ECCC)	SAR coordination
	Parks Canada Agency (PCA)	SAR in PCA managed waters
	Canadian Space Agency (CSA)	Satellite monitoring
	Committee on the Status of Endangered Wildlife in Canada (COSEWIC)	SAR recommendations
	NARW Advisory Committee	Stakeholder/rightsholder relations
	NARW Technical Working Group	NARW management advice
	Canadian Endangered Species Conservation Council	F/P/T ministers with SAR responsibility
	National Aboriginal Council for Species at Risk	SARA advice from Indigenous community reps.
	First Nations Advisory Committee on Species at Risk	SARA advice from AFN reps.
	Species at Risk Advisory Committee	SARA advice to assistant deputy ministers
	United States	National Oceanic and Atmospheric Administration (NOAA)
National Institute of Standards and Technology (NIST)		Biorepository for samples
Bureau of Ocean Energy Management (BOEM)		Offshore energy regulation and impacts
United States Fish and Wildlife Service (FWS)		Trade of CITES-listed species
United States Geological Survey (USGS)		PVA evaluation tool development
Marine Mammal Commission (MMC)		Marine mammal oversight
Council on Environmental Quality (CEQ)		Advises MMC on appointments
National Foundation of Science (NFS)		Advises MMC on appointments
National Academy of Sciences (NAS)		Advises MMC on appointments
Smithsonian Institution (SI)		Advises MMC on appointments
Atlantic/Joint Scientific Review Group (A/JSRG)		MMPA advice
Northeast/Southeast/Right Whale US Implementation Team (NE/SE/RWUS/IT)		ESA recovery plan advice
Population Evaluation Tool Subgroup (PET)		PVA evaluation
Atlantic Large Whale Take Reduction Team (ALWTRT)		Advice on fishing impacts
United States Coast Guard (USCG)		NARW sighting reports/ship briefings
United States Navy (USN)		Monitoring
United States Army Corps of Engineers (USACE)	Monitoring	
State-level departments	State regulations (i.e. vessel speed restrictions)	
International	Government of Saint Pierre and Miquelon (France)	Monitoring and recovery coordination
	Canada-US Transboundary Resources Steering Committee SAR Working Group	Transboundary SAR management at border
	US and Canada Bilateral Cetacean Working Group	Cetacean conservation coordination
	International Maritime Organization	International shipping

Chapter 5 – SWOT Analysis and Strategies Matrix

In Chapter 5, the combined results and discussion about the SWOT analysis applied to the NARW SPI are presented with recommendations for strategies to address these strengths, weaknesses, opportunities, and threats. While the acronym SWOT might suggest one should engage with the strengths and weaknesses of the system first (i.e. the internal components), best practices actually suggest that opportunities and threats (i.e. the external components) are the better factors with which to begin the analysis (Minsky & Aron, 2021).

5.1 SWOT Analysis

Table 4. Results of a Strengths, Weaknesses, Opportunities, Threats analysis of the North Atlantic Right Whale science-policy interface and conservation network. Factors placed in the centre are considered as both a strength/weakness or opportunity/threat.

Internal		External	
Strengths	Weaknesses	Opportunities	Threats
Precautionary approach Sectoral approach Communication	Transparency	International cooperation Weak Indigenous involvement Communication	Lack of funding Political will Uncertainty Jurisdiction International relations

5.1.1 External Factors (OT Analysis)

Fostering a stronger bilateral relationship between Canada and the US provides an opportunity for managing this transboundary species to improve coordination between the two nations. Similarly, opportunity lies with strengthening relationships with overseas nations that are the managing authority for vessels that use the Eastern seaboard and with the IMO which sets international standards. This is a chance to address the impacts of non-Canadian and American ships on NARW. As these ships are not managed by the American or Canadian governments, Canada and the US must be in a position to advocate for changes to these governments. Strengthening Indigenous involvement in NARW management offers an opportunity to advance reconciliation in both the Canadian and US contexts. This engagement also provides an opportunity to use approaches involving Indigenous worldviews, such as Two-Eyed Seeing, in NARW management. Stronger use of Indigenous approaches and knowledge in NARW

management would allow for more holistic management as different types of information and a stronger understanding of the historical NARW record could be used. It is imperative, however, that the use of such approaches and knowledge only occur with consent from the Indigenous Peoples themselves and under their guidance to ensure that the approaches and knowledge are used correctly, are non-extractive, and within the intended contexts (Table 4).

There are several recurring threats that typically face government work. Governmental programs require funding which is not guaranteed. The NARW management system is always threatened by the potential of future funding changes. For example, DFO funding for ghost gear retrieval has not been issued in 2024 (CBC News, 2024). NARW management is also impacted by political will. Conservation actions are only supported by governments when they are a priority. The relative prioritization of NARW conservation is subject to change and may increase or decrease in the future. It is also nearly impossible for one person or organization to have all the information to make informed management decisions in a natural resource context (Hemming et al., 2022; Kochenderfer, 2015). Uncertainty, therefore, is always present in any decision-making apparatus. This uncertainty always poses a threat to making decisions and may hinder management effectiveness. Lack of Indigenous involvement is also a threat to the management system. As discussed in Chapter 2, the GC has moral, ethical, and legal obligations to the Mi'kmaq, Wolastoqiyik, and Peskotomuhkati Nations in Atlantic Canada. Not fulfilling these obligations may lead to two different threats. Firstly, a lack of adequate Indigenous involvement may have legal consequences if treaty obligations and the principles of UNDRIP are not followed by DFO, PCA, and TC. Secondly, lack of Indigenous involvement limits the types of knowledge that are being used on NARW decision making and potentially contributes to less holistic management decisions. While the US has a different history and legal context with Indigenous peoples, the second threat is still applicable in that context. The presence of foreign vessels which are not regulated by the Canadian and US governments is another threat to the system (Table 4).

5.1.2 Internal Factors (SW Analysis)

Some governmental organizations, such as DFO, are mandated to use of the precautionary approach/principle as a way of dealing with uncertainty. This is a strength of the system that minimizes the risks from scientific uncertainty. Use of the precautionary approach

reduces the potential for choice-paralysis which may occur in an information limited context. As is the case elsewhere in many governments, NARW governance is structured on a sectoral basis. Rather than a dedicated NARW team, governing bodies are organized by sector, with NARW-related officials within each sector. For example, DFO Science has NARW science leads who manage NARW-related labs whereas NARW-related SAR policy is conducted within Ecosystem Management. A strength of this sectoral approach in DFO is that organization is structured by DFO mandate/duty. Housing all the officials that work within a specific mandate together may encourage cross-species group collaboration. This could allow for the application of information from different contexts more easily. For example, SAR decisions regarding NARW may impact other SAR or vice versa. These implications can be more easily considered through this sectoral approach as the teams are structured by type of work (SAR, fisheries management, etc.) rather than by species (Table 4).

There are trade-offs, however, to the sectoral approach to management, and some weaknesses are apparent. Spreading NARW-related officials throughout the department increases the frequency of lateral communication between teams necessary to coordinate activities and ensure holistic management. Another weakness of the system is transparency. The fact that this project is necessary underscores the opacity of the system to outsiders. Basic organizational charts and explanations of structures and processes are not publicly available, particularly from the Canadian government. In other words, one must already be an insider within this system, or have access to the insiders, to retrieve desired information about it. For example, NARW decision making in NOAA is entrusted to an executive committee which receives advice from a steering committee. Neither of these committees have an online presence which explains the structure and processes of these committees. This lack of transparency surrounding how decisions are made and lack of transparency surrounding how information flows can hinder the ability of the NARW conservation network to effectively communicate with governmental decision makers (Table 4).

5.2 Strategy Matrix

Table 5. Results of an Opportunity-Strength, Opportunity-Weakness, Threat-Strength, Threat-Weakness strategy matrix for the North Atlantic Right Whale science-policy interface and

	Strengths	Weaknesses
Opportunities	<u>OS Strategies</u> Novel solutions Shared values	<u>OW Strategies</u> Stake/rightsholder transparency
Threats	<u>TS Strategies</u> Precautionary approach	<u>TW Strategies</u> Stake/rightsholder transparency Strengthened communication

conservation network.

OS strategies look for ways to leverage the strengths of the system to seize opportunities (Feder, n.d.; University of Kansas, n.d.). The sectoral approach to management combines officials who work on similar issues but for different species together. Drawing from the diversity of contexts may allow for the discovery of novel solutions that can be applied to NARW-related issues. The precautionary approach and ecosystem-based management approaches used in the federal government also offer an opportunity for Indigenous involvement in the system, as they parallel the teachings of many Indigenous Peoples and are shared values by which a stronger relationship can be based upon (Frid et al., 2023). OW strategies look for ways to overcome the weaknesses that prevent opportunities from being realized (Feder, n.d.; University of Kansas, n.d.). The lack of transparency of the system can impede stakeholder and rightsholder involvement within the system. Improving transparency can help facilitate stronger stakeholder involvement in the system, including stronger Indigenous involvement (Table 5).

TS strategies seek to reduce the impacts of threats through the strengths of the system (Feder, n.d.; University of Kansas, n.d.). The precautionary principle is a strategy that helps reduce choice-paralysis which may occur from uncertainty and lack of information as it embodies the idea that “it is better to be safe than sorry.” If there is risk from inaction, then action should be taken even if there are data limitations and uncertainty (Birchall et al., 2017). Adopting this principle throughout all of the entities involved in the NARW SPI would help contribute to positive management efforts in the future. TW strategies seek to overcome the

weaknesses that may lead to threats being realized (Feder, n.d.; University of Kansas, n.d.). The lack of transparency of the system may be a factor contributing to Indigenous involvement in the system which contributes to the threats of non-holistic management and contravening treaty rights. The necessary lateral communication stemming from sectoral management is a potential threat that can lead to uncoordinated management efforts if it does not occur frequently and effectively. Communication issues are best resolved through a structured, regular communication regime which ensures that relevant parties are kept abreast of the actions of other NARW officials in the government. Foreign vessels that use Canadian and American waters are not regulated by these governments and may negatively impact NARW. Strengthening international collaboration, particularly through the IMO, is a pathway for addressing this threat to spur positive change to vessel design and practices globally (Table 5).

Chapter 6 – Recommendations and Conclusions

In this chapter, preliminary recommendations on how to improve the NARW management system are provided based on the strategies matrix created from the SWOT analysis of the system. Limitations of the study and areas for potential future research are also addressed.

6.1 Recommendations

This project sought to map the network of scientists and decision-makers that work at the SPI for NARW conservation and to conduct a preliminary assessment of the effectiveness of this network. Some key findings were that the management system is highly sectoral, non-transparent, and Indigenous involvement is currently weak. Based on the results of the SWOT analysis, five key strategies were devised to address these potential shortcomings in the NARW management and conservation network.

1. In order to maximize the strengths of the current sectoral management approach to address areas of uncertainty and data limitations, **NARW government officials could draw from the contexts of their co-workers to find novel solutions** from these other contexts and look for ways that solutions from the management of other species and areas can be applied to NARW.
2. Indigenous knowledge systems in Canada use principles that are similar to the precautionary approach used by the Canadian government. **This is a shared value that can be used as a starting point to increase Indigenous involvement in this system.** *Netukulimk*, for example, is a Mi'kmaw principle relating to living sustainably and maintaining balance in the world (Unama'ki Institute of Natural Resources [UINR], 2020). Both *Netukulimk* and the precautionary approach are based in the idea of doing what is necessary to reduce environmental harm.
3. **Further adoption of the precautionary principle** throughout the NARW management system would create a mandate for positive changes to occur. This would prevent the “do nothing” option from being considered. The status-quo is clearly not effective as anthropogenic mortality is high; therefore, actions must be taken.
4. **Increased transparency and communication of the system to both insiders and outsiders** who are knowledgeable, affected by, or interested in NARW is necessary for effective information flow within this system. It is imperative that those outside of government are able to communicate management effects and research findings with

decision-makers to ensure that management efforts are having meaningful effects and not having unintended consequences.

5. The sectoral approach to management requires increased lateral communication to coordinate NARW management actions within the system compared to non-sectoral management. **Increased, regular, communication is necessary for effective management.**

6.2 Limitations

This research is intended to be a preliminary step in understanding the SPI for NARW management. Due to the time constraints of conducting this research within a master's program, a more in-depth analysis, including formal interviews with government officials, was not possible. Due to this, information regarding the internal workings of organizations, including government, considered in this study was limited. This impacted the ability of this study to address research questions 1a and 1c. SWOT analyses as a framework have been criticized. Hill & Westbrook (1997) suggested that the results of SWOT analyses are often not useful as they are vague and non-descriptive, overly long, and do not prioritize actions well (Hill & Westbrook, 1997). Porter et al. (2002) criticized the method as non-rigorous as it assumes that each system has its own unique context rather than providing a prescriptive framework for analysis. This lack of prescriptive framework lends towards a more ad hoc approach to analysis. This is a limitation of the present study as researcher bias necessarily contributes to the consideration of factors used in the analysis.

6.3 Future Research

Future research should explore stakeholder and rightsholder involvement in the SPI and conservation network more in depth. More specifically, a future project should research the factors impacting Indigenous involvement in the system to look for ways that Indigenous input can be facilitated and find ways to better support participation of Indigenous Peoples. This project is part of the GE³LS component of the Conservation Genomics of the Endangered North Atlantic Right Whale Project. Other research projects related to the NARW SPI and conservation network have occurred. Future research should integrate these findings to contribute to a more holistic picture of the NARW SPI and conservation network.

6.4 Conclusions

In conclusion, the critically endangered North Atlantic Right Whale has not recovered successfully despite genetic evidence that recovery should be forthcoming. One potential factor that may have hampered recovery potential is ineffective management. In order to assess the effectiveness of the management regime, this study sought to document the science-policy interface for North Atlantic Right Whale and give a preliminary assessment of the system through a SWOT analysis and strategies matrix. This study found that the current management system is highly sectoral, weak on transparency, and does not have strong Indigenous involvement. It is recommended that **1)** solutions from different species-management contexts and geographic areas be explored for applicability to the North Atlantic Right Whale context; **2)** shared values are emphasized as a means of inviting stronger Indigenous involvement in the system; **3)** the precautionary principle be applied more broadly throughout the system; **4)** transparency of the governance system be increased and **5)** lateral communication be strengthened between the different entities within the system. Future research should occur to address the factors leading to the current weak Indigenous participation in the management system and to integrate these findings with the other findings of the GE³LS team.

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