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EXECUTIVE SUMMARY

The collapse of the fish stocks in the Northwest Atlantic presents possibly one of the greatest challenges ever faced by marine scientists, fisheries managers and resource users. This report focuses on the marine ecosystem of the southern Grand Bank and proposes a large-scale, high seas marine protected area (MPA) as a part of what must be a concerted effort to restore the once abundant marine life of this area.

The southern Grand Bank is a highly productive ecosystem, and has sustained a dynamic web of marine life for centuries. The area is defined by several distinct physical and geographical characteristics. The most significant is the Southeast Shoal - a shallow, sandy plateau where many species of fish, birds and marine mammals congregate to spawn and feed. Pressures of overfishing, particularly in the past 50 years, have left the area depleted of commercially harvested species. Populations of special concern include an offshore spawning population of capelin (an important forage species for groundfish, especially cod), offshore relict populations of the blue mussel and the wedge clam, a discrete population of humpback whales, several species of deep-sea coral as well as migrating leatherback and loggerhead turtles. The Southeast Shoal area provides nursery habitat for commercially important species such as cod, American plaice, and yellowtail flounder. Despite fisheries closures and a reduction in fishing effort over the last ten years, commercial fish stocks have not recovered and many species continue to be exploited as bycatch. A large-scale protected area, with a significant no-take component, presents an opportunity to restore fish stocks and offers further protection of the marine ecosystem.

The purpose of an MPA in this area is to conserve representative biodiversity of species and habitat, protect juvenile fish, investigate the effectiveness of a large-scale closure on depleted fish stocks and establish a precedent for open-ocean high seas protected areas. To provide a context for discussion and a rationale for protection, this report considers an area spanning the North Atlantic Fisheries Organization (NAFO) regulatory divisions 3N and 3O and encompasses approximately 36,000km^2, within the boundaries of 43°30'N to 44°30'N and 49°W to 53°W. Both shallow bank and continental slope habitats are represented within the boundaries of the proposed MPA. This proposal builds on current knowledge of the southern Grand Bank ecosystem and on past proposals for protection of this area.

Protection of the proposed area as an MPA would be politically significant, as it would straddle the 200-nautical-mile limit, thus requiring international cooperation for implementation. Political motivation to protect the area exists nationally, as promotion of an MPA by Canada would indicate to foreign fishing nations that alternative measures need to be taken to ensure compliance with fisheries conservation measures under NAFO and the United Nations. A review of national legislation and international agreements indicates that there are a wide range of legal and institutional tools that can be used to facilitate the protection of the southern Grand Bank. Despite these tools, the specific legal framework and institutional capacity, especially with regard to protecting an area outside the exclusive economic zone (EEZ), have yet to be established. Should this proposal move forward, it would be a significant precedent in high seas conservation.

Canada has committed to the conservation of biodiversity in the marine environment through adopting legislation such as the *Oceans Act*, the *Migratory Birds Convention Act*, the *Canada National Marine Conservation Areas Act* and the *Species at Risk Act*. International commitments to conservation include the *NAFO Convention*, the *United Nations Convention on the Law of the Sea*, the *United Nations Agreement on Straddling Stocks and Highly Migratory Species*, the *FAO Code of Conduct for Responsible Fisheries*, the *Convention on Biological Diversity* and the *Jakarta Mandate on Marine and Coastal Diversity*.

The southern Grand Bank area could serve as a pilot project for international cooperation in establishing a high seas MPA, thereby setting a precedent for meeting international conservation commitments and providing a way forward for other initiatives. International commitments to establish MPA networks by 2012 and achieve sustainable fisheries by 2015 were made at the 2002 World Summit on Sustainable Development indicating global interest in maintaining and conserving marine ecosystems.

Recommendations following this report include:

1) **Improving scientific information** through scientific synthesis and monitoring of non-commercial species, a comprehensive reconstruction of the southern Grand Bank ecosystem to determine baselines for conservation and restoration, and the creation of a small working group of scientists who have both expertise in the southern Grand Bank ecosystem and motivation for marine conservation.
2) **Stakeholder consultation and involvement** immediately upon the decision to move ahead with an MPA plan, including the establishment of specific goals, objectives and timelines and the development of a public education program.
3) **Creation of political motivation** at the provincial and federal levels of government through active solicitation of support for a high seas MPA on the Grand Bank.
4) **Thorough economic analysis of current uses** to highlight potential national and international economic losses and to determine potential gain in natural capital should an MPA be established.
5) **Organization of an international meeting** to define the appropriate legal framework through which an MPA on the southern Grand Bank could be established.

ABBREVIATIONS AND ACRONYMS

AOI	Area of Interest
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CBD	Convention on Biological Diversity
CFP	Common Fisheries Policy
CITES	Convention on International Trade in Endangered Species
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
ECAREG	Eastern Canada Traffic Systems
EEZ	exclusive economic zone
EFH	essential fish habitat
EU	European Union
FRCC	Fisheries Resource Conservation Council
GPS	Global Positioning System
GRT	gross registered tons
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
ICNAF	International Commission for Northwest Atlantic Fisheries
IUU	Illegal, Unreported and Unregulated
IMO	International Maritime Organization
ISA	International Seabed Authority
IUCN	The World Conservation Union
MARPOL	International Convention for the Prevention of Pollution from Ships
MBARI	Monterey Bay Aquarium Research Institute
MEPC	Marine Environment Protection Committee of IMO
MPA	marine protected area
MSC	Marine Stewardship Council
NAFO	Northwest Atlantic Fisheries Organization
NED	Northeast Distant region (of the US National Marine Fisheries Service)
NGO	Non-governmental Organization
NMFS	National Marine Fisheries Service (US)
NRC	National Research Council
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic (Oslo and Paris Conventions combined)
PSSA	particularly sensitive sea area
SARA	Species at Risk Act
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice (Advisory Group to the CBD)
SPAMI	Specially Protected Area of Mediterranean Importance" (SPAMI)
TEK	Traditional Ecological Knowledge
TAC	total allowable catch
UK	United Kingdom
US	United States
UNEP	United Nations Environment Program

UNFA	United Nations Fish Stocks Agreement relating to Straddling Fish Stocks and Highly Migratory Fish Stocks (also known as UNFSA)
UNCLOS	United Nations Convention of the Law of the Sea
VMS	Vessel Monitoring Systems
WCPA	World Commission on Protected Areas (an IUCN Experts' Commission)
WWF	World Wildlife Fund

1.0 INTRODUCTION

> *"The largest of the Grand Banks, known as the Grand Bank, is larger than Newfoundland. These are huge shoals on the edge of the North American continental shelf. The area is rich in phytoplankton, a growth produced by the nitrates stirred up by conflicting currents. Zooplankton, tiny sea creatures, gorge themselves on the phytoplankton. Tiny shrimp-like free floating creatures called krill eat the zooplankton. Herring and other mid-water species rise to eat the krill near the surface and seabirds dive for both the krill and the fish. Humpback whales also feed on the krill. And it is this rich environment on the banks that produces cod by the millions".* Kurlansky, *Cod* (1997)

For people to care about a habitat, it must exist in their imagination. When people care about it, a habitat becomes much easier to preserve. The great fisheries on the Grand Banks[1] exist in the world's imagination. For 500 years, this area has been an important source of food for southern Europe and the Caribbean and has played a role in many cultural traditions. Dried cod (*Gadus morhua*) from the Grand Banks is the traditional Christmas dish in Italy. Rudyard Kipling's *Captains Courageous* marks the Grand Banks in literary space. Mike Harris's *Lament for an Ocean* describes the political context within which the once abundant cod stocks were fished to the point of collapse. The decline of the fisheries on the Grand Banks has affected many people who knew only vaguely of its geographical location. The Grand Banks have a strong emotional appeal among the public; half the battle in gaining international support for protection of at least part of this area is already won.

When Canada extended its jurisdiction over fisheries to its 200-nautical-mile limit in 1977[2], one of the justifications for doing so was to increase its control over the fishery and facilitate conservation based fisheries management[3]. From the current status of demersal[4] fish stocks

[1] The term "Grand Banks" refers to Newfoundland's continental shelf, that is, the submerged border of the island that slopes gradually to a point of steeper descent to the ocean bottom. The Grand Banks comprises five banks, one of them being the Grand Bank. The area on which this report focuses is the southern part of the Grand Bank, also known as the Tail of the Banks, which contains the Southeast Shoal. For simplicity, however, throughout this report the plural term "Grand Banks" has been used to refer to this area.

[2] Marine zones of Canada are defined in the *Oceans Act*. Canada's marine realm has several components: internal waters, which are within an established coastal baseline; the territorial sea, which extends 12 nautical miles from the established coastal baseline, primarily used for the purposes of customs enforcement; and the exclusive economic zone (EEZ), which extends to a limit 200 nautical miles from the established coastal baseline. Canada has the power to regulate all activities within its internal waters and territorial seas (with some limitations with respect to foreign ships passing through but not stopping in Canadian ports). In its EEZ, Canada has sovereign rights over natural resources, but foreign states have certain rights, such as that of navigation, within that zone.

[3] The creation of the EEZ under UNCLOS originated from the 1958 UN Convention of Fishing and Conservation of the Living Resources of the High Seas, which enabled coastal states to take unilateral measures of conservation on the high seas adjacent to their territorial waters. The realization that post World War II factory trawlers could quickly deplete fish stocks, and that foreign fisheries could jeopardize fisheries within the territorial seas, instigated the desire of coastal nations for increased control over fisheries management and conservation.

in the Northwest Atlantic, it is evident that appropriate conservation measures did not follow the designation of the 200-mile limit. The collapse of the fisheries on the Grand Banks in the early 1990's continues to be one of the greatest failures of fisheries management (Pauly and MacLean 2002). A decade after the 1992 cod moratorium on the Grand Banks further restrictions on cod fishing were recommended (DFO 2002a) and four populations of Northwest Atlantic cod were listed as endangered (COSEWIC 2003). Given the capacity and efficiency of fishing fleets today, one of the few measures that may allow sustainable fisheries is creating no-take reserves in large parts of the world's oceans (Pauly et al. 2002).

Protected areas[5] are gaining worldwide support as an effective tool for marine resource management (Roberts 1995, Lauck et al. 1998, Sladek-Nowlis and Roberts 1999, Murray et al. 1999, Hyrenbach et al. 2000, Roberts et al. 2001). Current models of marine reserves, a type of MPA where fishing is prohibited, show that areas closed to fishing ultimately increase the resilience of the system to the effects of overexploitation (Quinn et al. 1993, Man et al. 1995, Lauck et al. 1999, Sladek-Nowlis and Roberts 1999). As an experiment in hindsight, Guénette et al. (2000) modeled the potential of marine reserves in preventing the 1992 collapse of the northern cod stocks. They found either very large reserves (80% of fishing grounds) or smaller reserves coupled with a reduction in fishing effort may have offered adequate protection. There is evidence that regardless of the size of the reserve, MPAs result in increased diversity and biomass in relatively short time periods (Halpern and Werner 2002, Halpern 2002). The majority of protected areas are in coastal, tropical areas of high habitat complexity. There are relatively few examples of temperate marine protected areas. In the past decade, implementation of various types of marine reserves and marine protected areas has underscored the need for empirical evidence for both the establishment and monitoring of these areas (Agardy et al 2003). In particular, the authors stress the need for MPA planning strategies and multi-disciplinary approaches to achieving predetermined conservation objectives. MPAs will not solve all marine conservation problems, but can be an important part of an ecosystem-based management strategy.

The Canadian Department of Fisheries and Oceans (DFO) has recognized the value of using MPAs as integral parts of successful fisheries management, and makes the statement:

> "MPAs are an effective way of incorporating precautionary and ecosystem approaches into fisheries management. Reduced fishing pressure, in an MPA with fisheries closures, may result in the increased abundance, size, weight and diversity of fisheries resources. Such closures could also be an effective means of protecting fisheries resources for future use. Moreover, MPAs can protect critical habitats from disturbances that would otherwise affect fish production. History shows that many traditional fisheries have enjoyed natural refuges in offshore locations that prevented over-fishing. However, new technologies, increased market value, lack of effective restrictions and

4 Demersal refers to fish that live on or near the ocean floor.

5 Protected areas have a wide range of functional definitions, from strictly protected marine reserves where extractive uses are prohibited, to areas zoned to accommodate multiple sustainable uses, which may include non-extractive areas. The Great Barrier Reef Marine Park is an existing example of a marine reserve, zoned for multiple uses, with some areas as non-extractive.

> expansion of the offshore fishery have led to the exploitation of these natural refuges. The restoration of some of these refuges through use of MPAs could help contribute to the sustainability of these fisheries." DFO (1997)

Despite the apparent support for MPAs as part of a fisheries management regime, large-scale marine reserves have yet to be integrated into current marine management plans in the Northwest Atlantic.

As ecosystems do not follow politically designated borders, protection of biodiversity necessitates high seas co-operation. The decline of fish stocks globally (Myers and Worm 2003), the multinational nature of many fisheries and the concern for highly migratory species have resulted in discussion of high seas protected areas and the necessary legal framework for implementation (Gjerde 2001a, Gjerde and Breide 2003). Cross-border protection has long been an issue in terrestrial environments. As of 2001, there were a total of 169 complexes of terrestrial protected areas throughout the world that span international boundaries (Zbicz 2001). The World Conservation Union (IUCN) has a well established program of Parks for Peace, which specifically advocates protected areas for the purpose of biodiversity conservation, conflict prevention and sustainable development (Sandwith et al. 2001). Given the international nature of the fisheries on the Grand Banks and its historic and present day cultural significance, co-operation to protect commercial stocks and marine biodiversity in general would set an important precedent for high seas marine ecosystem protection.

The concept of an MPA on the southern Grand Bank is not new. The primary incentive for protection currently and in the past has been the importance of the Southeast Shoal as a spawning and nursery area for juvenile groundfish (Walsh 1991, Walsh et al. 1995, Brodie 1996, Walsh et al. 2001). In the 1994 Halifax Declaration[6], the call was made for the establishment of an MPA on the southern Grand Bank, specifically to ensure the conservation and sustainability of juvenile Atlantic cod (*Gadus morhua*), American plaice (*Hippoglossoides platessoides*) and yellowtail flounder (*Limanda ferruginea*).

The area proposed for protection in this document encompasses the waters and sea floor within the approximate geographical boundaries of 43°30'N to 44°30'N and 49°W to 53°W (Figure 1). The area covers approximately 35,574 km^2 and represents a suggested minimum for an MPA on the southern Grand Bank[7]. The area straddles divisions 3N and 3O of the Northwest Atlantic Fisheries Organization (NAFO)[8] regulatory area. The justifications for

[6] The Halifax Declaration was drafted and adopted at the Second International Conference on the Science and Management of Marine Protected Areas in Halifax, Nova Scotia on 20 May 1994.

[7] Since 1994, there have been three closed areas on the US side of Georges Bank, totaling 17,000 km^2 . The Gully MPA is approximately 2360 km^2. The Coral Box located between Georges and Browns Bank in the Northeast Channel was closed in 2002 and covers 424 km^2. The April 2003 closure of three additional cod stocks, in Northeast Newfoundland and Labrador and in the Gulf of St. Lawrence, will further reduce fishing effort for groundfish throughout Atlantic Canadian waters.

[8] The Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries, to which Canada, Iceland, Norway and the then Soviet Union were signatories, came into force on 1 January 1979. The convention established NAFO, whose "primary objective is to contribute, through consultation and cooperation, to the optimum utilization, rational management and conservation of fishery resources of the convention area and to

extending past the 200-nautical-mile limit include maximizing the range of marine biodiversity and habitat to be protected, recognizing that the EEZ is not a meaningful biological boundary with respect to commercial fish stocks, and serving as a precedent for high seas marine conservation initiatives. The shape and boundaries of the proposed area have been selected in the interests of including maximum biological and habitat diversity, and should serve only as an example of what might be achieved following stakeholder consultation and political negotiations. Other potential alternatives to the shape and boundaries used as an example throughout this report may include a larger rectangle or an L-shaped area encompassing a greater percentage of the continental slope (Appendix 2).

The purpose of this report is to:

1. Provide a description of the southern Grand Bank ecosystem and a scientific basis for its protection,
2. Describe current uses of the area,
3. Briefly outline relevant national and international legislation as potential legal tools,
4. Explore impediments to implementation,
5. Provide potential strategies and recommendations needed to move forward on this proposal, and finally,
6. Stimulate discussion among resource users, government agencies and the general public with respect to the implementation of a southern Grand Bank high seas MPA.

promote to this end, scientific research and cooperation among the contracting parties" (NAFO website, www.nafo.org).

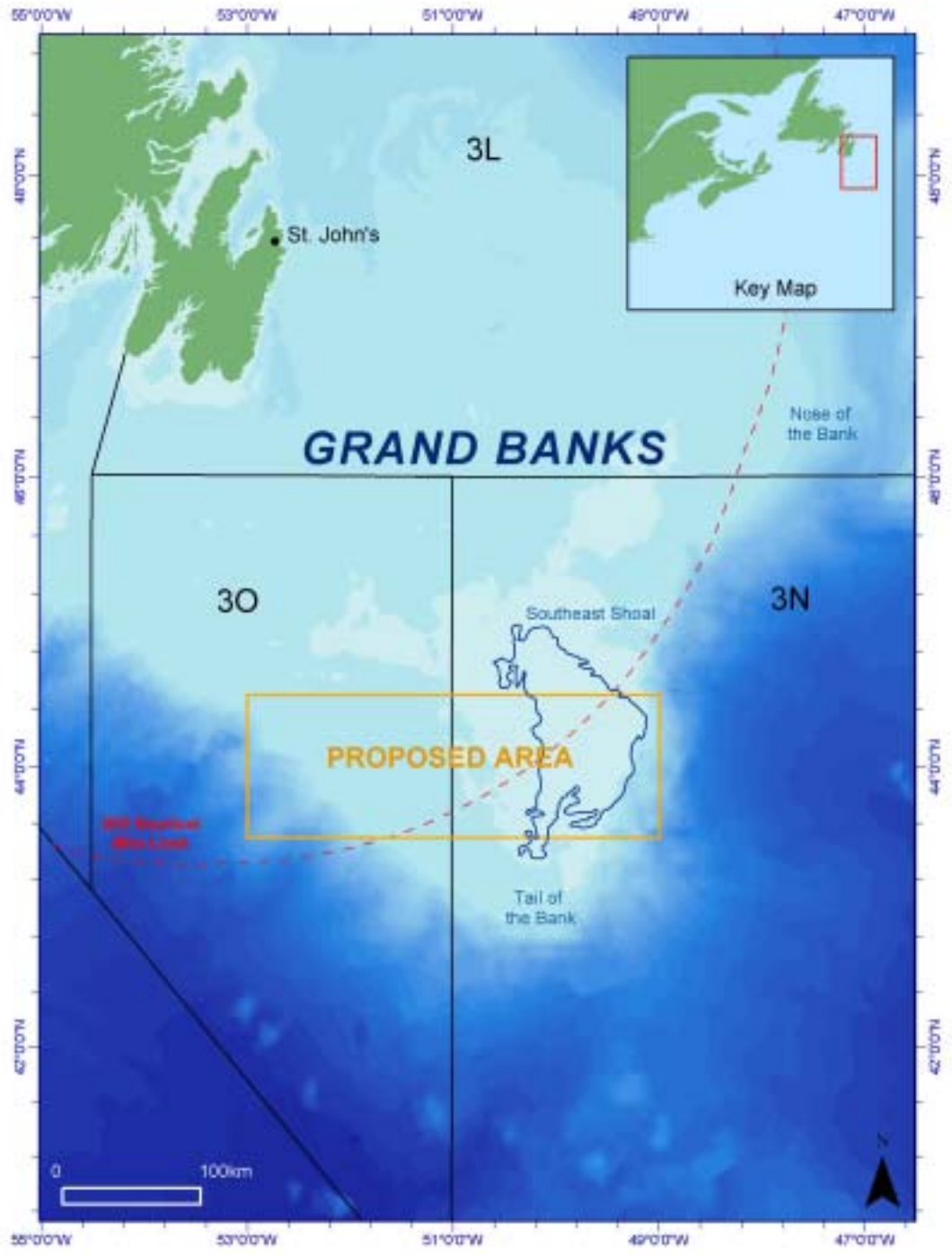

Figure 1 The proposed southern Grand Bank protected area is encompassed by geographic boundaries of 43°5'N to 44°5'N and 49°W to 53°W. The boundaries presented here were chosen as a basis for discussion, and do not necessarily represent ideal delimitations for maximum ecosystem protection. Consultation with stakeholders and review of existing scientific information as well as specification of the goals of the protected area will have to be completed before official boundaries can be decided upon.

2.0 WHY DESIGNATE AN MPA ON THE SOUTHERN GRAND BANK?

> *"The strongest argument that protected areas can benefit the Atlantic fishery is that they have done so in the past. Much of the offshore area was inaccessible before the advent of highly efficient fishing boats and sonar fish finders. That is, areas used to be protected by virtue of being distant, or covered by pack ice in the winter".* Shackell and Lien (1995)

> *"There are many arguments in favor of a closed or protected area as a management measure on the southern Grand Bank, and few against, particularly in the context of the current fishery moratorium".* Brodie (1996)

There is scientific support for MPAs as a general tool for marine conservation, and the southern Grand Bank ecosystem is well known from a scientific perspective. Most importantly, we know that fish stocks have collapsed and not recovered, fish habitat is being destroyed, and there is little protection from continued over-fishing. A no-take zone on the southern Grand Bank would offer a greater level of protection than the present fisheries moratoria[9]. The decline in the fishery on the Grand Banks and the failure of stocks to recover is a clear sign that new management regimes are needed.

While Newfoundland is known for its abundant fisheries and spectacular coastlines, very little of the marine environment surrounding the island is protected from resource extraction and development. As of 2001, only 1,084 km^2 – much less than one percent of the marine area – is fully protected either under the jurisdiction of the national park system or as provincial ecological reserves (Jameison and Levings 2001). Other areas are managed under seasonal fisheries closures, closures due to shellfish contamination, and protected as seabird sanctuaries (Anderson et al. 2000) or lobster conservation areas (Rowe 2001). There are remarkably few MPAs in the Northwest Atlantic and only one that is strictly for the protection of the marine environment. The 2004 designation of the Gully on the Scotian Shelf marks a first for a large-scale off-shore MPA established under the *Oceans Act*. Other candidates for protection under this legislation include Basin Head in Prince Edward Island, Musquash Estuary in New Brunswick, Gilbert Bay in Labrador and Eastport and Leading Tickle in Newfoundland. With the exception of the Gully, these sites are small-scale, inshore protected areas. The 2002 closure of deep-sea coral habitat in the Northeast Channel of the Northwest Atlantic under the *Fisheries Act*, indicates recognition of the importance of structure forming species by the federal Department of Fisheries and Oceans.

[9] On July 2, 1992, the Department of Fisheries and Oceans declared an end to the directed fishery for northern cod in NAFO areas 2J3KL for a period of two years. In 1993 the moratorium was extended indefinitely and 2002 marked the tenth year of the moratorium, with no sign of recovery of the northern cod stocks. In April of 2003, the northern cod fishery in the Gulf of St. Lawrence and Newfoundland was completely closed by the Minister of Fisheries and Oceans, the Hon. Robert Thibault. In addition to the original moratorium on northern cod in NAFO divisions 2J3KL in 1992, fishing on other stocks and species has also been restricted. Moratoria were placed on division 3NO cod in 1995, 3LN Redfish in 1998, 3LNO American plaice in 1995, 3LNO witch flounder in 1993, and 3NO capelin in 1993. Throughout this document, moratorium will refer to the original legislation in 1992 unless otherwise specified.

Justification for an MPA in the southern Grand Bank region is discussed in terms of geological features, physical oceanography, biological diversity, scientific, political and public support, current uses of the proposed area, and existing legislation that may be useful in developing an implementation plan. Requirements for success are also discussed. While other areas on the Grand Banks and along the continental shelf may be worthy of similar protection and may contain similar biological and geographical diversity, past suggestions that the Southeast Shoal be protected (Walsh et al. 1995, Brodie 1996, Walsh et al. 2001) have influenced the selection of the proposed area.

2.1 Geological Features

The geological history of the southern Grand Bank has contributed to the area's heterogeneous habitat and high species diversity. The Wisconsinan Glaciation took place approximately 20,000 years ago. Global climate models show that the Grand Banks were above sea level 18,000 years ago (Slatt 1977). As the glaciers receded and sea level rose, the Southeast Shoal was the last to become submerged. The sandy substrate on the Southeast Shoal is therefore not of glacial origin. The two bivalve species, the blue mussel *(Mytilus edulis)* and the wedge clam *(Mesoderma deauratum)*, as well as the spawning capelin *(Mallotus villosus)* stock, are thought to be relict populations of past beach habitat (Hutcheson and Stewart 1994). Carscadden et al. (1989) proposed that the sediment type of the former beach is one of the key factors affecting the spawning success of capelin.

The slope areas comprise mixed substrate, with corals and sponges occurring on hard bottom areas (Litvin and Rvachev 1963). Several canyons are found on the slope of the southern Grand Bank. Canyons in other parts of the Atlantic have been shown to contain diverse biological communities (Hecker et al. 1980, Harrison and Fenton 1998), however, there has been no in-depth study of the canyons on the slopes of the Grand Bank.

2.2 Physical Oceanography

The Labrador Current flows south along the eastern edge of the Grand Banks, while the North Atlantic Current runs northeast south of the banks. The meeting of these two masses of moving water contributes to the overall high productivity of the banks by creating a constant upwelling of nutrient-rich waters (Anderson and Gardner 1986). The surface water of the Southeast Shoal can be almost 10° C warmer in the summer than the cold Labrador Current to the east (Figure 2). Loder (1991) reports that the Southeast Shoal has the warmest bottom water temperatures, reaching a maximum of 4° C in the summer months, on the entire Grand Banks of Newfoundland. These warm temperatures are biologically important as they affect the location and timing of spawning of such species as capelin, American plaice and yellowtail flounder (Carscadden et al. 1978, Morgan 2001, Carscadden et al. 1989), the emergence and distribution of fish larvae (Frank and Carscadden 1989, Frank et al. 1992) and fish life history patterns (Walsh and Morgan 1999). Recent investigations into the physical oceanographic characteristics of the area have found a trend of gradually increasing water temperatures from the mid-1990s onwards (Colbourne and Fitzpatrick 2002).

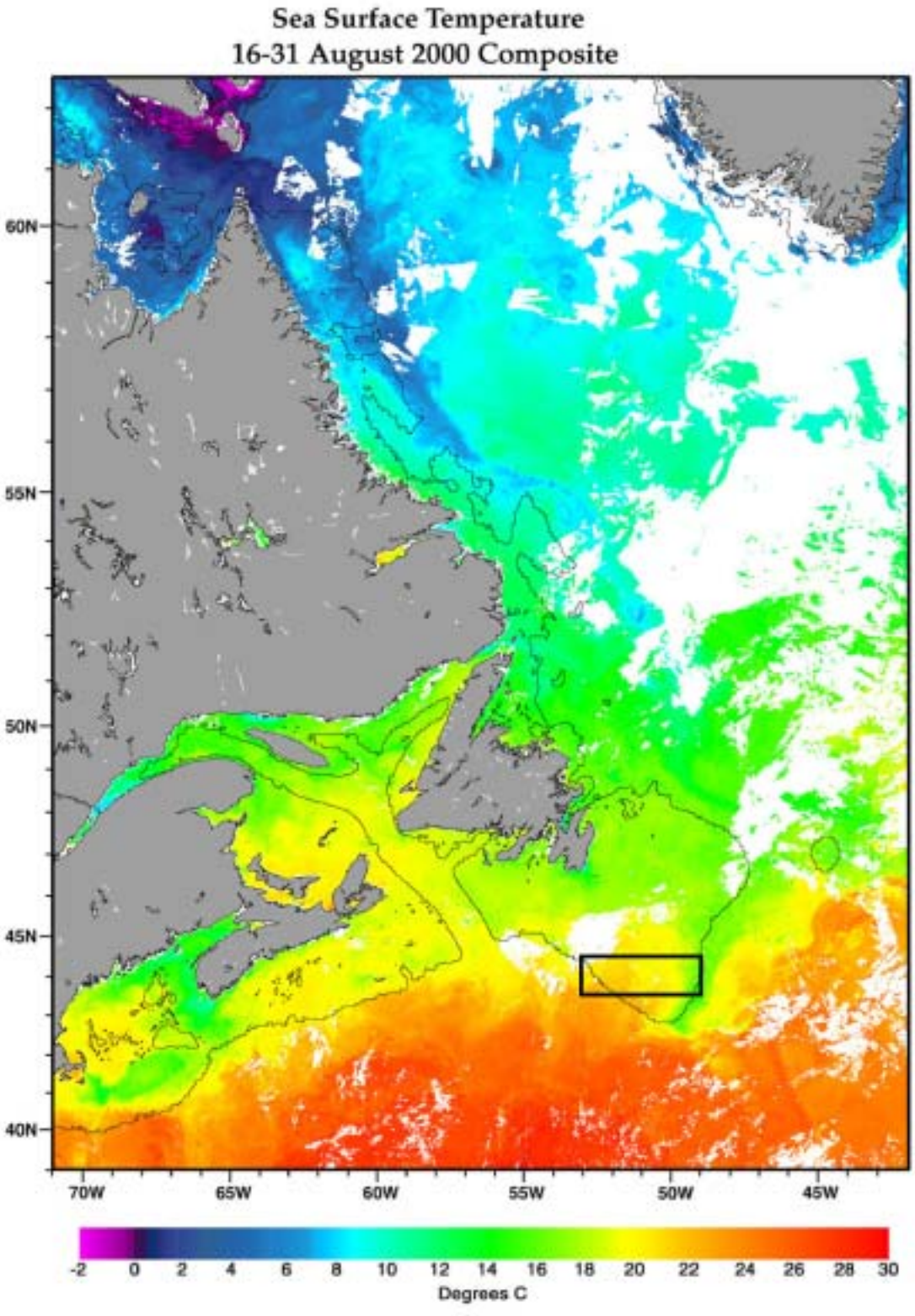

Figure 2 Surface water temperatures from summer 2000 in the North Atlantic. The proposed protected area contains some of the warmest waters on the Grand Banks, as well as cooler slope waters. (Information from DFO satellite data recording)

2.3 Biological Diversity

The southern Grand Bank is home to myriad species, from phytoplankton to commercially important fish, to whales and seabirds. Several species and populations warrant special consideration due to their current status in relation to past abundance or as unique populations. These species are discussed in more detail in Section 2.4. There is significant data on the commercial fish stocks on the southern Grand Bank due to the intensive groundfish fishery and research surveys conducted to determine species diversity and fish abundance. Historically, little attention has been paid to non-target or bycatch species in the Northwest Atlantic, but as scientists discover how vulnerable marine fish are to extinction (Casey and Myers 1998b, Hutchings 2000a, Stevens et al. 2000), regulatory agencies are paying more attention to the distribution of fish and other animals that have little commercial importance (Simpson and Kulka 2001, Kulka 2001, Kulka et al. 2001, Gass 2002). The biological diversity on the southern Grand Bank is described in terms of primary productivity (the basis of the food chain), benthic habitat, commercially important invertebrate and fish populations, marine mammals and seabirds.

2.3.1 Primary Productivity

There is a large spring phytoplankton bloom on the southern Grand Bank, followed by summer blooms in zooplankton (Myers et al. 1994), both of which provide food for other species and the basis for a diverse ecosystem. The high primary productivity of the area suggests that populations of overexploited species may recover if this area were protected from further over-harvesting and habitat destruction. Anderson and Gardner (1986) describe the plankton community on the Southeast Shoal, along the transition from the shelf break to the open ocean. They observed high chlorophyll concentrations on both the shelf and the shelf break and high abundances of fish larvae and eggs on the Southeast Shoal. The survival of larval fish has been linked to the timing of the spring phytoplankton bloom (Platt et al. 2003). Given the magnitude of the spring bloom on the Southeast Shoal and the location of spawning grounds in this area, it follows that a reduction in the fishing pressure for a period of several years may allow the system to replenish itself.

2.3.2 Benthic Habitat

Benthic[10] productivity on the shoals of the southern Grand Bank is high, and investigations into the benthic fauna reveal similarities to the fauna of the North Pacific (Nesis 1963). Early Russian surveys provide data on species collected in dredge samples (Litvin and Rvachev 1963), which include both boreal and Arctic species assemblages due to the cold and warm water currents circulating on either side of the banks (Nesis 1963). Attempts have been made to characterize sediment types and associated fauna of parts of the Grand Banks (Litvin and Rvachev 1963, Lawrence et al. 1985), but a systematic map of benthic habitats does not exist for the area. Due to the commercial importance of the fisheries, marine science has been dedicated mainly to fishery-related surveys. In the last decade, however, experiments on the effects of trawling on the Grand Bank have increased the knowledge of species found on sandy substrate (Prena et al. 1996, 1999, Kenchington et al. 2001, Gordon et al. 2002). Deep-

[10] Benthic relates to the organisms, both plant and animal, that live on the bottom of the ocean – the sea floor or benthos.

sea corals are also found in the canyons along the slope edge of the southern Grand Bank (Gass 2002, Figure 7).

It is generally accepted that bottom trawling and dredging have adverse effects on benthic habitat and marine biodiversity (Watling and Norse 1998, Thrush and Dayton 2002, NAS 2002). Habitat structure on the sea floor is an important factor for survival of juvenile groundfish (Tupper and Boutilier 1995, Lindholm et al. 1999, Lindholm et al. 2001). Protection of benthic habitat on the southern Grand Bank would allow for restoration of epifaunal structures and would provide a refuge for juvenile fish.

2.3.3 Commercial Fisheries

Centuries of fishing have resulted in the decline of many commercially important species on the Grand Banks. Reconstruction of the estimated fish biomass from 1952 to 1995 shows a remarkable decline of exploited species, particularly the gadoids (i.e. cod and haddock) and flatfish species (Figure 3, Casey 2000). Fish biomass on the southern Grand Bank is a fraction of what it was in the period immediately following World War II. Continued overfishing has led to the current state of fish stocks in this area. Despite the initial moratorium on the northern cod fishery in 1992, stocks have not returned. The April 2003 closure of additional cod fisheries northeast of Newfoundland and Labrador and in the Gulf of St. Lawrence will result in further reduction of fishing effort for groundfish throughout Atlantic Canadian waters. Extensive overfishing has lead to a fundamental change in fish community structure.

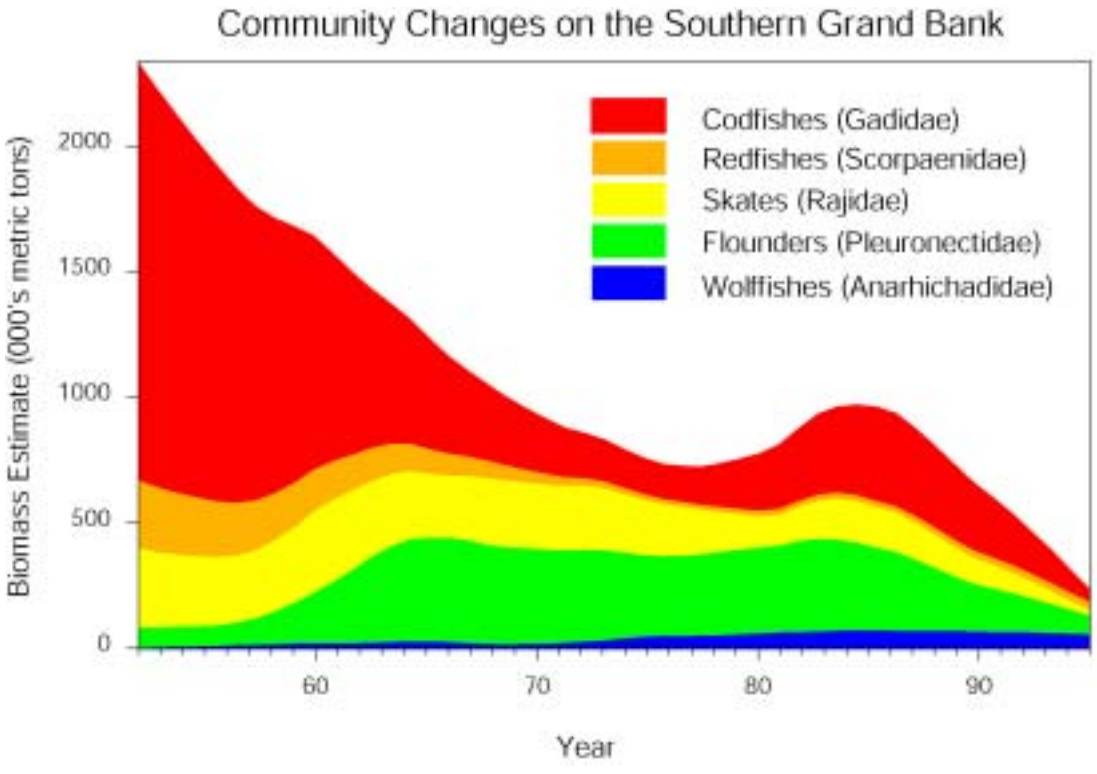

Figure 3 Changes in the fish community on the southern Grand Bank from 1952 to 1995, showing declines in the biomass of major groups of commercial fish species. (Adapted from Casey 2000)

Significant fisheries data for the proposed area, as one of the longest and most rigorous surveys for demersal fish in the world covers the southern Grand Bank. Catch statistics are available for the southern Grand Bank from ~1960 to the present (NAFO FISHSTAT[11]). This section focuses on commercial fisheries of importance specifically in divisions 3N and 3O.

2.3.3.1 Invertebrates

Molluscan fisheries have existed to varying degrees on parts of the Southeast Shoal and the slopes of the Grand Banks for many years and are of greatest importance in NAFO division 3N. Invertebrate fisheries are carried out almost solely by Canada. Canadian invertebrate catches greatly increased following the initial groundfish moratorium (Figure 4). Concern over this shift of target species has been raised by Pauly et al. (2001), as a marked decrease in the trophic level of exploited species. Species harvested include the Icelandic scallop *(Chlamys islandica)*, the ocean quahog *(Arctica islandica)* and the surf clam *(Mactromeris polynyma)*. Scallops are most abundant in the Lilly and Carson Canyons (DFO 2001e), north of the proposed protected area. The shallow sandy plateau of the Southeast Shoal provides ideal habitat for the surf clam and the quahog. A commercial fishery for snow crab *(Chionoecetes opilio)* in 3NO began in 1995 and is currently the dominant invertebrate fishery in division 3O. The fishery is concentrated along the shelf edge, straddling the border of 3N and 3O, but is generally focused in other NAFO divisions, with the majority of the catch in 2J, 3K and 3Ps (DFO 2003a). The northern shrimp *(Pandulus* spp.*)* fishery has also increased significantly since the cod moratorium, but the bulk of the catch does not occur in 3NO (DFO 2001d, DFO 2002g). Recent expansion of the fishery has been predominantly in waters further north of the Grand Bank, in divisions 3K to 0B (DFO 2002d). There is indication that crustacean populations have increased in abundance due to predation release, as groundfish stocks have remained low and are hence not consuming as many forage species (Worm and Myers 2002). Historically, squid *(Illex illecebrosus)* was also targeted in division 3O, but this appears to be due to a one-time spike in abundance between 1974 and 1980, and stocks have not been as high since then (Hendrickson et al. 2002).

[11] Fisheries catch statistics for NAFO member nations can be obtained from 1960 to the present for all commercially harvested species in the NAFO regulatory area. FISHSTAT Plus can be downloaded from www.nafo.ca or by going directly to ftp://ftp.fao.org/FI/STAT/Windows/FISHPLUS/fst_plus.zip.

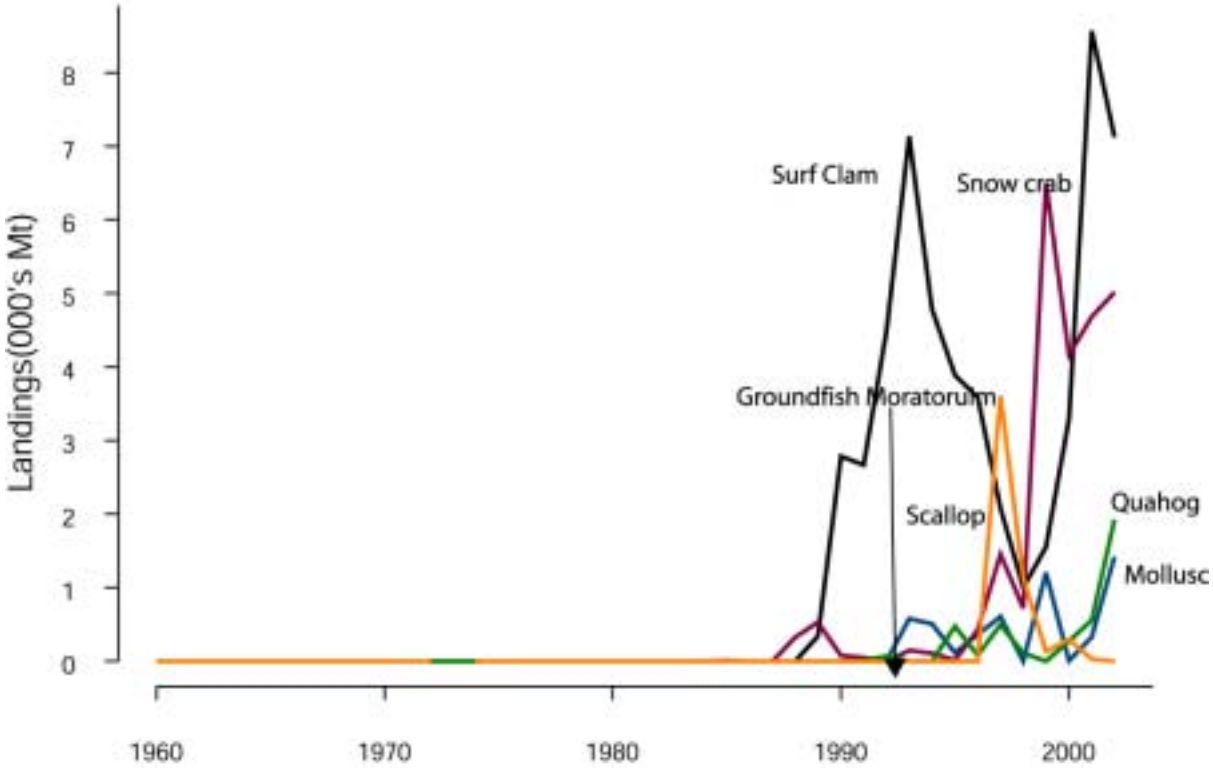

Figure 4 Reported landings from the Canadian fishery for invertebrate species in NAFO Divisions 3N0 from 1960 to 2002. (Data from NAFO FISHSTAT)

2.3.3.2 Fish

Prior to the groundfish moratorium in 1992, cod and haddock *(Melanogrammus aeglefinus)* were among the most important commercially exploited fish in 3N and 3O (Figure 5). By the early 1980s, stocks had been depleted to historically low levels. Despite this, fishing effort continued to increase, eventually leading to the collapse of groundfish stocks (Myers et al. 1997) and the subsequent closure of the groundfish fishery. Cod have been under moratorium since 1992, although there has been an inshore cod quota in Newfoundland for the last two years (FRCC 2001) and catches from the 3NO stock have increased since 1995 (Healey et al. 2002). At present, there is no quota for haddock in the southern Grand Bank area, but bycatch of non-target species often occurs (Breeze 1998). There has been concern that the increase in yellowtail flounder total allowable catch (TAC) beginning in 2001 would adversely affect the remaining haddock through bycatch (DFO 2001b). Haddock stocks are very low in the southern Grand Bank area, despite evidence of a strong 1998 year class (DFO 2000a).

Redfish *(Sebastes* spp.) catches (Figure 5) have remained relatively constant since the early 1960s with catches ranging between 20,000 and 40,000 tonnes (T). Redfish catches have dominated the groundfish fishery in Newfoundland since the early 1990s. The management of redfish includes both deepwater redfish *(Sebastes mentella)* and Acadian redfish *(Sebastes fasciatus)*. Since 1995, there has been no directed fishery for redfish in Division 3N, but

bycatch continues in the directed Greenland halibut fishery (DFO 2000a). In 1998 and 1999, a moratorium was placed on fishing for redfish in divisions 3LN while directed fishing continues in 3O.

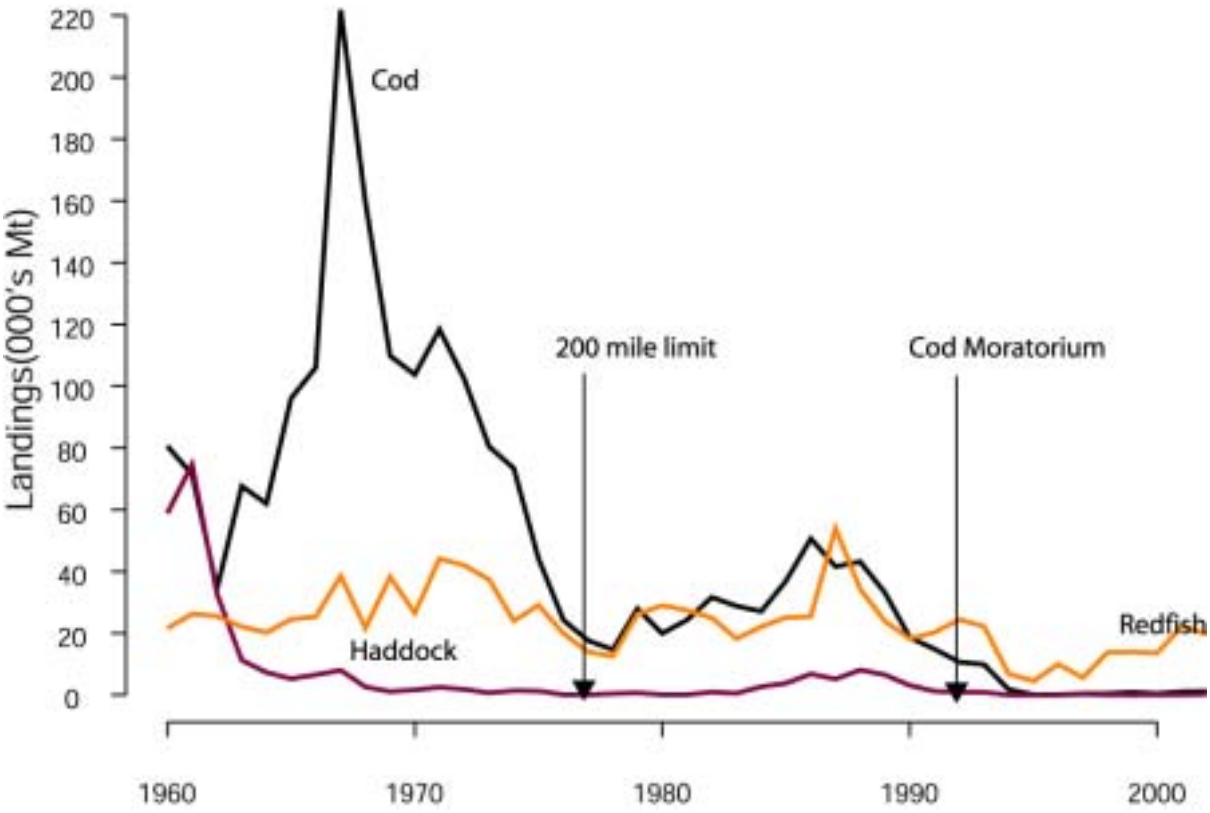

Figure 5 Total reported landings of cod, haddock and redfish from NAFO divisions 3NO for all member nations from 1960 to 2002. (Data from NAFO FISHSTAT)

Directed fisheries for Greenland halibut *(Reinhardtius hippoglossoides)*, also known as turbot, witch flounder *(Glyptocephalus cynoglossus)*, skates and yellowtail flounder take place on the southern Grand Bank (Figure 6). Bycatch of roughhead *(Macrourus berglax)* and roundnose grenadier *(Coryphaenoides rupestris)* occur in the Greenland halibut fishery in the deeper slope areas. Catches of Greenland halibut increased sharply in 1990 as the groundfish fishery collapsed and fishing effort moved to the deeper waters along the slopes of the banks. Flatfish fisheries on the southern Grand Bank consist mainly of yellowtail flounder and witch flounder. American plaice were once the most abundant flatfish in the area, however there has been a moratorium on directed fishing for this species in 1994. Research surveys indicate an increase in recruitment of American plaice over the last five years (Troncoso et al. 2002a). A seasonal moratorium on fishing for yellowtail flounder was in effect between 1994 and 1997. The stock size increased during the last year of the moratorium, and the fishery reopened in 1998 (Brodie et al. 1998). The stock is concentrated in the southern Grand Bank area and spawning grounds are found on the Southeast Shoal. There are indications that

stocks are continuing to increase (Paz et al. 2002). Cod and American plaice are the main bycatch of the yellowtail flounder fishery. The Grand Banks stock of witch flounder occurs mainly in NAFO Division 3O along the deeper slopes of the banks. The fishery takes place mostly in winter and spring and is focused on concentrations of spawning adults. The stock remains at a low level and research surveys indicate that it may be continuing to decline (Bowering 2002). Skates are predominantly harvested by foreign fishing nations in an unregulated fishery (Vinnichenko et al. 2002), however there has likely been significant bycatch of skate since the advent of the trawling fishery on the southern Grand Bank (DFO 2003b). A regulated skate fishery was established by Canada in 1995 inside the 200-mile limit. Of the ten species of skate found in Newfoundland waters, the thorny skate *(Amblyraja radiata)* is the most abundant.

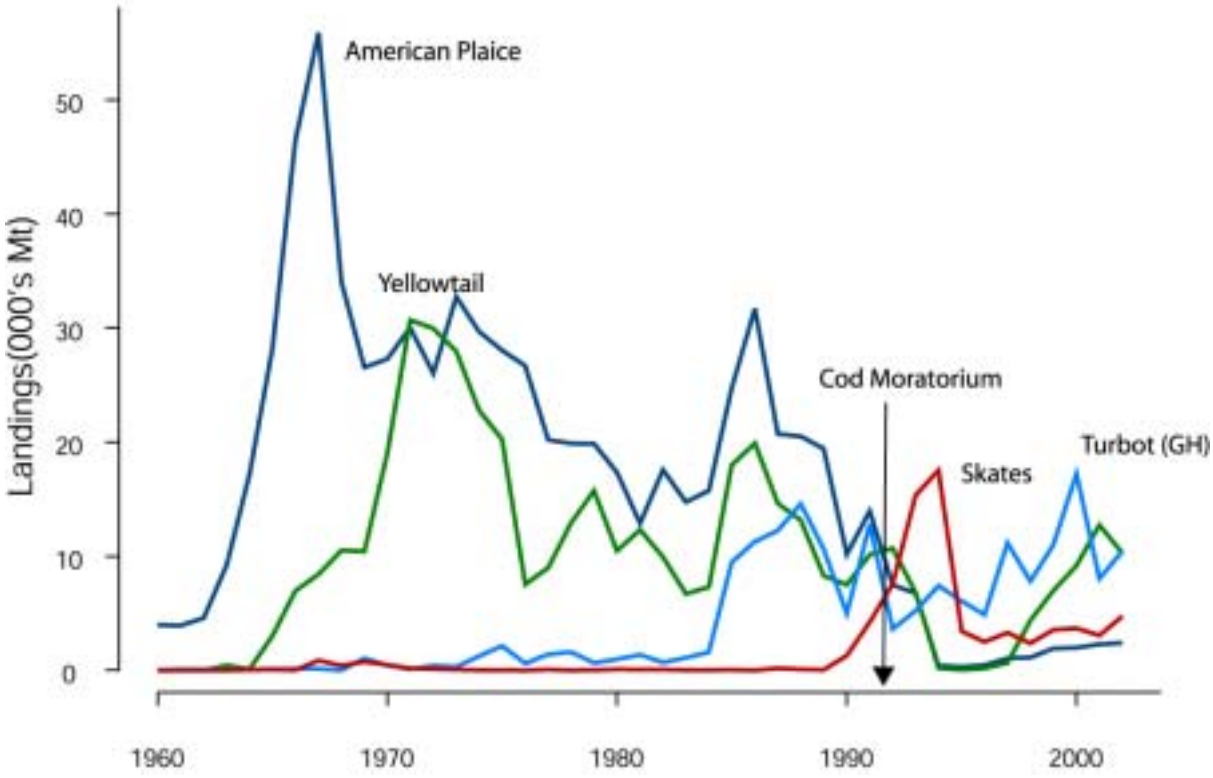

Figure 6 Total reported landings of flatfish species from NAFO division 3NO for all member nations from 1960 to 2002. (Data from NAFO FISHSTAT)

Prior to 1991, monkfish were caught primarily as bycatch in the groundfish fishery. After the 1992 moratorium, a directed fishery commenced. There is little known with regard to stock structure, age and size at maturity and reported catches, which makes accurate stock assessment of this species difficult (DFO 2000b, Kulka and Miri 2000). Research surveys show that 66% of the estimated biomass is found in division 3O, along the southwest slope of the Grand Banks and into the Laurentian Channel (Kulka and Miri 2000). There are currently no quota restrictions on this species and landings are declining (DFO 2000b). A spawning stock of capelin occurs on the Southeast Shoal and is important as a food fish for

larger groundfish species. Atlantic halibut *(Hippoglossus hippoglossus)* and several species of wolfish *(Anarhichas* spp.*)* also occur in the area. The proposed protected area covers four of the six fish assemblages found in Newfoundland as described by Haedrich et al. (1995).

Fisheries for demersal fish are the best known, yet there are also targeted fisheries for highly migratory species such as tuna (*Thunnus* spp.) and swordfish *(Xiphias gladius)*, which occur seasonally (Figure 7). Swordfish catches comprise the bulk of the large pelagic fishery (Figure 8). These species are harvested through pelagic longlines that frequently have high bycatch of other pelagic species such as sharks, turtles and juveniles of the target species (Alverson et al. 1994, Baum et al. 2003). Fisheries for large pelagic species are managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT). Due to the amount of steaming time involved in fishing for pelagic species and the fact that they are more difficult to catch than other fish species, the pelagic fishery does not seem to have been a major segment of the past fishery on the southern Grand Bank, nor is it one at present. Most of the pelagic longline fishery occurs outside the 200-mile limit. The pelagic fishery uses mostly longline gear, and there are currently no active harpooning licenses in Newfoundland. During the late 1990s, some Canadian longline boats shifted their efforts from the Scotian Shelf to the western edge of the Grand Banks as a result of the decline of the swordfish fishery on the Scotian Shelf.

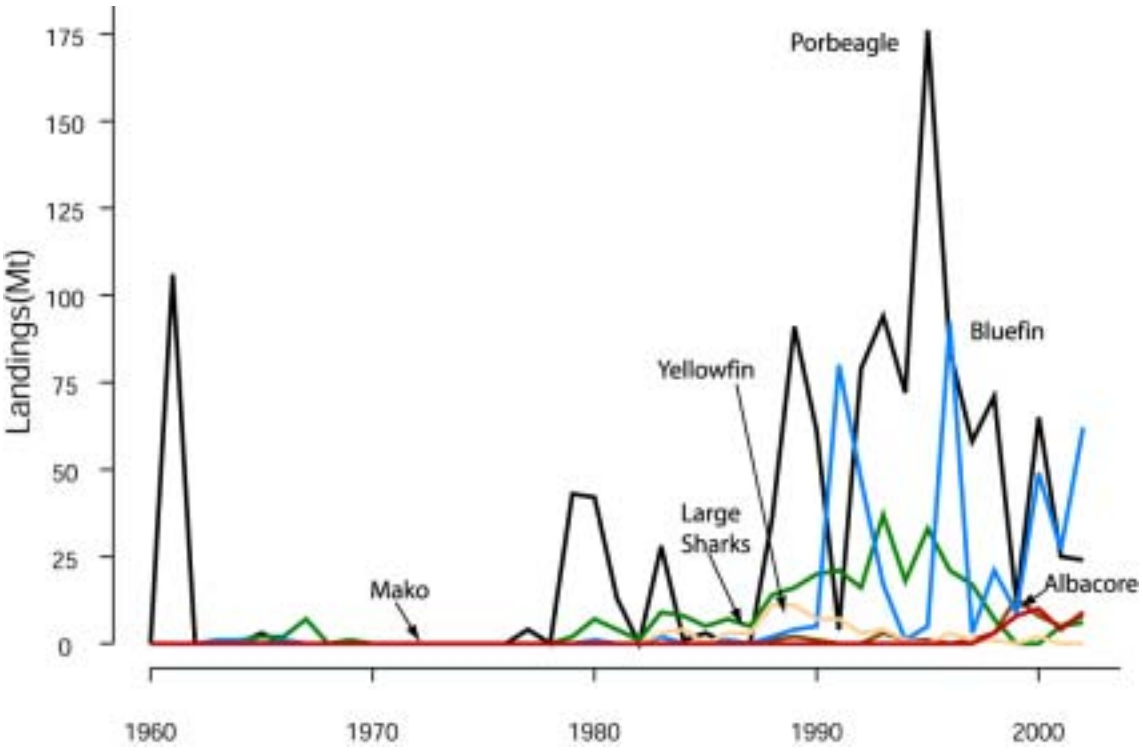

Figure 7 Total reported landings for large pelagic species from NAFO division 3NO for all member nations from 1960 to 2002. (Data from NAFO FISHSTAT)

Figure 8 Total reported landings for swordfish from NAFO division 3NO for all member nations from 1960 to 2002. (Data from NAFO FISHSTAT)

Information on the migration pathways of highly migratory fish species is needed to determine stock structure and status. While research related to fish migration is progressing slowly, tagging experiments are yielding information on the movement of species such as tuna (Block et al. 2001) and leatherback turtles (M. James, in prep). Such experiments are extremely costly and labour intensive, and thus are not conducted on a wide range of species. United States logbook data shows widespread decline in both coastal and oceanic sharks throughout the Northwest Atlantic as a result of the longline fishery (Baum et al. 2003). The porbeagle shark *(Lamna nasus),* listed as endangered in May 2004 (COSEWIC 2004) is the only species for which there is a directed fishery (DFO 1999) and has species has been in decline since peak catches in the 1960s (Campana et al. 2001).

2.3.4 Nursery Areas

In order for fish stocks to recover, juveniles should be protected until they have matured and adults must be protected while spawning. The present reduction in fishing effort in the Northwest Atlantic does not provide adequate protection for juvenile fish as they continue to be caught as bycatch in ongoing fisheries (Brodie 1996, Kulka 2001). As long as fishing continues, discarding of juveniles and other marine species will occur (Carbonell 1997, Hall et al. 2000, Erzini et al. 2002) and marine biodiversity and fish stocks will be in jeopardy.

The area from the Southeast Shoal to the Tail of the Grand Banks has been shown to be an oceanic nursery for many groundfish species. Both juvenile capelin and northern sand lance (*Ammodytes dubius*) use the shallow sandy bottom of the Southeast Shoal as habitat (Carscadden et al. 1978, Hutchings et al. 1993). These fish provide a primary food source for

many groundfish species. The nursery area extends past the 200-nautical-mile limit and overlaps with areas of adult distribution for many species (Brodie 1996).

Analyses of DFO trawl survey data show that the Southeast Shoal is an important nursery area for yellowtail flounder, American plaice and northern cod (Walsh et al. 1995, 2001). As the nursery is clearly defined by physical boundaries of the Shoal area, two areas (Figure 9) have been suggested for protection (Walsh et al. 2001). Each area suggested offers different levels of protection for the three species of concern, with the larger area, option B, offering significantly more protection for juvenile fish.

An MPA including the nursery area would enable scientists to further understand and monitor the effect of closed areas on juvenile species and perhaps help increase understanding of why neither cod nor haddock have returned since fisheries moratoriums have been imposed.

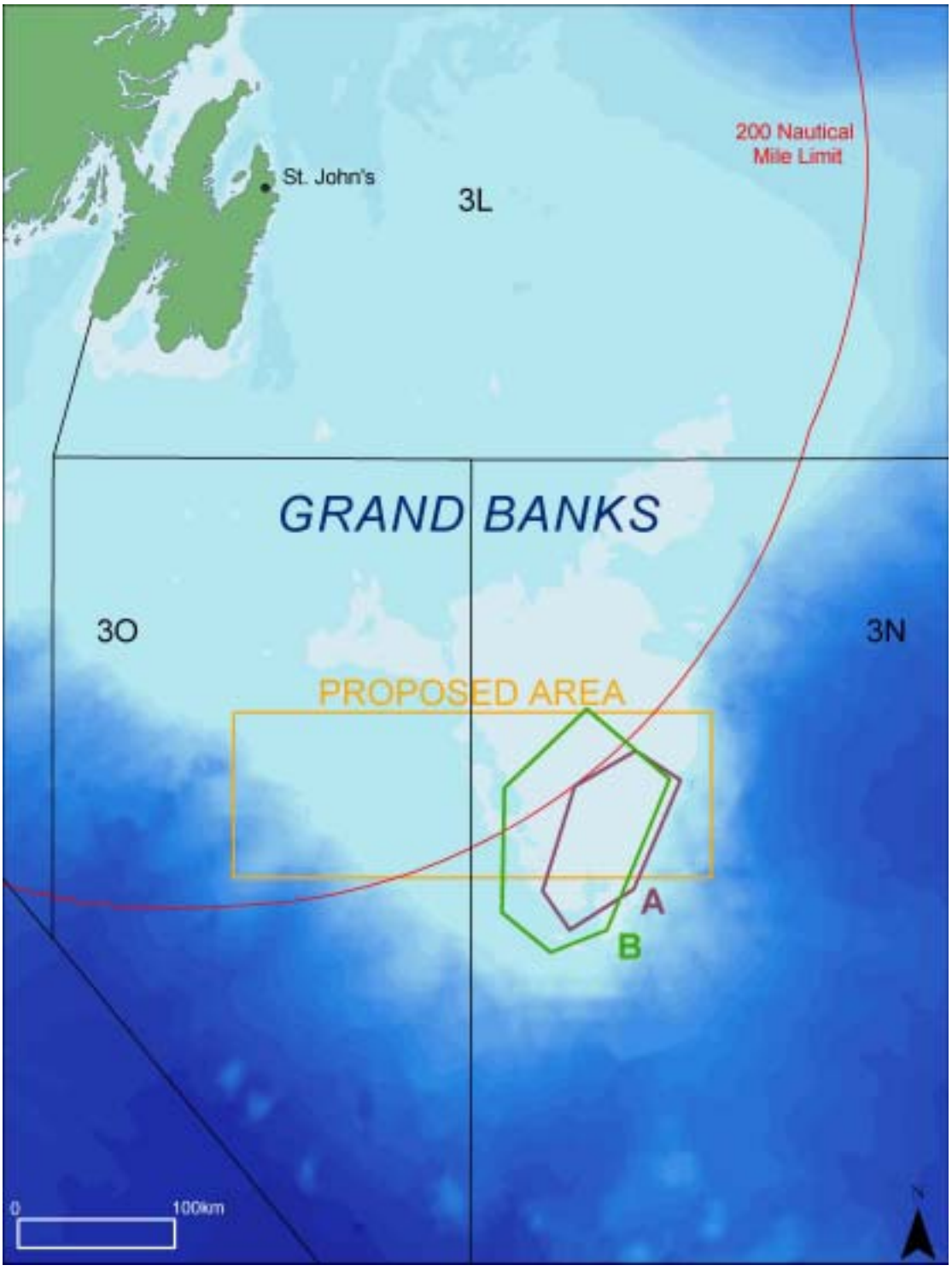

Figure 9 Areas proposed by Walsh et al. (2001) as potential no-take reserves to protect juvenile groundfish species on the Southern Grand Bank. Area A covers 16,451.7 km2 and Area B covers 31,284.6 km2. From analyses of DFO trawl survey data, area A offers protection for 61% of the yellowtail flounder population, 14% of the American plaice and 13% of the northern cod. Alternatively, area B would protect 83% of the yellowtail flounder, 32% of American plaice, 44% of the northern cod (Walsh et al. 2001). (Figure adapted from Walsh et al. 2001)

2.3.5 Marine Mammals

The shallow area of the Southeast Shoal is a prime feeding ground for many species of marine mammals. Sightings by trawl surveys and observers (Jack Lawton, Research Scientist, Northwest Atlantic Fisheries Centre, personal communication, 2002) and reports in the literature (Whitehead and Glass 1985a) show that many species of marine mammals appear seasonally on the southern Grand Bank. Marine mammal sightings were also reported during the biophysical assessment for the Hibernia offshore project (Mobil Oil Canada 1985). Humpback whales *(Megaptera novaeangliae)*, blue whales *(Balenoptera musculus)*, sperm whales *(Physeter macrocephalus)*, fin whales *(Balaenoptera physalus)*, minke whales *(Balaenoptera acutorostrata)*, orca whales *(Orcinus orca)*, harbour porpoises *(Phocoena phocoena)*, bottlenose dolphin *(Terciops truncates)*, white-beaked dolphins *(Lagenorhynchus albirostris)* and short-beaked common dolphins *(Delphinus delphis)* have all been sighted in the area (Whitehead and Glass 1985a, DFO Cetacean Sighting Database). Figure 10 shows marine mammal sightings in divisions 3N0 from 1979 to the present, as recorded in the DFO Cetacean database. The majority of the recorded sitings are from 1980-1981 with sporadic sightings in other years. Although this data set is limited and effort data is not available, the southern Grand Bank is host to a variety of marine mammal diversity, with a concentration of animals on the Southeast Shoal.

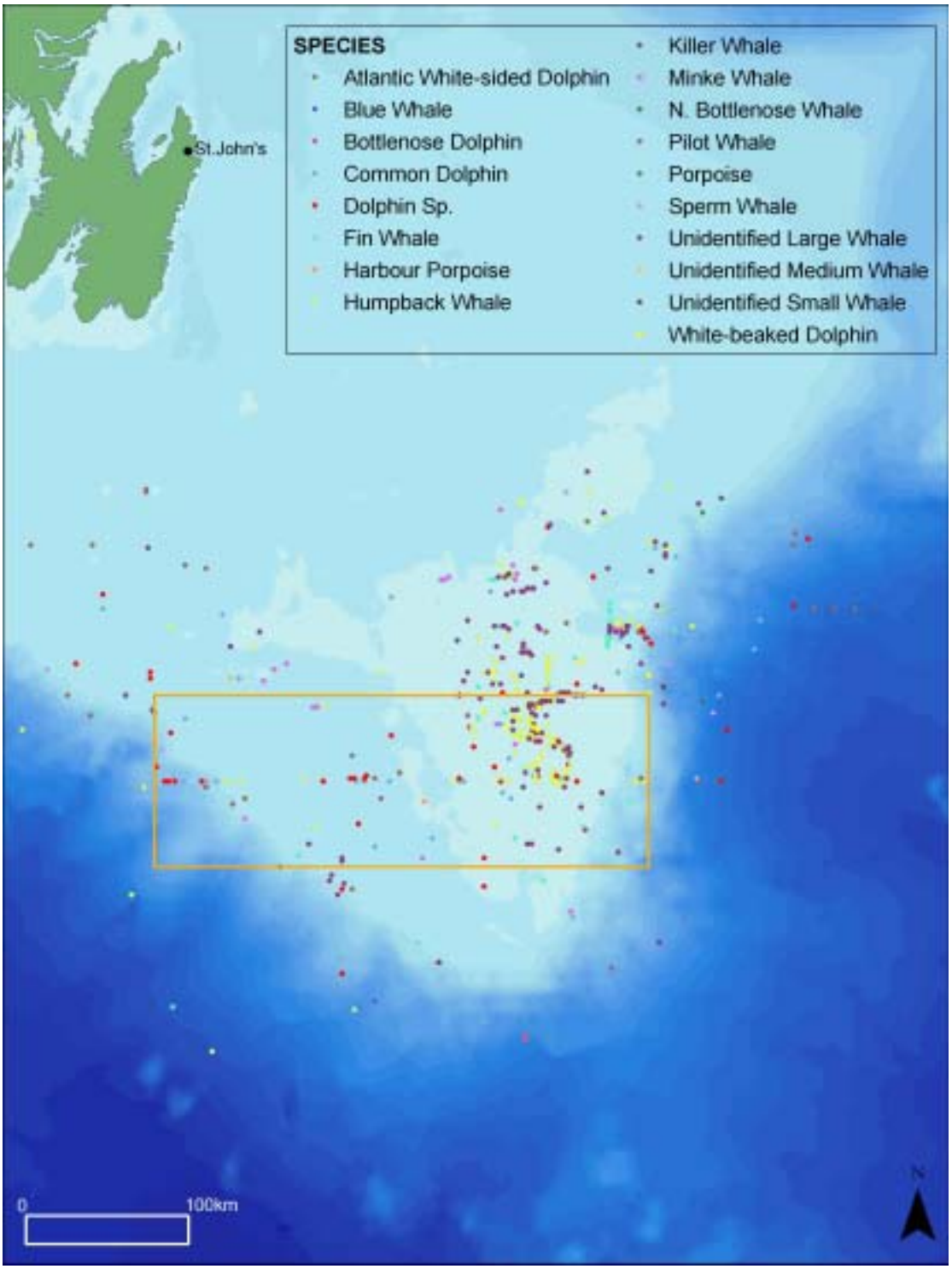

Figure 10 Cetacean sightings collected opportunistically from research surveys and fisheries observer reports from 1979 to 1999. (DFO Cetacean Sighting Database)

Humpback whales are known to feed on the spawning capelin stock on the Southeast Shoal (Whitehead and Glass 1985a). Orcas were observed attacking feeding groups of humpback

whales (Whitehead and Glass 1985b). Marine mammal sightings are highest on the shallower waters of the banks, and rare past the edge of the continental shelf.

Marine mammal populations are increasingly threatened by entanglement in fishing gear and by seismic testing related to oil and gas exploration (Richardson et al. 1995, Borggaard et al. 1999, Moscrop and Swift 1999, Caswell et al. 1999). The protection of open-ocean areas along the continental slope of the Northwest Atlantic would offer some potential refuge to these animals. Recent moves to protect right whale habitat in the Bay of Fundy (Brown et al. 2001a, 2001b) have indicated a willingness on the part of the shipping industry to address their effects on marine mammals. A similar restriction may be possible for cetaceans on the southern Grand Banks, however the right whale is extremely endangered and its chances of ship contact were high, so a different set of arguments would have to be used to gain such protection on the Southeast Shoal.

2.3.6 Seabirds

Several species of seabirds have been recorded from the southern Grand Bank. Both abundance and presence of seabirds vary by season. According to Brown et al. (1975) and Brown (1986), the following species have been recorded from this area:

Great black-backed gull *(Larus marinus)*
Herring gull *(Larus argentus)*
Great skua *(Stercorarius skua)*
Pomarine jaeger *(Stercorarius pomarinus)*
Greater shearwater *(Puffinus gravis)*
Sooty shearwater *(Puffinus griseus)*
Leach's storm-petrel *(Oceanodrama leucorhoa)*
Northern fulmar *(Fulmarus glacialis)*
Northern gannet *(Morus bassanus)*
Black-legged kittiwake *(Rissa tridactyla)*
Dovekie *(Alle alle)*
Common murre *(Uria aalge)*
Thick billed murre *(Uria lomvia)*

The effects of industrial fishing on seabirds on the Grand Banks has not been investigated, however, studies in other areas indicate that seabirds suffer significant mortality from fishing gear (Norman 2000, Tasker et al. 2000, Weimerskirch et al. 2000, Gilman 2001). There is growing concern that seabirds are being caught in nets and longlines at rates that may be harmful even to healthy populations (J. Chardine, Research Scientist, Department of Fisheries and Oceans, Newfoundland Region, personal communication).

As the southern Grand Bank is on the shipping route from Europe to North America, seabirds are vulnerable to the effects of ship source bilge water and oil (Chardine 1991, Brown 1991). Oil spills, even small ones, can result in high seabird mortality. The Canadian Wildlife Service (CWS) (2002) cites oil pollution as one of the greatest threats to seabird populations, and Wiese (2002) estimates up to 300,000 birds annually are killed by oil

pollution in the waters of the greater Grand Banks ecosystem. Wiese (2002) provides a detailed discussion and recommends solutions for the problem of illegal bilge dumping in Atlantic Canadian waters. Activities such as the flaring of natural gases on oil rigs, associated with the growing offshore oil and gas industry on the continental shelves and slopes of Newfoundland and Nova Scotia, can also have a negative effect on seabirds. Depending on the type of protective measures introduced (options might include an IMO approved "Area to be Avoided" or routing system, or more stringent discharge standards), additional protection for seabirds could be provided.

2.4 Species of Special Consideration

There are several distinct animal populations on the southern Grand Bank; some have severely declined due to over exploitation; others live in a restricted habitat range, making them vulnerable to habitat loss and human-induced pressures. The establishment of an MPA would serve to protect the habitats of many of these species, which is essential to their continued existence.

2.4.1 Invertebrates

The Southeast Shoal supports two unusual populations of bivalves typically found in inshore areas. As previously mentioned, the wedge clam is thought to be a relict species from the last glaciation (Hutcheson and Stewart 1994), and the blue mussel aggregation is one of the world's few sublittoral[12] populations (Nesis 1963). Both species are filter feeders, and provide food for bottom feeders as well as habitat for other invertebrates living in the spaces around the shells. Both species are common in shallow, inshore areas but do not generally occur offshore.

Several species of deep-sea corals have been recorded on the southwestern slope of the Grand Banks, including bubble gum coral *(Paragorgia arborea)*, sea corn coral *(Primnoa resedaeformis)*, gold banded coral, *(Keratoisis ornata)*, cup coral (*Flabellum alabastrum)*, *Radicipes gracilis,* and *Bathypathes arctica* (Litvin and Rvachev 1963, Gass 2002). Through the compilation of fisher's knowledge, trawl survey records and fisheries observer data, the distribution of corals on the slope of the Grand Banks is becoming better understood (Gass 2002) (Figure 11). The conservation of deep-sea corals has raised interested among the scientific community in recent years (Willison et al. 2001) due to the effects of fishing on these species and the possible role of coral structures in providing habitat for commercial fish species[13]. Corals have been found to host a multitude of associated species and can act as diversity hotspots in northern waters (Rogers 1999, Heifetz 2002). A conservation strategy for deep-sea corals in the Northwest Atlantic has been developed (Gass 2003). The high diversity of deep-sea corals found in the Gully is one of the justifications for its designation as an MPA. In comparison to the Scotian Shelf, there has been little research on corals of the Grand Banks.

[12] Sublittoral refers to the marine zone extending from the bottom of the intertidal zone to the outer edge of the continental shelf at a depth of ~200m.

[13] The Washington Post ran an article on November 11, 2002 entitled "Survival of Fish, Deep-Sea Corals May Be Linked", however there are few primary literature articles on this subject as research on this aspect of deep-sea corals is in preliminary stages.

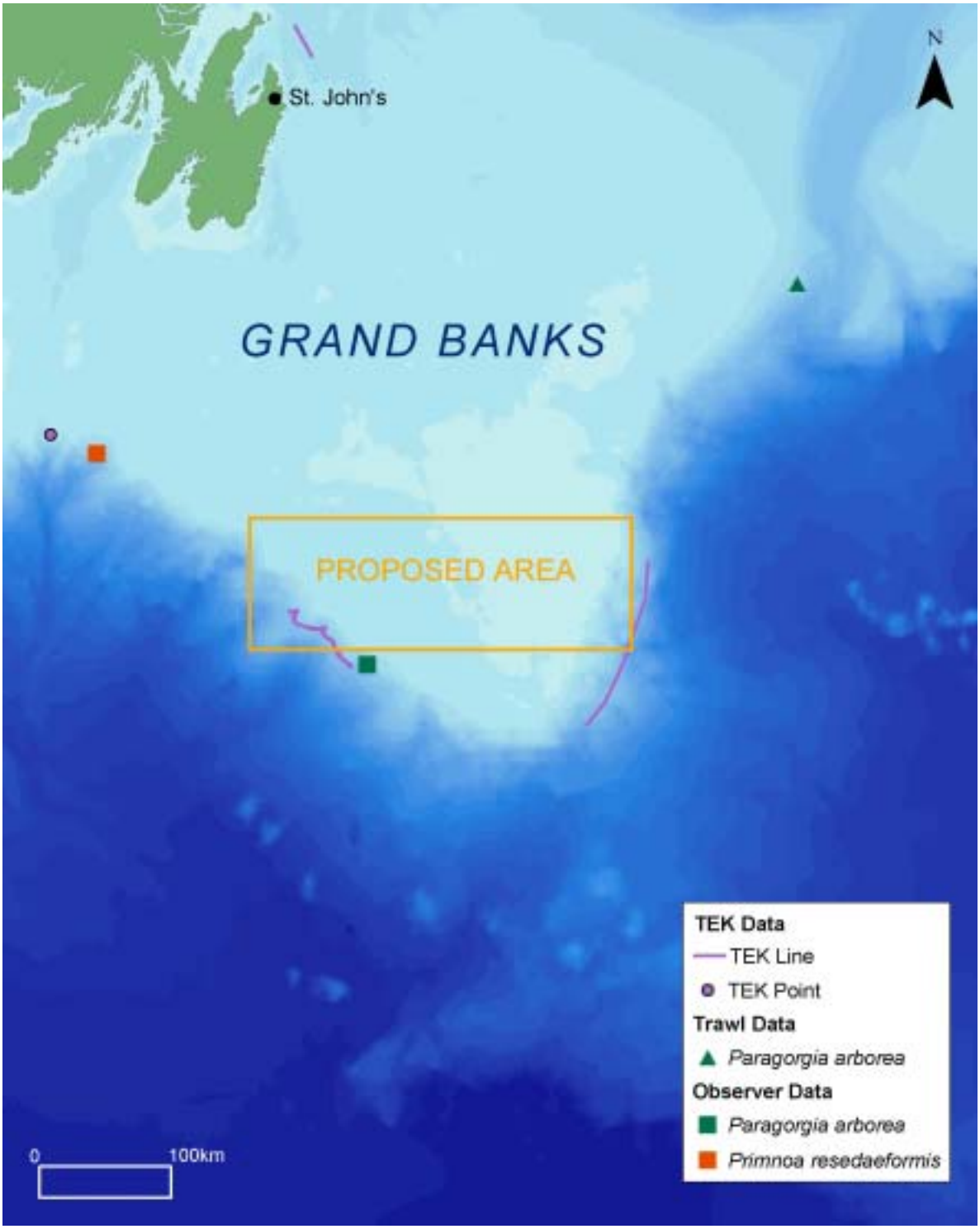

Figure 11 Deep-sea coral species recorded in DFO trawl surveys, observer reports and anecdotal evidence. (Replotted from Gass 2002)

2.4.2 Fish

In the years since the groundfish collapse, there has been increased concern about the extirpation and extinction of marine fish species. Table 1 lists marine fish species that have been assigned a status by the IUCN and/or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as of the latest assessment meetings in May 2004. The list includes those currently considered a high priority for assessment, but for which a status has yet to be assigned. The number of species to be reviewed by COSEWIC reflects the fact that marine fish conservation has been mostly ignored in the past. International organizations are beginning to address the depleted status of many of the world's fisheries. Co-operation between the Food and Agriculture Organization (FAO) and the Convention on International Trade in Endangered Species (CITES) has potential to regulate trade in endangered and threatened marine fish species and strengthen fisheries conservation objectives[14]. According to Musick et al. (2000), there are 82 marine fish species in US waters that are at risk of extinction. Hutchings (2000a, 2000b) shows that fish stocks may have much slower rates of recovery than previously predicted.

Increasing pressure for both conservation and the application of the precautionary approach[15] in fisheries management (see Vander Zwaag et al. 2003 for review of the implementation of the precautionary approach in Canadian coastal management), have begun to have an effect on how scientists view commercially exploited species and the bycatch incurred by these fisheries. There are several instances of commercial species that have experienced drastic reductions in their pre-exploitation biomass. The status of these species is reviewed in further detail below.

[14] The 12th Conference to Parties to CITES was held on November 12, 2002. Collaboration between FAO and CITES was discussed and a memorandum of understanding is to be drafted which will increase the future regulation of trade in marine fish species.

[15] Canada adopted the Food and Agriculture Organizations Fisheries Code of Conduct in 1995 and is subsequently developing a Canadian Code of Conduct for Responsible Fisheries. One of the driving principles behind the Code of Conduct is the Precautionary Approach. The FAO document (A/CONF.164/INF/8) outlines the definitions of the Precautionary Approach and established seven principle points: (1) the precautionary approach gives the benefit of doubt to the resource (burden of proof is therefore on industry and management agencies); (2) precaution is not new; (3) the precautionary approach requires preventive action in order to conserve fish stocks; (4) the need to agree to minimum standards, reference points and critical thresholds while recognizing the potentially non-precautionary nature of the maximum sustainable yield (MSY); (5) quantitative criteria and standards required for precautionary ecosystem management; (6) fisheries must have an impact on the resources and the ecosystem if they are to play a role as a human life-support system; and (7) the precautionary approach requires substantial support from fishery research.

Table 1. Status of demersal fish species occurring in the southern Grand Bank area.

Common Name	Latin Name	Status
Atlantic Halibut	*Hippoglossus hippoglossus*	high priority (COSEWIC candidate list - November 2003)
American Plaice	*Hippoglossiodes platessoides*	high priority (COSEWIC candidate list - November 2003)
Atlantic Cod	*Gadus morhua*	endangered (COSEWIC May 2003)
Atlantic Wolffish	*Anarhichas lupus*	special concern (COSEWIC November 2000)
Barndoor Skate	*Raja laevis*	endangered (IUCN assessment 2002)
Cusk	*Brosme brosme*	threatened (COSEWIC) May 2003
Golden Redfish	*Sebastes marinus*	high priority (COSEWIC candidate list - November 2003)
Haddock	*Melanogrammus aeglefinus*	high priority (COSEWIC candidate list - November 2003)
Northern Sandlance	*Ammodytes dubius*	high priority (COSEWIC candidate list - November 2003)
Northern Wolffish	*Anarhichas denticulatus*	threatened (COSEWIC May 2001)
Porbeagle Shark	*Lamna nasus*	endangered (COSWEIC May 2004)
Smooth Skate	*Malacoraja senta*	high priority (COSEWIC candidate list - November 2003)
White Hake	*Urophycis tenuis*	high priority (COSEWIC candidate list - November 2003)
Spotted Wolffish	*Anarhichas minor*	threatened (COSEWIC MAY 2001)
Thorny Skate	*Amblyraja radiata*	high priority (COSEWIC candidate list - November 2003))
Wolf Eelpout	*Lycenchelys verrillii*	high priority (COSEWIC candidate list - November 2003)
Yellowtail Flounder	*Pleuronectes ferruginea*	vulnerable (IUCN), intermediate priority (COSEWIC candidate list November 2003)

* Candidate species are species that are suspected of being at risk, but have not gone through an official status assessment.

2.4.2.1 American Plaice

The fishery for American plaice in divisions 3LNO was once the largest flatfish fishery in the Northwest Atlantic. There is currently a moratorium on a directed fishery for this species, however catches continued to increase from 1995 to 2001 (DFO 2000a). Scientific recommendations state that there be no directed fishing of this species and that bycatch be kept to a minimum (NAFO 2002). The increase in catch has been determined to be due to bycatch in the unregulated skate fishery, the yellowtail flounder fishery, and the Greenland halibut fishery (NAFO 2002). American plaice has been given high priority for a species status review under COSEWIC. The trends in reported landings since 1960 for major fishing nations are shown in Figure 12.

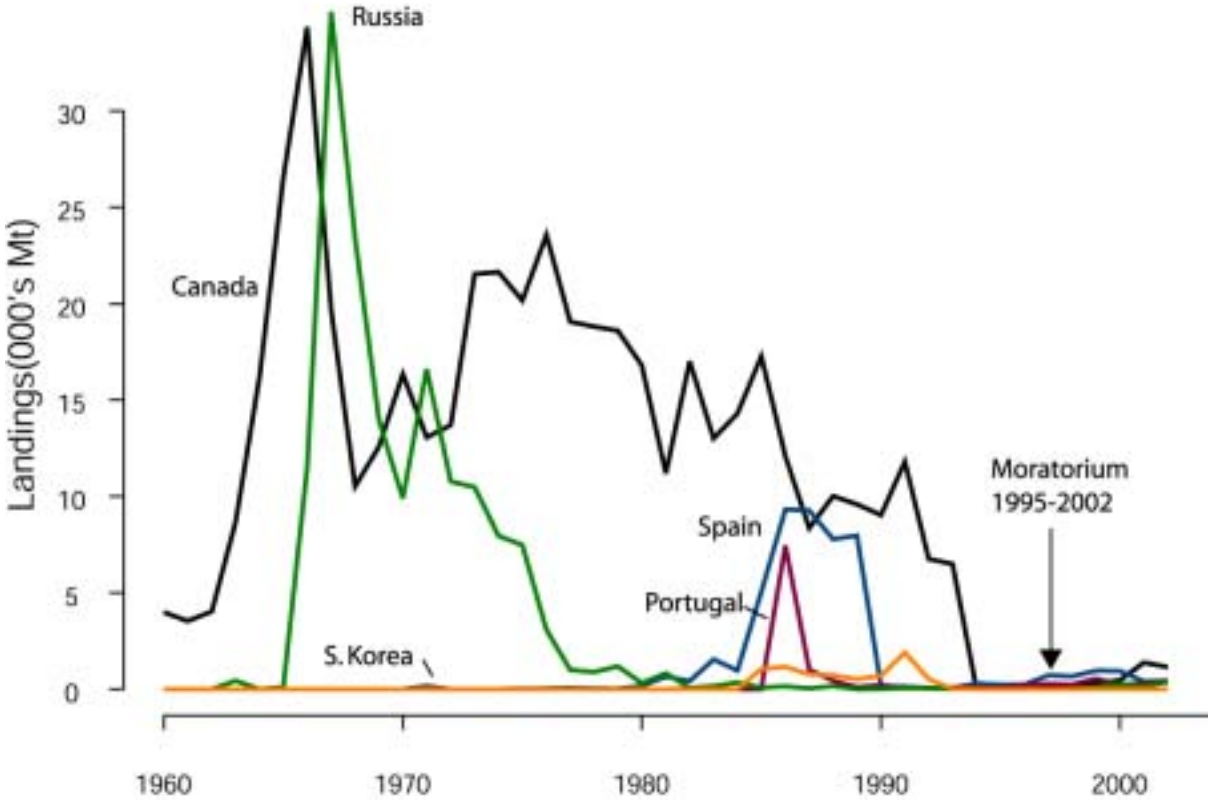

Figure 12 Total reported landings by major fishing nations for American plaice in NAFO divisions 3NO from 1960 to 2002. (Data from NAFO FISHSTAT)

2.4.2.2 Cod

The ecological and social tragedy of the collapse of the cod fishery in Newfoundland is one of the world's best-known examples of the negative effect of humans on the marine ecosystem. Cod are found over shallower parts of the southern Grand Bank in the summer, particularly on the Southeast Shoal. During the winter, cod move to the deeper waters along the slopes of the banks (Walsh et al. 2001). Catches of cod in this area have been declining since the 1960s (Figure 13) and fishing activities ceased in mid-1994 following the collapse of this species in the late 1980s and early 1990s. While there has been no directed fishery in NAFO divisions 3N and 3O since 1994, bycatch of juveniles and low recruitment indicate that stock recovery

is unlikely for years to come (Rivard et al. 1999). Recruitment to the fishery is low, and there is concern that fishing mortality[16] is too high for stock recovery to occur (Healey et al. 2002). If trawling continues to occur, it will be next to impossible to eliminate nominal catches of juveniles. Perhaps the only way to ensure that this species has a refuge from fishing pressure is through the designation and strict enforcement of a no-take zone.

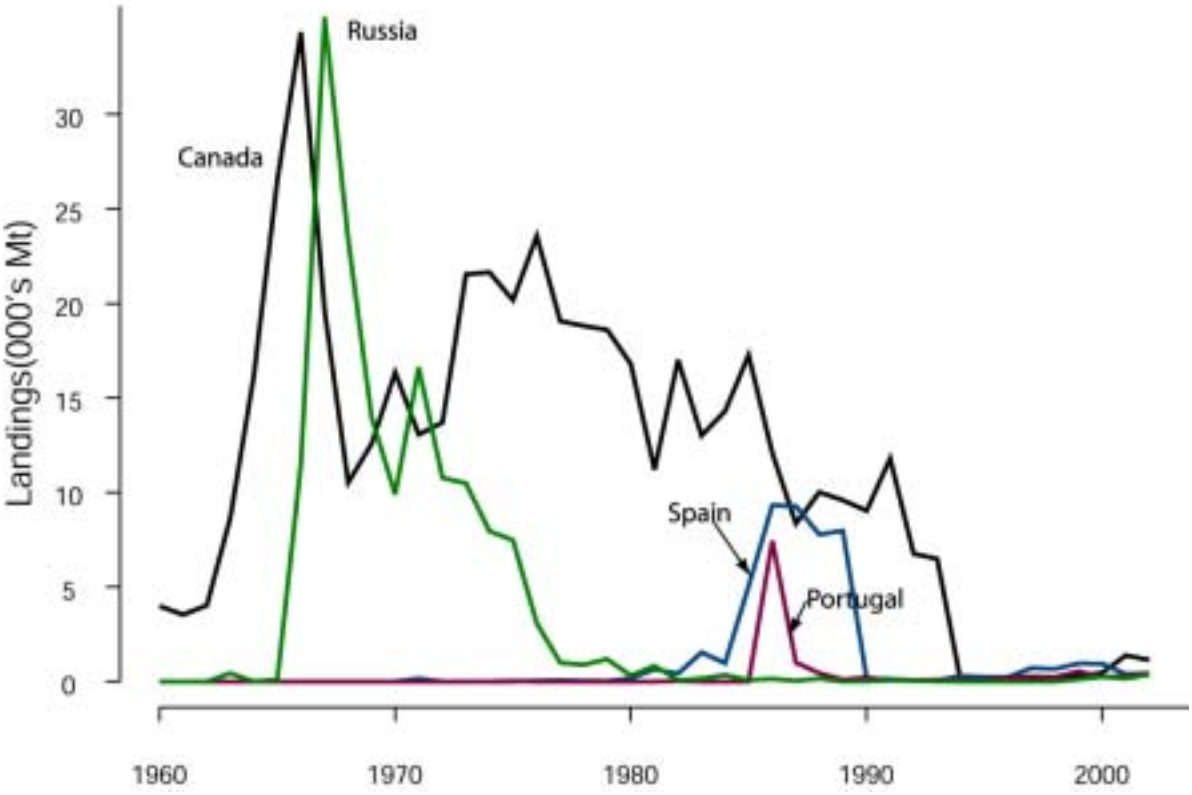

Figure 13 Total reported landings by major fishing nations for northern cod in NAFO divisions 3NO from 1960 to 2002. (Data from NAFO FISHSTAT)

2.4.2.3 Haddock

Once the most abundant demersal fish species in the southern Grand Bank region (Templeman et al. 1978), haddock has been nearly eliminated through over-fishing (Casey 2000). Haddock populations showed some signs of recovery in the 1980s but unsustainable fishing pressure continued (Figure 14). Despite decreased fishing pressure as a result of fisheries moratoria, stocks and catches remain low (DFO 2000a). Failure to protect the few

[16] Fishing mortality, or F, is a biological reference point used in fisheries science as a target for management recommendations. F is instantaneous fishing mortality derived from population models that predict biomass based on various levels of fishing effort. The adoption of the FAO Fisheries Code of Conduct and the UN Agreement on Straddling Stocks and Highly Migratory Fish Stocks suggest F_{MSY} (fishing mortality giving maximum sustainable yield of a stock) as a limit and $F_{0.1}$ (value of F when the yield is one tenth of the slope at the origin of a fisheries production model) as a target.

remaining fish in the 1980s resulted in low spawner[17] abundance and subsequent low stock recruitment[18] (Myers and Barrowman 1996).

The southern Grand Bank population of haddock is genetically distinct from haddock on the Scotian Shelf (Zwanenburg et al.1992). If the southern Grand Bank haddock stocks are driven to extinction, a significant recolonization within the foreseeable future is doubtful. Protecting habitat and reducing bycatch juveniles of this species may lead to its recovery.

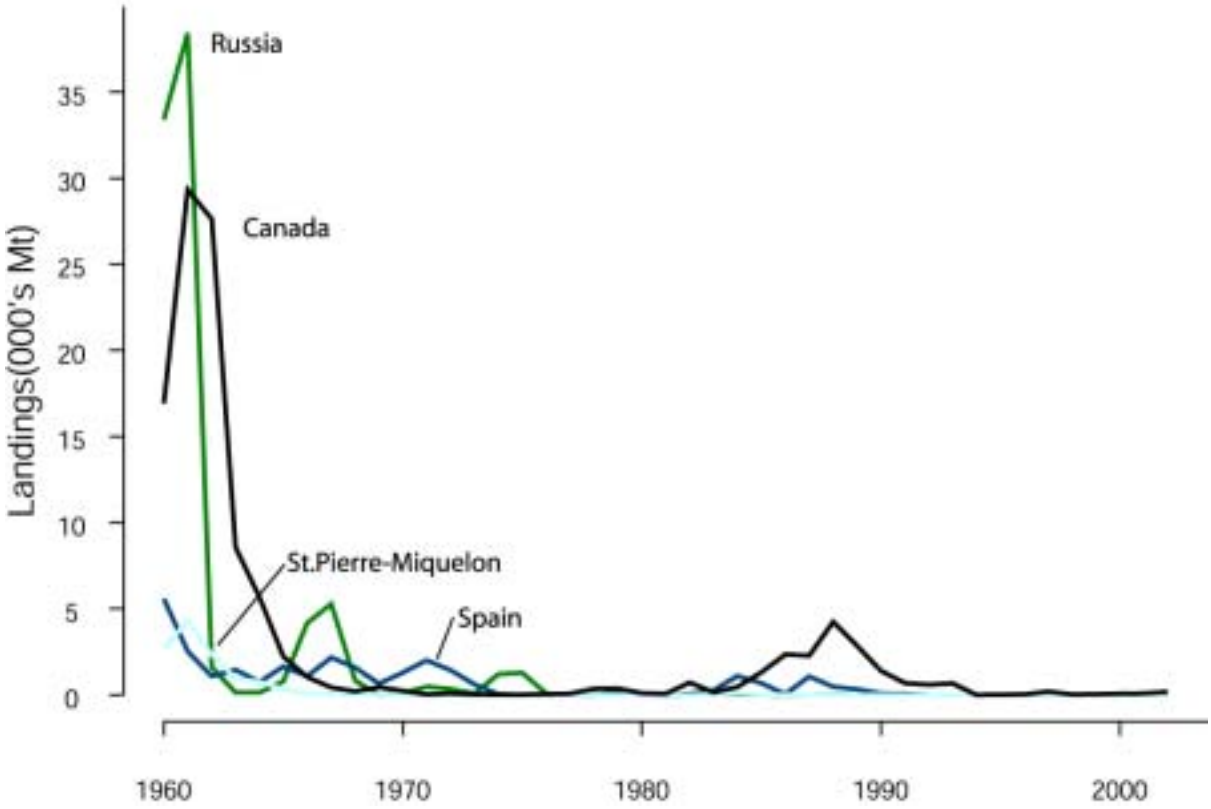

Figure 14 Total reported landings by major fishing nations for haddock in NAFO divisions 3NO from 1960 to 2002. (Data from NAFO FISHSTAT)

2.4.2.4 Atlantic Halibut

The Atlantic halibut has been extirpated from most of its former range on the continental shelf (Kristinsson 2002). Directed halibut fisheries still exist on the deeper slope regions and they are caught as bycatch in other fisheries. Catches of halibut in divisions 3N and 3O have never been high, as compared to catches of other groundfish species, and overall catches have

[17] Spawner refers to a fish that will reproduce that year.

[18] Recruitment is a term used in fisheries science to define the number of individuals that reach a specific stage in their lifecycle. Fisheries biologists often define recruitment as the abundance of the youngest year class entering the fishery. A poor recruitment event when fishing is high may result in the collapse of the fishery.

been declining (Figure 15). Analyses of research survey data and landing data indicate that the Atlantic halibut is in severe decline and suggest that recovery of this species is dependent on the reduction of bycatch in other commercial fisheries (Kristinsson 2002).

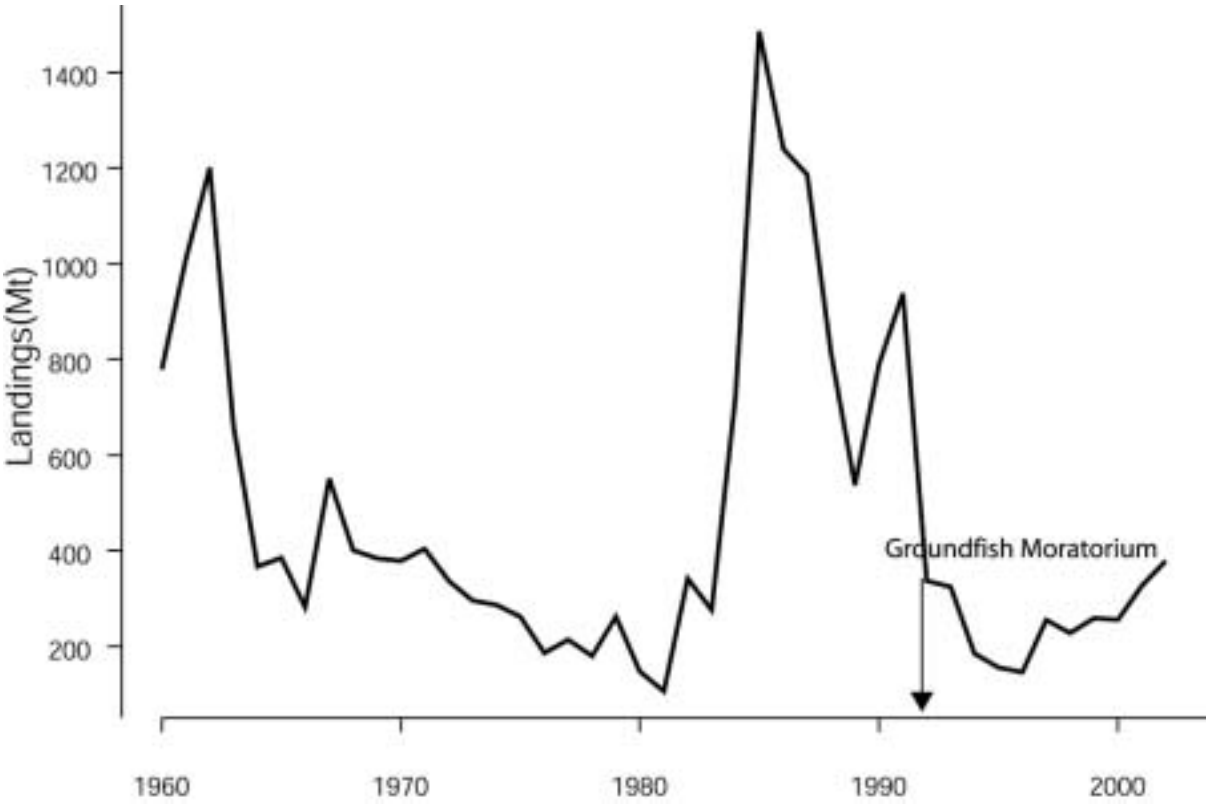

Figure 15 Total reported landings by major fishing nations for Atlantic halibut in NAFO divisions 3NO from 1960 to 2002. (Data from NAFO FISHSTAT)

2.4.2.5 Capelin

Capelin provides food for groundfish species, marine mammals and seabirds (DFO 2001f) and is thus an important part of the southern Grand Bank food web. The majority of capelin catch is from the inshore, however directed fisheries by Norway, Iceland and Russia have occurred in divisions 3N and 3O in the past (Figure 16). The spawning capelin population on the Southeast Shoal is unique in the Northwest Atlantic, and therefore warrants consideration in terms of protected area planning.

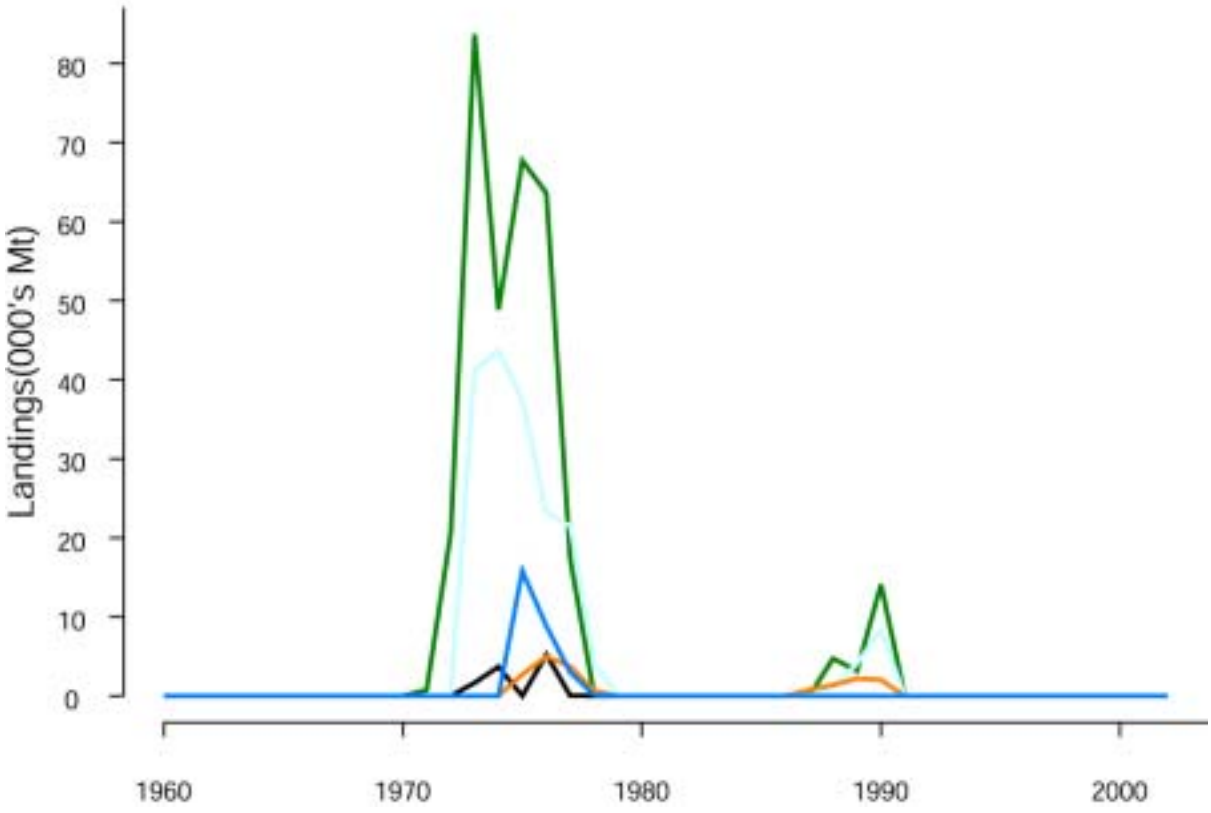

Figure 16 Total reported landings by major fishing nations for capelin in NAFO divisions 3NO from 1960 to 2002. (Data from NAFO FISHSTAT)

2.4.2.6 Wolffish

Wolffish have not been the subject of targeted fisheries, however bycatch of these fish in groundfish fisheries has resulted in severe decline of three species in the Northwest Atlantic. Catches, which include estimates for fish discarded at sea, of a total of 1,000 metric tonnes (Mt) per year were reported during the 1980s (DFO 2000a). This undoubtedly lead to the decline of all three species (O'Dea 2001). The northern wolffish *(Anarhichas denticulatus)* and the spotted wolffish *(A. minor)* are listed as threatened, while the Atlantic wolffish *(A. lupus)* has been given the status of special concern under COSEWIC. All three species occur in the proposed MPA (Simpson and Kulka 2001). Wolffish continue to be common bycatch in the shrimp fishery (Berenboim and Bakanev 2000), suggesting that protection for these fish is needed. Estimating the catch or fishing mortality of various species of wolffish is presently very difficult as species are not reported separately (Kulka 2002). While wolffish landings have not been consistently reported, Figure 17 shows marked decline and inconsistency in catch rates. Closing an area on the southern Grand Bank would protect a portion of wolffish habitat and perhaps assist in their recovery.

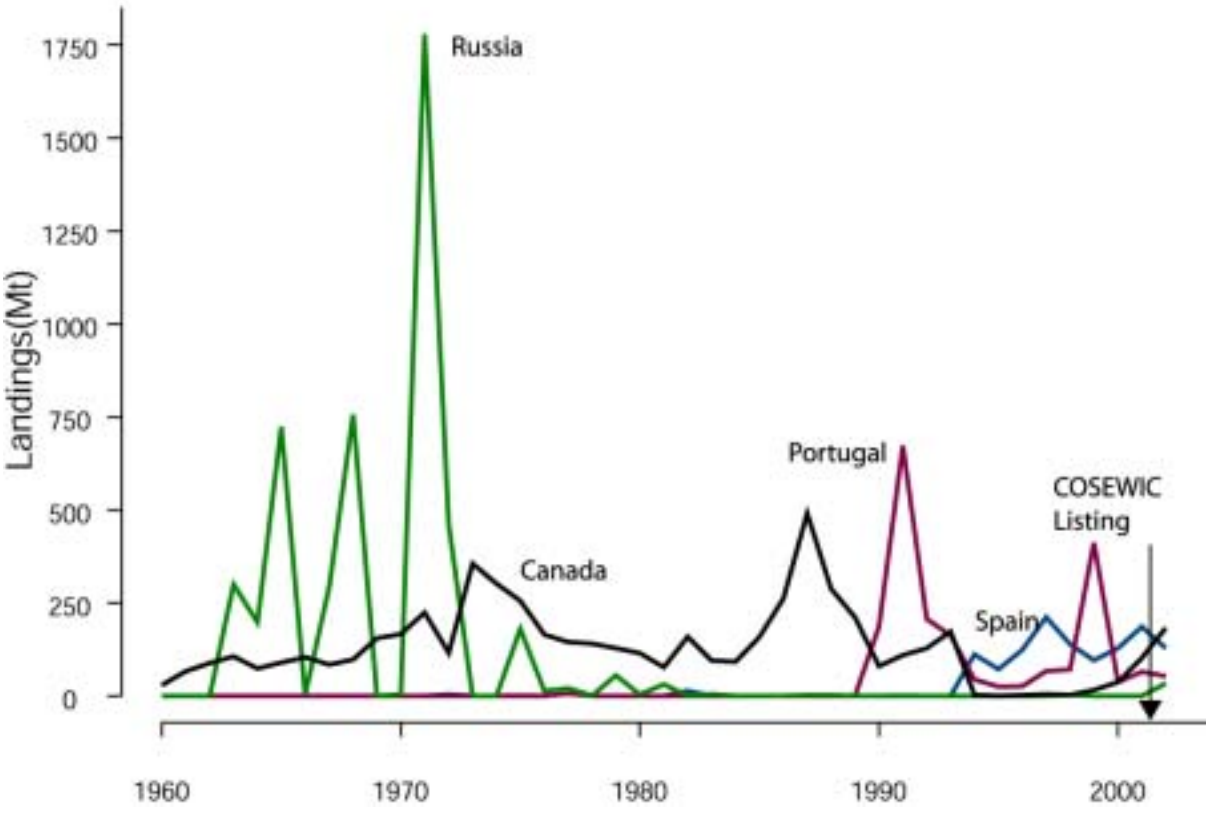

Figure 17 Total reported landings by major fishing nations for wolffish species in NAFO divisions 3NO from 1960 to 2002. Northern, spotted and Atlantic wolffish have been listed under COSEWIC as a result of overfishing mainly due to bycatch. (Data from NAFO FISHSTAT)

2.4.2.7 Barndoor Skate

The barndoor skate *(Dipturus laevis)* occurs at the northern end of the southern Grand Bank. Excessive fishing pressure greatly reduced its abundance in this area by the 1970s (Casey and Myers 1998b). This species is now restricted to water deeper than 1,000 metres (m) on the continental slope of the Grand Banks (Casey and Myers 1998b). The status of the barndoor skate is currently being reviewed officially by DFO, and a status report is being prepared for COSEWIC. This species has been listed as critically endangered on the IUCN red list (Dulvy 2002) and there is scientific concern with regard to skate populations globally (Stevens et al. 2000). Evidence suggests that this species is increasing in areas on Georges Bank where fishing effort has been reduced (Sosebee and Terceiro 2000).

2.4.3 Sea Turtles

Both leatherback turtles *(Dermochelys coriacea)* and loggerhead turtles *(Caretta caretta)* migrate north to, and feed in, the Grand Banks region in the summer. Ongoing research (tagging experiments) indicates that leatherback turtles use this area during the summer months (M. James, in prep). Figure 18 shows bycatch of both turtle species from 1992-2000 between 43˚N and 45˚N. The data are from US logbook records, which are assumed to be representative of the fishing effort in the area. While almost all catches are outside the

boundaries of the proposed area, this is due in part to the distribution of the effort. Negotiations to determine the boundaries of the area should take this into context, should marine turtle conservation be seen as an objective of the MPA. Incorporating more pelagic habitat would provide added protection for sea turtles but would also increase the area outside of Canada's EEZ for which enforcement and management would be required.

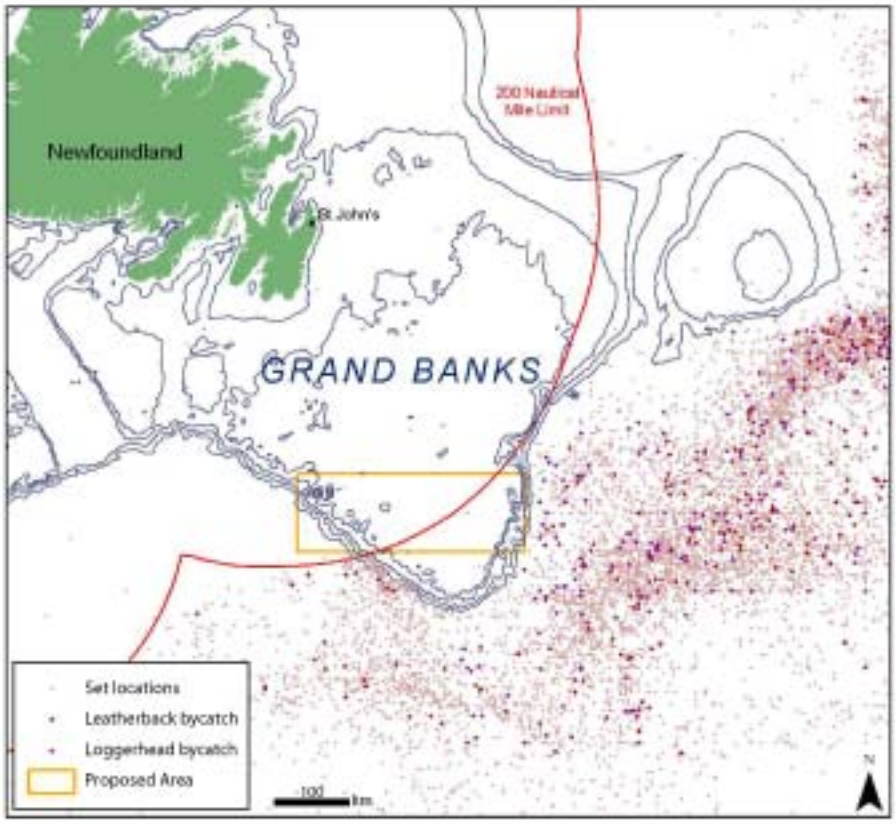

Figure 18 Distribution of bycatch of leatherback and loggerhead turtles caught in the United States longline fishery from 1985 to 1999. (Data obtained from U.S. logbook database)

According to observer reports of turtle bycatch, 80.1 % of all loggerheads and 70.4 % of all leatherbacks caught in 1998/99 in the US longline fishery were in the Northeast Distant region (NED) (20°W to 60°W, 35°N to 55°N) (Doherty 2002). The US National Marine Fishery Service (NMFS) closed an area near the Grand Banks to pelagic fishing for 180 days from 8 October 2000. Later this closure was expanded to the entire NED region from 15 July 2001 to 9 January 2002 (NMFS 2001). While overall turtle bycatch has been reduced as a result of the NED closure, there is evidence that reallocating fishing effort to other areas results in a disproportionate increase in bycatch of sharks and finfish (Doherty 2002, Baum et al. 2003).

2.4.4 Marine Mammals

The humpback whale has been found during June and July on the Southeast Shoal (Whitehead and Glass 1985a). This population is considered to be a reasonably discrete segment of the Newfoundland–Labrador feeding stock due to its summer feeding grounds on the Southeast Shoal and winter feeding grounds in the waters off Puerto Rico (Whitehead and Glass 1985a). Protecting this population from ship strikes, fishing gear entanglement and seismic testing will help ensure its persistence.

2.4 Scientific Support

Scientists with concern for the marine environment, in the North Atlantic in particular, advocate further reductions in fishing effort and large-scale closed areas as imperative to restoring marine life (Pauly and McLean 2002, Jackson et al. 2001, Christensen et al 2003, Myers and Worm 2003). In addition, precautionary management strategies must be applied, habitat damage and bycatch should be included in calculating the effect of fishing on the marine environment, the effects of large-scale factors such as climate change and biological invasions must be considered (Conover et al. 2002). In order to begin to reverse the changes that human impact has wrought on the marine environment, protection and restoration efforts must begin now.

Marine reserves have gradually become an accepted part of fisheries management in many areas of the world. It has been shown that they enhance fish populations outside the reserve and result in larger or more abundant fish inside the reserve boundaries (Roberts and Polunin 1991, Russ and Alcala 1996, Johnson et al. 1999, Roberts et al 2001 Murawski et al. 2000, Halpern and Werner 2002). Year-round fisheries closures on Georges Bank have benefited commercial species and fish habitat (Murawski et al. 2000). These examples support the implementation of marine reserves and MPAs with no-take areas for fish conservation and fisheries enhancement.

The southern Grand Bank area has been studied extensively by Canadian and international scientists. Canadian and foreign fisheries carry out annual research surveys of fish stocks both inside and outside Canada's 200-mile limit and annual landings data exist from 1960. Historically, the area has been investigated extensively in surveys by the former Soviet Union (Marti 1963). A year-round ecological survey was carried out in 1983 as a prerequisite for oil exploration and development in the region (Mobil Oil Canada 1985). Patterns in historical abundances and distributions of marine species can help determine baselines for restoration (eg., Lotze and Milewski 2002, Jackson et al. 2001). A comprehensive review of the data available would provide adequate baseline information from which to monitor the effects of a large closed area.

Scientists are increasingly advocating conservation measures for the marine ecosystem in the Northwest Atlantic (Pauly et al. 2002, Shiermeier 2002, PISCO 2002). Despite the groundfish moratoria on the Grand Banks, fish stocks are not increasing. Current

management regimes based on biological reference points[19] are not working. The effects of fishing with mobile gear is destroying marine habitat and decreasing biodiversity (Thrush and Dayton 2002). There are very few areas in the Northwest Atlantic where the sea floor is unaffected by fishing gear. A closed area would serve as a control site for studies of the resilience of the benthos to various disturbances. Food web structure of marine ecosystems is changing and we are fishing lower and lower on the food chain (Pauly et al. 2001). A marine reserve with a designated no-take area would allow scientists to study fish populations and fish habitat protected from fishing, and would facilitate research on marine ecosystem restoration.

2.6 Political Support

While there are strong scientifically defensible reasons to protect and restore the southern Grand Bank, a critical factor in the establishment of an MPA in this region is political will. A southern Grand Bank MPA is attractive from a Canadian political perspective because it would serve to protect fish stocks both within and beyond Canada's 200-nautical-mile limit. The effects of the foreign fishery have been, and continue to be, a concern for Canadian fisheries interests (House of Commons Standing Committee on Fisheries 2002). High seas protected areas are supported by international conventions signed by several NAFO countries (see Section 4.2 for more detail on international legislation).

July 2, 2002 marked the tenth anniversary of the cod moratorium, and 2002 is the 25th anniversary of the implementation of the 200-nautical-mile limit. It is recognized that protective efforts to date have not succeeded in restoring fish stocks, and indeed, that the fisheries crisis is far from over. Canadian parliamentary approval of the *Oceans Act* and the *National Marine Conservation Areas Act* suggests that there is widespread support for protected areas at the Canadian national level.

The announcement in April 2003 that the northern cod fishery would face further closure sparked political conflict between the federal government and the government of Newfoundland, with the refusal of the latter to prosecute fishers violating the terms of the moratorium. Yet, incidences of non-compliance with NAFO regulations by NAFO member nations have affected the political climate[20] and suggest a need for further enforcement of conservation measures. The Newfoundland government has taken a leadership role in examining the potential for custodial management of waters beyond the 200-mile limit, but must also accept the fact that compliance is required within the territorial seas.

[19] Following the extension of national jurisdiction to 200 miles off the coasts in 1977, fisheries scientists focused on methods to better predict stock recruitment and population dynamics. The 1995 FAO Code of Conduct suggests biological reference points[19] for both targets and limits of fishing mortality.

[20] During the January 2002 NAFO meeting in Helsingor, Denmark, Canadian representatives expressed concern about non-compliance, including directed fishing for species under moratoria, excessive bycatch of these species, excessive allocations, misreporting of catch, mesh size violations, and omission or late submission of observer reports. Canada requested change in the mesh size for the skate fishery, a limit of the Greenland halibut fishery to below 700m and addressing of the issue of misreporting of shrimp catches in the 3L shrimp fishery. The European Union voted against the depth restriction and voted for an increase in Greenland halibut TAC by 10%.

Gaining EU support will be necessary to create a high seas MPA. While EU countries may have been reluctant to agree to conservation measures on the western side of the Atlantic through NAFO, pressure to reform fisheries policy in European waters[21] resulted in the adoption of a new Common Fisheries Policy (CFP) in December 2002. The new CFP includes changes such as increased management for deep-sea stocks.

Current fishing levels in the proposed area are low compared to levels in the 1980s (Kulka and Pitcher 2001). There are moratoria on cod, haddock, capelin, American plaice, and redfish stocks, and the pelagic fishery lands a small portion of the Canadian quota. Fishers would not experience many further restrictions, with the potential exception of those on the snow crab and Greenland halibut fisheries, both of which have increased in catch and commercial value since the 1992 groundfish moratorium.

There is a general awareness of the importance of protecting spawning areas, and fishers have been reported to support the closing of fishing grounds during spawning times (Fuller and Cameron 1998, Graham et al. 2002). Fishers are well aware of the foreign fishing pressure both within and outside Canada's 200-nautical-mile limit. Restrictions on international fishing would be viewed as dealing with part of the problem, however, management of the domestic fishery must fulfill conservation obligations.

Seasonal closures are frequently used to manage fish stocks (Anderson et al. 2000). Closures under the *Fisheries Act*, rather than under the *Oceans Act*, can take place immediately and can be implemented year after year, to create permanent fisheries closures. There have been two recent uses of the *Fisheries Act* in this manner: one to protect deep-sea coral habitat in the Northeast Channel between Georges Bank and Browns Bank (DFO 2002b); and the other to protect sponge bioherms[22] (DFO 2002c) in the Hecate Strait on the west coast. Permanent no-take reserves have not been used as a management tool in the Northwest Atlantic, however such management practices have been applied in other countries. New Zealand, Hawaii and the Philippines have developed several coastal reserves and are achieving success in conserving fish habitat and increasing stock biomass (Russ and Alcala 1996, Johnson et al. 1999, Halpern and Werner 2002). The passing of Bill C-10 in June 2002 included the adoption of Canada's *National Marine Conservation Areas Act*, under the jurisdiction of the Minister of Heritage.

[21] In May 2002 the EU Commissioner of Fisheries and Agriculture proposed large-scale reform of the EU Common Fisheries Policy (CFP) based on the recommendations of the "Green Paper" published in March 2001. The proposal includes reducing fishing capacity up to 60% by 2003, increased prosecution of illegal fishing, creation of regional advisory councils, and the implementation of long-term management plans that cannot be influenced by short-term political agendas. Spain, Portugal and France are the largest fishing countries in the EU. Policy changes will have to be accepted by these nations in order to reduce fishing capacity. In addition, these policy objectives must also apply to the exploitation of foreign fisheries by EU countries. Details of the proposed policy changes can be found at http://europa.eu.int/comm/fisheries/policy_en.htm. Not all recommendations of the "Green Paper" were adopted at the policy reform in December 2002, however this document provides a blueprint for sustainable fisheries management practices and additional reforms will likely take place in the future.

[22] Bioherms refer to organisms that contribute to the formation of a reef system.

The greatest political impediment to establishing high seas MPAs may be lack of cooperation at an international level. Relations between Canada and foreign fishing nations have been strained in the past, particularly by the turbot controversy[23] with Spain in the early 1990s and more recently with Russia[24] and the Faroe Islands[25]. The EU has not ratified The United Nations High Seas Fishery Agreement (UNFA)[26] and EU countries vote as a whole in NAFO negotiations. While Canadian fishers may suffer some loss of revenue from crab and shrimp fisheries in the area, this may be offset by the potential gains in fish stocks offered by a fully protected reserve. The greatest political motivation for implementation of a protected area on the southern Grand Bank is the commitment made by the Canadian government, through federal legislation and international agreements to protect the marine environment.

2.7 Public Support

The creation of political will often arises through advocacy and pressure from constituents and lobby groups. As the human population continues to expand, there have been efforts to conserve terrestrial areas for future generations, for current recreational activities and either directly or inadvertently to protect biodiversity. Popular science books such as E.O. Wilson's "Biophelia Hypothesis" and the "Diversity of Life" have lauded the intrinsic value of biological diversity. Extensive publicity surrounding coral reef bleaching and the decline of global fisheries have raised the issue of marine protection in the public forum. Media focus on charismatic species, such as the North Atlantic right whale and deep-sea corals, has piqued public interest in the effects of fishing on the marine environment. Coverage of the incidences of non-compliance by foreign nations and attention to the 10th anniversary of the cod moratorium have reminded the public that the once endless fisheries on the Grand Banks have not recovered, and that current conservation measures are not sufficient. Efforts by the Audobon Society, the Monterey Bay Aquarium Research Institute (MBARI) and the Marine Stewardship Council (MSC) are helping to raise consumer awareness about sustainable fisheries through education on fishing methods and certification of sustainable fisheries.

Nevertheless, the concept of the oceans as the blue frontier remains and protection of the marine environment lags far behind that of terrestrial landscapes[27]. Gradually, the tide is

[23] In March 1995, a Canadian government vessel fired shots across the bow of the *Estai*, a Spanish trawler, and then seized it in international waters just beyond Canada's 200-nautical-mile limit. Canada claimed that Spain was taking more turbot (Greenland halibut) than the fishery could sustain. The ensuing conflict, known in the press as the "Turbot War," strained relations between Spain and Canada.

[24] In March 2002, the Russian fishing vessel *Olga* was caught in a Newfoundland port with 49 tonnes of illegally caught cod.

[25] The Federal Minister of Fisheries banned Faroese boats from landing in Newfoundland ports due to over-fishing of shrimp in NAFO division 3L in March 2002.

[26] UNFA was ratified by the required 30 countries in 2001 and came into force on 11 December 2001. As of 19 August 2003 there are 36 contracting parties.

[27] The 2003 United Nations List of Protected Areas indicates a total of 102,102 protected areas that fall into IUCN Categories I-IV. There are 4,114 areas that can be considered partially or entirely marine, with the majority falling into the partially marine category. As compared to 11.4% of the terrestrial environment, only 0.5% of the marine environment is protected.

shifting as the maintenance of natural fish stocks becomes increasingly difficult with current management regimes. Multi-stakeholder processes, though arduous and often conflicting, have resulted in the designation of protected areas such as the Channel Islands off California and the Gully off Nova Scotia. With the focus on the marine environment in the Northwest Atlantic (due, for example, to the fisheries collapse and the offshore oil and natural gas industries), public awareness of conservation has increased. Concerns about the decline of coastal communities and the continued failure of the groundfish stocks to recover are factors that work in favour of public acceptance of an MPA on the southern Grand Bank. More importantly, the establishment of such an MPA should be considered as a compliment to fisheries management practices.

In a public opinion survey conducted in the fall of 2001 by an international coalition of conservation groups (Edge Research 2001), 750 residents of New England and Atlantic Canada were interviewed regarding their support for marine reserves. The poll found that 74 per cent of New England respondents and 73 per cent of Canadian respondents support establishing fully protected ocean areas that bar all fishing, mining and other potentially damaging activities. When asked how much of the ocean was protected, Canadians thought that 20% of the Atlantic Ocean was off limits to extractive processes. In reality, less than one tenth of 1% of Canada's marine environment is protected. Canadians are under the impression that we protect the marine environment, when this is far from the truth.

Gaining public support for MPAs from the majority of Canadians may not be a challenge, however, gaining support from the people of Newfoundland may be more difficult. The groundfish moratoria have left many communities without a solid economic base. The concept of further restricting the fisheries through no-take reserves may not be well received. However, the recent concern over foreign over-fishing and the potential for an MPA to preserve habitat and fish stocks on the Tail of the Grand Banks may help garner public support. While foreign fishing effort has decreased since the groundfish moratoria, foreign fishing pressure outside Canada's EEZ continues, and regulation and enforcement of these fisheries is difficult. Given that the majority of the income from Newfoundland fisheries now comes from shrimp and crab harvests and neither of these fisheries is heavily concentrated on the southern Grand Bank, support from the fishing community may be relatively easily gained.

The initial planning process for the MPA must include clear goals and objectives. The public and user groups need to be involved in determining these objectives. Agardy (2000) outlines specific objectives for protected areas and the design considerations needed to achieve each of these objectives. Such an exercise would be useful for public forums and meetings with industry groups.

3.0 CURRENT USES OF THE PROPOSED AREA

Closing an area to industrial exploitation will inevitably result in economic loss in the short term. To gain widespread support for a southern Grand Bank MPA, long-term benefits must be seen to outweigh the short-term costs. Current and potential uses of the area include oil and gas exploration and commercial fishing.

3.1 Oil and Natural Gas Exploration

The oil and gas industry on Canada's east coast has been growing for the past decade. Approximately 7.7 million hectares of sea floor area off the Scotian Shelf have been leased for oil and gas exploration[28], and with the exception of the Gully, no area of the continental slope off Nova Scotia is protected from potential fossil fuel extraction. Newfoundland's Hibernia oil field and other oil development projects are northeast of the proposed area[29]. Recent parcels for oil exploration have been allocated in the Flemish Cap area, however, there are no immediate leases or exploratory licenses for the southern Grand Bank. As exploration and drilling activity increase on the Scotian Shelf, opportunities to implement more protected areas are becoming limited. To ensure that part of the Grand Banks is exempt from oil exploration and extraction, an MPA must be established prior to the issuing of exploration licenses. All oil and gas exploratory leases require an environmental assessment, and potential harmful effects of oil and gas exploration must be mitigated and reduced. A thorough review of the effects of oil and gas exploration and drilling has been compiled by Patin (1999). This review indicates fossil fuel exploration and extraction affects the marine environment in a variety of ways, including damage to larval fish and marine mammals through seismic exploration, exposure of marine life to drilling wastes and produced water which may contain elevated levels of hydrocarbons, metals, toxic chemicals and radionuclides, as well as destabilization of seabed geology. While no specific studies of the effects of oil and gas exploration have occurred on the southern Grand Bank, the marine mammals that congregate on the Southeast Shoal for feeding and the importance of the area for juvenile fish and spawning are indications that a precautionary approach should be adopted and that no exploratory activities should take place in this area. It is well known that marine mammals are particularly sensitive to noise and that shipping related noise[30] as well as noise originating from oil and gas exploration and drilling can have irreversible effects on these animals (Richardson et al. 1995).

3.2 Fishing Activity

Since the groundfish moratorium in 1992, invertebrate fisheries have become the most lucrative in Newfoundland waters (Figure 19). Much of the fishing effort has shifted from groundfish to shrimp and crab, although total landings of all fisheries have decreased

[28] A map of the leases on the Scotian Shelf can be viewed at http://www.cnsopb.ns.ca/Maps/map2001.html.

[29] A map of oil and gas leases in Newfoundland waters can be viewed at http://www.cnopb.nfnet.com.

[30] The United States Marine Mammal Commission is currently doing a study of the impacts of shipping related noise on marine mammals.

overtime (Figure 20). While the biomass of groundfish has decreased significantly, the relative value of the fisheries has generally increased. Invertebrate fisheries have become increasingly valuable over the years, especially since the initial cod moratorium in 1992 (Figure 19). While catches have not exceeded those during the bountiful years of the groundfish fisheries (Figure 20), higher prices for the invertebrate fisheries have resulted in steadily increasing revenue and the most lucrative fishery in the history of Newfoundland. Pelagic fisheries have not varied significantly in catch or value, although there has been a decrease in biomass over the years.

Fisheries occurring within and around the boundaries of the proposed MPA are largely focused on continental slope species due to the moratoria on many shallow water groundfish species. Canada, Portugal, Spain and Russia were responsible for the majority of the catch in 2001 (Table 3). The Canadian fishing effort by vessels greater than 150 Mt on the southern Grand Bank decreased significantly during the 1990s following the collapse of the cod stocks (Kulka and Pitcher 2001). Countries responsible for most of the catch in NAFO divisions 3N and 3O in 2000 include Canada, Portugal, Spain and Russia (including Estonia and Lithuania) (NAFO FISHSTAT). Negotiations would have to occur with NAFO countries to ensure compliance with a closed area. This section details the stock status of the commercial fisheries in divisions 3N and 3O.

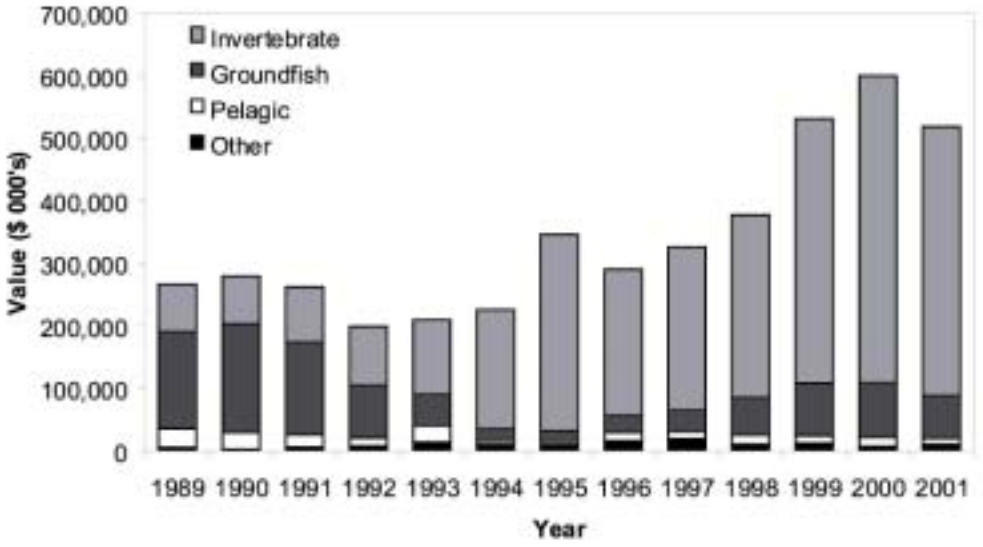

Figure 19 Monetary value of invertebrate, groundfish, pelagic and other fisheries in Newfoundland from 1989 to 2001. (Data compiled from NA DFO summary statistics)

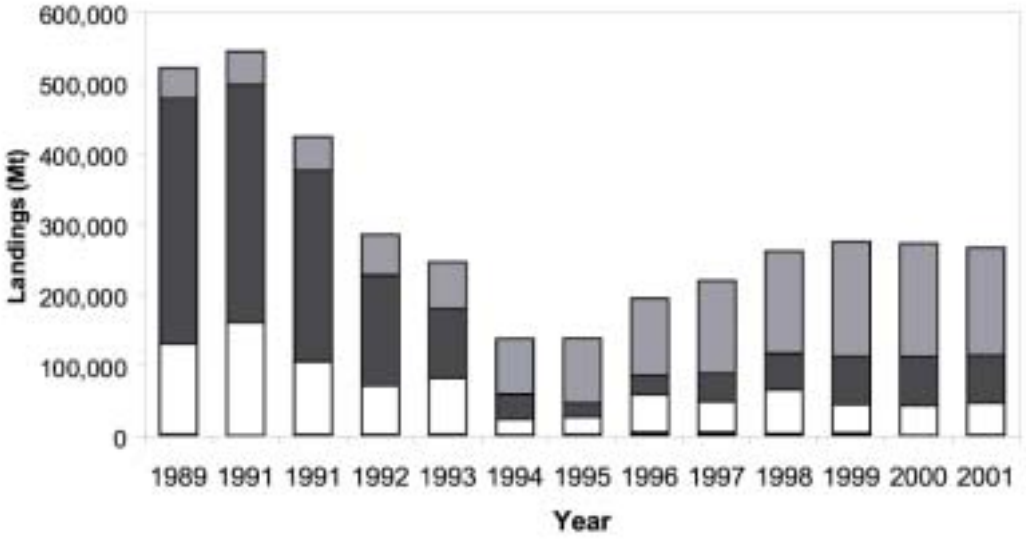

Figure 20 Landings in Mt of invertebrate, groundfish, pelagic and other fisheries in Newfoundland from 1989 to 2001. (Data compiled from NAFO FISHSTAT)

3.2.1 Commercial Fish Catches

The moratoria on fishing for groundfish on the Grand Banks have greatly reduced fishing effort and catches in the area. The establishment of a protected area would entail few additional restrictions on the current fisheries. Most species are harvested at reported catch rates of less than 100 Mt per year (Table 2). Table 3 lists species caught in 2001, reported catch, stock status and the most recent management recommendation. Many species have low and declining stocks indicating that despite the moratorium, fisheries are not recovering.

Table 2. Reported Landings of species caught by NAFO member nations in 2002 in Divisions 3NO

‹ 100Mt	‹ 1000Mt	‹10 000Mt	›10 000TMt
Albacore Tuna	Atlantic Cod	American Plaice	Atlantic Redfishes
Bigeye Tuna	Atlantic Halibut	Greenland Halibut	Skates
Blue Antimora	Dogfishes	Monkfish	Yellowtail Flounder
Cusk	Haddock	Ocean Quahog	
Large Sharks	Roughhead Grenadier	Red Hake	
Northern Bluefin Tuna	Roundnose Grenadier	Snow Crab	
Northern Shrimp	Swordfish	Surf Clams	
Pollock	White Hake	Yellowtail Flounder	
Porbeagle	Witch Flounder		
Short-Finned Mako	Wolffishes		
Silver Hake			
Winter Flounder			

Table 3. Southern Grand Banks Catch Records, Stock Status and Scientific Advice for Domestic and Foreign Fisheries 2002

Species	Most Common Gear Type Used	Canada (Nfld)	Canada (Mar)	Total Reported Cdn. Catch	Estonia	Spain	Portugal	Russia	Total Reported Foreign Catch	Total Reported Catch	Stock Status	Fishery Science Recommendation for 2002	Comments	References
Demersal Fish														
American Plaice	Otter trawl	1146	1	1147	14	437	436	367	1254	2401	Under moratorium from 1995-2002. Stock remains at low level, signs of new recruitment	No directed fishery	Highest by-catch species in Greenland Halibut fishery at depths <700m	NAFO 2002, Kulka 2001, DFO 2000a, Troncoso et al. 2002, Dwyer et al 2002.
Atlantic Cod	Otter trawl	422	22	444	8		405	344	757	1201	Stock at extremely low levels	No directed fishery	By-catch fishery	NAFO 2002, Healey et al. 2002, Rivard et al 1999
Atlantic Halibut	Bottom Longline	177	27	204	-	127	36	12	175	379	Unknown whether current catches are sustainable	1150T for 2000	Depleted throughout its range	DFO 2001a
Atlantic Redfishes	Otter trawl	2988	12	3000	-	795	4730	11253	16778	19778	Moratorium in 3LN since 1998. Stocks at low levels	No directed fishery in 3LN, directed fishery in 30	Main fishery in 30	NAFO 2002, DFO 2000a
Cusk	Otter trawl	-	1	1	-	-	-	-	-	-	Listed as Threatened by COSEWIC in May 2003	No directed fishery in 3LN		
Dogfishes	Otter trawl	-	-	0	-	232	-	-	232	232	Status unknown	Unregulated	By-catch fishery	NAFO FISHSTAT
Greenland Halibut	Otter trawl / Gillnet	113	1	114	-	2447	1839	351	4637	4751	Stock in recovery	Total quota raised by NAFO to 44000 T for 2002/2003	High catch of juveniles, bycatch of species under moratorium is a problem, Spain remarked on high discard rates in 3N	NAFO 2002, Troncoso et al. 2002b
Haddock	Otter trawl	183	30	213	-	-	78	29	107	320	Stock at low levels, potentially increasing	No directed fishery	By-catch fishery	DFO 2000a, DFO 2001b

Species	Most Common Gear Type Used	Canada (Nfld)	Canada (Mar)	Total Reported Cdn. Catch	Estonia	Spain	Portugal	Russia	Total Reported Foreign Catch	Total Reported Catch	Stock Status	Fishery Science Recommendation for 2002	Comments	References
Monkfish (American Angler)	Otter trawl	1687	-	1687	-	-	-	-	-	-	Stock status unknown, abundance and biomass estimates are variable at low levels	Unregulated, data deficient	Concentrated in 3O, southwest slope of the banks	DFO 2000b, Kulka and Miri 2000, DFO 2003 SSR 045
Pollock	Otter trawl	-	-	-	-	-	2	-	2	2	Stock status unknown	No directed fishery	At northen end of its range in Newfoundland waters, most catches in 3Ps, By-catch in grounfish fishery	DFO 2000a
Red Hake	Otter trawl	-	-	-	-	68	1965	1199	3232	3232	Stock status unknown	Unregulated	Bycatch of Greenland Halibut fishery, difficult to distinguish from white hake	Kulka 2001
Grenadier (Roughhead and Roundnose)	Otter trawl	4	-	4	-	919	207	70	1196	1200	Stock status unknown	Unregulated	No directed fishery, catch is taken as by catch in Greenland Halibut fishery	Kulka 2001, Savvatimsky and Gorchinsky 2001
Skates	Otter trawl	1089	-	1089	324	5096	886	3052	9358	10447	Stock status unknown, presumed to be healthy due to high catch levels	Unregulated outside 200 mile limit	95% of catch is the Thorny Skate, main bycatch is Yellowtail and American plaice	DFO 2002e, Vinnichenko et al. 2002, Luis del Rio et al. 2002
White Hake	Otter trawl	437	577	1014	-	2679	1674	-	4353	5367	Stock at low levels, potentially increasing	Unregulated	Closures due to high bycatch occur	DFO 2002d, DFO 2002h
Winter Flounder	Otter trawl	27	-	27	-	-	-	-	-	27	Stock status unknown	Unregulated		
Witch Flounder	Otter trawl	-	-	0	-	328	263	116	707	707	Stock at low level and declining	No directed fishing in 3NO	Stock is mainly in 3O, along deep slope waters	NAFO 2002, Bowering 2002

Species	Most Common Gear Type Used	Canada (Nfld)	Canada (Mar)	Total Reported Cdn. Catch	Estonia	Spain	Portugal	Russia	Total Reported Foreign Catch	Total Reported Catch	Stock Status	Fishery Science Recommendation for 2002	Comments	References
Wolffishes	Otter trawl	183	-	183	-	128	53	34	215	398	Three species listed under COSEWIC	Unregulated	Majority of reported catch is outside 200 mile limit	Simpson and Kulka 2001, DFO 2000a, DFO 2002e
Yellowtail Flounder	Otter trawl	9921	-	9921	14	119	118	103	354	10275	Stock increasing	13 000T for 2002	Moratorium in 3NO from1994-1997	NAFO 2002, Paz et al. 2002a, Dywer et al. 2002
Pelagic Fish														
Albacore Tuna	Surface longline	4	4	8	-	-	-	-	-	8	No recent assessment	Regulated by ICCAT	3NO are not areas of large pelagic catches	ICCAT Report 2000-2001
Bigeye Tuna	Surface longline	17	20	37	-	-	-	-	-	37	Stock status low	Regulated by ICCAT	3NO are not areas of large pelagic catches	ICCAT Report 2000-2001
Northern Bluefin Tuna	Surface longline	62	-	62	-	-	-	-	-	62	Currently under stock rebuilding plan, spawning biomass low	Regulated by ICCAT	3NO are not areas of large pelagic catches	ICCAT Report 2000-2001
Yellowfin Tuna	Surface longline	-	-	-	-	-	-	-	-	-	Stock status adequate	Regulated by ICCAT	3NO are not areas of large pelagic catches	ICCAT Report 2000-2001
Porbeagle	Surface longline	-	24	24	-	-	-	-	-	24	Stock status low	TAC in 1995 1500T	Only directed shark fishery in the area, catch in 2000 less then 10% of total	DFO 1999, Campana *et al.* 2001
Swordfish	Surface longline	32	90	122	-	-	-	-	0	122	Stock status low	regulated by ICCAT		ICCAT Report 2000-2001
Large Sharks	Surface longline	-			-	-	-	-	0	-	Stock status unknown	Unregulated	Predominantly taken as by-catch in pelagic longling and gillnet fisheries	

Species	Most Common Gear Type Used	Canada (Nfld)	Canada (Mar)	Total Reported Cdn. Catch	Estonia	Spain	Portugal	Russia	Total Reported Foreign Catch	Total Reported Catch	Stock Status	Fishery Science Recommendation for 2002	Comments	References
Capelin	Seine, trawl	-	-	-	-	-	-	-	-	-	Stock status unknown	No offshore catch reported, scienfic advice impossible due to lack of data	Capelin fishery occurs in inshore waters	NAFO 2001
Invertebrates														
Icelandic Scallop	Scallop dredge	-	-	-	-	-	-	-	-	-	Pulse fishing occurs on various aggregations, stock difficult to assess	5% of TAC was taken in 3LNO	Effort diversion into shrimp and crab fishery, 8 vessels participated in fishery in 3LNO in 2000	DFO 2001e
Ocean Quahaug	Hydraulic Clam dredge	1421	480	1901	-	-	-	-	-	1901	Stock status unknown		No stock assessment for Newfoundland available	
Molluscs unspecified	Hydraulic Clam dredge	464	1924	2388	-	-	-	-	-	2388				
Surf Clam	Hydraulic Clam dredge	4273	2850	7123	-	-	-	-	-	7123	Stock status adequate	20,000T for Banquereau and Southeast Shoal	Southeast Shoal is one of two areas where Surf Clams are fished, Market declined due to shellfish scare in Japan	DFO 1998a
Northern Shrimp	Shrimp bottom trawl	-	-	-	-	-	-	-	-	-	No estimates of stock size, high recruitment and spawning stock biomass in 2001	6000 T for 2002 in 3L	Fishing restricted to 3L for area around Southern Grand Bank	DFO 2002f, Orr et al. 2002

Species	Most Common Gear Type Used	Canada (Nfld)	Canada (Mar)	Total Reported Cdn. Catch	Estonia	Spain	Portugal	Russia	Total Reported Foreign Catch	Total Reported Catch	Stock Status	Fishery Science Recommendation for 2002	Comments	References
Snow Crab	Trap	5014	-	5014	-	-	-	-	-	5014	Stock at healthy levels for 2002	TAC 43 113T in 2001	Lack of fishery independent data, little catch in area as compared to all of Nfld., mainly in 3N, by-catch in trawl fisheries and subsequent damage is an unresolved issue	DFO 2002e, Pavlov 2002
Short finned squid	Seine	-	-	-	-	-	-	-	-	-	Stock status unknown	No directed fishery	Fishery peaked between 1974-1980 and biomass has been low since.	NAFO 2002, Hendrickson et al. 2002
Total catch (Mt)		**29664**	**6063**	**35727**	**360**	**13375**	**12692**	**16930**	**43357**	**77396**				

***** Highly migratory species are under the regulatory jurisdiction of the International (ICCAT)

3.2.1.1 Groundfish

In 2001, yellowtail flounder, redfish and Greenland halibut constituted the majority of the Canadian fish catch in divisions 3NO. The yellowtail fishery recommenced in 1998 following a four-year moratorium and subsequent stock increase (Brodie et al. 1998). A directed fishery for Greenland halibut takes place along the slopes of the southern Grand Bank. Catches of this species increased sharply following the cod moratorium. Recent catches consist mainly of juvenile fish (NAFO 2002). The Greenland halibut fishery is implicated in large bycatch of fish currently under moratoria (Kulka 2001). The TAC for Greenland halibut was recently raised from 40,000 Mt to 44,000 Mt against the recommendations of the NAFO scientific council (NAFO 2002). This has implications for species caught as bycatch. The NAFO report noted that the catches consist mainly of immature fish significantly younger than the age at which this species reaches sexual maturity.

There has been no directed fishery for redfish in division 3N since 1995 and in 1998 a moratorium was placed on redfish in divisions 3LN. The fishery continues in 3O with Portugal landing the greatest catch in 2000. NAFO scientific recommendations in 2001 (NAFO 2001c) suggested that there be no directed fishery for redfish and that bycatch be kept at the lowest possible level. No specific recommendations were made as to how to reduce bycatch. The fishery has continued in division 3O (DFO 2001c).

3.2.1.2. Pelagic Fisheries

Pelagic fishing does not account for a large proportion of the fishery in Newfoundland (see Table 3, Table 4). The US longline fishery is concentrated outside the 200-mile limit. The area proposed for protection does not currently experience significant effort for pelagic species as most effort is concentrated further off the continental shelf (see Baum et al. 2003) for US longline effort). In 1999, the Canadian quota for northern bluefin tuna *(Thunnus thynnus)* was set at 573 Mt with a 4 Mt carryover from 1998. Catches vary among fleet sectors, and the southern Grand Bank fishery did not contribute significantly to the total catch. Four vessels from Newfoundland fished off southwest Nova Scotia in the 1999 fishing season. Bluefin season typically opens in July or August and closes in October. No quota is set for yellowfin tuna *(Thunnus albacares)*, bigeye tuna *(Thunnus obesus)* or albacore tuna *(Thunnus alalunga)*, and these species are not part of a directed fishery. All species of tuna listed here as well as swordfish are overfished (Baum et al. 2003). These tunas are caught mainly as bycatch of the swordfish fishery, and the tuna season ends with the closing of the swordfish season. The swordfish fishery off Newfoundland takes place in the spring and fall of each year. In 1999, one swordfish vessel was active of the seven that held licences. The total catch from that vessel was approximately 10 to 15 Mt. Three or four Nova Scotian boats landed their catch in Newfoundland.

3.2.1.3 Invertebrates

Currently a fishery for Icelandic scallop occurs in NAFO Division 3N on the southern Grand Bank. Catches have been declining for the past four years and have been well below the TAC (DFO 2001e). The explanation for this decline was the transfer of fishing effort from the scallop to the shrimp and crab fisheries in addition to stock declines. Although no surf clam fishery appears to exist currently, harvesting occurred during the late 1980s on the eastern edge of the Southeast Shoal. At that time, this exploitation was of concern because of the

negative effects of hydraulic dredging on the flatfish stocks[31]. The viability of a surf clam fishery on the Southeast Shoal is described as marginal, with a total TAC under the 1998-2002 management plan set at 20,000 Mt for the Grand Bank area (DFO 1998a). The crab fishery has become the most lucrative invertebrate fishery in Divisions 3N and 3O and for all of Newfoundland. Catches reached a peak in 1999, and the 2002 stock assessment does not predict fishery prospects beyond 2003 (DFO 2003a). Snow crabs are widespread throughout the continental shelf of Newfoundland, and closure of one area would not likely affect the fishery, especially in the southern Grand Bank where effort is relatively low (DFO 2003a).

3.2.2 Economic Considerations

If Canada initiates the MPA process, economic losses due to fisheries closures in Newfoundland waters and for foreign fishing nations will first have to be addressed. Closure of fisheries over a large area will undoubtedly have at least short-term economic impacts in terms of a reduction in the overall landings from divisions 3NO. The initial challenge will be to convince the Newfoundland government that economic losses to the fishery will not greatly affect the province as a whole. Data are readily available for the estimated value of landings in Newfoundland, and hence an estimate of value/Mt can be obtained.

This section provides order of magnitude estimates of the potential financial losses to be incurred if the area proposed in this report were to be designated as a no-take marine reserve. Essentially, the estimates represent the greatest extent of the economic losses, assuming that market prices remain stable in the coming years. Species are divided into mobile, sedentary and highly migratory species (Table 4). Only species that are caught in significant amounts in 3NO are included (e.g., while shrimp is an important fishery in Newfoundland, it is not caught in abundance in 3N0 and is therefore omitted from the analysis). It is assumed that the fish are distributed evenly throughout divisions 3NO, with the exception of the sedentary species which occupy specific benthic habitats. It is acknowledged that landings data do not necessarily indicate the total biomass removed from the ecosystem as misreporting and discarding at sea are known to occur. Values are given in Canadian dollars. For foreign fisheries (Table 5), it is incorrectly assumed that fishing is distributed evenly throughout the proposed area. In reality, foreign fishing effort is concentrated on the boundary of and outside of the 200 mile-limit.

To determine relative short-term economic loss, the percentage of the total fishable area (defined as less than 300 m in depth) in 3NO (estimated at 253,492 km^2)(Myers et al. 2001) included in the proposed protected area was used as a unit to estimate monetary loss. The proposed area includes 30,504 km^2 in depths less than 300 m out of a total of 35,574 km^2. This represents 12% of the total fishable area in 3NO. The total area, including all depth ranges, represents 14% of that area. Closing this area would result in a loss of 6.5% to 7.6% of the total Canadian revenue from 3NO fisheries. The loss is approximately 0.6% of the total revenue from Newfoundland fisheries for 2003[32] and corresponds to $3.2-3.6 million (Table

[31] This statement refers to a communication by Peter Schwinghammer of DFO to Vic Young of Fisheries Products International in 1991 regarding the effects of clam dredging on the flounder stocks on the Southeast Shoal.

[32] Total landed value for all Newfoundland fisheries, including all species and vessel sizes in 2003 was $548,097,648. Values for particular species and vessel classes can be found at www.nfl.dfo-mpo.gc.ca.

4). Temporary loss of revenue of this magnitude is well worth the preservation and restoration of a once rich and dynamic ecosystem.

Some species will be affected more than others by the proposed closure. Mobile species such as yellowtail flounder, which is fished on the Southeast Shoal and the Tail of the Banks and redfish targeted in the slope waters of 3O will likely be affected more than other demersal species, due to the high concentrations within and near the proposed area. Sedentary species that are fished mainly on the Southeast Shoal, predominantly ocean quahog and surf clam fisheries, will face decreases in total landings. Catch from this area is underestimated in Table 4, as boats fishing in this area land in Nova Scotia as well. The seafood company Clearwater owns the majority of the quota landed in both areas and will suffer the majority of the loss if these fisheries are restricted. As only part of the Southeast Shoal is contained within the proposed area, species will be partially protected and fisheries partially restricted. The fishery for Iceland scallop is concentrated in the Lilly and Carson Canyon areas north of the proposed area (DFO 2001e) and will likely not be affected at all. Snow crab, by far the most valuable fishery in Newfoundland, is not abundant in division 3NO (Table 4, DFO 2003a). The majority of the catch is in 3O, near the boundary of 3L and 3Ps (DFO 2003a) and there is very little effort elsewhere, with the exception of on the slope of the Tail of the Grand Banks. This fishery will not be greatly affected by the closure of the proposed area, and potential financial loss as calculated in Table 4 is an overestimate. While a relatively high percentage of large, highly migratory, pelagic species are fished in 3NO, these species are low in total percentage of the Newfoundland fishery. As well, the effort and bycatch from the US longline fishery (see Figure 18) indicate that longlining occurs outside the boundaries of the proposed closure. This loss is considered short-term, and benefit to the fishery is expected to far exceed initial losses due to fisheries closures.

Table 4. Economic analysis of Canadian fisheries in 3NO and estimation of potential short-term economic loss based on 2002 landings and values. All values represent order of magnitude estimates.

Species[a]	Value/Mt ($)	NFLD Landings in 3NO[c] (Mt)	NFLD Landed Value in 3NO ($)	Canada (Maritimes) Landings in 3NO	Canada (Maritimes) Landed Value in 3NO	Total Canadian Landed Value in 3NO	Estimated Short Term Loss From MPA[e] (‹300m) ($)	Estimated Short Term Loss From MPA[d] (total area) ($)
Mobile Species								
American Plaice	803.00	1146	920,238	1	803	921,041	110,525	128,946
Atlantic Cod	1290.13	422	544,435	22	28,383	572,818	68,738	80,194
Atlantic Halibut	5652.40	177	1,000,475	27	152,615	1,153,090	138,371	161,433
Atlantic Redfishes	633.88	2988	1,894,033	12	7,607	1,901,640	228,197	266,230
Greenland Halibut	1098.56	113	124,137	1	1,099	125,236	15,028	17,533
Haddock	1053.29	183	192,752	30	31,599	224,351	26,922	31,409
Monkfish	1649.18	1687	2,782,167	0	0	2,782,167	333,860	389,503
Roughhead Grenadier	351.46	4	1,406	0	0	1,406	169	197
Skates	261.72	1089	285,013	0	0	285,013	34,202	39,902
White Hake	633.99	437	277,054	577	365,812	642,866	77,144	90,001
Winter Flounder	557.63	27	15,056	0	0	15,056	1,807	2,108
Witch Flounder	873.46	183	159,843	0	0	159,843	19,181	22,378
Yellowtail Flounder	806.22	9921	7,998,509	0	0	7,998,509	959,821	1,119,791
Total			**$16,195,117**		**$587,917**	**$16,783,034**	**$2,013,964**	**$2,349,625**
Sedentary Species								
Surf Clam	791.31	4273	3,381,268	2,850	2,255,234	5,636,501	676,380	789,110
Snow crab	4516.78	5014	22,647,135	0	0	22,647,135	27,177	31,706
Ocean Quahaug	799.46	1421	1,136,033	2,400	1,918,704	3,054,737	366,568	427,663
Total			**$27,164,435**		**$4,173,938**	**$31,338,373**	**$1,070,125**	**$1,248,479**
Highly Migratory Species								
Albacore Tuna	6387.36	4	25,549	4	25,549	51,099	6,132	7,154
Northern Bluefin Tuna	8496.26	62	526,768	0	0	526,768	63,212	73,748
Bigeye Tuna	5416.61	17	92,082	20	108,332	200,415	24,050	28,058
Swordfish	5888.67	32	188,437	90	529,980	718,418	86,210	100,578

Species[a]	Value/Mt ($)	NFLD Landings in 3NO[c] (Mt)	NFLD Landed Value in 3NO ($)	Canada (Maritimes) Landings in 3NO	Canada (Maritimes) Landed Value in 3NO	Total Canadian Landed Value in 3NO	Estimated Short Term Loss From MPA[e] (‹300m) ($)	Estimated Short Term Loss From MPA[d] (total area) ($)
Total			$832,837		$663,862	$1,496,699	$179,604	$209,538
TOTAL			$44,192,390		$5,425,716	$49,618,106	$3,263,693	$3,807,642

[a] Only species with significant catches within 3N0 are included.

[b] Data from NAFO Fishstat

[c,d] Data from DFO Newfoundland Region statistical reports. Values for 2003. http://www.nfl.dfo-mpo.gc.ca/publications/reports_rapports3.asp

[e] Values multiplied by 0.12, the fraction of the total fishable area (‹ 300m) of 3NO (253,492 km^2 (Myers et al. 2001) proposed for closure.

[f] Values multiplied by 0.14, assuming that the entire area proposed for closure can be considered fishable

[g] Snow crab catches are estimated as 1% of total for the area as most catches occur in NW 3O and will not be affected by the area closure.

The potential short-term economic loss to foreign fishing nations is outlined in Table 5. Portugal, Spain, Russia and Estonia are the four nations targeting fisheries in division 3NO according to NAFO fisheries statistics for 2002. Value/Mt was calculated from Canadians value information provided by DFO. While it is expected that price per kilogram changes depending on the time of year, place of landing, etc., this gives a general idea of the value of the fishery. Only fish species for which there is a corresponding economic value could be included. This excludes such species as red hake *(Urophycis chuss)*, dogfish *(Squalus spp.)*, wolfish and silver hake, which are targeted by foreign fishing nations. While excluding these species results in an underestimation of the potential economic loss, none of these species is caught in very large quantities in 3NO, so the omission is considered to have negligible affects. The potential catch reductions in Atlantic redfish, Greenland halibut and skates represent the greatest economic loss (Table 5). Losses were calculated using the two scenarios detailed above: 1) including the percent of the total fishable area only, and 2) the total area to be protected, including all depth ranges. Potential losses for Estonia were negligible; for Portugal, $1 to 1.2 million: for Spain, $0.9 to 1.1 million; and for Russia, $1.1 to 1.2 million. Russia catches a disproportionate amount of redfish, accounting for the majority of this potential loss.

The analysis in this report simply presents a preliminary estimate of potential economic loss, based on current landing statistics and market prices. The fishing industry must be consulted on these potential economic losses, and those most severely affected must be involved in the protected area process. Illegal catch, bycatch and discards are not included here. Unreported fish catches can account for a large proportion of total fish catches (Pauly et al. 2002) and therefore, the estimates provided here are likely lower than the total value of the fish actually brought to market. A more detailed economic modeling process, which is beyond the scope of this report, would require an estimate for the value of the discards and bycatch.

Table 5. Economic analysis of foreign fisheries in 3NO estimation of potential short term economic loss based on 2002 landings and values. All values represent order of magnitude estimates.

Species[a]	Value/Mt[c] ($)	Landings[b] in 3NO(Mt)	Value in 3NO ($)	Estimated Short Term Loss From MPA[e] (<300m) ($)	Estimated Short Term Loss From MPA[f] (total area) ($)
Portugal					
American Plaice	803	436	350,108	42,013	49,015
Atlantic Cod	1,290	405	522,503	62,700	73,150
Atlantic Halibut	5,652	36	203,486	24,418	28,488
Atlantic Redfishes	634	4730	2,998,252	359,790	419,755
Greenland Halibut	1,099	1839	2,020,252	242,430	282,835
Haddock	1,053	78	82,157	9,859	11,502
Red Hake[d]	634	1965	1,245,790	149,495	174,411
White Hake	634	1674	1,061,299	127,356	148,582
Roughhead Grenadier	351	207	72,752	8,730	10,185
Skates	262	886	231,884	27,826	32,464
Witch Flounder	873	263	229,720	27,566	32,161

Yellowtail Flounder	806	118	95,134	11,416	13,319
Total			**$9,113,338**	**$1,093,601**	**$1,275,867**
Spain					
American Plaice	803	437	350,911	42,109	49,128
Atlantic Halibut	5,652	127	717,855	86,143	100,500
Atlantic Redfishes	634	795	503,935	60,472	70,551
Greenland Halibut	1,099	2447	2,688,176	322,581	376,345
Roughhead Grenadier	351	919	322,992	38,759	45,219
Dogfishes	24	232	5,568	668	780
Skates	262	5096	1,333,725	160,047	186,722
Red Hake	634	68	43,111	5,173	6,036
White Hake	634	2679	1,698,459	203,815	237,784
Witch Flounder	873	328	286,495	34,379	40,109
Yellowtail Flounder	806	119	95,940	11,513	13,432
Total			**$8,047,167**	**$965,660**	**$1,125,603**
Russia					
American Plaice	803	367	294,701	35,364	41,258
Atlantic Cod	1,290	344	443,805	53,257	62,133
Atlantic Halibut	5,652	12	67,829	8,139	9,496
Atlantic Redfishes	634	11253	7,133,052	855,966	998,627
Greenland Halibut	1,099	351	385,595	46,271	53,983
Haddock	1,053	29	30,545	3,665	4,276
Roughhead Grenadier	351	70	24,602	2,952	3,444
Skates	262	3052	798,769	95,852	111,828
Witch Flounder	873	116	101,321	12,159	14,185
Yellowtail Flounder	806	103	83,041	9,965	11,626
Total			**$9,363,260**	**$1,123,591**	**$1,310,856**
Estonia					
American Plaice	803	14	11,242	1,349	1,574
Atlantic Cod	1,290	8	10,321	1,239	1,445
Skates	262	324	84,797	10,176	11,872
Yellowtail Flounder	806	14	11,287	1,354	1,580
Total			**$117,647**	**$14,118**	**$16,471**
Total for all countries			**$26,641,412**	**$3,196,969**	**$3,729,798**

[a] Only species with significant catches within 3N0 are included.

[b] Data from NAFO Fishstat, catch statistics for 2002

[c] Data from DFO Newfoundland Region statistical reports. Values for 2003. http://www.nfl.dfo-mpo.gc.ca/publications/reports_rapports3.asp

[d] No domestic value given for Red Hake so value for White Hake used

[e] Values multiplied by 0.12, the fraction of the total fishable area (< 300m) of 3NO (253,492 km^2 (Myers et al. 2001) proposed for closure.
Calculation makes the false assumtion that foreign fishing effort is equally distributed within the proposed protected area.

[f] Values multiplied by 0.14, assuming that the entire area proposed for closure can be considered fishable

3.3 Shipping Routes

The southern Grand Bank region off Newfoundland represents a major "crossroads" for vessels transiting the Northwest Atlantic between North American and Europe. The key traffic patterns include those of vessels entering and leaving the Gulf of St. Lawrence through the Cabot Strait (i.e., going to and from the St. Lawrence Seaway and the Great Lakes) and vessels en route between northern and western Europe and the eastern North American seaboard (including Halifax and St. John's), as well as more specialized traffic patterns (i.e., oil transshipments in Placentia Bay and the Strait of Canso). International traffic through this region includes container vessels, bulk carriers and various types of general and specialized carriers.

Figure 21 is a thematic map showing generalized vessel density plots based on actual vessel call-in point data, interpolated ship tracks and recommended vessel routings. Vessel data was obtained from the Canadian Coast Guard's Eastern Canada Traffic Systems (ECAREG), a mandatory reporting system for all commercial vessels over 500 gross registered tons (GRT) with transits within Canada's 12 nautical mile (nm) territorial sea and/or internal waters. It is important to note that these data do not include vessels transiting through Canada's 200 nm EEZ but not within the territorial sea.

The regulation of shipping routes is the responsibility of Transport Canada and the International Maritime Organization (IMO). Measures affecting ships en route through the EEZ must generally be adopted by the IMO and implemented by Transport Canada. The regulation of shipping routes or establishment of any "Areas to be Avoided" in the southern Grand Bank region would be determined based on stakeholder consultations and IMO deliberations. An increasing concern is the effect of bilge water dumping and oil spills on seabirds off Newfoundland (Wiese 2002). Also, ballast water dumping and the concomitant release of foreign organisms present a threat in terms of the introduction of biologically invasive species to the area. Recent efforts to preserve the North Atlantic right whale populations in the Bay of Fundy (Brown et al. 2001a, Brown et al. 2001b) have succeeded in altering shipping lanes during critical feeding times for this animal[33] and a second proposal to alter shipping routes through Roseway Basin has also been submitted to the IMO (Taggart 2002). As the southern Grand Bank experiences relatively heavy shipping traffic, Canada could consider the development of additional measures to protect its marine wildlife and environment from ship discharges and other impacts. Such measures would require extensive domestic and international consultations and the raising of awareness to ensure their effectiveness.

[33] The International Maritime Organization (IMO) accepted a proposal by Transport Canada in July 2000 to move ship traffic lanes in the Bay of Fundy so that they avoid the area where most right whales congregate.

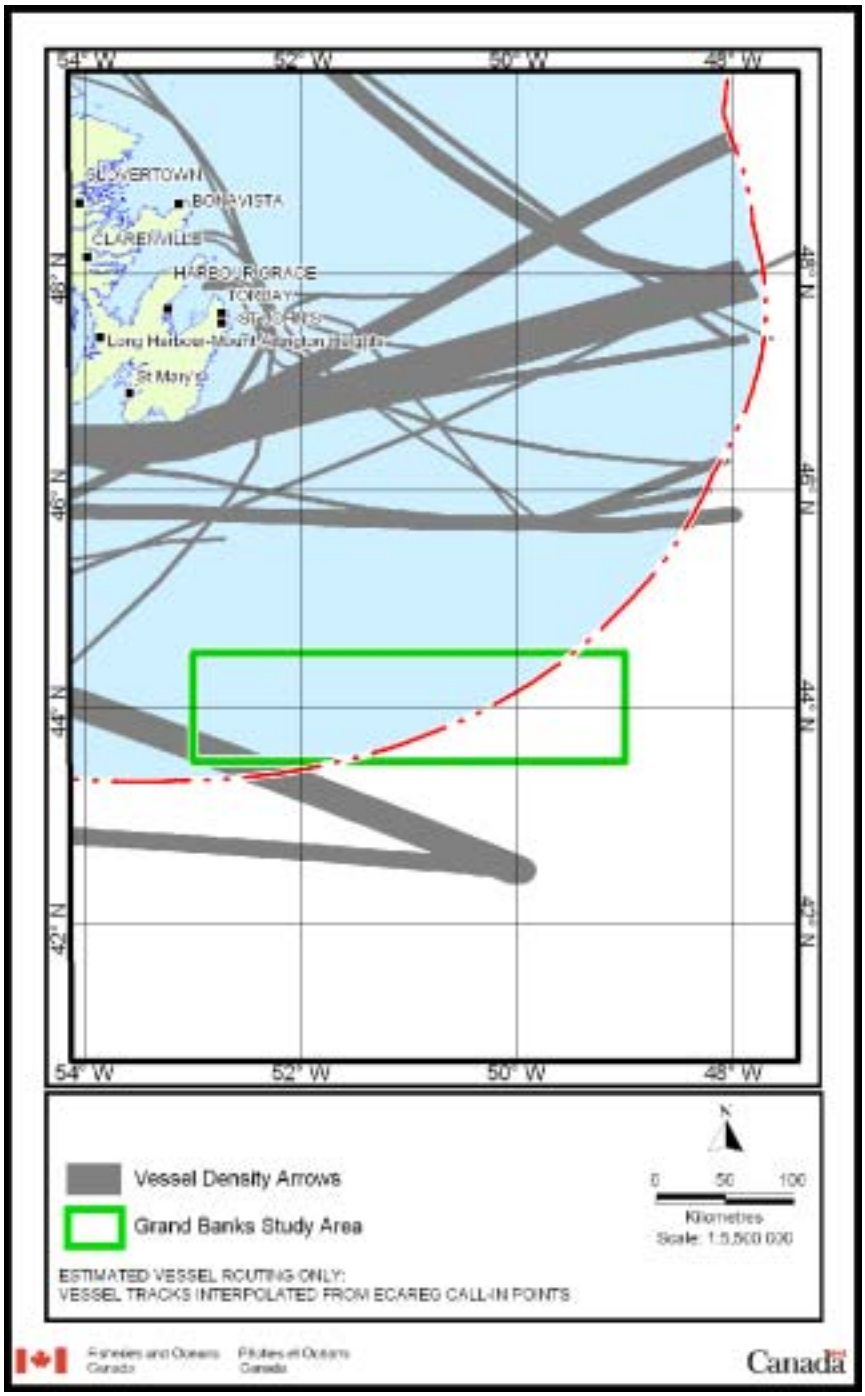

Figure 21 Map of generalized vessel traffic based on actual vessel call-in point data, interpolated ship tracks and recommended vessel routings. The width of the tracks represents density of shipping traffic. (Data provided by DFO)

4.0 POSSIBLE LEGAL CONSIDERATIONS FOR A HIGH SEAS MPA

International concern for the state of the world's oceans has led to considerable progress in defining high seas MPAs and exploring existing legislation through which designation could be possible (Gjerde 2001a, Gjerde and Breide 2003, Scovazzi 2003). A case for protection of the southern Grand Bank can be made through national legislation, which may be used in the short term to begin the process within the EEZ. As the proposed area spans the 200-mile limit, international agreements, institutional cooperation and international legislation will be necessary to protect the waters outside Canada's EEZ.

Currently, there is no international legal regime or ocean management institution that has either the jurisdiction or capacity to designate or maintain a high seas protected area. Nevertheless, there are many legislative and regulatory avenues that have the potential to establish a high seas MPA. This section briefly outlines the relevant Canadian and international legislation, agreements and policies pertaining to marine conservation and protected areas. It is not the purpose of this report to provide a detailed legal road map but to present possible tools that may be considered in determining the way forward.

4.1 Canadian Legislation and Policies

Canada has the necessary legislation to protect both habitat and species within the EEZ and territorial waters, and is in the process of designating several MPAs in coastal and oceanic habitats. Existing legislative Acts could be used to establish an MPA on the southern Grand Bank. Canadian legislation specifically addresses marine conservation through the *Oceans Act*, the *National Parks Act*, the *Canada Wildlife Act*, the *Migratory Birds Convention Act* and the newly adopted *National Marine Conservation Areas Act* and the *Species At Risk Act (SARA)*. The *Fisheries Act* does not specifically address biodiversity conservation but can be used to close an area to fishing either seasonally or indefinitely. The *Oceans Act* calls for the development and implementation of Canada's Ocean Strategy[34], which is based on integrated management planning and includes the use of MPAs. In addition to legislative Acts, the *Canadian Policy for the Management of Fish Habitat* could provide additional protection of the southern Grand Bank. The *Canadian Code of Conduct for Responsible Fisheries* (DFO 1998b), which was developed based on the *FAO Code of Conduct*, includes voluntary guidelines for the protection of fish stocks. Sovereign jurisdiction of coastal states over the extended continental shelf (beyond the 200-mile limit) is provided for in the *United Nations Law of the Sea Convention* for the purposes of both exploring and exploiting natural resources. This jurisdiction extends to non-living resources and sedentary species, but has generally been used to exploit oil and gas resources and not for conservation purposes. Further examination of these laws and policies is required as part of a legal framework for the establishment of a high seas MPA.

The province of Newfoundland and Labrador has expressed interest in asserting custodial management of fisheries on the Nose and Tail of the Grand Bank as well as the Flemish Cap,

[34] The outline for Canada's Ocean Strategy and recent publications relating to the Strategy can be found at www.cos-soc.gc.ca

in hopes of mitigating the effects of foreign fisheries on the depleted fish stocks. A coalition was formed in September 2002, following the House of Commons Standing Committee on Fisheries and Oceans report, with a mandate to implement recommendations from this report.

4.2 International Legislation and Conventions

Perhaps the most important consideration with respect to international law, as it pertains to the establishment of a high seas MPA, is that a number of approaches may be possible and various uncertainties exist for each of these approaches. An effort to implement such an MPA will be breaking new ground as there exists no process, to date, to establish high seas MPAs. International legislation has been developed to address fisheries management issues, biological conservation and shipping, all of which will need to be considered in any strategy to establish a high seas MPA. Despite these various legal tools, no process exists through which a high seas MPA has been established.

Initial attempts to regulate high seas fisheries in the Northwest Atlantic began in 1949 with the formation of the International Commission for Northwest Atlantic Fisheries (ICNAF), which later became NAFO in 1979 with the establishment of the *Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries* (herein referred to as the NAFO Convention). As of 2004, NAFO has 17 member states, with the major fishing nations, Spain and Portugal represented by the European Union and is the regional fisheries management organization for the Northwest Atlantic. The Canadian Department of Fisheries and Oceans has jurisdiction within Canada's territorial sea. The primary aim of the NAFO Convention is to promote the conservation and optimum use of the fisheries of the Northwest Atlantic. Despite attempts to successfully manage fisheries in the NAFO regulatory area, there continue to be disputes over straddling stocks.

The 1982 *United Nations Convention on the Law of the Sea* (UNCLOS) delimits coastal state jurisdiction within the EEZ and the extended continental shelf area. Uses of the non-living resources extending to the edge of the continental shelf are generally dealt with by the UN International Seabed Authority (ISA). UNCLOS has been in force since November 1994, and has 157 signatory nations and 144 parties to the agreement (including Canada as of November 2003). Under UNCLOS, states are called upon to deal with enforcement issues through dispute resolution and cooperation. While there is no direct provision for the declaration of MPAs in UNCLOS, it can be used as a legislative body through which international conservation agreements can be made.

The *United Nations Fish Stocks Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks* (UNFA) was agreed to in August 1995 in New York and came into force in 2001. According to Article 5 of this agreement, parties must be conscious of the need to avoid negative effects on the marine environment, preserve biodiversity, maintain the integrity of marine ecosystems, and minimize the risk of long-term or irreversible effects of fishing operations. Rieser (1997) clearly outlines the various elements of UNFA that strengthen the authority of states in high seas fisheries management and the necessity of cooperation between states through regional management bodies. In addition, Rieser (1997) details the duty of signatory parties, through the regional management bodies (in this case, NAFO and DFO) to protect and conserve marine biodiversity according to the standards set in UNFA. The inclusion of

the precautionary approach to fisheries management in UNFA (see Article 6, Annex II) broadly defines the obligation of states to protect marine biodiversity and practice responsible fisheries management, in the face of uncertainty and despite the lack of scientific proof of the effects of fishing on biodiversity.

The *FAO Code of Conduct for Responsible Fisheries* was signed by Canada in 1995 and was developed to address the collapse of fisheries worldwide (FAO 1995). The Code outlines basic principles and standards of responsible fishing practices with the intention of ensuring effective conservation and management of aquatic resources. The Code requires voluntary compliance (similar to the Canadian Code of Conduct) and therefore cannot be enforced, although it is assumed that signatory nations strive to achieve the standards outlined by the FAO. Cooperation of parties in complying with conservation and fisheries management measures is emphasized. The Code of Conduct also includes an Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, otherwise known as the *Compliance Agreement*. The *Compliance Agreement* (Article III, Section 1(a)) attributes specific responsibility to Flag States. Specifically stating:

> "Each Party shall take such measures as may be necessary to ensure that fishing vessels entitled to fly its flag do not engage in any activity that undermines the effectiveness of international conservation and management measures."

In the preamble of the Compliance Agreement, parties are reminded of commitments to conservation and sustainable fisheries made under Agenda 21. Were parties truly committed to sustainable fishing practices, as outlined in the Code of Conduct, the protection and conservation of the southern Grand Bank would be well on its way.

Shipping is regulated independently from fishing by the International Maritime Organization (IMO), the United Nations agency responsible for improving maritime safety and preventing pollution from ships. The IMO Marine Environment Protection Committee (MEPC) can enhance marine protection through the regulation of ship discharges, as well as through improvements in ship design, construction, equipment and manning standards. Applications can be made under the International Convention for the Prevention of Pollution from Ships (often referred to as MARPOL) for designation of special areas where ship discharges are more strictly regulated than in the open ocean. The MEPC may also designate an area as a "particularly sensitive sea area" (PSSA). Applications to the MEPC are evaluated under ecological criteria (unique or rare ecosystem, biological diversity, vulnerability to degradation by natural events or human activities), social, cultural and economic criteria (significance of the area for recreation or tourism), and scientific and educational criteria (biological research or historical value). Designation of an area as a PSSA helps inform the international community of the significance of the area, and warns mariners of the importance of taking special care when navigating through the area (See Gjerde, 2001b). With the exception of the PSSAs designated by the IMO, and the change in shipping lanes in the Bay of Fundy to protect North Atlantic right whales, there has been little movement toward regulating navigation in MPAs (see Spadi 2000 for more examples), though routing measures have frequently been used to protect environmentally sensitive areas. The lethal impacts of bilge water and oil dumping from ships in the Northwest Atlantic (Wiese 2002)

may provide incentive for an application to the IMO for restricting shipping through a southern Grand Bank MPA.

The 1992 IUCN *Convention on Biological Diversity* (CBD) is perhaps the key international agreement for species protection. The overriding objective of this convention is "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources." Canada was among the first 30 countries to ratify the Convention in 1993. The CBD is the first global, comprehensive agreement to address all aspects of biological diversity including genetic resources, species and ecosystems. To achieve its objectives, the convention (in accordance with the *Rio Declaration on Environment and Development*[35]) promotes a renewed partnership among countries to preserve biological diversity. As global fisheries decline became increasingly relevant to biodiversity conservation, marine and coastal diversity preservation was the subject of the third meeting of the CBD Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA3) (Montreal, 1-5 September 1997). Section C. 53 of the conclusions and recommendation from that meeting states the following:

> "The unique significance of certain high seas and deep-seabed areas (such as identified spawning areas, deep ocean trenches and certain hydrothermal vents) outside the limits of national jurisdiction calls for consideration to be given to the development of means and modalities for the establishment of marine protected areas in such locations."

More recently, the SBSTTA8 met in March 2003 and provided key recommendations with regard to the continued decline of marine and coastal biodiversity (see UNEP (CBD) 2003). Specifically, the goal for work under the Convention, in terms of marine and coastal protected areas, was indicated as follows:

> "The establishment and maintenance of marine and coastal protected areas that are effectively managed, ecologically based and contribute to a permanent representative global network of marine and coastal protected areas, building upon national networks, including a range of levels of protection, where human activities are managed, particularly through national legislation, regional programmes and policies, traditional and cultural practices and international agreements, to maintain the structure and functioning of the full range of marine and coastal ecosystems, in order to provide benefits to both present and future generations."

Particular reference to marine protection outside of national boundaries was made, and it was agreed that there exists an urgent need to protect marine diversity on the high seas, in accordance with international law. A specific request was made that the SBSTTA Executive Secretary work with other international bodies including the FAO, the IMO and the UN Division for Ocean Affairs and the Law of the Sea, among others, to "identify appropriate

[35] The RIO Declaration on Environment and Development (1992) reaffirmed the Declaration of the United Nations and outlined principles by which countries would achieve sustainable development.

mechanisms for the establishment and effective management of marine and coastal protected areas beyond national jurisdiction". Numerous recommendations for marine and coastal biodiversity conservation were made, including the establishment of pilot projects, the implementation of protected area networks and the need to build on regional and national programs for marine conservation areas.

The *Jakarta Mandate on Marine and Coastal Biodiversity*[36] was developed to assist states with implementing the CBD in the marine environment and includes specific objectives for marine conservation. MPAs are described as a critical component of biodiversity conservation strategies. The Jakarta Mandate provides an infrastructure through which the international community could work to protect the southern Grand Bank and indeed suggests pilot projects through which to implement its objectives.

The IUCN also supports the World Commission on Protected Areas (WCPA), which promotes "the establishment and effective management of a world-wide representative network of terrestrial and marine protected areas, as an integral contribution to the IUCN mission". The WPCA provides guidelines for MPA selection (Kelleher 1999) that would be useful in planning the southern Grand Bank MPA in an international context. The IUCN identifies six management categories of protected areas that allow for varying uses and levels of management. These categories include: I) Strict Nature Reserve/ Wilderness Area, II) National Park, III) Natural Monument, IV) Habitat/ Species Management Area, V) Protected Landscape/ Seascape, VI) Marine Resource Protected Area. The southern Grand Bank protected area would fit in several of these categories, including I, IV, V and VI and the final categorical designation will be highly dependent on the process through which the area is protected.

The state of global fish populations (e.g. Pauly and McLean 2003, Myers and Worm 2003) has inspired other international efforts to restore the marine environment and develop sustainable fishing practices. One of the major outcomes of the 2002 World Summit on Sustainable Development in Johannesburg, South Africa (a follow up meeting to that held in Rio in 1992 which resulted in the creation of the CBD) was a commitment by the international community to maintain or restore depleted fish stocks to levels that can produce maximum sustainable yield by 2015. Participating countries have committed to the following broad mandate to achieve sustainable oceans management:

> 1) Develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing processes, the establishment of marine protected areas consistent with international law and based on scientific information including representative networks by 2012.
>
> 2) Establish by 2004 a regular process under the United Nations for global reporting and assessment of the state of the environment.

[36] The Jakarta Mandate on Marine and Coastal Biodiversity outlines a program of action to be followed by countries that have ratified the Convention on Biological Diversity. The Mandate was adopted in 1995 and contains five key elements including the implementation of integrated marine and coastal area management, marine and coastal living resources, marine and coastal protected areas, aquaculture and invasive species.

3) Eliminate subsidies that contribute to illegal, unreported and unregulated (IUU) fishing and to overcapacity.

While commitments made in Johannesburg are not currently legally binding, they do represent international recognition that marine ecosystems are threatened and offer means to help restore these systems.

A meeting held in Paris in November 2003, explored the implementation of the commitments made in Johannesburg (UNESCO 2003). Key presentations included a strategy for high seas protected areas (Gjerde 2003b) and an outline of a conservation vision for the Grand Banks of Newfoundland (Breide and Rangeley 2003). There is obviously international momentum behind marine conservation initiatives and a broad recognition that commitments must be met if humans expect the marine environment to continue to support the services upon which they are dependent.

To summarize, there are several international conventions and commitments that emphasize the need for international cooperation to conserve and sustain the marine environment. To date, there has been little outcome resulting from these conventions, although there is considerable acknowledgement and more recent mobilization by international NGOs and government groups to move forward on marine conservation initiatives (see for example Gjerde and Breide 2003, UNESCO 2003, UNEP (CBD) 2003). The discussion of legal aspects in this report is preliminary and simply outlines the key conventions and agreements. A more detailed examination of the legal framework can be found in Gjerde and Breide (2003), the proceedings of a workshop to design a strategy for high seas marine protected areas. Specific recommendations from this workshop include three priority actions towards addressing the threats to high seas marine biodiversity. These actions are as follows:

1) Coalition building,
2) International recognition of the concept of high seas marine protected areas, and
3) Designation of the first high seas marine protected areas as test cases.

4.3 Relevant MPA Precedents

The designation of MPAs both in Canada and throughout the world has begun to change the face of the marine environment. Legal frameworks, management plans and economic costs and benefits have been determined for countless areas throughout the world's coastal zones. In conceiving a southern Grand Bank MPA, there are many places from where lessons can be learned, and recent designations nationally and internationally illustrate important marine conservation precedents.

4.3.1 Canadian MPAs

Initiatives to protect the marine environment have evolved in Canada over the last 30 years and internationally over the last eight years. In March 2003, the Endeavour hydrothermal vent MPA on Canada's west coast was the first area to be protected under Canada's *Oceans Act*. This is notable for conservation reasons, but also because this designation means that there is now a process that can be followed for creating MPAs under the *Oceans Act*. There are currently eight other "areas of interest" for MPA designation under the *Oceans Act*, including:

- Race Rocks, Strait of Juan de Fuca, Northeast Pacific
- Gabriola Passage, Gulf Islands off British Columbia, Northeast Pacific
- The Gully, Scotian Shelf, Northwest Atlantic
- Bowie Seamount, Northeast Pacific
- Basin Head (lagoon), Northumberland Strait, Northwest Atlantic
- Gilbert Bay, Labrador Coast, Northwest Atlantic
- Eastport Peninsula, Bonavista Bay, Northwest Atlantic
- Musquash Estuary, Bay of Fundy, Northwest Atlantic
- Leading Tickles, Notre Dame Bay, Newfoundland, Northwest Atlantic

During the summer of 2002, the federal government committed to the establishment of five new national marine conservation areas under the *Canada National Marine Conservation Areas Act*, which will include Gwaii Haanas and the Gulf Islands in the Northeast Pacific, Western Lake Superior, and two sites that are presently undetermined. Perhaps the most relevant site to the southern Grand Bank is The Gully, an offshore MPA that has limited recreational value. A draft management plan, which includes a zoning scheme to accommodate existing uses, has been developed for The Gully (DFO 2002f).

4.3.2. High Seas MPAs and other National MPA Precedents

From a legal standpoint, it is much easier to establish MPAs in areas under national jurisdiction where processes now exist. Internationally, there is much work to be done to develop a legal framework and institutional capacity for establishing MPAs. International cooperation led to the designation of the Pelagos Sanctuary for Mediterranean Marine Mammals[37]. This MPA has been established in the Mediterranean Ligurian Sea through the cooperation of France, Italy and Monaco. Scovazzi (2003) cautions that the designation of the Pelagos Sanctuary was made possible mainly by regional legislation, notably the *Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean*. In addition, this high seas sanctuary was designated for the specific purpose of marine mammal protection, rather than protection of the marine environment. As well, enforcement in the Mediterranean poses fewer challenges than enforcement on the open ocean.

Nationally, other countries have moved forward to establish protected areas over large tracts of the ocean. Australia recently designated the world's largest marine reserve (76,000 km^2) around the Heard and McDonald Islands in the sub-Antarctic ocean to protect benthic habitat, seabird foraging areas and juvenile habitat for the Patagonian toothfish. This designation is significant both in the size of the area to be protected and extension of the protected area boundaries to Australia's EEZ. The protection of this area has spurred the IUCN to pressure the Commission for the Conservation of Antarctic Marine Living

[37]The "Pelagos Sanctuary for Mediterranean Marine Mammals" in the Ligurian Sea was established by three countries (France, Italy and Monaco) through a trilateral agreement. The area is vast, covering 96,000 km^2 of sea surface, 53% of which is technically high seas (in the Mediterranean, the high seas begins at the 12-nautical-mile territorial sea limit, as few EEZs have been designated). In 2001, the Pelagos Sanctuary was regionally endorsed as a "Specially Protected Area of Mediterranean Importance" (SPAMI) pursuant to the Barcelona Protocol on Specially Protected Areas and Biodiversity. The Barcelona Protocol specifically provides for the designation and endorsement of "SPAMIs" beyond national jurisdiction (Notarbartolo di Sciara, G. et al. 2003).

Resources (CCAMLR[38]) to implement a system of marine reserves. This would require a high level of international cooperation. Australia's lead on protecting the Southern Ocean is significant in terms of both the size of the reserve and the potential for other countries to follow suit.

Through the IMO, six PSSAs have been designated for protection, including the Great Barrier Reef in Australia, the Sabana-Camagüey Archipelago in Cuba, the Florida Keys in the US, Malpelo Island in Columbia, the Wadden Sea shared by Denmark, the Netherlands and Germany, and Paracas Marine Reserve in Peru. There are currently two more that have been approved as PSSAs "in principle", pending review of their associated protective measures (the Torres Strait between Australia and Papua New Guinea, and the Western European waters PSSA proposed by Belgium, France, Ireland, Portugal, Spain and the United Kingdom). The altering of shipping routes in the Bay of Fundy for right whale protection provides a Canadian precedent for securing enhanced protection from shipping impacts through the IMO.

After four years of public negotiations, the California Fish and Game Commission recently voted to protect approximately 450 km^2 of marine habitat surrounding the Channel Islands. Fishing activity will be banned in the reserves to allow depleted populations to rebound. Members of the fishing community were heavily involved in the planning of the marine reserves.

[38] CCAMLR is similar to NAFO in its jurisdictional responsibilities.

5.0 REQUIREMENTS FOR SUCCESSFUL ESTABLISHMENT AND POSSIBLE IMPEDIMENTS

For a southern Grand Bank MPA to be successful, past marine protection initiatives in Newfoundland and other parts of the Northwest Atlantic should be closely scrutinized. The process of public consultation should be informative for proponents of the MPA and for the people who may be affected by its implementation. There must be clear goals and objectives for the MPA, and economic costs for implementation and management should be estimated. Consideration will have to be given to future use of the area. Finally, the cooperation of national and international governments will be crucial to this endeavour.

5.1 Local Considerations and Past Initiatives

Local participation will be a key to the success of a southern Grand Bank MPA. The perception of conservation initiatives in Newfoundland is not entirely positive. Negative publicity about the seal hunt and the past presence of non-governmental organizations involved in international conservation have led many people to be suspicious of environmental and conservation groups. This attitudinal obstacle must be overcome.

Fishers are more supportive of spawning area closures, and the importance of the southern Grand Bank for spawning cannot be overlooked. Mondor et al. (1995) claim that "the heightened awareness of the need for MPAs, particularly by the coastal communities, brought on by the collapse of a number of fisheries, is one of the greatest opportunities available to accelerate the establishment of various types of MPAs in Canadian waters."

Lien (1999) outlines the difficulties encountered in attempts to establish a marine adjunct to Terra Nova National Park. Factors contributing to the failure to implement a network of MPAs include inadequate public consultation, a lack of existing MPAs to serve as positive examples, and numerous practical impediments including jurisdictional conflicts and lack of political will. The failure of efforts to protect an area adjacent to Terra Nova National Park in 1999 has resulted in little local support for MPAs. Local people, believing that their rights to the resources in the area will be removed, distrust government organizations involved in the establishment of MPAs. The lobster conservation area initiative in Eastport has been a much more productive and empowering process than the aforementioned, and exemplifies the level of community cooperation that can be achieved. Any attempt to establish a southern Grand Bank MPA must include, from the outset of the initiative, a clear definition of the protected area, a well-developed public education plan and consultations with resource users.

Conservation and protection of the natural environment are often interpreted as being synonymous with job loss and destruction of a rural resource-based economy. Increased technology has led to tremendous increases in efficiency in the fishery, and thereby to its collapse (Myers and Hoenig 1997). To gain further public acceptance, the MPA proposal could be incorporated into a larger plan for rural economic development. Education on the role of MPAs and the long-term benefits of habitat conservation are key components to gaining local support.

The mistrust of government and non-government groups in Newfoundland must be addressed and overcome, at least in terms of conservation issues. The mistrust is based on historical and current experiences with agencies such as the Grenfell Mission, DFO and Greenpeace. Trust must be established before an MPA proposal will be accepted. Establishing this trust will require, from the beginning of the process, fostering local participation and being clear about allocation of funds for the establishment and management of the MPA. The continued decline of the fisheries and lack of success of current management strategies has prompted the initiation of discussion for management changes and more conservation oriented approaches.

5.2 Realistic Goals and Objectives

One of the key challenges in MPA planning and implementation is to consider both top-down (legislative) and bottom-up (community based management) directives (Jones 2002). The differences between government-led and community-based conservation initiatives, and the need to balance the two, are detailed by Jones (2002). In the case of a southern Grand Bank MPA, this is of great importance, as management must ultimately be carried out at the government level but co-operation, direction and stewardship is needed from the fishing community.

Expectations for the recovery of the biological community must be clearly outlined and monitoring systems put in place before the establishment of the MPA. There are clear guidelines that can be followed to set up management plans, monitoring programs and business plans for an MPA (e.g., Agardy 2001, Phillips 2000, Kelleher 1999). Expectations for recovery of commercial species must be realistic and appropriate baselines must be chosen, with considerable allowance for variability. Lessons can be learned from other fisheries closures in the Northwest Atlantic. For example, the "haddock box"[39], a large year-round fisheries closure on the Scotian Shelf, has been closed to fishing for 15 years, yet there has been no marked increase in the abundance of this species (Frank et al. 2000). The closure, however, has had an effect on the adult biomass of American plaice and winter flounder *(Pseudopleuronectes americanus)* (Frank et al. 2000). The closure on the US side of Georges Bank shows marked improvement in the biomass assessment of several commercial species (Murawski 2000).

The legal framework (i.e., which Acts are being used, which government departments are responsible and accountable) for the MPA must be understood and accepted by the local population. The legislation should be clear about the criteria used to determine the location and boundaries of the protected area, and the management plan for the area must be well developed. The strategy for implementing an MPA should include a comprehensive conservation plan and a list of predicted outcomes. There are several models to follow (Agardy 2000). The increase in MPAs throughout the world's oceans increases knowledge of important ecological, social and economic criteria (Agardy et al 2003).

[39] A juvenile haddock closed area was established on the offshore banks (Emerald and Western) of the central Scotian Shelf (NAFO Div. 4w) in 1987 with the management objective of protecting incoming recruits and thereby allowing the stock to rebuild.

5.3 Economic Support

The economic implications of a southern Grand Bank MPA must be determined at the beginning of the process and be linked explicitly to short-term losses and long-term gains. Initial funds will be required to assess the feasibility of the proposed MPA and bring about its implementation. As well, it is unlikely that local people will support the use of tax dollars for something they expect will give them no direct benefit. While the MPA establishment process can be both lengthy and costly (e.g., The Gully), closures under the *Fisheries Act* have been implemented in consultation with fishers, and have been expedient and relatively low-cost (e.g., Northeast Channel Coral Box). The detail, breadth and cost of a management plan will depend on the strategy chosen to protect the southern Grand Bank. The offshore nature of the proposed MPA has both economic advantages and disadvantages. There will be no requirement for a recreational or eco-tourism management plan, which will save costs, yet there will be no revenue from these sources either. Funds will be required for the development of a management plan, monitoring, public outreach to maintain support for marine biodiversity protection and, most importantly, enforcement.

Phillips (2000) outlines an approach for financial planning for protected areas and suggests several options for funding of high seas proposals. The international nature of the proposed MPA creates several opportunities that are not afforded to national protected areas and parks. Phillips (2000) describes revenue-generating activities within protected areas, which, as previously mentioned, will be limited for an offshore area.

5.4 Future Use of the Southern Grand Bank

Assuming that fishing will continue to some degree in various zones of the proposed MPA, it is considered separately from other future uses. The burgeoning oil and gas industry offshore of Atlantic Canada may present a future impediment to the protection of the southern Grand Bank. Resistance may come from government departments such as the federal Department of Natural Resources and from agencies responsible for employment and economic growth in Newfoundland. Given that there are currently no leases in this area, oil and gas exploration is not imminent.

The current volume of shipping traffic across the southern Grand Bank (see Section 3.3) presents an impediment to protection of the marine environment. From a legislative point of view, UNCLOS and the IMO do allow nations to place certain restrictions on foreign ships to protect natural resources. Shipping restrictions have occurred in other MPAs, though predominantly in areas adjacent to the coast. It will be essential to consult with the shipping industry and the IMO to determine whether, where and how improvements can be made[40].

Any initiatives to protect the southern Grand Bank will have to include consultation and consideration of plans to expand marine based industries in the area. The Canadian National Research Council (NRC) and the government of Newfoundland and Labrador formed the Oceans Advance partnership in 2002[41], in the interests of increasing marine resource based

[40] For example, it may be possible to work with IMO to designate one or more Areas to be Avoided, shift shipping lanes to other areas, establish reporting requirements, implement special discharge requirements, designate the area as a PSSA or develop other protective measures (see Gjerde, 2001b).

industries. This partnership should be advised of conservation initiatives, in order to achieve protection of the marine environment and sustainable development of the Newfoundland and Labrador economy.

5.5 Cooperation of National Governments and International Organizations

During the last initiative to establish an MPA in Newfoundland (see Section 5.1), one of the obstacles cited by Lien (1999) was the inadequate cooperation between Parks Canada and the DFO. Since a southern Grand Bank MPA would not be part of an existing national park, this specific obstacle is unlikely to arise. The *National Marine Conservation Areas Act* under Parks Canada, coupled with the *Fisheries Act* and the *Oceans Act*, provide an interdepartmental legal framework through which cooperation could be achieved. Government agencies must work together and present a unified position to the public.

Cooperation between international bodies will have to be sought to gain the support of NAFO countries currently fishing in or around the proposed area. International conventions, such as the UNCLOS, the *FAO Code of Conduct*, the *Convention on Biodiversity*, the *Jakarta Mandate on Marine and Coastal Biodiversity*, national legislation such as the *Oceans Act* and commitments made at the 2002 World Summit on Sustainable Development must be adhered to and acted upon. Recent commitments by the EU through the OSPAR Convention indicate that there is room for cooperation on marine conservation and high seas MPAs (see Section 6.0 for more detail). The EU Common Fisheries Policy was reformed for the first time in ten years in December 2002. Part of the reform requires that the EU apply the precautionary approach in taking measures designed to protect and conserve aquatic living resources. During the summer of 2002, the UK announced the formation of a Royal Commission to investigate the environmental effects of marine fisheries[42]. The final report is due in 2004, and will hopefully include some directives for marine habitat protection. Spain and Portugal are members of the EU and negotiations with these countries will be necessary to plan and implement an MPA on the southern Grand Bank. Negotiations with Russia will have to occur outside any EU discussions.

5.6 Enforcement

The enforcement of fisheries management decisions has continued to be an issue, particularly with regard to international fisheries. Monitoring and enforcement through the use of fisheries enforcement officers and patrol boats is costly, and there are far too many fishing boats to ensure that no illegal fishing is occurring. The use of the Global Positioning System

[41] Details on the Oceans Advance partnership, NRC investment in the partnership and potential industrial advances can be found at www.nrc-cnrc.gc.ca.

[42] Detailed information on the Royal Commission on Environment Pollution, the lead investigative body on the effects of marine fisheries for the UK, can be found at www.rcep.org.uk.

(GPS) and Vessel Monitoring Systems[43] (VMS) would make enforcement much easier (Knauss and Alexander 2000). Countries can track the location of vessels (similar to tracking the path of cargo ships) and vessels can use VMS to send basic information to regulatory agencies. VMS systems are being used extensively in the United States in several fisheries to better track fishing effort and days at sea, and to stem illegal fishing (see www.nmfs.noaa.gov/ole/vms.html for examples). It is acknowledged that VMS systems incur an expense for either individual fishers, companies or the respective governments involved. ICCAT requirements since 2000 include VMS systems on vessels greater than 24 metres that are targeting pelagic species outside the EEZ. According to the FAO, a growing number of countries have started to make their vessels and foreign vessels fishing in their waters use VMS (FAO 2002) and there is also an international network for the cooperation and coordination of fisheries related monitoring (see http://swr.uscd.edu/enf/mcs/mcs.htm).

Since the technology exists and there is support from international organizations, enforcement of fishing effort within and on the boundaries of a southern Grand Bank MPA is possible. NAFO member nations would have to commit to VMS systems, and this would take considerable co-operation, both financially and politically, but it is certainly possible given the numerous international treaties and conventions that exist in the name of protecting biodiversity.

[43] Vessel Monitoring Systems are electronic navigational systems that collect, record and analyse information regarding the location and activity of fishing vessels. This information is used to track fishing effort, locate boats that may be fishing illegally, and once installed, is more accurate and complete than log book data or information collected from fisheries enforcement vessels.

6.0 POTENTIAL STRATEGIES FOR IMPLEMENTATION OF A SOUTHERN GRAND BANK MPA

Given the current national and international legislation and international commitments to biodiversity conservation, there are several potential paths to follow that could lead to the designation of a southern Grand Bank MPA. Depending on the level of protection from human impact and the level of political will from a national and international perspective, the legal framework could vary considerably. An MPA can include protection based on a range of restrictions on activities, from the prohibition of all human uses to a combination of several specific restrictions. The levels of protection to be considered are:

- Protection from the use of destructive fishing gear, resulting in zoning or restriction of specific gear types;
- Protection from all fishing activities, regardless of gear type;
- Protection from oil exploration, drilling and mining for aggregates;
- Protection from shipping;
- Protection from military practices.

Protection from one or two of these activities is more likely to be politically successful than protection from all of them at once. The recommended next step in the process of protecting the southern Grand Bank is for the Canadian and the Newfoundland and Labrador governments to host an international symposium, where various strategies towards designation of a high seas MPA could be discussed. Three possible strategies for discussion follow.

6.1 Canada Hosts International Symposium

Since a high seas MPA of this type has yet to be established, the southern Grand Bank area provides an ideal case study for planning and setting clear goals and objectives for similar initiatives. Calling for an international symposium on the subject is the most logical step towards realizing the goals of protection of the southern Grand Bank. Such a meeting would build on past meetings (see Gjerde 2001) and provide action and mobilization toward the priorities set by the SBSTTA8 and the recommendations of Gjerde and Breide (2003). Legislation and any international agreements required to establish high seas MPAs could be further explored, and the process through which such MPAs could be created would be outlined. The proposed southern Grand Bank MPA would be addressed as an example, with the intent that the meeting would result in a plan for protection. The meeting would offer opportunities for the presentation of community perspectives, as well as scientific studies. Several legislative avenues could be followed and the details of legal framework developed by considering the following options.

6.1.1 Canada Enacts National Legislation

Canada could move forward on designating an MPA under the *Oceans Act*, the *Canada National Marine Conservation Areas Act* or a fisheries closure under the *Fisheries Act* for an area within its EEZ. Under existing national legislation, the MPA could be divided into zones that allow

varying levels of activity to take place. In Section 4(4) of the *Canada National Marine Conservation Areas Act*, it is stated that:

> "Each marine conservation area shall be divided into zones, which must include at least one zone that fosters and encourages ecologically sustainable use of marine resources and at least one zone that fully protects special features or sensitive elements of ecosystems and may include other types of zones."

This would likely be acceptable to fishing interests, and is similar to the zoning scheme for The Gully MPA on the Scotian Shelf.

The *Canada National Marine Conservation Areas Act* could effectively reduce ship source pollution substance disposal (see Section 14.1). The Act also calls for the regulation or restriction of ship traffic in accordance with the *Canada Shipping Act*. If Canada were to use national legislation, there are a variety of legal tactics that can be used, and the level of protection will depend on which Act is invoked.

6.1.2 Canada Leads Protected Area Initiative Using International Agreements

Beginning with the commitments to achieving sustainable fishing by 2015 made by the international community at the 2002 World Summit on Sustainable Development, Canada could call for more effective implementation and enforcement of other international agreements[44]. The ratification of the UNFA by the EU countries in 2003 binds these countries to manage fisheries in a sustainable manner. The UNFA and the *FAO Code of Conduct* assert that the Precautionary Approach be used in fisheries management decisions. The designation of a no-take reserve as part of a larger MPA would be a strong step in the name of precaution. Parties to the CBD are committed to protecting species and to controlling processes and activities under their jurisdiction or control that may affect biological diversity beyond national jurisdiction. The biological diversity represented on the southern Grand Bank is worthy of protection. The identification of the Grand Bank as a "potentially favorable political opportunity for designation as a high seas MPA" (Gjerde and Breide 2003) by international experts marks the recognition of the importance of the area. International conservation organizations could assist in promoting the high seas MPA.

There is evidence that the EU countries have a commitment to marine conservation and are willing to extend this beyond their territorial waters. This was made clear in a recent publication entitled "Safeguarding our Seas" published by the UK Department for Environment, Food and Rural Affairs (DEFRA 2002). Since the ratification by the EU of the OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic in May of 2000 (entry into force in August 2000), there has been increased initiative to preserve the marine environment. Annex V makes particular reference to the protection of

[44] The option of expanding Canada's jurisdiction beyond the 200-nautical-mile limit has been the subject of public and government discussion (House of Commons Standing Committee on Fisheries 2002). Though extension of the EEZ could be costly at the global political level, serious discussion of this option did occur following the rejection of Canada's proposals at the January 2002 NAFO meetings, when the Canadian Broadcasting Corporation held a public forum on the question "Should Canada Extend the 200-nautical-mile limit?"

marine habitat and diversity. In "Safeguarding our Seas", (Section 2.20) high seas marine protected areas are discussed, and the following statement made: "We will explore with other countries and through appropriate international fora the case for, and the feasibility of, marine protected areas on the high seas." This statement could be easily turned into action through the protection of the southern Grand Banks. Specific pressure on the EU fishing nations to protect foreign waters would be an important step in global fisheries conservation.

6.1.3 NAFO Leads Protected Area Initiative

Working directly though NAFO, as the regional fisheries management organization, Canada could propose a high seas MPA on the southern Grand Bank. If the EU adopts a conservation-based fisheries management policy, designating the MPA through NAFO may be the best strategy as it is a forum for international cooperation. The member nations of NAFO are parties to international agreements that commit nations to both fisheries and biodiversity protection. Under the 1995 UNFA, NAFO has certain rights to control the actions of non-NAFO members in the area. Given the current moratoria and the relatively dismal history of NAFO in applying conservation measures, now might be the right time for political action that would yield positive results. NAFO could be used as the regional body through which conservation discussions could be led. Given the level of conflict at NAFO meetings, with regard to quota distributions and limits, this strategy could prove difficult, but is worth considering.

Discussion of one or all of the strategies described above will likely lead to other avenues through which the southern Grand Bank could be protected.

7.0 CONCLUSION

Conservation of the marine environment and restoration of global fisheries will require that large areas be protected from human impact. Given the uncertainty of recovery time from overfishing of many fish species (Hutchings 2000a), that some long-living benthic species take hundreds of years to recover (Hall-Spencer et al. 2002), the considerable political impediments to reducing subsidies and fishing capacity there are many obstacles to achieving sustainable fisheries and ensuring protection of marine biodiversity. Nevertheless, there is scientific evidence that marine reserves can result in species and biomass recovery on relatively short time scales (Halpern and Werner 2002), and the continuing decline of fisheries worldwide requires unprecedented management changes and the use of zoned marine conservation areas as management tools (Murray et al. 1999, Hyrenbach et al. 2000). Balmford et al. (2004) show that the monetary cost of protecting 20-30% of marine habitat globally, would be less than the current subsidies to the fishing industry.

Protection of the southern Grand Bank would set an important precedent for high seas conservation. There are many choices in terms of legal jurisdiction, level of protection and category of protected area - from a fisheries closure, to a MPA with zones for human activities, to a strictly no-take marine wilderness area. From a scientific perspective, the MPA could be seen as an experiment, as a means of protecting part of the ecosystem and being able to monitor recovery of fish stocks and marine habitat. From a political perspective, a protected area would begin to address commitments to marine conservation outlined in national legislation and international conventions, as well as non-binding agreements. While current fisheries would be affected, the potential economic loss for Newfoundland is a relatively small portion of the total value of the fisheries in the province and is highly subject to market price and stock status of lucrative invertebrate fisheries. The fishing industry must be involved in the decision making process as they will incur financial losses. The industry should consider the future potential for economic gain if the MPA is successful in serving to increase fish stocks.

The design of a southern Grand Bank MPA must include regulatory measures that ensure areas outside the reserve boundaries are not placed under increased fishing pressure. Industry representatives and citizens potentially affected by the implementation of an MPA on the southern Grand Bank must be involved in the consultation process from the outset. The final design of the reserve should take into consideration local fishers and coastal communities as well as those of the fishing and other industries who benefit from offshore resources.

Canada must begin to implement alternative management strategies and use the Precautionary Approach in efforts to rebuild fish stocks and protect marine habitat. In a sense, there is historical proof that closed areas work; when fishing was less intense and when offshore areas were inaccessible due to the lack of technology, fish were abundant. Motivation for the protection of the southern Grand Bank already exists, and no other public proposals have been made for protection in the region. Several alternatives to the boundaries suggested in this report are possible, but any alternative proposals should consider protecting shelf and slope species and an adequate area spanning Canada's 200-nautical-mile

limit. A clear legislative framework must be constructed from existing national legislation, and protection of the high seas beyond the EEZ will require international cooperation and creative use of existing international conventions and commitments to biodiversity conservation.

8.0 RECOMMENDATIONS

The rationale for a major conservation initiative on the southern Grand Bank has been developed throughout this report. There are incentives to adapt new management strategies to protect straddling fish stocks and attempt to restore the once abundant fisheries on the Grand Bank. This report calls upon the Canadian government, resource users, the general public and the international community as a whole to act responsibly and to fulfill commitments to conserve, protect and restore the marine environment. To follow is a list of recommendations that suggests next steps in this initiative. Many of these recommendations can be the basis of a management plan for a southern Grand Bank MPA.

Science

1) While there is a valuable time series of data on commercial species, there is a relative paucity of information on non-commercial species on the southern Grand Bank. A simple way to improve this situation and begin developing a monitoring plan for the marine ecosystem of that area is to work in conjunction with ongoing surveys such as the DFO trawl surveys and fisheries observer programs to increase the number of species that are recorded. This would be particularly useful for non-commercial species such as seabirds, marine mammals and structure-forming species such as sponges and corals.

2) A comprehensive reconstruction of the southern Grand Bank ecosystem, using available data, would be helpful in determining baselines for restoration. This project is not immediately necessary to begin the process of MPA planning, but could be part of the longer term research initiatives included in the MPA management plan. Such an exercise could be an important public relations initiative as it would bring attention to the extent to which human activities have altered the marine ecosystem.

3) Scientific consensus is often useful in gaining public and political support. A small working group of scientists who have both expertise in the southern Grand Bank ecosystem and motivation for marine conservation should be organized to assist in the planning process and to develop scientific monitoring programs.

Stakeholder consultation and involvement

1) Consultation with resource users must begin immediately upon the decision to move ahead with an MPA plan. Impediments to protecting this area must be dealt with from the outset. One option for consultation is through the Custodial Management Process that is currently being led by the Newfoundland Department of Fisheries.

2) Specific goals, objectives and timelines must be part of initial and ongoing public and industry consultation so that the participants and the general public have the ability to view the progress of the protected area implementation and have the opportunity to provide input. Public consultation must not be token, after most decisions have already been made; if resource users are not empowered by the planning and decision making process, there will be little incentive for stewardship of the protected area. Goals and objectives can be

developed in cooperation between resource users, government and the scientific working group.

3) The development of a public education program to begin garnering public support for an open ocean, high seas MPA will be an important step in gaining political support. Benefits to the public will not be easily visible, however there is general public awareness of the state of the marine ecosystem, and a desire to do what is necessary to conserve the fisheries for future generations. An international symposium on high seas MPA's would be a good place to solicit media attention and begin the public education process.

Political motivation

1) The idea for a southern Grand Bank MPA is not new, and both provincial and federal levels of government are aware of this proposal as a management option. A first step in gaining real political support for a large-scale MPA would be to draft a letter for relevant provincial and federal politicians outlining the proposal and rationale for an MPA. The letter would simply request that the commitments that have been made nationally and internationally to conserve and protect the marine environment be upheld and that action be taken now.

2) The provincial government of Newfoundland could suggest a fisheries closure under federal jurisdiction to indicate their commitment to resolving the fisheries crisis and including MPAs as part of fisheries management.

Current Uses

The economic analysis in this report presents rough estimates of the potential economic losses should an MPA be established, and includes only fisheries landings information. Consultation with the fishing industry, and inclusion of other economic activity, will be necessary to draft a plan for the implementation of the MPA and to more fully assess all the implications of protection of the area. Inclusion of unreported fisheries landings and bycatch will also be important to show that fishing mortality is often far greater than expected and that MPAs are one of the few management tools that can prevent this from happening, at least within defined boundaries.

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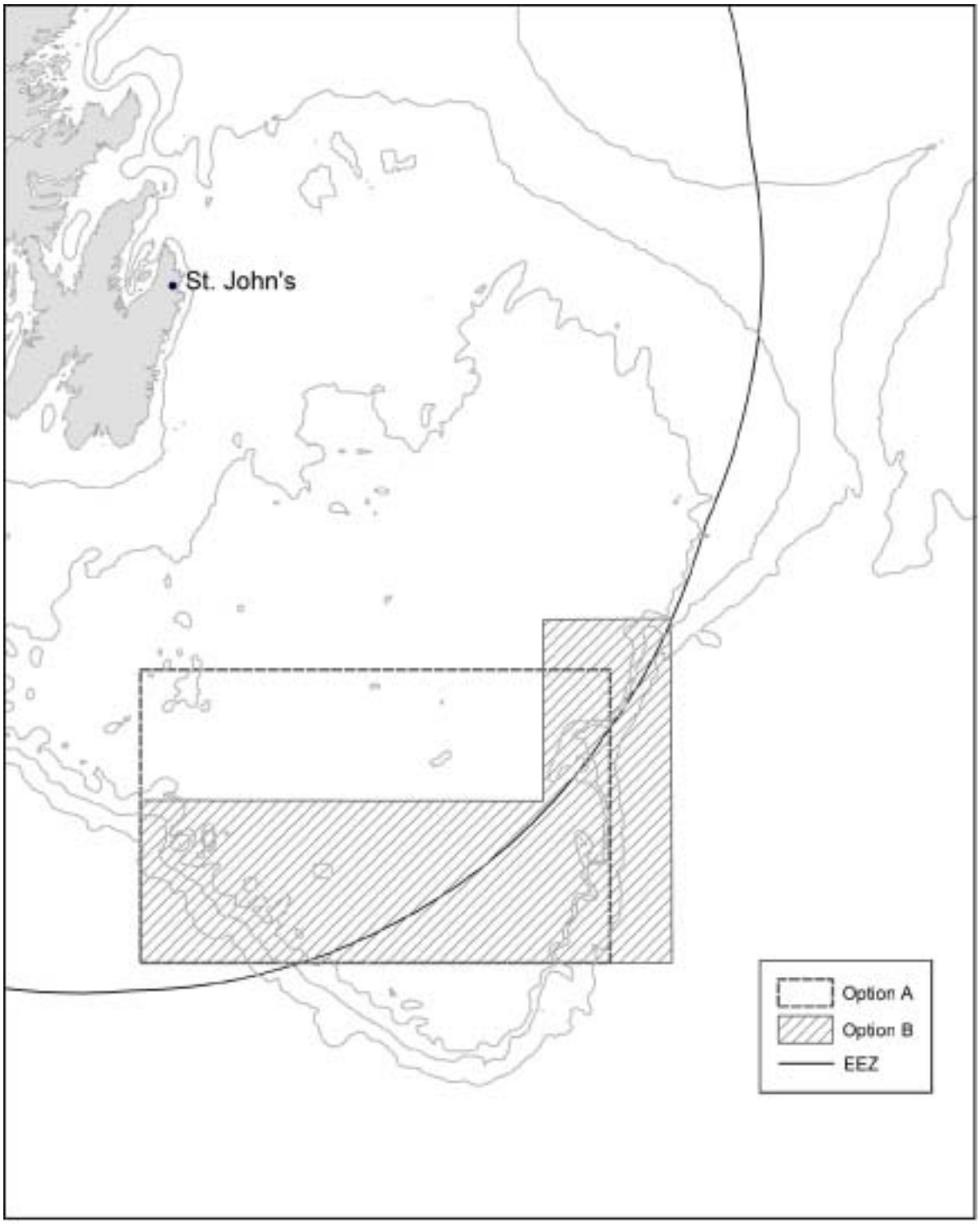
APPENDIX 1: Options for MPA Boundaries



APPENDIX 2: Species Names

Invertebrates

Bathypathes arctica
Blue mussel *(Mytilus edulis)*
Bubblegum coral *(Paragorgia arborea)*
Cup coral *(Flabellum alabastrum)*
Icelandic scallop *(Chlamys islandica)*
Gold banded coral *(Keratoisis ornate)*
Northern shrimp *(Pandulus* spp.*)*
Ocean quahog *(Arctica islandica)*
Radicipes gracilis
Sea corn coral *(Primnoa resedaeformis)*
Snow crab *(Chionoecetes opilio)*
Squid *(Illex illecebrosus)*
Surf clam *(Mactromeris polynyma)*
Wedge clam *(Mesoderma deauratum)*

Fish

Acadian Redfish *(Sebastes fasciatus)*
Albacore tuna *(Thunnus alalunga)*
American plaice *(Hippoglossoides platessoides)*
Atlantic cod *(Gadus morhua)*
Atlantic halibut *(Hippoglossus hippoglossus)*
Atlantic wolffish *(Anarhichas lupus*
Barndoor skate *(Dipturus laevis)*
Bigeye tuna *(Thunnus obesus)*
Bluefin tuna *(Thunnus thynnus)*
Capelin *(Mallotus villosus)*
Dogfish *(Squalus* spp.*)*
Deepwater redfish (*Sebastes mentella*)
Greenland halibut *(Reinhardtius hippoglossoides)*
Golden redfish *(Sebastes marinus)*
Haddock *(Melanogrammus aeglefinus)*
Monkfish *(Lophuis americanus)*
Northern sand lance *(Ammodytes dubius)*
Northern wolffish *(Anarhichas denticulatus)*
Porbeagle shark *(Lamna nasus)*
Red hake *(Urophycis chuss)*
Roughhead grenadier *(Macrourus berglax)*
Roundnose grenadier *(Coryphaenoides rupestris)*
Silver hake *(Merluccius bilinearis)*
Smooth skate *(Malacoraja senta)*

Spotted wolffish *(Anarhichas minor)*
Swordfish *(Xiphias gladius)*
Thorny skate *(Raja radiata)*
Winter flounder *(Pleuronectes americanus)*
Witch flounder *(Glyptocephalus cynoglossus)*
White hake *(Urophycis tenuis)*
Wolf eelpout *(Lycenchelys verrillii)*
Yellowfin tuna *(Thunnus albacares)*
Yellowtail flounder *(Pleuronectes ferruginea)*

Marine Mammals
Blue whale *(Balenoptera musculus)*
Finback whale *(Balaenoptera physalus)*
Harbour porpoise *(Phocoena phocoena)*
Humpback whale *(Megaptera novaeangliae)*
Minke whale *(Balaenoptera acutorostrata)*
North Atlantic right whale *(Eubalaena glacialis)*
Orca whale *(Orcinus orca)*
Pilot whale *(Globicephala melaena)*
Saddlebackdolphin *(Delphinus delphis)*
Sperm whale *(Physeter macrocephalus)*
Bottlenose dolphin *(Terciops truncates)*
White-beaked dolphin *(Lagenorhynchus albirostris)*

Sea Turtles
Leatherback turtle *(Dermochelys coriacea)*
Loggerhead turtle *(Caretta caretta)*

Seabirds
Black-legged kittiwake *(Rissa tridactyla)*
Common Murre *(Uria aalge)*
Dovekie *(Alle alle)*
Great black-backed Gull *(Larus marinus)*
Great skua *(Stercorarius skua)*
Greater shearwater *(Puffinus gravis)*
Herring gull *(Larus argentus)*
Leach's storm-petrel *(Oceanodrama leucorhoa)*
Northern fulmar *(Fulmarus glacialis)*
Northern gannet *(Morus bassanus)*
Pomarine jaeger *(Stercorarius pomarinus)*
Sooty shearwater *(Puffinus griseus)*
Thick billed Murre *(Uria lomvia)*