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**Commercial fisheries of the Sable Gully  
and surrounding region:  
Historical and present activities**

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HISTORICAL AND PRESENT ACTIVITIES

by

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## ABSTRACT

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This overview of fisheries in the area of the Sable Gully was undertaken to assist in the design of a potential marine protected area (MPA) in the area of the Gully. The fisheries of the Gully Assessment Area (GAA) are described, including the history of fisheries in the area, species caught, location of fisheries, and their general importance to the larger area. Historically, there were fisheries for many species of groundfish in the area of the Gully. After the fisheries for cod and haddock closed in September 1993, fishing activity in the area decreased. There are currently two important fisheries carried out in the area, a bottom longline fishery for halibut and a pelagic longline fishery for swordfish. Vessels that regularly use these areas are based in Sambro, in communities in Shelburne County, and a few other ports along the south and eastern shores.

## RÉSUMÉ

H. Breeze. 2002. Commercial fisheries of the Sable Gully and surrounding region: Historical and present activities. Can. Manuscr. Rep. Fish. Aquat. Sci. 2612: viii + 83 pp.

Le présent survol des pêches dans la région du Goulet de l'île de Sable a été entrepris pour aider à l'établissement d'une éventuelle zone de protection marine (ZPM) dans la région du Goulet. On y décrit les diverses pêches ayant lieu dans la zone d'évaluation du Goulet, notamment leur historique, les espèces capturées, les lieux de pêche et l'importance générale de ces pêches pour l'ensemble de la région. Par le passé, on pêchait de nombreuses espèces de poisson de fond dans les eaux du Goulet. Après le moratoire de 1993, l'activité à cet endroit a diminué et on y pratique actuellement deux pêches importantes, soit une pêche du flétan à la palangre de fond et une pêche pélagique de l'espadon à la palangre. Les bateaux qui pêchent régulièrement dans ces eaux ont pour port d'attache Sambro, des ports du comté de Shelburne et quelques autres des côtes sud et est.

PNW,  
Commercial fisheries; historical account; pelagic fisheries;  
groundfish fisheries; finfish fisheries

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## **1.0 INTRODUCTION**

This overview provides a description of the fisheries of the Sable Gully on the Scotian Shelf. The Sable Gully, also known simply as the Gully, is the largest submarine canyon in the northwest Atlantic. Located east of Sable Island, the canyon bisects the Scotian Shelf between Banquereau and Sable Island Bank (Figure 1). The Gully has a diversity of species, including marine mammals, invertebrates, and fish. For over 100 years, the Gully and adjacent areas have been important for fisheries in the region, particularly fisheries for halibut, cod, and redfish, and more recently, swordfish.

### **1.1 Purpose of the Fisheries Overview**

Over the past ten years, the Gully has been the focus of heightened conservation interest from numerous agencies and organizations. Primary factors behind this recent interest are the Gully's resident population of northern bottlenose whales and the proximity of the canyon to oil and gas development. Important events in the development of a conservation strategy for the Gully have been summarized by Fenton et al. (2002).

The core area of the Gully ecosystem was selected as an Area of Interest (AOI) in the Marine Protected Areas (MPA) Program in late 1998. AOIs represent sites that Fisheries and Oceans Canada (DFO) has committed to advancing through the MPA Program framework. DFO's *National Framework for Establishing and Managing MPAs* (1999a) sets out several steps for the establishment of marine protected areas. Step three of the framework specifies a "socio-economic assessment" be conducted to determine how MPA establishment may affect economic uses, including fisheries.

This fisheries overview was completed under contract to the Oceans and Coastal Management Division (Maritimes Region), Fisheries and Oceans Canada as part of the broader socio-economic assessment of the proposed Sable Gully Marine Protected Area. Its primary purpose is to support discussion of the design of the proposed MPA, including its boundaries and zoning schemes within the MPA.<sup>1</sup>

Given the known importance of fisheries in the area to specific users and coastal communities, a detailed description of fishing activities was required to update and supplement previous efforts to describe the fisheries. The following questions are addressed in this overview:

- What species are caught?
- What gear sectors are involved? From which communities?
- Where within the Gully area do the fisheries occur?
- When do the fisheries occur?

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<sup>1</sup> In the fall of 2002, since this report was prepared but before it was published, the Oceans and Coastal Management Division released a proposal that provides a boundary and a zoning scheme for the Gully MPA. This boundary falls completely within the GAA.

- How does the fishery within the Gully study area compare with the comparison area (defined below), in terms of catch and effort?

As fisheries have changed extensively from ten years ago, a history of the key fisheries is provided to give a sense of their former importance and potential future importance in the area of the Gully.

This report uses the findings of previous studies as a starting point and provides additional details on the history of fisheries in the Gully, current status, and location of activities, as well as information provided by the Gully working group of the Scotia-Fundy Fisheries Roundtable. Some of the relevant fisheries management measures are described here, but it should be noted that regulations may change from year to year and all regulations currently in force are not listed.

The spatial and temporal aspects of the fisheries – where and when they occur – are emphasized to aid in developing the design of the proposed Gully MPA. The potential effects of fisheries on conservation values and priorities – the ecological impacts of fisheries and how well particular fisheries fit with a marine protected area – are not addressed here. Nor is there a full assessment of the economic benefits of fishing in the area or the economic impact of the proposed MPA on existing fisheries.

## 1.2 Geographical Boundaries of the Overview

The study area for this fisheries overview encompasses the canyon, the AOI boundary and surrounding waters (Figure 2). The co-ordinates defining the study area are as follows:

44° 20'N, 59° 20'W  
43° 35'N, 59° 20'W  
43° 35'N, 58° 35'W  
44° 00'N, 58° 35'W  
44° 20'N, 59° 00'W

This area is referred to as the Gully Assessment Area (GAA) throughout the report. It is approximately 4400 square kilometres.

This study area is the same for all components of the socio-economic assessment. For example, it will also be used for assessments of mineral and hydrocarbon resources.<sup>2</sup> The objective is to understand activities both within the proposed marine protected area (the AOI) and adjacent areas. Activities within the 1998 AOI boundary are highlighted. The area of the AOI is 1850 square kilometres (Fenton et al. 2002), less than half the size of the

---

<sup>2</sup> This boundary is different in size and orientation than the assessment boundary used by GTA Consultants (1999). The previous boundary delineated a larger area that included more of the trough, Banquereau, and Sable Island Bank, and did not extend as far to the south (Figure 3). There is more fishing activity in the larger area used by GTA Consultants and some fisheries (e.g., Icelandic scallop) occur in that area that do not occur in the Gully Assessment Area used in this report.

assessment area. The assessment area is larger than the AOI to allow planners to gain some understanding of the surrounding activities that could potentially impact the canyon ecosystem. Conversely, future limitations on activities within the AOI could affect activities in adjacent areas.

Throughout the report, fisheries activities within the GAA are compared with activities in a larger area of the eastern Scotian Shelf. The area used for comparison consists of NAFO (North Atlantic Fisheries Organization) unit areas 4VSc, 4VSe, 4Wf, and 4Wg. Parts of the GAA fall within each of these units. Throughout the report, the broader area used for comparison is called the “comparison area”. It includes the Gully and parts of the trough, Sable Island Bank, Banquereau, and the Scotian slope and rise (Figure 4). This area is approximately 139,400 square kilometres, more than 30 times the size of the GAA. However much of the comparison area is made up of 4VSe (78,000 square kilometres), which is located over the deep waters of the continental slope where little fishing activity occurs. During the historical period (pre-1977), activities within the larger NAFO division areas 4W and 4VS are used as a point of reference (Figure 4), as information was not readily available at a finer resolution (i.e., at the scale of unit areas).

### **1.3 Organization of the Report**

This report is organized into five major sections. The first section is the Introduction. In the second section, the sources and methods used for this report are described. The third section consists of a history of fisheries in the area from the 1800s to 1977. The fourth section describes the modern fishery since 1977, when Canada implemented a 200-nautical mile fishing zone (later proclaimed as an exclusive economic zone). The fisheries are divided into four main groupings: groundfish (except halibut), halibut, large pelagics, and invertebrates. Because of the long-term importance of the area for halibut, the halibut fishery was given a separate sub-section and is described in more detail than the other fisheries. The fifth and final section of the report summarizes what is known about fisheries in the Gully and makes conclusions on the current importance of the Gully to various fisheries.

## **2.0 METHODS AND PREVIOUS STUDIES**

### **2.1 Information Sources**

Previous studies of the Gully were used as a starting point in identifying the important fisheries in the GAA. These studies were supplemented by meetings with participants in the fishery, and information provided by fisheries scientists. Descriptions and assessments of fisheries are regularly carried out by fisheries scientists and managers to aid in decision-making for the fisheries (see DFO 2002a, 2002b, Koeller et al. 2001). Those documents were important sources of information for this report.

The information found in this report drew on those sources; however, the organization is somewhat different. While other reports often describe activities over large geographic areas

or entire stocks, this overview of the fisheries looks at activities within a small geographic area. Studies of fisheries within small geographic areas have been carried out in the context of planned hydrocarbon extraction activities and their potential impact on fisheries (see e.g., Kulka 1991, MacLaren Plansearch 1996). In other parts of Canada, fisheries in a particular area have been examined in the context of marine reserve and protected area planning (see e.g., Sloan et al. 2001, Morris et al. 2002).

DFO commercial fisheries data provided a key source of information for this assessment. Information on commercial landings from the zonal interchange format (ZIF) database, from industry surveys, and from the observer program were used to create the maps and tables found here. Those data sources are described in more detail below.

A literature search was carried out to find descriptions of fisheries on the Scotian Shelf, particularly in NAFO area 4VSW. For the period prior to 1977, accounts of fisheries found in the literature, such as reports of the US Commission of Fish and Fisheries, were the primary source of information. Data from NAFO were used for information on landings in the general area after 1960 and before 1977 for all vessels. It was used for information on landings by foreign vessels for all years after 1960.

## **2.2 Previous Studies**

### 2.2.1 Reports on the Gully

As a result of the sustained conservation interest in the Gully, there have been a number of reports over the last decade that have described the fishing activities of the Gully area. Earlier efforts to describe fishing activity specifically in the area of the Gully include:

- A preliminary overview of the Gully fisheries, produced by the Resource Development Branch of DFO (Jerry Conway, unpublished and undated) in the mid 1990s. This DFO internal report provided a quick overview of major fisheries and presented the information sources available at that time.
- A brief overview of fisheries of the Gully prepared by Milewski (1996) for the World Wildlife Fund. This report was based primarily on discussions with representatives of key associations and related some of the key issues expressed by fishing organizations related to a potential MPA in the Gully and MPAs in general.
- A description of fish communities of the canyon and surrounding areas was prepared for the Gully Science Review (Zwanenburg 1998). Some general information on fisheries and commercial landings was provided, particularly for species where scientific survey information was inadequate.
- A review of invertebrate fisheries of the Gully and nearby areas prepared by Tremblay (1998), again for the Gully Science Review.
- A “Socio-economic Profile of the Sable Gully” (GTA Consultants 1999) commissioned by Fisheries and Oceans Canada as part of the Gully Conservation Strategy. It contains the most detailed account of fisheries of the area and their economic value and its findings are discussed below.

The “Socio-economic Profile of the Sable Gully” described each fishery, including the level of fishing activity, the primary stakeholders, and economic values for a selected year. As well, generalized maps of the location of these fisheries were included (Figure 5). It did not provide detailed information from the DFO databases. The main findings of that report, as related to fishing, were:

- “For the fishing industry, the Gully is one of a large number of fishing grounds on the Eastern Scotian Shelf.
  - the Gully is used regularly and is a valued fishing location for several fleet sectors harvesting groundfish, large pelagic species and some shellfish.
  - For most fisheries, with the exception of halibut, the Gully is not an essential fishing ground. It does not provide a critically important component of their overall catch and earnings profile.
  - the Gully is an essential area for the hook and line fishery for halibut. A small number of enterprises would suffer economic losses if the Gully were closed to them.
  - Groundfish stocks in the Gully area are expected to recover and there may be more valuable fisheries for snow crab and shrimp, but the area is not essential to any of these fisheries” (GTA Consultants 1999).

The present document, “Commercial fisheries of the Sable Gully and surrounding region,” updates and, in some cases, replaces the findings of the GTA study. It is intended to provide further detail on the fisheries in the Gully, particularly detail on the location of the fisheries and the participants.

## **2.3 Fisheries and Oceans Canada Databases**

### **2.3.1 Zonal Interchange Format (ZIF) Data**

DFO collects information on commercial landings and location of fisheries through the use of logbooks and the dockside monitoring program. This information is compiled in the zonal interchange format (ZIF) database. The reporting requirements vary by fishery, vessel size, and gear type. For the period prior to 1990 for trawlers<sup>3</sup> and 1996 for fixed gear vessels, detailed reporting of location of groundfish landings is not available through ZIF, thus it is not possible to separate landings within the GAA from the rest of the NAFO sub-unit area prior to those years. Information in the ZIF database for non-groundfish fisheries is available for the post-1996 period and occasionally earlier.

Even after 1996, the level of detail in the ZIF database is not optimal for an assessment of a small area of the ocean. ZIF is summarized to the subtrip level, so that a single fishing location is entered for several sets within the subtrip. This method of summarizing the data

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<sup>3</sup> For some vessel classes, information is available prior to 1990 or 1996.

may result in some sets being included in summarized statistics of landings that actually took place outside the study area (although within the same general area), or sets being excluded that took place within the study area. Information on the location of individual sets is available on the original forms; however, due to the amount of information involved it was not deemed necessary to go through all the forms pertaining to the GAA and comparison area. Despite its limitations, the ZIF database is able to provide a general sense of fishing areas and was an important source for the maps and data found here.

The same years, and in some cases, the same viewing window are not used for all maps. Not all fisheries occurred in all years. For example, there was no directed fishery for albacore, yellowfin, and bigeye tunas until the mid-1990s and maps are provided for the late 1990s only for those species. In some cases, maps both of the GAA and of the eastern Scotian Shelf have been provided to show the importance of the GAA to the fishery to the broader area.

### 2.3.2 Observer Data

The observer program began in 1978 as one of the strategies to improve management of marine resources after Canada extended its jurisdiction to a 200-nautical mile fishing zone (later exclusive economic zone). During the first few years, about 40 percent of foreign vessels fishing within Canada's fishing zone carried an observer. In 1980, observers were introduced to the domestic offshore fleet. Coverage of foreign vessels expanded to 100 percent in 1988 and coverage within the domestic fleet also expanded, though to a lesser degree. Presently, nearly all domestic fisheries have some coverage, with the level of coverage varying according to fleet type, the size of the vessel, and the requirements of the management plan.

The observers monitor compliance with fishing regulations and collect certain biological information, such as information on species and amount caught, location fished, and other details as required. Data from the observer program is more detailed than that found in the ZIF database. For example, the particular route taken by a trawler as it fishes is recorded by the observer and is included in the observer database. However, since the primary purpose of the observers is to increase compliance with fishing regulations, the particular areas covered are not standardized. Information from observers often provides a good indication of where a fishery occurs but does not necessarily cover every area where the fishery occurs.

### 2.3.3 Industry/DFO Surveys

To gain a better understanding of the dynamics of particular fish stocks, scientists and fishermen have collaborated on industry/DFO surveys. These surveys are carried out by fishermen using their own fishing vessels and gear. The industry/DFO survey is particularly important for halibut, a species that is not caught consistently by the groundfish research trawl survey. Information from that survey is used in this report.

The industry/DFO survey for halibut began in 1998. There are two parts to the halibut survey, a stratified random phase and a commercial index phase (Zwanenburg and Wilson 2000). The stratified random phase provides an indication of halibut abundance while the commercial index phase is used to calculate catch per unit effort. As well, during the stratified random phase, biological information on halibut is collected. More information on fishing protocols and other details of the survey can be found in Zwanenburg and Wilson (2000).

#### 2.3.4 Research Trawl Survey

The summer groundfish research vessel trawl survey is conducted using a standard protocol (Koeller 1981). Relatively little information from that survey is used in this document, as the focus is on the fisheries presently occurring in the Gully and not on potential biomass available to fisheries. Data from the research trawl surveys are used to show distribution of a few species that are not fished in the Gully at this time but have high landings elsewhere on the shelf.

### **2.4 Feedback from Stakeholders**

The information found in the DFO databases and in previous reports was supplemented by the knowledge and observations of those in the industry and other experts from science and fisheries management. The “Socio-economic Profile of the Sable Gully” was widely distributed to stakeholders and comments from them have provided additional details on the specific nature of fisheries. As well, to continue to build a better understanding of the fishery in the area, a variety of discussions with fishery interests have been held. To assist with this effort, the Scotia-Fundy Fisheries Roundtable established a Gully working group in 2002. This group includes representatives of all past and present fleets that fished the Gully and nearby areas and provides the input and advice required in the process to review the Sable Gully Marine Protected Area initiative.

The form of the present document is based partially on suggestions from representatives of the fishing industry. They suggested that a report describing the fisheries that made extensive use of the DFO databases was needed. As well, they suggested that information on the fisheries that occurred prior to 1993 be included, including historical information. Other feedback from stakeholders can be found throughout the document.

## **3.0 HISTORICAL OVERVIEW (EARLIEST FISHERIES TO 1977)**

### **3.1 Early records**

Europeans began to regularly visit Newfoundland and Nova Scotia's offshore banks in the sixteenth century, seeking fish and whales (de la Morandière 1962). Europeans fished on the banks during the period of calmest weather, from the spring until about September (Gough 1993). Both the French and English set up shore stations by the late sixteenth century as a base for their summer fisheries. Canseau (Canso), for example, was frequented by French vessels since the mid-part of the sixteenth century (de la Morandière 1962). At the time, the general phrase "Grand Banks" included the easternmost banks off Nova Scotia and Banquereau was known to be regularly used by the French fishermen of the seventeenth and eighteenth centuries (de la Morandière 1962). As Europeans settled Nova Scotia, they tended to fish closer to shore, where they could combine fishing with farming (Gough 1993). However, between the settlers who did venture offshore and the Americans and Europeans attracted by the rich cod grounds, there was a fishery on Nova Scotia's offshore banks from the early sixteenth century to the present. Some of this fishery likely occurred in areas within the GAA.

### **3.2 The Halibut Fishery**

#### **3.2.1 The Fishery in the Nineteenth Century**

In the mid-nineteenth century, Nova Scotians fished halibut (*Hippoglossus hippoglossus*) from large sailing vessels known as "bankers" in the Sable Island Bank and Banquereau area (Knight 1867). The exact location of the fishery on those two banks is not known, but it is likely that some activities occurred within the GAA. The halibut fishery was a small part of the summer groundfish fishery of the time, which focussed on cod (*Gadus morhua*). By 1867, the Nova Scotia fishermen considered that halibut were "decreasing in numbers" (Knight 1867: 3).

Although Nova Scotia fishermen considered halibut to be decreasing in the 1860s, the first vessels that reported fishing directly in the Gully itself came from Gloucester, Massachusetts, at about that time, seeking halibut.<sup>4</sup> In the early 1820s, there was increasing demand for halibut in the Boston market. Before this time, halibut were considered a nuisance to the cod fishermen of Massachusetts Bay and Cape Cod (Trumble et al. 1993). With increasing demand, the area near Boston rapidly became fished out and halibut fishermen moved farther and farther offshore. By 1848, Georges Bank had been fished out and vessels moved on in search of new grounds (Goode and Collins 1887). By the 1860s, the fresh halibut fishery had spread over the Scotian Shelf and out to the Grand Banks (Goode and Collins 1887). Boats in the salt fishery went even farther – to the Labrador coast, Davis Strait, and Greenland (Goode and Collins 1887).

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<sup>4</sup> Gloucester boats fished for cod on the banks of Nova Scotia and Newfoundland even earlier, in the mid-1700s (Goode and Collins 1887); however, it is likely that trips to the Gully were not made regularly until the halibut fishery became profitable.

By 1869 or 1870 at the latest, halibut were being caught in the Gully by Gloucester boats (Collins 1887). In 1879-1880, the Gully was one of the five major halibut grounds used by Gloucester fishermen (Goode and Collins 1887) and was indicated on charts of the time (Figure 6). Fishermen of the time considered the Gully to include the wide trough area at the head of the canyon, much of which is outside the GAA. Banquereau was another important ground and both the slope and the “southwest prong” of Banquereau next to the Gully were fished heavily (Collins 1887). The fishery in the Gully was carried out in 75 to 350 fathoms (137 to 640 metres) of water, while that along the slope of Banquereau occurred in 100 to 400 fathoms (183 to 732 metres) (Goode and Collins 1887).

During the 1870s and 1880s, the halibut fishery was carried out year-round. Many vessels took a short break in late December and captains would race to be the first to carry out a trip in January, when fish prices were high (Goode and Collins 1887). The fishermen tried to fill their schooners as quickly as possible and return to Gloucester before the other vessels, thus ensuring a better price for their fish (Goode and Collins 1887). While some fishermen continued to handline for catches, by the 1850s fishing by “bultow” or “trawling” was widespread (Knight 1867, Goode and Collins 1887). This technique was later called “line trawling,” then “longlining” to distinguish it from trawling (dragging) as we know it today. Fishermen set a line with a series of baited hooks attached at intervals and anchored to the bottom. Dories were used to set trawl-lines around the halibut schooners. Even in the late nineteenth century, these lines were one to two miles (1.6 to 3.2 kilometres) in length (Goode and Collins 1887).

The late 1860s and 1870s were periods of high catches, with trip totals much higher than those landed by halibut fishermen today. On May 22, 1877, the schooner G.P. Whitman arrived in Gloucester from a four-week trip to the Gully with what was believed to be the largest halibut catch ever from one trip: 137,510 pounds (62.37 metric tonnes) (Goode and Collins 1887). This tremendous catch was not the highest valued catch even in the historical period, as fish were plentiful at the time and prices were low. As new grounds were found, they would be fished heavily by a succession of vessels until the fish were “broken up” – in other words, the area was fished out (Goode and Collins 1887). By the 1880s, few new grounds were being found.

Captain Collins was the master of a Gloucester halibut schooner and an avid naturalist who contributed to the reports of the US Commission of Fish and Fisheries. He remarked on the distribution of halibut on the offshore banks: “From my own observations, I believe that bottom where the rocks are supplemented with a growth of corals is peculiarly attractive to halibut” (Collins 1887: 58). Collins commented that areas dense with halibut would often be very small – three-quarters of a mile (1.4 kilometres) in diameter or less – and would often be areas of very rough bottom (Collins 1887). The Gully corresponds well with the description of areas dense with halibut, having areas of corals and areas of very rough bottom.

Although the vessels were from Gloucester, many of their captains and crew were Nova Scotians. People from Gloucester referred to the Canadians as “provincials,” and the vast majority of provincials engaged in the Gloucester halibut fishery were originally from Nova Scotia. An inventory of Gloucester crews for 1879-1880 found that of 646 men employed on

ships, 393 were “provincials” (Goode and Collins 1887). The Nova Scotians were mostly from Cape Breton and fishing ports along the south and eastern shores of the province. Many travelled back and forth to Nova Scotia, keeping one foot in both countries. Others became permanent residents and prominent citizens of Gloucester (Gloucester’s Fish Fleet 1888).

### 3.2.2 The Fishery in the Twentieth Century

The US Bureau of Fisheries reported on landings from the fishing grounds used by the New England fishing fleet in the early part of the century. “The Gully” was one of the fishing grounds listed in the statistics of the 1920s and early 1930s, along with La Have Bank, Quereau Bank (Banquereau), Grand Bank, Browns Bank, and other grounds now within Canada’s exclusive economic zone (EEZ) (see e.g., Sette 1926, Fielder et al. 1934).

Records of activities in the Gully for the next 50 years are less detailed. In 1932, the North American Council on Fishery Investigations (Canada, Newfoundland, France and the United States) agreed to adopt standardized areas – known as statistical areas – for reporting (Fielder 1933). The Americans continued to report by both statistical area and fishing ground for some years after this decision (see e.g., Fielder et al. 1934, Fielder 1940), but by the late 1930s, no trips to the Gully were reported by American vessels and it no longer warranted a line of its own in the fishing statistics (e.g., Fielder 1940). However, Americans continued to fish Banquereau and Sable Island Bank, parts of which fall within the GAA. In the late 1930s, American landings from the Scotian Shelf and Grand Banks were about one-fifth of the total halibut landed by Canadian and American fishermen combined (McKenzie 1946a). American fishermen made a little over two-fifths of the halibut landings from the Banquereau-Sable Island Bank area (McKenzie 1946a).

In Canada, the statistical area method of reporting seems to have been readily adopted, at least for scientific reports. The Gully continued to be known and exploited as a fishing area. However, in Canada the Gully was divided in two for reporting purposes. Catches from there were grouped with Banquereau or with the eastern portion of Sable Island Bank and the adjacent slope (see Figure 7 for divisions). Landings from the Banquereau area, which included part of the Gully, were the highest of all the sub-areas in the late 1930s (Figure 7, McKenzie 1946a).

Although scientists grouped the Gully with adjacent areas, they realized it had particular importance for halibut. Researchers studying halibut targeted the Gully for a tagging study conducted in the late 1950s and early 1960s (Kohler 1964). McCracken (1958) indicated that the Gully and adjacent areas were important halibut fishing grounds (Figure 8).

With technological changes in the fishery, halibut assumed less prominence in the overall groundfish fishery. Other flounders (Pleuronectiformes), cod, haddock (*Melanogrammus aeglefinus*), pollock (*Pollachius virens*), and redfish (*Sebastes* sp.) were generally more

easily caught by otter trawl than halibut, and catches of those fish became more prominent in the fishing statistics.<sup>5</sup>

### **3.3 Fisheries for other Finfish Species**

#### 3.3.1 Groundfish

In the mid-nineteenth century, Nova Scotia fishermen were travelling in large sailing vessels to Sable Island Bank and Banquereau in search of cod (Knight 1867). The bank fishing vessels of the mid-nineteenth century ranged from 30 to 100 tons in size and carried out most of their activities on the offshore banks from April to June, before moving to grounds in the Gulf of St. Lawrence for much of the summer (Knight 1867).

In the late nineteenth and early twentieth century, Americans were prominent in the offshore fishery. Fishing for groundfish, mainly cod, was carried out on the southwestern part of Banquereau by the Gloucester schooners as well as by other banks schooners largely based in Lunenburg. These were large vessels for the time, 75 to 125 tons or more, and up to 145 feet (44 metres) long (Brinkhurst and Hord 1976). The schooners also fished on the portion of Sable Island Bank that lies within the Gully Assessment Area. However there are fewer references to Sable Island Bank in the historical records and Banquereau seems to have been a more heavily used area, at least during the nineteenth century.

By the 1930s, Spain and Portugal were fishing for cod off Nova Scotia and Newfoundland using motorized trawlers that towed nets over the ocean bottom (Brinkhurst and Hord 1976). Canadian and American vessels also fished the offshore banks in the 1930s. Canada's offshore banks east of Halifax were considered the most important for Canadian fishermen, and Banquereau and Saint Pierre Bank were the most important of these, not including the Grand Bank (McKenzie 1942). Both longliners and "steam drag trawlers" were in extensive use (McKenzie 1942). These vessels fished Banquereau almost year-round in the late 1930s, although activities were very limited in August and September (McKenzie 1942).

Haddock was also fished in the Banquereau and Sable Island Bank area by Canadian and American boats. The easternmost portion of Sable Island Bank, partially within the GAA, was regularly fished by Canadian fishermen in the late 1930s and early 1940s (Figure 9, McKenzie 1946b). However, the southwestern grounds of the Scotian Shelf were more important to the offshore haddock fishery of the time than the grounds east of Western Bank (McKenzie 1946b).

The International Convention for the Northwest Atlantic Fisheries (ICNAF) came into force in 1951, prompted by US and Canadian concern for the status of fisheries off their coasts. Parsons (1993) describes fisheries management off Canada's coasts during this period. In the 1950s, ICNAF began to regulate mesh controls in the ICNAF area. No limits on the amount of fishing or the size of catches were established until the early 1970s (Parsons 1993).

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<sup>5</sup> There have been high catches of halibut by otter trawl in some areas at certain times of year.

In the 1950s and 60s, the USSR expanded their fishery on the Scotian Shelf and slope. The USSR landed a greater variety of species, in greater numbers than the other countries throughout the 1960s and 70s (Table 1). Soviet vessels landed large numbers of American angler/monkfish (*Lophius americanus*), skates (Rajidae), and flounders, as well as the cod and redfish traditionally taken by the European countries. In the early 1960s, the USSR began a fishery for silver hake (*Merluccius bilinearis*) and by the early 1970s their vessels were taking more than 100,000 tonnes of silver hake annually from NAFO area 4W (Table 1). Silver hake was largely taken from the continental slope, but until the introduction of the small mesh gear line (SMGL), it was also caught in the deep waters of Emerald and LaHave Basins and, during August and September, over the fish's spawning grounds on Sable Island-Middle Bank (see Hare 1977). Although the Gully was not considered an area with particularly high concentrations of silver hake, records from observers from the late 1970s show that the Gully area was regularly used by vessels in that fishery (see later in this report).

Other countries were also carrying out fisheries on the Scotian Shelf, mainly for cod, but also for haddock, pollock, and redfishes (Table 2, Table 3). Spain and Portugal continued to be prominent in the cod fishery in the area in the late 1960s and 1970s. In the early 1970s, Spain was catching more cod than any other country in 4VSW, taking 25,000 to 30,000 tonnes each year (Table 3), mainly by pair trawling (Pinhorn and Halliday 1975).

In the 1960s and 1970s, Canada, the US, Japan, and the USSR were making large catches of redfish in 4VSW (Tables 3 and 4). The Gully was identified as one of four principal zones of redfish concentration over a broad area that included the Gulf of Maine, Scotian Shelf, and Gulf of St. Lawrence (Hare 1977). The fishery for redfish used both bottom and mid-water trawls.

Fisheries in 4VSW for cod and silver hake had their highest landings in the 1960s (cod) and 1970s (silver hake) (see Tables 2 and 3), well before Canada's declaration of a 200-mile fishing zone in 1977. After that declaration, the locations of fishing activities within Canada's zone began to be tracked in more detail. While it is not possible to break down the location of the cod, silver hake, and redfish fisheries in the 1970s within the NAFO sub-areas of 4VS and 4W by using existing databases, it is likely that a portion of those catches were obtained from the Gully Assessment Area. The Gully was included in maps showing major offshore fisheries in winter and spring, based on information from Canadian surveillance data collected from 1974-1976 (Figures 10 and 11, Hare 1977). Later observations by fisheries observers showed activities occurring in the Gully (see later in this report).

### 3.3.2 Small pelagics

Large amounts of mackerel (*Scomber scombrus*) together with the groundfish argentine (*Argentina silus*) were caught in 4W throughout the 1960s and 70s but these catches came mostly from the continental slope south of Western Bank and further southwest (see Halliday 1974, Koeller 1982). An extensive fishery for herring (*Clupea harengus*) was carried out in 4W and 4VS, on Banquereau, Sable Island, Western, and Emerald Banks (Hare 1977,

Stephenson 1987). Parsons and Hodder (1972) sampled herring from the slope of Banquereau, by the Southwest Peak, in March 1971, one of the few locations where they sampled herring during their offshore survey. This suggests that some of this fishery was carried out within the GAA.

### 3.3.3 Large pelagics

American vessels fished, at least casually, for swordfish (*Xiphias gladius*) off Nova Scotia as early as the 1880s (Gibson 1998), while Canadian fishermen have targeted swordfish on the Scotian Shelf since the early 1900s (DFO 1988, Gibson 1998). The Canadian fishery was quite small until the 1930s. It appears to have moved further and further offshore, until by the 1960s, most swordfish were being taken along the slope of the Scotian Shelf and Laurentian Channel (see Gibson 1998, Fitzgerald 2000). Before 1962, the Canadian fishery was solely a harpoon fishery. Late in the 1962 fishing season, the pelagic longline fishery for swordfish was introduced and expanded rapidly, with Canadian catches from 1963 almost quadruple those of 1962 (Tibbo 1964). By August 1963, the edge of the shelf was "crowded with American and Canadian longliners" (Gibson 1998: 32). The edge and slope of the shelf, including the mouth of the Gully, was and is a key swordfish fishing area of the Scotian Shelf (Figure 12).

In 1969, the US Food and Drug Administration banned the market sale of swordfish with concentrations of mercury greater than 5/10 ppm (Gibson 1998) and shortly after, the US banned imports of swordfish because of concern about mercury levels. Most swordfish landed in Canada was exported to the US and this effectively ended the Canadian swordfish fishery until 1979, when the mercury regulations were changed (DFO 1988). Canadian landings in the re-opened fishery have not reached their pre-ban levels.

## **3.4 Invertebrate fisheries**

Shortfin squid were caught in great numbers along the shelf edge in the mid- and late 1970s and that fishery will be discussed in the post-1977 section. There was no directed fishery for other invertebrates in the GAA prior to 1977.

## **3.5 Whaling**

Modern whaling occurred on the Scotian Shelf from 1962 to 1972. Fin whales were the main species caught off Nova Scotia by whalers. Minke whales were also captured in this fishery, as were northern bottlenose whales, and several other species. Mitchell (1974) reported that 87 bottlenose whales were taken off Nova Scotia and Newfoundland from 1962 to 1967, mainly in the area of Sable Island and the edge of the Grand Bank. Sixty-two of those whales were taken in 1962 and 1963 (Committee for Whaling Statistics 1964).

Vessels based in Blandford carried out a whaling operation from 1962 to 1972 (Gillespie 1962, Sutcliffe and Brodie 1977). In the first years of the station, one of their vessels focussed on small whales, such as the northern bottlenose, due to the vessel's relatively small size and lack of power (Jenkins 1990). In an article on whaling off Nova Scotia, Karl Karlsen, the station's owner, commented "We worked around Sable Island and found some very interesting spots in the deep water in that area. We struck schools of bottlenose whales" (Gillespie 1962: 8). Records from whaling stations show that at least 24 northern bottlenose whales were caught in the vicinity of the Gully from 1964 to 1967 (Reeves et al. 1993) by the Blandford whalers.<sup>6</sup> Fin and minke whales were also caught by the whalers in the Gully area (see Sutcliffe and Brodie 1977). Twenty-nine whales, all fin whales, were taken by the Blandford whalers in the area of the Gully, trough and adjacent slope from 1968 to 1972 (see Sutcliffe and Brodie 1977). Canada's Minister of Fisheries announced a ban on whaling at the end of 1972 (Jenkins 1990).

#### **4.0 FISHERIES 1977 TO PRESENT**

Most foreign fishing vessels were excluded from Canada's 200-nautical mile fishing zone after 1977 and Canada assumed management of fisheries within this region (see Parsons (1993) for more detail on this development). Foreign boats continued to fish for short-fin squid, silver hake, and redfish within Canada's fishing zone in the vicinity of the Gully. However, there has been a steady decline in the foreign vessels fishing off Nova Scotia and few licenses have been issued to foreign vessels in the last few years. The Canadian fishery on the offshore banks expanded after 1977. In most fisheries, catches from Canadian vessels made up the bulk of landings from the general area of 4VSW after 1977.

##### **4.1 Groundfish (except halibut)**

Canadian vessels expanded their use of the offshore banks in the groundfish fishery in the 1980s. Cod, haddock, pollock, redfish, and silver hake were fished in the Gully and adjacent areas. Most landings were from large trawlers. These vessels catch fish by towing cone-shaped nets along the ocean floor. The net is held open by rectangular otterboards – the "doors" – that are attached to cables at either end of the net. Weights on the bottom of the net and floats on the top of it also serve to hold the net open. Side trawlers haul the net over the side of the vessel, while stern trawlers haul it up a stern ramp designed for that purpose. Most trawlers in current use are stern trawlers.

After more than a hundred years of generally high landings, with occasional periods of low catches, stocks of the key groundfish species of cod and haddock collapsed in the early 1990s. The fishery for those species was put under moratorium in September 1993 on the eastern Scotian Shelf (Mohn and MacEachern 1994, Lear 1998). Fisheries for other groundfish species continued, although at a much lower level than before the moratorium.

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<sup>6</sup> Records for 1962 and 1963 could not be found.

#### 4.1.1 Cod, haddock, pollock

In the 1980s and early 1990s, catches of cod, haddock, and pollock from the GAA by the domestic fishery were much higher than they are today. Most of the landings were made by large trawlers over 65 feet in length, such as the many vessels owned by National Sea Products (now Highliner Foods) and based in Lunenburg, Louisbourg, and Canso. The GAA was regularly used, particularly the sides of the Gully and the small bank in the trough known as Gilligan's Island (see Figures 13, 14, and 15). The GAA continued to be heavily used in the late 1980s and early 1990s, even as groundfish fishing activity in the general area declined (Figures 16 and 17, Table 4). Most trawling occurred at depths of 200 metres or less and there was little or no trawling activity below depths of about 400 metres in the central part of the canyon.

In the early 1990s, approximately 30 to 60 percent of the pollock caught by trawlers in 4VSc, 4VSe, 4Wf, and 4Wg – the comparison area – came from the GAA (Table 6). The GAA was also important for haddock in the area, although the western Scotian Shelf was more important overall for haddock. Catches from the GAA made up between 8 and 26 percent of cod catches in the comparison area from 1990 to 1992. Significant amounts of non-targeted species also came from the Gully. Of the halibut and cusk caught as bycatch by trawlers in the comparison area, most came from the GAA.

Portugal and Canada had a bilateral agreement whereby Portugal was given an allocation for cod in 4VSW from 1983 to 1985 (Resource Allocation Branch 1985, Table 5). Some of this fishery was carried out in the GAA, on the eastern side of the Gully and the southwest peak of Banquereau and generally at depths less than 200 metres (Figure 18).

Although directed fisheries for cod and haddock have been under moratorium since September 1993 on the eastern Scotian Shelf (including the GAA), cod and haddock are still taken as bycatch in fisheries for halibut, redfish, and pollock. These incidental catches of cod and haddock have been very small compared to the directed catches of previous periods. In total, 13 tonnes of haddock were landed from the GAA over the six-year period from 1996 to 2001 (Table 7). Fifty-one tonnes of cod were taken over the same period (Table 7, Figure 19). This is a small fraction of the 1076 tonnes of cod that were taken in 1990 alone by trawlers working in the Gully area (Table 6). Recent summer research vessel surveys show the distribution of cod and haddock within the GAA at that time of year (Figures 20 and 21). Very small amounts of cod and haddock have been caught by the survey in the GAA in recent years, consistent with the very low catch rates on the rest of the eastern Scotian Shelf.

Although pollock is not under moratorium on the eastern Scotian Shelf, landings from the GAA have been much smaller than previous landings for the area. The total catch of pollock in the GAA was 0.63 tonnes in 2000 and 2 tonnes in 2001 (Table 7). In contrast, trawlers caught 2142 tonnes of pollock in the GAA in 1990 and 2702 tonnes in 1991. In essence, there is no directed fishery for pollock in the GAA at the present time.

#### 4.1.2 Flounders

Three flatfishes – witch flounder (*Glyptocephalus cynoglossus*), yellowtail flounder (*Limanda ferruginea*), and American plaice (*Hippoglossoides platessoides*) – are managed together under one total allowable catch (TAC) due to inconsistencies in recording the different species at landing (DFO 2001a). From 1997, witch flounder was given a separate assessment but is still part of the general flatfish TAC. Most catches from these flounder fisheries have traditionally been by large trawlers, with some effort by Danish seiners and occasionally longliners (Fowler and Stobo 2000). Flatfish are often not recorded separately in landing data; however, fishermen report that they direct for particular species (Fowler and Stobo 2000).

In the late 1970s and 1980s, witch flounder, yellowtail flounder, and plaice were regularly fished in the GAA. Stakeholders have stated that flounders were fished in the general vicinity of the Gully in the 1980s and 1990s. Before 1987, yellowtail was fairly evenly distributed over Western Bank, Sable Island Bank, and Banquereau (DFO 2001a). After that, the declining population was centred in two areas of abundance, one over Sable Island Bank, and one over the southeast corner of Banquereau, next to the Laurentian Channel. From 1987 to about 1995, the fishery for yellowtail in 4VW was concentrated on the southeast corner of Banquereau (DFO 2001a, see also Figure 22). Some effort occurred within the GAA, in the trough and along the eastern side of the canyon (Figures 22 and 23), but the total flounder catch in the GAA for the period 1990-1995 was just over one percent of the catch from the comparison area (Table 6). The flatfish fisheries occurred in waters less than 200 metres deep. The fishery for yellowtail rapidly declined after 1995 (DFO 2001a).

Plaice are more widely distributed in 4VW than yellowtail, but much of the fishery occurs where it is also possible to take yellowtail flounder. Witch flounder is primarily found in water deeper than 183 metres (DFO 1997b). According to research vessel trawl surveys, there are concentrations of witch flounder in the Gully, particularly of small flounders not yet available to the fishery (DFO 1997b).

Since 1992, most of the flatfish fisheries on the eastern Scotian Shelf have been carried out by Danish seine, with about two-thirds of the landings of plaice and yellowtail coming from Danish seine and one-third from otter trawl (Fowler and Stobo 2000). The remaining yellowtail fishery in 4VS occurs on the southeast corner of Banquereau, as does much of the fishery for plaice (M. Fowler pers. comm.). In 4VW, witch flounder is caught mostly at the edge of the Laurentian Channel, the southeast corner of Banquereau, and in the holes above Banquereau (DFO 1997b). For the last few years, landings of flounders have not reached the level of the total allowable catch (DFO 2001a). Very few flounders have been caught from the GAA in recent years compared to Banquereau and nearby areas (see Figure 24 and Table 7), suggesting little to no directed activity for flounders in the GAA in the last six years.

### 4.1.3 Redfish

Bilateral agreements allowed France, Japan, the US, and the USSR to carry out fisheries for redfish in 4VWX during some periods of the late 1970s and 1980s (see Table 5 for foreign catches of this species). These allocations were much smaller than previous redfish fisheries by those countries and a fraction of the Canadian landings. Observer records show that fisheries within the GAA occurred along the sides of the Gully and the edge of the shelf, at depths between 200 and 500 metres, and occasionally deeper (Figure 25).

Most domestic redfish catches are made by large trawlers. In the early 1990s, the Gully seems to have been more important for the domestic redfish fishery than it is presently, with large trawlers taking between 4 and 33 percent of the total comparison area catch from the GAA in the period from 1990 to 1993 (Table 6). Based on observer records, most of the GAA redfish fishery in the late 1980s and early 1990s occurred on the small bank at the head of the Gully, along the eastern side of the Gully, and along the slope of the shelf at the mouth of the Gully (Figure 26). Most of the fishery occurred beyond depths of at least 200 metres, with many tracks between the 200-metre and 1000-metre isobath. This fishery is carried out primarily by bottom trawl and occasionally by midwater trawl. When redfish migrate upwards in the water column at night, they become available to midwater trawl.

NAFO sub-unit area 4VSc has high landings of redfish; however, relatively little of that catch has come from the GAA in recent years. From 1996-2001, very few vessels directed for redfish in the area. Catches from the GAA were, at most, 3 percent of catches made in the comparison area for each of those years (Table 7). During this period, the largest catches in the GAA were taken from the edge of the shelf at the mouth of the Gully, over depths of 200 to 1000 metres (Figure 28). In the two-year period 2000-2001, two large trawlers caught just over 100 tonnes of redfish in the GAA. However, those totals are small compared to the total catches for the comparison area, where 4339 tonnes of redfish were caught over the same two-year period (Table 7, see also Figure 27). Small trawlers (less than 65 feet) reported only 3.36 tonnes of redfish caught in the GAA for the 1996 to 2001 period. Very small amounts of redfish are caught as bycatch in the halibut longline fishery.

### 4.1.4 Silver hake

The fishery for silver hake has been largely carried out by foreign vessels using trawls with small meshed gear. Starting in 1977, the fishery occurred only west of 60°W and south of the small mesh gear line (SMGL), in an area known as the silver hake box. This restricted the fishery to depths greater than about 100 metres. The silver hake box was extended to 59°W, at the mouth of the Gully, in 1979. From 1977 to 1979, certain Russian and Cuban vessels were allowed to fish shoreward of the SMGL and eastward of 59°W (Waldron and Sinclair 1984) and extensive activity occurred along both sides of the Gully and on the southwest peak of Banquereau (Figure 29). After 1980, all vessels were prohibited from fishing shoreward of the SMGL (Waldron and Sinclair 1984). In 1994, further restrictions were introduced to reduce bycatches of cod, haddock, and pollock: the SMGL was moved further offshore, approximating the 190-metre isobath, and separator grates became

mandatory (Showell and Fanning 1999). Between 1980 and 1983, fishing as far east as 57°W was permitted for certain license holders; then, from 1984 to 1999, the eastward extension was reduced to 59°W (Showell and Fanning 1999). Some vessels were granted exemptions to these restrictions (Showell and Fanning 1999). As late as 1999, one vessel was permitted to fish for silver hake as far east as 57°30'; however, the license conditions prohibited fishing within the Gully AOI (see Fenton et al. 2002). All vessels currently fish west of 59°W.

Both effort and total catches in the foreign silver hake fishery dropped steadily in the 1990s (GTA Consultants 1999) and all quota has been allocated to the domestic fleet since 1998 (DFO 2000). Since 1995, there has been a silver hake fishery in Emerald and LaHave Basins conducted by domestic vessels. Scotian Shelf catches and the TAC dropped in the late 1990s. In 1997, only 17,000 metric tonnes of the overall total allowable catch of 50,000 metric tonnes were landed (DFO 2001d). By 2000, the TAC had dropped to 20,000 tonnes; only 14,500 tonnes were landed (FRCC 2002).

While some vessels are known to have fished at the mouth of the Gully, west of 59°W, in 1998 (GTA Consultants 1999, see also Figure 29), most of the fishery for silver hake has occurred in the western portion of the silver hake box and in the basins, well away from the GAA. The few domestic landings of silver hake in the GAA are bycatch from other fisheries (Figure 30).

#### 4.1.5 Value of the GAA Catch

Since the closure of the fisheries for cod and haddock in 1993, landings of groundfish (except halibut) from the GAA have been negligible. However, groundfish fisheries from the area had a high value prior to the closure. As an example, values of landings from the GAA for 1990 and 1991 for cod, haddock, and pollock were calculated based on average values for the year (Table 8). In 1990, the value of cod, haddock, and pollock landed from the GAA was estimated to be \$2.6 million; in 1991 it was \$3 million.

## **4.2 Halibut**

After 1977, the Gully continued to be a key area for the halibut fishery. During the late 1970s and 1980s, halibut landings were a small percentage of the groundfish fishery. However, as the populations of other groundfish species declined, halibut has gained more importance. Landings of halibut from the comparison area have stayed relatively stable over the last 5 years, with landings between 183 and 290 tonnes each year (Table 7).

### 4.2.1 Fishing methods and operational rules

The halibut fishery of today is carried out by longline, in much the same areas that it was 100 years ago. Kenchington and Halliday (1994) provide extensive detail on the practice of

longline fishing in the Scotia-Fundy region. A brief outline of the methods used in this fishery can be found in Appendix 1.

Conservation Harvesting Plans are prepared for each gear sector to outline the operational rules for each fishery. Integrated Fisheries Management Plans and license conditions set out further conditions on how the fishery will be conducted. For 2001, the quota for halibut (all gears) was 1150 tonnes for NAFO Divisions 3NOPs4VWX5Zc (Scotian Shelf and Grand Banks). Details on how this quota is allocated can be found in the Groundfish Integrated Fisheries Management Plan (DFO 2000, 2002).

#### 4.2.2 Grounds fished in the GAA

According to commercial landings data, the western slope of the Gully canyon, the southwest peak of Banquereau and areas of the trough within the GAA are used regularly by halibut fishermen at the present time (Figures 32 and 33). Feeder canyons on the western side of the Gully are regularly used and some have been given names, such as two canyons known as Hell's Kitchen and The Crack (Figure 15). Most catches are made between the 200-metre and 500-metre isobath, with reports of gear set to 350 or 400 fathoms (640 or 730 metres).<sup>7</sup> The Gully is targeted by fishermen taking part in the commercial index survey (Figures 34 to 37). Halibut fishermen often return to the same grounds every year. Those using the GAA have their own preferred grounds within it.

Halibut from the GAA is a significant proportion of halibut caught on the eastern Scotian Shelf: catches from the Gully area have been between about one-quarter and one-half of all catches in the comparison area for the last few years (Table 7). While there are other important areas within the comparison area, the Gully is one of the two or three most important areas on the eastern Scotian Shelf (Figure 38). The GAA is also a significant fishing area overall. In 2001, just over 47 tonnes of halibut were taken from the GAA during the commercial fishery (not including the halibut survey). This is about 4 percent of the 2001 TAC of 1150 tonnes for the Scotian Shelf and Grand Banks. The industry survey for halibut has taken between 10 and 20 tonnes of halibut from the GAA each year since 1998. This represents between 10 and 15 percent of the total catch for the survey.<sup>8</sup>

Successful halibuting involves detailed knowledge of individual grounds, often at a very fine scale (Kenchington and Halliday 1994). There are a limited number of good halibut grounds, and experience is important in knowing where there is good bottom (Kenchington and Halliday 1994). Thus, particular grounds within the GAA are important to different halibut fishermen. They may know some parts of the GAA very well, and return to them year after year. Other grounds within the GAA may not be used at all by some fishermen. For example, some fishermen fish only north of The Crack (see Figure 33), others fish only near

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<sup>7</sup> Kenchington and Halliday (1994) reported that some fishermen with less than 45-foot boats fished as deep as 500 fathoms (915 metres).

<sup>8</sup> Catches from the industry survey are not part of the TAC and are not included in the commercial landings database (ZIF). A maximum of 100 tonnes on top of the TAC is allowed each year for the industry survey (FRCC 2002). This amount is usually caught (Wilson pers. comm.).

the mouth of the Gully. Others may make broader use of the whole GAA. According to the fishermen interviewed by Kenchington and Halliday (1994), it is easy to fish out small areas and fishermen may try several different spots known to them in search of good catches.

#### 4.2.3 Vessels and communities involved

From 1996-2001, approximately 43 longline vessels fished in the Gully Assessment Area, according to the commercial landings database. Over the period 2000 and 2001, 24 longline vessels in total fished in the GAA. Not all vessels were involved every year; however, nine of those vessels fished for halibut and other groundfish in the GAA at least four of the years from 1996 to 2001. Two other vessels did not fish in the GAA before 1999 but have fished there for the last three years. The nine vessels that fished in four of the six years from 1996 to 2001 and the two other vessels who fished there every year since 1999 are considered the core users for the purposes of this report. This core group of eleven vessels has taken over half the halibut caught in the GAA in the last two years (Tables 9 and 10). One of the core vessels is not currently active.

Five of the ten active core vessels are less than 45 feet in length, three are in the 45 to 65 foot category, and two are greater than 65 feet in length. The small vessels took just over half of the catch in the GAA in the year 2000, with the other two size classes splitting the remainder of the catch (Table 11).<sup>9</sup> In the year 2001, two vessels that had previously not fished in the GAA took substantial catches there. These vessels likely replaced existing vessels used by fishermen who were already fishing in the Gully.

Most landings from the halibut fishery in the GAA are from vessels based in Sambro, with Sambro vessels landing 66 percent of the halibut catch in 2000 and 69 percent in 2001 (Tables 13 and 14). Half of the core vessels that make regular use of the GAA are based in Sambro. However, individual vessels from Shelburne County (Woods Harbour, Sandy Point, and Shelburne), Eastern Passage, and Ecum Secum are also part of the core group. There are also vessels that make less habitual use of the GAA, with longline vessels from Sambro, Liverpool, the eastern shore, and from several ports in Shelburne County fishing periodically in the GAA over the last six years, and vessels from other areas occasionally involved. Most trips are made during the spring and early summer; however, some vessels from Sambro make substantial catches in January and February (Tables 15 and 16). For the vessels that return to the Gully year after year, this area is a significant ground.

#### 4.2.4 Value of GAA catch

In 2000, the value of halibut in the Scotia-Fundy fishery was \$8.73/kilogram, based on DFO landing and value statistics averaged over the year. In 1999, the averaged value was \$7.72/kilogram. Based on those values, the 2000 halibut catch of 39.2 tonnes from the GAA was worth \$342,216 and the 1999 catch of 62.65 tonnes was worth \$546,934. However,

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<sup>9</sup> Note that this description is intended to illustrate the types of vessels fishing in the GAA in recent years and is not a reflection of how quota is allocated among the different vessel classes.

these figures are based on average values and do not reflect tactics taken by fishermen to maximize the value of their catches. The price of halibut in the New England fresh fish market in January and February is higher than it is in June, and several Sambro vessels fish in the GAA at that time of year to take advantage of the higher prices. The average value of American imports of fresh Atlantic halibut in January-February 2000 was US \$12.33/kilogram (C\$17.71/kilogram).<sup>10</sup> By July 2000, this value, as averaged over the year, had fallen to US \$9.26/kilogram (C\$13.70). In January-February 1999, the value was US \$9.39/kilogram (C\$14.27/kilogram). By July 1999, the value as averaged over the year, had fallen to US\$7.65/kilogram (C\$11.31/kilogram). This is the value as reported by importers and may represent the value paid to a fish buyer and not the amount paid directly to the fisherman. Nonetheless, the substantially higher per kilogram value earlier in the year indicates that the value averaged over the year does not necessarily reflect the value of all catches from the GAA.

Net revenue is not a measure of true economic value and a full economic assessment would consider costs to fishermen in generating that income, as well as benefits for other sectors. Revenue generated by the halibut fishery leads to economic spin-offs in other areas. The extended value of fisheries varies and is dependent on local economic conditions. DFO's Scotia-Fundy groundfish management plan uses a multiplier of 2.1; for example, for every \$1 million generated by fishing vessels and fish processors, another \$2.1 million is generated in GDP (DFO 2002c).

#### 4.2.5 Incidental catches

Other species are caught incidentally by longline vessels targeting halibut. A bycatch profile prepared for the halibut survey, based on the 1998 and 1999 surveys, showed that cusk (*Brosme brosme*), white hake (*Urophycis tenuis*), cod, haddock, skates, dogfishes (*Centroscyllium fabricii*, *Squalus acanthias*), and wolffishes (*Anarhichas* spp.) were the most common species caught incidentally in the whole area of the survey, with many other species caught in very low numbers (Zwanenburg and Wilson 2000). Examination of observer records from the GAA show that these species are also caught as bycatch within the GAA. In particular, large numbers of white hake and cusk have been caught by longliners in recent years.

Longliners formerly directed for white hake and took most of the catches on the Scotian Shelf in the late 1990s (DFO 2001e). Between 1990 and 2000, 73 percent of white hake was landed as main species in 4VS (DFO 2002d). Fishermen are no longer supposed to direct for this species and DFO monitors levels of bycatches (DFO 2002d). Since 1996, catches of white hake in the GAA by longliners have ranged from a high of 19 tonnes in 1998 to a low of 2 tonnes in 2000 (Table 7). This compares with catches of 64 tonnes of halibut in 1998 and 39 tonnes of halibut in 2000. The catch of white hake from the GAA was just over 11 percent of the total catch of the comparison area for the period from 1996-2001. As a

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<sup>10</sup> Exchange values reflect the exchange rate during the month discussed and are taken from the Bank of Canada website, <http://www.bankofcanada.ca/en/exchange.htm>.

comparison, 25 percent of the total halibut catch in the comparison area came from the GAA during that period.

There is presently no directed fishery for cusk and it was put under a bycatch limitation in 1999 (DFO 2001b). There is concern about the state of the stock, as research vessel surveys show a collapse of the stock in 1992 and no indications of subsequent recovery (DFO 2001b). Most of the cusk caught on the Scotian Shelf are caught on the southwestern part of the shelf and landings from 4VSW are very low in comparison (DFO 2001b). However, within 4VSW, the Gully and adjacent areas appear to be a key location for cusk (see Figure 39). During the period 1996-2001, 31 percent of the cusk caught by longliners in the comparison area came from the GAA (Table 7). In the early 1990s, the GAA was the source of much of the cusk bycatch for the large trawlers fishing within the comparison area (Table 6).

### 4.3 Large Pelagics

#### 4.3.1 Swordfish (*Xiphias gladius*)

Swordfish is caught by pelagic longliners all along the edge of the continental shelf from Georges Bank to the Grand Banks, including the mouth of the Gully.<sup>11</sup> Quotas in this fishery have been steadily dropping and Canada's TAC for 2000, 2001, and 2002 was set at 1018 tonnes per year (both longline and harpoon), about half of the 1991 and 1992 TACs and one-third of the 1990 TAC (see DFO n.d.). The Swordfish Integrated Fisheries Management Plan (DFO n.d.) describes the major management measures for this fishery. License conditions set out further details on how the fishery is to be conducted.

The lines are set near the surface (see Figure A-1), suspended over depths greater than 150 metres. This fishery involves very long lines, usually more than 3 nautical miles in length, and occasionally up to 40 nautical miles in length or more. The lines are not anchored and may drift from the original setting location. Much of the fishery takes place seaward of the 200-metre isobath, near the shelf edge and over the slope, and the selection of areas to fish is highly dependent on temperature. Swordfish are found in areas where waters are above 15° Celsius

##### 4.3.1.1 *Catches and grounds fished in the GAA*

Because of the nature of this fishery – very long lines that drift – it is not possible to fully depict and assess the swordfish fishing activities in the Gully. Records from observers show the location of sets within the GAA; however, there are relatively few observer records from the area in the 1996-2001 period (Figure 40). Landings (ZIF) data have been used as a general guide to the location of the fishery in the GAA (Figure 41). The dots shown on the ZIF maps represent only a single location for the set, and sets – and thus, fishing activity –

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<sup>11</sup> Many of the vessels involved in the halibut fishery in the GAA have harpoon licenses for swordfish; however, there have been no records of swordfish caught by harpoon in the GAA in the last 3 years.

may cover a much greater distance than shown by the single dot on the map. According to the ZIF data, most of the activity in the GAA is at either side of the mouth of the canyon, where it meets the slope, although some swordfish are taken directly over the mouth of the canyon. Discussions with fishermen should establish if this is an accurate portrayal of the location of this fishery, or if this is an artifact of how catch locations are recorded and entered into the ZIF database. In general, the GAA is part of a continuum of swordfish fishing activity that occurs along the slope of the Scotian Shelf (Figure 42).

Just under 32 percent of the comparison area's landings have been from the GAA over the past 6 years (Table 7). Catches from the GAA accounted for 10 percent of Canada's swordfish TAC of 1018 tonnes in 2001. However, catches from the GAA appear to be highly variable. While 102 tonnes were landed from the GAA in 2001, only 28 tonnes were taken in 1999 (Table 7) – just 2.5 percent of Canada's TAC of 1095 tonnes. Again, this apparent variability may be due to the nature of this fishery – it seeks out certain water temperatures and uses drifting lines – and how the location of catches are recorded.

#### *4.3.1.2 Vessels and communities involved*

Forty different longline vessels fished for swordfish in the GAA over the period 1996-2001. Not all vessels were involved every year. Seven of those vessels reported landings from the GAA in at least four of those six years and two others travelled to the Gully in three of the last four years; those vessels are considered the core users of the GAA for the purpose of this report. One of those vessels is not currently active. The eight active core vessels are based in several different ports along the south and eastern shores. The core group definition for swordfish is less stringent than that for halibut and there has generally been a greater turnover in vessels using the GAA from year to year. The core vessels accounted for 80 percent of the swordfish caught in the GAA in 2000, but only 38 percent in 2001 (Tables 17 and 18). A few of the swordfish vessels also participate in the halibut longline fishery; however, only one vessel fits the core vessel definition for both the halibut and swordfish fishery in the GAA. In recent years, most swordfish in the GAA has been taken by small vessels, less than 45 feet in length (Tables 19 and 20).

Longline vessels based in Shelburne County (Woods Harbour, Sandy Point, Clarks Harbour, Jordan Falls, and Gunning Cove) are the major participants in the swordfish fishery in the GAA (Tables 21 and 22). However, large catches are also made by vessels from West Dover, Port Medway, Sambro, Lower Argyle, and Eastern Passage. In this fishery, landings are made in communities other than the home port fairly regularly. The communities of Woods Harbour, Sambro, Sandy Point, and Shelburne reported the largest landings of swordfish from the GAA in 2000 and 2001 (Tables 23 and 24).

Swordfish migrate north in the spring and summer, and south in the fall. The swordfish fishery occurs during the summer and early fall, when waters are warm and swordfish are present. Most landings from the GAA are taken in August (Tables 25 and 26).

#### 4.3.1.3 Value of GAA catch

The average value of swordfish taken in the Scotia-Fundy fishery in 2000 was \$8.18/kilogram, based on DFO landings and value statistics. In 1999, the average value was \$7.51/kilogram. Based on that, the value of the swordfish fishery in the GAA was \$498,816 in 2000 and \$213,284 in 1999. As stated earlier, a full economic assessment would consider both operating costs and benefits. The direct revenue generated by catches of swordfish has economic spin-offs in other sectors. The extended value of the catch is related to economic conditions and the economic multiplier will vary according to those conditions. DFO uses a multiplier of 2.1 to calculate the extended value of groundfish fisheries.

#### 4.3.2 Albacore, bigeye and yellowfin tunas (*Thunnus alalunga*, *T. obesus*, *T. albacares*)

There is a fishery for albacore, bigeye, and yellowfin tunas along the slope, including the area of the Gully (Figure 43). These tunas are commonly referred to as “other” tunas to distinguish this fishery from the fishery for bluefin tuna. The other tuna fishery is carried out by many of the same vessels involved in the swordfish fishery. Albacore, bigeye, and yellowfin tunas were caught only as bycatch in the swordfish and shark fisheries until the mid-1990s, when some vessels began to direct for tunas (GTA Consultants 1999). The development of this fishery has been spurred by declining swordfish stocks. Most of the Scotia-Fundy fishery occurs on the southwestern part of the Scotian Shelf and the adjacent slope. Occurrence of these tunas on the eastern Scotian Shelf in general has been characterized as “incidental” (Stone 1998). Stone (1998) reported that bycatch of tunas in the Gully in the mid-1990s was low compared with other areas of the shelf. GTA Consultants (1998) reported that only modest amounts of tuna have been caught in the Gully. Detailed examination of recent landings confirms that the GAA continues to play a small role in the tuna fishery (Table 7).

Landings of other tunas from within the GAA have been highly variable; however, very small numbers are involved. The fishery in both the GAA and the comparison area is relatively minor compared to the western Scotian Shelf. A total of only 9.2 tonnes of tunas were landed from the GAA during the entire period 1996-2001. Yellowfin tuna in particular has very low landings from the GAA and the eastern Scotian Shelf.

In 1998 and 1999, catches of yellowfin, albacore, and bigeye tunas from the GAA were less than 5 percent of catches in the comparison area (Table 7). In 2000, catches from the GAA were 32 percent of catches in the comparison area and in 2001 they were 21 percent of catches in the comparison area. More than 50 percent of the catches of albacore tuna in the comparison area were from the GAA in both 2000 and 2001; again, relatively small numbers were involved. Very little yellowfin tuna has been caught in the GAA.

About 23 longline vessels landed tuna from the GAA in 1996-2001. Many of those landed very small amounts and were catching tuna as bycatch while directing for swordfish. At most three or four vessels have directed for tuna in the GAA in the last few years. The fishery is still developing and preferred areas may change as more is known about fishing

methods. The fishery occurs from May to November with most landings from the Gully area occurring in August.

#### 4.3.3 Sharks

There has been a directed fishery for porbeagle (*Lamna nasus*) and blue shark (*Prionace glauca*) along the slope, including in the GAA, since the early 1990s (Figure 44). There are only 22 license holders in the porbeagle/blue shark fishery and two others who hold licenses solely for blue shark (DFO 1999b). The fishery is still developing and continues to be considered an exploratory fishery (DFO 1999b, GTA Consultants 1999). There is very little directed effort for blue shark (DFO 1999b). Catches of porbeagle in the GAA are a relatively small proportion of catches in the shark fishery and were less than 8 percent of the catches in the comparison area for the period 1996-2001 (Table 7). Short-fin mako sharks are taken as bycatch in the porbeagle/blue shark fishery and all three shark species are taken as bycatch in the swordfish and the other tuna fisheries.

About 40 longline vessels landed shark from the GAA in the period from 1996-2001. Most of these landings were very small amounts taken as bycatch in the swordfish fishery. Two large (over 100-foot) vessels have directed for porbeagle in the GAA almost every year for the past six years. Those two vessels account for most of the shark catch on the Scotian Shelf (GTA Consultants 1999). Several other vessels based in Sambro and in Shelburne County have licenses to fish for shark as well as halibut and swordfish. The amounts they landed from the GAA in the last five years were very small (Table 7). The fishery is carried out from April to October.

#### 4.3.4 Incidental catches

The fisheries for large pelagic species catch other, non-targetted pelagic species. There has been no analysis of bycatch taken by pelagic fisheries within the GAA. However, Smith (2001) reported on incidental catch in large pelagic fisheries from the Canadian Atlantic in general, based on reports by fisheries observers. He found that the following non-commercial species had a catch rate greater than 0.5/1000 hooks in either 1999 or 2000:<sup>12</sup>

- lancetfish (*Alepisaurus ferox*)
- sea turtles (leatherbacks and loggerheads)
- mahi-mahi (*Coryphaena hippurus*, common dolphinfish)
- pelagic stingray (*Pteroplatytrygon violacea*).

Bluefin tuna – a species commercially fished inshore – also had a catch rate higher than 0.5/1000 hooks. As well, blue sharks, a species also fished commercially, had one of the highest rates of capture – higher than either swordfish or the commercially fished tunas for the two years analysed, 2000 and 2001 (Smith 2001). These sharks are caught incidentally

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<sup>12</sup> The commercially targetted swordfish had a catch rate of 7.08/1000 hooks in 1999 and 8.96/1000 hooks in 2000, while the yellowfin tuna, also targetted, had a catch rate of 0.57/1000 hooks in 1999 and 1.91/1000 hooks in 2000.

by swordfish and tuna fishermen as well as by shark fishermen. While many are released alive, their survivability afterwards is not known. There were infrequent reports of catches of marine mammals (e.g., pilot whales, and seals), and seabirds (e.g., Great Black-Backed Gulls, Herring Gulls, and Shearwaters).

#### **4.4 Invertebrates**

##### 4.4.1 Short-fin Squid (*Illex illecebrosus*)

Squid was first caught in high numbers by foreign vessels during the early 1970s. After Canada extended its jurisdiction, Cuba, the USSR, Japan, and many European countries continued to catch high numbers of squid (Table 27). This fishery occurred along the continental slope during the summer and autumn when squid are present, including the sides of the Gully at its mouth (Figure 45). By the late 1980s and early 1990s, squid was mainly taken by Cuba during their fishery for silver hake, in the same area as the silver hake fishery, with some catches made in the GAA by the USSR in the course of the silver hake fishery, and some by Japan (Figure 46). Cuba continued to make small catches of squid into the late 1990s.

Most of the squid caught in the domestic fishery is taken as bait. The domestic fishery generally occurs on the shelf itself, rather than the shelf edge or slope, and no landings from the GAA have been recorded in the last five years.

##### 4.4.2 Snow crab (*Chionoecetes opilio*)

The fishery for snow crab on the Scotian Shelf is concentrated in the deep holes north of Banquereau and off Cape Breton. The crabs are caught using baited traps set on muddy or sandy bottom (DFO 2002b, GTA Consultants 1999). Only male crabs are kept in this fishery. The fishery is carried out from June or July to September.

The Gully is not one of the traditional snow crab fishing areas and catches from within the GAA have been a very small percentage of catches within the comparison area (Table 7). However, the fishery has expanded to new areas, particularly since the late 1980s. The snow crab fishery is currently excluded from the Gully AOI, with fishing areas configured around its boundaries (M. Eagles pers. comm.). The first records of snow crab trips to the GAA are from 1998. There has been some effort concentrated in the trough north of Sable Island Bank, just outside the GAA, in snow crab fishing areas 23 and 24D (Figure 47). Most boats that have landed catches from the GAA are based in Glace Bay. Vessels from Petit de Grat, Louisbourg, Canso, Marie Joseph, and Port Bickerton have had landings from the Gully. Amounts are small and vessels taking catches from the GAA have changed each year.

#### 4.4.3 Northern Shrimp (*Pandalus borealis*)

GTA Consultants (1999) reported that fishing for shrimp occurred in the Gully trough; however, no trips have been reported from the GAA in the last six years and few landings came from nearby areas outside the GAA (Figure 48). It is possible that shallower areas of the GAA and adjacent areas of the trough may have commercial concentrations of northern shrimp (see Tremblay 1998, GTA Consultants 1999). Most of the shrimp landed in the Scotia-Fundy region is taken from the holes north of Banquereau and Middle Bank and northeast of Misaine Bank. The fishery occurs in areas of cool water and muddy bottom below depths of 200 metres.

#### 4.4.4 Icelandic Scallop (*Chlamys islandica*)

There is a relatively small fishery for Icelandic scallop (*Chlamys islandica*) on Banquereau. The fishery generally takes place outside the GAA. There was some activity on the border of the GAA in 2000 and 2001, on the southwest peak of Banquereau (see Figures 49 and 50). The fishery is still in the exploratory phase and it is possible that commercial concentrations of Icelandic scallop could be found in some parts of the GAA. However, based on this species' habitat preferences, commercial quantities are not likely to be found within the Gully AOI.

#### 4.4.5 Stimpson's (Arctic) Surf Clam (*Mactromeris polynyma*)

A fishery for Stimpson's (Arctic) surf clam began in the 1980s on Banquereau. Only three vessels are involved and catches are taken using hydraulic clam dredges. There is no fishing activity for this species within the Gully Assessment Area (Figure 51) and no future activity is likely. The species is generally found in depths of less than 100 metres.

### **4.5 Potential fisheries**

There are many different fishes and invertebrates found in the Gully that are not currently of commercial interest. It is not known if they could be of commercial interest in the future.

## **5.0 CONCLUSION AND SUMMARY**

### **5.1 Groundfish**

Before 1993, the GAA was fished for a variety of groundfish species, including cod, haddock, pollock, halibut and other flounders, redfish, and silver hake. Prior to 1977, both foreign and domestic vessels fished in the area. The vessels involved in the pre-1993 groundfish fishery were large trawlers (greater than 65 feet in length) and longliners from all

vessel classes, with the largest proportion of the catches made by large trawlers for most species. It was one of a number of important grounds on the eastern Scotian Shelf for large trawlers and longliners during the pre-1993 period.

Although GTA Consultants (1999) reported that before 1993, several hundred small and mid-size trawlers (less than 65 feet) fished in the area during the summer, the amounts landed by these vessels from the GAA were very small. It is likely that nearby areas outside the GAA were more important for the mid-size and small trawlers.

The pre-1993 groundfish fishery took place along the sides of the canyon, on the small bank near the head of the canyon (Gilligan's Island), and on the southwest peak of Banquereau. For most groundfish species, the fishery took place at depths shallower than 200 metres, with occasional sets in deeper waters. Fisheries for halibut and redfish took place at depths below 200 metres. Large trawlers (greater than 65 feet) fished for redfish along the sides of the canyon and at its mouth, generally between the 200 and 500 metre isobath.

While historically the GAA was important for many groundfish species, the only groundfish fished in any numbers at the present time is halibut. The Gully has long been an important halibut area and early records of the canyon come from the halibut fishermen of the late nineteenth century. The habitat within the Gully appears to be particularly appealing for halibut, and fishermen have travelled regularly to the Gully because of this. It is one of the two or three most important halibut fishing areas on the eastern Scotian Shelf. Halibut was and is fished by longline vessels to a depth of about 500 metres, with occasional sets in deeper water. Within the GAA, halibut fishing occurs along the western side of the canyon, in the feeder canyons, at the head of the canyon and in the trough, with some activity on the slope at the mouth of the canyon and on the southwest peak of Banquereau.

There is a core group of ten active halibut longline vessels that have used the GAA regularly in the past few years. Most landings of halibut from the Gully are taken by vessels based in Sambro, with individual vessels from Shelburne County, Eastern Passage, and Ecum Secum also making large catches. For the halibut fishermen of Sambro and for the regular users from other ports who make up the core group, the Gully is an essential fishing area and changes in the management of fisheries in the area will have a direct impact on their regular activities. The TAC for the overall halibut fishery has been fairly stable over the last few years and the most recent update from the Fisheries Resource Conservation Council indicates that this fishery will continue with at least the same level of activity in the near future (FRCC 2002).

There is very little directed fishery for other species of groundfish in the GAA. Large trawlers have caught a relatively small amount of redfish in the GAA in the last few years, mainly at the mouth of the canyon between the 200 and 500 metre isobath. At present, there are relatively few large trawlers active on the eastern Scotian Shelf because of the 1993 moratorium on cod and haddock. Contrary to suggestions in GTA Consultants (1999), the status of cod and haddock stocks on the eastern Scotian Shelf, including the Gully, continues to be poor.

To sum up:

- The Gully is currently one of a number of important fishing grounds on the Scotian Shelf.
- The GAA was formerly an important ground for large trawlers (greater than 65 feet) and longliners fishing for many different species of groundfish. Small and mid-size trawlers (less than 65 feet in length) fished in the GAA relatively little.
- Since the 1993 moratorium on cod and haddock, the only important groundfish fishery in the GAA is the longline fishery for halibut.
- Within the GAA, the halibut fishery is conducted along the western side of the canyon, in the feeder canyons, at the head of the canyon, and in the trough, with some activity on the slope at the mouth of the canyon and on the southwest peak of Banquereau.
- The GAA is an essential area for the ten active longline vessels that have regularly used the Gully over the past several years.
- The status of the cod and haddock stocks on the eastern Scotian Shelf, including the GAA, continues to be poor.

## 5.2 Large pelagics

Swordfish has been fished along the edge of the Scotian Shelf and Slope since at least the 1960s. Swordfish is fished regularly in the GAA; however, catches from the area are variable. In the year 2001, the catch from the GAA was 10 percent of Canada's TAC; in 1999, the catch was less than 3 percent of the TAC. This variation is perhaps due to the habitat preferences of swordfish. Swordfish are highly mobile, migratory animals that are distributed along the edge and slope of the continental shelf, where waters are above 15° Celsius. The variability may also be due to how location data is recorded for this fishery and entered into the ZIF database.

Because of the high catches in some years, the GAA appears to be a somewhat important area for this fishery. However, TACs in this fishery have been steadily declining and longline fisheries have been initiated for other large pelagic species, such as sharks and yellowfin, albacore and bigeye tunas. Neither the shark nor the tuna fisheries catch significant amounts in the GAA as compared with other areas. The eastern Scotian Shelf as a whole is of minor importance for albacore, bigeye, and yellowfin tunas.

Vessels involved in the swordfish and the other tuna fisheries in the GAA are based in ports along the south and eastern shores, with highest representation from Shelburne County ports, and significant catches landed in the Shelburne County ports and Sambro. Nine core vessels have travelled regularly to the GAA to fish for swordfish in the last six years; eight of those vessels are currently active. The swordfish core group is more loosely defined than the halibut fishery core group and large swordfish catches are frequently made by non-core vessels within the GAA.

The fishery for large pelagics within the GAA appears to be concentrated around the slope of the Scotian Shelf, at either side of the mouth of the Gully. According to the ZIF data, there are fewer sets over the deep central part of the canyon. The reason for this gear setting pattern should be discussed in more detail with fishermen.

To sum up:

- Landings from the GAA are variable for undetermined reasons and the GAA is an important location for the swordfish fishery in some years.
- Swordfish and the swordfish fishery are distributed in a continuum along the slope and edge of the Scotian Shelf and further east.
- Within the GAA, the swordfish fishery appears to be concentrated around the slope of the Scotian Shelf at the mouth of the Gully.
- There is a core group of eight active swordfish vessels that use the GAA regularly.
- Catches of other commercial large pelagic species (sharks and albacore, yellowfin, and bigeye tunas) are minor compared with the western Scotian Shelf.

### **5.3 Invertebrate fisheries**

The GAA is currently of little importance for invertebrate fisheries. The report by GTA Consultants (1999) noted that the Gully was used by shrimp fishermen. However, landings data do not show use of the study area by shrimp fishermen. The activities reported by GTA Consultants appear to fall outside the assessment area defined in the present report. Reported snow crab landings within the GAA are very low.

To sum up:

- The GAA is currently of little importance for invertebrate fisheries.

### **5.4 Potential Fisheries**

The GAA is home to many species that are not currently exploited. Their future potential for commercial fisheries is not known.

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## **Appendix 1: Description of Bottom Longlining**

Bottom longline gear consists of a long mainline, or “groundline,” with other lines branching from it (Figure A-1). These branches are called gangions. At the end of each gangion is a baited hook. The mainline is anchored to the bottom at either end and there are often weights attached at intervals to keep the line near the bottom. Buoys mark the end of the line.

The baited lines are coiled in tubs and several tubs of gear are usually linked to make one “string,” although patterns vary widely among fishermen (Kenchington and Halliday 1994). Several strings are usually set. Fishermen have remarked that they vary the length of their strings according to the grounds, available bottom, and personal preference (Kenchington and Halliday 1994). For example, shorter strings are used in areas of rough bottom and the length of the strings will often match the size of the area of bottom being targeted. The number of hooks per line and the total length of groundline set are also variable, depending on species targeted, size of vessel, and area fished (see Kenchington and Halliday 1994). The length of strings may vary from a few hundred metres to several kilometres, and the number of hooks from less than a hundred to more than a thousand. After set in the water, gear could be left to “soak” (fish) for up to one day, or for less than six hours.

	1968		1969		1970		1971		1972		1973		1974		1975		1976	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
American angler (monkfish)	317	2101	121	3170		2123	1311	12061	328	2523	381	8568		10411	648	15502	2703	608
American plaice	2627	6619	428	3876	192	1697	1420	5227	1154	2399	4375	2765	5085	4496	1522	3504	2090	1925
Argentines (ns)*	450	878	1136	2721	56	1434	248	2551	100	2080	78	729	160	10764		8050	3877	2132
Atlantic cod	844	4021	117	2666	45	2476	163	4343	1329	3317	446	2472	20	3077	309	2733	719	299
Atlantic halibut	31	1						42										
Atlantic herring	774	1900	53494	12094	12456	59103	5658	23218	1268	15300	73	13153	49	10851	104	2695	713	2376
Atlantic mackerel	42	9321	22	4042	60	3832	163	8822	64	5269	655	14499	16	20840	569	18483	4321	11410
Atlantic redfishes (ns)	163	23	669	1272	4135	8699	7464	11901	2572	8513	4665	5451	2118	3980	1098	3665		261
Dogfishes (ns)			4	223					258	2194	112	2288		4323	146	3528	1605	953
Finfishes (ns)			512	3026	333	5963	696	10676	383	6745	429	8645	249	8123	350	9231	4237	1637
Haddock	59	195	235	34	636	11	464	3	103	76			30	102	52	9	15	
Pollock (saithe)	14	178	29		474	5	556	2	2011	294				1725	5	1668	592	742
Red hake		523	13	1344	23	1120	273	1426	14	1255	13	698	94	1501	85	2617	627	295
Shortfin squid	11	28	65		1238	66	7113	7	1783	169	7078		54	139	10115	11497	4142	
Silver hake	235	3150	1226	43543	5111	158902	2994	119451	69	108588	3417	265094	593	86904	1468	95385	44005	30083
Skates (ns)	780	5397	269	4122	60	3802	1519	15970	894	4325	364	6287		8323	633	15451	6026	1738
Winter flounder	1	24	1	11		42	229	1359	62	535	210	654	306	906	51	466	42	326
Witch flounder	1432	11385	201	7137		1059	1409	9252	790	4322	2831	5069	92	1252	1010	4409	885	2325
Yellowtail Flounder	2672	5036	257	985	126	2488	160	568	183	256	710	303	15	104	193	207	96	185

\*ns means species not specified.

Table 1. Reported catches from 4VSW by the USSR, 1968-1976 (Source: NAFO)

Table 2. Reported catches from 4VSW, 1961-1965, excluding Canada (Source: NAFO)

2a. Atlantic cod catches (tons) from 4VSW, 1961-1965, excluding Canada										
	1961		1962		1963		1964		1965	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Federal Republic of Germany					107	110	185	340		33
France Mainland	2834	418	2291	354	72		1010		474	
Poland						23				69
Spain	27808	13076	21660	20486	25466	19062	22061	17629	28611	10669
Portugal	1632		225		617				88	
United Kingdom						23	129	267		
USSR		113		1917		9505		7133		7856
USA	3	39	4	56	2	42	11	26	6	13

2b. Haddock catches (tons) from 4VSW 1961-1965, excluding Canada										
	1961		1962		1963		1964		1965	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Federal Republic of Germany					195	818		1873	32	96
France Mainland	5	16					2			
Poland										
Spain	1526	1441	1076	3224	2828	4915	2057	2884	1806	1500
Portugal										
United Kingdom						48	2	16		
USSR		151		2567		3295		4391		42876
USA		23		51	1	60	11	42		8

2c. Pollock catches (tons) from 4VSW, 1961-1965, excluding Canada										
	1961		1962		1963		1964		1965	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Federal Republic of Germany					80	38		208	43	28
France Mainland										
Poland										
Spain	825	110							693	662
Portugal										
United Kingdom						28		29		
USSR						291		633		610
USA	16	121	15	141	28	426	4	139		36

2d. Catches of unspecified redfishes (tons) from 4VSW, 1961-1965, excluding Canada										
	1961		1962		1963		1964		1965	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Federal Republic of Germany					5	1	116	103	3	10
France Mainland										
Poland										
Spain										
Portugal										
United Kingdom						2		5		
USSR		8		3870		12002		2888		1314
USA	3717	9027	3400	11872	5268	7682	6280	3252	1957	5689

Table 3. Reported catches from 4VSW, 1972-1976, excluding Canada (Source: NAFO)

3a. Atlantic cod catches (tons) from 4VSW, 1972-1976, excluding Canada										
	1972		1973		1974		1975		1976	
	4VS	4W	4VS	4W	4Vs	4W	4VS	4W	4VS	4W
Cuba		1		23				481		587
Faroe Islands	2364	3944	1662	819	169	534	622		1417	
France Mainland		269	325	484	29		1724	90	514	14
Japan	21	1	17	1	6					
Norway					281		381		26	
Poland			22							
Portugal	856		774	75	1464		301	245		
Spain	21466	7076	13566	17317	12905	14479	6412	9199	4911	6179
United Kingdom	294	192			15	27				
USA		269		48	11	13	3	12		5
USSR	1329	3317	446	2472	20	3077	309	2733	719	299

3b. Haddock catches (tons) from 4VSW 1972-1976, excluding Canada										
	1972		1973		1974		1975		1976	
	4Vs	4W	4Vs	4W	4Vs	4W	4Vs	4W	4Vs	4W
Cuba								57		
Faroe Islands	10	62			1	1				
France Mainland				16	1		2	2		
Japan		23	2	2						
Spain	599	737	431	95	174	521	48	63		
United Kingdom	25	1			194	77				
USA		70		173		6	1	20	1	31
USSR	3	103		76	30	102		52	9	15

3c. Pollock catches (tons) from 4VSW, 1972-1976, excluding Canada										
	1972		1973		1974		1975		1976	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Cuba								53		342
Faroe Islands	4	40								
France Mainland							6	37	5	
Japan	1		753	4	40					
Spain	261	207	15	2296	96	362	277	237	195	96
United Kingdom	4									
USA		49	10	59	4	41	4	46		83
USSR	2	2011		294		1725	5	1668	592	742

Table 3. (cont.)

3d. Catches of unspecified redfishes (tons) from 4VSW, 1972-1976, excluding Canada										
	1972		1973		1974		1975		1976	
	4Vs	4W	4Vs	4W	4Vs	4W	4Vs	4W	4Vs	4W
Cuba								21		38
Faroe Islands	7	65	6	6						
France Mainland							27		5	
Japan	2242	28	1679	26	153	17	22		26	15
Poland	45		49					230		
Portugal			63				90			
Spain							8	18		
United Kingdom	8	3			1	21				
USA	197	6439	381	4810	416	5123	61	2579	16	724
USSR	2572	8513	4665	5451	2118	3980	1098	3665		261

3e. Silver hake catches (tons) from 4VSW, 1972-1976, excluding Canada										
	1972		1973		1974		1975		1976	
	4VS	4W	4Vs	4W	4Vs	4W	4Vs	4W	4Vs	4W
Bulgaria									417	3088
Cuba		171		909				1724		12572
Japan	6		14	11	66	1	44			78
Spain								6		
USSR	69	108588	3417	265094	593	86904	1468	95385	44005	30083

Table 4. Reported catches by Canada from 4VsW, 1969-1992 (Source: NAFO)

4a. Reported catches by Canada from 4VSW, 1969-76

	1969		1970		1971		1972		1973		1974		1975		1976	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Albacore Tuna																
American Angler				1				7	1	39	1	10	1	10		12
American Plaice	5230	913	2972	696	3870	761	3772	756	2646	640	3950	452	3786	608	3424	425
Atlantic Cod	3590	10598	3076	8742	5867	11197	9975	10012	6477	9452	4700	6000	1887	8052	3797	5770
Atlantic Halibut	129	431	88	347	204	314	163	193	139	225	103	127	99	157	132	147
Atlantic Herring		27744		29151		53583		18002		5998		27456		33268		30709
Atlantic Mackerel		2124		938		1307		1015		1243		1378		1054		1119
Atlantic Redfishes (ns)*	1639	1726	1594	6031	9847	6002	7891	7175	4164	4415	5249	2446	5439	2974	4499	2186
Bigeye Tuna																
Clams (ns)				2		1		1		11				26		9
Cusk (Tusk)	24	335	15	371	23	292	28	231	37	474	34	522	49	526	76	508
Flatfishes (ns)											8		1	7	61	1
Groundfishes (ns)	216	211	89	254	299	596	269	243	90	227	141	204	105	443	128	422
Haddock	726	8270	620	4754	1133	7940	421	2096	233	2830	147	907	107	1393	52	1198
Large Sharks (ns)	3	1	2	2												
Northern Bluefin Tuna										4		7		2		6
Pandalid Shrimps				2		29								14		21
Pollock (Saithe)	91	3046	108	2003	106	897	207	1112	56	3218	99	2612	327	3650	243	2161
Porbeagle																
Queen Crab						1						5				
Shortfin Squid				6		9		7		8		58		78	21	238
Silver Hake												9		7	2	13
Skates (ns)	4	10	2	24	12	1	1		3	2		61	2		705	57
Soft Clam		4		3		33		2		11		7		5		4
Stimpson Surf Clam																
Swordfish	349	453	565	396										13		
Tunas (ns)	12	19	18	34				4		1						
White Hake	38	543	47	718	117	1453	95	1203	126	1445	137	1329	138	1336	157	756
Witch Flounder	2039	1826	1011	894	1897	1816	2210	1367	1839	1780	2514	752	874	883	630	357
Wolffishes (ns)	99	334	68	306	159	381	119	222	59	200	67	110	50	132	23	114
Yellowfin Tuna																
Yellowtail Flounder	2225	149	505	197	710	98	471	368	208	82	333	21	887	16	357	16

\*ns means species not specified.

## 4b. Reported catches by Canada from 4VSW, 1977-1984

	1977		1978		1979		1980		1981		1982		1983		1984	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Albacore Tuna																
American Angler		39	1	31	1	60	2	23	1	46		22	1	26	8	136
American Plaice	4644	544	4124	716	3679	487	4934	570	4294	516	3552	394	3738	389	4081	210
Atlantic Cod	2805	7085	9874	14768	15377	23842	31378	17443	32107	20946	40110	15565	31963	18935	42292	9812
Atlantic Halibut	70	176	226	276	215	358	323	371	224	379	320	475	399	545	445	572
Atlantic Herring		18440		23452		5239		12042		21814		9743		11103		8588
Atlantic Mackerel	3	2383		1982		1976	1	1751		1324		994	5	716		592
Atlantic Redfishes (ns)	7106	1506	7749	1338	4975	1780	5431	2360	6760	2650	4585	485	3747	1428	1883	1672
Bigeye Tuna																
Clams (ns)		13		2		5				95		234		62		
Cusk (Tusk)	33	255	54	401	47	391	67	181	62	360	82	607	89	444	68	181
Flatfishes (ns)	11	8	5	25	8	50	11		17	3	3	4	25	3	1	2
Groundfishes (ns)	363	350	486	332	307	510	73	525	19	536	40	369	36	39	57	11
Haddock	144	2845	441	4949	650	2339	1841	12448	1796	17684	2373	12498	1542	7302	3195	3992
Large Sharks (ns)														3	1	5
Northern Bluefin Tuna		6		10			1	2				1				2
Pink (=pandalid) Shrimps		44		23	144	470	251	335	121	2	4	155	56	480	19	211
Pollock (Saithe)	1181	5760	2672	4341	4472	4005	3306	6637	2029	15322	2717	8991	5352	5304	5035	5822
Porbeagle														4	2	2
Queen Crab				18		124		131		32		70		66		53
Shortfin Squid	397	336		551		2737		332		72		633				
Silver Hake		1		8	4			98				1		1		3
Skates (ns)	382	52	109	26	52	36	59	12	7	2				9	7	9
Soft Clam		7		6		8		24		37		153		125		148
Stimpson Surf Clam																
Swordfish	97						246	343	178	200	531	222	66	685	70	112
Tunas (ns)														1		1
White Hake	152	848	242	769	181	366	369	341	222	412	204	595	315	626	298	688
Witch Flounder	503	422	554	436	575	206	728	186	416	156	256	97	215	114	301	119
Wolffishes (ns)	51	149	104	211	77	179	192	231	209	281	251	211	272	153	183	73
Yellowfin Tuna																
Yellowtail Flounder	989	40	1006	155	1591	144	2106	78	2516	123	2345	49	2005	59	2156	45

4c. Reported catches by Canada from 4VSW, 1985-1992

	1985		1986		1987		1988		1989		1990		1991		1992	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Albacore Tuna								1			2	1		2		1
American Angler	7	124	37	1848	38	1410	22	205	13	304	24	308	22	127	13	251
American Plaice	2802	174	1480	269	2785	377	1502	303	1858	391	1098	175	97	6	317	2
Atlantic Cod	47309	9244	43996	7471	39737	5693	33704	4511	29372	7247	26271	7901	24596	8208	21351	8484
Atlantic Halibut	572	606	488	572	278	349	246	360	263	415	235	366	201	365	197	361
Atlantic Herring		9237		9293		9153		9636	2	10437		16566		14899		12129
Atlantic Mackerel		596		500	3	838	1	729		264	2	539	3	807		619
Atlantic Redfishes (ns)	3648	1630	1546	1202	2707	1418	2446	893	4591	1474	5849	393	8038	381	1727	723
Bigeye Tuna				6						2	4	6		6		8
Clams (ns)				7												
Cusk (Tusk)	55	167	82	235	162	322	88	186	98	338	74	534	107	548	24	479
Flatfishes (ns)	3	1	40	14	18	7	45	19	14	78	4	15	751	84	1251	77
Groundfishes (ns)	15	19	8	45	22	47	10	34	60	53	12	32	21	23	4	8
Haddock	7291	2862	8798	6277	1587	994	2057	1176	3108	3582	2429	4077	984	3824	778	5154
Large Sharks (ns)		5		8	1	13	1	4	1	9	2	8	13	160	10	78
Northern Bluefin Tuna				3		2		3		3	6	30		15	2	35
Pandalid Shrimps	10	15			4		6	1			33		642	66	1199	589
Pollock (Saithe)	10639	2860	12932	3083	11291	3764	10056	3078	7569	3840	6071	4081	3014	6718	2133	5676
Porbeagle		4		4	1	13	4	10	5	23	3	22			18	105
Queen Crab		45		59		104		161		206		580	10	645	182	754
Shortfin Squid		4		31		9		12		14		26		22		
Silver Hake		1	6		5	4	2			337				12		81
Skates (ns)	7		6	6	17	28	3	4	3	7		1	5	8		2
Soft Clam		99		160		157		94		107		184		150		255
Stimpson Surf Clam					883		2513		7859		5635	686	684			
Swordfish	5	115	19	193	21	166	42	170	34	421	24	329	52	363	136	492
Tunas (ns)						1				1				1		
White Hake	526	1105	518	1407	743	1588	378	789	476	938	311	1237	301	1044	304	809
Witch Flounder	373	52	679	108	749	125	417	109	269	155	417	146	329	37	238	79
Wolfishes (ns)	272	36	126	76	131	66	116	45	112	30	113	72	62	53	62	71
Yellowfin Tuna										1	4	2	1	2		1
Yellowtail Flounder	744	9	502	22	756	94	673	46	1270	74	2724	115	1338	11	1350	16

Table 5. Catches by Foreign Countries in 4VSW, 1980-1985

5a. Atlantic cod landings (tons) from 4VSW, 1980-85, excluding Canada

	1980		1981		1982		1983		1984		1985	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Cuba		61		35		33		59		24		1
EU-France Mainland		17										
EU-Portugal		5					1207	23	282	21	870	
Japan		4				1		3	4	1	10	
USSR		338		630		45		190		110		21

5b. Silver hake landings (tons) from 4VSW, 1980-85, excluding Canada

	1980		1981		1982		1983		1984		1985	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Cuba		2287		642		11969		7418		14496		17683
EU-Portugal		55		1988				378		1714		1338
Japan		76	1	39		904		643	4	526	44	68
USSR		34605	487	37433		47261	318	25600	124	57299		56337

5c. Redfish landings (tons) from 4VSW, 1980-85, excluding Canada

	1980		1981		1982		1983		1984		1985	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Cuba		10				17		20		11		93
EU-Portugal		2					10					
Japan		2		3					484	3	854	10
USSR		58	29	392		96	1	43		22		111

5d. Pollock landings (tons) from 4VSW, 1980-85, excluding Canada

	1980		1981		1982		1983		1984		1985	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Cuba		32				84		261		123		66
Japan	4	5				1	1	2	1		17	
USSR		837		356		297		220		97		336

5e. Haddock landings (tons) from 4VSW, 1980-85, excluding Canada

	1980		1981		1982		1983		1984		1985	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Cuba		20		14		41		126		229		79
EU-France Mainland		1										
Japan		10		7		8		40	1	3	2	
USSR		209		187		53		149	2	168		275

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Table 6. Catches in the Gully Assessment Area and Comparison Area by Canadian mobile gear vessels, 1990-1995, from ZIF data\*

Species/gear type	GAA 1990	CA 1990	% of catch 1990	GAA 1991	CA 1991	% of catch 1991	GAA 1992	CA 1992	% of catch 1992	GAA 1993	CA 1993	% of catch 1993
<b>Cod trawl &gt;65</b>	1060.40	12221.61	8.68	1071.82	5816.12	18.43	1964.54	6657.92	29.51	83.32	613.57	13.58
<b>Cod trawl &lt;65</b>	15.90	1420.60	1.12	13.28	1688.28	0.79	120.68	1149.93	10.49	81.63	532.84	15.32
<b>Cod seine &gt;65</b>	0.00	39.51	0.00	0.00	31.24	0.00	0.27	9.02	2.99	0.00	6.95	0.00
<b>Cod seine &lt;65</b>	0.00	242.36	0.00	0.00	244.03	0.00	0.00	225.35	0.00	1.37	135.69	1.01
<b>total cod</b>	1076.30	13924.08	7.73	1085.10	7779.67	13.95	2085.49	8042.22	25.93	166.32	1289.04	12.90
<b>Haddock trawl &gt;65</b>	486.05	1611.05	30.17	286.78	671.05	42.74	161.25	497.04	32.44	52.27	188.68	27.70
<b>Haddock trawl &lt;65</b>	8.53	587.19	1.45	3.60	137.13	2.63	11.26	142.55	7.90	2.96	67.06	4.41
<b>Haddock seine &gt;65</b>	0.00	1.46	0.00	0.71	0.79	89.87	0.00	1.28	0.00	0.00	5.94	0.00
<b>Haddock seine &lt;65</b>	0.00	190.78	0.00	0.00	32.42	0.00	0.00	149.51	0.00	4.10	45.47	9.02
<b>total haddock</b>	494.58	2390.48	20.69	291.09	841.39	34.60	172.51	790.37	21.83	59.33	307.14	19.32
<b>Pollock trawl &gt;65</b>	2135.40	5546.00	38.50	2702.30	4653.26	58.07	896.96	2793.98	32.10	106.94	568.46	18.81
<b>Pollock trawl &lt;65</b>	6.95	229.34	3.03	3.10	28.67	10.81	27.70	54.21	51.10	10.35	123.67	8.37
<b>Pollock seine &gt;65</b>	0.00	3.83	0.00	0.00	1.30	0.00	0.68	2.54	26.77	0.00	0.00	n/a
<b>Pollock seine &lt;65</b>	0.00	25.36	0.00	0.00	2.25	0.00	0.00	2.21	0.00	0.09	6.89	1.31
<b>total pollock</b>	2142.35	5804.53	36.91	2705.40	4685.48	57.74	924.66	2852.94	32.41	117.37	699.02	16.79
<b>Redfish trawl &gt;65</b>	64.14	1569.03	4.09	128.94	2653.98	4.86	417.44	1264.20	33.02	59.14	877.24	6.74
<b>Redfish trawl &lt;65</b>	0.00	125.20	0.00	0.71	26.73	2.66	2.48	11.51	21.55	1.85	53.08	3.49
<b>Redfish seine &gt;65</b>	0.00	4.03	0.00	0.00	0.01	0.00	0.00	0.00	n/a	0.00	0.00	n/a
<b>Redfish seine &lt;65</b>	0.00	1.45	0.00	0.00	4.01	0.00	0.00	2.69	0.00	0.00	6.14	0.00
<b>total redfish</b>	64.14	1699.71	3.77	129.65	2684.73	4.83	419.92	1278.40	32.85	60.99	936.46	6.51
<b>Halibut trawl &gt;65</b>	7.22	18.39	39.27	8.45	19.06	44.33	5.44	9.19	59.19	4.56	10.13	45.01
<b>Halibut trawl &lt;65</b>	0.00	1.70	0.00	0.00	0.23	0.00	0.06	0.19	31.58	0.00	0.43	0.00
<b>Halibut seine &lt;65</b>	0.00	0.89	0.00	0.00	0.02	0.00	0.00	0.10	0.00	0.05	0.11	45.45
<b>total halibut</b>	7.22	20.98	34.41	8.45	19.30	43.78	5.50	9.48	58.02	4.61	10.67	43.21
<b>White hake trawl &gt;65</b>	1.24	10.36	11.97	2.71	10.40	26.06	2.28	8.74	26.09	1.57	5.55	28.29
<b>White hake trawl &lt;65</b>	0.00	4.49	0.00	0.00	0.00	n/a	0.02	0.10	20.00	0.01	0.72	1.39
<b>White hake seine &lt;65</b>	0.00	0.00	n/a	0.00	0.00	n/a	0.00	0.06	0.00	0.01	0.02	50.00
<b>total white hake</b>	1.24	14.86	8.34	2.71	10.40	26.06	2.30	8.89	25.87	1.59	6.29	25.28
<b>Cusk trawl &gt;65</b>	0.89	2.41	36.93	0.49	1.23	39.84	0.54	1.28	42.19	0.29	0.60	48.33
<b>Cusk trawl &lt;65</b>	0.00	0.00	n/a	0.00	0.00	n/a	0.00	0.00	0.00	0.00	0.01	0.00
<b>total cusk</b>	0.89	2.41	36.93	0.49	1.23	39.84	0.54	1.28	42.19	0.29	0.61	47.54
<b>Flounders** trawl &gt;65</b>	34.68	734.17	4.72	45.88	580.03	7.91	69.97	1015.42	6.89	5.74	165.43	3.47
<b>Flounders trawl &lt;65</b>	2.62	2455.11	0.11	1.48	671.13	0.22	2.01	396.39	0.51	2.59	802.00	0.32
<b>Flounders seine &gt;65</b>	0.00	1.75	0.00	0.18	4.03	4.47	0.07	103.07	0.07	0.00	186.73	0.00
<b>Flounders seine &lt;65</b>	0.00	652.04	0.00	3.07	662.09	0.46	0.00	996.48	0.00	0.47	1711.94	0.03
<b>total flounders</b>	37.30	3843.07	0.97	50.61	1917.28	2.64	72.05	2511.35	2.87	8.79	2866.09	0.31
<b>Swordfish longline</b>										15.28	327.19	4.67
<b>Albacore tuna</b>										0.01	0.75	1.33
<b>Bigeye tuna</b>										0.00	7.61	0.00
<b>Yellowfin tuna</b>										0.03	2.25	1.33
<b>total tunas</b>										0.04	10.60	0.38
<b>Porbeagle shark</b>												
<b>Mako (mackerel)</b>												
<b>Blue</b>												
<b>total sharks</b>												
<b>Snow Crab</b>												

GAA=Gully Assessment Area CA=Comparison Area (4VSc, 4VSe, 4Wf, 4WG, including GAA)  
 % of catch=% of catch from the comparison area (CA) that was taken in the GAA

\* Records of groundfish caught from longline vessels for this period are not readily available at the data resolution needed to compare areas. Based on the breakdown of catches from the larger NAFO sub-unit, if longline records were readily available for the GAA, totals of halibut, cusk, and white hake would be many times higher, cod and haddock totals would be significantly higher, and flounders, redfish, and pollock totals would only be slightly higher. \*\* "Flounders" includes yellowtail flounder, witch flounder, American plaice, and unspecified flounders.

Table 6. (cont.)

Species/gear type	GAA 1994	CA 1994	% of catch 1994	GAA 1995	CA 1995	% of catch 1995	Total GAA catch 1990-1995	Total CA catch 1990-1995	% of catch 1990-1995****
Cod trawl >65	13.23	105.39	12.55	3.60	95.96	3.75	4196.91	25510.57	16.45
Cod trawl <65	0.00	24.76	0.00	0.05	9.00	0.56	231.54	4825.41	4.80
Cod seine >65	0.00	0.00	n/a	0.00	0.00	n/a	0.27	86.72	0.31
Cod seine <65	0.00	3.40	0.00	0.00	0.43	0.00	1.37	851.26	0.16
<b>total cod</b>	<b>13.23</b>	<b>133.55</b>	<b>9.91</b>	<b>3.64</b>	<b>105.39</b>	<b>3.45</b>	<b>4430.09</b>	<b>31273.95</b>	<b>14.17</b>
Haddock trawl >65	6.90	14.82	46.56	4.99	25.07	19.90	998.24	3007.71	33.19
Haddock trawl <65	0.03	6.44	0.47	0.00	2.01	0.00	26.38	942.37	2.80
Haddock seine >65	0.00	0.00	n/a	0.00	0.00	n/a	0.71	9.47	7.50
Haddock seine <65	0.00	2.91	0.00	0.00	2.62	0.00	4.10	423.71	0.97
<b>total haddock</b>	<b>6.93</b>	<b>24.17</b>	<b>28.67</b>	<b>4.99</b>	<b>29.70</b>	<b>16.80</b>	<b>1029.43</b>	<b>4383.25</b>	<b>23.49</b>
Pollock trawl >65	64.82	302.51	21.43	2.62	619.34	0.42	5609.04	14483.55	38.73
Pollock trawl <65	0.34	32.31	1.05	0.02	22.11	0.09	48.45	490.31	9.88
Pollock seine >65	0.00	0.00	n/a	0.00	0.00	n/a	0.68	7.67	8.87
Pollock seine <65	0.00	1.39	0.00	0.00	0.12	0.00	0.09	38.22	0.24
<b>total pollock</b>	<b>65.16</b>	<b>336.22</b>	<b>19.38</b>	<b>2.64</b>	<b>641.57</b>	<b>0.41</b>	<b>5658.26</b>	<b>15019.75</b>	<b>37.67</b>
Redfish trawl >65	101.13	3908.40	2.59	298.29	3643.25	8.19	1069.08	13916.11	7.68
Redfish trawl <65	0.00	685.62	0.00	0.20	595.50	0.03	5.24	1497.64	0.35
Redfish seine >65	0.00	0.00	n/a	0.00	0.00	n/a	0.00	4.04	0.00
Redfish seine <65	0.00	27.68	0.00	0.00	0.24	0.00	0.00	42.22	0.00
<b>total redfish</b>	<b>101.13</b>	<b>4621.70</b>	<b>2.19</b>	<b>298.48</b>	<b>4239.00</b>	<b>7.04</b>	<b>1074.32</b>	<b>15460.01</b>	<b>6.95</b>
Halibut trawl >65	0.45	6.88	6.54	2.63	22.16	11.87	28.75	85.81	33.50
Halibut trawl <65	0.00	0.36	0.00	0.00	1.79	0.00	0.07	4.68	1.50
Halibut seine <65	0.00	0.01	0.00	0.00	0.02	0.00	0.05	1.15	4.35
<b>total halibut</b>	<b>0.46</b>	<b>7.25</b>	<b>6.34</b>	<b>2.63</b>	<b>23.96</b>	<b>10.98</b>	<b>28.87</b>	<b>91.64</b>	<b>31.50</b>
White hake trawl >65	0.72	26.13	2.76	3.73	35.60	10.48	12.25	96.78	12.66
White hake trawl <65	0.00	0.65	0.00	0.02	2.90	0.69	0.04	8.85	0.45
White hake seine <65	0.00	0.00	n/a	0.00	0.00	n/a	0.01	0.09	11.11
<b>total white hake</b>	<b>0.72</b>	<b>26.78</b>	<b>2.69</b>	<b>3.75</b>	<b>38.50</b>	<b>9.74</b>	<b>12.30</b>	<b>105.72</b>	<b>11.63</b>
Cusk trawl >65	0.56	2.18	25.69	0.57	2.27	25.11	3.34	9.96	33.53
Cusk trawl <65	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.07	0.00
<b>total cusk</b>	<b>0.56</b>	<b>2.20</b>	<b>25.45</b>	<b>0.57</b>	<b>2.30</b>	<b>24.78</b>	<b>3.34</b>	<b>10.03</b>	<b>33.30</b>
Flounders trawl >65	0.28	188.07	0.15	0.48	161.29	0.30	157.03	2844.39	5.52
Flounders trawl <65	0.50	601.68	0.08	0.02	533.23	0.00	9.22	5459.53	0.17
Flounders seine >65	0.00	0.00	n/a	0.00	0.00	n/a	0.24	295.57	0.08
Flounders seine <65	0.49	1419.96	0.03	0.00	903.28	0.00	4.03	6345.79	0.06
<b>total flounders</b>	<b>1.27</b>	<b>2209.70</b>	<b>0.06</b>	<b>0.51</b>	<b>1597.79</b>	<b>0.03</b>	<b>170.52</b>	<b>14945.28</b>	<b>1.14</b>
Swordfish longline	33.04	279.55	11.82	117.68	418.33	28.13	166.00	1025.08	16.19
Albacore tuna	0.00	4.47	0.00	0.03	2.12	1.42	0.04	7.34	0.54
Bigeye tuna	0.05	9.81	0.51	0.24	16.91	1.42	0.28	34.33	0.82
Yellowfin tuna	0.00	1.77	0.00	0.15	6.68	2.25	0.18	10.69	1.68
<b>total tunas</b>	<b>0.05</b>	<b>16.05</b>	<b>0.31</b>	<b>0.41</b>	<b>25.71</b>	<b>1.59</b>	<b>0.50</b>	<b>52.36</b>	<b>0.95</b>
Porbeagle shark	44.35	346.15	12.81	20.94	193.79	10.81	65.29	539.95	12.09
Mako (mackerel)***	1.94	21.45	9.04	2.24	19.00	11.79	4.18	40.45	10.33
Blue	0.12	2.04	5.88	0.00	0.26	0.00	0.12	2.29	5.24
<b>total sharks</b>	<b>46.41</b>	<b>369.63</b>	<b>12.56</b>	<b>23.18</b>	<b>213.05</b>	<b>22.59</b>	<b>69.59</b>	<b>582.68</b>	<b>11.94</b>
Snow Crab	1.09	17.93	6.08	1.14	29.08	3.92	2.23	47.01	4.74

\*\*\* Note that porbeagle sharks are also mackerel sharks but shark fishermen report porbeagle as porbeagle and short-fin mako as mackerel. Other fishermen who get porbeagle as bycatch may report it as mackerel (S. Campana, pers. comm.).

\*\*\*\* Averages for swordfish, tunas, sharks, and snow crab are for available years.

Table 7. Catches in the Gully Assessment Area and Comparison Area by Canadian vessels, 1996-2001, from ZIF data.

Species/gear type	GAA 1996	CA 1996	% of catch 1996	GAA 1997	CA 1997	% of catch 1997	GAA 1998	CA 1998	% of catch 1998	GAA 1999	CA 1999	% of catch 1999
Cod trawl >65	0.07	73.98	0.09	0.29	29.04	1.00	0.32	13.80	2.32	0.00	52.92	0.00
Cod trawl <65	0.00	6.21	0.00	0.00	5.45	0.00	0.00	4.34	0.00	0.00	6.80	0.00
Cod seine <65	0.00	0.77	0.00	0.00	0.39	0.00	0.00	0.14	0.00	0.00	0.00	n/a
Cod longline	9.25	37.30	<b>24.80</b>	15.38	57.56	<b>26.72</b>	16.53	81.86	<b>20.19</b>	4.61	58.99	7.81
Cod total	9.32	118.26	7.88	15.67	92.43	<b>16.95</b>	16.84	100.13	<b>16.82</b>	4.61	118.71	3.88
Haddock trawl >65	1.00	15.52	6.44	0.56	3.02	<b>18.54</b>	0.25	1.78	<b>14.04</b>	0.00	17.39	0.00
Haddock trawl <65	0.00	1.87	0.00	0.00	3.88	0.00	0.01	3.54	0.28	0.00	2.92	0.00
Haddock seine <65	0.00	3.78	0.00	0.00	0.22	0.00	0.00	0.22	0.00	0.00	0.00	n/a
Haddock longline	2.58	11.18	<b>23.08</b>	1.95	10.74	<b>18.16</b>	3.05	11.31	<b>26.97</b>	1.78	5.01	<b>35.53</b>
Haddock total	3.58	32.36	<b>11.06</b>	2.51	17.86	<b>14.05</b>	3.31	16.85	<b>19.64</b>	1.78	25.32	7.03
Pollock trawl >65	12.80	358.26	3.57	3.04	20.53	<b>14.80</b>	0.01	150.73	0.00	0.00	490.13	0.00
Pollock trawl <65	0.00	1.11	0.00	0.00	2.39	0.00	0.00	1.37	0.00	0.00	1.48	0.00
Pollock longline	0.02	1.18	1.69	0.01	0.35	2.86	0.05	0.17	<b>29.41</b>	0.00	0.01	0.00
Pollock total*	12.82	360.56	3.56	3.05	23.27	<b>13.12</b>	0.06	152.28	0.04	0.00	491.62	0.00
Redfish trawl >65	4.84	1494.63	0.32	5.01	1782.59	0.28	0.48	531.79	0.09	0.00	2392.95	0.00
Redfish trawl <65	0.00	49.96	0.00	0.00	224.00	0.00	0.00	3.30	0.00	0.00	2.41	0.00
Redfish longline	1.27	3.09	<b>41.10</b>	1.58	2.99	<b>52.84</b>	2.78	6.01	<b>46.26</b>	1.38	1.96	<b>70.41</b>
Redfish total*	6.11	1547.67	0.39	6.60	2009.57	0.33	3.27	541.09	0.60	1.38	2397.31	0.06
Halibut trawl >65	0.75	11.13	6.71	0.12	9.23	1.30	0.01	1.22	0.82	0.00	6.05	0.00
Halibut trawl <65	0.00	0.00	n/a	0.00	1.35	0.00	0.00	0.05	0.00	0.00	2.35	0.00
Halibut longline	41.14	151.19	<b>27.21</b>	45.46	192.09	<b>23.67</b>	54.60	158.40	<b>34.47</b>	53.41	146.29	<b>36.51</b>
Halibut comm index**	n/a	n/a	n/a	n/a	n/a	n/a	9.46	51.52	<b>18.36</b>	9.17	34.54	<b>26.55</b>
Halibut fixed survey**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.07	16.16	0.43
Halibut total*	41.88	162.32	<b>25.80</b>	45.57	202.67	<b>22.49</b>	64.07	211.19	<b>30.34</b>	62.65	205.39	<b>30.50</b>
White hake trawl >65	0.70	15.63	4.48	0.42	7.42	5.66	0.01	1.51	0.66	0.01	5.60	0.18
White hake trawl <65	0.00	0.06	0.00	0.00	1.59	0.00	0.00	0.61	0.00	0.00	0.06	0.00
White hake longline	12.67	98.22	<b>12.90</b>	11.21	70.89	<b>15.81</b>	15.79	109.36	<b>14.44</b>	5.61	57.74	9.72
White hake comm index**	n/a	n/a	n/a	n/a	n/a	n/a	3.50	10.36	<b>33.78</b>	3.03	6.79	<b>44.62</b>
White hake fixed survey**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.02	4.33	0.46
White hake total*	13.37	113.91	<b>11.74</b>	11.63	79.90	<b>14.56</b>	19.30	121.84	<b>15.84</b>	8.67	74.51	<b>11.64</b>
Cusk trawl >65	0.00	0.48	0.00	0.01	0.60	1.67	0.02	0.14	<b>14.29</b>	0.00	0.40	0.00
Cusk longline	15.31	52.15	<b>29.36</b>	13.80	55.94	<b>24.67</b>	15.45	59.91	<b>25.78</b>	16.49	48.62	<b>33.92</b>
Cusk comm index**	n/a	n/a	n/a	n/a	n/a	n/a	5.86	21.91	<b>26.75</b>	6.59	18.10	<b>36.41</b>
Cusk fixed survey**	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.01	4.15	0.24
Cusk total***	15.31	52.73	<b>29.03</b>	13.81	56.54	<b>24.43</b>	21.33	81.96	<b>26.02</b>	23.09	71.27	<b>32.40</b>
Flounders trawl >65	2.22	74.22	2.99	3.63	18.92	<b>19.19</b>	0.07	1.47	4.76	0.00	5.70	0.00
Flounders trawl <65	0.02	484.95	0.00	0.00	380.60	0.00	0.64	351.42	0.18	0.00	481.93	0.00
Flounders seine <65	0.00	554.54	0.00	0.00	579.20	0.00	0.00	401.42	0.00	0.83	297.50	0.28
Flounders longline	0.00	0.36	0.00	0.00	0.05	0.00	0.00	0.05	0.00	0.03	2.25	1.33
Flounders total	2.24	1114.07	0.20	3.64	978.77	0.37	0.71	754.36	0.09	0.87	787.38	0.11
Swordfish longline****	26.23	139.94	<b>18.74</b>	37.15	125.10	<b>29.70</b>	82.00	198.46	<b>41.32</b>	28.40	249.30	<b>11.39</b>
Albacore tuna	0.02	0.33	6.06	0.21	4.48	4.69	0.17	2.46	6.91	0.02	0.24	8.33
Bigeye tuna	0.14	2.10	6.67	0.24	7.83	3.07	0.14	8.40	1.67	0.02	0.91	2.20
Yellowfin tuna	0.00	0.92	0.00	0.13	0.87	<b>14.94</b>	0.02	1.54	1.30	0.00	0.03	0.00
Tunas total	0.15	3.35	4.48	0.58	13.19	4.40	0.33	12.40	2.66	0.03	1.17	2.56
Porbeagle shark	1.12	31.78	3.52	9.58	200.16	4.79	5.09	82.90	6.14	44.44	297.80	<b>14.92</b>
Mako (mackerel)*****	1.99	9.36	<b>21.26</b>	2.62	8.93	<b>29.34</b>	1.65	6.25	<b>26.40</b>	1.12	6.92	<b>16.18</b>
Blue	0.00	0.01	0.00	0.00	0.06	0.00	0.00	0.00	n/a	1.56	1.57	<b>99.36</b>
Sharks total	3.11	41.15	7.56	12.20	209.15	5.83	6.74	89.15	7.56	47.11	306.29	<b>15.38</b>
Snow Crab	0.00	21.14	0.00	0.00	17.98	0.00	0.00	128.88	0.00	11.76	302.64	3.89

GAA=Gully Assessment Area CA=Comparison Area (4VSc, 4VSe, 4Wf, 4WG, including GAA)  
 % of catch=% of catch from the comparison area (CA) that was taken in the GAA

\* Pollock, redfish, halibut, and white hake totals do not include the amount caught by seiners. However, the total amount of these species caught by seiners in the entire comparison area between 1996 and 2001 was negligible (0.38 tonnes pollock, 0.93 tonnes redfish, 0.15 tonnes halibut, and 0.01 tonnes white hake).

\*\* Halibut commercial survey and fixed survey were not separated in 1998. They are listed together under commercial survey (species: halibut, white hake, cusk).

Table 7. (cont.)

Species/gear type	GAA 2000	CA 2000	% of catch 2000	GAA 2001	CA 2001	% of catch 2001	Total GAA catch 1996-2001	Total CA catch 1996-2001	% of catch 1996-2001
Cod trawl >65	0.02	41.47	0.05	0.01	36.16	0.03	0.71	247.37	0.29
Cod trawl <65	0.00	4.69	0.00	0.14	12.49	1.12	0.14	39.98	0.35
Cod seine <65	0.00	0.00	n/a	0.00	0.00	n/a	0.00	1.29	0.00
Cod longline	1.37	36.02	3.80	3.22	25.76	12.50	50.34	297.48	16.92
Cod total	1.39	82.18	1.69	3.37	74.41	4.53	51.19	586.12	8.73
Haddock trawl >65	0.06	13.15	0.46	1.10	17.48	6.29	2.97	68.33	4.35
Haddock trawl <65	0.00	4.20	0.00	0.23	2.90	7.93	0.24	19.31	1.24
Haddock seine <65	0.00	0.00	n/a	0.00	0.02	0.00	0.00	4.24	0.00
Haddock longline	0.06	2.14	2.80	0.87	2.06	42.23	10.29	42.44	24.25
Haddock total	0.12	19.48	0.61	2.20	22.46	9.80	13.50	134.32	10.05
Pollock trawl >65	0.63	254.58	0.25	1.97	100.89	1.95	18.44	1375.13	1.34
Pollock trawl <65	0.00	0.64	0.00	0.02	13.53	0.15	0.02	20.53	0.10
Pollock longline	0.00	0.01	0.00	0.01	0.01	100.00	0.10	1.73	5.78
Pollock total*	0.63	255.24	0.25	2.00	114.43	1.75	18.56	1397.38	1.33
Redfish trawl >65	40.84	1320.68	3.09	67.91	3018.65	2.25	119.09	10541.28	1.13
Redfish trawl <65	0.00	13.24	0.00	3.36	656.18	0.51	3.36	949.08	0.35
Redfish longline	0.21	0.42	50.00	0.63	2.11	29.86	7.86	16.56	47.46
Redfish total*	41.05	1334.34	3.08	71.90	3676.93	1.96	130.31	11506.91	1.13
Halibut trawl >65	0.02	1.84	1.14	0.12	4.62	2.51	1.01	34.08	2.96
Halibut trawl <65	0.00	0.07	0.00	0.00	0.00	n/a	0.00	3.82	0.00
Halibut longline	16.13	115.64	13.95	47.29	223.47	21.16	258.03	987.08	26.14
Halibut comm index**	20.92	42.98	48.67	17.34	45.96	37.73	56.89	174.99	32.51
Halibut fixed survey**	2.13	22.46	9.48	0.48	17.22	2.79	2.67	55.84	4.78
Halibut total*	39.20	182.98	21.42	65.22	291.27	22.39	318.60	1252.14	25.37
White hake trawl >65	0.02	1.38	1.45	0.10	5.03	1.99	1.24	36.57	3.39
White hake trawl <65	0.00	0.03	0.00	0.07	14.11	0.50	0.07	16.45	0.43
White hake longline	0.82	60.73	1.35	5.75	62.36	9.22	51.87	459.28	11.29
White hake comm index**	1.18	5.88	20.07	1.97	9.93	19.84	9.66	32.96	29.31
White hake fixed survey**	0.19	7.64	2.49	0.16	3.27	4.89	0.37	15.23	2.43
White hake total*	2.21	75.65	2.92	8.04	94.69	8.49	63.21	560.49	11.28
Cusk trawl >65	0.01	0.04	25.00	0.04	0.34	11.76	0.08	2.00	
Cusk longline	17.16	46.01	37.30	16.78	56.74	29.57	94.98	319.38	29.74
Cusk comm index**	14.54	24.22	60.03	7.64	18.52	41.25	34.62	82.75	41.84
Cusk fixed survey**	0.01	5.01	0.20	0.09	3.55	2.54	0.10	12.71	0.79
Cusk total***	31.71	75.28	42.12	24.54	79.16	31.00	129.78	416.84	31.13
Flounders trawl >65	0.05	0.69	7.25	0.05	1.92	2.60	6.02	102.92	5.85
Flounders trawl <65	0.00	329.49	0.00	0.11	179.47	0.06	0.77	2207.85	0.04
Flounders seine <65	0.00	95.53	0.00	0.00	103.23	0.00	0.83	2031.42	0.04
Flounders longline	0.00	0.04	0.00	0.00	0.00	n/a	0.04	2.75	1.45
Flounders total	0.05	425.75	0.01	0.16	284.62	0.06	7.67	4344.94	0.18
Swordfish longline****	60.98	161.53	37.75	101.98	185.85	54.87	336.74	1060.17	31.76
Albacore tuna	3.23	5.17	62.48	2.36	4.11	57.42	6.01	16.79	35.79
Bigeye tuna	1.09	6.36	17.14	1.11	7.01	15.83	2.72	32.62	8.34
Yellowfin tuna	0.31	3.02	10.26	0.00	5.23	0.00	0.47	11.60	4.05
Tunas total	4.64	14.54	31.92	3.46	16.35	21.16	9.20	61.00	15.08
Porbeagle shark	20.56	252.57	8.14	0.72	210.19	0.34	81.51	1075.40	7.58
Mako (mackerel)*****	3.32	8.64	38.43	2.94	7.42	39.62	13.64	47.52	28.70
Blue	0.04	0.25	16.00	0.00	0.00	n/a	1.60	1.89	84.66
Sharks total	23.92	261.46	9.15	3.66	217.61	1.68	96.75	1124.81	8.60
Snow Crab	60.59	2441.12	2.48	64.77	3220.31	2.01	137.13	6132.07	2.24

\*\*\* Cusk total does not include amount caught by small trawlers. However, the total amount of cusk caught by small trawlers in the entire comparison area (4VSc, 4VSe, 4Wf, and 4Wg) between 1996 and 2001 was negligible (0.19 tonnes).

\*\*\*\* Swordfish harpoon is not included because the amount caught in 4VSc, 4VSe, 4Wf and 4Wg between 1996 and 2001 was very small (1.29 tonnes).

\*\*\*\*\* Note that porbeagle sharks are also mackerel sharks but shark fishermen report porbeagle as porbeagle and short-fin mako as mackerel. Other fishermen who get porbeagle as bycatch may report it as mackerel (S. Campana, pers. comm.).

**Table 8. Groundfish landed values, GAA, 1990-1991 (values from Statistical Services 2001)**

Species	Average Value 1990	GAA Catch* 1990 (t)	Total Value GAA 1990	Average Value 1991	GAA Catch* 1991 (t)	Total Value GAA 1991
Cod	\$0.7954/kg	1076.30	\$ 856,089	\$0.9364/kg	1085.10	\$1,016,088
Haddock	\$1.1552/kg	494.58	\$ 571,339	\$1.449/kg	296.09	\$ 421,789
Pollock	\$0.5333/kg	2142.35	\$1,142,515	\$0.5949/kg	2704.40	\$1,609,442
<b>Total Value, chp</b>			\$2,569,943			\$3,047,319

\*GAA Catch is mobile gear catch only

**Table 9. Halibut Catches (longline) from GAA, Catches by core vs. non-core vessels, 2000**

Vessel group	% of catch
"Core" vessels (vessels with catches from the GAA in at least 4 of the years from 1996-2001 or 3 of the last 3 years)	54.60
Non-core vessels	45.40

**Table 10. Halibut Catches (longline) from GAA, Catches by core vs. non-core vessels, 2001**

Vessel group	% of catch
"Core" vessels (vessels with catches from the GAA in at least 4 of the years from 1996-2001 or 3 of the last 3 years)	60.55
Non-core vessels	39.45

**Table 11. Halibut Catches (longline) from GAA by Vessel Size, 2000\***

Vessel size	% of catch
less than 45 feet	52.72
45 to 65 feet	20.7
over 65 feet	26.58

\*This table is meant to convey the types of vessels involved in the fishery in the GAA in recent years. Note that each vessel class is not managed the same way and they are not sharing the same quota for the GAA. In some cases, different vessels may be used by the same fisherman.

**Table 12. Halibut Catches (longline) from GAA by Vessel Size, 2001**

Vessel Size	% of catch
less than 45 feet	38.45
45 to 65 feet	35.66
over 65 feet	25.88

\*This table is meant to convey the types of vessels involved in the fishery in the GAA in recent years. Note that each vessel class is not managed the same way and they are not sharing the same quota for the GAA. In some cases, different vessels may be used by the same fisherman.

**Table 13. Halibut Catches (longline) from GAA by Home Port, 2000**

Home Port	% of catch
Sambro	65.9
Liverpool	12.4
Shelburne	9.54
Woods Harbour	5.56
Eastern Passage	3.51
Ecum Secum	3.1

**Table 14. Halibut Catches (longline) from GAA by Home Port, 2001**

Home Port	% of catch
Sambro	69.12
Ecum Secum	8.26
Shelburne	6.88
Eastern Passage	6.79
Sandy Point	2.88
Glace Bay	2.75
Woods Harbour	2.42
Louisbourg	0.76
Marie Joseph	0.14

**Table 15. Halibut Catches from GAA, Catches by month, 2000**

Month	% of catch
January	18.34
February	7.89
March	0.96
April	0.56
May	18.97
June	49.25
July	3.54
August	0.47
September	-
October	-
November	-
December	-

**Table 16. Halibut Catches from GAA, Catches by month, 2001**

Month	% of catch
January	10.36
February	24.11
March	9.53
April	2.95
May	4.95
June	27.71
July	10.84
August	6.71
September	1.4
October	0.06
November	0.44
December	0.94

**Table 17. Swordfish Catches (longline) from GAA, Catches by core vs. non-core vessels, 2000**

Vessel group	% of catch
"Core" vessels (vessels with catches from the GAA in at least 3 of the years from 1996-2001)	80.38
Non-core vessels	19.62

**Table 18. Swordfish Catches (longline) from GAA, Catches by core vs. non-core vessels, 2001**

Vessel group	% of catch
"Core" vessels (vessels with catches from the GAA in at least 3 of the years from 1996-2001)	37.6
Non-core vessels	62.4

**Table 19. Swordfish Catches (longline) from GAA by Vessel Size, 2000\***

Vessel size	% of catch
less than 45 feet	72.11
45 to 65 feet	27.89

\*This table is meant to convey the types of vessels active in this fishery in the GAA and is not meant to portray the allocation of quota in this fishery.

**Table 20. Swordfish Catches (longline) from GAA by Vessel Size, 2001**

Vessel Size	% of catch
less than 45 feet	78.84
45 to 65 feet	21.16

\*This table is meant to convey the types of vessels active in this fishery in the GAA and is not meant to portray the allocation of quota in this fishery.

**Table 21. Swordfish Catches (longline) from GAA by Home Port, 2000**

Home Port	% of catch
Jordan Falls	19.95
West Dover	15.12
Eastern Passage	13.2
Lower Argyle	12.66
Sandy Point	12.09
Woods Harbour	12.07
Port Medway	11.27
Gunning Cove	3.64

**Table 22. Swordfish Catches (longline) from GAA by Home Port, 2001**

Home Port	% of catch
Woods Harbour	14.82
Clarks Harbour	14.78
Gunning Cove	13.42
Sambro	13.34
Pubnico	8.81
Truro	6.82
Eastern Passage	5.93
West Dover	5.53
Jordan Falls	5.44
Liverpool	5.4
Port Medway	2.65
Lower Argyle	1.69
Shelburne	1.36

**Table 23. Swordfish Catches (longline) from GAA by Landing Port, 2000**

Home Port	% of catch
Sandy Point	32.03
Shelburne	15.98
West Dover	15.12
Port Medway	11.27
Eastern Passage	10.6
Woods Harbour	8.76
Gunning Cove	3.64
Lower East Pubnico	2.6

**Table 24. Swordfish Catches (longline) from GAA by Landing Port, 2001**

Home Port	% of catch
Woods Harbour	23.87
Sandy Point	20.82
Sambro	19.65
Lower East Pubnico	8.82
Eastern Passage	5.93
West Dover	5.53
Gunning Cove	4.8
Port Medway	4.34
Louisbourg	4.09
Shelburne	1.37
Lower West Pubnico	0.77

**Table 25. Swordfish Catches from GAA, Catches by month, 2000**

Month	% of catch
January	-
February	-
March	-
April	-
May	-
June	-
July	11.27
August	88.73
September	-
October	-
November	-
December	-

**Table 26. Swordfish Catches from GAA, Catches by month, 2001**

Month	% of catch
January	-
February	-
March	-
April	-
May	-
June	-
July	12.17
August	85.72
September	2.11
October	-
November	-
December	-

Table 27. Squid catches by foreign countries, 1975-83, 1984-1992, 1993-2000 (Source: NAFO)

	1975		1976		1977		1978		1979		1980		1981		1982		1983	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Bulgaria	-	19	-	1034	-	2998	-	955	-	3006	-	220	-	-	-	-	-	-
Cuba	-	-	-	3248	-	3267	311	2440	441	3447	-	1589	-	1830	-	93	-	3
Federal Republic of Germany	-	-	-	-	-	7689	309	337	941	843	-	-	-	-	-	-	-	-
France Mainland	-	-	-	-	-	775	670	1332	7	1919	-	320	-	-	-	-	-	-
German Democratic Republic	-	-	-	-	-	-	9	341	-	-	-	-	-	-	-	-	-	-
Ireland	-	-	2257	444	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Japan	44	103	714	2141	189	2610	4223	18826	10656	15160	6	3695	4	1961	-	255	-	381
Poland	-	-	809	-	-	5593	-	1762	-	10405	-	489	-	621	-	77	-	-
Portugal	-	-	-	-	-	-	-	582	-	1754	-	1921	-	659	-	-	-	-
Romania	-	-	-	-	-	1301	-	977	-	832	-	-	-	-	-	-	-	-
Spain	94	148	-	754	-	3000	1126	2262	-	3156	-	1891	-	-	-	-	-	-
USSR	139	10115	11497	4142	-	18812	2630	9804	8	8577	-	6627	49	4739	-	124	3	-

	1984		1985		1986		1987		1988		1989		1990		1991		1992	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Bulgaria														39				
Cuba		34		8		4		2		156		1231		2728		283		405
EU-Portugal		17																
Japan		74		3				3					30	392		48		66
Russian Federation																		25
USSR		191		247		39		336		342		1318		1947		584		

	1993		1994		1995		1996		1997		1998		1999		2000	
	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W	4VS	4W
Cuba		669		3940		830		349		2511		1084		280		
Russian Federation		89										29				12

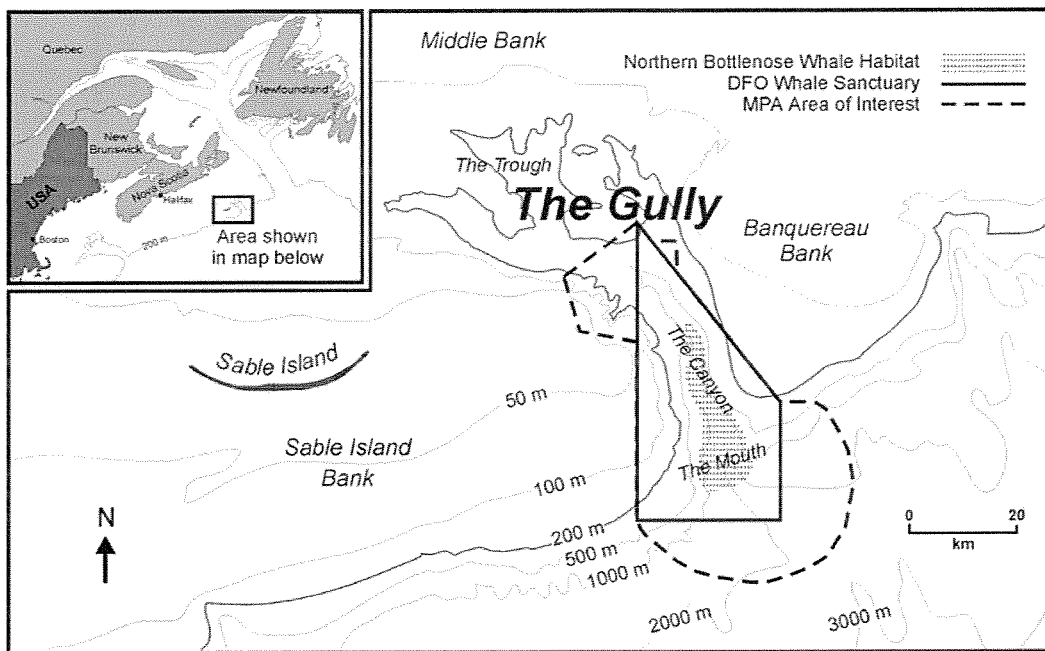


Figure 1. Location of the Gully (from Fenton et. al 2001)

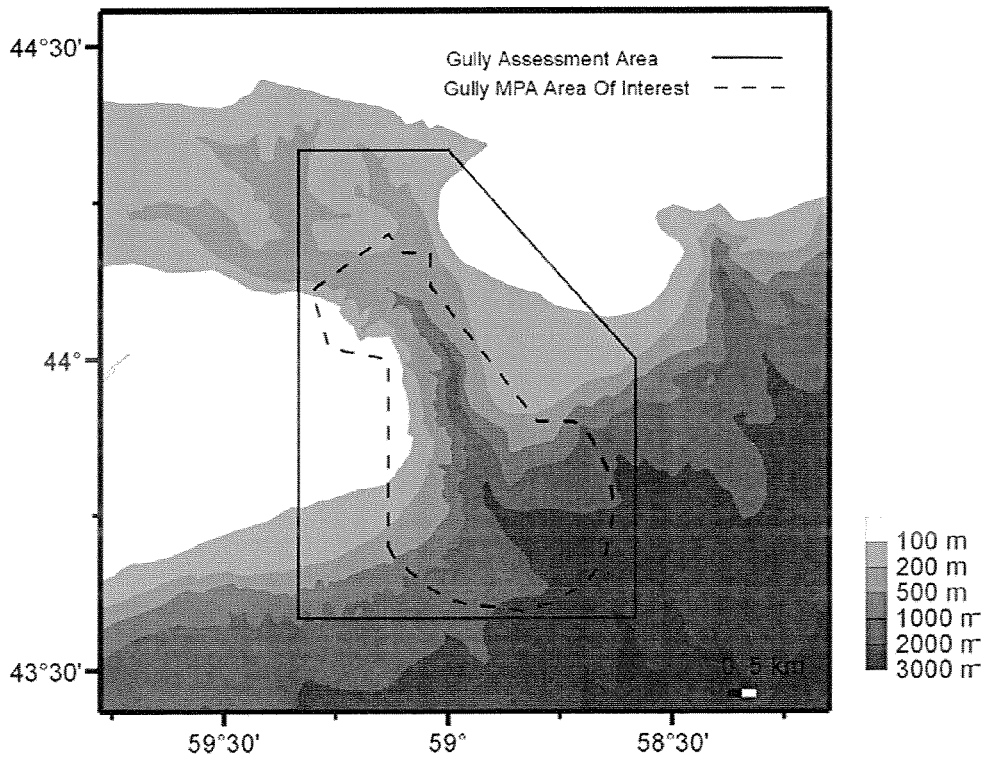


Figure 2. Fisheries Overview Boundary, called the Gully Assessment Area (outer boundary marked on map). 1998 Gully Area of Interest Boundary (inner boundary) is also shown.

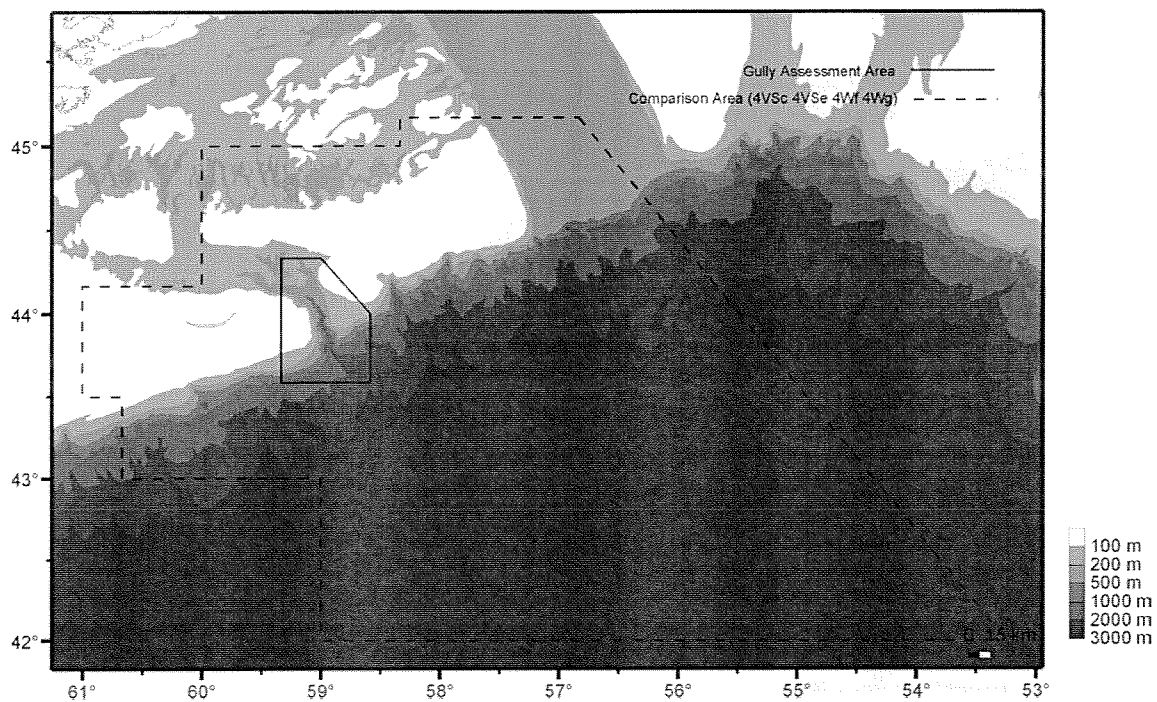


Figure 3. Boundaries of the comparison area (4VSc, 4VSe, 4Wf, and 4Wg) and the Gully Assessment Area (GAA).

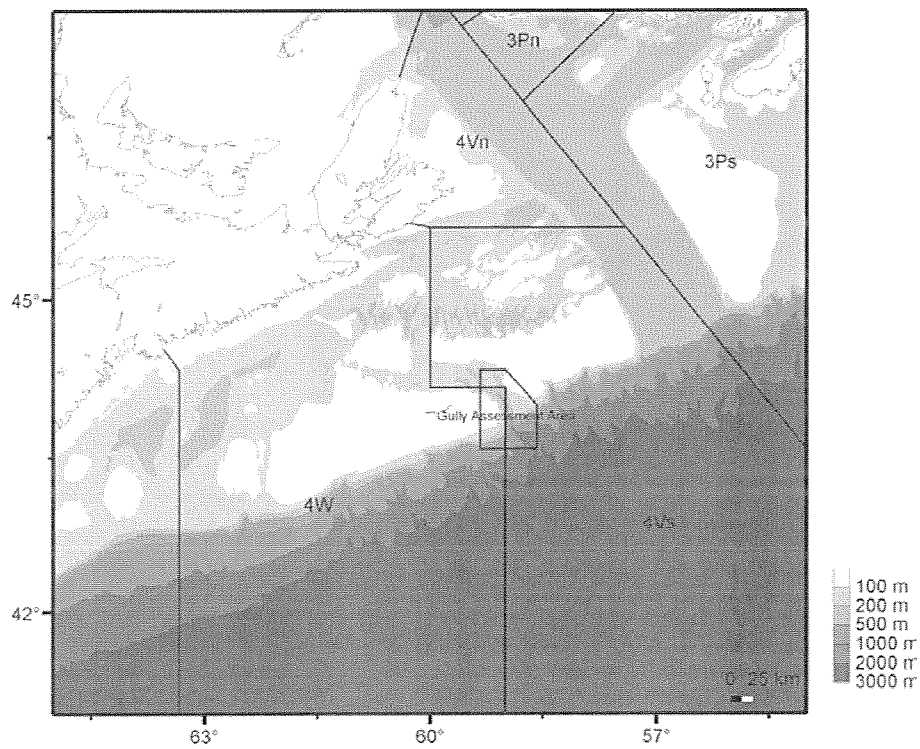


Figure 4. Position of the GAA within NAFO Divisions 4VSW.

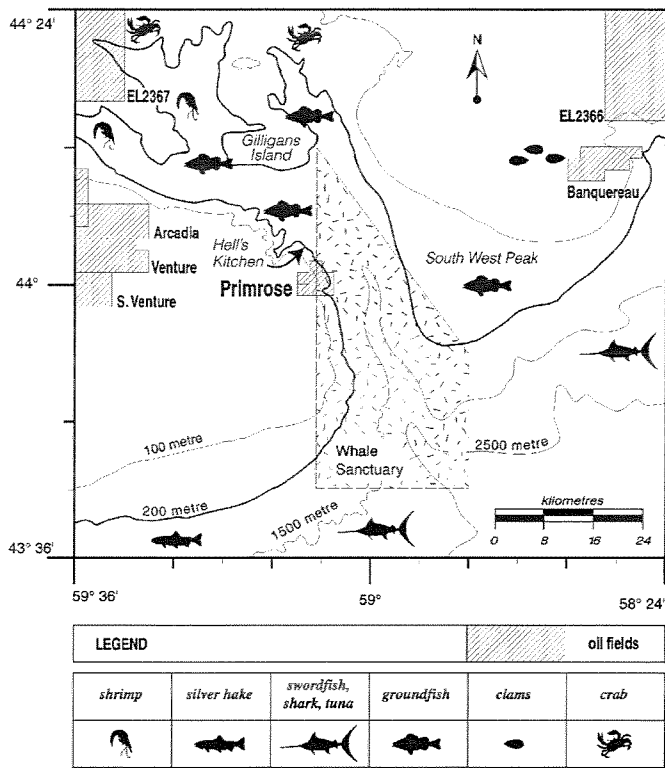


Figure 5. Fisheries and oil and gas activities in the area of the Gully (GTA Consultants 1999).

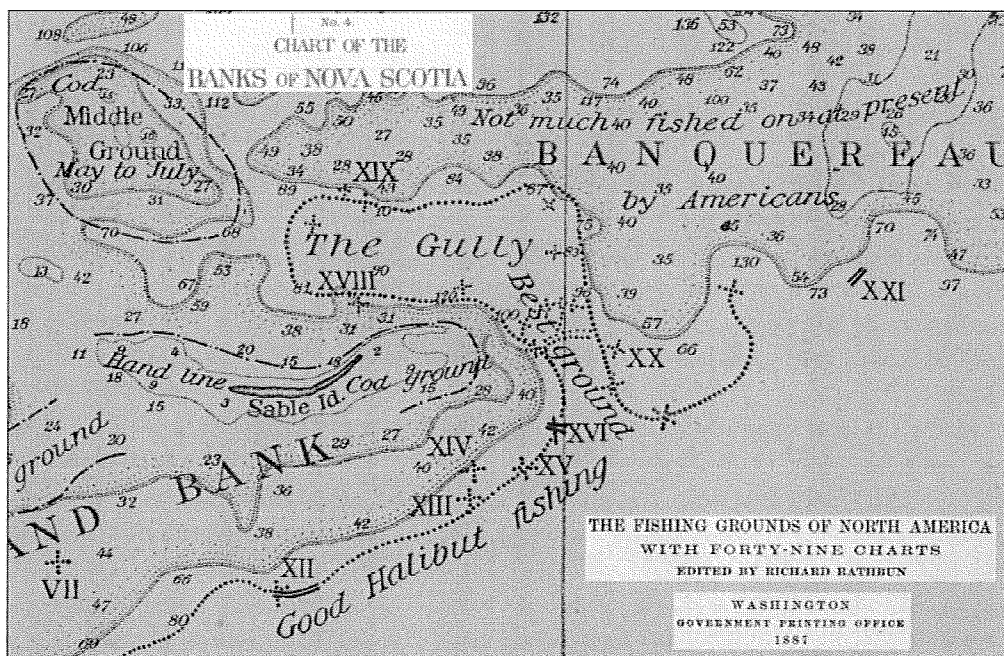


Figure 6. Chart showing The Gully, "best ground" for halibut fishing (Collins and Rathbun 1887).

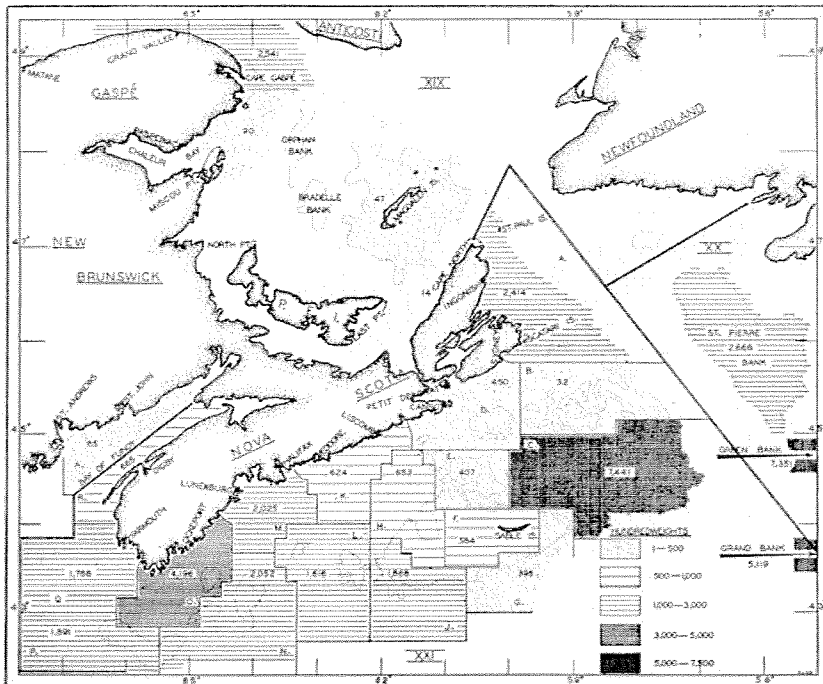


Figure 7. Map of halibut production from international subareas (from McKenzie 1946). One hundredweight (cwt.) equals 112 pounds (English system). Fisheries for halibut were carried out in this area year-round (McKenzie 1946a).

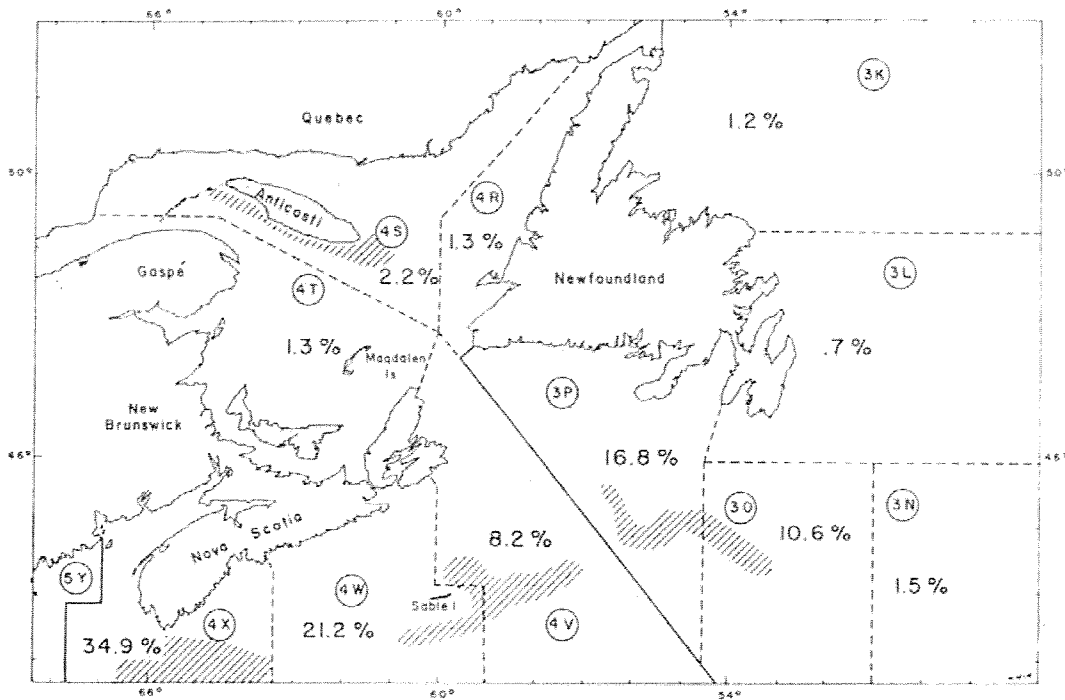


Figure 8. Important halibut fishing grounds of 1953-1954 denoted by cross-hatching (McCracken 1958).

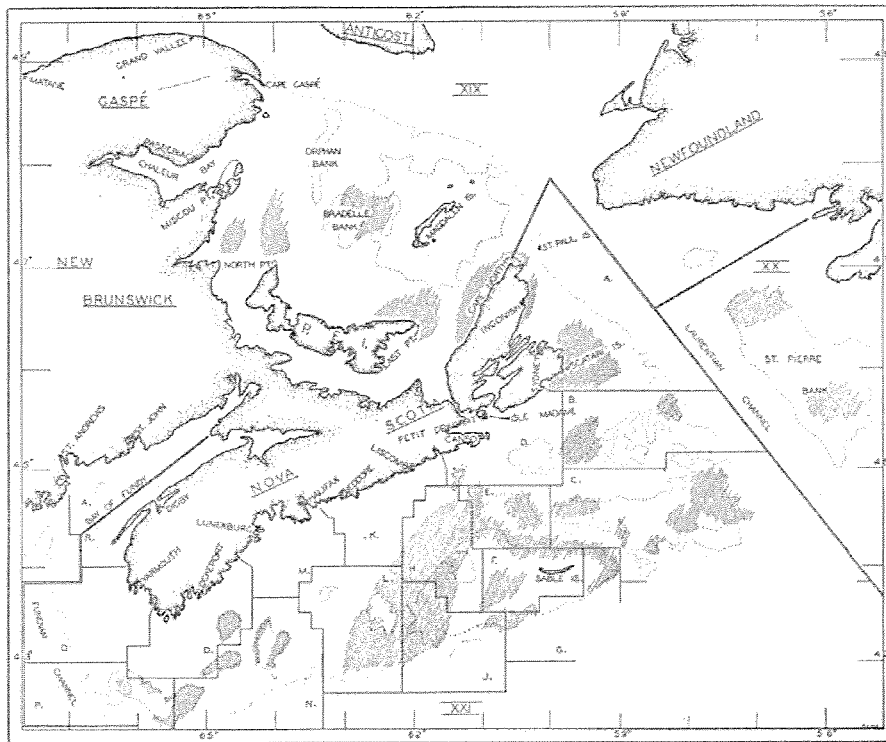


Figure 9. Places most frequently fished for haddock by the Canadian offshore fishermen, indicated by lines (from McKenzie 1946b).

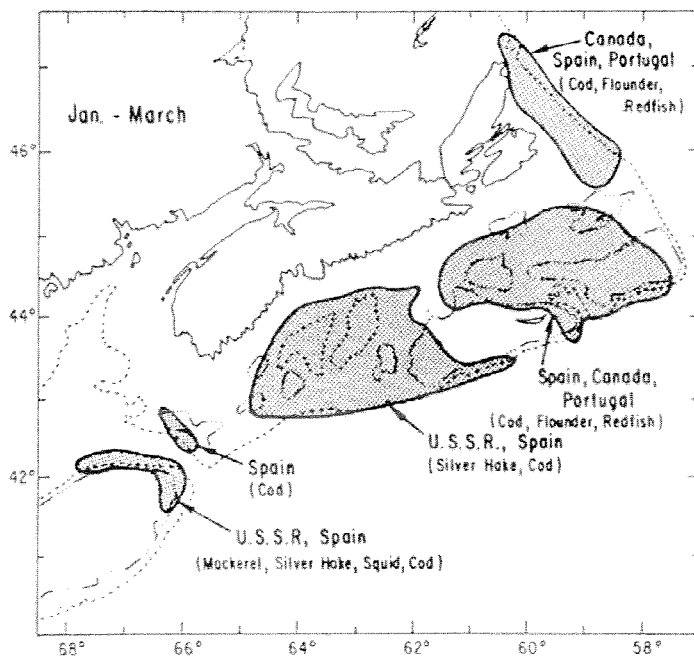


Figure 10. Location of major offshore fisheries on the Scotian Shelf and Gulf of Maine during winter, 1974-1976 (from Hare 1977).

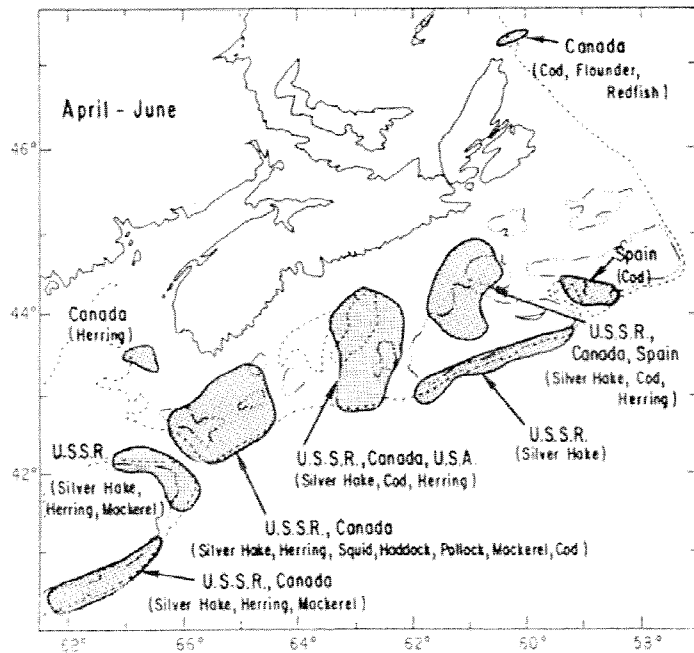


Figure 11. Location of major offshore fisheries on the Scotian Shelf and Gulf of Maine during spring, 1974-1976 (from Hare 1977).

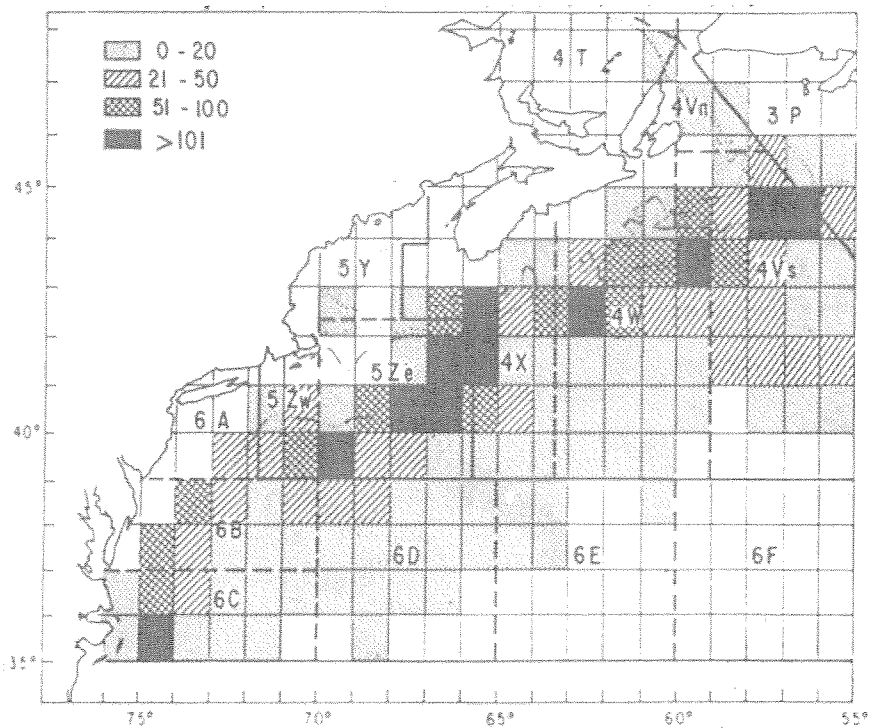


Figure 12. Distribution of swordfish along the U.S. and Canadian Atlantic coasts, from reported Canadian catches, 1959-1970 (from Hare 1977).

4VS 4W JAN-DEC 1981-1985, Observer Data Fishing Tracks

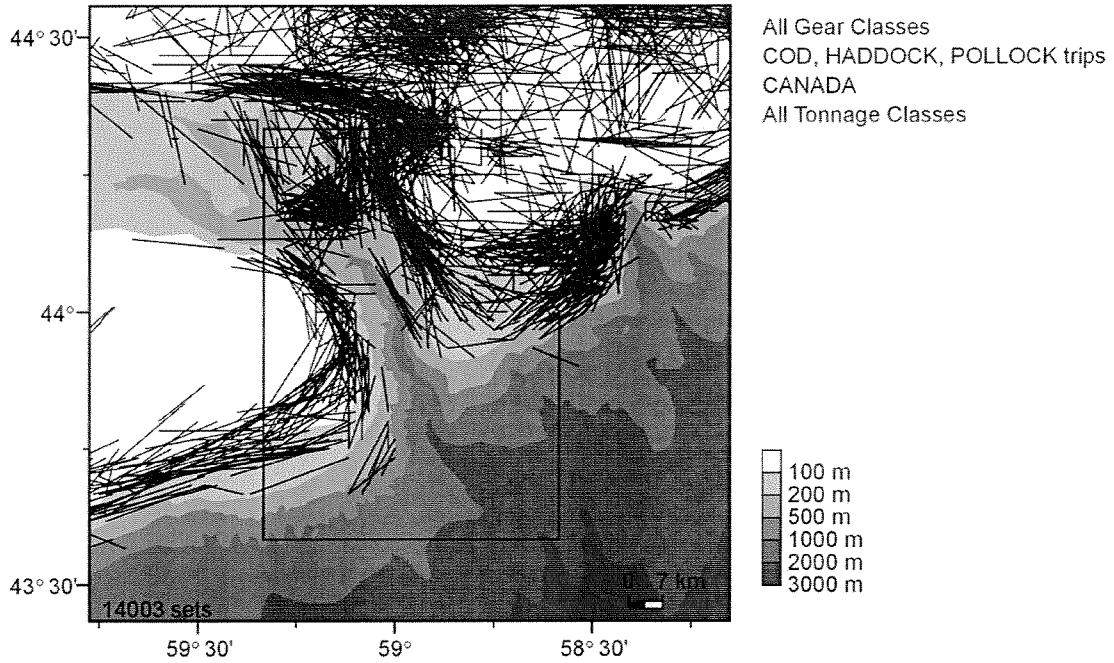


Figure 13. Trips to the GAA by Canadian vessels with observers, showing track made by fishing vessels, 1981-1985.

4VS 4W JAN-DEC 1988-1992, Observer Data Fishing Tracks

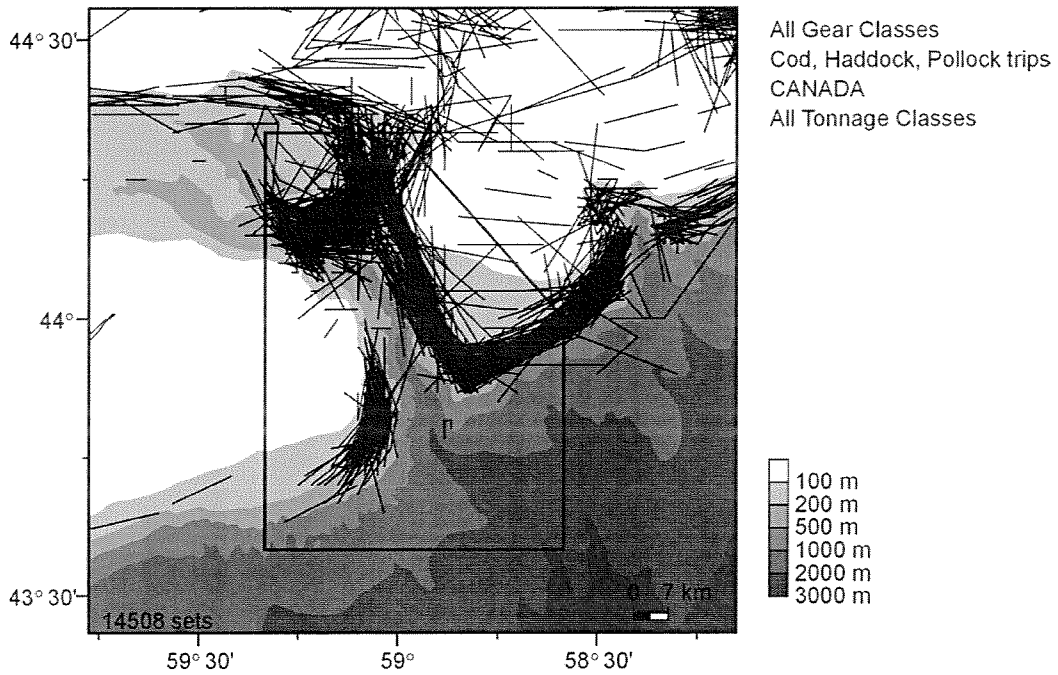


Figure 14. Trips to the GAA by Canadian vessels with observers, showing track made by fishing vessels, 1988-1992.

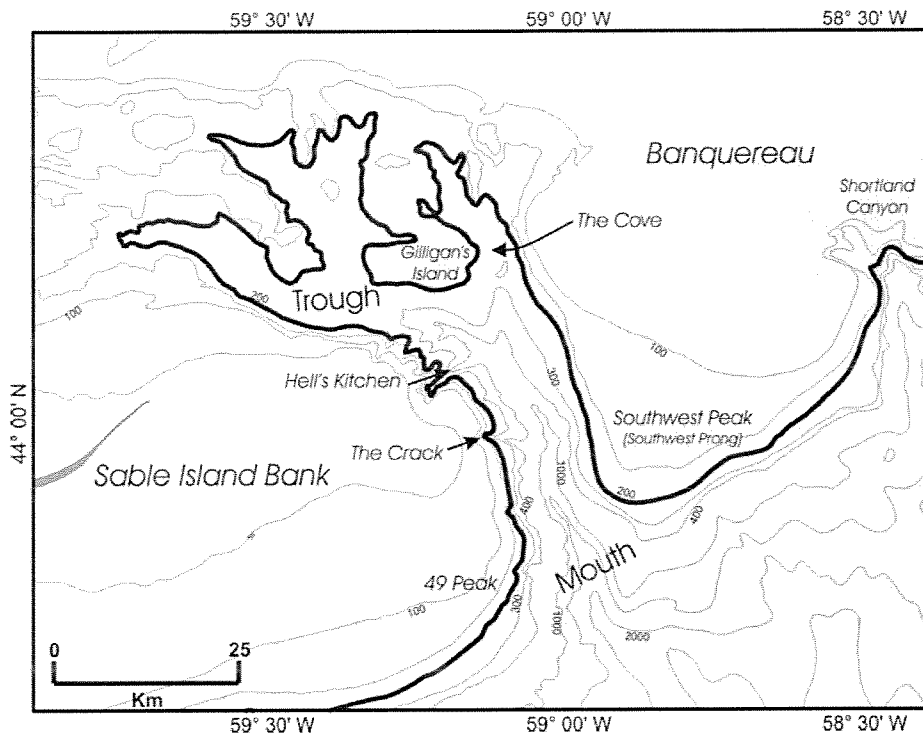


Figure 15. Location of features in the Gully, including names used by fishermen.

4VS 4W JAN-DEC 1981-1985, Observer Data Fishing Tracks

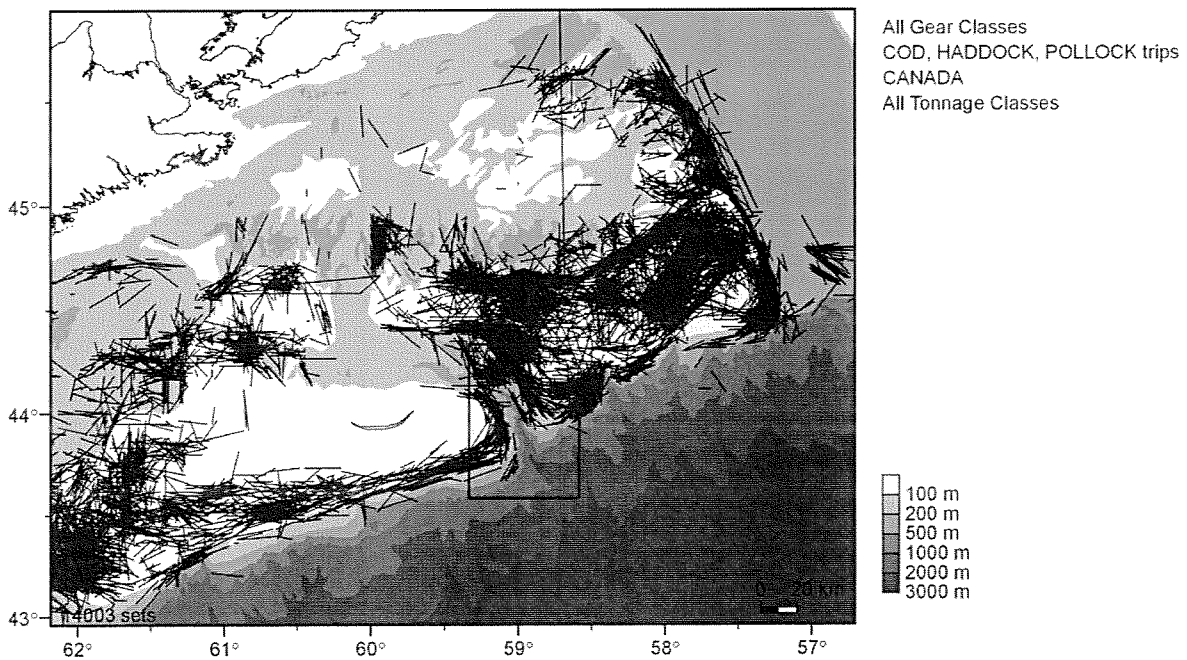


Figure 16. Trips to 4VSW by Canadian vessels with observers, showing tracks made by fishing vessels, 1981-1985.

4VS 4W JAN-DEC 1988-1992, Observer Data Fishing Tracks

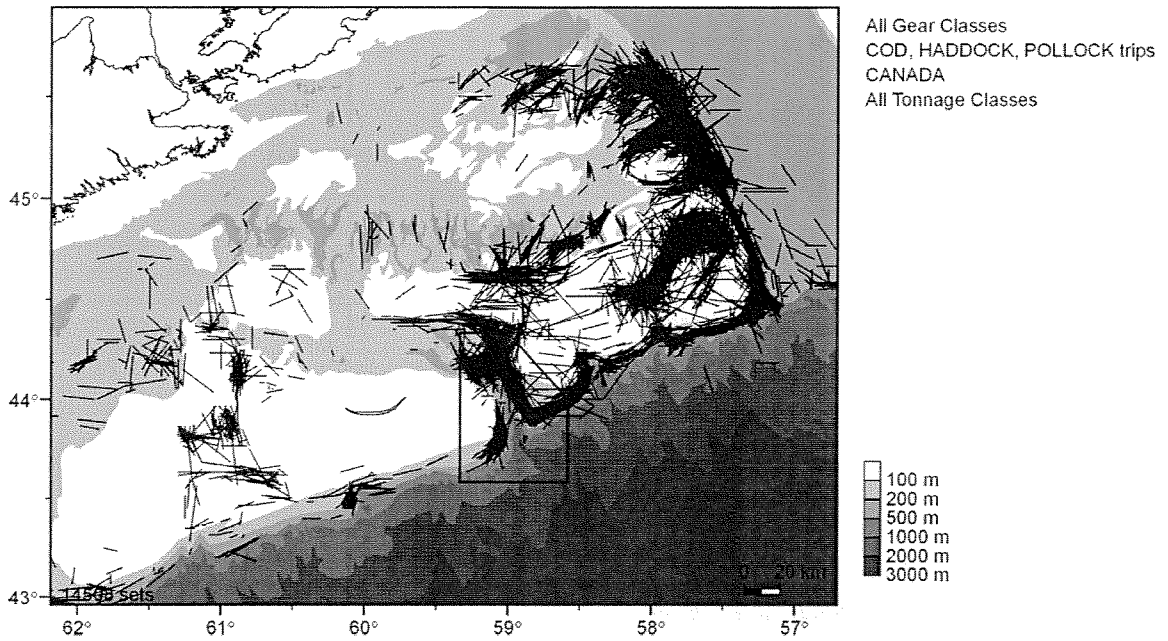


Figure 17. Trips to 4VSW by Canadian vessels with observers, showing tracks made by fishing vessels, 1988-1992.

4VS 4W JAN-DEC 1983-1985, Observer Data Fishing Tracks

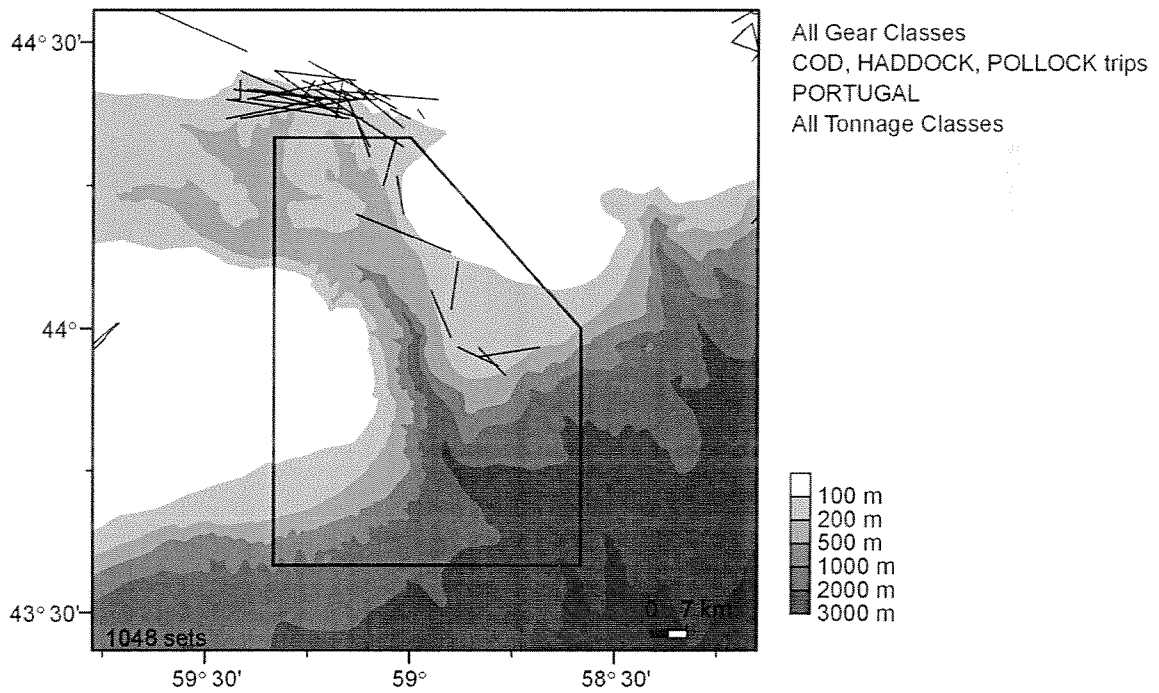


Figure 18. Observer map, 1983-1985, cod trips by Portuguese vessels to the GAA.

4VSc 4VSe 4Wf 4Wg Cod, Haddock, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

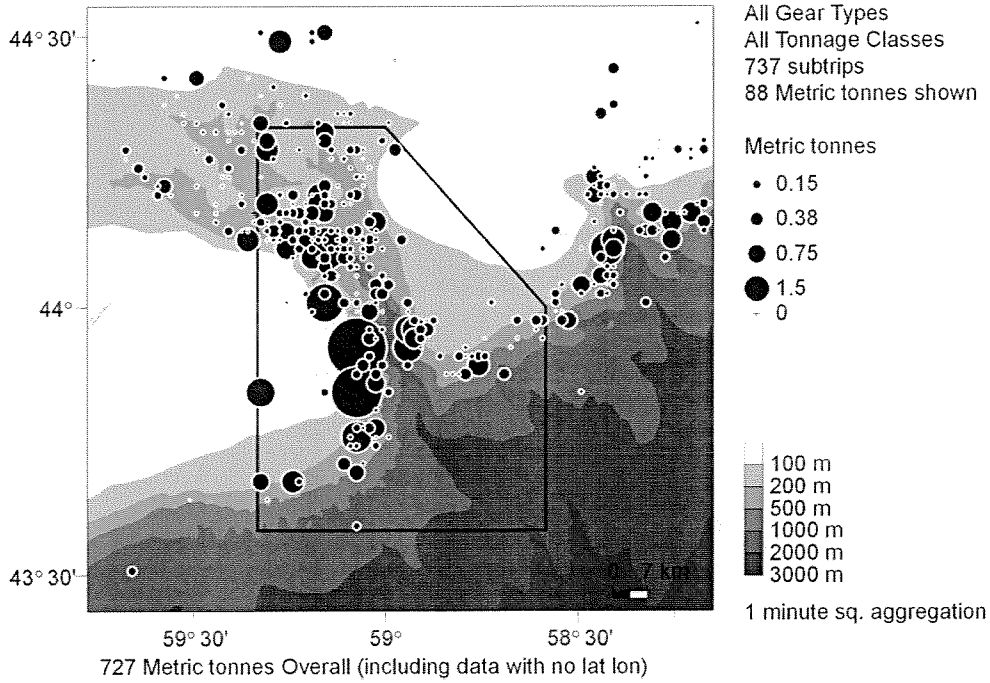


Figure 19. Cod and haddock landed from the GAA, all vessels 1996-2001.

4VSW Haddock  
 SUMMER Stratified Random 1997-2001 Avg. Adj. TotWgt

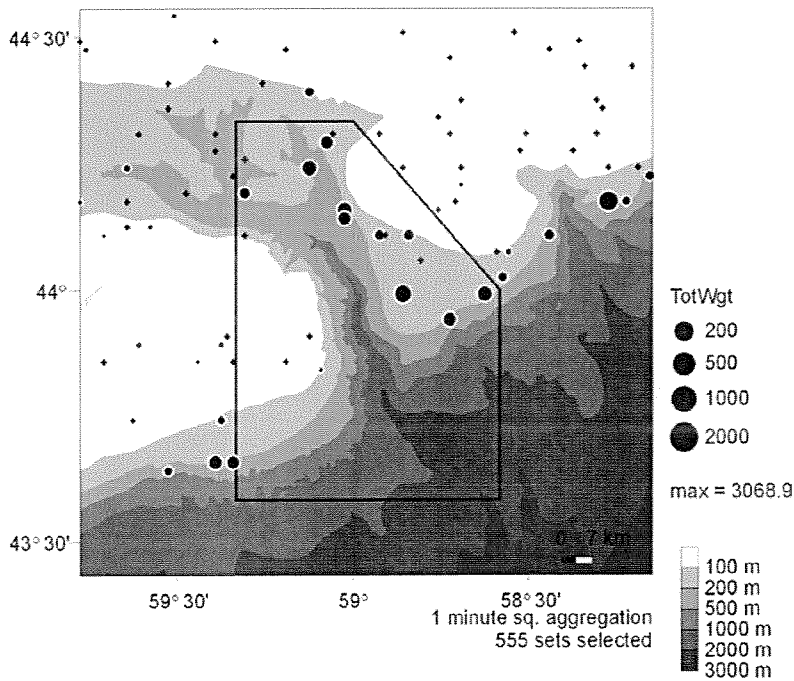


Figure 20. Summer research vessel trawl survey, haddock, 1997-2001.

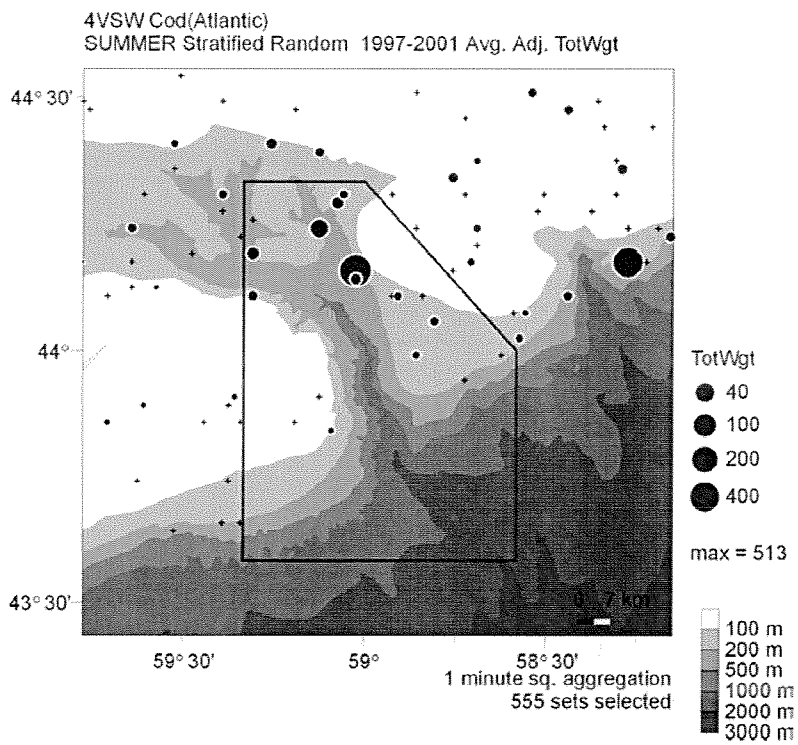


Figure 21. Summer research vessel trawl survey, cod, 1997-2001.

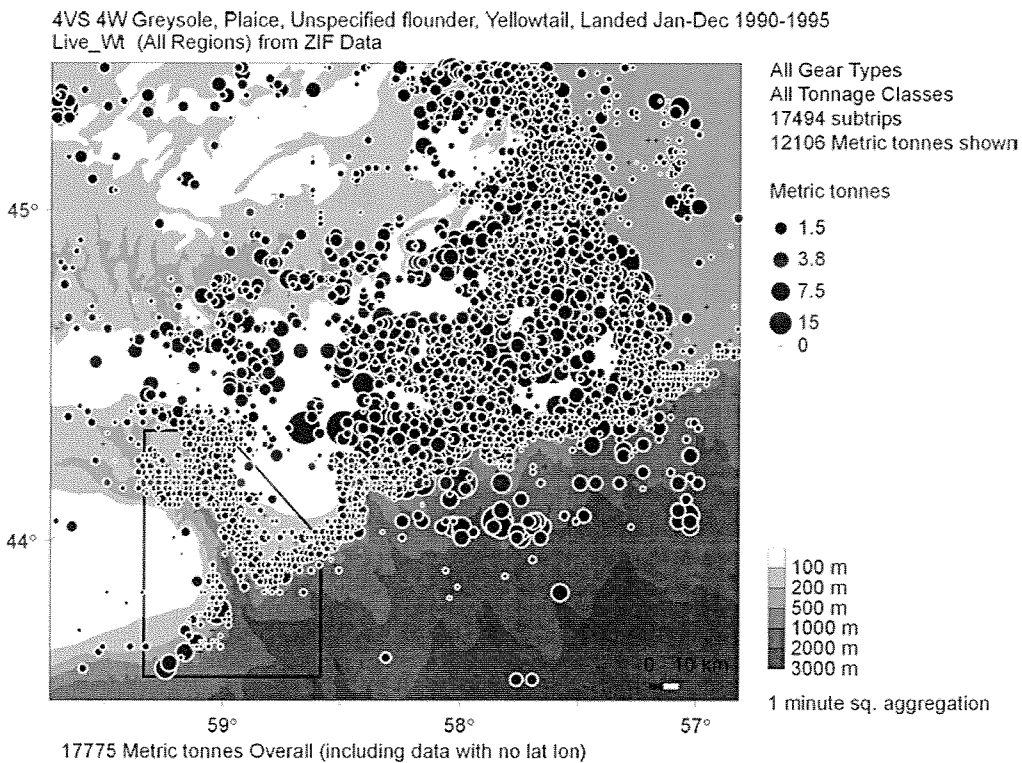


Figure 22. Catches of flounders in the GAA and Banquereau, 1990-1995.

4VS 4W JAN-DEC 1987-1995, Observer Data Fishing Tracks

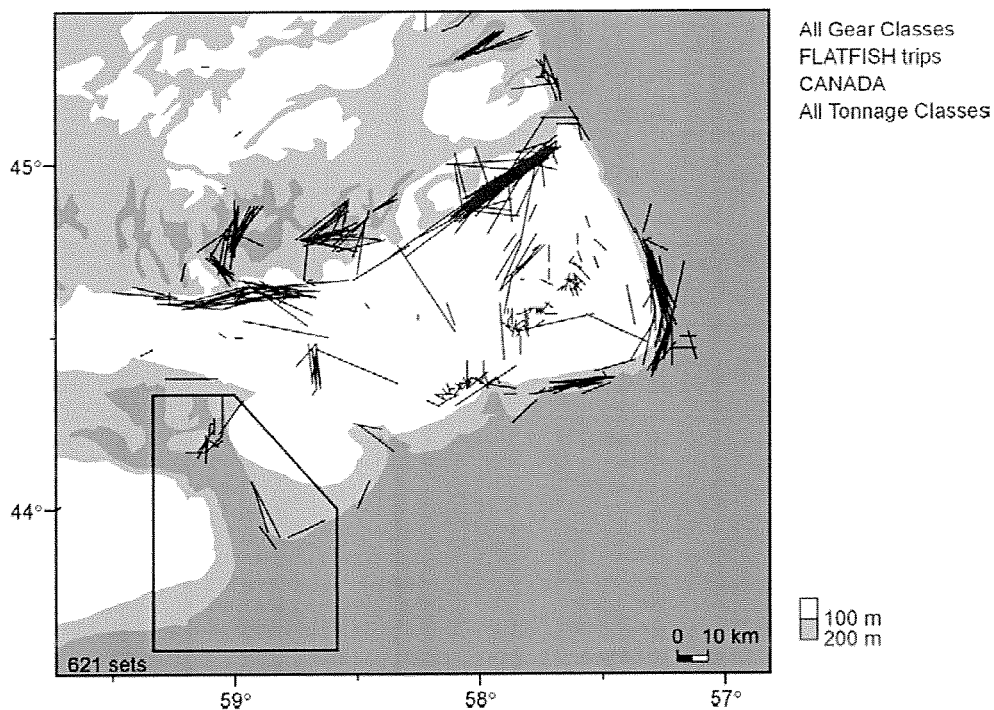


Figure 23. Observer records, flounder trips, Canada, 1987-1995.

4VS 4W Greysole, Plaice, Unspecified flounder, Yellowfin tuna, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

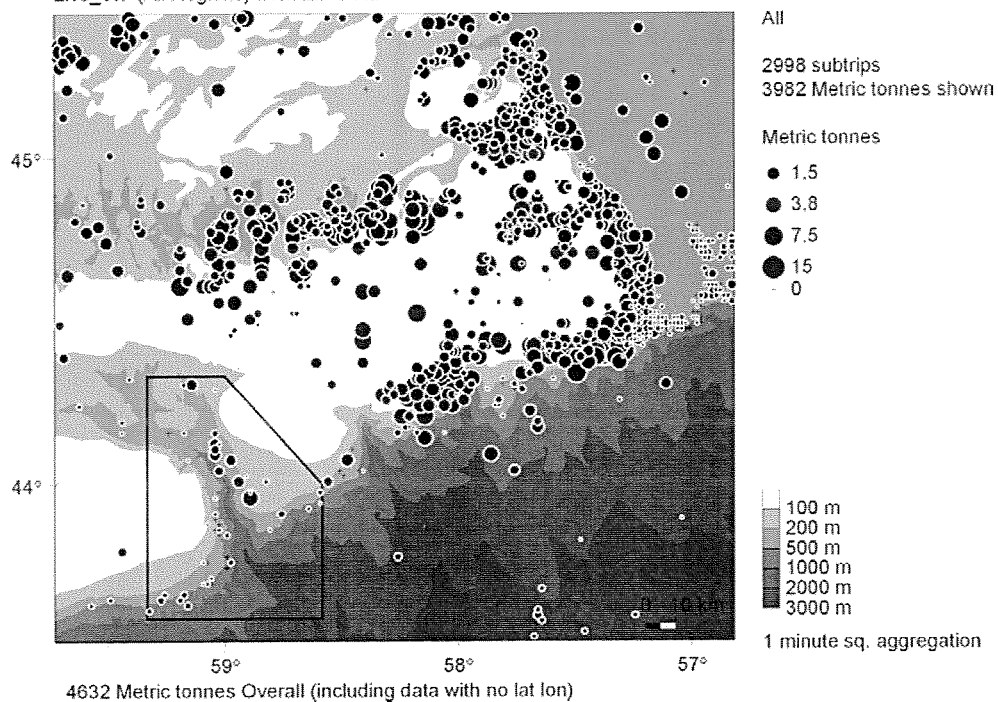


Figure 24. Catches of flounders in the GAA and Banquereau, 1996-2001.

4VS 4W JAN-DEC 1978-1985, Observer Data Fishing Tracks

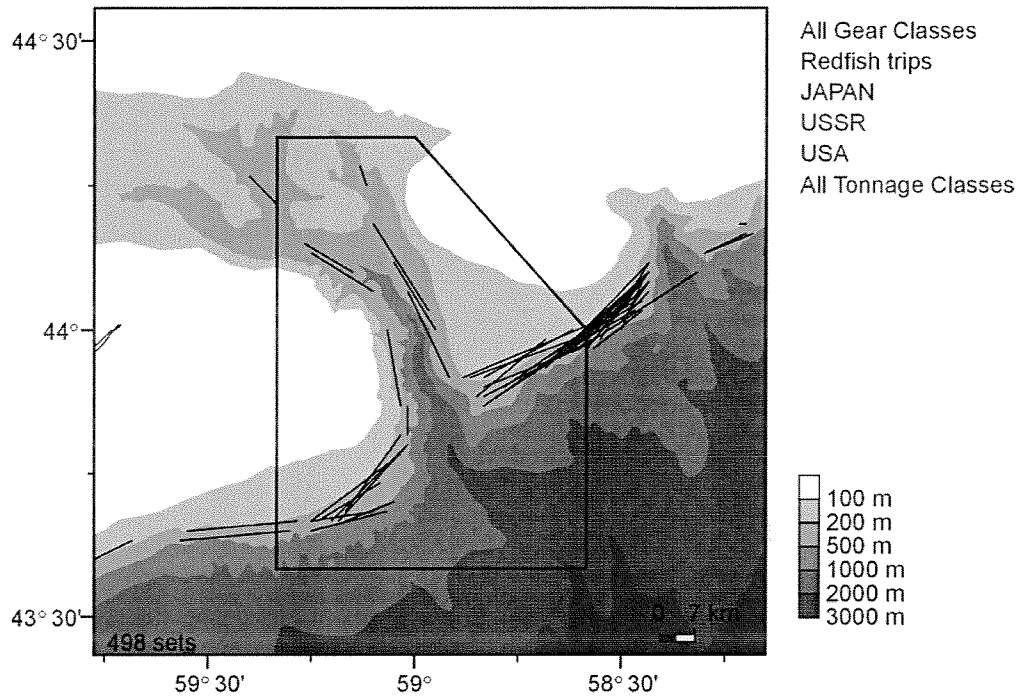


Figure 25. Observer map, 1978-1985, redfish trips by French, Japanese, Soviet, and American vessels to the GAA.

4VS 4W JAN-DEC 1988-1992, Observer Data Fishing Tracks

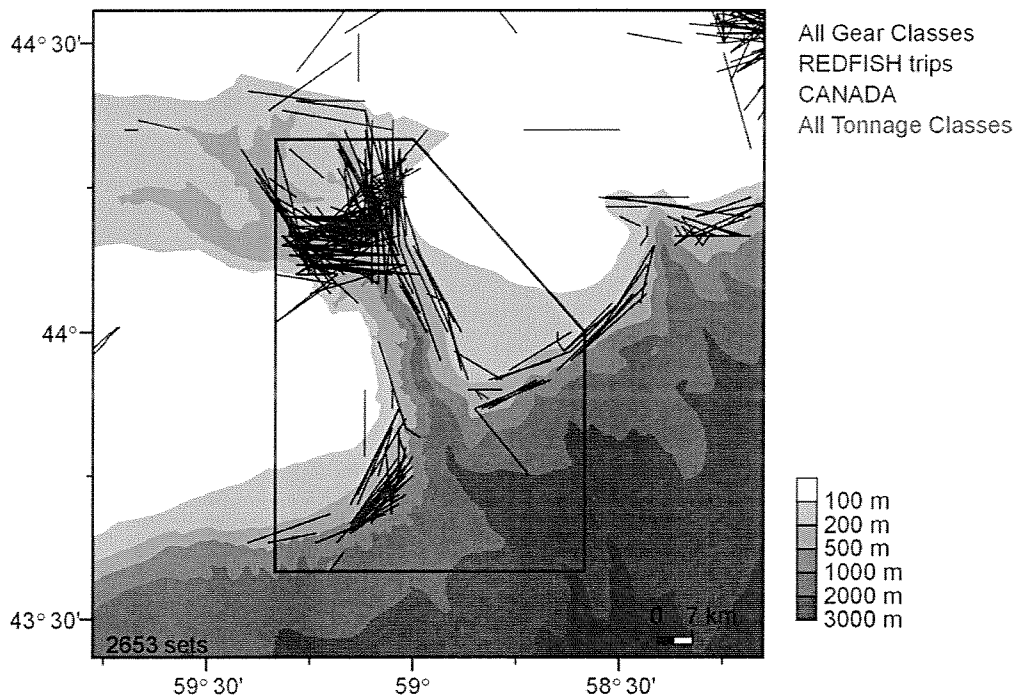


Figure 26. Observer map, 1988-92, redfish trips by Canadian vessels to the GAA.

4VS 4W Redfish, Landed Jan-Dec 1996-2001  
Live\_Wt (All Regions) from ZIF Data

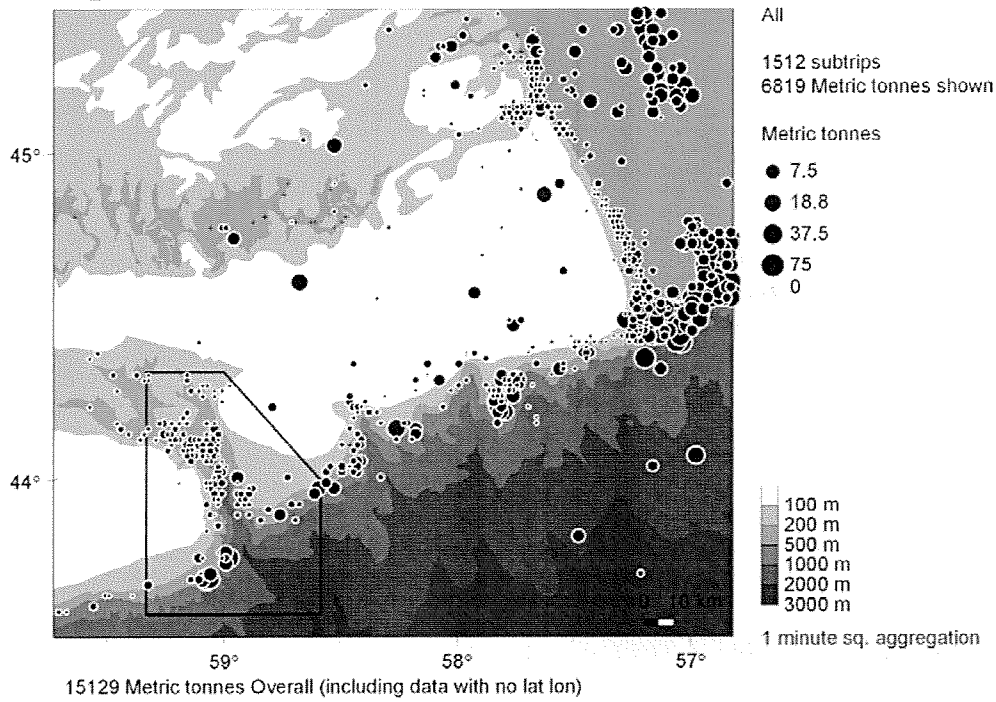


Figure 27. Catch of redfish by Canadian vessels, 1996-2001, GAA and Banquereau.

4VSc 4VSe 4Wf 4Wg Redfish, Landed Jan-Dec 1996-2001  
Live\_Wt (All Regions) from ZIF Data

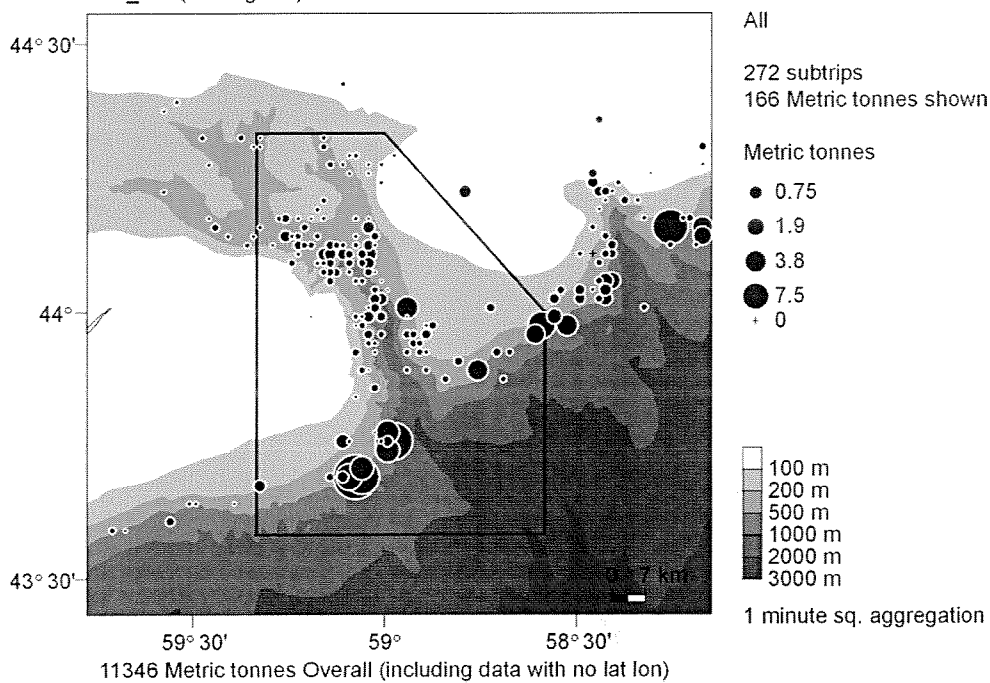


Figure 28. Catch and effort map for redfish, 1996-2001 (Canada), GAA.

4VS 4W JAN-DEC 1977-1979, Observer Data Fishing Tracks

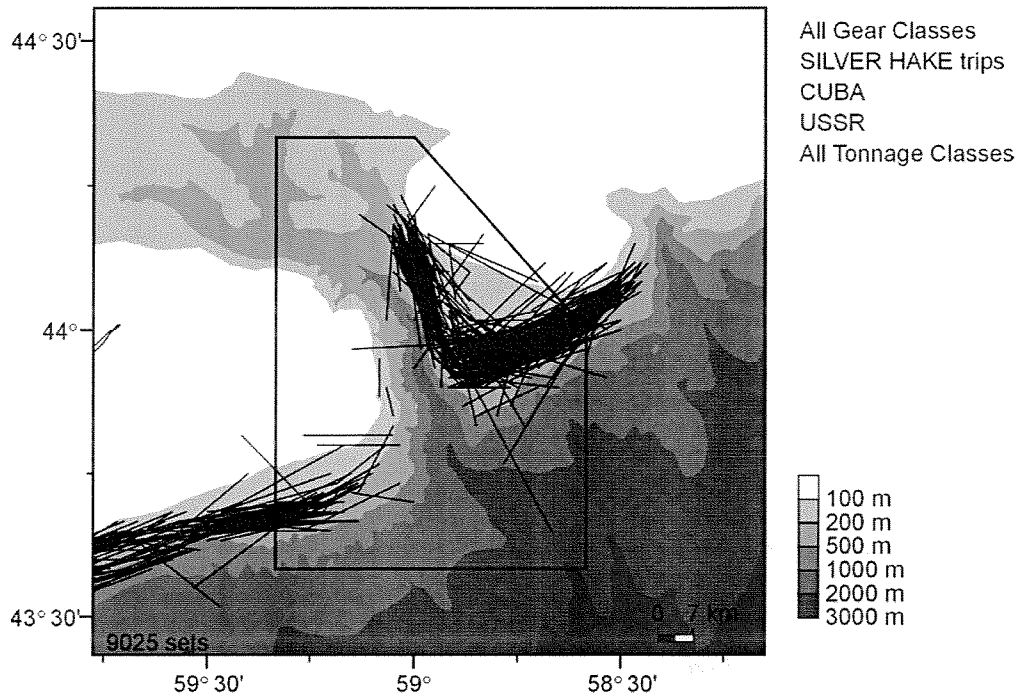


Figure 29. Observer map, 1977-79, silver hake trips (USSR and Cuba), GAA.

4VS 4W JAN-DEC 1996-2001, Observer Data Fishing Tracks

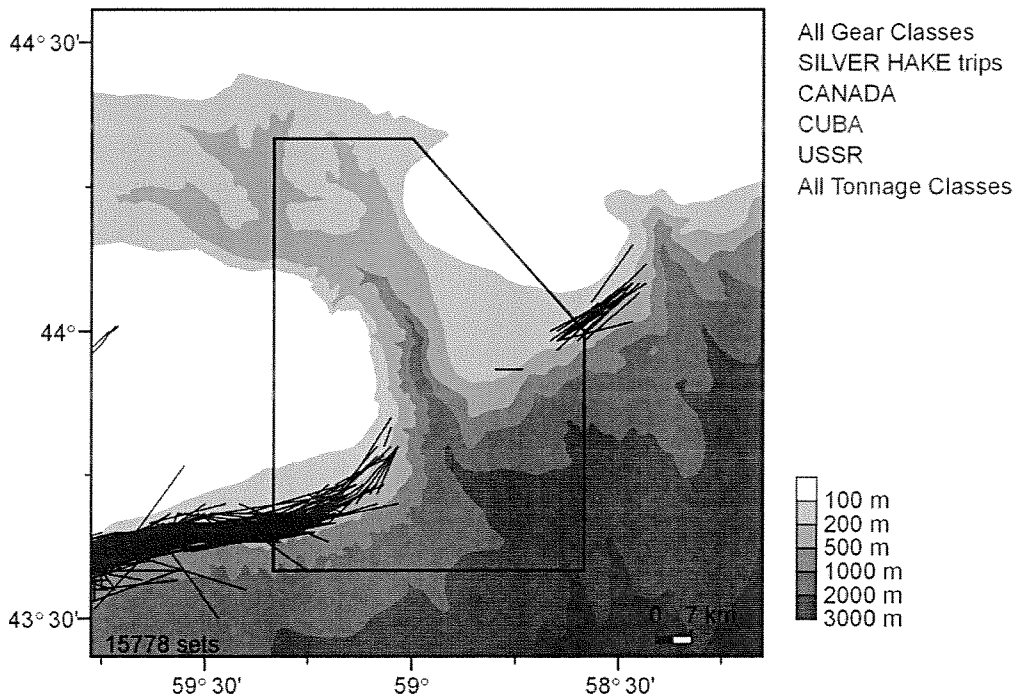
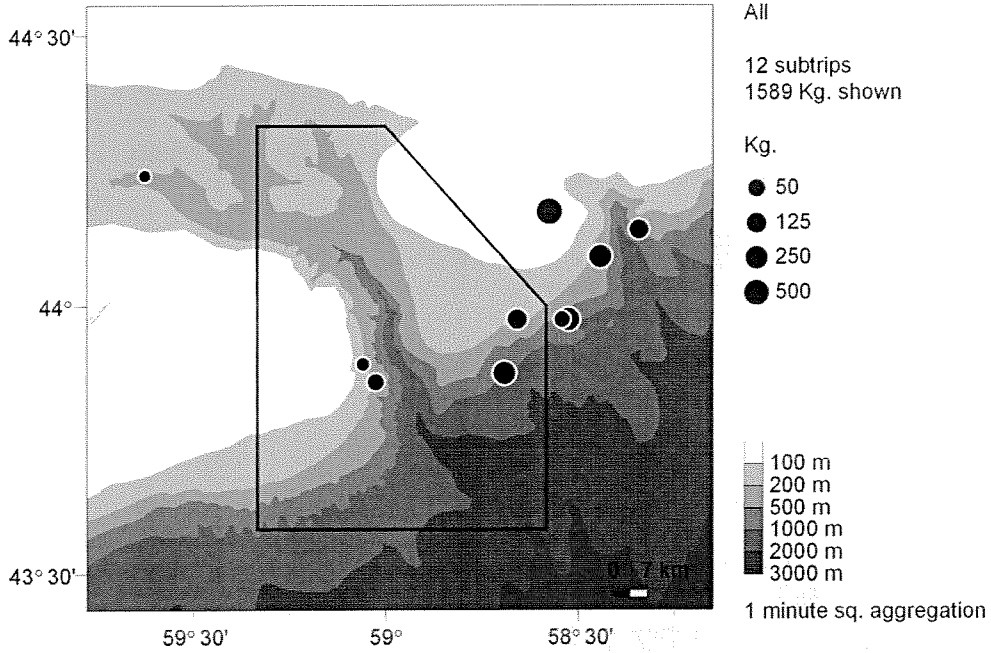


Figure 30. Observer map, 1996-2001, silver hake trips (USSR, Cuba, and Canada), GAA.

4VS 4W Silver hake, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data



74126 Metric tonnes Overall (including data with no lat lon)

Figure 31. Catch of silver hake by Canadian vessels, 1996-2001, GAA.

4VSc 4VSe 4Wf 4Wg Halibut, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

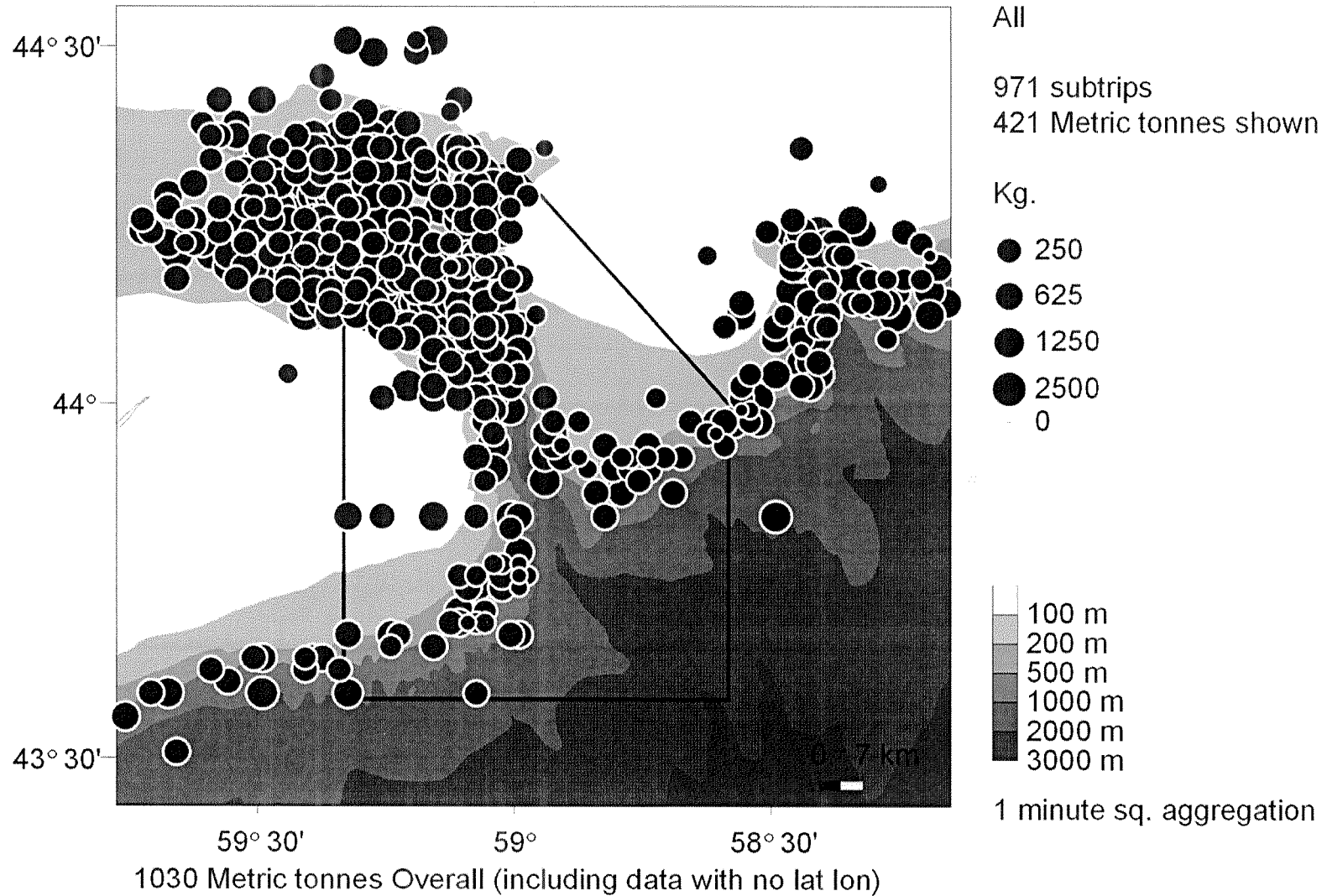


Figure 32. Catches of halibut (Canada), 1996-2001, GAA. Catches from the halibut survey are not included.

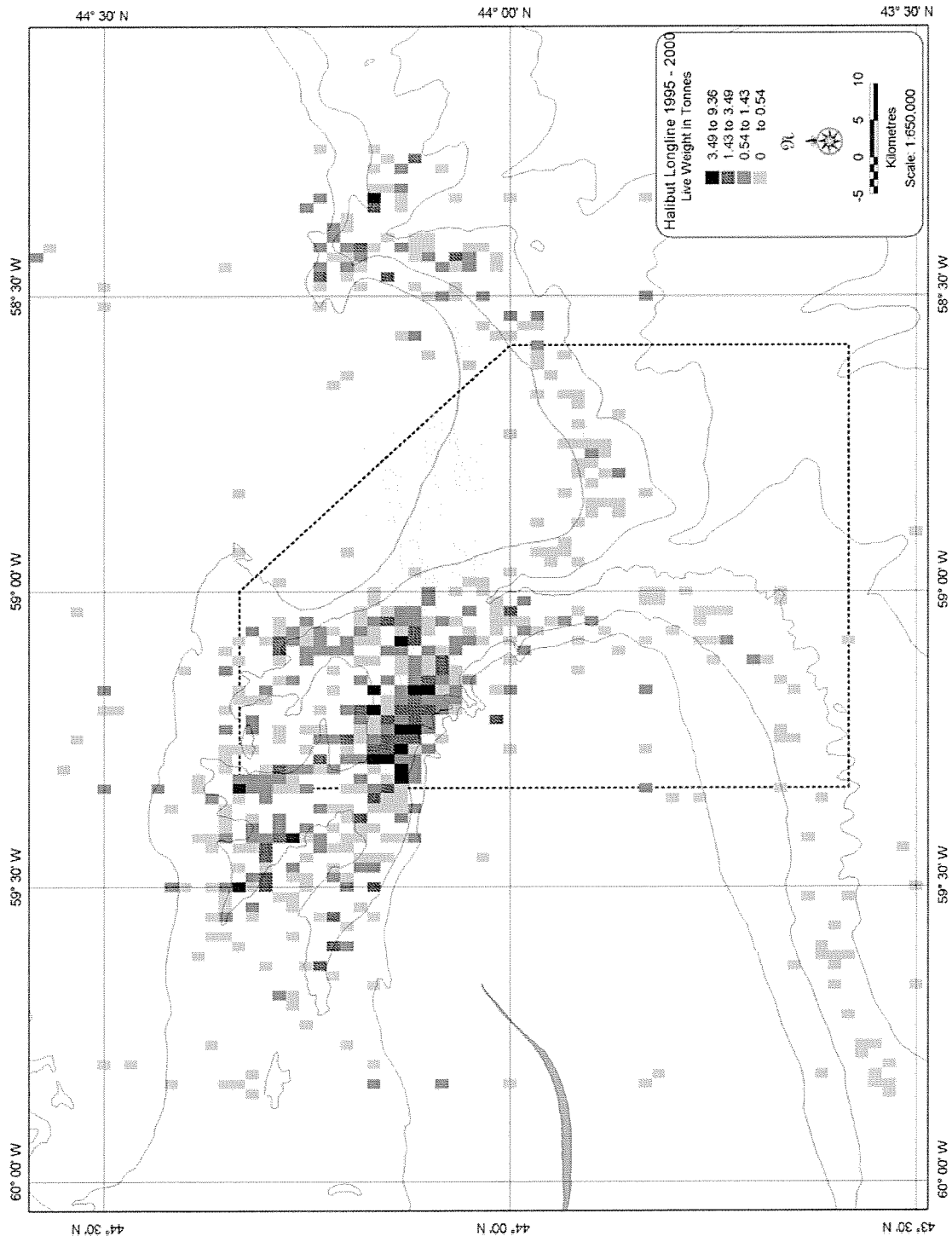


Figure 33. Catches of halibut (Canada) in the GAA, 1995-2000, shown by shaded one-minute squares. Catches from the halibut survey are not included. The GAA is the area outlined by the dotted line.

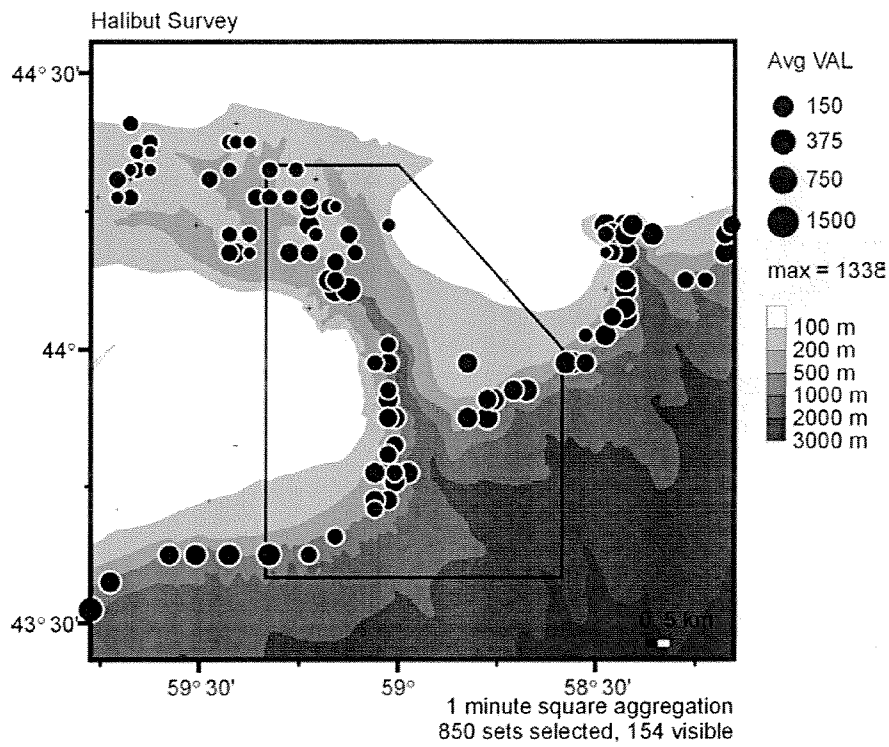


Figure 34. Commercial index and fixed survey, 1998, halibut, GAA.

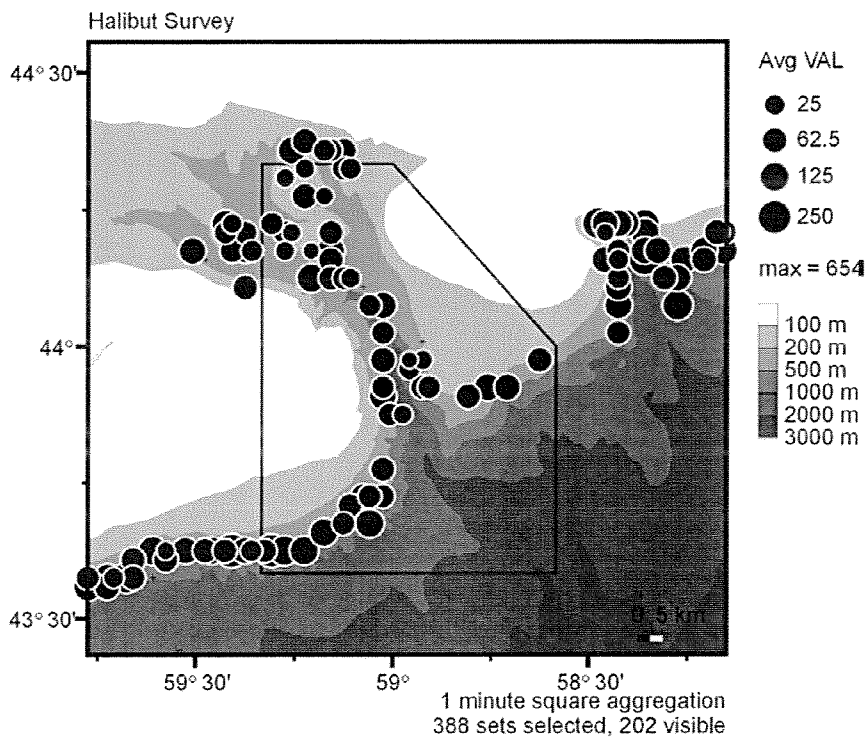


Figure 35. Commercial index survey, 1999, halibut, GAA.

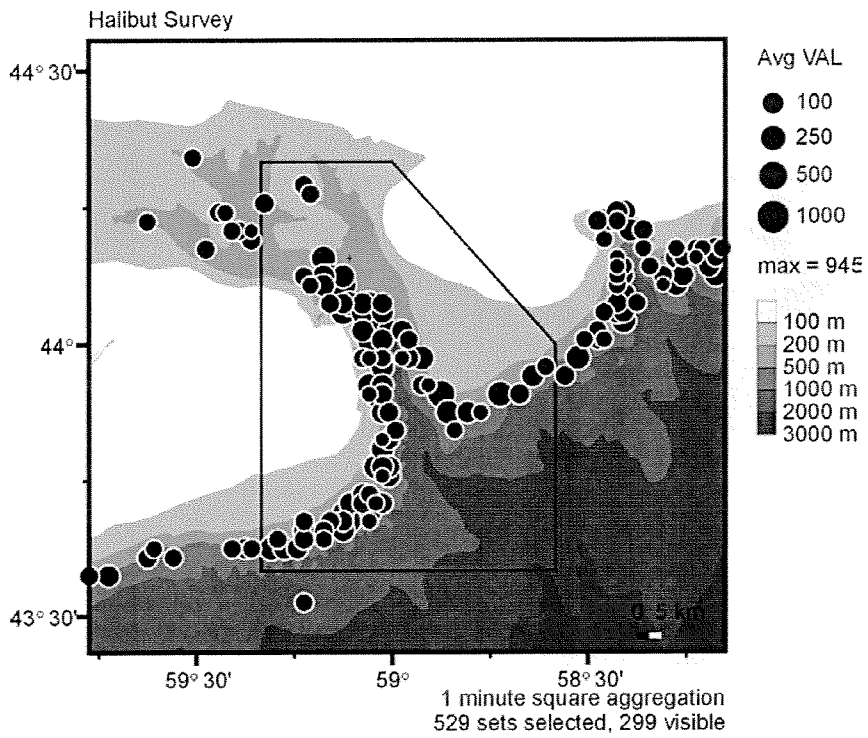


Figure 36. Commercial index survey, 2000, halibut, GAA.

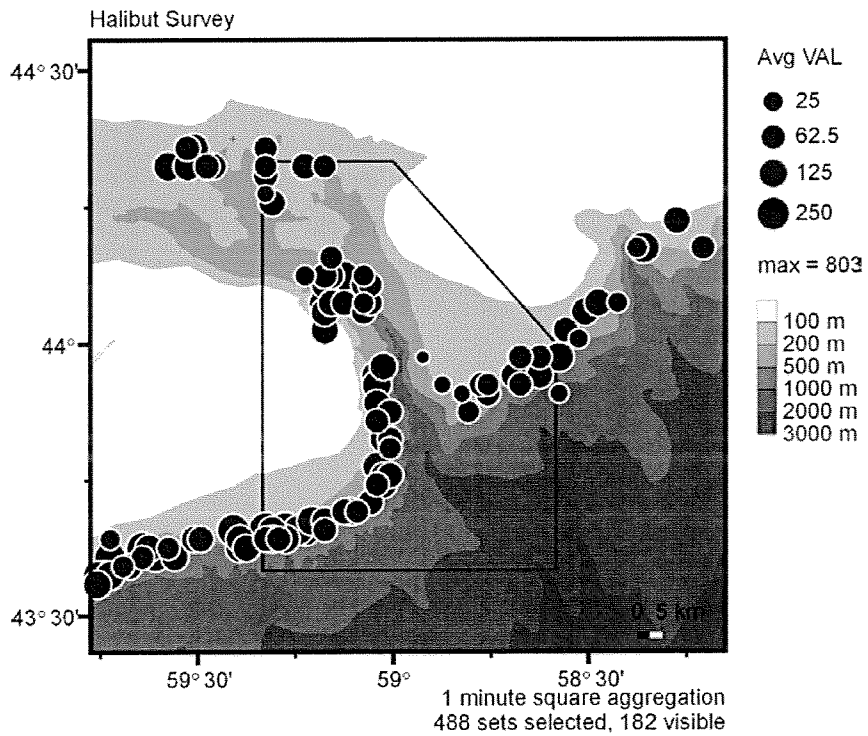


Figure 37. Commercial index survey, 2001, halibut, GAA.

4VS 4W Halibut, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

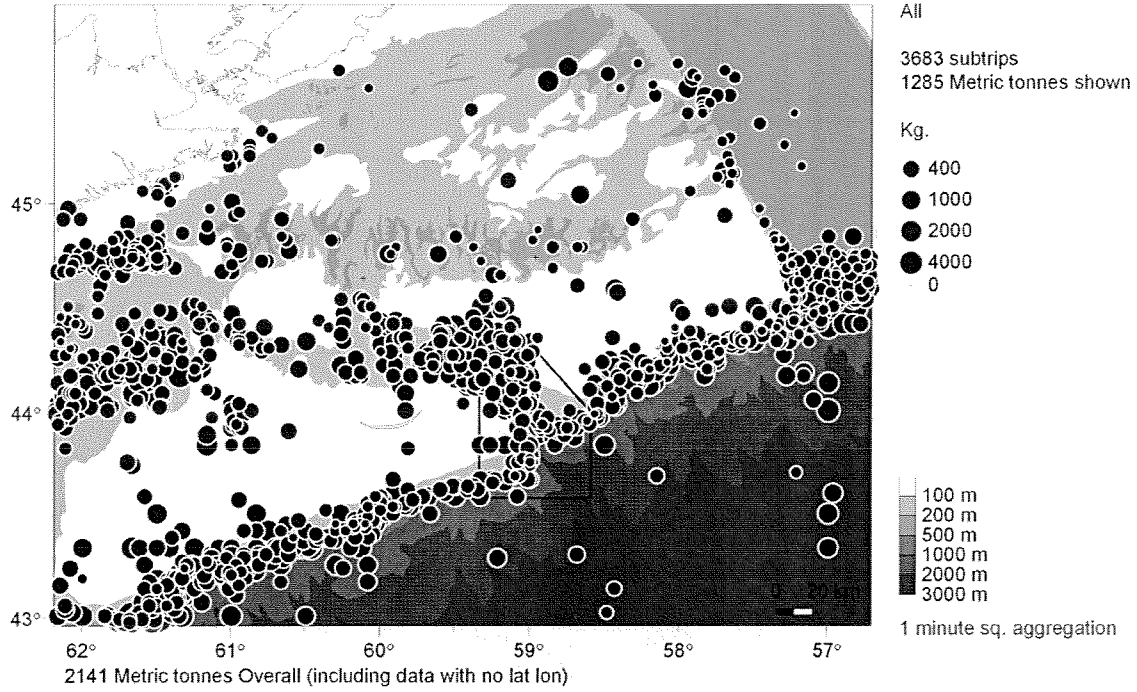


Figure 38. Catches of halibut on the eastern Scotian Shelf, 1996-2001. Catches from the halibut survey are not included.

4VS 4W Cusk, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

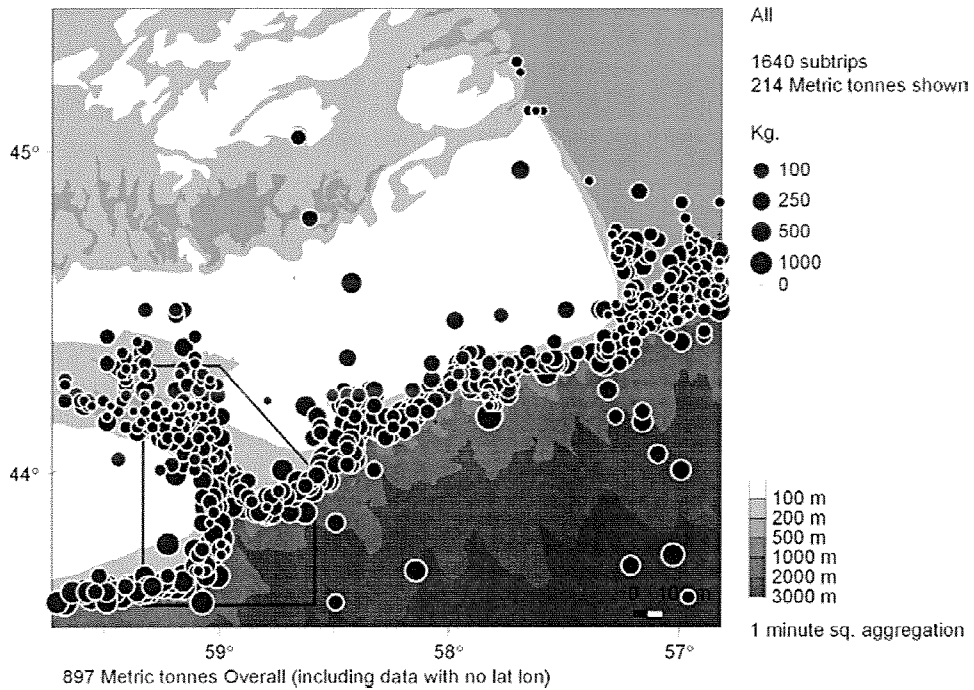


Figure 39. Catches of cusk in the GAA and Banquereau, 1996-2001.

4VS 4W JAN-DEC 1996-2001, Observer Data Fishing Tracks

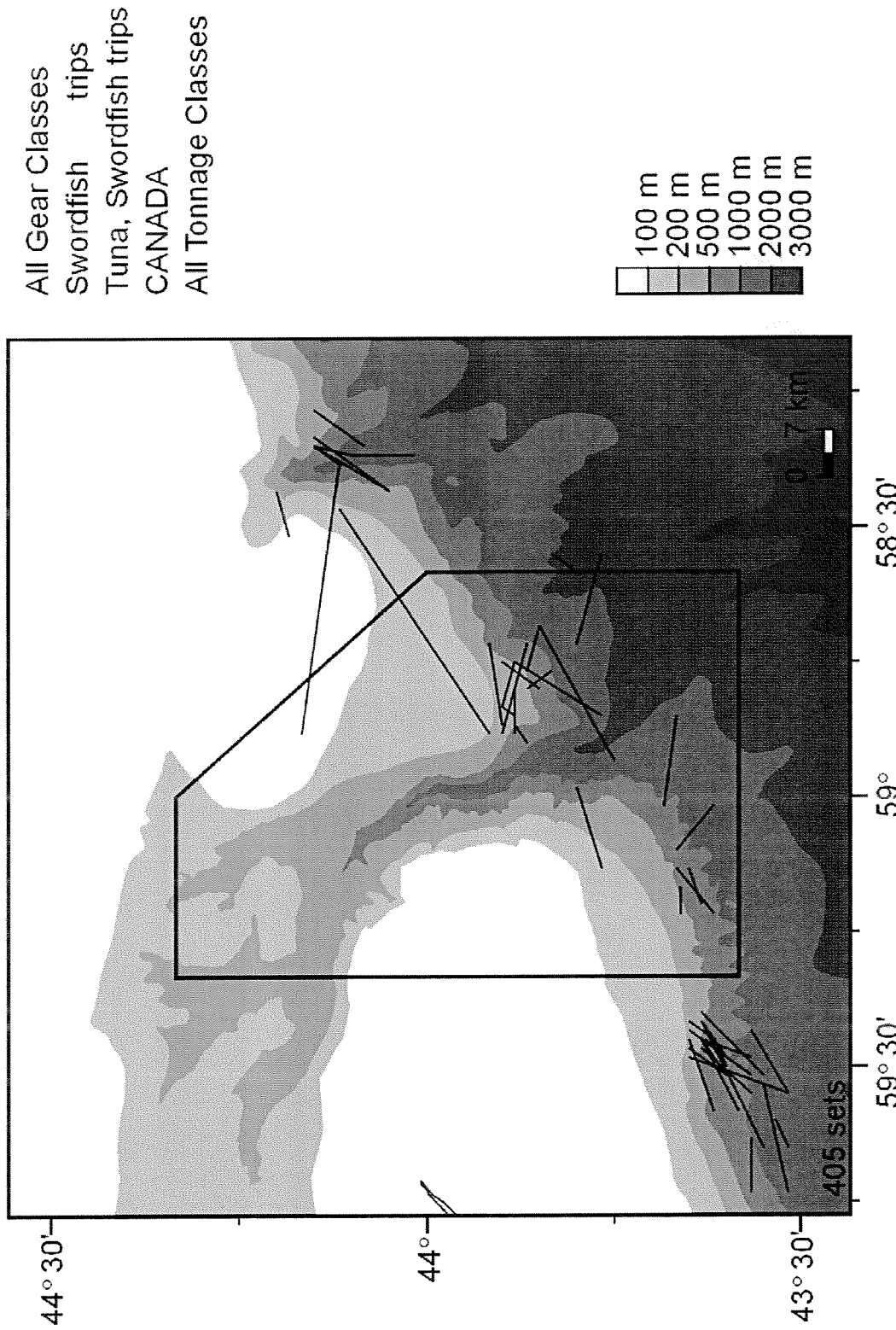
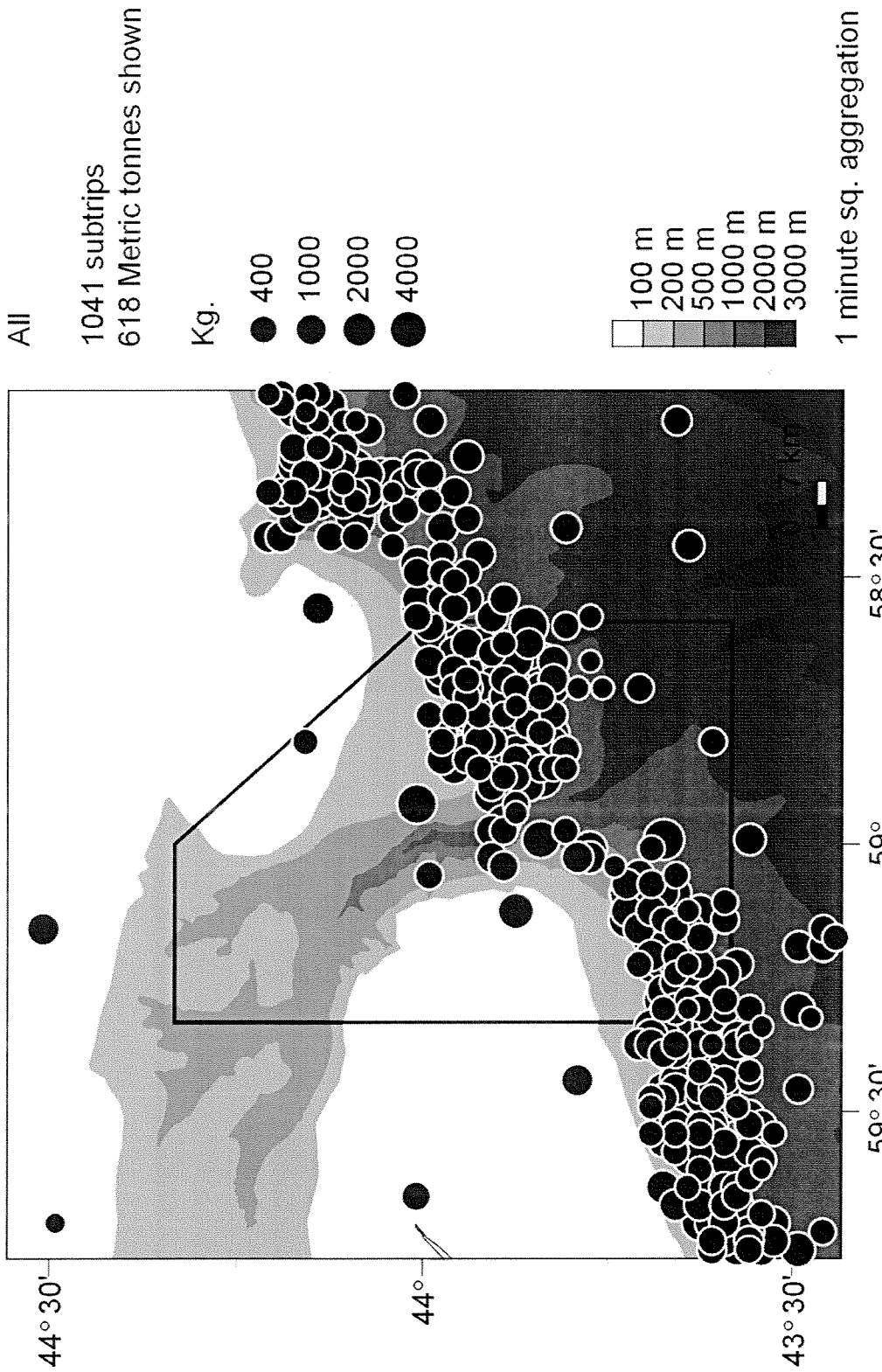


Figure 40. Trips to the GAA with observers by vessels fishing for swordfish and/or other tunas. Lines show location of sets, 1996-2001.

4VSc 4VSe 4Wf 4Wg Swordfish, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data



1061 Metric tonnes Overall (including data with no lat lon)

Figure 41. Swordfish landings (Canada), 1996-2001, GAA.

4VS 4W Swordfish, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

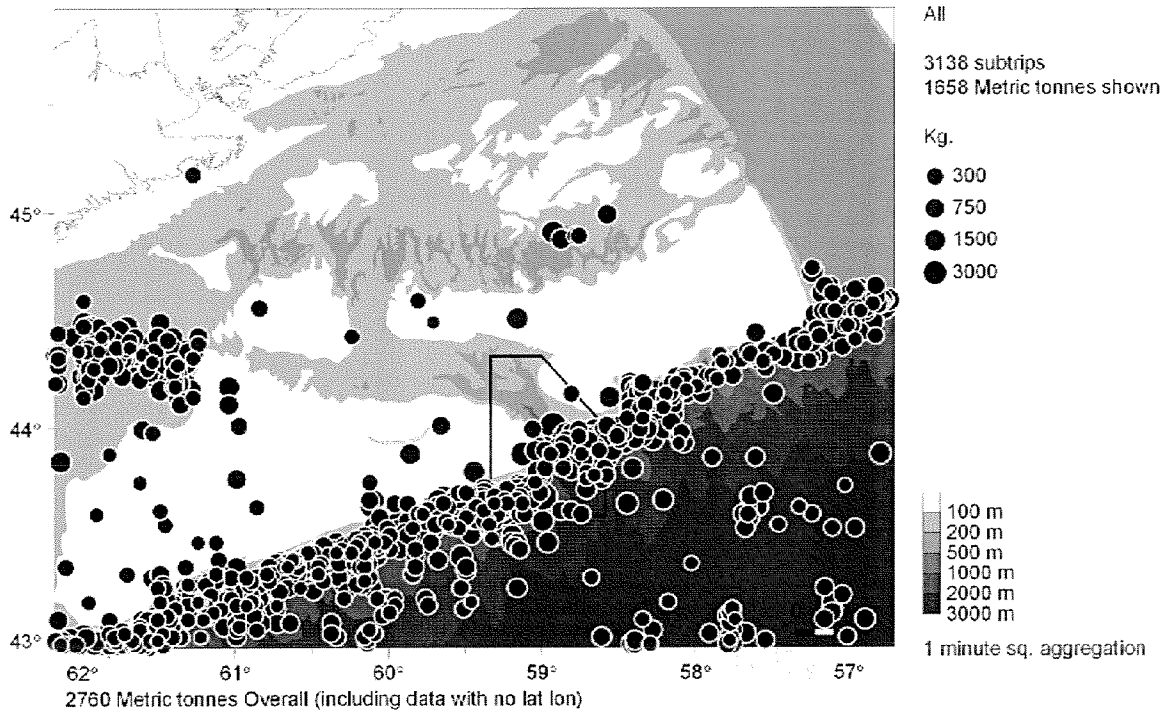


Figure 42. Swordfish landings (Canada), 1996-2001, eastern Scotian Shelf.

4VSc 4VSe 4Wf 4Wg Albacore tuna, Bigeye tuna, Yellowfin tuna, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

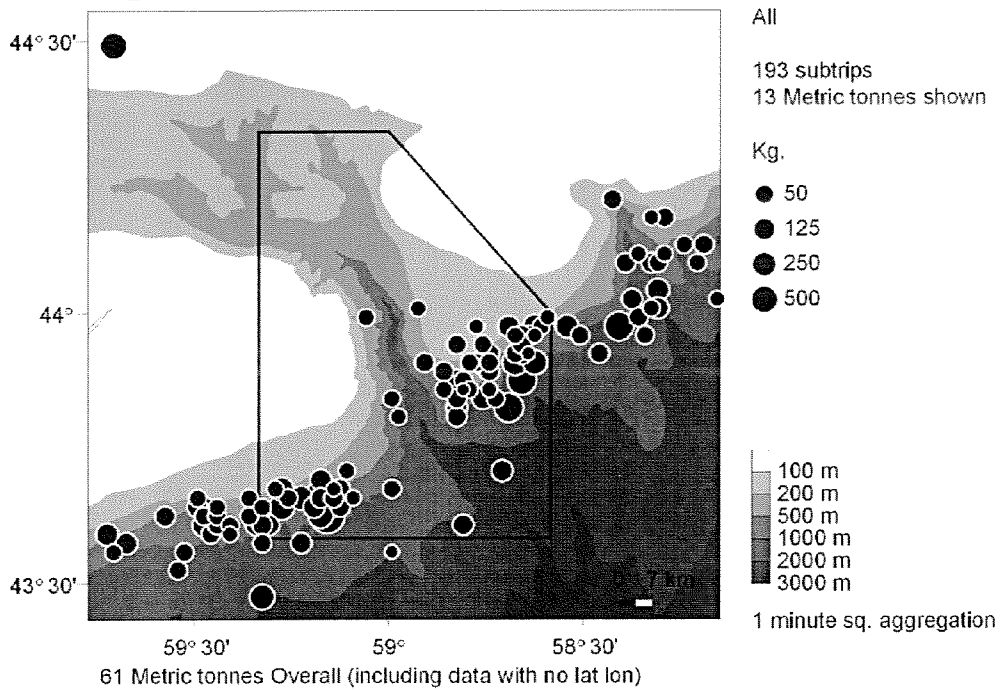


Figure 43. Bigeye, albacore, and yellowfin tuna landings, 1996-2001, GAA.

4VSc 4VSe 4Wf 4Wg Shark, porbeagle, Landed Jan-Dec 1996-2001  
Live\_Wt (All Regions) from ZIF Data

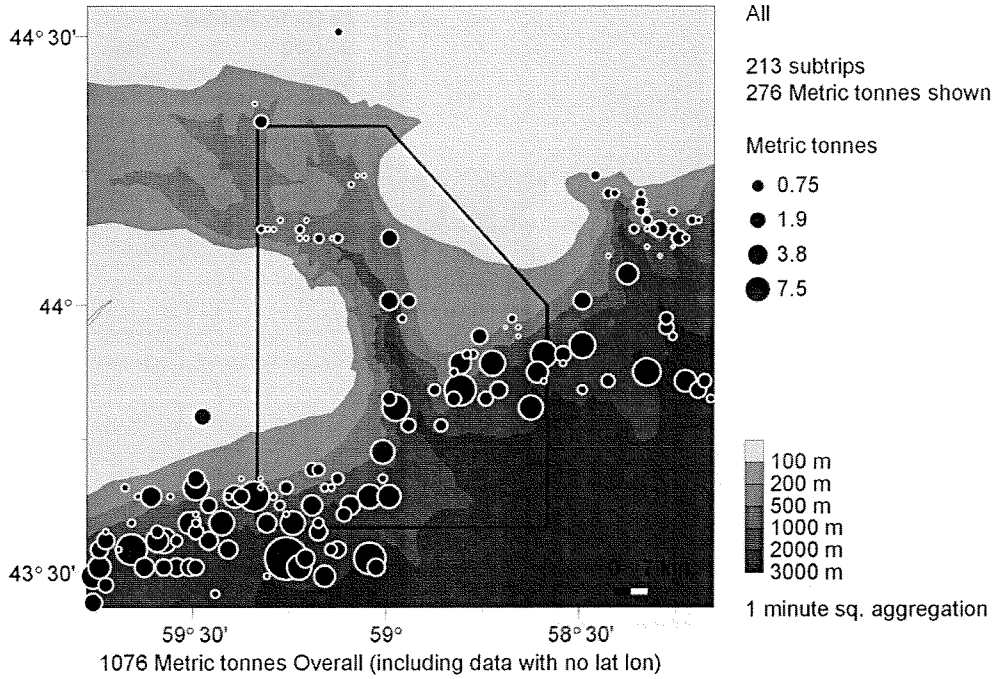


Figure 44. Porbeagle shark landings, 1996-2001, GAA.

4VS 4W SHORT-FIN, JAN-DEC 1996-2001, Observer Data Fishing Tracks

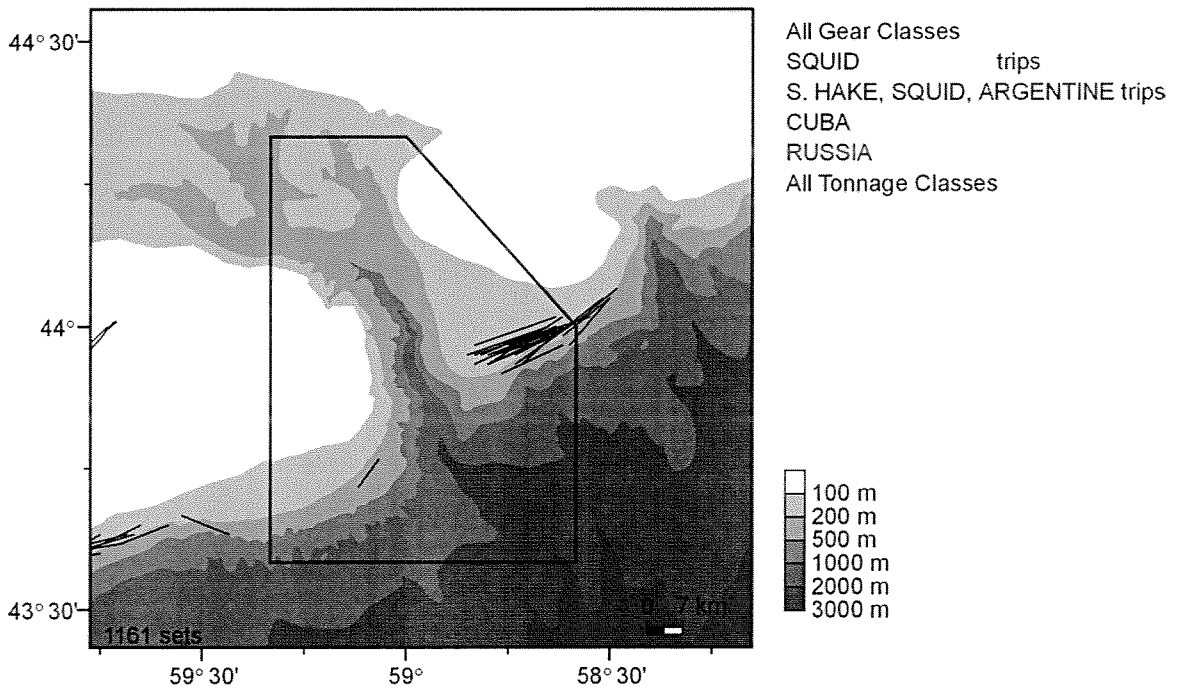


Figure 45. Observer map, 1977-81, squid (foreign countries listed in Table 9), GAA.

4VS 4W SHORT-FIN, JAN-DEC 1996-2001, Observer Data Fishing Tracks

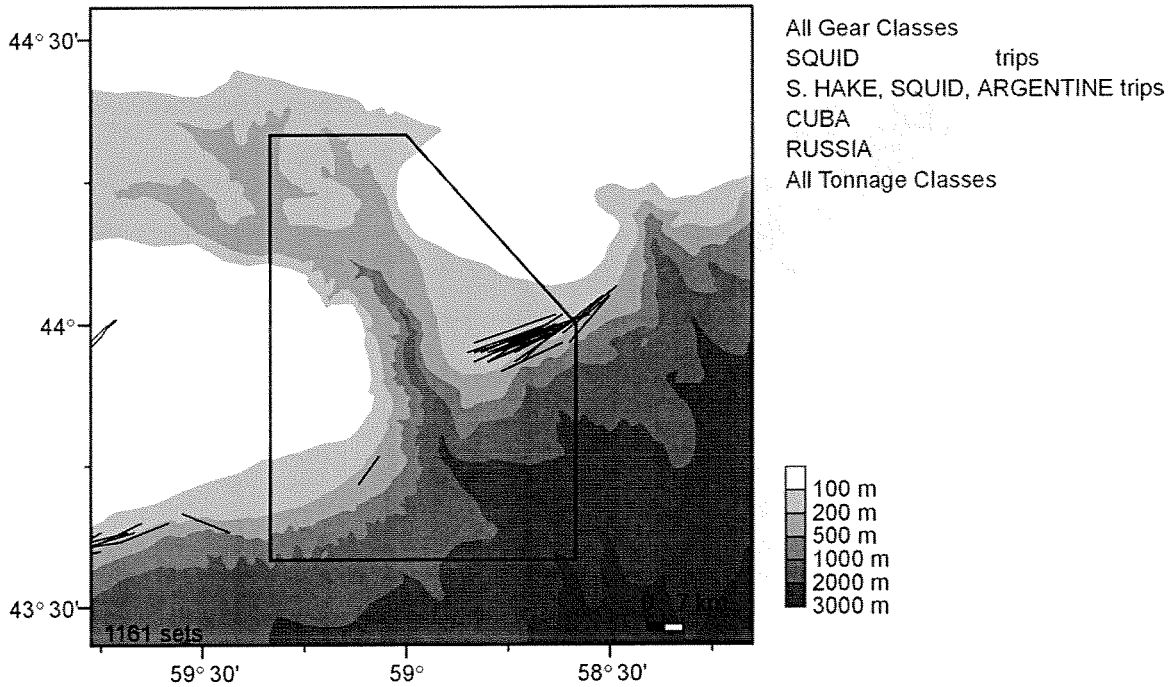


Figure 46. Observer map, 1996-2001, squid (Cuba and Russia), GAA.

4VSc 4VSe 4Wf 4Wg Snow crab (queen), Landed Jan-Dec 1996-2001  
Live\_Wt (All Regions) from ZIF Data

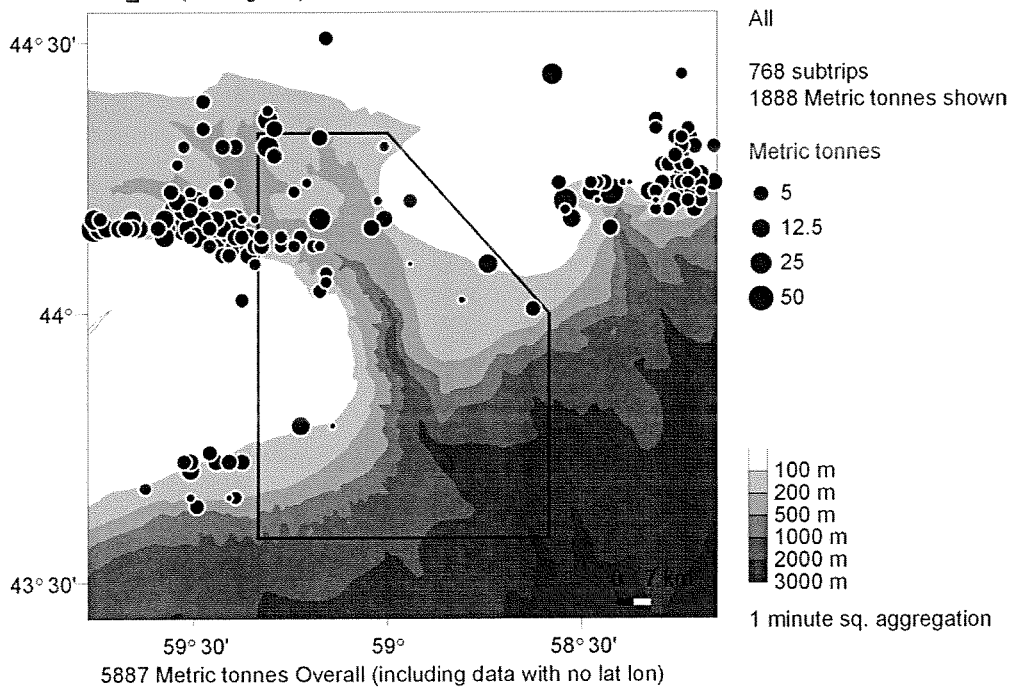


Figure 47. Snow crab landings, 1999-2001, GAA.

4VSc 4VSe 4Wf 4Wg Shrimp, Shrimp pand borealis, Landed Jan-Dec 1996-2001  
 Live\_Wt (All Regions) from ZIF Data

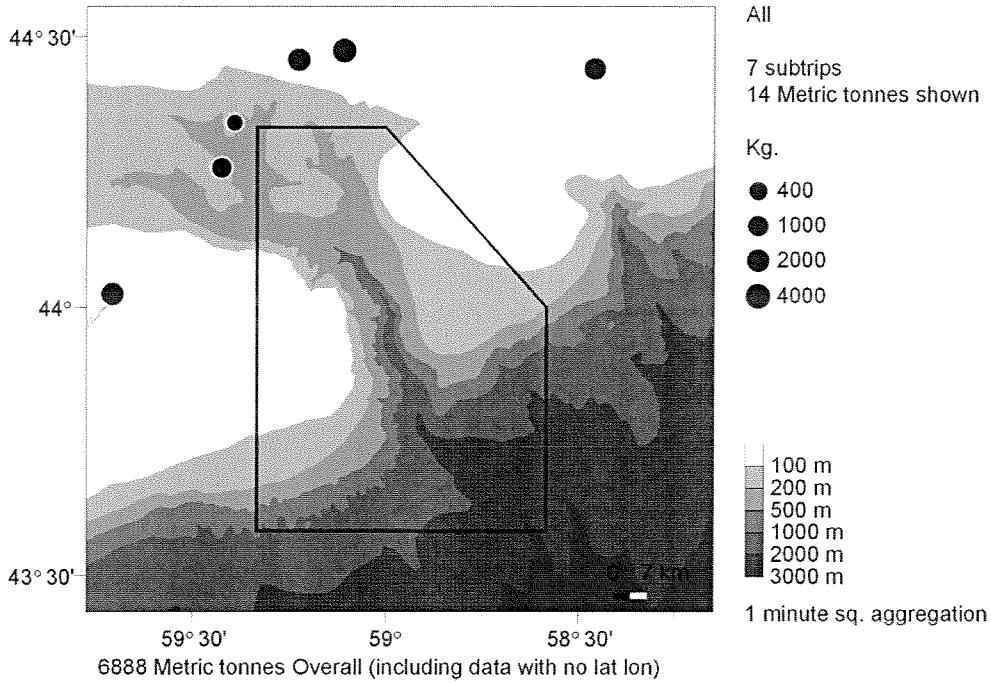


Figure 48. Shrimp landings, 1996-2001, GAA.

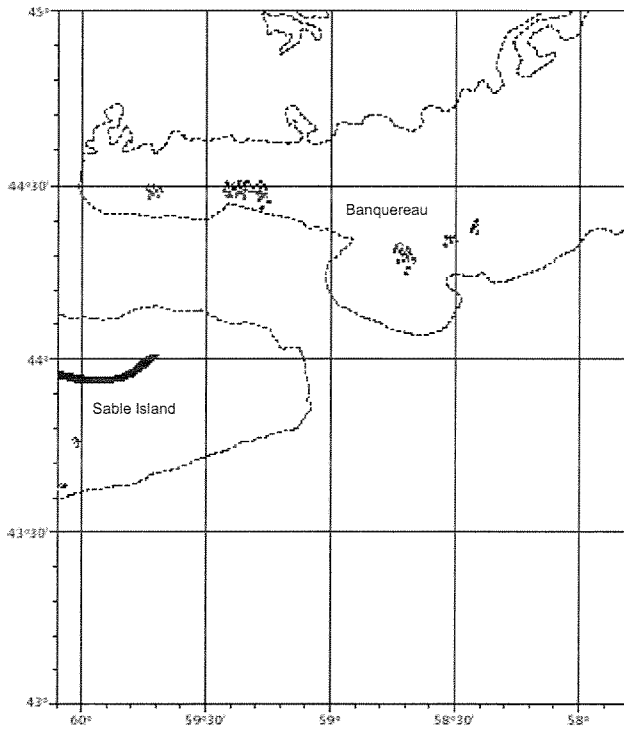


Figure 49. Location of Icelandic scallop fishery on the Scotian Shelf, 2000 (provided by G. Robert, Invertebrate Fisheries Division, Fisheries and Oceans Canada).

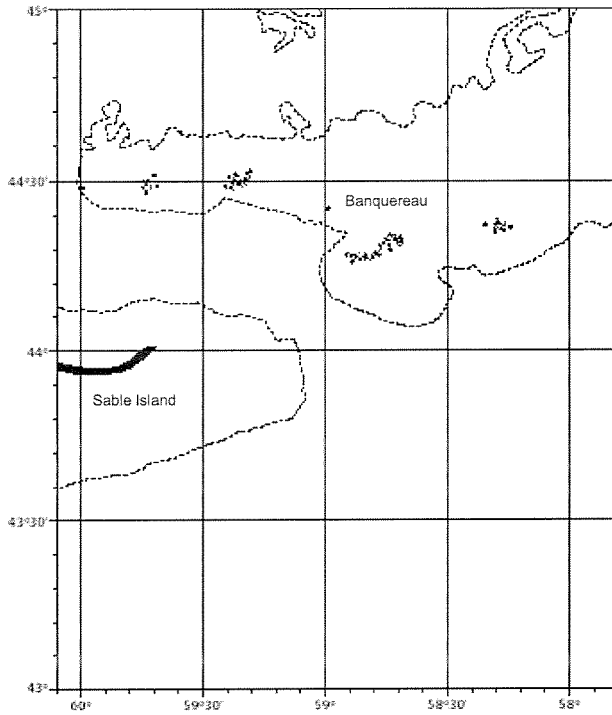


Figure 50. Location of Icelandic scallop fishery on the Scotian Shelf, 2001 (provided by G. Robert, Invertebrate Fisheries Division, Fisheries and Oceans Canada).

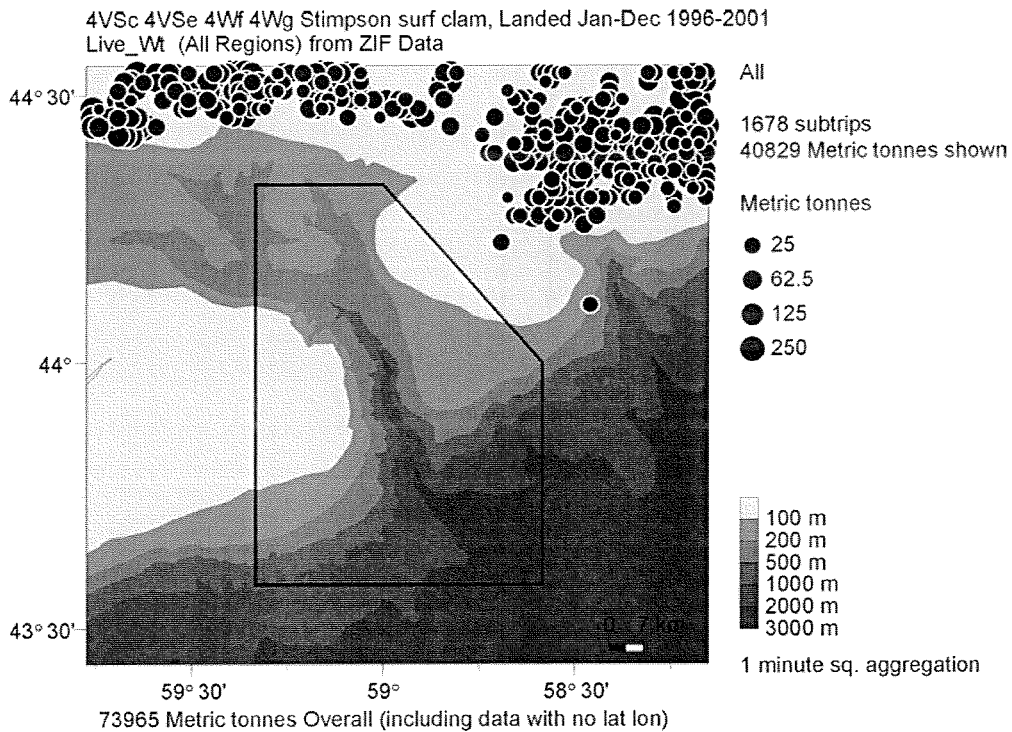


Figure 51. Map of Stimpson's (Arctic) surf clam landings, 1996-2001, GAA.

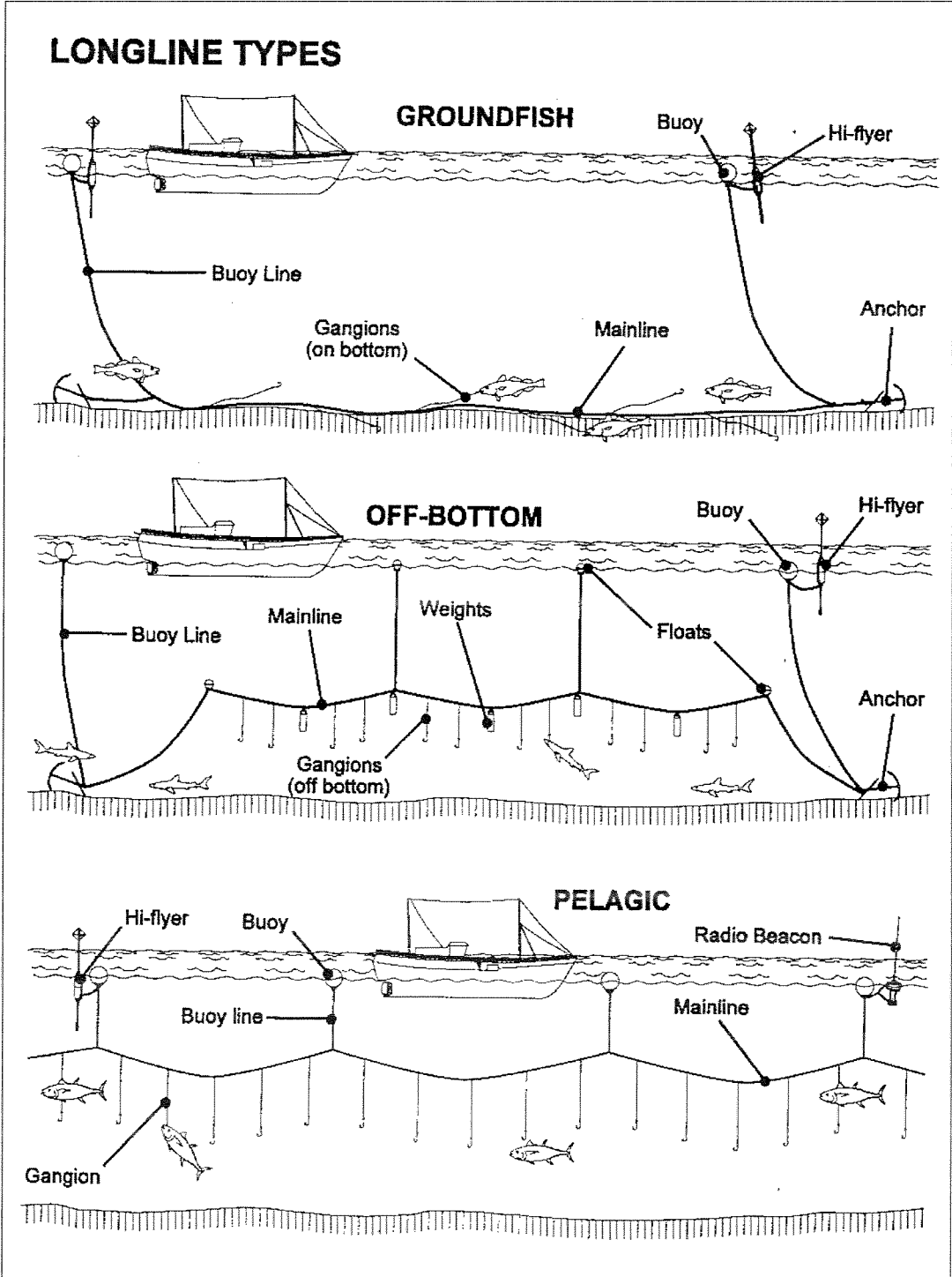


Figure A-1. Diagram showing longline gear, both bottom longline, used for halibut (top diagram) and pelagic longline, used for swordfish and tunas (bottom diagram) (used with permission of National At-Sea Fisheries Observer Program, DFO).