ACADIA ESTUARINE CENTRE FOR RESEARCH

Fisheries Management Issues in the Upper Bay of Fundy

A Report prepared for the EJLB Foundation

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Executive Summary

The Upper Bay of Fundy is a unique body of water exhibiting the world's highest tides, high and variable biological productivity, and numerous cumulative effects of human activities. It provides habitat for many species of fish, birds and mammals that breed elsewhere, but regularly migrate to the Bay for feeding purposes. These biological resources have been important to local residents for thousands of years, but have recently exhibited significant decline. Because of its unique features, its relatively enclosed nature, and the apparent failure of management policies and practice to conserve the stocks, the Upper Bay of Fundy has been identified as an ideal location to develop the practice of *integrated ecosystem management* as prescribed in Canada's Oceans Act. The EJLB Foundation provided funds in 2004-2005 to initiate a pilot project to demonstrate the benefits of integrated, community-based management of coastal resources.

The project had two objectives: a survey of existing information on the fisheries, fishermen's organizations, and fisheries issues related to the Upper Bay, and a contemporary survey of fish stocks in the Minas Basin and Scots Bay area. Ms. Christie Dyer was contracted to compile the available fisheries data, and Ms Sierra Wehrell and Glanville Travis conducted experimental otter trawl tows for demersal fish in areas of the Inner Bay.

Fisheries activities in the Upper Bay of Fundy have historically targeted more than 20 species of marine and diadromous fish, including: cod, haddock, halibut, pollock, silver hake, witch flounder, winter flounder, yellowtail flounder, American plaice, Atlantic salmon, striped bass, herring, shad, eel and gaspereau. In addition to finfish, lobster, scallop, clams and marine worms are important resources taken in the Upper Bay. Several of the fish stocks may be specifically associated with the Upper Bay of Fundy, representing distinct spawning populations from other stocks of the same species further seaward. Many of these species have shown significant declines in recent decades; opinion of fishers indicates that over harvesting is the principal cause, although habitat destruction is an important factor, especially for anadromous species such as salmon, shad and gaspereau.

Fisheries management in the Bay of Fundy is a confused and confusing process: fisheries management areas vary from species to species; responsibility is commonly divided between several different offices of the Department of Fisheries and Oceans (DFO); and management practice fails to recognise the potential distinctiveness of stocks that spawn in the Upper Bay. Landings data usually fail to reflect and document the contribution of the Upper Bay stocks and fishing areas to catches recorded from mobile fleets that also fill their quotas from other parts of the coastal seas. Recent staff reductions and reassignments have resulted in a significantly reduced capacity in DFO to conduct the necessary scientific evaluation of stocks, to identify and monitor the fishing activities in the Upper Bay, and to deal with the issues of small scale, localised fisheries. Opinion of many Upper Bay fishers is that management decisions favour larger corporate interests, including those that are licensed for other coastal areas in Eastern Canada, but who are also able to take quota from the Upper Bay.

Current status of stocks in the Upper Bay varies from species to species. Lobster landings have increased since 1990, and the scallop fishery is recovering from a steep decline in the late 1990s. Catches of pelagic fish, especially herring, are currently much higher, and may not be sustainable. Several species are in severe decline, including Atlantic salmon, shad, striped bass, flounder, and softshell clams. A new fishery for marine worms has increased significantly in recent years, and may also not be sustainable for much longer.

It is abundantly clear that not only is the Upper Bay of Fundy an ideal area to develop ecosystem- and community-based integrated management, such management is necessary if many of the traditional fisheries, and the human communities that have depended upon them, are to survive in the future.

An experimental survey with an otter trawl during the summer of 2004 collected >44,000 fish, representing 21 species. Of these, more than 85% were winter flounder, ranging in age from 2 to 9 years. Other important species were dogfish (> 5,000), skates (724) and Atlantic sturgeon (39). Full results are presented as an Honours B.Sc. thesis by Sierra Wehrell (2005).

Because of time restrictions, delays in obtaining data held in DFO databases, and difficulties in identifying representatives of fishers' groups, a complete description of the state of the fisheries in the Upper Bay of Fundy cannot yet be compiled. This report is a valuable beginning, but there remains much to be done.

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Introduction to the Report

The upper portion of the Bay of Fundy is a unique geographic region where natural conditions such as the highest and lowest tides in the world, strong tidal currents and sedimentation, and often poor weather, limit small-scale fishermen in their harvesting activities. However, such fisheries are still one of the principal elements of local community economies. In recent years, larger vessels from the deeper, more open waters of the Bay have followed and harvested fish stocks as they migrate into the Upper Bay, in competition with smaller vessels from the ports adjacent to the Upper Bay. This more flexible and powerful fishing pressure, added to the local community fishery, has significantly reduced Upper Bay fish stocks and their availability to local economies. In addition, the effects of local recreational marine fisheries, (e.g. for dulse, clams, striped bass and flounder), and other existing and potential marine activities (e.g. bloodworm harvesting, extraction of titanium, and aggregate) and the impact of many land-based activities, are poorly known.

The management of these fisheries and other activities is obviously neither ecosystem-based, nor integrated within local economies, both of which are mandated under the recent federal Oceans Act. Lack of experience in Canada with ecosystem- and community-based management of fisheries resources is a significant impediment to their development, and therefore to the nation's ability to meet the objectives of the Oceans Act. It has therefore seemed prudent to develop pilot projects that would allow demonstration and exploration of the principles and practices of community-based integrated resource management. Because of its geographic circumscription, its specialised fisheries resources, and the importance of those resources to local communities — coupled with the general failure of traditional management approaches to protect these resources — the Upper Bay of Fundy represented an ideal site for such a pilot project.

For this reason, Upper Bay of Fundy fishermen and communities alike have come together to request from DFO the right and responsibility to develop community- and ecosystem-based fisheries management for resources in the Upper Bay of Fundy. An

initial proposal submitted to the Minister of Fisheries and Oceans in 2002 received approval in principle, but lack of funds prevented its initiation. A subsequent proposal, supported by fisheries organizations and communities in the area, was submitted to the EJLB Foundation in February 2004 by a consortium including the Upper Bay Marine Resource Centre, the Acadia Centre for Estuarine Research, and the Bay of Fundy Ecosystem Partnership. Funds were provided for the initial year.

This report represents a summary of actions and achievements during 2004-2005. it consists of two parts:

A. A Portrait of the Fisheries in the Upper Bay of Fundy, based on a report prepared by Christie Dyer;
B. A Report on an Experimental Fisheries Survey conducted in the Minas Basin and Scots Bay region from June to October 2004, prepared by Sierra Wehrell.

Part A: Portrait of Fisheries in the Upper Bay of Fundy

Christie Dyer

and

Graham R. Daborn

Part A. Portrait of the Upper Bay of Fundy Fisheries

By Christie Dyer and Graham R. Daborn.

Introduction

This report is a contribution to the first year of a multi-year project the vision for which is to develop more localized ecosystem-based fisheries management in the Upper Bay of Fundy, in order to preserve existing lifestyles and to optimize the contribution of fisheries activities to the economies of local communities. The need for this project emerged as trends in the fishery saw larger vessels from the deeper, more open waters of the Bay of Fundy and beyond, follow and harvest fish stocks as they migrate into the Upper Bay. In some cases this more flexible and powerful fishing pressure, added to a long-standing local community fishery, has significantly reduced Upper Bay fish stocks and their availability to local economies. In addition to commercial fishing, the effects of local recreational marine fisheries, a relatively new industry harvesting bloodworms, and the impact of land-based activities, are poorly known. In future, increases in tourism and the potential exploitation of minerals such as titanium from the intertidal sands of Cobequid Bay and the Shubenacadie Estuary, represent further potential impacts on the marine resources and human communities of the Upper Bay.

This report gives a portrait of fishing activity, past and present, in the Upper Bay of Fundy. Information was gathered from available literature, DFO fisheries data, and discussions with fishers and community members from around the upper Bay. Discussions with fishers and community members especially sought to generate comments on the prospects for localized ecosystem-based fisheries management for the upper Bay. Overall, people thought that ecosystem-based management would be a move in a positive direction, often citing specific concerns related to their particular fishery. Every fishery group remarked that the lack of DFO resources, especially in the area of science, was a major obstacle. The management challenge for fishers in these cases is the lack of effective input to DFO management.

Management of fisheries resources in the Upper Bay is fragmented. Many tidal and river fisheries are managed at a local level, on the scale of rivers and beaches. The lobster fishery is unique in the Upper Bay in the sense that its management unit is roughly the Upper Bay and that it has experienced continuous growth in landings, giving fishers a general satisfaction with management measures. The scallop, groundfish, and herring fisheries in the Upper Bay, on the other hand, are managed in terms of broadly based areas, in a way that is clearly not aimed at supporting Upper Bay communities. This disconnect between resource harvesting and the communities that traditionally depended upon them, is a significant threat to the sustainability both of the resources and the communities.

Outcomes from this project include the development of connections among fishing associations, First Nation communities, and conservation-oriented community groups around the Upper Bay (Appendix II), all of whom are interested in participating in future Upper Bay discussions.

Discussions with fishers and community members also identified services that the Upper Bay of Fundy Marine Resource Centre could provide to support associations and community groups. These services include:

- Support in initiating and carrying out community-based science;
- Assistance with developing local fishing plans;
- Information on fisheries practices, management, and science that have proved valuable elsewhere;
- Translating science documents and making them available to fishers and the public;
- A neutral meeting space for fishers, community, DFO and other stakeholders;
- Support and facilitation of discussion of fisheries and marine issues;

Upper Bay of Fundy Fisheries

For the purposes of this project the 'Upper Bay of Fundy' was considered to include marine and coastal waters in the Bay of Fundy north of the 8U line (from Port Lorne, NS to St. Martins, NB) to the head of the Bay of Fundy. This area includes Chignecto Bay, Shepody Bay, Cumberland Basin, the Minas Channel, Minas Basin, and Cobequid Bay. This is the area within which fishers from the Upper Bay generally harvest marine resources. Figure A 1 illustrates the major waterbodies, rivers, wharves and ports that are involved in the Upper Bay of Fundy fisheries.

The upper portion of the Bay of Fundy is a unique geographic region where natural conditions such as the highest tidal range in the world, strong tidal currents, sedimentation, and often poor weather, challenge local small-boat fishermen in their harvesting activities. In addition to the commercial vessel fisheries there are other inter-tidal and river fisheries conducted by both commercial harvesters and recreational fishers. Over the past few decades the nature of many of these fisheries has changed, however, they are still one of the principal elements of local community economies and culture.

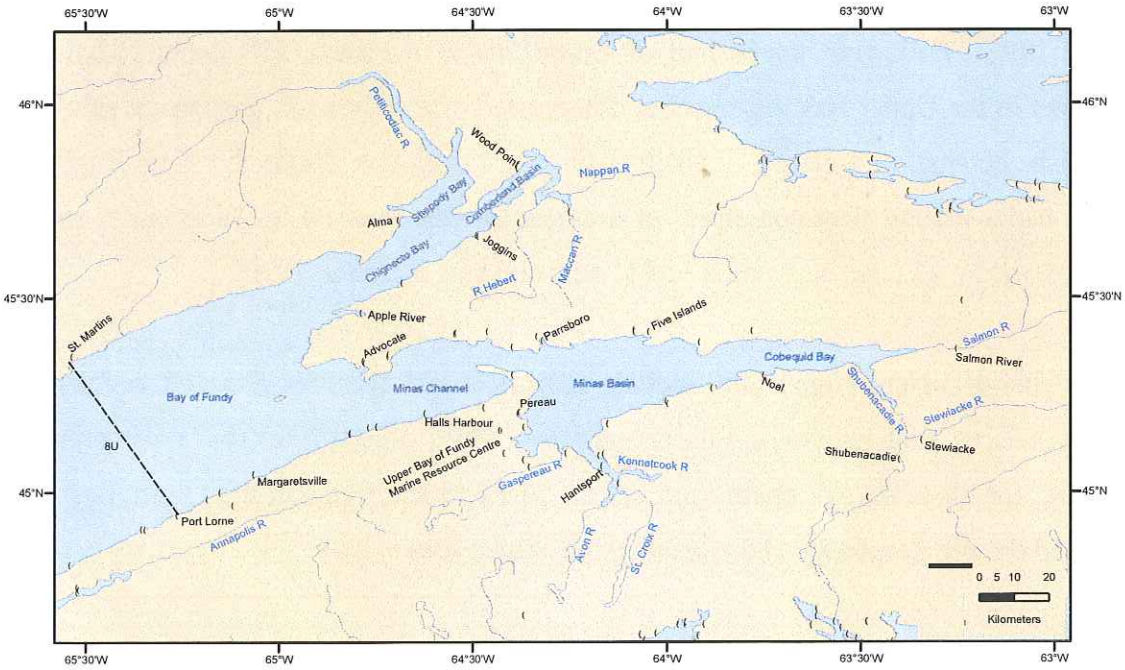


Figure A 1. Upper Bay of Fundy Project Area. Wharf and Port locations for Nova Scotia

were obtained from the Coastal Communities Network (2004). Wharf locations for New Brunswick were acquired from Small Craft Harbours, Moncton, NB.

The Bay's inner basins are summer feeding grounds for many southern fish, including shad, striped bass, alewives, sturgeon, and dogfish, that move up the Eastern Seaboard and into the Bay of Fundy on a tidal migratory circuit. As well, the tides bring a variety of anadromous and estuarine species including salmon, shad, gaspereau, tomcod and smelt that spawn in the rivers at the head of the Bay. Other deep-water species, such as cod, pollock, mackerel, halibut, and flounder, also visit the shallow upper reaches of the Bay during certain months to feed off the mud flats and salt marshes. However, there is considerable opinion that stocks of some species found in Upper Bay waters, especially flounder, are distinct from stocks of the same species in the outer Bay of Fundy, and thus require separate management.

The subsistence of people on the harvest of marine and other natural resources in the Maritime provinces goes back to the first people known to inhabit the area from the period 11,000 to 9,000 B.P. Evidence of hunting and fishing in the Upper Bay has been obtained in the present area of Kings County, Nova Scotia, near coastal Mi'kmaq settlements that have been dated from 2500 to 500 B.P. (The Blomidon Naturalist Society, 1992). Following the arrival of Europeans in the early 17th century, fishing enterprises in the Upper Bay expanded and harvested primarily shad, gaspereau, salmon, groundfish, herring, and clams. In Kings County in the late 1800s the New England Planters had a fishing fleet composed of 6 larger vessels, manned by 28 men, 50 small boats manned by 43 men, and a total of 141 nets and seines (Eaton 1910).

Today fisheries in the Upper Bay include marine vessel fisheries directed at lobster, scallops, herring, and various groundfish species, while coastal intertidal areas support harvesting for bloodworms, clams, and dulse. Many of the rivers in the Upper Bay are still fished for eel, gaspereau, shad, smelts, and striped bass.

Figure A 2 is a summary of fishing activity in the Upper Bay for 2003. The map illustrates commercial marine fishing based on logbook records kept by fishers, lobster ports with active licenses[1], rivers identified as having commercial and recreational fishing activity, and intertidal areas known to be harvested for clams, blood worms, and marine plants.

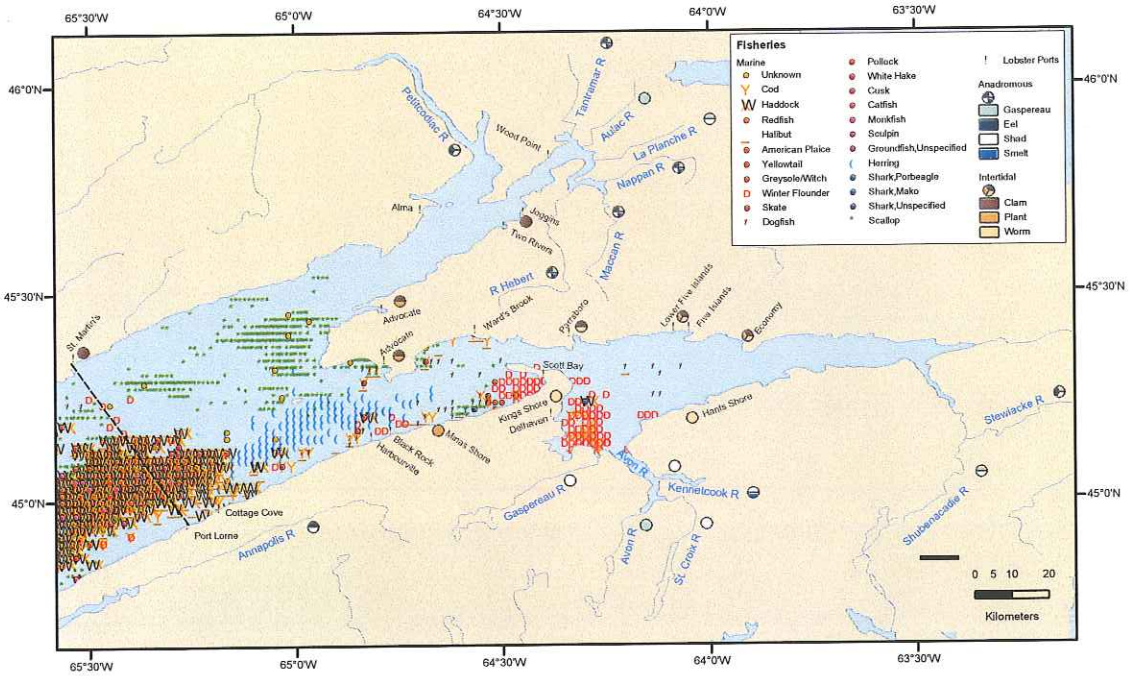


Figure A 2. Upper Bay of Fundy Fisheries 2003.

[1] Prior to 2004 lobster fishers did not report the location of their fishing.

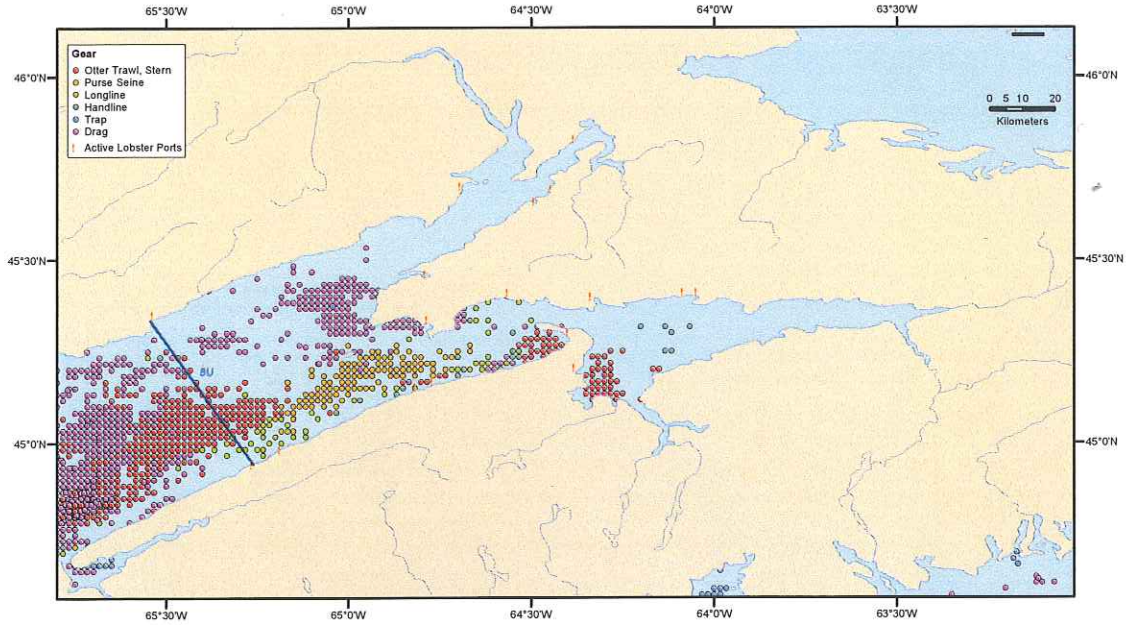


Figure A 3. Upper Bay of Fundy Marine Fisheries by Gear Type 2003.

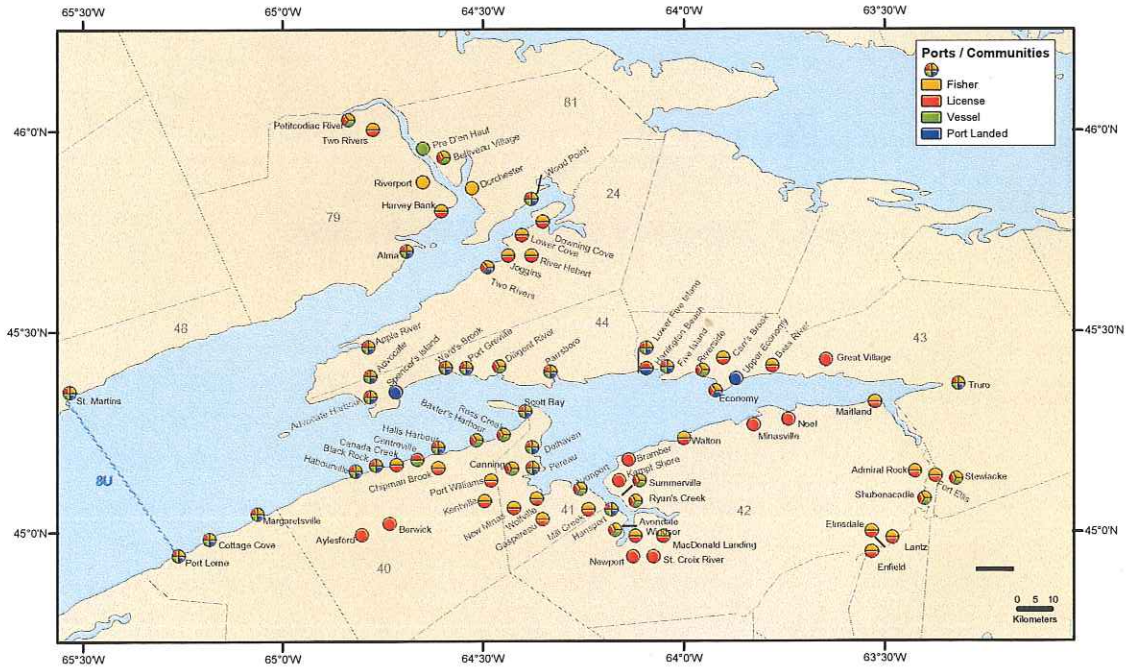


Figure A 4. Upper Bay of Fundy Fishing Ports and Communities 2003. The map illustrates communities in the Upper Bay that have registered fishers and license holders, and ports with registered vessels that received landings in 2003.

Commercial Fisheries: Synopsis of Trends and Issues

A review of documents and discussions with local fishers and scientists have generated the following general observations:

- Overall there is inadequate science to assess and monitor stocks;
- Exploratory fisheries for new target species are opened before sufficient baseline science has been completed;
- Several fishing sectors / groups find it difficult to operate under the current DFO management system;
- Several fisheries (with the notable exception of the lobster fishery) have experienced serious declines.

o

As a consequence, the fisheries in the Upper Bay have exhibited important changes in effort. For example:

- The number of fishing vessels from Districts 35 – 42 has fallen by approximately half over the past 18 years;.
- The number of fishers has similarly fallen in districts 35 and 42;
- In district 40 the number of fishers peaked at 71 in 1995, but has returned to the 1986 level of 60. A similar trend occurred in district 41: there were about 78 fishers in 1986, 99 in 1998 , but in 2003 the number registered was back at 77.
- The increase of registered fishers in the last few years could be due to development of fisheries, such as the bloodworm (*Glycera dibranchiata)*.
- District 43 saw a steep decline in the number of fishers from 323 in 1986 to 118 in 2004, probably as a result of the downturn in the clam fishery.

The short 1997 – 2004 time-series of data from New Brunswick, does not show the same major changes, although over this time district 79 saw an increase in both fishers (9) and vessels (6).

Table A1. Registered Fishers and Vessels

	Fishers			Vessels		
	1986	1997	2004	1986	1997	2004
District 35 *exc.Hampton	33		18(2001)	31		19(2001)
District 40	59		60	41		21
District 41	78		77	22		10
District 42	67		32	35		15
District 43	323		118	29		29
District 44	108		98	32		22
District 24	40		54	4		10
District 81		23	21		10	6
District 79		57	66		14	20
District 48 *includes only St. Martins		16	17		4	6 (2002)

Species at Risk. Several species in the Upper Bay of Fundy are of special conservation interest: the Inner Bay of Fundy stocks of Atlantic salmon are listed as endangered; striped bass stocks are considered as threatened; and the American eel is listed on the High Priority Assessment list by COSEWIC.

Anadromous species. DFO knowledge of fishing effort on anadromous species (e.g. shad, alewife, blueback herring and smelt) around the Upper Bay is limited. Most of the minimal science work conducted on these species has been limited to the major rivers, particularly the Gaspereau and Shubenacadie-Stewiacke River systems. The Gaspereau River gaspereau population[2] is rebounding, attributed to a 5 year management plan, that included a reduction in fishing effort. Gaspereau fishers have been in conflict with NS Power and DFO for effective river management, and conflict continues over issues such as fish kills and loss of fishing gear[3].

Groundfish. Over the past century there has been a drop in Upper Bay groundfish species that were previously abundant in tidal waters. Currently, there is little knowledge and negligible monitoring of Upper Bay groundfish stocks. The Scotia-Fundy Groundfish Survey, for example, has only one site in the Upper Bay. Management of the recently

[2] The local term 'gaspereau' refers to two similar species: the alewife (*Pseudoharengus americanus*) and the blueback herring (*P. aestivalis*).

[3] Fishers feel that the river is not managed properly, and that their knowledge and river monitoring is dismissed by both NS Power and DFO

introduced dogfish fishery is currently experimental only, constituting the 3rd year of a 5 year science program to develop a population model that will then be used to suggest a 'sustainable quota'. The Upper Bay generalist fleet cannot access the local dogfish stock, which is fished by other gear sectors. The stock status for flatfish in region 4X indicates a worsening situation for American plaice, stable Winter flounder, improving Yellowtail flounder. The Witch flounder biomass is low but recovering.

Pelagic Fisheries. Current catch of herring in the Upper Bay is substantially higher than would be consistent with a moderate fishing mortality (DFO 2004d). Total 2003 landings for the SW Nova Scotia/Bay of Fundy Spawning Component of herring were 89,360 tonnes, the highest since 1993. The Scots Bay spawning ground was the site for some of the largest catches by purse seine fishers based elsewhere. Herring catches in the Nova Scotia weirs, in 2003, were the third lowest in the 40 year record of landings from this fishery. The pelagic shad fishery in the Upper Bay has declined drastically over the past hundred years. Apart from research in the 1970s by Dr. M. Dadswell and associates, there is little knowledge about shad stocks that migrate into the Upper Bay of Fundy for feeding purposes, although these represent all of the major stocks of shad on the east coast of North America. In the Shubenacadie-Stewiacke River system there is continuing conflict over the reasons for the shad decline; some fishers suggest a connection between the decline in shad numbers and conservation of striped bass. The recreational striped bass fishers association is interested in participating in science work, and in providing better education of fishers on the state of the bass population, however there has been a lack of DFO leadership to bring stakeholders together and discuss solutions.

Lobster. Lobster fisheries have demonstrated increased landings and value: in 1990 the catch was187 t, worth $1,369,555, whereas in 2002 673 t worth $8,359,861 were landed. There is, however, little stock assessment conducted on lobster in the Upper Bay and little prospect that it will be (DFO 2004). In 2005, DFO initiated a new process in which the LFA 35 Advisory Committee / Fishers will develop a management plan with indicators (biological, economic etc.), identifying the science that needs to be done.

Scallop. The scallop fishery suffered a steep decline in landings in late 1990s, although it is recovering.(cf. Table A2) :

Table A2. Scallop landings in the Bay of Fundy, 1990-2002.

	Value	Volume (kg)
1990	$2,329,690	2,088,737
1997	$197,750	89,479
2002	$1,025,422	766,576

The Bay is fished by three scallop fleets: Upper, Mid and Full Bay fleets, and all three take heavily from the most productive area in the Upper Bay. The Upper Bay fleet would like to have the Upper Bay restricted to them, with their own quota; however there are problems in negotiating with all three fleets. The Upper Bay fleet shares quota with the Mid Bay fleet, although the Mid Bay Fleet is also permitted to fish all of the New Brunswick coast.

Soft shell Clams (*Mya* arenaria). Clam stocks have exhibited serious decline in recent years: in 1982 710 t were harvested (worth c. $500,000 dollars); in 2002 yield was only 9.5 tonnes, worth $17,500. Apart from some student projects in the early 1990s, no scientific investigations or monitoring have been conducted recently, and currently DFO has no clam science staff. The Minas Basin Clam Fishers Association is very interested in doing / participating in science; currently the group is developing a management plan for harvesting on the North Shore. Sewage and pollution continue to cause closure of clam beds.

Baitworms (*Glycera dibranchiata*). Worm licenses in Parrsboro area have increased dramatically in recent years, although DFO Eastern NS Management is apparently not aware of this. In 2002 there were 8 licenses; 63 in 2003 and 61 in 2004. No effective planning is in place for the Parrsborough shore. On the Hants shore, however, a community group concerned with impacts of worm and clam harvesting on shorebird feeding habitat claimed difficulty in accessing / participating in DFO management design process.

Other fisheries in the Upper Bay of Fundy.

Fixed Gear. DFO is unclear of the operation of weir(s) in the Walton area but confirmed 10 weirs in Minas Basin (2 inactive) plus 1 Morton / Margaretsville. There are still five active fixed gear fishers in the Upper Bay registered with Fundy Fixed Gear Council.

Recreational Fishing. In tidal and marine waters there is no licensing of recreational fishers, and it is not known how many fishers there are or how much they catch. 'Recreational fishing' includes an estimated 130 beach seine nets plus dipping and angling from shore and boats.

Landing locations of Upper Bay of Fundy catches.

Of the fishing activity that takes place in the Upper Bay of Fundy only a portion is landed in the Upper Bay. Figure A 5 illustrates DFO statistical fishing districts where fish catches from the Upper Bay were landed in 2003. (N.B. these figures do not necessarily include the inshore lobster or intertidal fisheries).

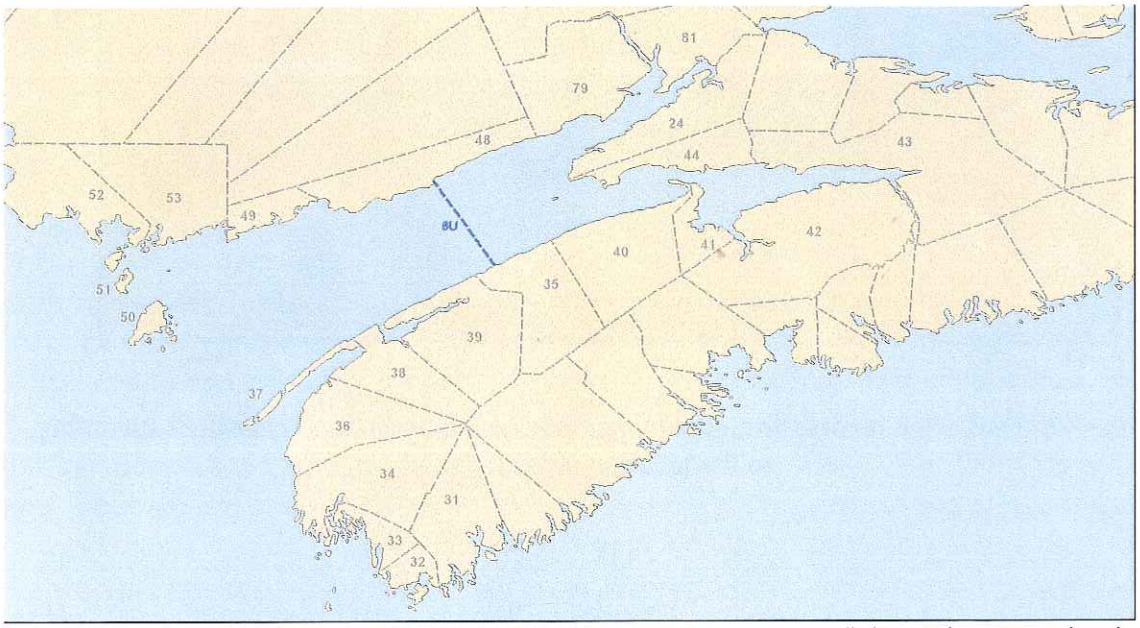


Figure A 5. DFO Statistical Fishery Districts where Upper Bay fish catches were landed in 2003.

In Figure A 6, fish catches recorded in DFO records for the 2003 season are shown in colours that correspond to the location of landing. White points in Figure A 6 indicate fish landed in the Upper Bay districts 35 (excluding Hampton) – 48 (St. Martins); these catches were mostly taken by the fixed gear groundfish fleet, mobile groundfish fleet, and scallop fleet. Green points represent fish, that were landed in Southwest Nova Scotia in districts 31 – 34. These were largely catches of the mobile gear groundfish fleet. Fish landed in districts 36-39 are given in blue, and these represent some of the catches by the mobile gear groundfish fleet, mobile gear herring fleet, and the scallop fleet. Yellow points represent fish landed in districts 48 (from Saint John) to 53 in Southwest New Brunswick ; this is primarily fishing by the scallop and mobile herring fleets.

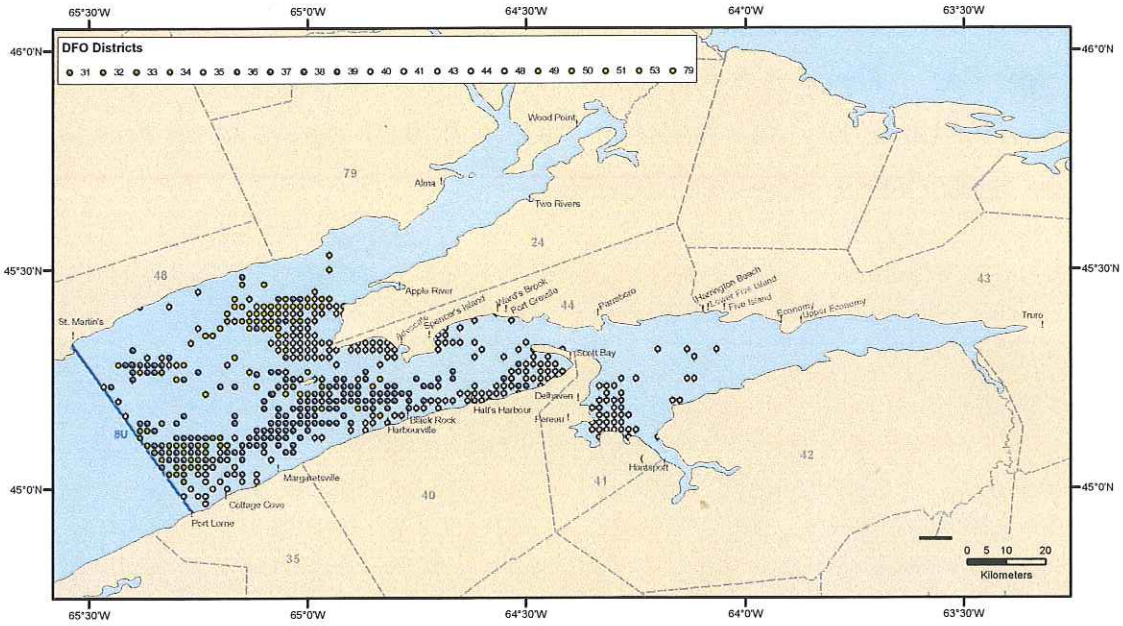


Figure A 6. Fish catch records from the Upper Bay of Fundy in 2003 classified according to the location of landing.

Overview of DFO Management of Upper Bay Fisheries

The Upper Bay of Fundy comes under the management of three DFO jurisdictions in the Maritimes. These are: Eastern NS, Southwest NS, and Southwest NB. According to these jurisdictions, Eastern NS DFO, the main office of which is in Sydney, has responsibility for the portion of the Upper Bay from Windsor in Hants County to the Nova Scotia – New Brunswick Border; Southwest NS DFO, with a main office in Yarmouth, manages the rest of the Nova Scotia side of the Upper Bay, from Windsor in Hants County to Port Lorne at the 8U line; and Southwest NB DFO, based at the main office in St. Andrews (NB), is responsible for fisheries on the New Brunswick side of the Upper Bay. The head DFO office of the Maritimes region is based in Dartmouth, Nova Scotia

The major commercial marine species, namely lobster, scallop, herring, and groundfish, are managed out of the head DFO office in Dartmouth. Intertidal and anadromous species are generally under the direction of area managers in each of the three DFO Maritime jurisdictions. Licensing services to fishers in the Upper Bay are provided from the three main DFO jurisdictional offices, however all licensing information is processed centrally in Dartmouth.

Habitat Management operates out of three satellite offices, including: Bridgewater for Southwest NS DFO, Truro for Eastern NS DFO, and Sussex for Southwest NB DFO.

DFO fisheries officers operate from a separate set of satellite offices at Kentville (NS), Parrsboro (NS), and St. John (NB). The Parrsboro office has a staff of three who are responsible for the area from the Nova Scotia – New Brunswick border to Windsor in Hants County. The Kentville office has one fisheries officer who covers an area from Windsor to Digby[4]. Fisheries officers at the St. John office are responsible for the area from St. John to the New Brunswick – Nova Scotia border. Several officers commented that in the past licensing was done from their offices and that through this they knew fishers, what they caught, and where they fished. The transferring of license administration to Dartmouth saw the loss of much of this local knowledge.

[4] It is anticipated that in a year this position will be phased out when the current officer retires

Figure A 7 illustrates the DFO jurisdictional areas and offices with responsibilities for fisheries in the upper Bay. Appendix I provides a table of DFO personnel who currently have management, science, and enforcement responsibilities in the upper Bay.

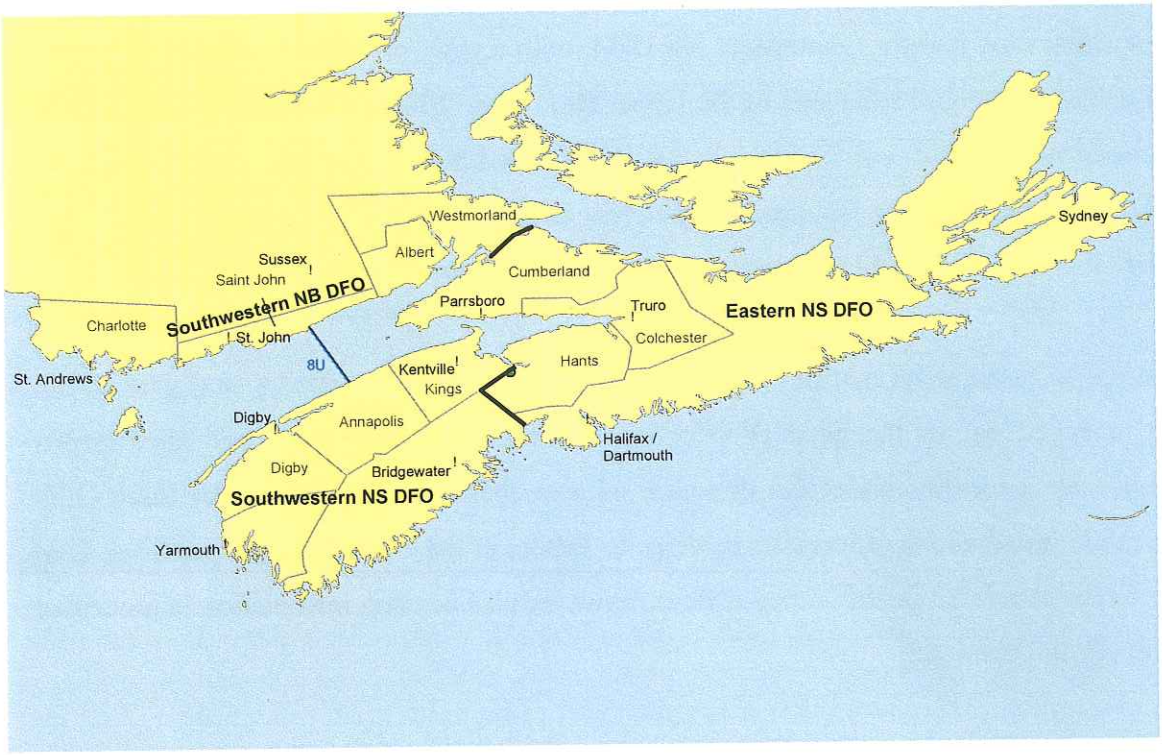
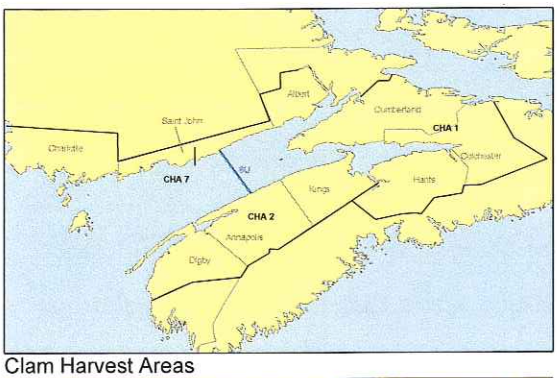
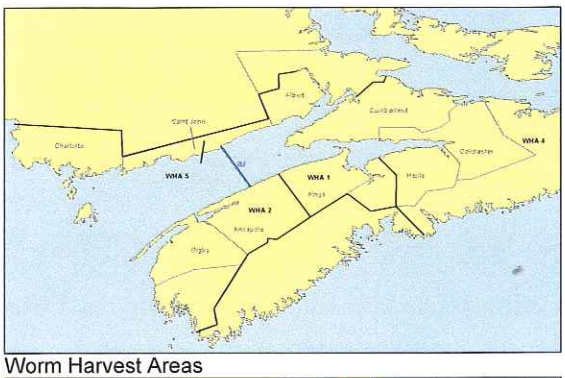


Figure A 7. DFO jurisdictional areas and offices with responsibilities for fisheries in the upper Bay.

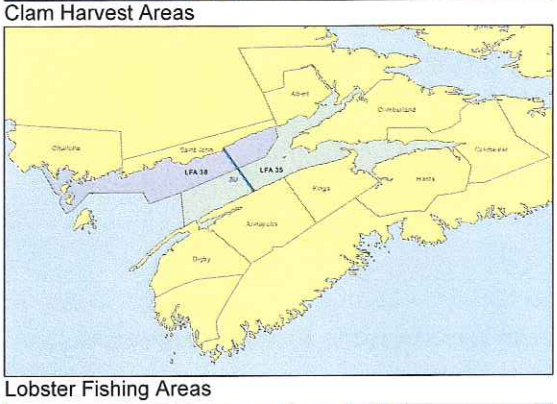
Comment by the fishing industry and community groups on fishery management plans and regulations is provided through DFO-run Advisory Committees which have fishery / community representatives. While fishers and community representatives provide advice and comments to these Advisory Committees, DFO personnel make the final decisions regarding management. The work of these advisory committees and particular management issues are discussed in greater detail in each species section. Fisheries in the Upper Bay are organised into a number of management areas, for each species, as shown in Figure A 8:



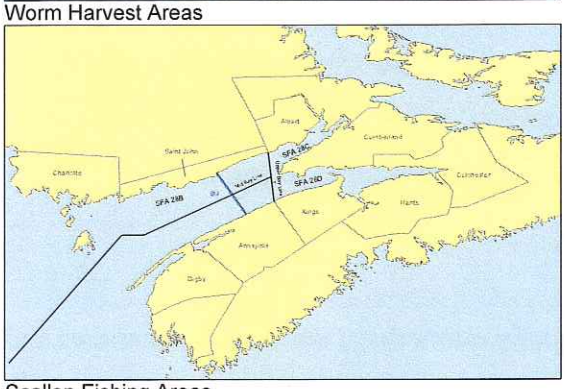
Clam Harvest Areas



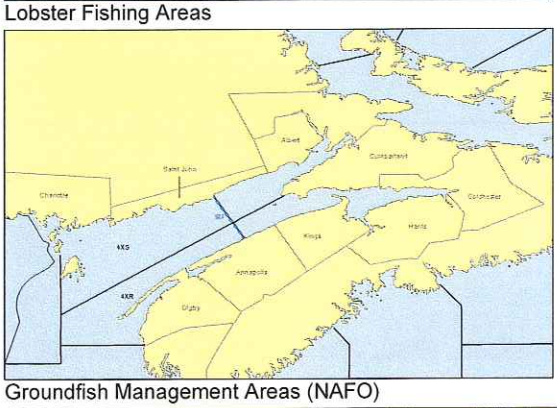
Worm Harvest Areas



Lobster Fishing Areas

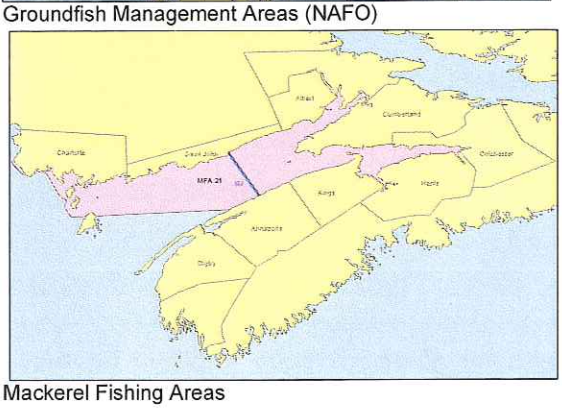


Scallop Fishing Areas



Groundfish Management Areas (NAFO)

Herring Fishing Areas



Mackerel Fishing Areas

Figure A 8. Fishery management areas that encompass the Upper Bay of Fundy. Where it occurs, management of anadromous fishes is carried out on a river basis.

Upper Bay of Fundy Fisheries Profiles

Recreational Fishing

Anadromous / Catadromous Species

There is no licensing of recreational fishers in tidal waters. In 2002 however, DFO made amendments to the Maritime Provinces Fishery Regulations that introduced regulations for recreational fisheries. In 2002, for the first time, quota (bag) limits, size limits and closure times came into effect for recreational fish species, including, smelt, eel, shad, gaspereau, white and yellow perch, lake and round whitefish, chain pickerel and burbot. A calendar of closed and open seasons is shown in Figure A 9.

Daily quota (bag) limits for recreational fisheries in the Maritime Provinces are now:

- Smelt – 60 maximum possession 30 fish collected by dip net
- Eel – 10
- Shad – 5
- Gaspereau – 20
- Striped bass - 1

Size limits exist for eel and striped bass. For gaspereau, shad, and eel there is generally no closed season, except that no one is permitted to angle in non-tidal waters unless an open season for sport fishing is in effect in those waters. Smelt has a season of April – May in New Brunswick and April – June in Nova Scotia. In Nova Scotia there is no closed season for striped bass while in New Brunswick angling is restricted to July – October.

Prior to the implementation of the 2002 amendments there were no controls on the number of lines and hooks that could be used when angling in tidal waters. With the exception of certain winter fisheries, recreational anglers became restricted to one line and a maximum of three hooks when angling for sportfish in tidal waters and to five lines

and a maximum of 6 hooks per line when angling for other species in tidal waters (DFO 2002e).

Recreational groundfishing is allowed all year round with a bag limit of 10 fish, which must not include halibut. Catches are thought to be low and have been ignored in stock assessment and in TAC setting and allocation, but no system is in place to allow the collection of catch information (DFO 2002). One fisher in the Minas Basin, however, talked about a very active recreational fishery with a large catch, certainly more than the bag limit of 10 fish. Recreational clam harvesters are not required to have a license and are permitted a maximum of 100 clams/day.

In Nova Scotia the Department of Fisheries and Agriculture manages recreational inland and river fisheries by Recreational Fishing Areas (RFA). Each RFA has a Recreational Fisheries Advisory Council that is open to the public and consists of anglers and volunteer sportfishing organizations with participation from other government agencies. In the Upper Bay, RFAs include: Area 6 – Cumberland and Colchester Counties and Area 5 – Hants, Kings, Annapolis (Nova Scotia Department of Agriculture and Fisheries 2005).

In New Brunswick the provincial Department of Natural Resources manages recreational fishing according to recreational fishery areas, one of which is the Inner Bay of Fundy. This includes all lakes, rivers and streams draining into the Bay of Fundy eastward of the Saint John Harbour bridge to the provincial border between New Brunswick and Nova Scotia (New Brunswick Department of Natural Resources 2005).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Striped Bass, (R)												
Clam (C)												
Clam (R)												
Eel (C)												
Eel (R)												
Gaspereau (C)												
Gaspereau (R)												
Groundfish (C)												
Groundfish (R)												
Herring (C)												
Lobster (C) LFA 35												
Lobster (C) LFA 36												
Marine Plants (C)												
Scallop (C) Full Bay												
Scallop (C) Mid +Upper Bay												
Shad (C)												
Shad (R)												
Smelt (C)												
Smelt (R)												
Worm (C)												

Figure A 9. Seasonal calendar of some fisheries in the Upper Bay of Fundy. (C = licensed commercial; R= recreational; dark blue represents commercial fishing seasons)

Surveys conducted every five years, by DFO and provincial fishery departments, illustrate that there is indeed an active recreational fishery carried out by licensed anglers. In Nova Scotia, in 2000, licensed anglers, averaged 72 fish caught per angler, of which 32 were retained. The chart below gives the numbers of days fished by licensed anglers,

every five years for the period of 1985 – 2000, for counties that border the Upper Bay (Nova Scotia Department of Agriculture and Fisheries 2000).

Table A3. Comparison of angling effort (days fished by licensed anglers) by county in Nova Scotia in 1985, 1990, 1995, and 2000.

County	1985	1990	1995	2000
Kings	58,274	106,036	44,228	29,508
Hants	55,459	41,589	33,097	56,379
Colchester	67,741	63,096	59,572	56,788
Cumberland	49,778	88,812	44,280	35,415

First Nations Fisheries

Members of the Annapolis First Nation, located in Cambridge, Kings County, are active participants in the Upper Bay fisheries. In the commercial fishery the Band currently fishes two LFA 35 lobster licenses, based out of Digby and Harbourville and 1 Full Bay scallop license based out of Digby. Community members also have a communal food fishery for local (Margaretsville to Cape Split) intertidal, river, and lake species, including lake trout, clams, herring and mackerel. The last fishery uses another vessel and crew. Food fishery species are taken within the DFO regulated seasons (pers. comm. Holly MacDonald, Fisheries Coordinator, Annapolis First Nation).

Milbrook First Nation currently fishes two Full Bay scallop licenses out of Digby. They also fish five LFA 35 lobster licenses, four from Digby and one from Joggins. They anticipate, however, moving the Joggins license to Digby to eliminate fishing with the Upper Bay tide which has proved difficult. The community also fishes gaspereau throughout Colchester County (pers. comm. Adrian Gloade, Fisheries Coordinator, Milbrook First Nation).

Fort Folly First Nation, located outside Dorchester New Brunswick, has a long history of fishing and conservation work in its community. Currently the community has two boats located in Parrsboro that fish lobster in LFA 35. Locally, eel and other river fishes are taken for food. The community is also active in the Recovery Strategy for Inner Bay of Fundy salmon through habitat restoration projects (pers. comm. Rebecca Knockwood, Fisheries Coordinator, Fort Folly First Nation).

Target species of recreational and commercial fisheries

1. Striped Bass

Striped bass (*Morone saxatilis)* has long been a popular recreational fish species in the Upper Bay. The species is known to undergo extensive fluctuations in abundance. Stocks of striped bass in the Maritimes, may be on the decline, particularly on the Shubenacadie-Stewiacke river system, and this has become a point of contention among recreational fishers and commercial shad fishers.

In November 2004 COSEWIC designated the striped bass population in the Bay of Fundy as ***threatened***. The population met the criteria for ***endangered***, however was listed as threatened because the one remaining spawning population, in the Shubenacadie River, does not appear to be at imminent risk. The reason for designation was:

> "Repeated spawning failures led to the disappearance of the Annapolis and Saint John River populations. These disappearances are thought to be due to changes in flow regime and poor water quality. In the Shubenacadie River population, the presence of the introduced chain pickerel in overwintering sites may constitute a threat. Another threat to the population is bycatch from various commercial fisheries. The Bay of Fundy is also used by striped bass breeding in rivers in the United States. These fish were not assessed."
> (COSEWIC In Press: iii)

Young-of the-year are caught in the lower reaches of the Shubenacadie-Stewiacke river in the early summer, and later on the north shore of Cobequid Bay in August and September (Rulifson *et al.* 1987; Douglas *et al.* 2003). Striped bass from the Shubenacadie River migrated upstream to overwinter in Grand Lake, where they can be caught in the winter ice fishery (Jessop 1991). In May, they migrate downstream to Minas Basin in the southern Bay of Fundy

The importance of the Shubenacadie population is highlighted by the loss of:

- Populations from the Saint John and Annapolis rivers where to date no plan has been established for the recovery of striped bass in these rivers (Douglas et al. 2003).
- The population in the St. Lawrence Estuary, which disappeared as a consequence of illegal fishing, with the last record dating from 1968. The species was designated ***extirpated*** from the St. Lawrence system in November 2004 (COSEWIC In Press).

Management of the striped bass fishery in the Maritimes is based on the premise that there are currently only two populations: that of the Miramichi River and that of the Shubenacadie River[5]. To date, there are no conservation reference points for Bay of Fundy striped bass. Only indirect abundance indices are available for Shubenacadie River striped bass for years prior to 1999. Sport fishery data suggest that a decline in striped bass abundance occurred in the Shubenacadie River between 1950 and 1975, but that the numbers subsequently remained relatively stable (Jessop 1991).

Mark-recapture experiments were developed in 1999 to estimate the abundance of this population. Because of methodological and logistical problems during the first three years of the experiments (1999 to 2001), however, 2002 was the first year for which reliable abundance estimates are available. In 2002, the Shubenacadie River population was estimated to be between 18,000 and 27,000 striped bass, at least 15,000 of which were of minimum reproductive age (3 years or more) and at least 7,000 of which were 4 years and over.

Recently a Nova Scotia Striped Bass Association was formed, in response to: a) the recent decline of striped bass numbers; b) the lack of a conservation / recreational angling voice; and c) suggestions from DFO personnel that an association is essential and timely. Members fish striped bass on the Stewiacke/Shubenacadie River System (including Shubenacadie Grand Lake), Porters Lake/Rocky Run, Minas Basin, and Annapolis Basin.

[5] Striped bass also occur in the Annapolis, Gaspereau, and possibly other rivers, but these fish may be feeding migrants from US rivers. Although a spawning stock was found in the Annapolis River in the 1970s (Williams *et al* 1984), there is doubt about its continued existence.

Current issues identified by the Association for the recreational bass fishery include:

- lack of enforcement;
- common ignorance of regulations (such as retaining of undersized bass);,
- misinformation about the reasons for the decline of the shad fishery;
- lack of science population assessments; and
- recent COSEWIC designation of striped bass as threatened.

The Shubenacadie Driftnet Fishers Association, which represents local commercial shad fishers, maintains that striped bass are responsible for the decline of the shad fishery in the Shubenacadie. These fishers would like to see an increase in the allowable take of bass by recreational fishers. In April 2004, DFO held a meeting with all concerned parties, to discuss the bass issue on the river; however, the commercial fishermen feel that this consultation brought little clarity to the situation. In an effort to discuss the issue in advance of the 2005 season, the president of the Association wrote to the Minister of Fisheries and Oceans to ask that another meeting be convened among all parties. The Minister replied that this would occur before the 2005 fishing season. At the time of writing this report, the President of the Association had heard nothing further.

2. Atlantic salmon

Salmon populations in the inner Bay of Fundy rivers were designated ***Endangered*** by COSEWIC in May 2001. In the Upper Bay several community groups have been active in salmon conservation initiatives, including the Cobequid Salmon Association, the Cumberland County River Enhancement Association, the Parrsboro & Area Recreational Fishing Association, and Fort Folly First Nation.

At one time in the Upper Bay, salmon supported a productive commercial and recreational fishery. In the 1800s, Atlantic salmon were the base of the second most important fishery after shad. They were caught by anglers, in weirs, and with fixed or floating gill nets. The largest numbers were caught in the Avon and Economy rivers and in Cobequid Bay (Percy 2001). Information from fishery surveys in the 1970s tells of the

fishing and catch that still existed at that time with one salmon weir at Harbourville, two at Canada Creek and three at Hall's Harbour. In addition, there were two licensed salmon drift net fishermen; one in the Avon River, and a second in Cobequid Bay off Highland Village. Approximately 100 – 300 fish were taken annually in the drift nets. An additional 100 were taken incidentally in weirs. Recreational angling took place on several rivers, listed below in Table A4:

Table A4. Estimates of Atlantic salmon catch in Bay of Fundy rivers in the 18th and early 19th centuries.

River	Recorded Catch
Shubenacadie	250 – 800
Stewiacke	1,500 – 2,500
Salmon	100 – 300
North River	100 – 300
Chiganois	35
Great Village	25 – 35
Debert	100 – 300
Folly	100 – 300
Bass	25
Portapique	100 – 200
Economy	200 – 400
Kennetcook	20 - 25

(source: Maritime Resource Management Services 1979)

3. *Clam*

Clam harvesting in the Upper Bay occurs on the shores of Colchester and Cumberland counties bordering the Minas Basin. There is a long history of clam harvesting on this shore.

Commercial clam harvesting began early in the 1940s, with a peak production of 946 tonnes in 1946. Over the next two decades, production declined as the existing large clams were depleted. A rise in abundance, accompanied by an increasing demand and climbing prices, led to resurgence in production in the 1970s (Witherspoon 1984). During this time these extremely productive beds were described as providing

recreational clam digging opportunities for thousands of people each year. Clams were also dug for bait from closed areas at Parrsboro, Riverside Beach, Diligent River and Advocate Harbour (Maritime Resource Management Service 1979).

By the early 1980s, Minas Basin accounted for almost a third of Nova Scotia's clam production. In 1982, 110 full-time, licensed harvesters, many part-timers and three processing plants produced over 710 tonnes of clams, worth over $0.5M (Witherspoon 1984). The current chairman of the Minas Basin Clam Fishers Association recalls that it was not uncommon in the 1980s to see 400 people out on the flats harvesting, before licensing was introduced to restrict participants.

The landed weight and value of clams continued to rise in the 1980s and in 1991 952 tonnes were landed, worth just under a million dollars. The harvest then began to drop dramatically, falling in 1995 to 223 tonnes, earning $345,000. 1999 saw a modest harvest of 153 tonnes, earning $360,000, but this too declined to a low in 2002 of 9.5 tonnes worth $17,500. Figure A 10 illustrates the decline in clam harvest over the past decade in all districts around the Upper Bay, almost all of which harvest is in district 43 on the Minas Basin.

It has been estimated that only about one and one half percent of the Basin's extensive tidal flats, or about 445 hectares, have the appropriate mix of sand and mud for prime clam habitat. The most productive flats are located along the northern shore of the Basin, particularly between Five Islands and Bass River (Percy 2001). Harvesting technology has changed very little over the last century; hand harvesting using a clam fork is still the only method used.

As the availability of the resource declined, so did the number of active harvesters. Today although there are 133 licenses (cf. Table A5), but it is estimated that only 50 are active. In 2004 Minas Basin clam diggers formed the Minas Basin Clam Fishers Association to organize management of the clam stock and control over harvesting. The group is currently working on the development of a clam harvest management plan for

the Minas Basin, with the assistance of the Eastern DFO office. Part of this plan and current management is that harvesting only takes place from May – October.

Table A5. Upper Bay Clam Licenses 2004.

Licenses 2004	**Soft Shell Clam**
District 35	3
District 42	3
District 43	96 (Five Island – 53, Lower Five Islands – 17, Truro - 18)
District 44	15
District 24	14 (Apple River – 14)
District 48	2
Total	**133**

Logbooks are kept and reported to a dockside monitoring company, however analysis of these data and reporting back to harvesters has not been done. There is currently a freeze on the transfer of licenses. Since 1995 licenses have been required and restrictions placed on recreational digging (DFO 1996). There is little recreational clam harvesting in the area now.

There has been no DFO led science as part of clam management for the past several years. It is unlikely that this situation will change due to fiscal restraints at DFO (pers. comm. Maureen Butler, Senior Advisor Resource Management, DFO, Dartmouth). Research work conducted in the early 1990s was limited to the calculation of catch rates (DFO 1996). The Minas Basin Clam Fishers Association, however, is interested in having scientific work undertaken and participating in it.

4. *American Eel*

The American eel is a catadromous species, spending most of its life in fresh water, and spawning at sea. In the 1970s a potential for commercial eel harvest was said to exist in all rivers in DFO statistical districts 41 and 42, especially the Avon, Shubenacadie and Kennetcook. There were, however, only two traps in the Little Dyke River and one in the Shubenacadie (Maritime Resource Management Services 1979). Interest in the

commercial harvest of eels grew throughout the Maritime Provinces in the 1990s as demand from the Asian market expanded (Haro *et al.* 2000). Landings in the Upper Bay fluctuated throughout the 1990s, with the highest landings in DFO statistical districts 24 and 44. Due to limited information it cannot be determined if these fluctuations in landings are due to changes in the availability of the resource, changes in harvesting levels, or some combination of both.

According to landings (Figure A 11) and licensing information (Table 6,) eeling is still done by a few harvesters throughout the Upper Bay. Fishermen and DFO (pers. comm. Jim Kiersted, DFO Enforcement, St. John, NB) both identified the Tantramar River as one area where eeling still takes place with fyke nets, in the intertidal area. Eels are more often fished for food than commercially.

Table A6. Eel licenses in the Bay of Fundy, 2004.

Licenses 2004	**Eel**
District 35	1
District 41	2
District 42	1
District 43	7
District 44	6
District 81	3
District 79	2
Total	22

The current health of the eastern seaboard American eel populations, all of which spawn in the Sargasso Sea, is unknown. In February 2005 COSEWIC listed the American eel in its Group 1 for High Priority Candidates to be assessed, for its range in Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland. COSEWIC candidate species are species not yet assessed by COSEWIC but that have been identified by COSEWIC as potentially being at risk (COSEWIC 2005).

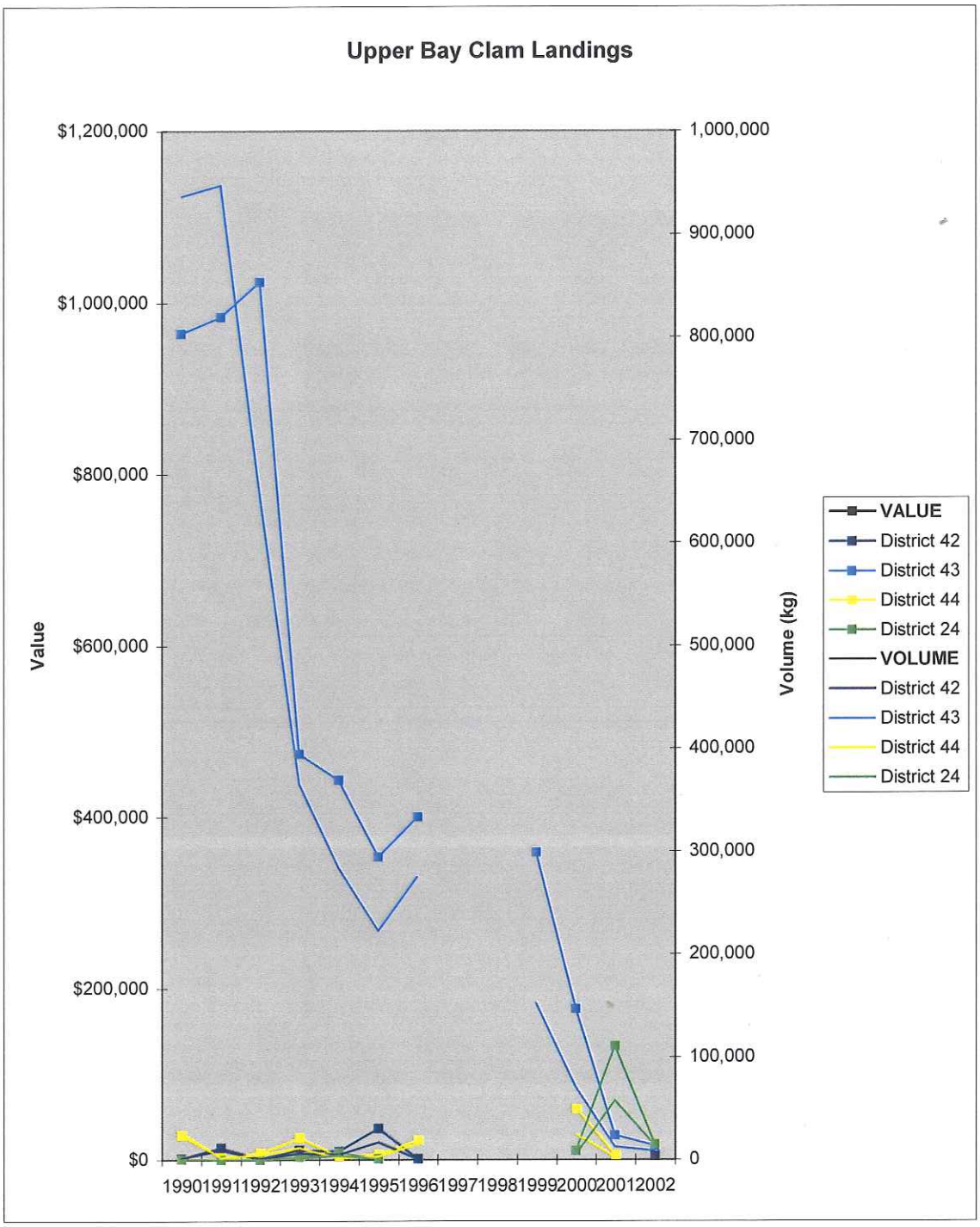


Figure A 10. Upper Bay Clam Landings, 1990 – 2002[6].

[6] Data for 1997 and 1998 are absent because this was the transition period in which DFO devolved landings recording responsibilities to fishers. From these years landings were monitored. In subsequent years fishers paid dockside monitoring companies to perform the recording of landings.

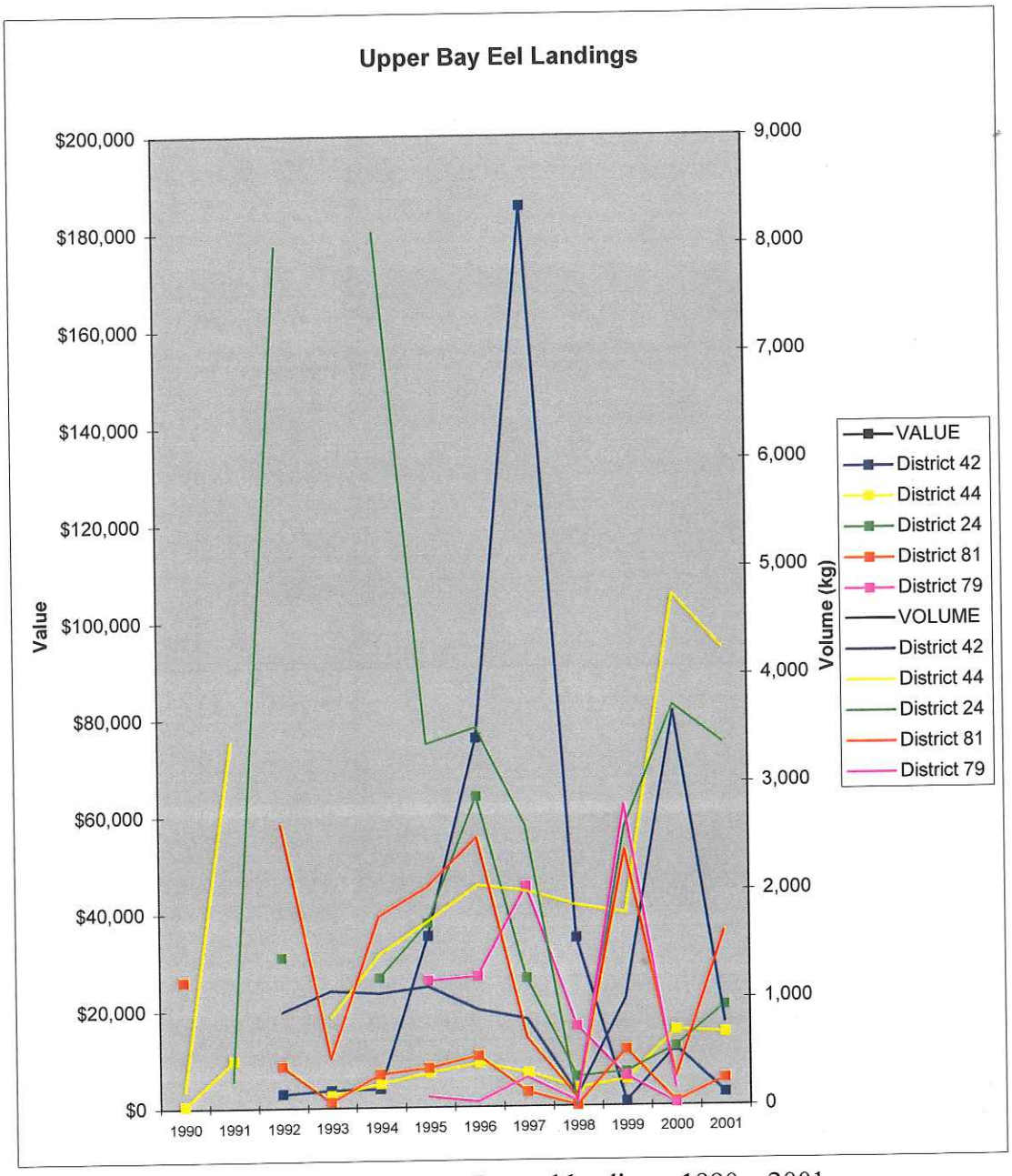


Figure A 11. Upper Bay eel landings, 1990 – 2001.

Although no information exists that would determine the likelihood that eels in different tributaries or streams are part of the same population, the numbers of eels in Ontario and Quebec waters have declined dramatically in the last three decades. In Ontario it is estimated that the eel population may have declined by more than 90% since the 1980s The decline in Ontario and Quebec has caused remaining jurisdictions to reconsider the

eel's status and it appears the situation may now be one of decline throughout the Canadian range (COSEWIC 2005).

5. *Gaspereau*

Gaspereau[7] are fished throughout the Upper Bay. Landings over the past decade are shown in Figure A 12, and current licensing information in Table A7. Landings for the past decade show consistent fishing activity in districts 41, 42, 43, 81, and 79. While licenses are not assigned to a specific river (but can be traced to registered fishers in certain communities and within the larger DFO Statistical Fishery District), it cannot be said with certainty, in some districts, in which rivers fishing occurs. Knowledge of fishing on the Gaspereau and Stewiacke-Shubenacadie rivers is well established and other gaspereau fishing was reported on the Tantramar River and in the Harvey Bank area near the mouth of Shepody Bay in New Brunswick. Gaspereau from both these areas were sold as bait to the lobster fishery or exported in salted form to Caribbean countries. The occurrence or impact of the recreational tidal gaspereau fishery is unknown, as licenses are not required. One fisher reported that in the Tantramar area illegal fishing is at times so high that there is hardly any room for the regular fishers' stands.

Fishing gaspereau on the Gaspereau River has a rich history from the first Mi'kmaq inhabitants to the arrival of the European Planters in the 1700s. In the original land draw of 1760, every Planter was assured property fronting on either the Gaspereau River, the Avon River or the Minas Basin. Regulations were established to control local fishing at this early date. In 1871, some of the regulations pertaining to the Gaspereau River read as follows:

> " No Gaspereau seines shall be drawn in Gaspereau River at any time on any pretense whatsoever... that Salmon sein (sic) shall be drawn only two days in the week, and no such sein shall be drawn up higher up the River than 5 rods above the Upper and Bishop's Bridge, commonly so called, which shall be

[7] The regional common name, *Gaspereau*, refers to two related species: the alewife, *Alosa pseudoharengus*, and the blueback herring, *Alosa aestivalis*. These species are not commonly distinguished in fisheries records, but differ in preferred spawning habitat and time of upstream migration. Some rivers are dominated by one species, but many harbour both.

> staked off by the Oversear of the River Fishery to prevent anyone from pleading ignorance. That no Gaspereau fish shall be taken out of the River with other nets, other than with square or scoop nets and that no eddies, sein, or obstruction for taking said fish shall be erected opposite each other, or across more than 1/3 of where the fish swim."
>
> (quoted in The Blomidon Naturalist Society 1992).

In the 1970s government fishing surveys reported that dip net stands on the Shubenacadie River harvested approximately 363,640 kilograms annually. Drift net operations, including 18 boats on the Avon River, harvested approximately 68,180 kilograms annually. The River Hebert had a small early run of gaspereau. During the run, commencing in early April, 150 fish were caught per day in gillnets. Small runs of gaspereau with some recreational fishing occurred on the Parrsboro River, La Planche River, and Macaan River (Maritime Resource Management Services 1979).

Today drift gill nets and dip nets at weirs are used in the Shubenacadie River while the square net is unique to the Gaspereau River. The Gaspereau fishery occurs along the 4 km stretch of river between the head of tide and the White Rock Generating Station. Currently, 15 square trap net licenses are issued on this river. Under current regulations, the fishing season opens March 15. Fishing begins when alewives first enter the river in late April or early May, and the season closes May 31. The fishery is closed on Wednesdays and the weekends. The stock is almost entirely of alewife.

In the Gaspereau River, since 1964, landings have averaged 208 t, peaking in 1978 at 605 t; in 2000 they totalled 180 t. This stock, together with that of the Annapolis River, has been studied quite extensively since the 1980s (cf. Gibson and Daborn 1993, 1994, 1995, 1998). In the late 1990s harvest exploitation rates of 0.89 were above the reference level of 0.65. The stock exhibited characteristics of a heavily impacted population in each of seven assessments between 1982 and 2001 (DFO 2001b). It was recognised that exploitation rates had to be reduced in order to increase escapement and ultimately production. In the absence of specific biological and fisheries information, the management objective is to maintain harvest at about long-term mean levels. In the Bay of Fundy a reference exploitation level of 0.65 is used.

The Gaspereau River watershed has been extensively modified for hydroelectric generation. Under current water management practices, alewives are diverted past four of the five generating stations in the watershed. Downstream escapement is facilitated by water management at several of the impoundments, especially Gaspereau Lake; mortality of alewives at the White Rock Generating Station has been noted occasionally, but the extent is not known.

In 2001 the Gaspereau River Advisory Committee was created by DFO and includes DFO, local fishers, Nova Scotia Power Ltd. and provincial government agencies. Communications between Nova Scotia Power and fishermen regarding their operations on the river have been poor, or absent. Fishermen have had their gear washed away and destroyed on the river, in some cases amounting to losses of $10,000, due to sudden releases of water on the river by Nova Scotia Power. The Advisory Committee was formed to resolve conflicts that arose following fish kills and loss of fishing gear.

Since 2001 there have been several more incidents of fish kills on the Gaspereau River, identified by fishers who live by the River and regularly monitor its activity. Fishers claim that the response to incident reports of fish kills and other management issues to Nova Scotia Power and DFO has habitually been inadequate and untimely. Fishermen have experienced a lack of acknowledgement of their river monitoring work, fish data counting, and other knowledge passed down to them from older generations and acquired from years of their own fishing on the river. It does appear however that a more positive relationship is slowly being established between the fishers and Nova Scotia Power. Recently, at the Gaspereau Advisory Committee meeting, the Upper Bay Marine Resource Centre was approached by Nova Scotia Power to jointly host a summer student to do work on the river.

Other management issues include DFO's lack of resources to conduct science on the river or produce timely / annual results of logbook records[8]. Gaspereau data on the river rely on counting done at Nova Scotia Power's fishway.

Table A7. Gaspereau Licenses in the Upper Bay of Fundy, 2004.

Licenses 2004	**Gaspereau**
District 35	1
District 40	1
District 41	19 (Gaspereau – 13)
District 42	24
District 43	31 (Stewiacke – 17, Truro - 10)
District 44	10
District 24	4
District 81	5
District 79	9
District 48	2
Total	106

6. *Groundfish*

The presence of groundfish species and their harvesting in the Upper Bay have changed dramatically over the past century. An observer in the 1850s reported that there was, on average, one weir for every mile along the north shore of the Basin. In particularly favourable areas there was an almost unbroken line of weirs, with ends almost touching (Percy 2001). Thurston (1990) describes residents in the 19th century using pitchforks in the intertidal pools near Five Islands where they caught a variety of species including cod, pollock, and halibut, as well as herring so thick they could be scooped out by hand. During the same time there was fishing for cod in Minas Channel on the north shore, from Parrsboro to Cobequid Bay, and at the mouth of the Avon River (Bousfield and Leim 1959). Rich (1929), based on his research with fishermen, marks the Minas Channel as a major haddock fishing ground.

[8] Another recent issue that arose, which points out an inadequacy of single species Advisory Committees, was when a fisher asked what the impact would be on harvesting in the river from the SARA listing of Atlantic salmon as endangered. DFO representatives would not engage in a discussion stating that people were responsible to acquire this information for themselves.

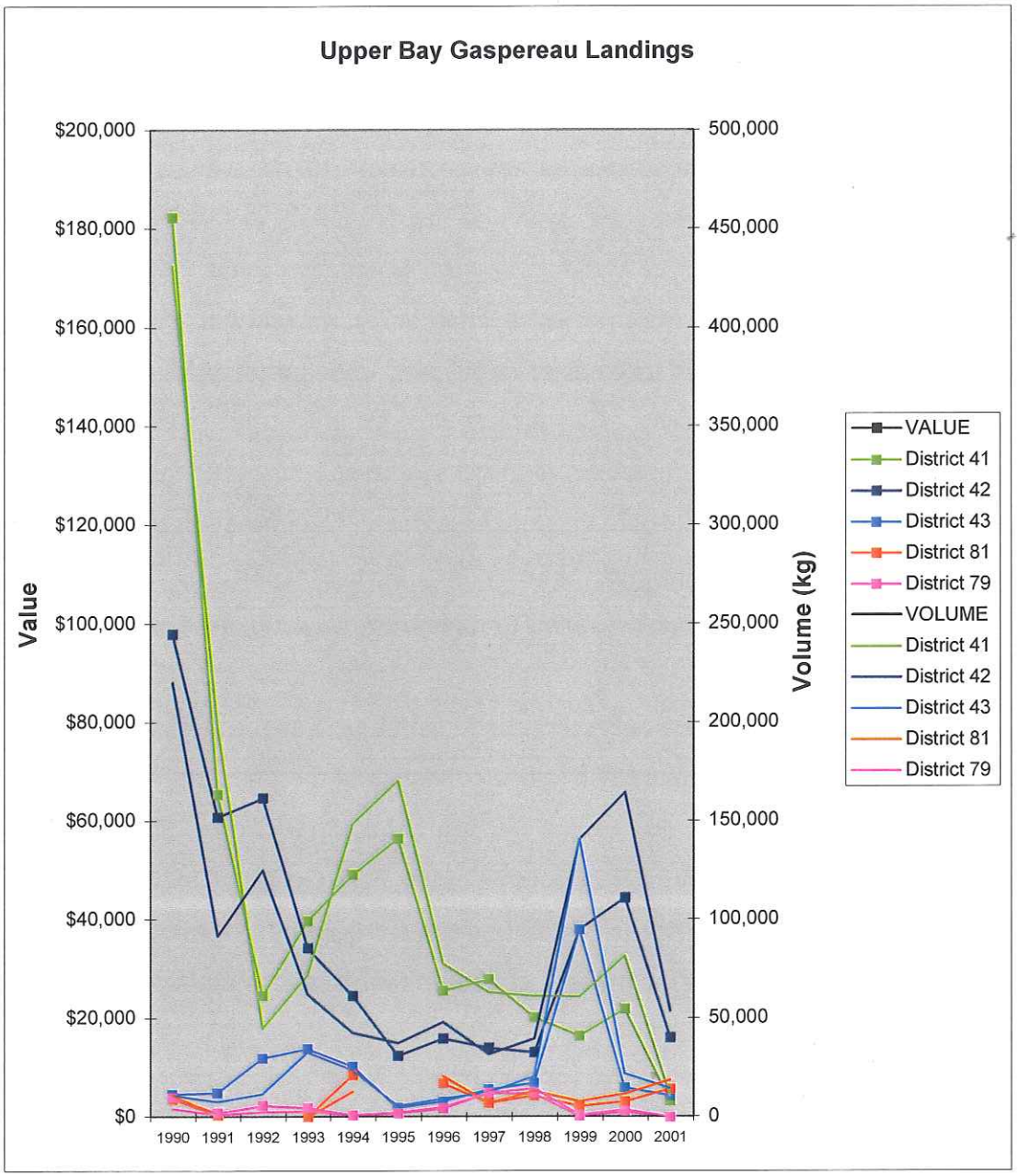


Figure A 12. Gaspereau landings in the Upper Bay, 1990 – 2001.

Graham *et al.* (2002), from interviews of Bay of Fundy fishermen about past groundfish spawning areas, documented that from the 1930s – 1960s the Upper Bay was fished for both cod and haddock. Haddock were said to spawn around Ile Haute and Scots Bay, while cod spawning was reported along the coast of New Brunswick between St. Martins and Chignecto Bay. Fishermen associated the decline in haddock with overexploitation of stocks during the 1960s and in the mid 1980s. The decline of what might have been a

local cod stock was attributed by fishers to changes in bottom conditions from the construction of the Petiticodiac Causeway and the operations of large scallop draggers.

Fishing groundfish in tidal and estuarine areas was reported as still occurring in the 1970s when a government estuarine fishing survey found that from July to October flounder were fished by hand line in Advocate Harbour, Spencer Island, Fox Point, West Bay and Clarke Head (Maritime Resource Management Service 1979). In addition, a more active recreational groundfish fishery had taken place in the past, when people held recreational licenses for longlines with 100 hooks. Baited lines were set at low tide in the mud, the hooks being covered with plastic containers to guard against seagulls; after the tide came in and started to recede again people would gather the lines. The impact on the resource from these licenses was not determined, however they were eliminated by DFO in the early 1990s (pers. comm. Hank Sweeney, DFO Enforcement, Kentville, NS).

Today there is still a network of active brush weirs in the Minas Basin and Channel. Two of these weirs are licensed for flounder, one in Economy and the other at Five Islands. DFO Enforcement suggests that the weir at Walton fishes for flounder, however the licensing of the weir is currently unclear (pers. comm. Paul Gentile, Chief, Resource Management, DFO ENS Area Office). The other weirs are licensed as herring weirs but are known to catch groundfish as a bycatch although the amount is unknown and not accounted for in the groundfish TAC.

Brush weirs exist in the following areas in the Minas Basin and Channel:

- Partridge Island / Parrsboro – 1 Active
- Moose River – 1 Inactive
- Above Five Islands – 2 Active
- Lower Economy (between Carrs Brook and Sauly Cove) – 4 Active
- Upper Economy – 1 Active, 1 Inactive
- Walton – 1 Active
- East Walton – 1 Active
- Morton / Margaretsville – 1 Active

Over the past ten years fishing effort has shifted from further south in the Bay of Fundy to the Upper Bay as the lower Bay has been heavily fished, resulting in declining stocks. Fishermen trace the increase in effort to the transfer of the offshore quota to 65' foot boats that then began to operate in the Bay of Fundy in the late 1990s. This increased fishing pressure on traditional groundfish species, and also introduced harvesting of species such as dogfish that were previously considered a nuisance by drift-net fishers, but for which a market has now been found[9].

Management of groundfish in the Upper Bay is done within the large 4X NAFO management area, a management unit based on administrative, rather than biological considerations. TACs are set for flatfish, cod, pollock, silver hake, and cusk within 4X. The flatfish TAC includes Witch flounder, American Plaice, Yellowtail flounder, and Winter flounder. The TAC for each species is divided among the fleets. Each fleet has a conservation harvesting plan that provides the regulations and restrictions their fleet must abide by. The broader objectives, management strategies and measures, for the Scotia-Fundy ground fishery are given in the *Groundfish Management Plan, Scotia-Fundy Fisheries Maritimes Region, April 1, 2002 – March 31, 2007.*

[9] Attempts to establish a market for the Spiny dogfish (*Squalus acanthias*) have been made by DFO and its predecessors for almost a century, generally without success.

Brush Weir Management in the Minas Basin

The genesis of the current management approach to "weir" fishing in the Upper Bay Upper Bay of Fundy commenced in the mid 1980's. Regulatory and bycatch issues associated with seafish traps (as they were called at the time) resulted in the issuance of species-specific licences. Weir (trap) fishers in the Minas Basin between Walton and Parrsboro were affected by this licence change and have been ever since.

Prior to 1983, Fisheries and Oceans Canada (DFO) issued a number of "seafish trap" licences (primarily for waters of the Bay of Fundy), that permitted the licence holder to retain most fish species that were in season. In 1983, however, it was recognized that no authority existed under federal fisheries regulations to issue seafish trap licences and a change in approach was required.

The "seafish trap" designation posed a problem with regard to retention of species like salmon, and consequently, most of these seafish trap licences were phased out by 1986 and replaced with species-specific licences.

Weir fishing, by its nature, has incidental catches of species other than the species-specific licence for which it was designed to fish (herring or flounder-with 90% being for herring). In 1997, after the *Maritime Provinces Fishery Regulations* were amended to prevent the retention and sale of striped bass caught incidentally in other licensed fisheries, the incidental catch in weir operations became a more pressing area of concern.

Subsequently DFO reviewed the weir participants and their respective catches in the Upper Bay. Following this review a freeze was placed on the transfer of these weir licences until the issue surrounding the retention of incidentally caught species could be resolved.

The resolution to the bycatch issue was found in conditions of license which permitted the retention of one (1) striped bass per day, 68 cm or more in length, for personal use, a prohibition on the retention of sturgeon, and an assurance from DFO to review and follow up on the retention of other species for which the weirs were not specifically licensed to fish. Catches in the weir fishery between 1998 and 2000 were:

Species	3 yr. Avg. in Lbs.
Herring	**74,300**
Shad	**115,500**
Gaspereau	**40,666**
Flounder	**10,933**
Bass (units for personal consumption)	**54**
Sturgeon (units released)	**155**

At present DFO and the industry continue to work on a long-term resolution to the "freeze" currently in place

Source: Paul Gentile, Chief, Resource Management, DFO ENS Area Office
March 2005

Groundfish in the Upper Bay, as described in an earlier section, are fished by a variety of mobile and fixed gear fleets. Mobile fleets fishing in the Upper Bay have landed fish in ports in Southwest Nova Scotia, in districts 31 – 24, in districts 36 – 39 at the mouth of the Bay of Fundy on the Nova Scotia side, and in the Upper Bay by the resident smaller dragger Generalist fleet. In addition, a small fixed gear fleet from the Upper Bay and other operators from further south in the Bay also fish the waters of the Upper Bay.

Fishers in the Generalist fleet in the Upper Bay are part of the larger Scotia-Fundy Generalist fleet which operates with the combined ITQs of members as fleet quotas. Generalists retain the option of moving to the ITQ fleet and as a result the Generalist fleet is currently one third of its size on establishment in 1991 (DFO 2002f). In the Upper Bay the Generalist fleet is based out of Delhaven and consists now of 3 vessels. Prior to ITQs, additional groundfish vessels from this area harvested other species, such as lobster outside of the groundfish fishing seasons.. These vessels, however, eventually stopped groundfishing because in the ITQ system they had minimal fishing history to be put towards the amount of quota they would be allocated. The Generalist fleet now primarily fishes for flounder.

In terms of fishery management in the Upper Bay, the Generalist fleet is subject to the broadest DFO management unit of NAFO division 4X. This broad management unit for groundfish fleets, as stated earlier, enables fleets from anywhere of any size to fish in the Upper Bay, depleting resources that otherwise could be fished by Upper Bay vessels. This broad management unit ignores the potential of locally distinct stocks, and is also not designed to work with the Upper Bay ecosystem. For example, the start of the season in 4X is the same as the start of the season everywhere, regardless of whether fish in the Upper Bay have fully spawned and rebuilt their body mass.

Other management challenges facing the Generalist fleet in the Upper Bay include management of dogfish where mobile gear license holders are limited to a bycatch. The view of fishers in the Generalist fleet, however, is that dogfish are a local resource that

they should be able to fish. Generalist fishers who also hold fixed gear licenses encounter another particular obstacle where they are not permitted to fish the fixed gear license with a vessel that carries mobile gear. In the recent past, one Generalist fisher who holds a license for fixed gear has tried to register with the Fundy Fixed Gear Council but not been allowed by DFO.

Since 1996 the 'less than 45' fixed gear vessel' category remains under a competitive fishery but the available quota is divided among geographically-based Community Boards based on the catch history of their members. Each Community Management Board is responsible for distribution of catch allocations and development of in-season management plans.

The Fundy Fixed Gear Council is the community board for fixed gear on the Nova Scotia side of the Bay of Fundy and encompasses any 'less than 45' fixed gear vessel' license holders in the upper Bay. A handful of fishers from the Upper Bay registered with the Fundy Fixed Gear Council to fish in 2005. Their home ports and gear are:

- Advocate Harbour – Longline
- Apple River – Longline
- Delhaven – Handline
- Hall's Harbour – Longline
- Scots Bay – Handline

Excluding dogfish and flounder, there was generally a small amount of groundfish landed in districts around the Upper Bay for the period 1990 – 2001. Species that composed the minimal groundfish landings are listed below, by DFO statistical districts:

- District 35 - cod, haddock, halibut
- District 40 – cod, haddock, halibut
- District 41 – cod, haddock
- District 44 - halibut

In total in 2004 there were 37 groundfish licenses in the Upper Bay (see table A8), encompassing all gear types. It seems likely that approximately ten of these licenses are active when considering the numbers of fishers in the Generalist fleet (3), flounder licensed weir holders (2), and fixed gear license holders who registered with the Fundy Fixed Gear Council (5).

Table A8. Groundfish licenses held by fishers in the Upper Bay of Fundy, 2004

Licenses 2004	**Groundfish licenses**
District 35	5
District 40	10
District 41	3
District 43	3
District 44	4
District 24	3
District 79	4
District 48	5
Total	37

7. *Dogfish*

In recent years dogfish, *Squalus acanthias,* previously a nuisance species, began being harvested by fishers both in the US and Canada. By 1996, U.S. stock assessments showed that the dogfish population, particularly mature females, was being depleted. The species was declared overfished in 1998. Regulations beginning in the spring 2000 have cut the quota and limited fishing to half the year. The issue is particularly complicated by the biology of dogfish. While the fish are currently abundant, scientists say the important question is not how many fish there are, but whether the catch is sustainable. Female dogfish do not reach sexual maturity until age 12. While much younger female codfish, for example, produce five million eggs a year, the spiny dogfish bears live pups, about six at a time, after a gestation period of 22 to 24 months.

The closing of the year-round fishery in the United States has implications for spiny dogfish that migrate into Canadian waters. The Department of Fisheries and Oceans (DFO) in 2002 imposed its first quota, 2500t, on the small but growing dogfish fishery,. This quota is fished by the fixed gear under 45 feet vessel fleets in Scotia-Fundy. All other fleets are limited to a bycatch (DFO 2002c). The quota is conceived as a conservative estimate in the absence of sufficient scientific data to assign an appropriate quota. The dogfish science program is in its third year of a five year program aimed at building a population model for the species that will then be used to develop a sustainable quota for the fishery (pers. comm., Dr. Steve Campana, DFO).

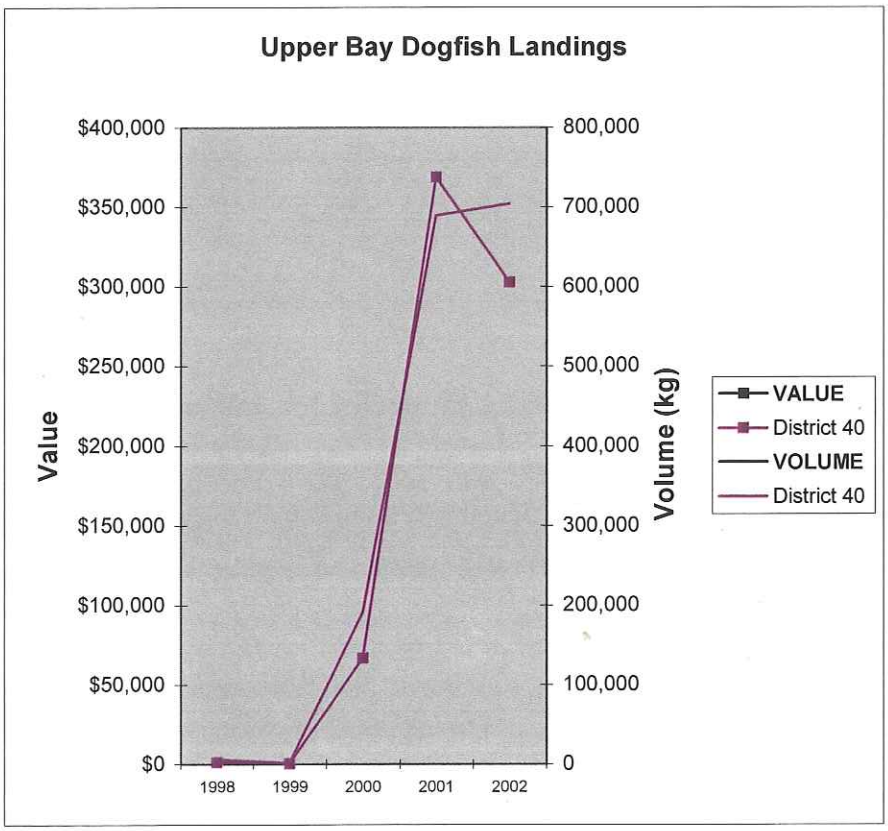


Figure A 13. Landings of dogfish in the Upper Bay of Fundy, 1998-2002.

8. *Flatfish*

The most recent Stock Status Report for flatfishes (American plaice – *Hippoglossoides platessoides*, Yellowtail - *Limanda ferruginea,* and Winter flounder, *Pseudopleuronectes americana*) in 4X5Y was prepared by DFO Science in 1997. Annual updates have been

conducted since. Information from the fishery and the summer research vessel survey are reported annually. DFO's annual Scotian Shelf groundfish survey includes one site in the Upper Bay (DFO 2003).

The lack of adequate information regarding species identification of landings covered by the generic 4X flatfish TAC is a major constraint to conducting assessments of the three separate stocks within the single management unit. Current information indicates a very mixed set of stock status scenarios – a worsening situation for American plaice, an improving situation for yellowtail flounder, relative stability in stock status of winter flounder, while the witch flounder biomass remains low but shows positive signs of recovery with improved recruitment coming into the fishable population (DFO 2002b).

9. *Herring*

In the Upper Bay herring (*Clupea harengus*) contribute to the catch of the mobile purse seine fleet that currently consists of 19 active vessels fishing 40 licenses (DFO 2003d) Herring are also fished in the Upper Bay by commercial brush weirs and through recreational fishing that uses beach seine nets.

The 4WX herring fisheries are predominantly based on fish from major spawning areas. The mobile seine fleet that fishes in the Upper Bay is managed on a unit called the SW Nova Scotia/Bay of Fundy Spawning Component. In 2003, within the SW Nova Scotia/Bay of Fundy Spawning Component, the largest purse seine fisheries occurred on the German Bank and Scots Bay spawning grounds, and on summer-feeding fish off Long Island, N.S. and around Grand Manan (DFO 2004).

In 2003, total landings for the SW Nova Scotia/Bay of Fundy Spawning Component were 89,360t, the highest since 1993. Increased landings by the purse seine sector (88,000t) accounted for the increase, as landings by both the gillnet sector (440t) and the Nova Scotia weirs (920t) were similar to 2002. Catches in the Nova Scotia weirs, although

only a little lower than in 2002, were the third lowest in the 40 year record of landings from this fishery.

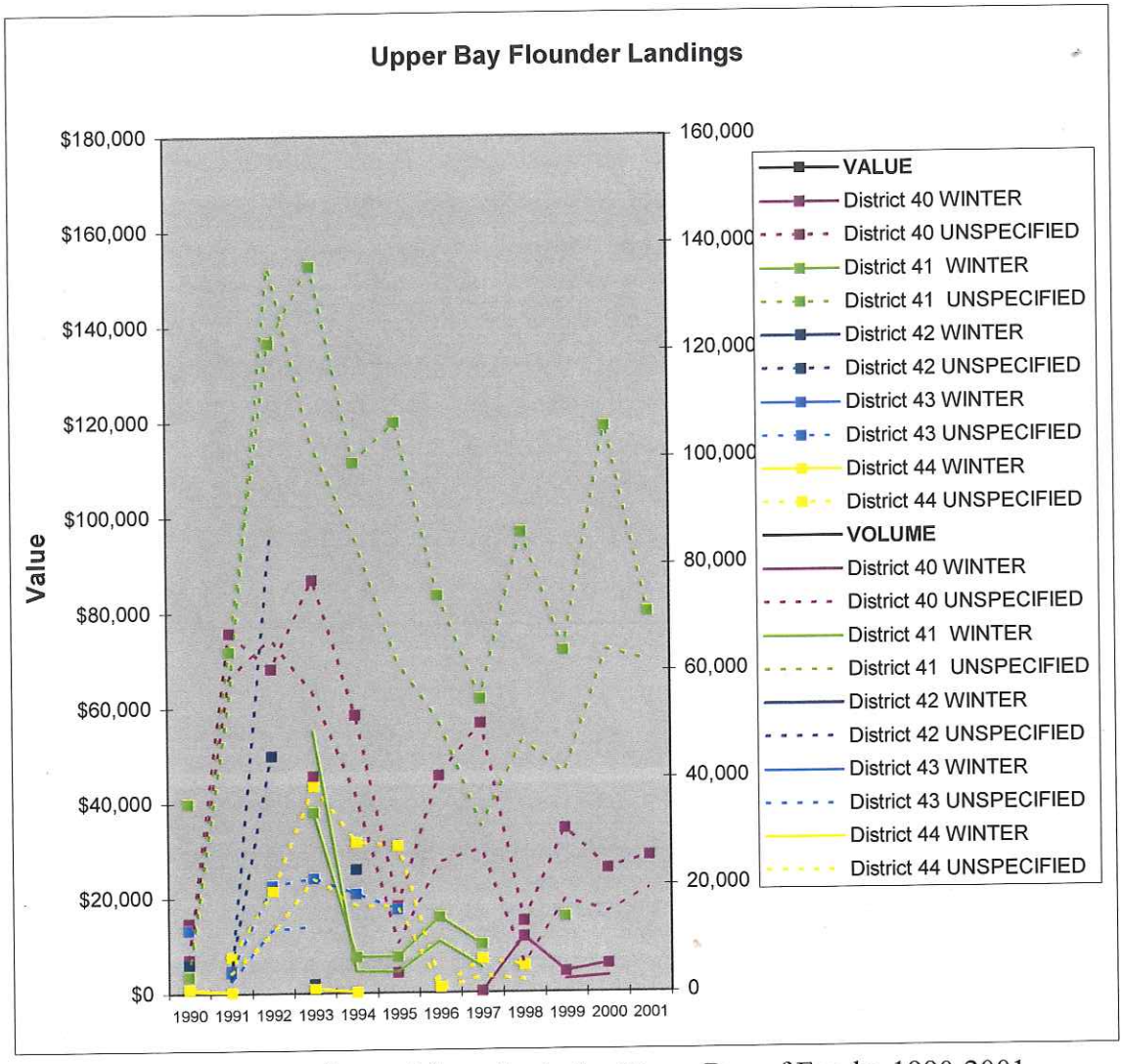


Figure A 14. Landings of flounder in the Upper Bay of Fundy, 1990-2001.

The annual percentage contributions of the Scots Bay herring spawning ground to the total herring purse seine catches from 1986 to 2001 are shown in Figure A 15:

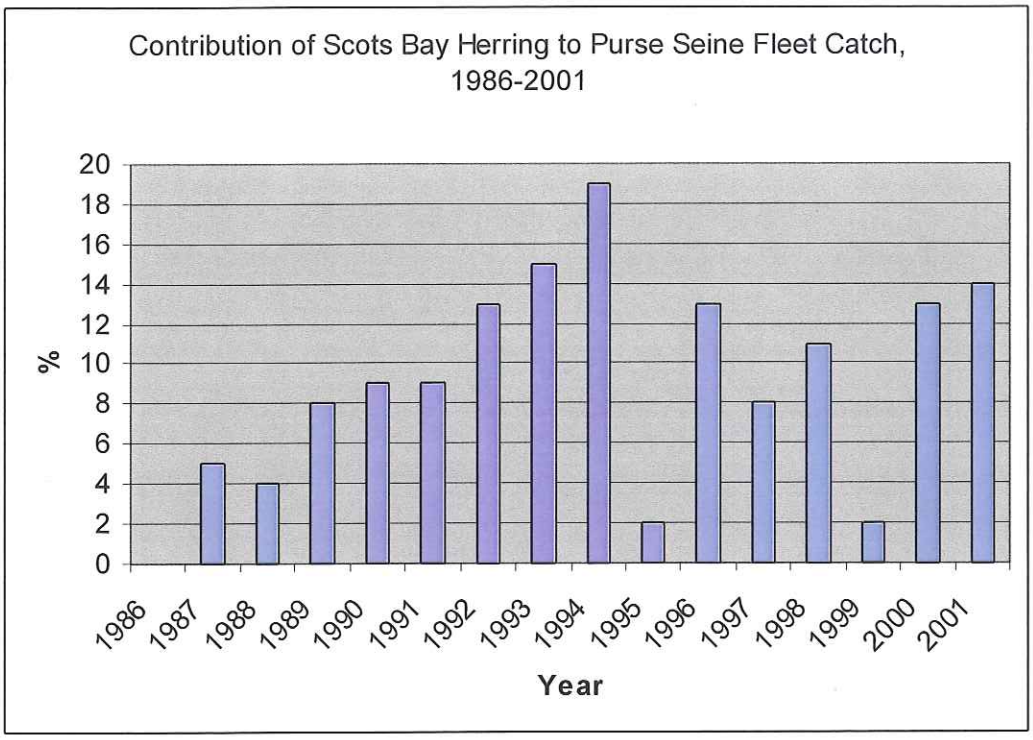


Figure A 15. Contribution of Scots Bay Herring to Purse Seine Fleet Catch, 1986-2001.

Herring are also caught in the Upper Bay by recreational fishers licensed for beach seine nets. There are reported to be 97 nets from Amherst to Windsor (pers. comm.. Vince Smith, DFO Enforcement, Parrsboro, NS), and 20 – 30 on the Windsor to Digby coastline (pers. comm.. Hank Sweeney, DFO Enforcement, Kentville, NS). In light of current official licensing information, that totals 160 herring licenses in the Upper Bay; there may be more or there could be commercial licenses for herring setnet and driftnet for vessels under 45'. Unfortunately the lack of more specific licensing information doesn't permit an accurate analysis.

Some fishers are concerned that the beach seine nets are indiscriminately catching too much and that this fish is sold 'under the table'. According to licensing information, large clusters of nets could exist in certain coastal areas near Parrsboro, Truro, Walton, and Kentville.

Since 1998, stock status of the SW Nova Scotia/Bay of Fundy Spawning Component has been evaluated using acoustic surveys on spawning grounds and biological characteristics

of the stock component. There has not been consistency in the operation of the surveys and data from 1997 and 1998 are not comparable in coverage to data from 1999 – 2003 (DFO 2004c).

Table A9. Pelagic licenses by district, 2004.

Licenses 2004	**Herring**	**Herring/Mackerel**
District 35	5	3
District 40	16	2
District 41	22 (Kentville – 15)	1
District 42	20 (Walton – 16)	1
District 43	39 (Truro – 20)	3
District 44	42 (Parrsboro – 31)	9
District 24	10	5
District 81		3
District 79	6	2
District 48		3
Total	160	32

There has been deterioration in the state of the stock and some of the conservation objectives specified for the fishery are not being met. There is an absence of older fish in the population and increased targeting of juveniles. The spawning stock biomass on Trinity Ledge and Seal Island spawning areas remain well below historical levels. The rapid decline in year-classes indicates high total mortality. The current catch is substantially higher that what would be consistent with a moderate fishing mortality (DFO 2004c).

10. *Lobster*

The lobster fishery in the Upper Bay occurs in both LFA 35 and a portion of LFA 36 on the New Brunswick side of the Bay. A new Lobster Conservation Strategy is currently under discussion for LFAs in the Maritimes Region. The DFO document, *2004-2008 Lobster Conservation Strategy, Scotia-Fundy Fisheries Sector, Maritimes Region, 3rd Draft*, distributed to fishers, forms the basis for future discussion on development of conservation harvesting plans within each LFA with the intent to create a more strategic

approach than in the past. The expectation is that each LFA will attempt to reach consensus on a strategy that is acceptable and begin to identify a number of indicators, and the data required to support them, beginning with the 2005 lobster season. The indicators can be biological, economic or other factors that industry want used to measure the state of the lobster stocks over some identified time frame. The process will also begin to assess what data requirements are needed and whether they are currently available, need improvement, or need to be developed altogether (DFO 2004b).

The lobster season for each LFA is:

- LFA 35: October 14 to December 31, and March 1 to July 31. Little gear is traditionally set in March.
- LFA 36: Second Tuesday in November to January 14, and April 1 to June 29.

Lobster landings in the Bay of Fundy were first reported on an annual basis in 1892. Landings peaked in 1895 at 1415 t, then subsequently declined over a 40 year period, to a low of 179 t in 1938. From 1939 onwards, landings increased to a second peak of 807 t in 1953 (DFO 2001).

Total landings in the Bay of Fundy were relatively stable (between 491-897 t) from 1946 to 1974. A low of 296 t was reported in 1976, then landings rebounded to 545 t the following year and subsequently increased through the 1980s. From 1986 to 1994, landings stabilized at approximately 1000 t. Landings subsequently increased by approximately 300 t each fishing season to reach 2566 t in 1999 (DFO 2001).

Lobster landings in LFA 35 from the 1940s to the mid 1980s ranged between 100 – 150 t. From the mid 1980s to the mid 1990s landings ranged between 200 – 300 metric tonnes. In the late 1990s landings rose to approximately 1,150 t in 2001 (DFO 2003c). Changes in participation level and exploration of new fishing grounds account for some of this increase. Fishing grounds have expanded over the past two decades with fishers extending their fishing operations several miles farther away from the coast. In 2001 some LFA 35 fishers had begun fishing in the vicinity of Isle Haute in the central portion

of the Upper Bay (DFO 2001). This is still the case with fishers from New Brunswick who operate throughout LFA 35 – to the middle, by Digby, and in the Cumberland Basin. Lobster fishermen from Nova Scotia reported fishing closer inshore throughout the Cumberland Basin, Minas Channel, and Minas Basin.

Lobster landings in the Upper Bay over the past decade have experienced a steady increase. In 1990 the volume landed was 187 t, which grew to 673 t in 2002; corresponding values in 1990 were $1,369,555 and in 2002 $8,359,861. The highest lobster landings in the Upper Bay are recorded for district 79 at Alma, followed by district 44 and then district 40 (Figure A 16).

DFO reports that there are currently 76 lobster licenses throughout the Upper Bay. Not all of these licenses however are fished in the Upper Bay. Probably half of the licenses in Truro are held by the Millbrook First Nation who fish 5 of their licenses in LFA 35, with one in the Upper Bay. The majority of licenses in the community of St. Martin in district 48 are likely fished in LFA 36, with one known to fish in LFA 35. Fishers in Alma calculate that there are 13 active lobster licenses in their community.

In the Bay of Fundy, for the 2004 fishing season, new effort and location reporting was requested of fishers by DFO. New data requested included effort information (trap hauls per day) and a 10 minute grid reporting of effort and catches. DFO anticipates that the adoption of the 10 minute grid approach will provide the opportunity to aggregate information from lobster and other fisheries at a similar standard spatial scale which will contribute to developing ecosystem-level science approaches (DFO 2003c).

Lobster science work in the Upper Bay area of LFA 35 is limited, as expressed by DFO in past LFA 35 Advisory Committee meetings (2003c). In 2003 it was stated that plans for fishery sampling would be at a low level, emphasizing key historical sampling areas, due to prevailing budget allocations with DFO Science. Since completion of baseline work on fisheries in the Chignecto Bay area in relation to the Petitcodiac Causeway issue, DFO lobster research centred again on the Lower Bay of Fundy, in large part due to

continuing issues related to salmon aquaculture development. Provision of additional funding to support work on topical regional issues currently drives the research program, which has been identified as a problem for maintaining a comprehensive long-term balanced program on the fishery (DFO 2003c).

Table A10. Lobster licenses by district, 2004.

Licenses 2004	**Lobster**
District 35	5
District 40	8
District 41	4
District 42	2
District 43	12 (Truro – 10)
District 44	12
District 24	3
District 81	1
District 79	18 (Alma – 18)
District 48	11 (St. Martins – 11)
Total	76

Lobster fishermen interviewed generally thought that lobster management currently is sufficient, including the functioning of the LFA 35 Lobster Advisory Committee. Further comments are listed below.

- Not enough science done in LFA 35 and what is carried out is by DFO Science in St. Andrews with whom fishers have little contact.
- It was calculated that over the past few years there has been a loss of 12 lobster licenses from the Nova Scotia side of the upper Bay, representing at least 33 jobs.
- In contrast, due to the inter-provincial freeze on licenses, licenses have remained at Alma in New Brunswick.
- Lobster licenses bought by DFO at extremely high prices have put the future purchase of lobster licenses out of the reach of interested fishers in the community.

- LFA 35 has introduced conservation measures before the adjacent LFA 36, with the result that LFA 36 catches lobsters that have escaped due to LFA 35 conservation measures.
- New Brunswick fishers raised concerns over the management of aquaculture, its potential development in the Upper Bay, and damage to the ecosystem.
- One person in Nova Scotia raised concern that the price paid to fishers for their product is being controlled by a dwindling number of larger companies which are buying up the smaller independent players and reducing competition and therefore prices.
- In New Brunswick there have been problems with the Full Bay Scallop fleet dragging over lobster grounds.
- Concern that scallop activity was occurring in unexpected areas prior to the opening of the lobster season, such as areas inside 1 to 3 miles.
- Concern over policies affecting the owner/operator and license transfers into the Digby area of LFA 35 by interests controlled in LFA 34.
- Concerns that they were not involved in any SARA consultation leading up to the listing requests under the Act. DFO staff commented that it is not a "DFO" driven process and they must educate themselves on how the legislation works, where and how to participate.

The resource status of Bay of Fundy lobsters, and within this LFA 35, has been assessed using fishery dependent and independent data. Fishery dependent data, include trends in landings, size frequencies in the commercial catch, presence of pre-recruit lobsters in commercial trap sampling, and trends in catch rate. Fishery independent data, derived from diving studies, help interpret trends in recruitment, and enable decadal-scale contrasts in population size distribution (DFO 2001).

There are limited fishery dependent data on which to evaluate long-term trends, and no comprehensive time series on catch per unit of effort. Only four areas have been sampled consistently since 1978 in the Bay of Fundy: Seal Cove (LFA 38), Dipper Harbour (LFA 36), North Head (LFA 38), and Alma (LFA 35). Fishery independent data have been

collected from two dive studies: one in the Fundy Isles Region of LFA 36 and the other in Grand Manan (LFA 38) (DFO 2001).

Overall, the status of the Bay of Fundy lobster, considered to be a part of a Gulf of Maine lobster metapopulation, has a positive outlook for the short-term. However, in terms of the long-term outlook, DFO (2001) states that,

> "The historical stability of the Bay of Fundy lobster fishery, recent increase in landings, and recruitment pulse in the Upper Bay need to be better understood in the context of the Gulf of Maine system before long term landings projections may be made."

11. *Scallop*

In 1987 the DFO licensing system recognized three distinct scallop fleets in the Bay of Fundy: the Full Bay fleet, a Mid Bay fleet that was licensed to fish from the New Brunswick shore out to a "mid-bay" line, and an Upper Bay fleet that was confined to the upper reaches of the Bay. The inshore scallop fisheries are the oldest, having begun by the late nineteenth century in various parts of the Bay and on the south coast of Nova Scotia (Peacock *et al.* 2000). The 1997 Bay of Fundy harvest plan produced a new management strategy in which the Bay was divided into 7 biologically defined fishing areas. The intent of the plan was to manage each area individually with differing regulations adapted to the biology of the resource.

The Full Bay fleet has traditionally been Digby-based with larger vessels (> 14.5 m and < 19.8 m Length Over All (LOA)) fishing only scallops, The Mid Bay fleet consists mainly of New Brunswick-based, smaller (< 14.5 m LOA) vessels, with multiple licenses for different species, and the Upper Bay fleet is Nova Scotian- and New Brunswick-based smaller, multi-species vessels. The Full Bay fleet fishes under Individual Transferable Quotas (ITQ's) with a season from 1 October to 30 September, while the Mid and Upper Bay fleets fish a competitive quota split into two seasons: 8 January to 30 April and 5 August to 30 September, or until the quota is filled. The Mid Bay Fleet can fish in SFA 28BC whereas the Upper Bay Fleet can fish in SFA 28C,D.

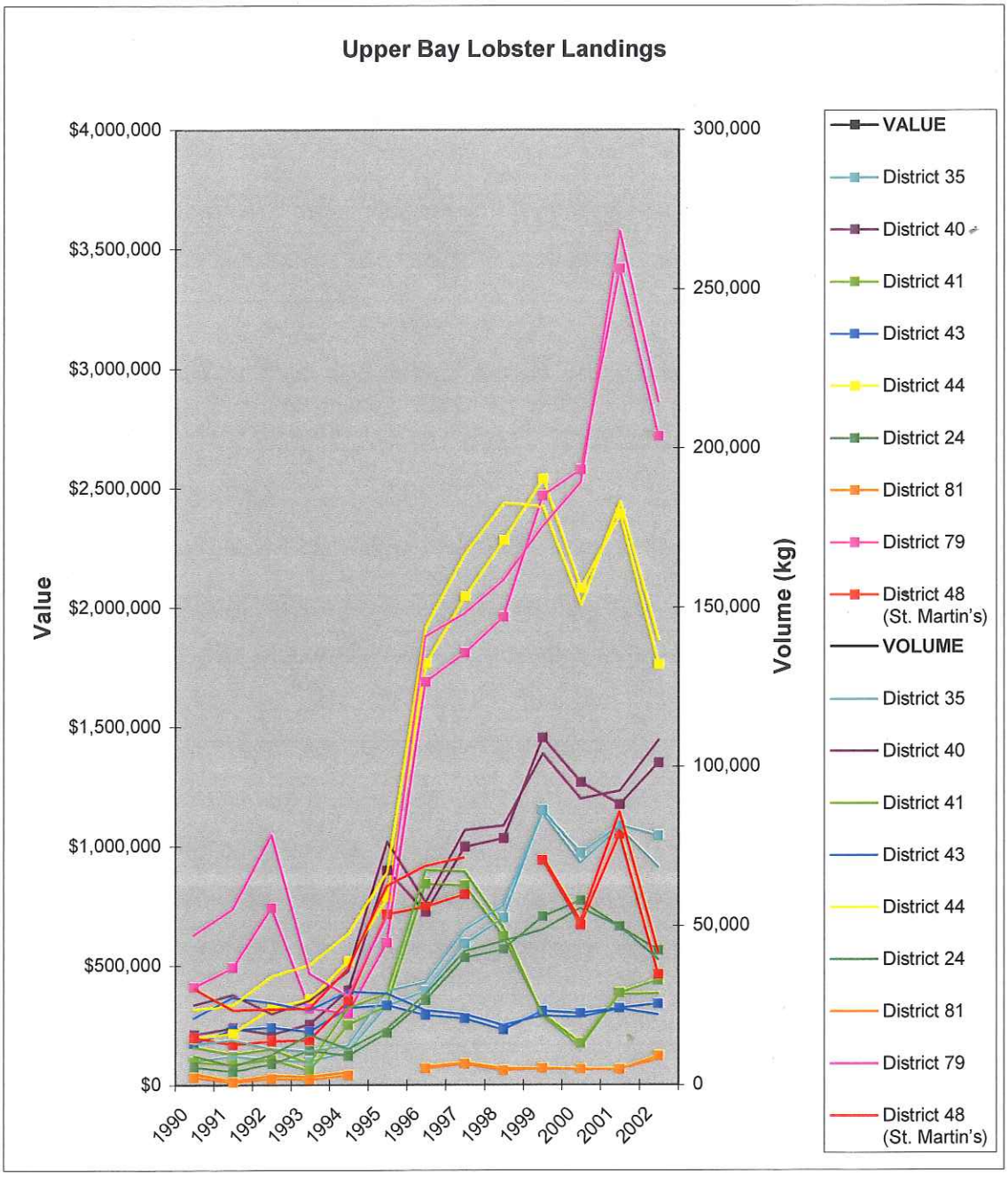


Figure A 16. Lobster landings in the Upper Bay from 1990 – 2002.

Table A11. Scallop licenses by district, 2004.

Licenses 2004	Scallop
District 35	
District 40	7
District 41	1
District 42	
District 43	
District 44	9
District 24	5
District 81	
District 79	12
District 48	3
Total	37

Scallop landings in the Upper Bay have fluctuated greatly over the past decade, with a substantial dip in the mid – 1990s followed by an increase to date. Landings describing the trend are given in Table A12 below and illustrated in Figure A 15.

Table A12. Landings and value of scallops in the Bay of Fundy, 1990 – 2002.

Year	Value	Volume (kg)
1990	$ 2,329,690	2,088,737
1997	$ 197,750	89,479
2002	$ 1,025,422	766,576

Issues that fishermen raised with respect to scallop management were mainly from the Nova Scotia Upper Bay fleet and are given below:

- Members of the Upper Bay fleet, based out of Nova Scotia, would like to separate from a shared quota system with the Mid Bay fleet. While the Upper Bay fleet has no access to area 28B, catches are registered against the quota that they share with the Mid Bay fleet.
- The Upper Bay fleet fishers would like to see their quota not come from SPA1 but from SFA28C&D. In their opinion, management with both scallop production areas and scallop fishing areas doesn't make sense.

- The Upper Bay fleet would like to see the Full Bay fleet not fish on or past the Upper Bay Line.
- Upper Bay fleet members stated that it is difficult to change any management measures because everything has to be discussed and negotiated with all the fleets.
- The major portion of the Upper Bay fleet quota comes from SFA28C, however at times the Full Bay fleet can heavily fish this area, close to the Upper Bay Line.

The Upper Bay area was surveyed in 1986-87, in conjunction with studies on the effects of opening the Petitcodiac River causeway in 1998, and twice in 1999. The area was surveyed with industry cooperation in 2000, and as part of the annual DFO Bay of Fundy surveys since then (DFO 2003d).

12. *Shad*

The shad (*Alosa sapidissima*) fishery has an extensive history in the Upper Bay, particularly in the Cobequid Bay and Cumberland Basin. The Colchester Historical Museum has undertaken a community project that tells the story of the Cobequid Bay Shad Fishery. It is part of their Community Memories Exhibit, which gives an account of the (now gone) fishery in Cobequid Bay from 1840-1994.

In 1840 the driftnet and shadboat fishery was introduced to Cobequid Bay; prior to this the shad fishery had been a smaller river-based fishery. Fishermen who took shad in the rivers thought that the driftnetting was damaging the stocks and requested government intervention, however the fishery was permitted to continue. By 1870 many local fishermen had adopted the driftnet method of fishing which at that point included ninety boats fishing forty miles of net from Harrington River to Chiganois River. At night, it is said that these ninety boats, each with its light, gave the appearance of a floating village.

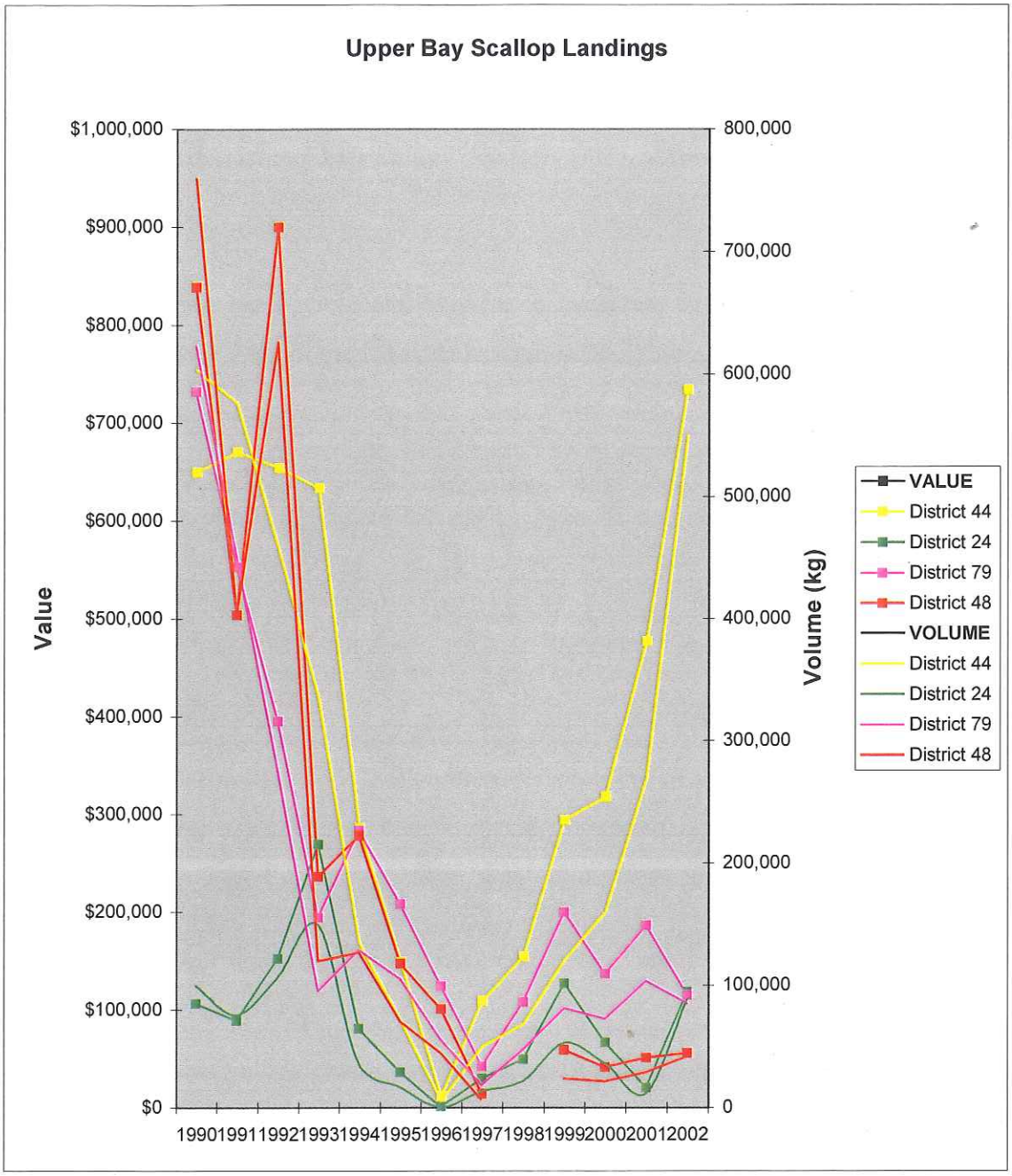


Figure A 17. Upper Bay scallop landings for 1990 – 2002.

In 1850 reports of a thriving shad fishery on the New Brunswick side of the Upper Bay were recorded by M.H. Perley, Her Majesty's Emigration Officer at Saint John, New Brunswick, when he was dispatched to the Upper Bay to prepare a report on the sea and river fisheries of New Brunswick. The fishery was carried on by "fishing-farmers" between seed time and hay making.

As many as 100,000 shad were harvested in a single tide by drift net and in stationary weirs. It was reported by Perley of the commercial shad fishery in the Upper Bay:

> "At the present time, there is a great demand for shad caught at the head of this Bay as being of superior quality – much fatter and more delicious flavour than any found on American shores ... That the supply is inexhaustible is plain to everyone; for notwithstanding the number of people employed, and the means for capture have greatly increased within the last few years, there appears not the least diminution in the quantity of fish ... We consider our shad fishery to be only in its infancy."
>
> (Quoted in Thurston 1990)

After the turn of the century, catches suddenly plummeted. The export trade petered out in the 1920s, as shad, no longer frequented Fundy waters in bountiful numbers. A major cause of the decline was the construction of dams, primarily for hydroelectricity, on many of the home spawning rivers.

In the 1970s a government fishery survey reported that there were over 60 licensed shad drift net fishermen in the Shubenacadie River and approximately 25 in Cobequid Bay and the Minas Basin. The average annual catch per net was approximately 10,000 to 15,000 fish (Maritime Resource Management Services 1979).

Thurston (1990) reported that Marvin Snowdon was the last of the New Brunswick shad fishermen in the Cumberland Basin. Today Mr. Snowdon no longer makes a living fishing shad, due to the deterioration in the fishery, however he does still catch shad for personal use. Shad are still taken by a few fishers on the Petitcodiac River in July and August, with driftnet, for personal consumption. In years past there was an active fishing

association in the area, the Belliveau Fishermen's Association, however it hasn't been active for the past five years. Prior to the establishment of the Petitcodiac Causeway, fishing was very successful for shad, salmon, and many other species. DFO provided a list of participating organizations in a Southwest New Brunswick Shad/Gaspereau Advisory Committee, however the Upper Bay participating organizations, the Alma Fishermen's Association and the Belliveau Fishermen's Association were not aware of the Advisory Committee.

Fisheries for shad today are prosecuted using set and drift gillnets, dipnets, square nets, and trapnets. Shad may also be caught and retained as bycatch in licensed commercial gaspereau fisheries, however, this regulation may be revoked or a set minimum shad retention number could become a specific condition of a gaspereau license.

The recreational fishery has a bag limit of five shad per day for inland and tidal waters of the Maritime provinces, however there are no statistics on the number of people angling for shad or the number of shad captured by angling fishers.

Dadswell (1986) summarized the landings of American shad from Cumberland and Minas Basins for 1870 to 1978. Peak landings of 100 to 200 t per year were reported at the turn of the century in Cumberland and Minas Basins. Recent landings have been below historic levels, fluctuating between 32 t and 110 t in the last decade. In the Upper Bay the greatest proportion of landings is recorded from upper Cumberland Basin (district 81) on the New Brunswick shore and from districts 42 and 43 on the Minas Basin. The Shubenacadie/Stewiacke River supports a large April-June shad fishery.

In 2003 Chaput and Bradford stated that very little is known to date of the American shad in the Maritime provinces in terms of population occupancy, area of occupancy, and trends in abundance, due to the lack of dedicated assessment programs, and landings data that are considered incomplete. There is about 50% return rate of completed logbooks in the commercial fishery.

Table A13. Shad licenses by district, 2004.

Licenses 2004	Shad licenses
District 35	
District 40	1
District 41	1
District 42	19
District 43	19 (Stewiacke – 16)
District 44	5
District 24	8
District 81	13 (Belliveau Village – 10)
District 79	1
District 48	
Total	67

Currently on the Stewiacke River there is a variety of gear types fishing for shad and Gaspereau, including brush weir fishermen, 12 active driftnet licenses with only 3 or 4 people fishing towards the end of the season, and another 12 fishers using gillnets at the peak of the season.

The Driftnetters Association has a range of concerns with respect to management of fisheries on the river.

- There is no management plan for the river.
- The Association is not involved in any science, however they are willing to participate. In the past they cooperated on a striped bass tagging project in which they returned the bass tags to DFO. The fishers have ecosystem concerns; they record having seen diseased fish.

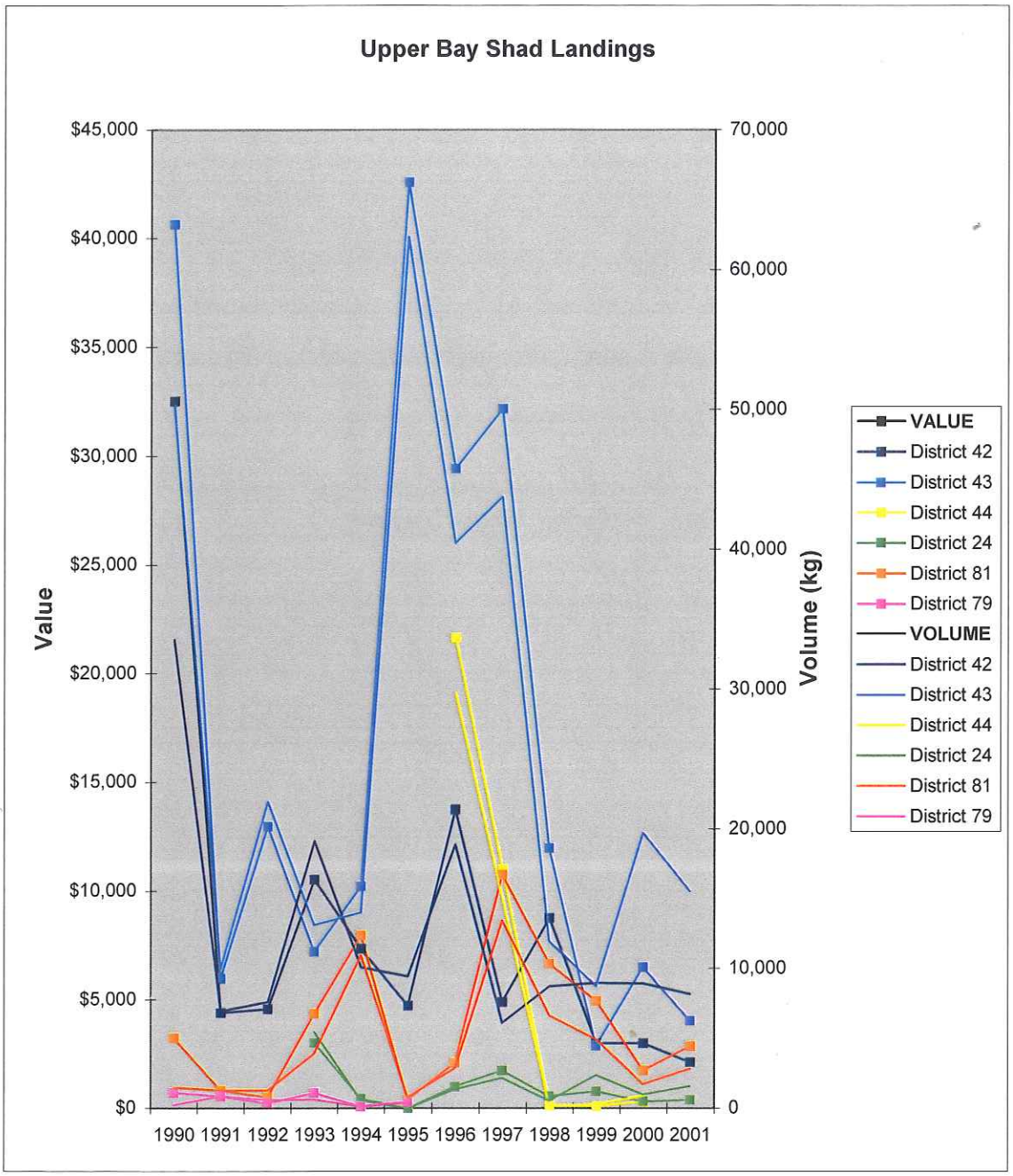


Figure A 18. Shad landings and value in the Upper Bay of Fundy, 1990 – 2001.

13. *Marine Worms*

Marine worm harvesting in the Upper Bay occurs primarily in the Minas Basin and has been conducted in this area for over 30 years. The worms (*Glycera dibranchiata*) are sold as live bait for recreational fishers. Until 2002, the fishery was unregulated, with no

limit on the number of harvesters or quantity of worms harvested. In the Minas Basin in 2004 there were 42 commercial exploratory licenses issued. This was a substantial decrease from the more than 100 harvesters who participated in the area's harvest in 2002 (DFO 2004).

Of particular note is the sharp increase in marine worm licenses in the Parrsboro area from 8 licenses in 2002, to 63 in 2003 and 61 in 2004. Despite these numbers, DFO Enforcement staff have seen little marine worm harvesting activity. This could be a case of people acquiring licenses just in case.

Table A14. Marine worm licenses in the Upper Bay of Fundy, 2004.

Licenses 2004	**Marine Worm Licenses**
District 35	
District 40	3
District 41	40 (Kentville – 13, Port Williams - 16)
District 42	38 (Walton – 12)
District 43	34 (Five Island – 17, Lower Five Islands – 12))
District 44	61 (Parrsboro – 61)
District 24	7
District 81	
District 79	
District 48	
Total	183

A DFO Minas Basin Marine Worm Management Advisory Committee has been formed to enable harvesters and concerned citizens to raise issues they have concerning the harvest. The Hants Shore Concerned Citizens Group is now in its fourth year of trying to participate in the DFO management process of the harvest. This is the first year in which they were able to raise suggestions for regulation that were considered in the development of the management plan. In the past they were not informed of meetings or invited into the DFO Advisory Committee process. The group is concerned about the state of science being conducted and its translation to them. They feel there is not enough being done to consider the ecosystem or the rejuvenation of the flats.

Scientific evaluation studies were conducted in 2004 by DFO on flats in the Avonport area.

Registered Fishers and Vessels

Data for the years 1986 – 1996 were taken from the Wharfs database (Coastal Communities Network) for the Districts in Nova Scotia. Data from 1997 – 2004 were provided by DFO however this was only given in terms of the entire district, not by port, as requested. In light of this, data for district 35 only goes to 2001 and is entirely from the Wharfs database. For district 48, St. Martins, data were acquired from Small Craft Harbours, Moncton, NB.

Table A15. Numbers of fishers and vessels by district, 1986 – 2004.

	Fishers			**Vessels**		
	1986	1997	2004	1986	1997	2004
District 35 *excluding Hampton	33		18 (2001)	31		19 (2001)
District 40	59		60	41		21
District 41	78		77	22		10
District 42	67		32	35		15
District 43	323		118	29		29
District 44	108		98	32		22
District 24	40		54	4		10
District 81		23	21		10	6
District 79		57	66		14	20
District 48 *includes only St. Martins		16	17		4	6 (2002)

Bay of Fundy Fisheries Organisations

A considerable amount of time was invested during this project to identify, inventory and confirm the representatives of fishers' groups and others with knowledge of Bay of Fundy fisheries. As many as possible of these were interviewed by Christie Dyer to provide the state of the fishery, and the concerns of Upper Bay fishers described above in this report. The comments that follow are her candid assessments of these important local

leaders. A list of contacts in the Department of Fisheries and Oceans is provided in Appendix I. A list of fishers and community groups, and their current representatives, is provided in Appendix II.

Among the tidal and river fisheries all the representatives of Associations indicated that they were:

- very interested in integrated resource management,
- have a long history in harvesting / fishing,
- were trying to work towards better management of their fishery, and
- in general have encountered similar challenges in dealing with DFO.

Active tidal and river associations are:

Minas Basin Clam Fishers
Mike Lewis (Chairman)

Shubenacadie Driftnet Fishers Association
Gerald Blake (President)

Gaspereau River Square-Net Fishermen's Association
Mickey Coldwell (President)

Kings and Hants County Bait Fishermen Society
Arthur Purchase

Christie Dyer was unable to get in touch with the Cobequid Bay Salmon Association, the Cumberland County River Enhancement Association or Shepody Bay Fish and Game Association during the course of the project. However, a meeting with the Cobequid Salmon Association is scheduled for June 2005. The Parrsboro Recreational Fishers Association appears not really to be an active organisation anymore; previously they

worked primarily on salmon habitat restoration. The past President, Randy Corcoran, however indicated that he would be pleased to be part of any Upper Bay work.

Project Limitations

This project was initiated in the fall of 2004, and was conceived as the first phase of a multi-year study aimed at the production of a viable, community-endorsed, ecosystem-based management plan for fishery resources in the Upper Bay of Fundy While it has achieved most of the original expectations and objectives, the scope of the report is limited by some significant impediments, as listed below.

The length of time required for obtaining data, identifying appropriate contact people, and conducting interviews was much greater than expected. Acquiring requested Upper Bay data from DFO took from 2 – 3 months, and at the time of writing (March 2005), some have still not been received. Several times data that were provided were not what were requested, which consequently required multiple communications that spanned over months. In particular: licensing information was requested for the years from 1985 to the present (2004); data were received for 1997 – 2004 (twice), but each time proved not to be fully what was requested. The data were also corrupt: each time the data varied somewhat, and contained incorrect numbers due to mistakes in querying of the DFO database. Licensing data before 1997 are held in a separate DFO database. The lack of licensing data prevented the analysis of license changes in communities that would have helped explain changes in fishing effort, types of fishing, and economic impact from these shifts.

The researcher and the Upper Bay of Fundy Marine Resource Centre were not previously known to any fishing / community participants that were contacted in this project, with the exception of a few fishers in the immediate area of the Centre. Although those contacted generally spoke freely of their fishing experience and knowledge there was likely some scepticism both of the researcher and of the project.

In some cases information collected from fishing associations (clam, shad) and community groups (worm) were from a single source who had been identified as a representative of the group but may not have encompassed the views of all fishers or community people within that group.

The absence of formal fishing organisations, with contact information, in certain areas of the Upper Bay, for both commercial and recreational fisheries, means that knowledge from fishers in these areas is not represented in this project. For example weir fishers, and the many shad/gaspereau/eel fishers scattered throughout the Upper Bay but not in major rivers, are not represented. In addition, in the future it would be interesting to engage crew members in discussions. There are likely many other community organisations, such as lighthouse groups, around the Upper Bay that would be interested in future Upper Bay work.

Information gathered only scratched the surface what is happening in Upper Bay fisheries. It would be valuable to verify the information acquired, by discussions in the field during fishing seasons.

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Part B: Experimental Survey of Groundfish in Minas Basin and Scots Bay, 2004

Abstracts from:

Sierra A. Wehrell (2005)

A Survey of the Groundfish caught by the Summer Trawl Fishery in Minas Basin and Scots Bay.

Thesis
Submitted in partial fulfillment of the
Requirements for the Degree of
Bachelor of Science with
Honours in Biology

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Edited and abstracted by

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Abstract

A survey of the groundfish in Minas Basin and Scots Bay was conducted during the summer of 2004. A small trawl fishery for groundfish exists in the Upper Bay of Fundy which is regulated in a similar manner to trawl fisheries occurring elsewhere in the Bay, regardless of the complex environmental variables of the upper Bay. Twenty one different species were caught during the four month survey, but only winter flounder, spiny dogfish, Atlantic sturgeon, and skates were consistently caught during the fishing season. Length and weight measurements were obtained for all species except for sturgeon which were not weighed due to their large size. Age and sex were determined for winter flounder only. The average fork length of spiny dogfish was 75 cm and the average weight was 2.9 kg. Average length of skates was 48 centimeters, average weight 1.0 kg, and mean pectoral width was 29.5 cm. The sturgeon captured averaged 152 cm and weighed up to an estimated 100kg. Most sturgeon were tagged but no tag returns have been received to date. A total of 39 sturgeon were caught and 27 of them were tagged and measured. The winter flounder caught ranged in age from 2 to 9 years and in length from 19 to 49.5 centimeters. Mean total filet weight for legal winter flounder was 205 gms. During June and the first 2 weeks of July winter flounder were ripe or recently spent. Landings reached their peak during the month of July at a total of 13640 kg of flounder. The fishery in Minas Basin is dependant on the catch of winter flounder but if a consistent market for dogfish could be established this would be a valuable asset to the local fishers.

Introduction

Fishing in the Bay of Fundy has long been an important activity for the people living on its shores (Perley 1852, Scarratt 1977, Thurston 1990). Many methods for fishing have developed to accommodate market demand for various fish species, their habits, and the fluctuations in the abundance of fish (Perley 1852, Thurston 1990). In the upper reaches of the Bay of Fundy fishers have adapted their practices to use the extreme tides to their advantage in the pursuit of fish. Weirs are built near shore in areas that are

covered by water during high tide and drained with the ebb tide, leaving fish trapped and easily accessible. Drift nets capture fish traveling with the current by drifting with the outgoing tide and returning on the following high tide (Thurston, 1990). Various kinds of trawls have been developed to catch benthic organisms that inhabit the floor of the Bay (Brylinsky and Gibson 1994) and technological development has enhanced their efficiency (Carrothers 1968). Today a small commercial fishery consisting of a few fishing vessels operate out of Delhaven, Nova Scotia. These fishermen target winter flounder, *Pseudopleuronectes americanus* (Walbaum, 1972), spiny dogfish, *Squalus acanthias* Linnaeus, 1758, and lobster, *Homarus americanus* Edwards, 1837.

Concern about the environmental impact from the use of trawls as a method of fishing has existed for quite some time (Brylinsky and Gibson 1994). Trawls can change the composition of the sediment surface, alter the benthic communities, and affect the rate of chemical exchange between the water and the sediment. Experiments done within Minas Basin have shown that the region recovers within a year from the disturbance caused by trawlers (Brylinsky and Gibson 1994). Trawlers using nets without tickle chains left furrows in the mud caused by the doors and the rollers that lasted for at least 2 to 7 months (Brylinsky and Gibson 1994). The impact on the macrofauna and microfauna from the experiments were minor and prior population levels were obtained within weeks (Brylinsky 1994). Otter trawls of all sizes are useful for benthic fish and invertebrate sampling (Dadswell 1975).

It has been stressed that there is a lack of knowledge on biological processes in the inner basins of the Upper Bay of Fundy (Daborn and Bleakney 1977). The fisheries at the mouth of the Bay of Fundy are better known because they are of greater economic importance than those in the inner Bay (Daborn and Bleakney 1977, Simon and Campana 1987). As it stands, the Upper Bay is managed together with the rest of the Bay of Fundy and part of the Scotian Shelf in the 4X ICNAF (International Conference of the North Atlantic Fishery) zone under the government fisheries program (Scarratt 1977). Even though Minas Basin is connected to the rest of the Bay of Fundy, a high degree of ecological heterogeneity exists in the upper part the Bay of Fundy (Daborn and Bleakney 1977). The environmental differences between Minas Basin and the rest of the Bay of Fundy allow a mixture of species to exist there that are not normally present elsewhere in

the Bay (Dadswell *et al* 1984a, Bromley and Bleakney 1984). The heterogeneity of the Bay of Fundy should discourage general statements of biological processes for the entire area (Daborn and Bleakney 1977) and therefore fishery decisions for the 4X ICNF zone made based on assessments from the mouth of the Bay may not properly represent the entire region.

This work represents a preliminary study of the groundfish captured in the trawl fishery in Minas Basin and Scots Bay. I examined the environmental characteristics of the region, and the diversity and catch rate for the different species. Growth, condition factor, sex ratios, and age of the main commercial species, the winter flounder, were determined for the summer period of 2004 to assess the impact of the fishery on this population.

Study area

Minas Basin, Minas Channel, and Scots Bay lie between 45°05` and 45°25` N and 63°30` and 64°55` W, situated at the head of the Bay of Fundy. They are all part of the 4X ICNAF region.The surface area of Minas Basin and Channel combined is 1176 km^2 (Bousfield and Leim, 1958).

The central trough of the Minas Channel reaches depths as great as 100m. On either side of the central trough the depth ranges between 25 and 50 meters. Most of the Minas Basin has a depth of 25 meters at high tide (Bousfield and Leim, 1958). The mean high water depth of the Minas Channel is 46 meters and the mean low water depth is 35.3 meters. The mean high water depth of the Minas Basin is 20.9 meters and the mean low water depth is 14.6 meters (Bousfield and Leim, 1958). Tidal currents vary between 1.5 $m.s^{-1}$ in Minas Basin and 4 $m.s^{-1}$ in the Minas Channel (Greenberg, 1984). The circulation of the residual currents forms a figure -eight within Minas Basin and Cobequid Bay.

Scots Bay is an indentation along the southern side of the Minas Channel. Its shoreline is lined with coarse gravel above the high water mark and its ocean floor is covered in a mixture of sand, mud, and rock (Bousfield and Leim, 1958). The Minas Basin shoreline is dominated by Triassic sandstone cliffs. Glanville Travis (pers. comm.) described some floor areas of Minas Basin as having protruding sandstone ledges that

create difficult areas for trawling and fields of sandstone boulders are found under water near the shore of Cape Blomidon.

An average of 99 m^2/s of fresh water enters Minas Basin and Minas Channel from its watersheds during the summer months, July through September (Bousfield and Leim, 1958). This fresh water does not greatly affect the salinity of the majority of Minas Basin or Channel because of the intense vertical tidal mixing (Keizer, 1984). During summer months surface salinity levels are usually constant from 29.5 to 30$^{o}/_{oo}$ within the Minas Channel and the main part of the Minas Basin but decrease significantly close to the Avon River and in Cobequid Bay to below 25$^{o}/_{oo}$ (Bousfield and Leim, 1958).

The water of the Minas Channel is cooler than the waters of Minas Basin during summer months. The surface temperature of the Minas Channel ranges from 13.0 to 15.0^{o}C. The surface temperature of the main part of the Minas Basin has been recorded at 18°C (Bousfield and Leim, 1958) and as high as 21°C within the estuaries (Greenberg, 1984).

Materials and Methods

Fish samples were collected in Minas Basin and Scots Bay (Fig. B1) from June through September 2004 during the groundfish season. Sampling occurred on three occasions in June, four in July, twice in August, and three times in September (Appendix 3). Fishing days were chosen at the discretion of the skipper, Glanville Travis. Days were selected based on the weather, weekly or bi-weekly fish quotas, and the personal agenda of the fishers.

Eleven trips were made with myself as an onboard observer. Six of the trips were made for commercial catch and the other five trips consisted of experimental tows around the fishing grounds. Information on the catch and catch rate of fish from September 5 was collected by the fishers. Tow times during the commercial fishing trips ranged between 15 and 150 minutes. The length of the tow depended on the sea floor, the catch size, and the tides. A research permit was issued by the Department of Fisheries and Oceans limiting experimental tows to a maximum of 30 minutes.

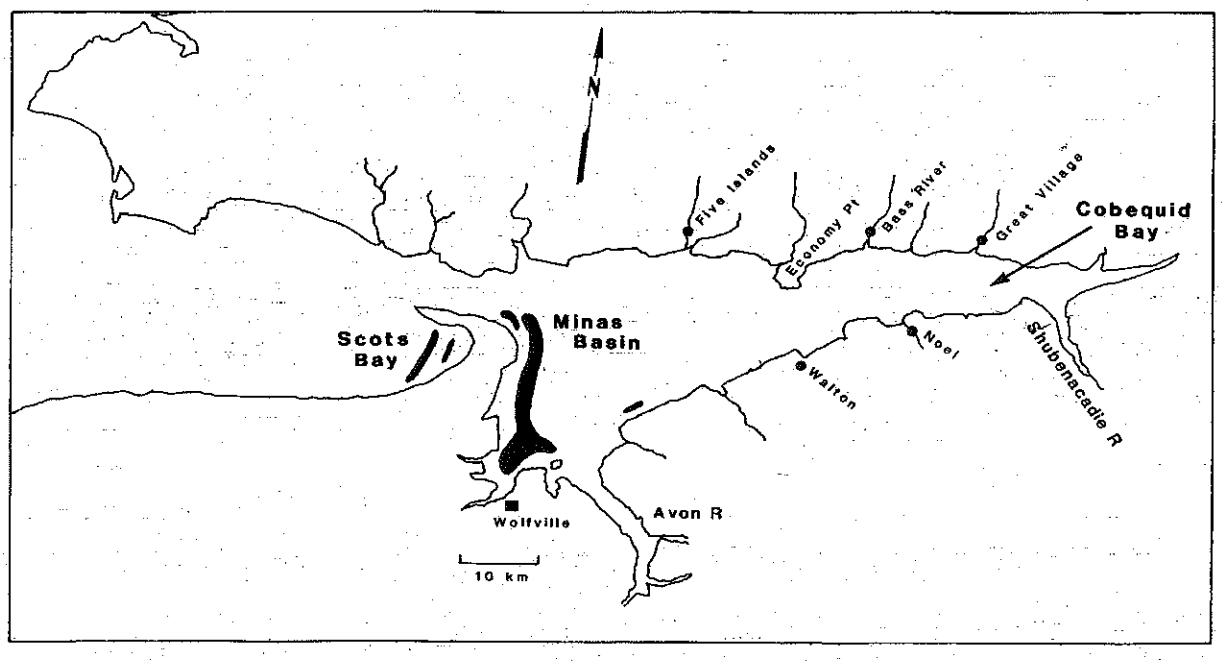

Figure B1: Map of study area. Locations sampled during the months of June through September are indicated by dark areas in Minas Basin and Scots Bay.

Collections were made from the vessel Terri & Sandy, owned by Glanville Travis. The vessel measured 43 ft in length and traveled at an average speed of 3 knots during tow periods. The net was a 24m-box trawl with a mesh size of 140mm and was equipped with a tickle chain, 200kg metal Bison doors, and modified rock hopper equipment.

Captured fishes were identified using the identification key in Scott and Scott (1988). Unfortunately, there was no easy method to distinguish between winter skates (*Raja ocellata* Mitchill, 1815) and little skates (*Raja erinacea* Mitchill, 1825) while at sea so the tallying and measurements of all skates were grouped together under *Raja*.

While at sea basic measurements were made from each species. Procedures to assess fork length and total length were followed as outlined by Nielsen and Johnson (1983). A hand-held spring scale manufactured by Pesola that measured in 10 gram increments was used to weigh the smaller fish weighing less than one kilogram. A Chatillion spring scale that measured in increments of 100g was used for determining the weight of the larger fish up to 50 kilograms.

A total of 1681 individual winter flounder were measured for total length, width, thickness, and weight. A measuring board was used to determine the total length and width in centimeters. The width was determined by measuring the widest part of the body with the dorsal and anal fin compressed against the body. Calipers were used to gauge the maximum thickness in centimeters for the thickest part of the dorsal side of the fish.

The width and total length of one hundred and forty skates were measured to the nearest half a centimeter. Pectoral fins were measured from tip to tip to determine width, and total length was measured from the rostrum anterior to the tip of the tail.

Seventy-five spiny dogfish were measured for fork length and total length to the nearest half a centimeter, and weight in kilograms. If they were in good condition, they were tagged with a plastic, T-bar tag at the base of the dorsal fin before returning them to water. If dead or in poor condition they were returned to the water without taking measurements or tagging them.

Twenty-four Atlantic sturgeon (*Acipenser oxyrhynchus* Mitchill, 1814) were measured for fork length and total length to the nearest half a centimeter using a measuring tape. They were tagged with a plastic dart tag at the base of the dorsal fin. It was not possible to weigh individuals with the equipment on the ship since most weighed over 50kg.

A total of 175 rarely captured fishes were measured for fork length or total length in centimeters and weighed in grams or kilograms no matter where they were located in the sampling grid system.

A total of 120 winter flounder separate from those sampled onboard the boat and were returned to the laboratory. These flounder were acquired over the summer by removing approximately 10 individual winter flounder from each day's catch. These individuals were measured for length, width, and thickness in the same manner as those sampled at sea. Their weight was determined using a model Mettler PJ 3600 Deltarange electric scale and these data were also used to assess the accuracy of the spring scale. Their total fillet weight was determined with the electrical scale after being removed from the fish and the skin removed. The sex and the stage of reproduction for each individual were determined. The sagittae pair of otoliths was removed from each winter flounder,

cleaned, immersed in clove oil, and viewed under a dissecting microscope to determine age. Opaque and translucent band pairs of the otoliths were counted three times on separate occasions by two readers using a method described by Wischniowski and Bobko (1998).

Data gathered for Minas Basin and Scots Bay were combined for the results of this survey. This was done due to their close proximity and their similarity in environmental conditions.

Results

Twenty-one species of fish were caught during the four months of the groundfish survey (Table B1). Of these, only five species (the winter flounder, the dogfish, the Atlantic sturgeon, the windowpane flounder, and the skates) were abundant and caught consistently throughout the summer. Fish diversity was highest during June and decreased as the summer progressed (Figure B2).

A total of more than 44,800 fish were caught during the surveys, 85% of which were winter flounder (38,210). Length and weight measurements were obtained for all species except for sturgeon which were not weighed due to their large size. Age and sex were determined for winter flounder only. The average fork length of spiny dogfish was 75 cm and the average weight was 2.9 kg. Average length of skates was 48 centimeters, average weight 1.0 kg, and mean pectoral width was 29.5 cm. The sturgeon captured averaged 152 cm and weighed up to an estimated 100 kg. A total of 39 sturgeon were caught and 27 of them were tagged and measured. The winter flounder caught ranged in age from 2 to 9 years and in length from 19 to 49.5 centimeters. Mean total filet weight for legal winter flounder was 205 gms. During June and the first 2 weeks of July winter flounder were ripe or recently spent. Landings reached their peak during the month of July at a total of 13640 kg of flounder. The fishery in Minas Basin is dependant on the catch of winter flounder but if a consistent market for dogfish could be established this would be a valuable asset to the local fishers.

Full details including sex ratios, weights, length-weight relationships, age, and condition, of the more common species are provided in the complete thesis (Wehrell 2005).

Table B1: Residency and abundance of fishes occurring in the Minas Basin and Scots Bay during the summer of 2004. Residency is early sum. = June, middle sum. = July and August, summer = entire catch period

Species	**Species Common name**	**Residency period**	**Abundance**
Squalus acanthias	Dogfish	mid summer	abundant
Raja ocellata and Raja erinacea	Skates	summer	abundant
Acipenser oxyrhynchus	Atlantic sturgeon	mid summer	common
Alosa pseudoharengus	Alewife	early summer.	rare
Osmerus mordax	Smelt	early summer.	rare
Gadus morhua	Cod	early summer	rare
Microgadus tomcod	Tomcod	early summer	rare
Merluccius bilinearis	Silver hake	mid summer	rare
Macrozoarces americanus	Ocean pout	mid summer	rare
Cyclopterus lumpus	Lumpfish	early summer	common
Morone saxatilis	Striped bass	Summer	rare
Myoxocephalus octodecemspinosus	Longhorn Sculpin	mid summer	rare
Myoxocephalus aenaeus	Grubby	early summer	rare
Myoxocephalus scorpius	Shorthorn Sculpin	early summer	common
Hemitripterus americanus	Sea Raven	early summer	common
Pseudopleuronectes americanus	Winter flounder	Summer	abundant
Liopsetta putnami	Smooth flounder	early summer	rare
Limanda ferruginea	Yellowtail Flouner	Summer	rare
Hippoglossus hippoglossus	Halibut	early summer	rare
Scophthalmus aquosus	Windowpane flounder	Summer	abundant
Lophius piscatorius	Monkfish	mid summer	rare

Figure B2: Number of fish species caught per month by box trawl in Minas Basin and Scots Bay during the summer of 2004.

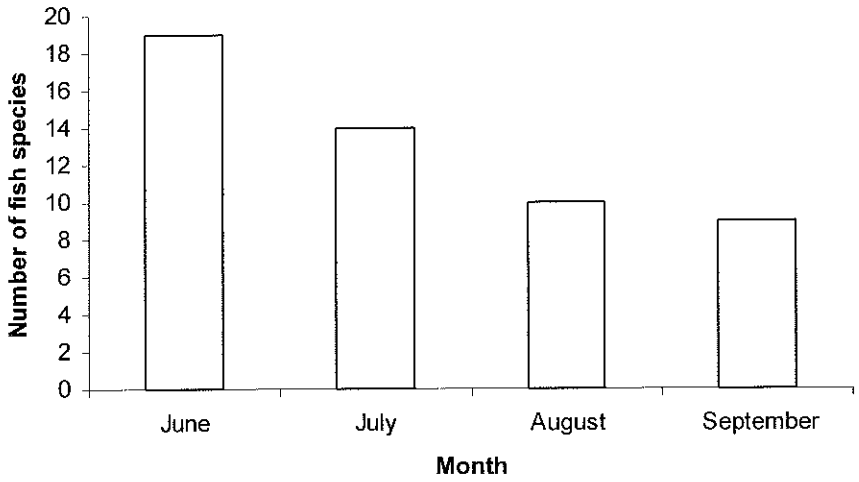

Table B2: Number of fish caught by box trawl in Minas Basin and Scots Bay for each sampling date during the summer of 2004.

Common name	12-Jun	22-Jun	26-Jun	10-Jul	12-Jul	22-Jul	25-Jul	19-Aug	23-Aug	5-Sep	12-Sep	22-Sep
Dogfish	3	3	3	10	37	12	5173	53	109	78	22	12
Skates	159	90	23	51	32	27		123	21	122	23	33
Atlantic sturgeon			2	2	3	3		10	9	6	3	1
Alewife	6		2									
Smelt			2						1			
Cod	4			1	1							
Tomcod	6	3										
Silver hake		3		2	5	2						
Ocean pout					2	1					1	
Lumpfish	4	13	5									
Striped bass		1		1				1				2
Longhorn Sculpin	2				8				5	9		1
Grubby		10										
Shorthorn Sculpin	65	10	1									
Sea Raven		51	14	8		7		3				1
Winter flounder	1770	4500	2723	1113	4978	5600	6645	1303	3762	3940	1016	860
Smooth flounder	3		9			2						
Yellowtail Flouner			2						1			
Halibut	4	7		3		1						
Windowpane flounder			13	32		23		54		3		17
Monkfish					1	1				1		

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Appendix I. DFO Personnel Contacts for the Upper Bay of Fundy

Fishery Area	Head Manager	Local Management	Science
Eastern Nova Scotia	Paul Gentille Area Chief, Resource Management Fisheries and Oceans Canada Area Director's Office Coast Guard College PO Box: 1085 Sydney, Nova Scotia B1P 6J7 Tel: 902 564-7777 Fax: 902 562-6113 Gus vanHelvoort Area Director ENS Sydney, NS Tel: 902 564 2400		
Southwest Nova Scotia	Anne Sweeney Area Chief, Resource Management Fisheries and Oceans Canada Area Director's Office 215 Main Street Yarmouth, Nova Scotia B5A 1C6 Tel: 902 742-0859 Tel: 902 740-0248 Fax: 902 742-6893 Ian Marshal Area Director SWNS Yarmouth, NS Tel: 902 742 0871		
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SWNB
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Lobster	Jim Jamieson DFO, P.O. Box 1035 Dartmouth, NS B2Y 4T3 Tel 902 426 8981 Fax 902 426 9683 JamiesonJE@mar.dfo-mpo.gc.ca	Peter Lawton Biologist Biological Station 531 Brandy Cove Road St. Andrews, NB E5B 2L9 Tel: 506 529 8854 David Robicheau Biologist Biological Station 531 Brandy Cove Road St. Andrews, NB E5B 2L9 Tel: 506 529 8854 Fax: 506 5962
Marine Worms	Verna Docherty Advisor, Resource Management, Developing Species Scotia-Fundy Sector 176 Portland St., 5th Floor Marine House PO Box 1035, Dartmouth, NS B2Y4T3 Tel: 902 426 4669 Fax: 902 426 9683 DochertyV@mar.dfo-mpo.gc.ca	Dr. Bob Miller Fisheries and Oceans Canada Invertebrate Fisheries Division 1 Challenger Drive PO Box: PO Box 1006 Dartmouth, Nova Scotia B2Y 4A2 Tel: 902 426-8108 Fax: 902 426-1862

Clams	Maureen Butler Senior Advisor, Resource Management Scotia-Fundy Sector 176 Portland St., 5th Floor Marine House PO Box 1035, Dartmouth, NS B2Y4T3 Tel: 902 426 9856 Fax: 902 426 9683 ButlerM@mar.dfo-mpo.gc.ca	Lorne Penny Eastern NS DFO Canadian Shellfish Sanitation Program Officer Fisheries and Oceans Canada Conservation and Protection - St Peters 9931 Grenville Street PO Box: 1085 Port Hawkesbury, Nova Scotia B0E 3B0 Tel: 902 564 2574 Fax: 902 564 7398	None
Anadromous Species (Shad, Gaspereau, Bass, Recreational Fishing (Incl. Weirs))	Greg Stevens Sr. Advisor, Anadramous and Freshwater Fisheries/Offshore Fisheries and Oceans Canada Resource Management PO Box 1035 Dartmouth, Nova Scotia B2Y 4T3 Tel: 902 426 5433 Fax: 902 426 9683 StevensG@mar.dfo-mpo.gc.ca		Rod Bradford Diadromous Assessment Species at Risk Biologist, BIO Fisheries and Oceans Canada Diadromous Fish Division PO Box 1006 Dartmouth, Nova Scotia B2Y 4A2 Tel: 902 426 4555 Fax: 902 426 6814 BradfordR@mar.dfo-mpo.gc.ca
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FowlerM@mar.dfo-mpo.gc.ca

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Salmon	Larry Marshall DFO Chairman, Inner Bay of Fundy Salmon Recovery Team A/Manager, Diadromous Fish Division, BIO Fisheries and Oceans Canada Diadromous Fish Division PO Box 1006 Dartmouth, Nova Scotia B2Y 4A2 Tel: 902 426-3605 Fax: 902 426-6814	

Habitat	Shayne McQuaid Stewardship and Science Liaison Unit Head Habitat Management Division Fisheries and Oceans Canada PO Box 1006 Dartmouth, Nova Scotia B2Y 4A2 Tel: 902 426 4612 mcquaids@mar.dfo-mpo.gc.ca	Thomas Wheaton Area Habitat Coordinator Fisheries and Oceans Canada Area Office Southwest NS 280 Logan Road PO Box: 2500 Bridgewater, N.S. B4V 3X1 Tel: 902 527 5596 Craig Hominick Area Habitat Coordinator Fisheries and Oceans Canada Area Office Eastern NS 28D Esplanade St. PO Box: PO Box 1085 Truro, Nova Scotia Tel: 902 896 3605 Fax: 902 896 3607 Brian Keating Area Habitat Coordinator - Sussex Fisheries and Oceans Canada Area Office Southwest NB 140 Main Street Tel: 506 432 4152 Fax: 506 432 5081

Enforcement	Harvey Millar Area Chief Enforcement Officer SWNB Scotia-Fundy Sector 201-203 Water St. St. Andrews, NB E0G 2X0 Tel 506 529 5940	John Taylor Senior Fisheries Officer Parrsboro, NS Tel: 902 254 2467
	Alan Clarke Area Chief Enforcement Officer SWNS Scotia-Fundy Sector 215 Main St. Yarmouth, NS Tel 902 742 0887 Fax 902 7426893	Frank Sweeney Fisheries Officer Kentville, NS Tel: 902 680 6550
		Jim Kiersted Fisheries Officer Saint John, NB Tel: 506 636 4733
Statistics: Landings	Elaine Walker Head, Statistical Operations Fisheries and Oceans Canada Commercial Data Division Marine House 176 Portland Street PO Box: PO Box 1035 Dartmouth, Nova Scotia Tel: 902 426 6384 Fax: (902) 426-6767 WalkerE@mar.dfo-mpo.gc.ca	
Statistics: Licenses, Vessels, Fishers	Paulette Gardner Licensing Officer Fisheries and Oceans Canada Regional Director's Office, Scotia-Fundy Fisheries PO Box 1035 Dartmouth, Nova Scotia B2Y 4T3 Tel: (902) 426-1929 Fax: (902) 426-7967 GardnerP@mar.dfo-mpo.gc.ca	

Appendix II. Fishing Organisations and Community Groups Involved in Fisheries in the Upper Bay of Fundy

Lobster / Scallop	Graham Copp President, Alma Fishermen's Association Mid Bay Scallop Fleet LFA 35 Advisory Committee Member Alma to Wood Point Rep Po Box 3876, Scenic Drive Alma, NB E4H 1P5 Tel: 506 887 2174 Fax: 506 887 2441	Eric Lockhart Mid Bay Scallop Fleet LFA 35 Advisory Committee Member Alma to Wood Point Rep 5463 Route 114 Hopewell Hill, NB E4H 3M9 Tel: 506 882 0895 Fax: 506 882 2032	Joseph MacDonald Mid Bay Scallop Fleet LFA 35 Advisory Committee Alternate Rep 895 Main St. Alma, NB E4H 1N6 Tel: 506 887 2550	Troy Wilson Mid Bay Scallop Fleet LFA 35 Advisory Committee 3166 Route 915 Waterside, NB E4H 4N2 Tel: 506 887 1082
	Wayne Patterson LFA 35 Advisory Committee Member Five Islands to Joggins Joggins, NS B0L 1AO Tel: 902 251 2426	Dallas Fletcher Contact, Fundy East Fishermen's Association Upper Bay Scallop Fleet Advocate Harbour Authority Rep LFA 35 Advisory Committee Member Five Islands to Joggins PO Box 49 Advoctae Harbour, NS Tel: 902 392 2501 Fax: 902 392 2221	Dan Thompson 2004 Retired LFA 35 Lobster RR#3 Parrsboro, NS B0M 1S0 Tel: 902 392 2608	Michael Fraser Upper Bay Scallop Fleet LFA 35 Advisory Committee Member Five Islands to Joggins 135 Back St. Advocate Harbour, NS B0M 1A0 Te: 902 392 2549
	Michael Hayes LFA 35 Advisory Committee Member Hampton to Margaretville RR#1, Middleton, NS B0S 1P0 Tel: 902 825 4265	Martin Lewis LFA 35 Advisory Committee Member Hampton to Margaretville 747 Brinton Road Paradise, NS B0S 1R0 Tel: 902 584 3176 Fax: 902 584 3209	Greg Hamilton Upper Bay Scallop Fleet LFA 35 Advisory Committee Member Harbourville to Scots Bay RR#5 Berwick, NS B0P 1E0 Tel: 902 538 9707	Mark Taylor LFA 35 Advisory Committee Member Delhaven PO Box 124 Centreville, NS B0P 1J0 Tel: 902 679 1527

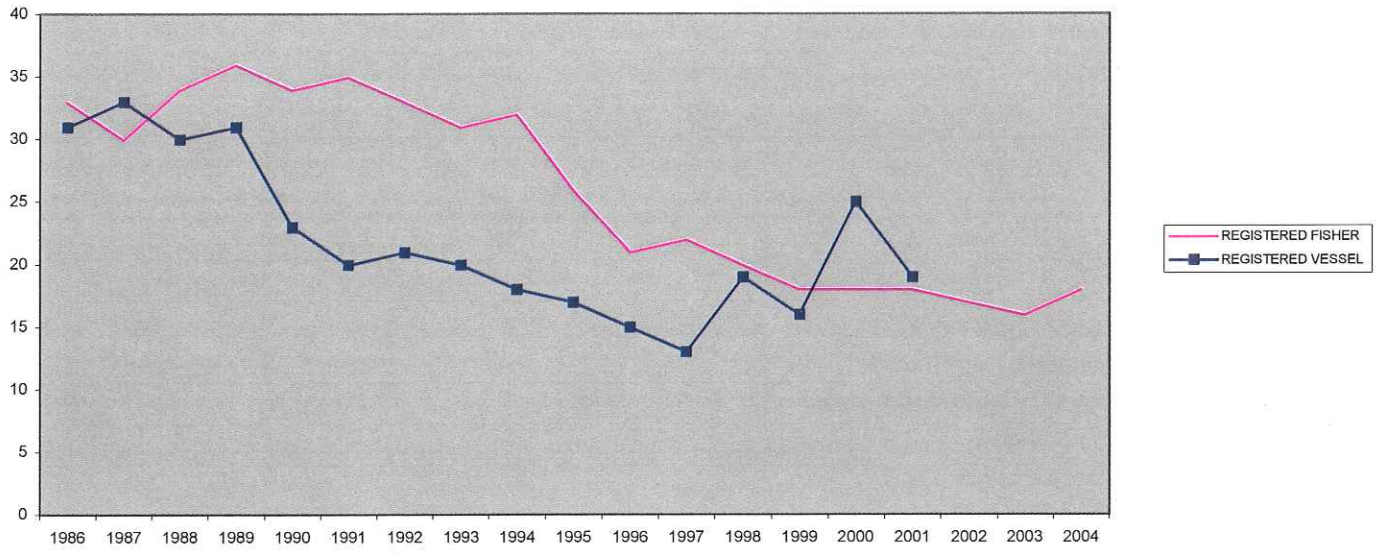
	Roger Cameron, Manager and Fisherman Halls' Harbour Lobster Pound Tel: 902 679 5299	Scott Woolaver LFA 35 2051 Pereau Rd. Canning, NS B0P 1H0 Tel: 902 582 7931		
First Nations	Holly MacDonald Fisheries Coordinator Annapolis First Nation PO Box 89, Cambridge NS B0P 1G0 Tel: 902 538 7149 wk, 538 0570 hm	Rebecca Knockwood Fisheries Coordinator Fort Folly First Nation PO Box 971, 38 Bernard Trail Dorchester, NB E4K 3V5 Tel: 506 379 3400 Fax: 506 379 3408	Adrian Gloade Millbrook First Nation PO Box 634 Truro, NS B2N 5E5 Tel: 902 897 0402 Fax: 902 893 4785	
Marine Worms	Arthur Purchase Kings and Hants County Bait Fishermen Society 14 Park St. Kentville, NS B4N 1L8 Tel: 902 678 9618	Hazel Dill Hants Shore Concerned Citizens Tel: 902 633 6300 (Sir Arthur Hines School)		
Clam	Mike Lewis Chairman Minas Basin Clam Fishers Association Tel: 902 254 3387			
Gaspereau, Eel, Shad	Marven Snowdon Lobster / Gaspereau Fisher Sackville / Wood Point, NB Tel: 506 536 2797	Victor LeBlanc Shad and Eel Fisher Belliveau Village, NB Tel: 506 758 9071	Gerald Blake President Shubenacadie Driftnet Fishers Association Shubenacadie, NS B0N 2H0 Tel: 902 758 2392	Mickey Coldwell President Gaspereau River Square-Net Fishermen's Association 1587 Ridge Rd Wolfville, NS B4P 2R1 Tel: 902 542 5345
Bass	David Doggett Nova Scotia Striped Bass Association dave@novascotiafishing.com Tel: 902 489 1938			

Groundfish	Glanville Travis Upper Bay Generalist Fleet Box 112, Canning NS B0P 1H0 Tel: 902 582 7395 gtravis@ns.sympatico.ca	Terry Farnsworth Handliner Fundy Fixed Gear Council Tel: 902 245 5843		
River	Cumberland County River Enhancement Association Danny Ripley, Project Manager 43 Hill Street Amherst NS, B4H 2N2 Tel: 902 661 1439	Cobequid Salmon Association Tom Falle, Project Coordinator Tel: (902) 893-6610 PO Box 1874, Truro NS B2N 3C7 csa@ns.sympatico.ca	Parrsboro & Area Recreational Fishing Association Randy Corcoran Phone and fax: 902-254-3664 PO Box 560, Parrsboro, NS B0M 1S0	Petitcodiac Riverkeepers Daniel LeBlanc PO Box 300 18 Botsford St. Moncton, NB Tel: 506 388 5337 info@petitcodiac.org
River	Gary Collins President Shepody Fish and Game Association Germantown NB E4H 2J4 Tel: 506 882 2342			

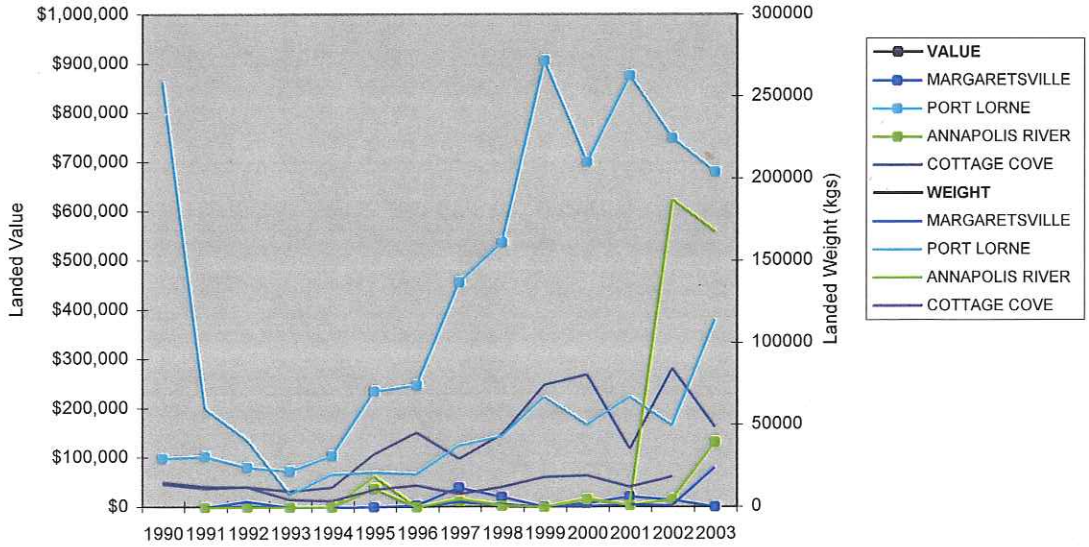
Appendix III DFO District Fisheries Data:

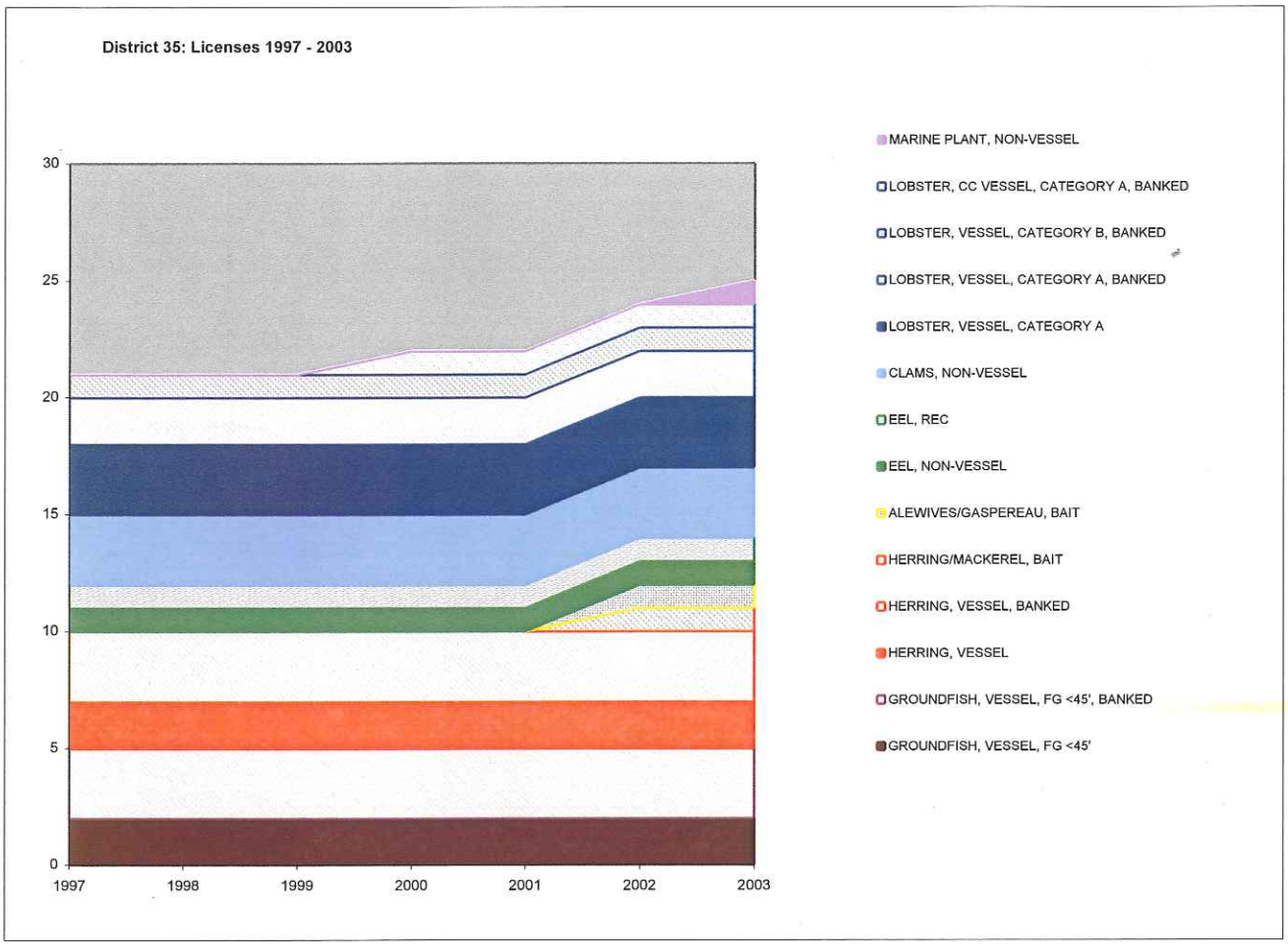
- Registered Fishers and Vessels, 1986 – 2004
- Landings by Port, 1990 – 2003
- Licenses, 1997 – 2003
- Landings by Species, 1990 - 2002

District 35: Registered Fishers and Vessels

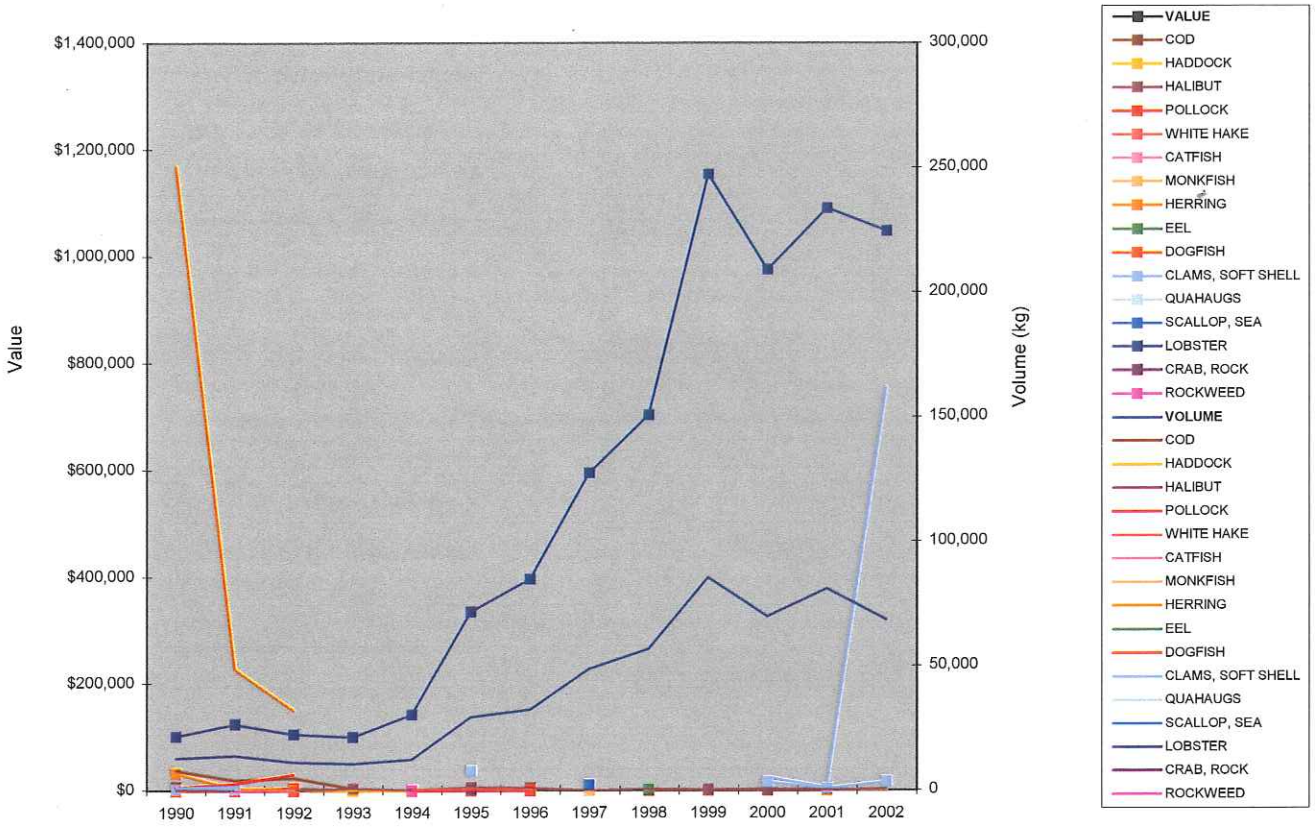


District 35: Landings by Port

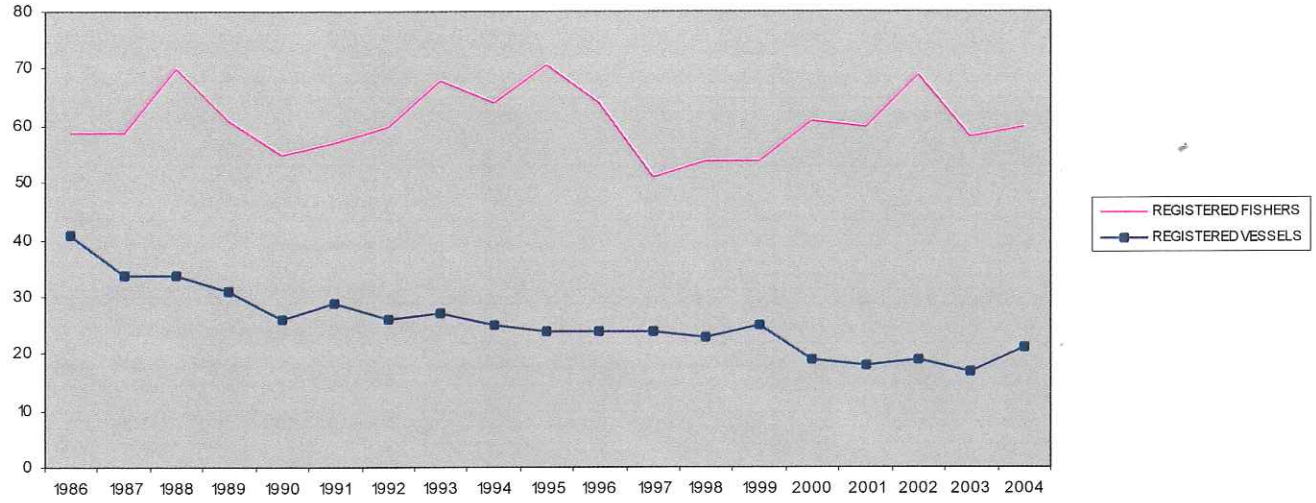



District 35: Licenses 1997 - 2003
30
25
20
15
10
5
0
1997
1998
1999
2000
2001
2002
2003
MARINE PLANT, NON-VESSEL
LOBSTER, CC VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY B, BANKED
LOBSTER, VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A
CLAMS, NON-VESSEL
EEL, REC
EEL, NON-VESSEL
ALEWIVES/GASPEREAU, BAIT
HERRING/MACKEREL, BAIT
HERRING, VESSEL, BANKED
HERRING, VESSEL
GROUNDFISH, VESSEL, FG <45', BANKED
GROUNDFISH, VESSEL, FG <45'

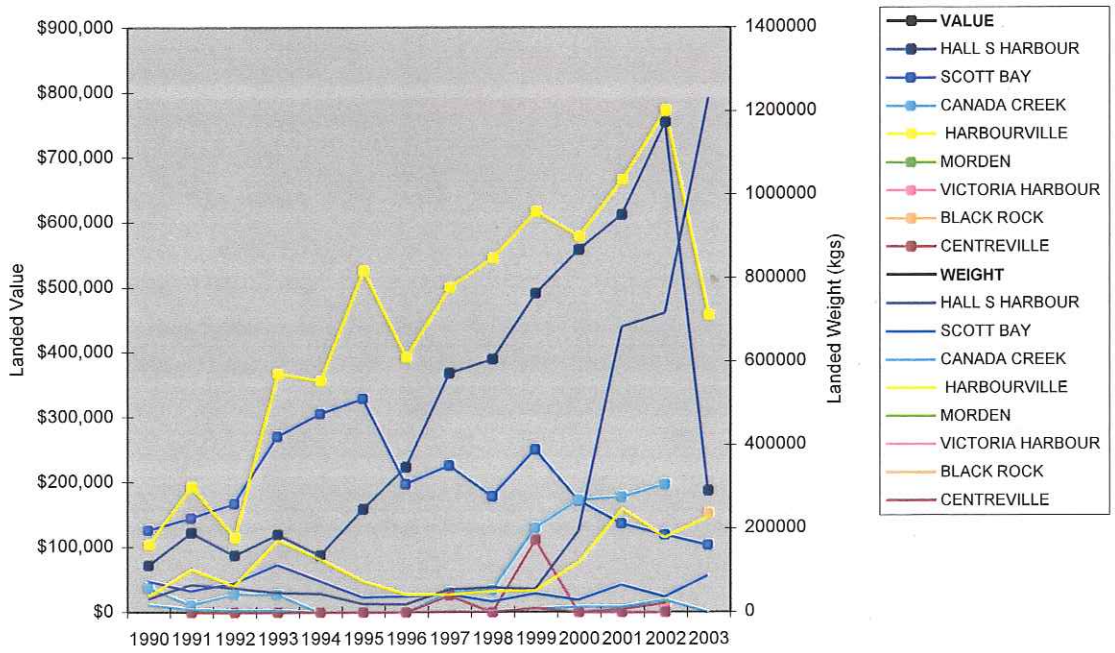
District 35: Landings by Species

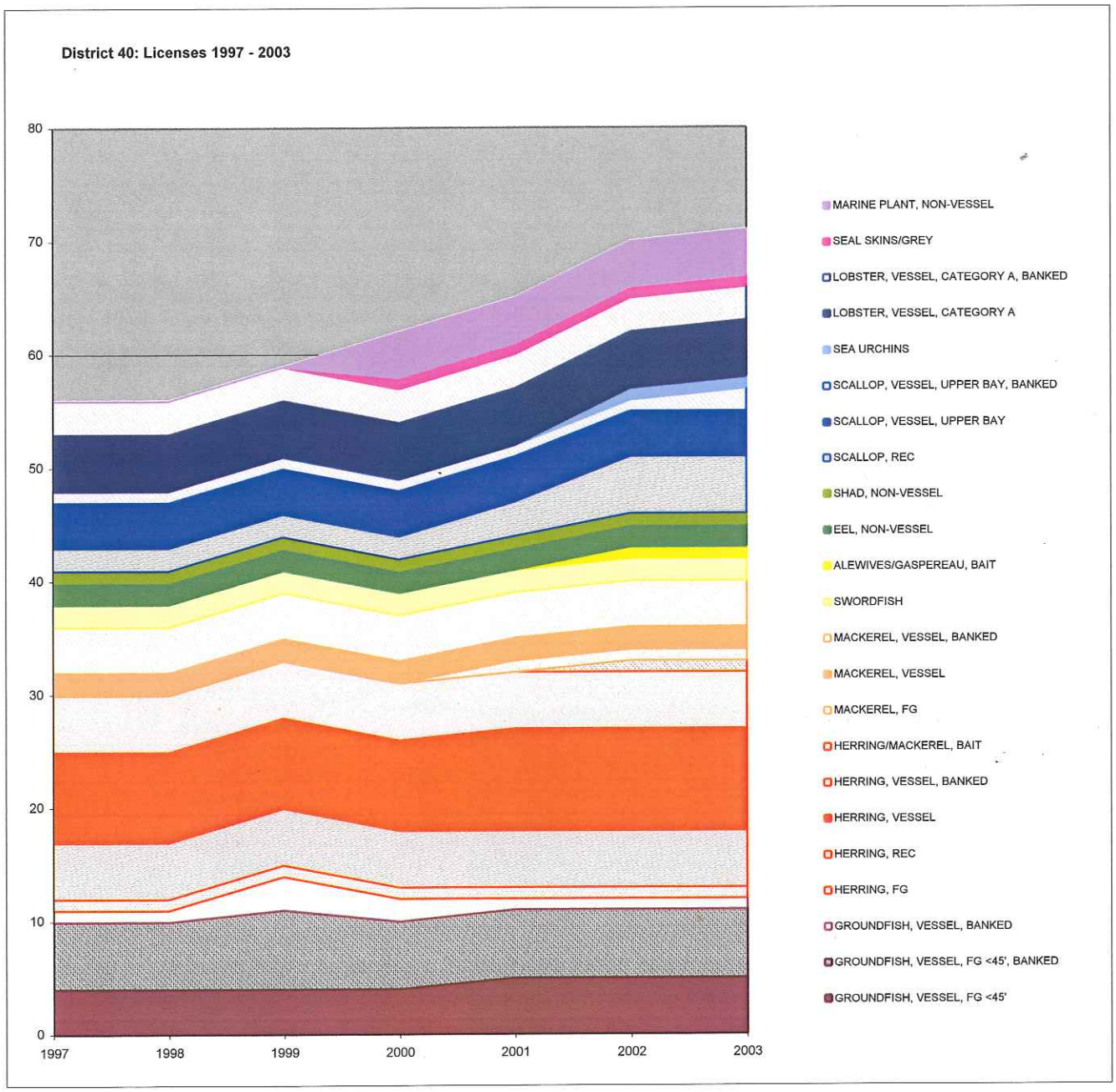


District 40: Registered Fishers and Vessels

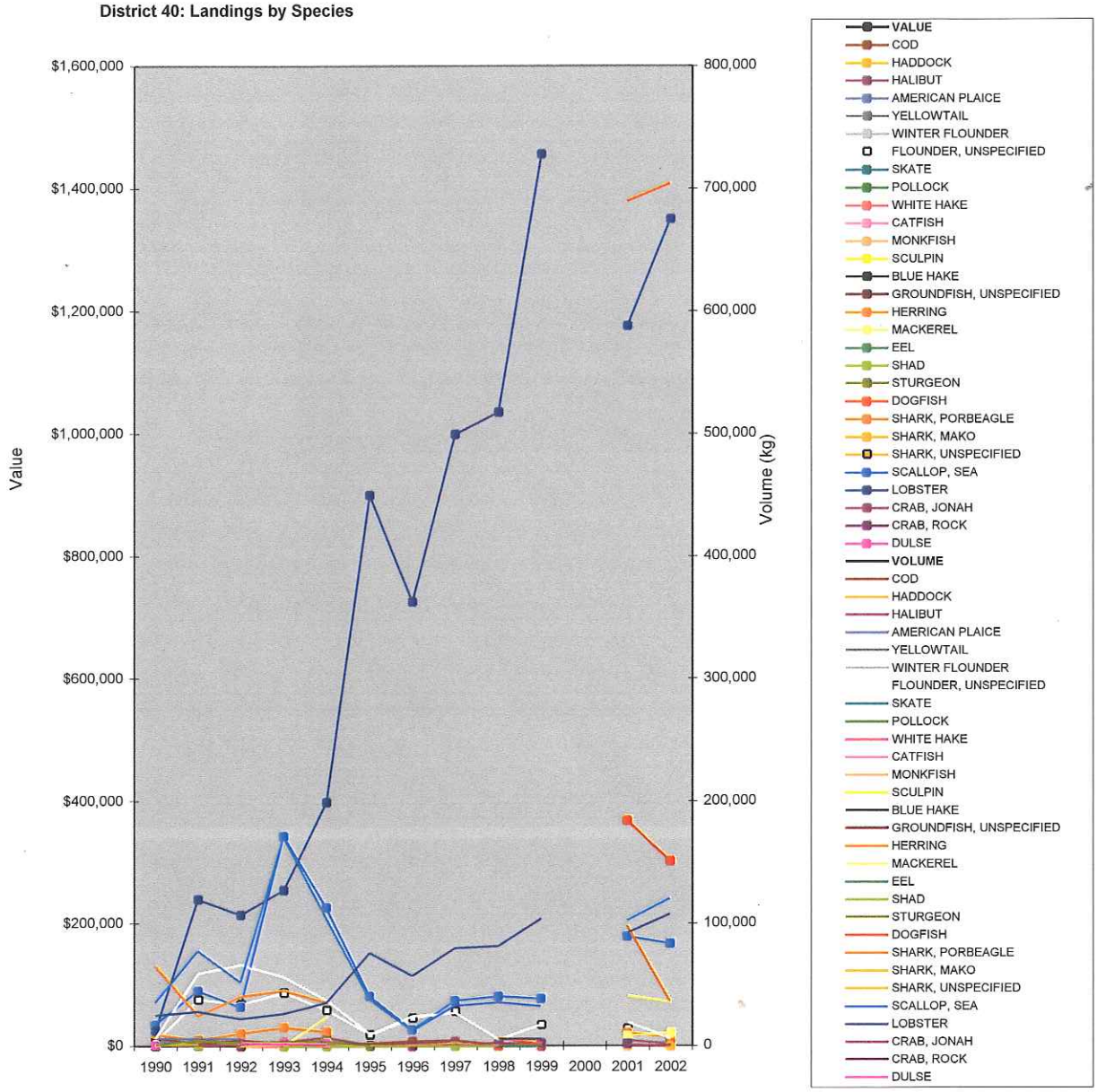


District 40: Landings by Port

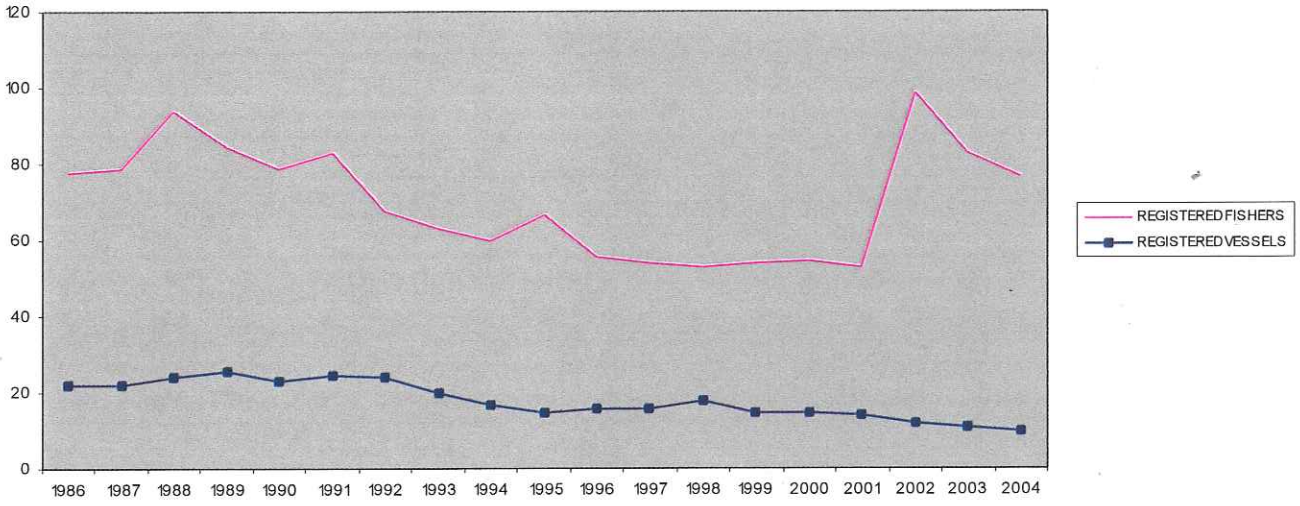


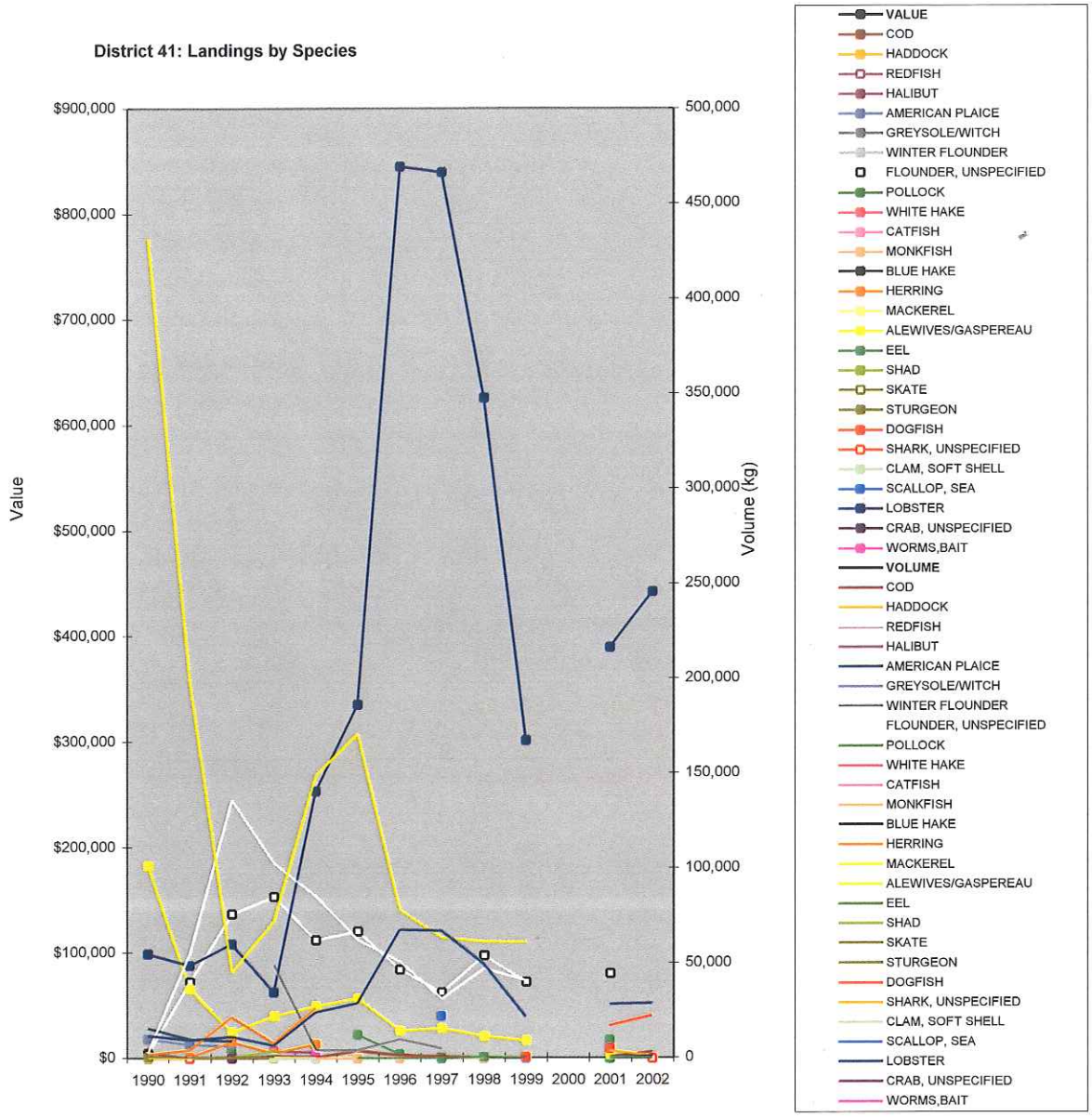

District 40: Licenses 1997 - 2003
80
70
60
50
40
30
20
10
0
1997
1998
1999
2000
2001
2002
2003
MARINE PLANT, NON-VESSEL
SEAL SKINS/GREY
LOBSTER, VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A
SEA URCHINS
SCALLOP, VESSEL, UPPER BAY, BANKED
SCALLOP, VESSEL, UPPER BAY
SCALLOP, REC
SHAD, NON-VESSEL
EEL, NON-VESSEL
ALEWIVES/GASPEREAU, BAIT
SWORDFISH
MACKEREL, VESSEL, BANKED
MACKEREL, VESSEL
MACKEREL, FG
HERRING/MACKEREL, BAIT
HERRING, VESSEL, BANKED
HERRING, VESSEL
HERRING, REC
HERRING, FG
GROUNDFISH, VESSEL, BANKED
GROUNDFISH, VESSEL, FG <45', BANKED
GROUNDFISH, VESSEL, FG <45'

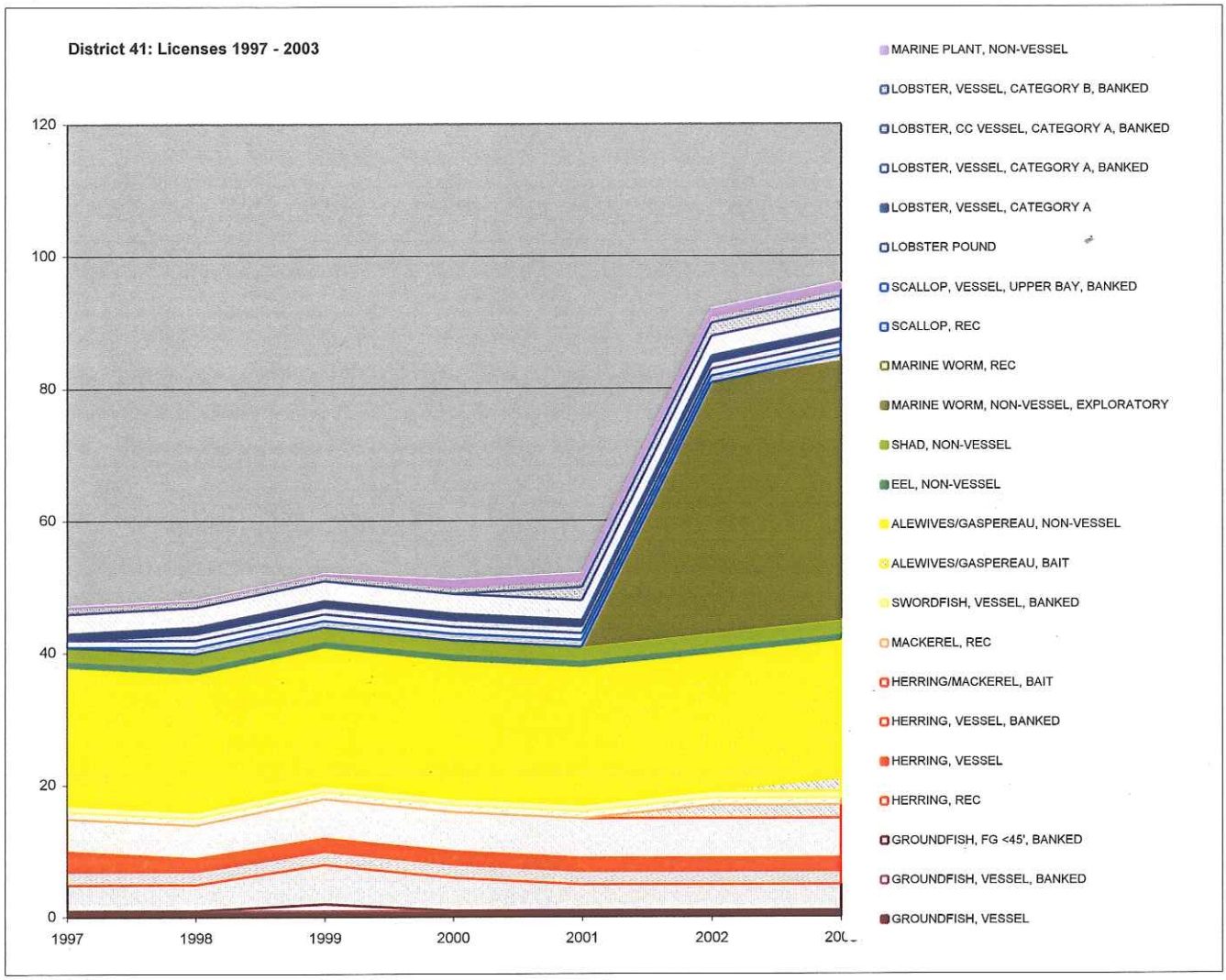
District 40: Landings by Species



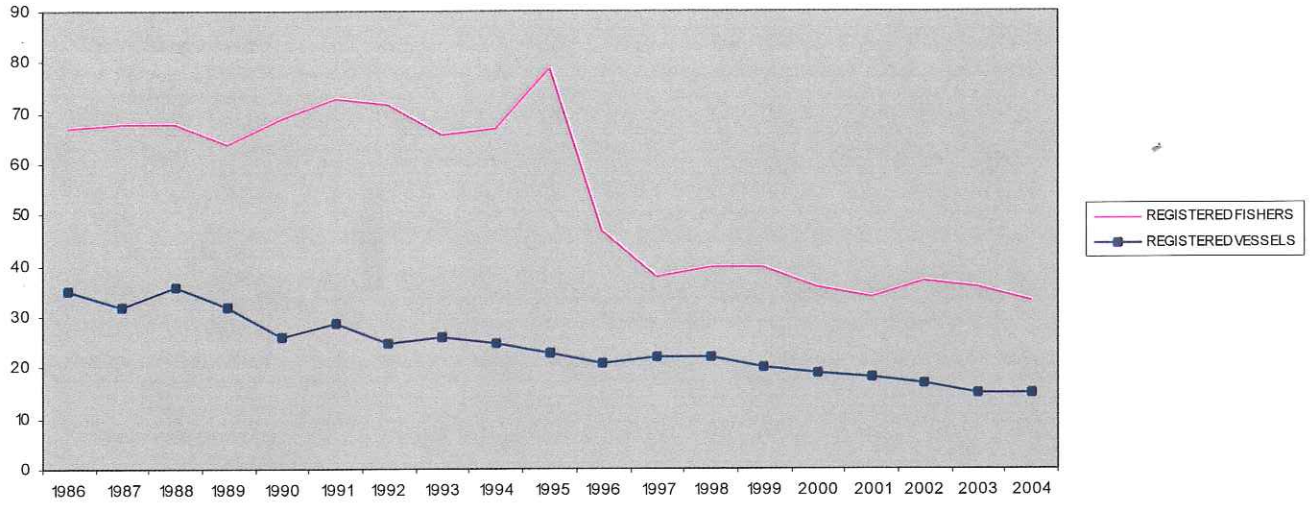
District 41: Registered Fishers and Vessels



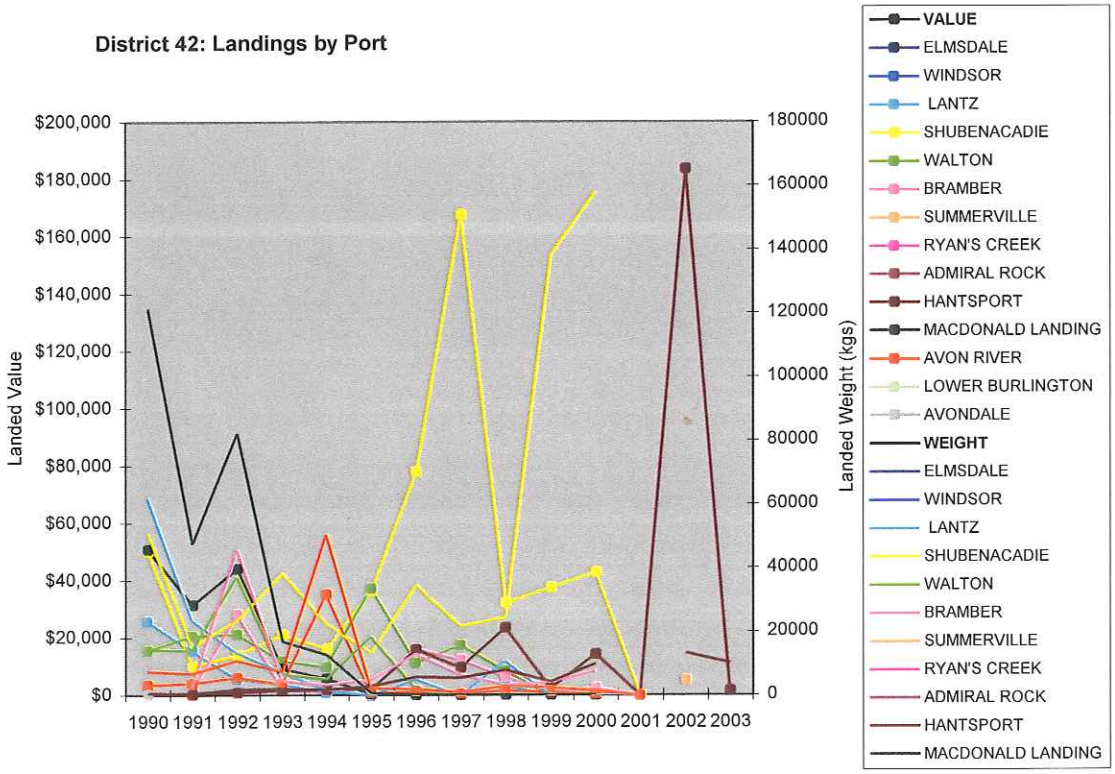

District 41: Landings by Species
Value
Volume (kg)
$900,000
$800,000
$700,000
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
VALUE
COD
HADDOCK
REDFISH
HALIBUT
AMERICAN PLAICE
GREYSOLE/WITCH
WINTER FLOUNDER
FLOUNDER, UNSPECIFIED
POLLOCK
WHITE HAKE
CATFISH
MONKFISH
BLUE HAKE
HERRING
MACKEREL
ALEWIVES/GASPEREAU
EEL
SHAD
SKATE
STURGEON
DOGFISH
SHARK, UNSPECIFIED
CLAM, SOFT SHELL
SCALLOP, SEA
LOBSTER
CRAB, UNSPECIFIED
WORMS,BAIT
VOLUME
COD
HADDOCK
REDFISH
HALIBUT
AMERICAN PLAICE
GREYSOLE/WITCH
WINTER FLOUNDER
FLOUNDER, UNSPECIFIED
POLLOCK
WHITE HAKE
CATFISH
MONKFISH
BLUE HAKE
HERRING
MACKEREL
ALEWIVES/GASPEREAU
EEL
SHAD
SKATE
STURGEON
DOGFISH
SHARK, UNSPECIFIED
CLAM, SOFT SHELL
SCALLOP, SEA
LOBSTER
CRAB, UNSPECIFIED
WORMS,BAIT

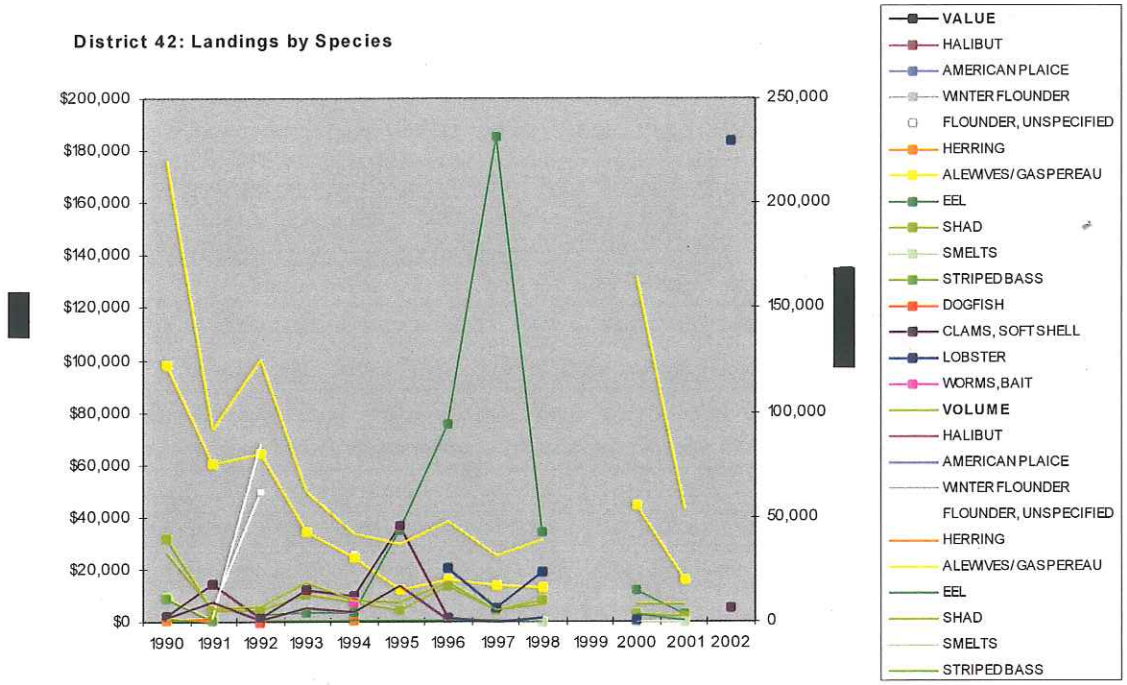

District 41: Licenses 1997 - 2003
120
100
80
60
40
20
0
1997
1998
1999
2000
2001
2002
MARINE PLANT, NON-VESSEL
LOBSTER, VESSEL, CATEGORY B, BANKED
LOBSTER, CC VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A
LOBSTER POUND
SCALLOP, VESSEL, UPPER BAY, BANKED
SCALLOP, REC
MARINE WORM, REC
MARINE WORM, NON-VESSEL, EXPLORATORY
SHAD, NON-VESSEL
EEL, NON-VESSEL
ALEWIVES/GASPEREAU, NON-VESSEL
ALEWIVES/GASPEREAU, BAIT
SWORDFISH, VESSEL, BANKED
MACKEREL, REC
HERRING/MACKEREL, BAIT
HERRING, VESSEL, BANKED
HERRING, VESSEL
HERRING, REC
GROUNDFISH, FG <45', BANKED
GROUNDFISH, VESSEL, BANKED
GROUNDFISH, VESSEL

District 42: Registered Fishers and Vessels

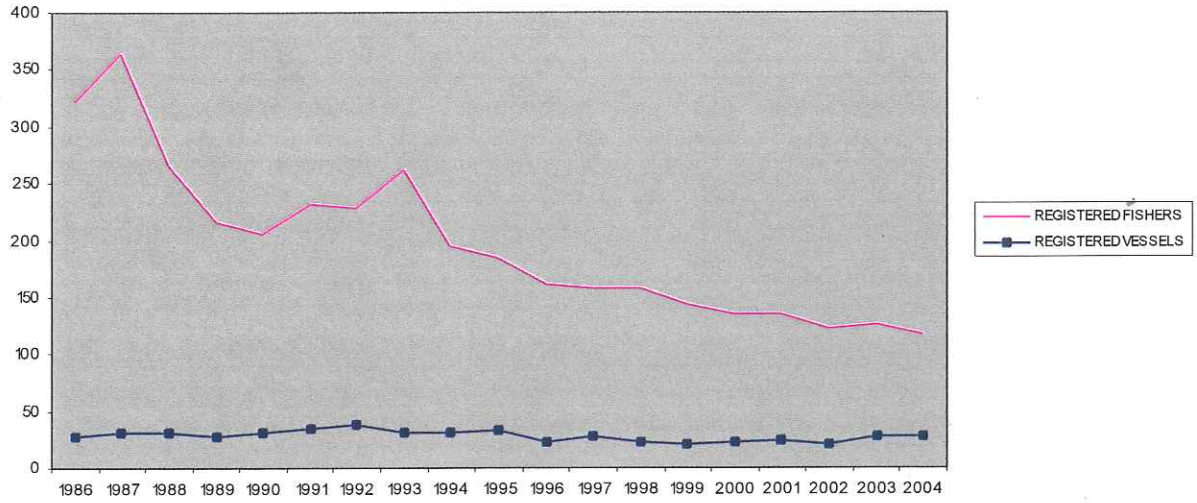


District 42: Landings by Port

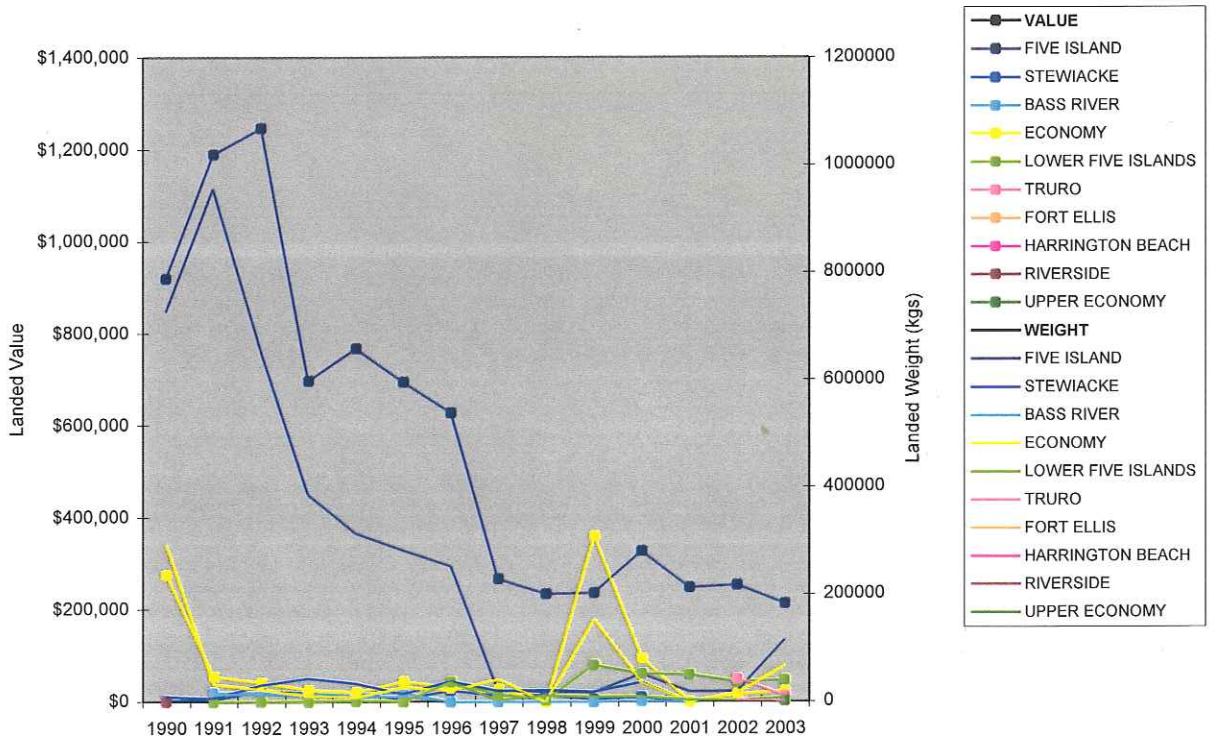


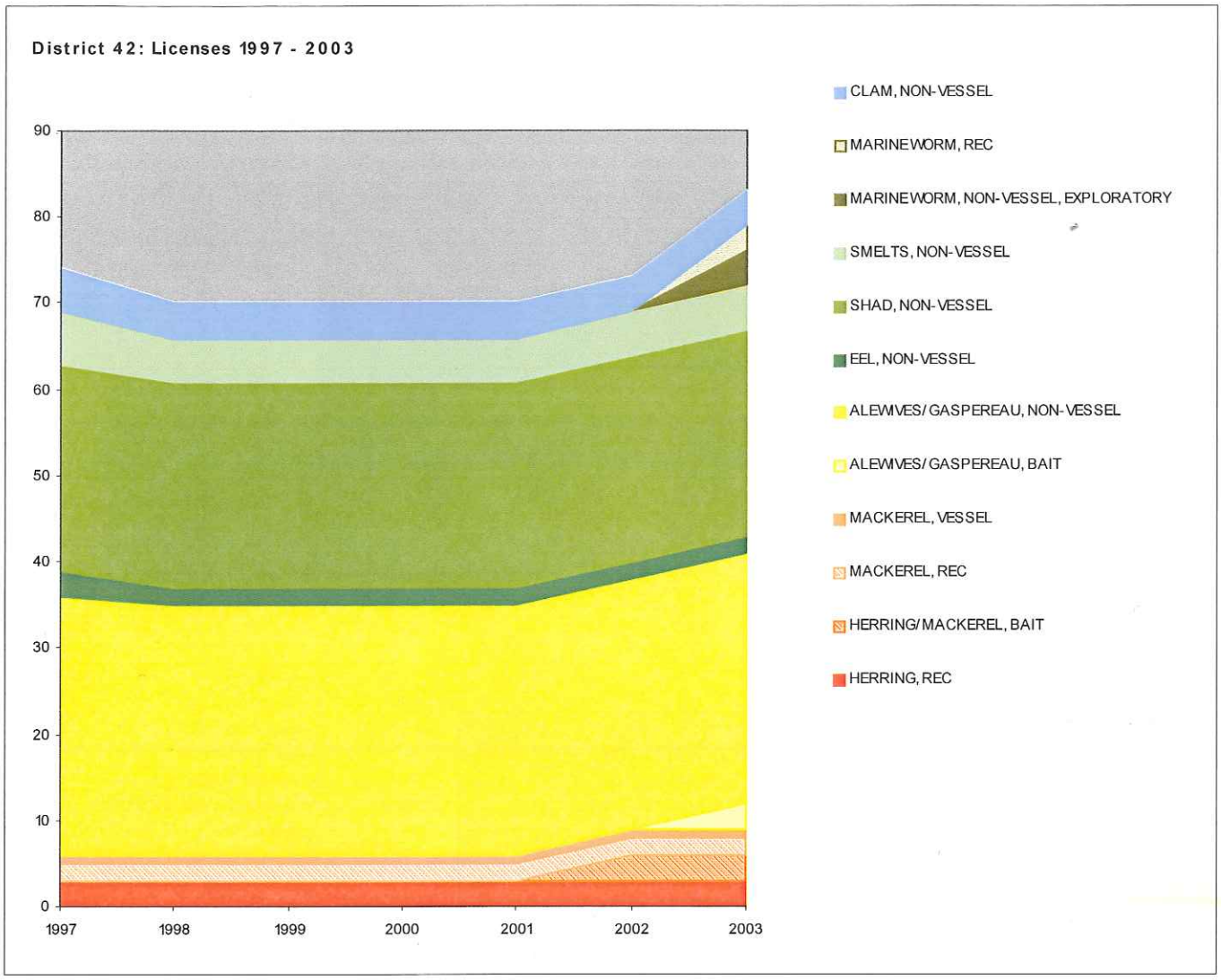

District 42: Landings by Species
$200,000
$180,000
$160,000
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
250,000
200,000
150,000
100,000
50,000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
VALUE
HALIBUT
AMERICAN PLAICE
WINTER FLOUNDER
FLOUNDER, UNSPECIFIED
HERRING
ALEWIVES/GASPEREAU
EEL
SHAD
SMELTS
STRIPED BASS
DOGFISH
CLAMS, SOFT SHELL
LOBSTER
WORMS, BAIT
VOLUME
HALIBUT
AMERICAN PLAICE
WINTER FLOUNDER
FLOUNDER, UNSPECIFIED
HERRING
ALEWIVES/GASPEREAU
EEL
SHAD
SMELTS
STRIPED BASS

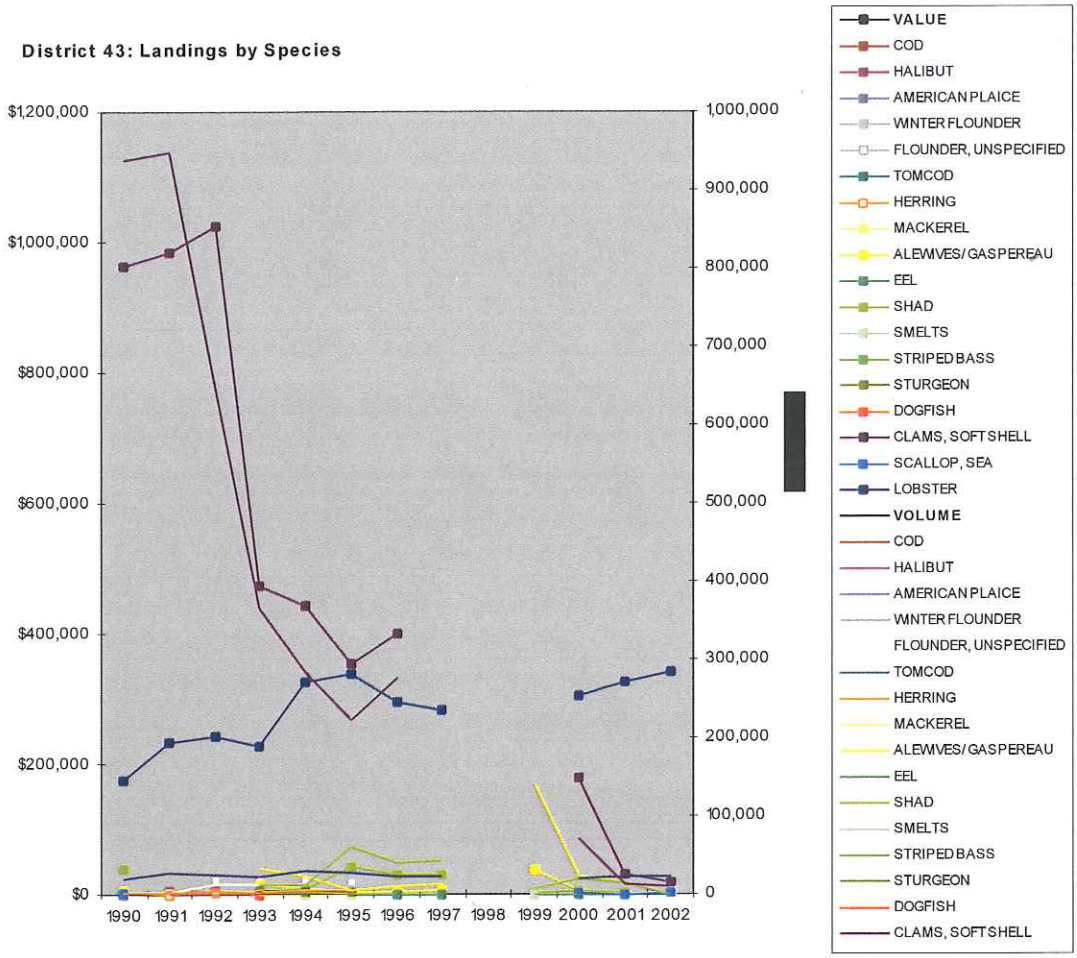
District 43: Registered Fishers and Vessels



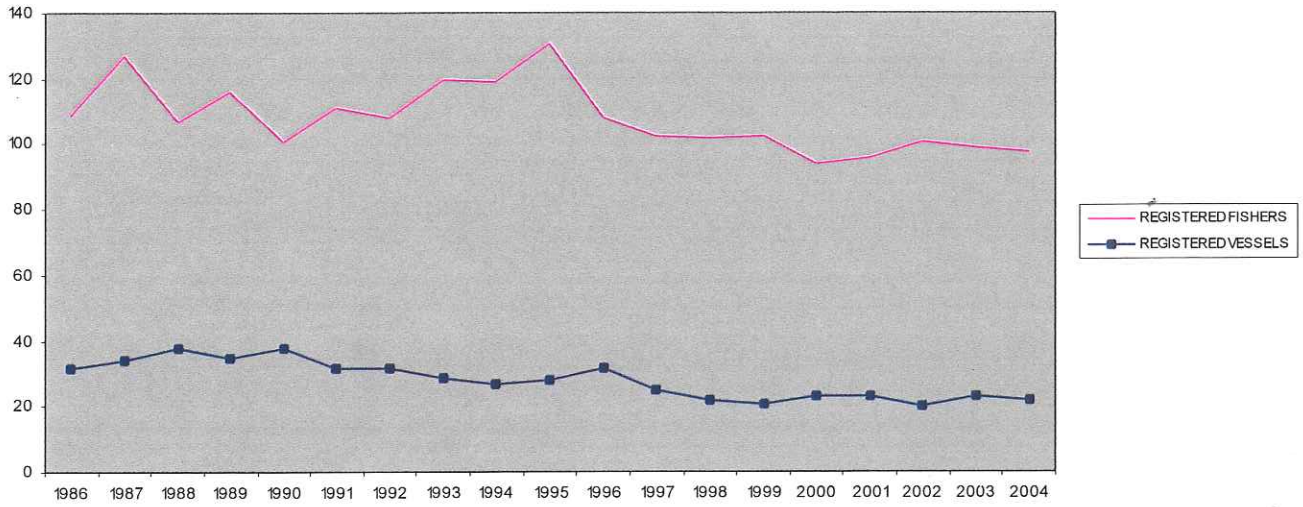
District 43: Landings by Port



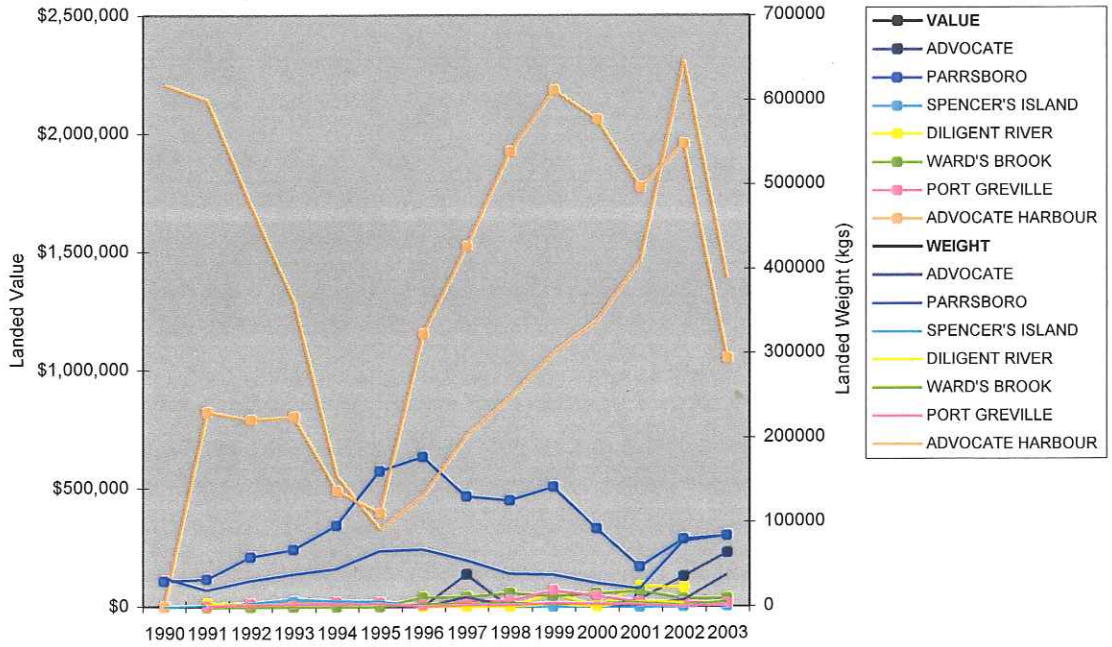

District 42: Licenses 1997 - 2003
90
80
70
60
50
40
30
20
10
0
1997
1998
1999
2000
2001
2002
2003
CLAM, NON-VESSEL
MARINEWORM, REC
MARINEWORM, NON-VESSEL, EXPLORATORY
SMELTS, NON-VESSEL
SHAD, NON-VESSEL
EEL, NON-VESSEL
ALEWIVES/GASPEREAU, NON-VESSEL
ALEWIVES/GASPEREAU, BAIT
MACKEREL, VESSEL
MACKEREL, REC
HERRING/MACKEREL, BAIT
HERRING, REC

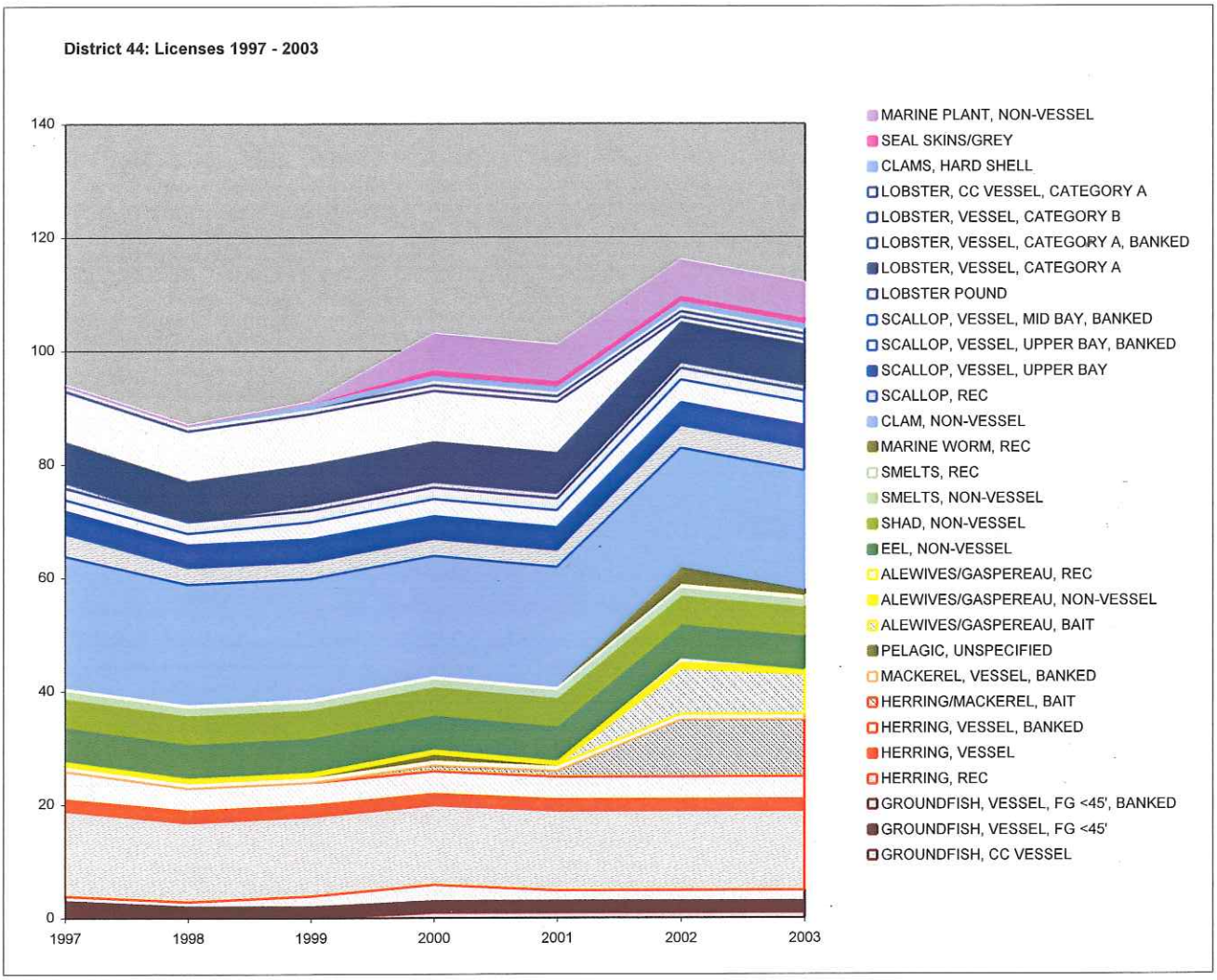

District 43: Landings by Species
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
VALUE
COD
HALIBUT
AMERICAN PLAICE
WINTER FLOUNDER
FLOUNDER, UNSPECIFIED
TOMCOD
HERRING
MACKEREL
ALEWIVES/GASPEREAU
EEL
SHAD
SMELTS
STRIPED BASS
STURGEON
DOGFISH
CLAMS, SOFTSHELL
SCALLOP, SEA
LOBSTER
VOLUME
COD
HALIBUT
AMERICAN PLAICE
WINTER FLOUNDER
FLOUNDER, UNSPECIFIED
TOMCOD
HERRING
MACKEREL
ALEWIVES/GASPEREAU
EEL
SHAD
SMELTS
STRIPED BASS
STURGEON
DOGFISH
CLAMS, SOFTSHELL

District 44: Registered Fishers and Vessels

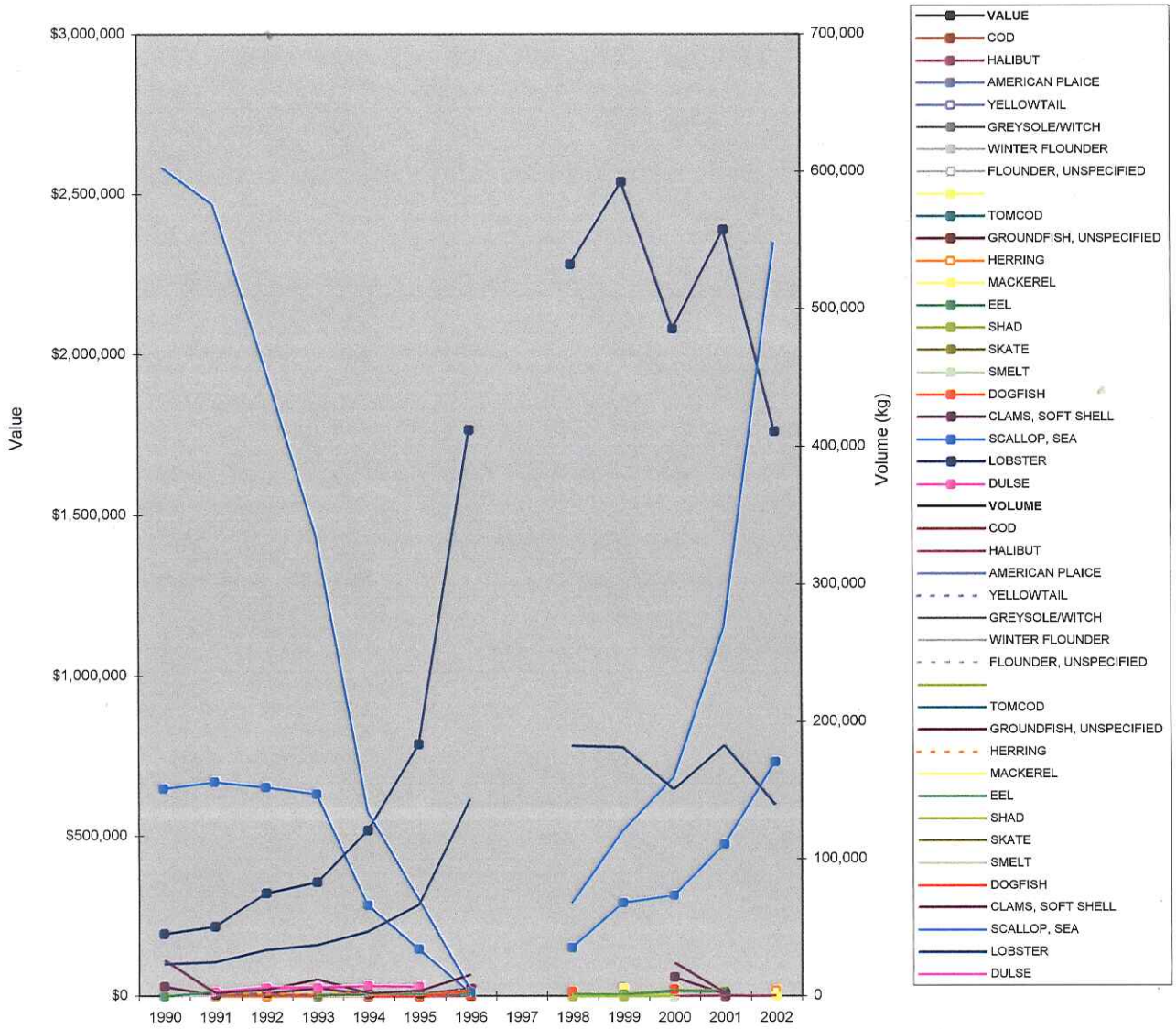


District 44: Landings by Port

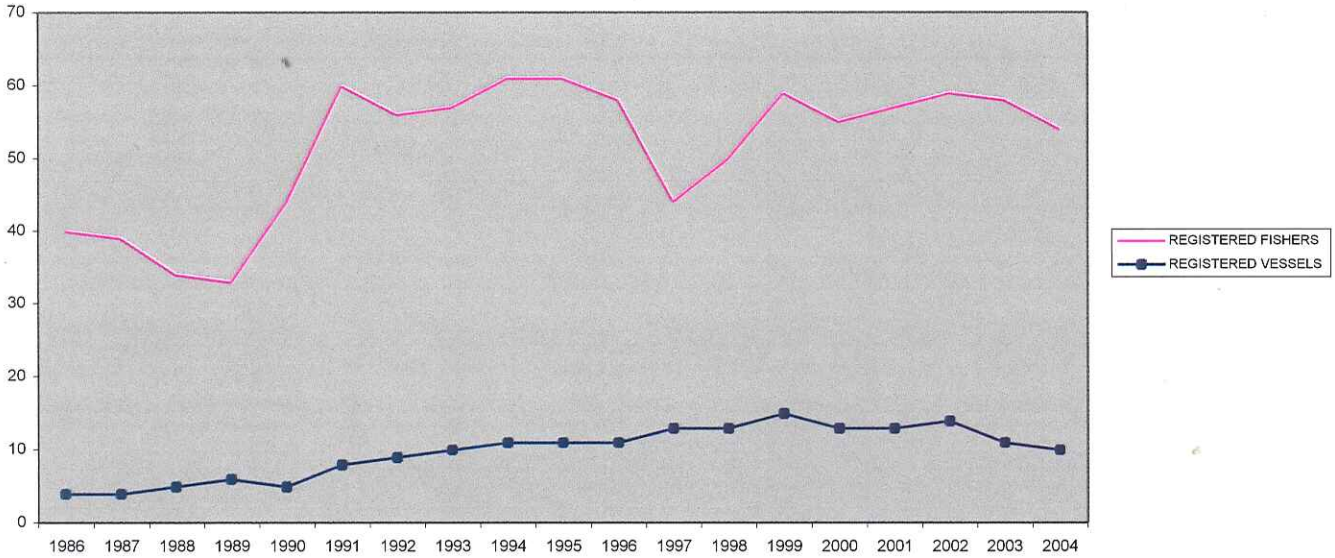



District 44: Licenses 1997 - 2003
140
120
100
80
60
40
20
0
1997
1998
1999
2000
2001
2002
2003
MARINE PLANT, NON-VESSEL
SEAL SKINS/GREY
CLAMS, HARD SHELL
LOBSTER, CC VESSEL, CATEGORY A
LOBSTER, VESSEL, CATEGORY B
LOBSTER, VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A
LOBSTER POUND
SCALLOP, VESSEL, MID BAY, BANKED
SCALLOP, VESSEL, UPPER BAY, BANKED
SCALLOP, VESSEL, UPPER BAY
SCALLOP, REC
CLAM, NON-VESSEL
MARINE WORM, REC
SMELTS, REC
SMELTS, NON-VESSEL
SHAD, NON-VESSEL
EEL, NON-VESSEL
ALEWIVES/GASPEREAU, REC
ALEWIVES/GASPEREAU, NON-VESSEL
ALEWIVES/GASPEREAU, BAIT
PELAGIC, UNSPECIFIED
MACKEREL, VESSEL, BANKED
HERRING/MACKEREL, BAIT
HERRING, VESSEL, BANKED
HERRING, VESSEL
HERRING, REC
GROUNDFISH, VESSEL, FG <45', BANKED
GROUNDFISH, VESSEL, FG <45'
GROUNDFISH, CC VESSEL

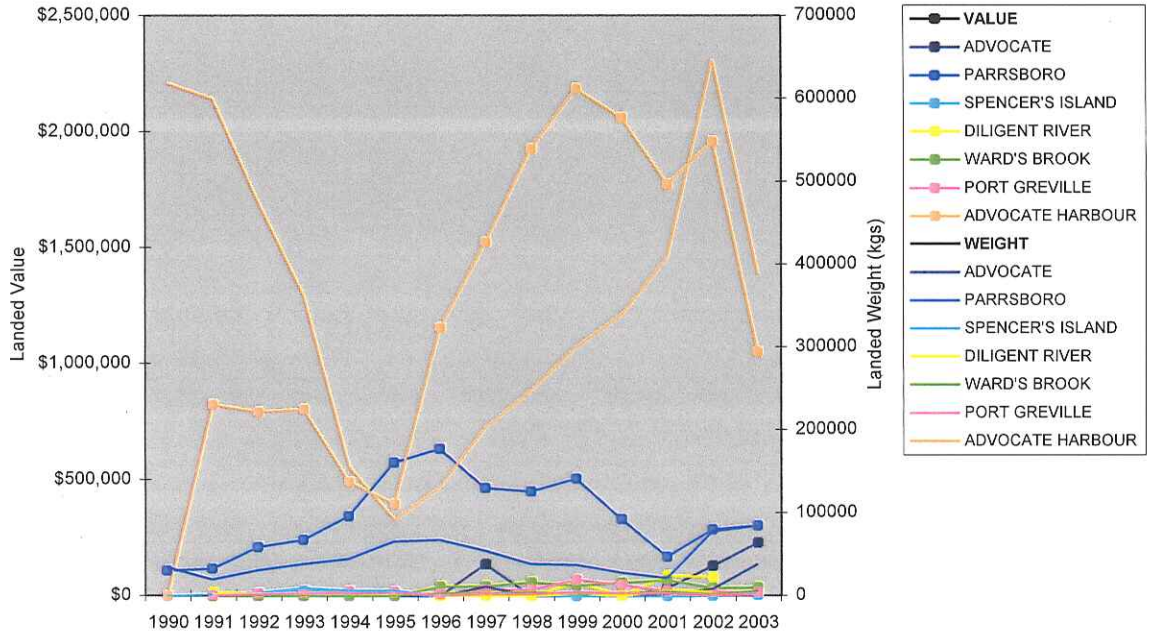
District 44: Landings by Species



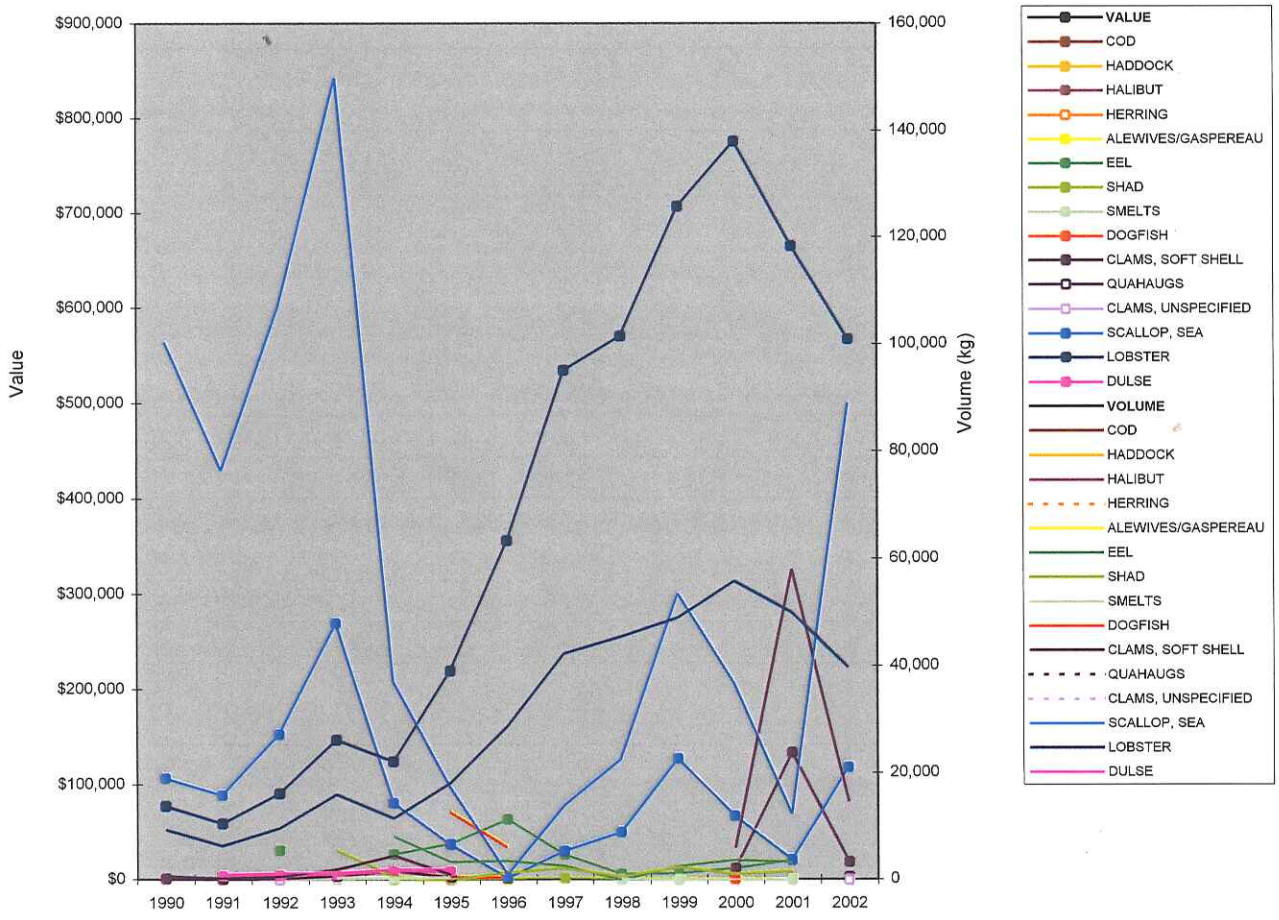
District 24: Registered Fishers and Vessels

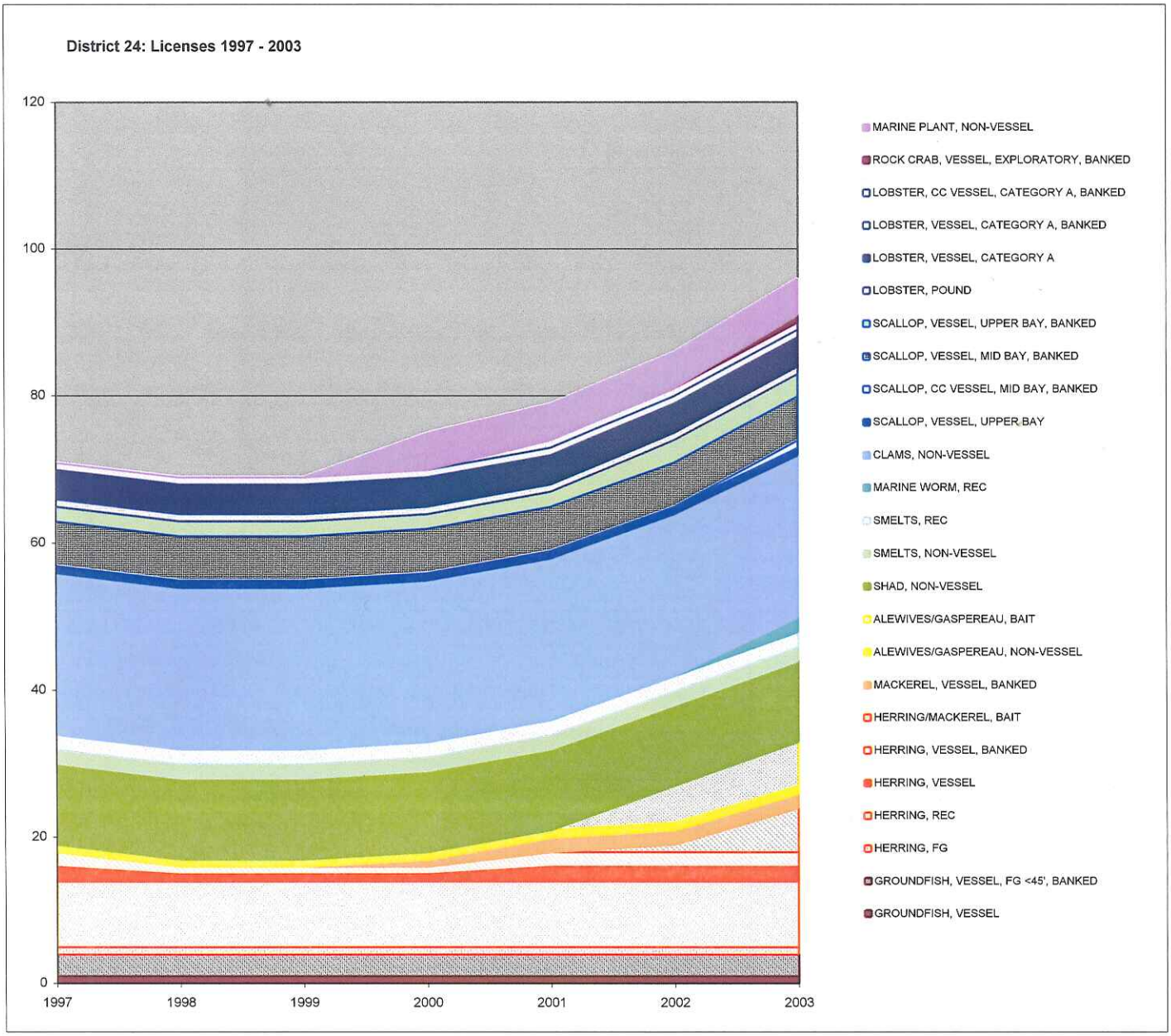


District 24: Landings by Port

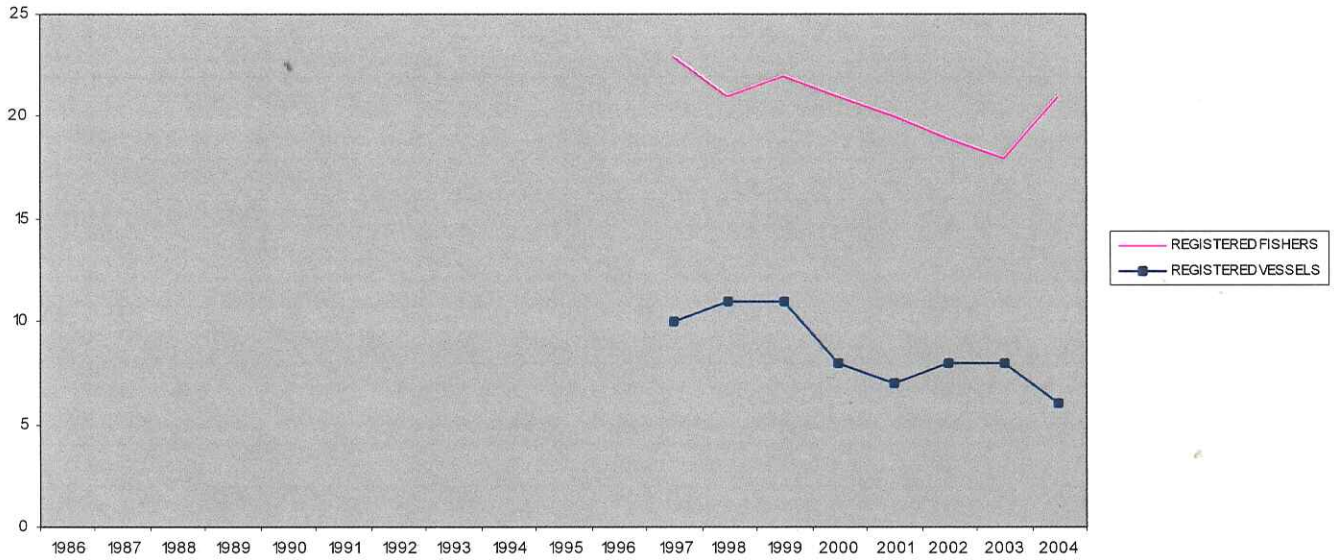


District 24: Landings by Species

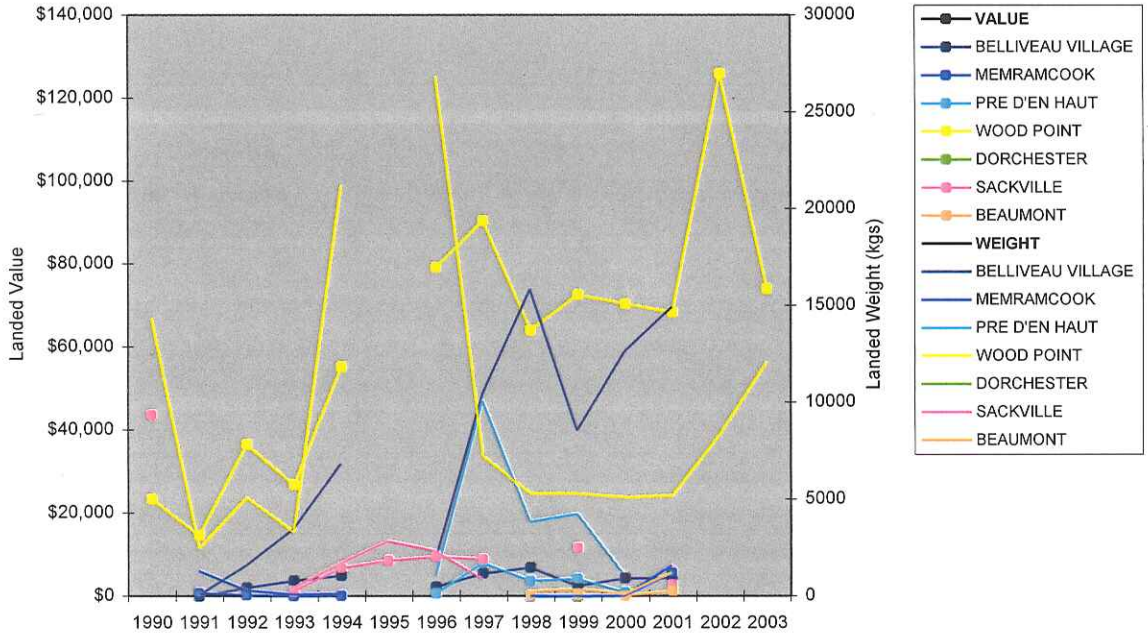



District 24: Licenses 1997 - 2003
120
100
80
60
40
20
0
1997
1998
1999
2000
2001
2002
2003
MARINE PLANT, NON-VESSEL
ROCK CRAB, VESSEL, EXPLORATORY, BANKED
LOBSTER, CC VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A
LOBSTER, POUND
SCALLOP, VESSEL, UPPER BAY, BANKED
SCALLOP, VESSEL, MID BAY, BANKED
SCALLOP, CC VESSEL, MID BAY, BANKED
SCALLOP, VESSEL, UPPER BAY
CLAMS, NON-VESSEL
MARINE WORM, REC
SMELTS, REC
SMELTS, NON-VESSEL
SHAD, NON-VESSEL
ALEWIVES/GASPEREAU, BAIT
ALEWIVES/GASPEREAU, NON-VESSEL
MACKEREL, VESSEL, BANKED
HERRING/MACKEREL, BAIT
HERRING, VESSEL, BANKED
HERRING, VESSEL
HERRING, REC
HERRING, FG
GROUNDFISH, VESSEL, FG <45', BANKED
GROUNDFISH, VESSEL

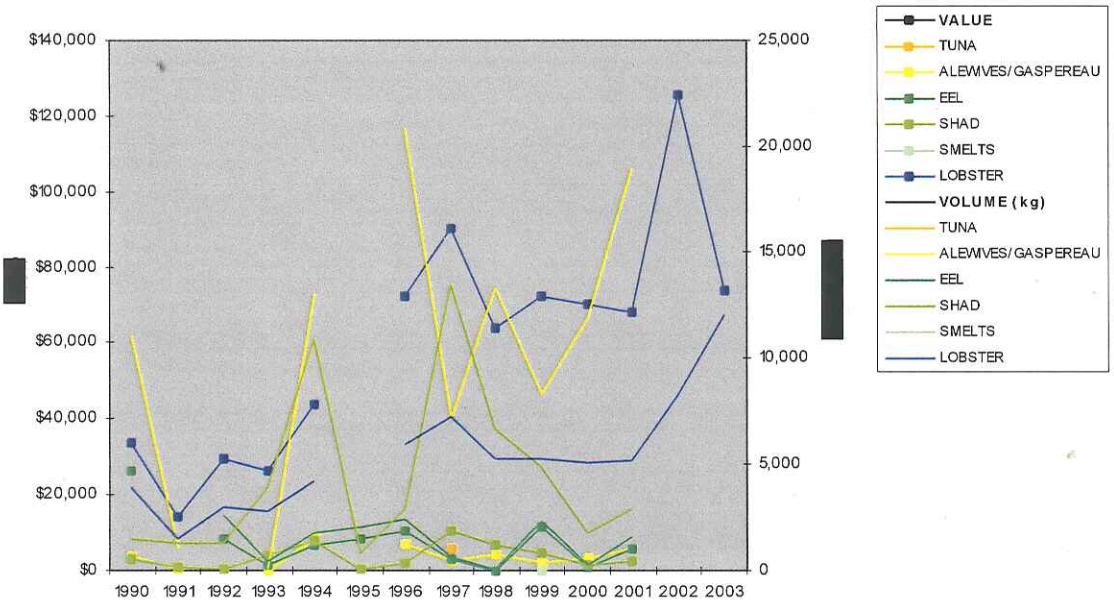
District 81: Registered Fishers and Vessels



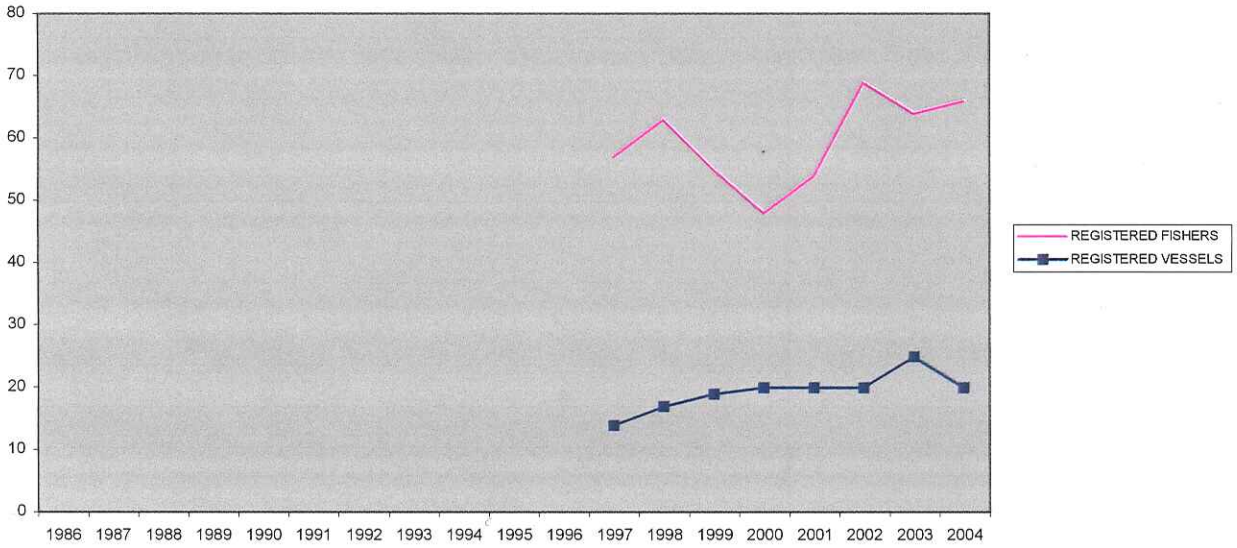
District 81: Landings by Port



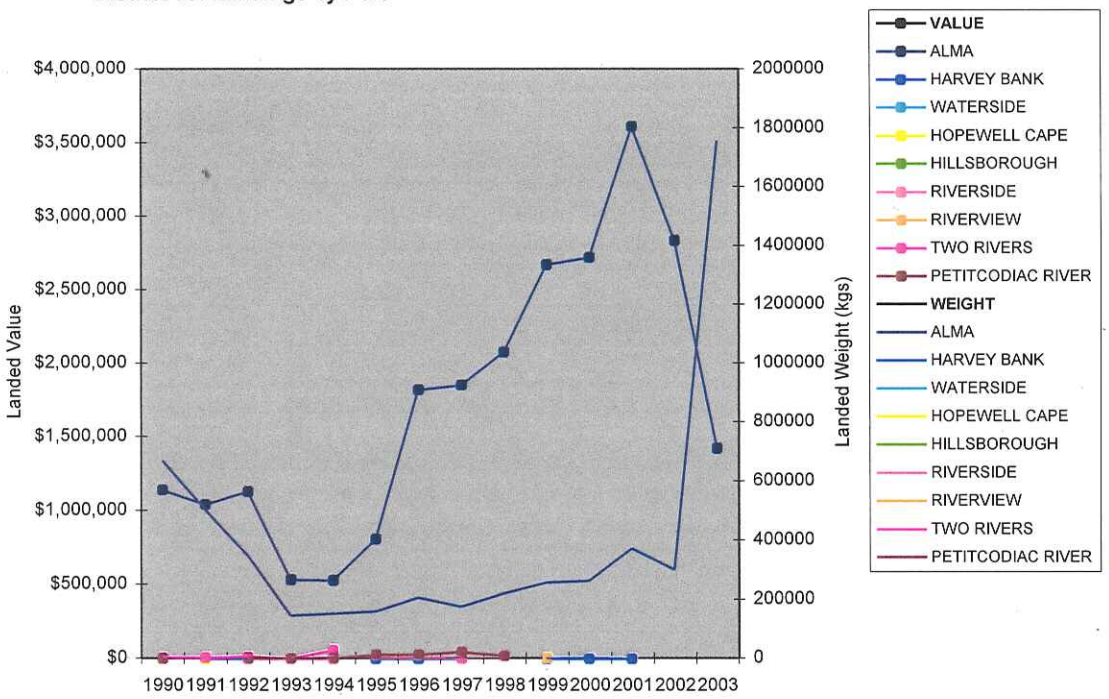
District 81: Landings by Species



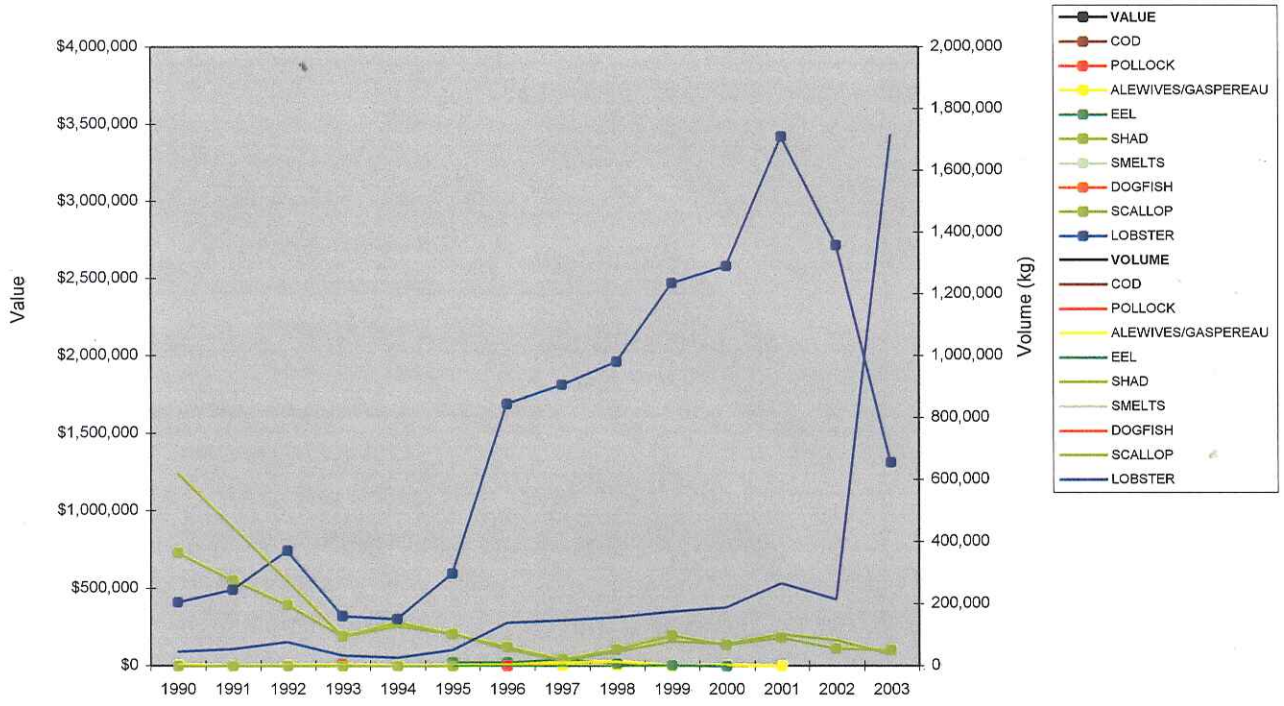
District 79: Registered Fishers and Vessels

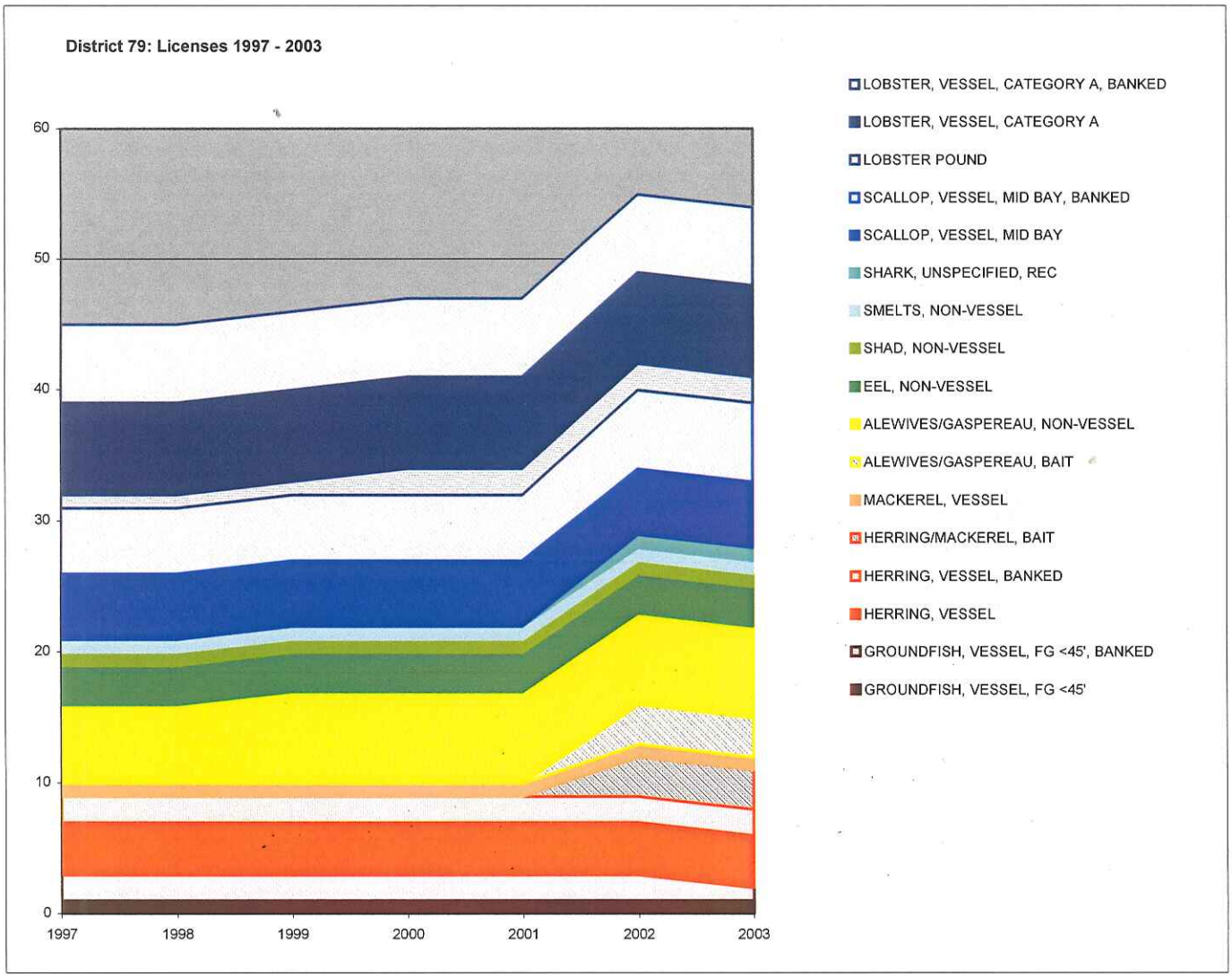


District 79: Landings by Port

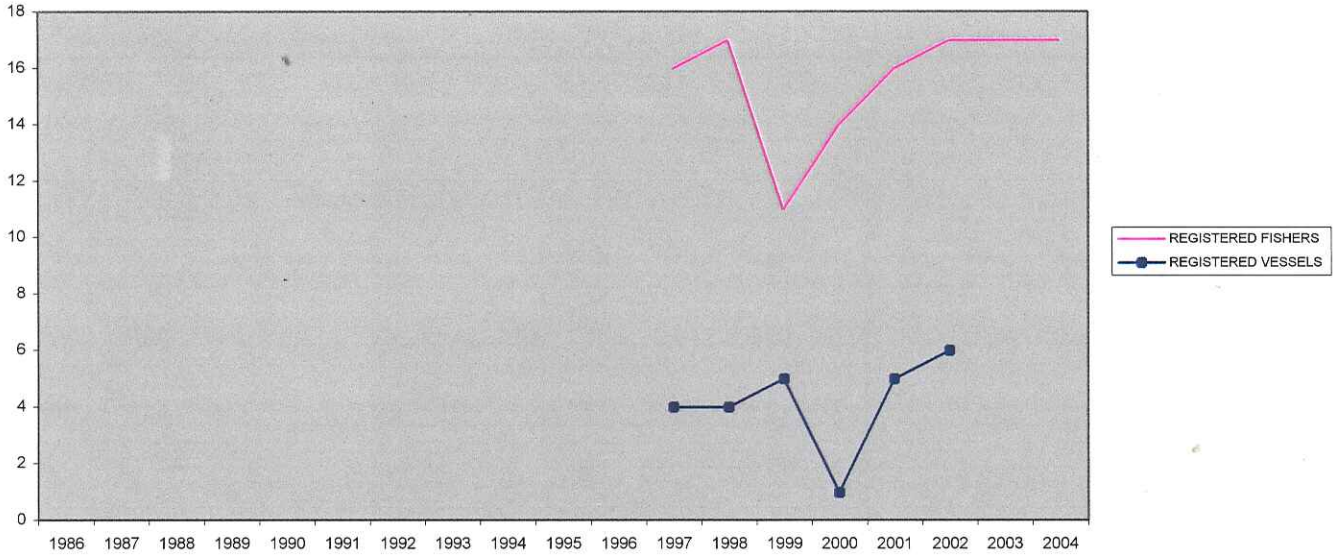


District 79: Landings by Species

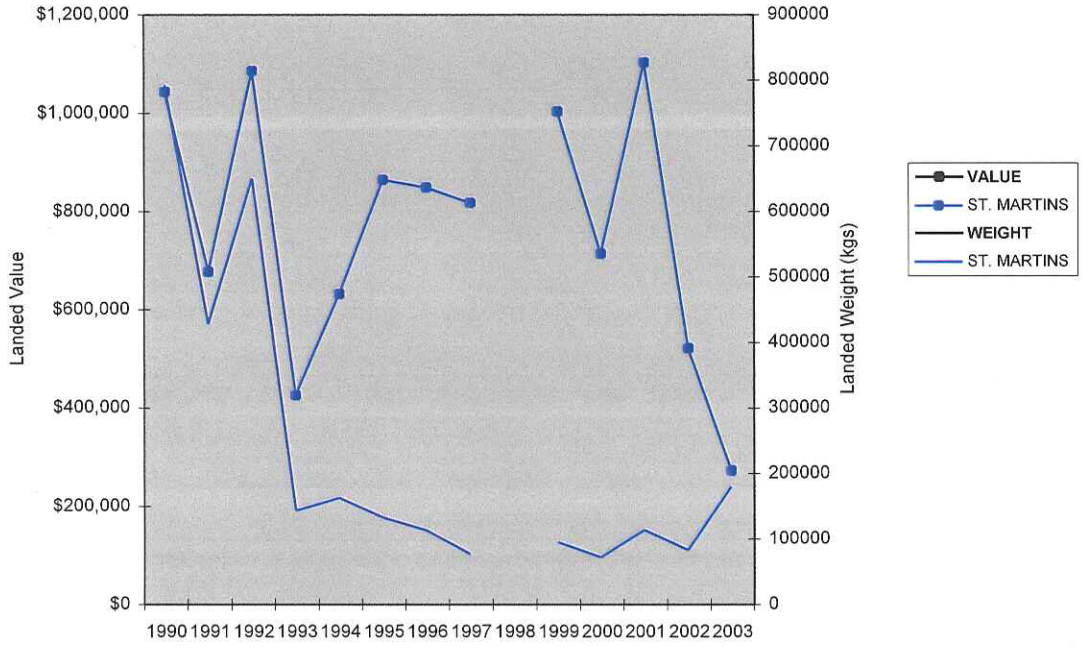
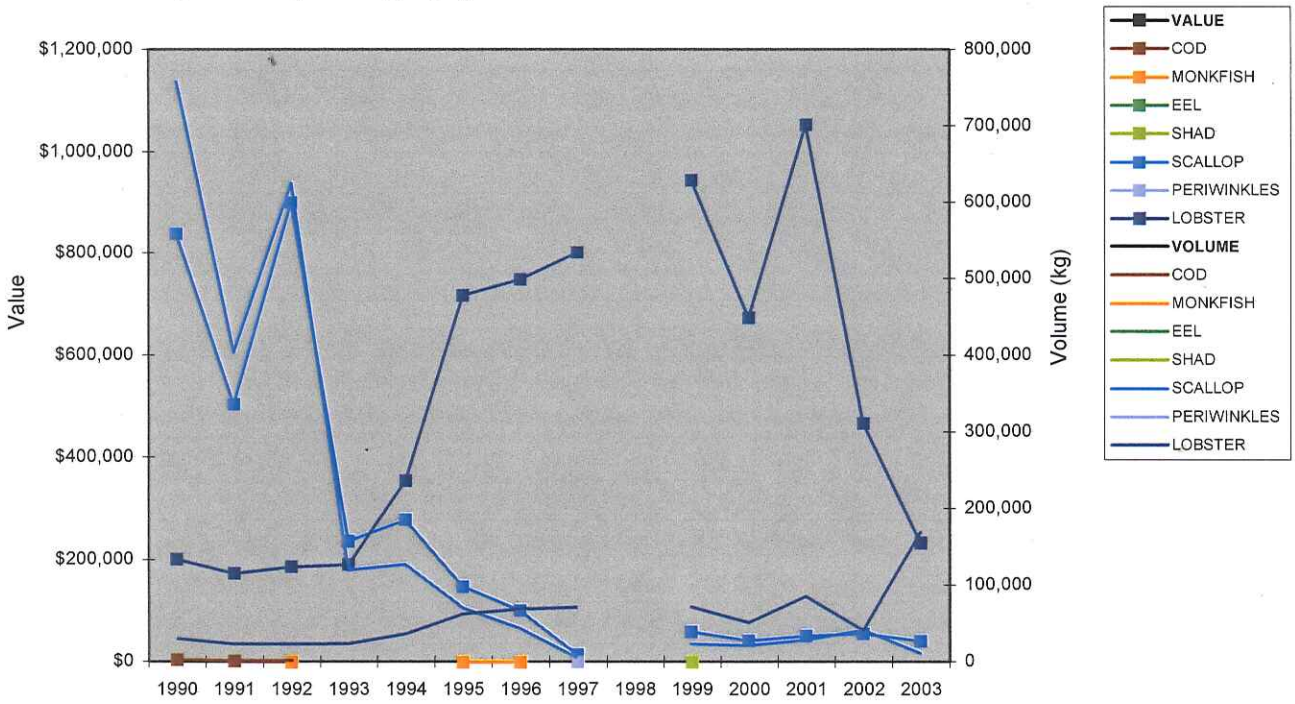



District 79: Licenses 1997 - 2003
60
50
40
30
20
10
0
1997
1998
1999
2000
2001
2002
2003
LOBSTER, VESSEL, CATEGORY A, BANKED
LOBSTER, VESSEL, CATEGORY A
LOBSTER POUND
SCALLOP, VESSEL, MID BAY, BANKED
SCALLOP, VESSEL, MID BAY
SHARK, UNSPECIFIED, REC
SMELTS, NON-VESSEL
SHAD, NON-VESSEL
EEL, NON-VESSEL
ALEWIVES/GASPEREAU, NON-VESSEL
ALEWIVES/GASPEREAU, BAIT
MACKEREL, VESSEL
HERRING/MACKEREL, BAIT
HERRING, VESSEL, BANKED
HERRING, VESSEL
GROUNDFISH, VESSEL, FG <45', BANKED
GROUNDFISH, VESSEL, FG <45'

District 48 (St. Martins): Registered Fishers and Vessels



District 48: Landings by Port



District 48 (St. Martins): Landings by Species