

Gulf of St. Lawrence Marine Fisheries Overview

Background

The fisheries in the Gulf have been traditionally dominated by cod, lobster, herring and redfish. In the last twenty years, significant changes have taken place as the crab and shrimp fisheries greatly expanded, and the cod and redfish fisheries were closed following collapse of these resources. The present document presents a brief overview of the status of the various fisheries in the Gulf of St. Lawrence, following reviews made by scientists from the Department of Fisheries and Oceans at the Maurice-Lamontagne Institute and at the Gulf Fisheries Centre in late 1996 and 1997.

Stocks of invertebrates are, with a few exceptions, at above average abundance despite intense exploitation. The biomass of pelagic fish, which are moderately exploited, is near or above long-term averages. On the other hand, groundfish stocks continue to be in generally poor condition, at levels close to and even below historical lows. In 1997, the cod fishery has reopened on a small and still experimental basis. Finally, seal populations are still increasing at a rapid rate.

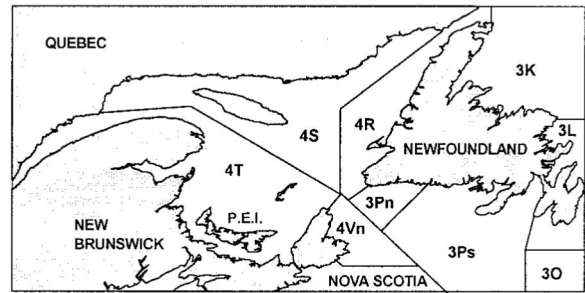


Figure 1. Map of the Gulf of St. Lawrence showing the boundaries of the NAFO Divisions.

Introduction

The fisheries of the Gulf of St. Lawrence have always been dominated by groundfish, which accounted for 50 to 70% of the landings in the Gulf in the recent past (Figure 2), followed by the pelagic fishes (mostly herring). However, in term of values, the crustacean fisheries have been the most lucrative. Since the early 1970s, the shellfish fisheries have grown considerably, accounting for about 22% of the overall landings from the Gulf (and considerably more in terms of landed value) during the 1980s.

Following excessive exploitation, combined with a decline in the productivity, the major groundfish stocks all but collapsed in the early 1990s, in parallel with similar events around Newfoundland and eastern Nova Scotia. In 1996, directed commercial fisheries on the two cod stocks (3Pn, 4RS and 4T-Vn (N-A)), Unit 1 redfish (4RST + 3Pn4Vn [Jan.-May]) and white hake in the southern Gulf were still prohibited. In 1997, the Minister of Fisheries and Oceans announced a limited re-opening of the directed cod fishery in the northern Gulf with a TAC of 6,000 t. In the southern Gulf, a limited allocation of 2,000 t to cover by-catches, the

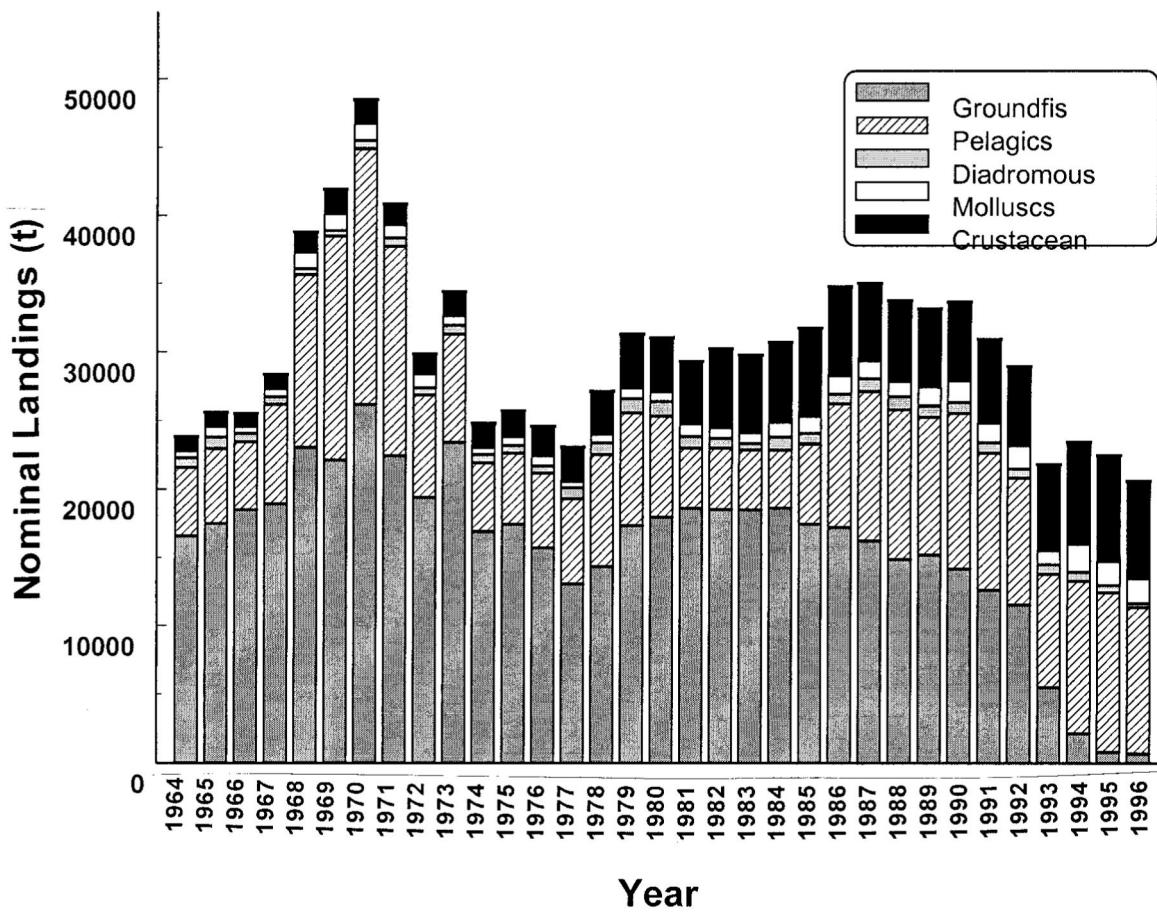


Figure 2. Reported landings from the Gulf of St. Lawrence during the 1964-1996 period by major species groups.

sentinel surveys, and some experimental projects was established.

Based on reviews of the status of the resources conducted by staff from the Gulf Fisheries Centre (Moncton) and the Maurice-Lamontagne Institute (Mont-Joli), this report presents a general overview of the status of the resources in the Gulf of St. Lawrence. The assessments on which this report is based were produced at various times during 1997. The reader should note that throughout this report trends in landings are presented. These are representative of trends in the fishery and are not to be confused with trends in resource abundance as discussed in the text.

Crustaceans

Three species of crustaceans are fished intensively in the Gulf of St. Lawrence: northern shrimp, snow crab and lobster. The lobster fishery has a long history in the Gulf, whereas the two others have developed recently. These three species represent almost the totality of crustaceans' landings from the Gulf (Figure 3). Other crustaceans species such as rock crab and toad crab, are the object of developing fisheries, particularly in the southern Gulf. However, there is little information on the abundance and the level of exploitation for these species.

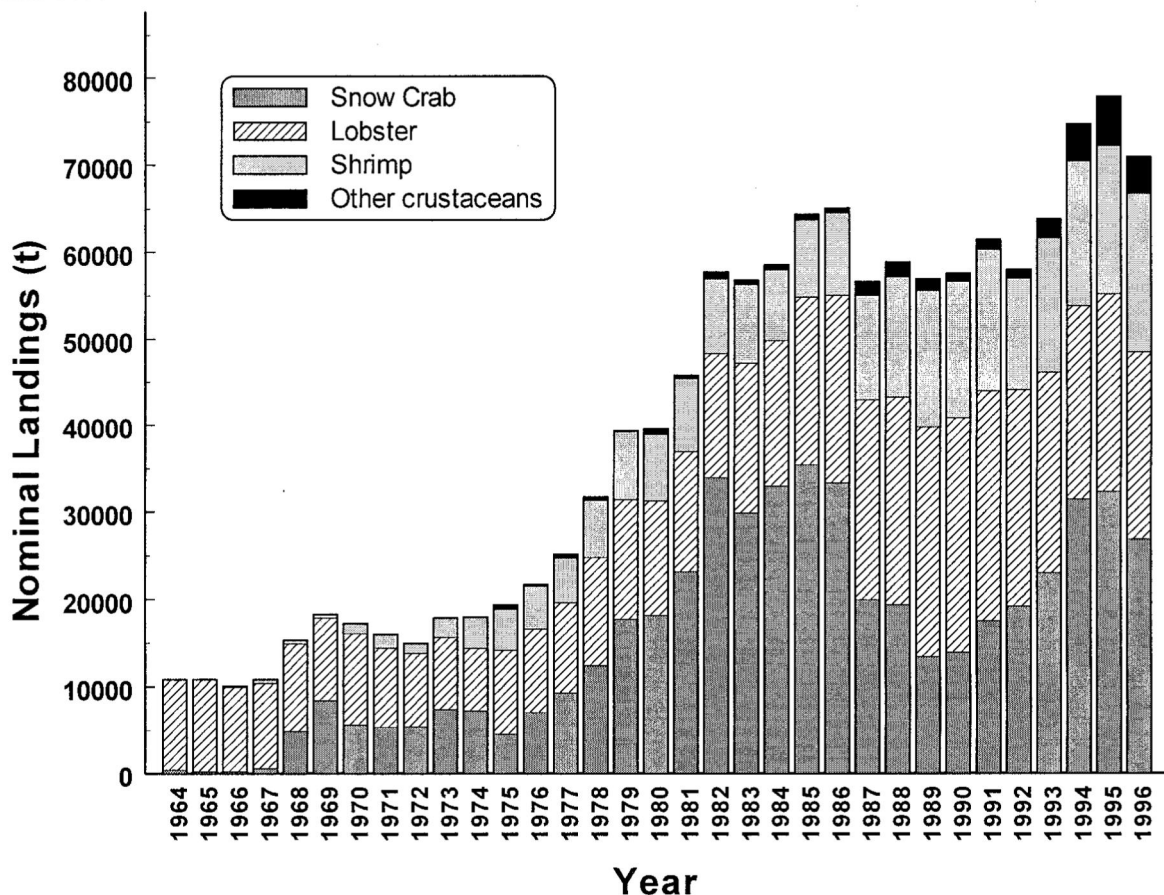


Figure 3. Nominal landings of crustaceans from the Gulf of St. Lawrence during the 1964-1996 period. The category "other crustacean" is almost entirely composed of rock crab.

Northern shrimp

There are four main concentrations of shrimp in the Gulf, namely in the Estuary of the St. Lawrence, west of Anticosti Island, north of Anticosti Island and in the Esquiman Channel. They are managed as four independent stocks. The shrimp biomass in the Gulf has increased almost continuously since the early 1980s. The landings have followed a similar trend, the TAC (Total Allowable Catch) for 1997 (20,031 t) being the highest ever. In recent years, the spatial range of shrimp in the Gulf has considerably increased, with large concentrations of shrimps now being found towards the Southeast in the Laurentian Channel in areas where they were previously rare. This re-

cent range extension is perhaps related to the reduction in predation by the now scarce cod and redfish, which are known to be major predators of shrimp.

Snow crab

Snow crabs live at medium depths (70-100 m) on relatively soft bottoms. The fishery targets mature males measuring over 95 mm of carapace width, which recruit to the fishery around age 10. Although high in the early 1990s, the crab biomass is currently at low to medium levels throughout the Gulf, as result of the arrival of a series of weak year-classes (called a recruitment trough) in the exploitable population. The subsequent year-classes appear strong, and the biomass should begin to increase again

in the near future. In the meantime, catches and catch rates should remain at low levels, and the fishery will be affected by problems of soft crab. Similar phenomena have been observed in the past. These fluctuations appear to be linked to biological mechanisms that are internal to the crab populations and relatively independent of climatic conditions.

Lobster

In the Gulf of Saint-Lawrence, lobsters live mainly on rocky bottoms near the coast. They are most common in the southern Gulf, but they can be found at low densities along the Québec North Shore and Newfoundland coast. The lobster fishery is managed through a combination of effort control (number of licenses, number of traps, seasons), minimum size, and the requirement for returning berried females to the water. Exploitation on lobster is intense, and catches are essentially based on annual recruitment.

Landings in Quebec and along the Gulf coastline of the Maritimes Provinces, as in the entire Northwest Atlantic, increased steadily over 20 years until the early 1990s. This constant increase was attributed to a combination of environmental factors that may have favoured the survival and recruitment of lobster. However, significant increases in the efficiency of the fishing fleets may have also contributed to the increase in landings. In the Magdalen Islands, where trends in effort were examined in detail, the combination of more efficient gear, more powerful vessels, and the addition of electronic navigation and sounding equipment have resulted in significant increase in capacity and in exploitation rate. Many trends in biological characteristics, like the reduction in size of landed lobster and egg bearing females, and the near absence of large lobsters, also point toward an increase in the

exploitation rate of lobster during that period.

Since 1990, catches have started to decline, and while still above average, they were down by 19% in 1996 in relation to the maximum of 1990; they have further declined in 1997. Although the reasons for this decline are not fully identified, a reduction in recruitment may have played an important role.

Molluscs

Many species of molluscs are exploited in the Gulf of St. Lawrence (scallops, oysters, clams, surfclams, quahaug, etc.). These species live either directly on the bottom, or buried in the sediments. Their presence is thus strongly linked to the nature of the bottom. They are often found in localised, well defined areas called beds. Management of these resources is usually done through fishing seasons and minimum size on a small geographical scale, although some species are under quota management (Arctic surfclams, some scallop areas). Because of the multiplicity of species and populations, it is difficult to give an overall picture of molluscs in the Gulf, although it appears, that for the most valuable species, exploitation is intense.

Scallops

There are two species of scallops exploited in the Gulf of Saint-Lawrence: giant scallops (*Placopecten magellanicus*) and Iceland scallop (*Chlamys islandica*). Giant scallop is the most common species in the southern Gulf, whereas Iceland scallop is common in the Northern Gulf, especially from western Anticosti Island to Belle-Isle Strait. They are the molluscs species for which we have the most information in terms of population abundance. Most of the major scallop beds are the subject of commercial fisheries, particularly in the Northumberland Strait, the

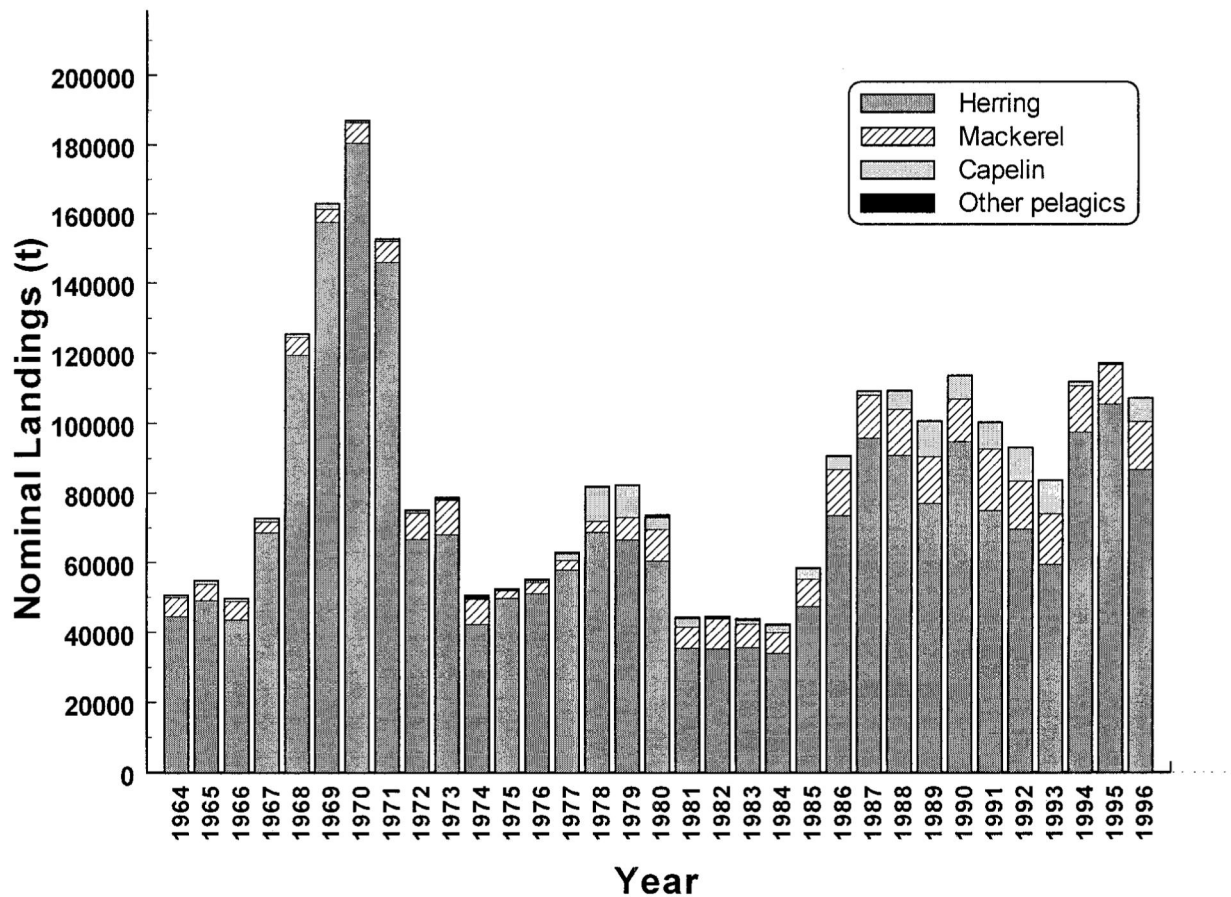


Figure 4. Nominal landings of pelagic fishes from the Gulf of St. Lawrence during the 1964-1996 period. The category "other pelagics" is almost entirely composed tunas and swordfish, but their landings are usually minimal.

Mingan area, and the Magdalen Islands. Indications are that they are heavily fished. For instance, the biomass of scallops in the various beds in the Magdalen Islands is now at a very low level, with the fishery being sustained only by annual recruitment.

Pelagic Fish

Pelagic fishes are fish that live usually in the water column, well above the bottom. Their fisheries in the Gulf are dominated by herring (Figure 4), with a relatively small and variable contribution from mackerel and capelin. Bluefin tuna are also exploited in the southern Gulf.

Herring

Herring is the most important exploited pelagic species. Four major stocks are recognized; spring and fall spawners are found in both the northern (NAFO Division 4R) and in the southern (NAFO Division 4T) Gulf respectively. There are additional stocks of spring and fall spawning herring in NAFO Division 4S, but their boundaries and their relationships with neighbouring stocks are not well understood.

In recent years, the exploitation in the Gulf have exceeded 24%, which is the management target ($F_{0.1}$) for herring stocks. In the southern Gulf, the herring biomass is currently decreasing from a peak reached in

1992, because recent year-classes have been of average and below average abundance. The fall spawner biomass is estimated at 230,000 t while the spring spawner biomass is estimated at about 80,000 t. The biomass in the northern Gulf, however, appears to have grown back to, or even above average levels, following the low abundance of the mid 1980s. An area of concern in recent years was Bay St. George, on the Southwest coast of Newfoundland, where the local spring spawning component had been decimated following intense exploitation. The Bay was closed to purse seiners in 1995, but the arrival of the above average 1990 year-class has permitted a cautious reopening of fishing on that component.

Atlantic Mackerel

Mackerel is a summer visitor to the Gulf. In the winter, the mackerel gather on the edge of the continental slope off New England and Nova Scotia. In summer, a large portion of this population comes into the Gulf to spawn (June-July). After spawning, the mackerel scatter to such areas as the Gulf and Grand Banks to feed, then leave in the winter. Mackerel is not currently heavily exploited, and its biomass is high. Fluctuations in abundance are mainly due to fluctuations in recruitment. Major year-classes of mackerel are only produced on occasion (for instance in 1967, 1982, 1988). The 1988 year-class has allowed the biomass to stabilise at relatively high levels, and the abundance of young fish in the commercial catch in 1995 (age one and two) is an indication that there were probably strong pulses of recruitment in both 1993 and 1994.

Capelin

Capelin is another major pelagic species in the Gulf, but it is not extensively harvested; there is only a small fishery in the northern Gulf. Landings are driven by market conditions and interest is highest when there is an

abundance of large capelin for the roe market. The capelin biomass is presumed to be large, but little information is currently available on its abundance and variations. Capelin is one of the major prey for cod in the northern Gulf, as well as many other species like seals and summer visitors such as whales.

Groundfish

The groundfish fishery in the Gulf of St. Lawrence has been dominated traditionally by cod (Figure 5), which is often taken in mixed fisheries with flatfishes, especially in the southern Gulf. There are also distinct smaller flatfish fisheries in the deep water of the Laurentian Channel for witch, Atlantic and Greenland halibut. The redfish fishery is a relatively recent development, having only started in the early 1950s, but it quickly assumed second place, in terms of landings, in the groundfishery. With the closure of the cod fishery, landings of many other species, which are often by-catches in the cod fishery also declined. The abundance of most groundfish stocks in the Gulf is currently very low.

Cod

There are two cod stocks in the Gulf of St. Lawrence, in the southern Gulf (NAFO Divisions 4T,Vn[Nov.-April]) and in the northern Gulf (NAFO Divisions 3Pn4RS) respectively. Both stocks are currently at very low levels, and directed fishing has been prohibited since September 1993 (south) and January 1994 (north). Although the biomass of cod has slightly increased since the closure, most of this was caused by an increase in the weight of the remaining fishes that were allowed to grow in the absence of fishing. In 1997, the directed fishery in the northern Gulf was re-opened with a TAC of 6,000 t. In the southern Gulf, the directed fishery remained closed but 2,000 t

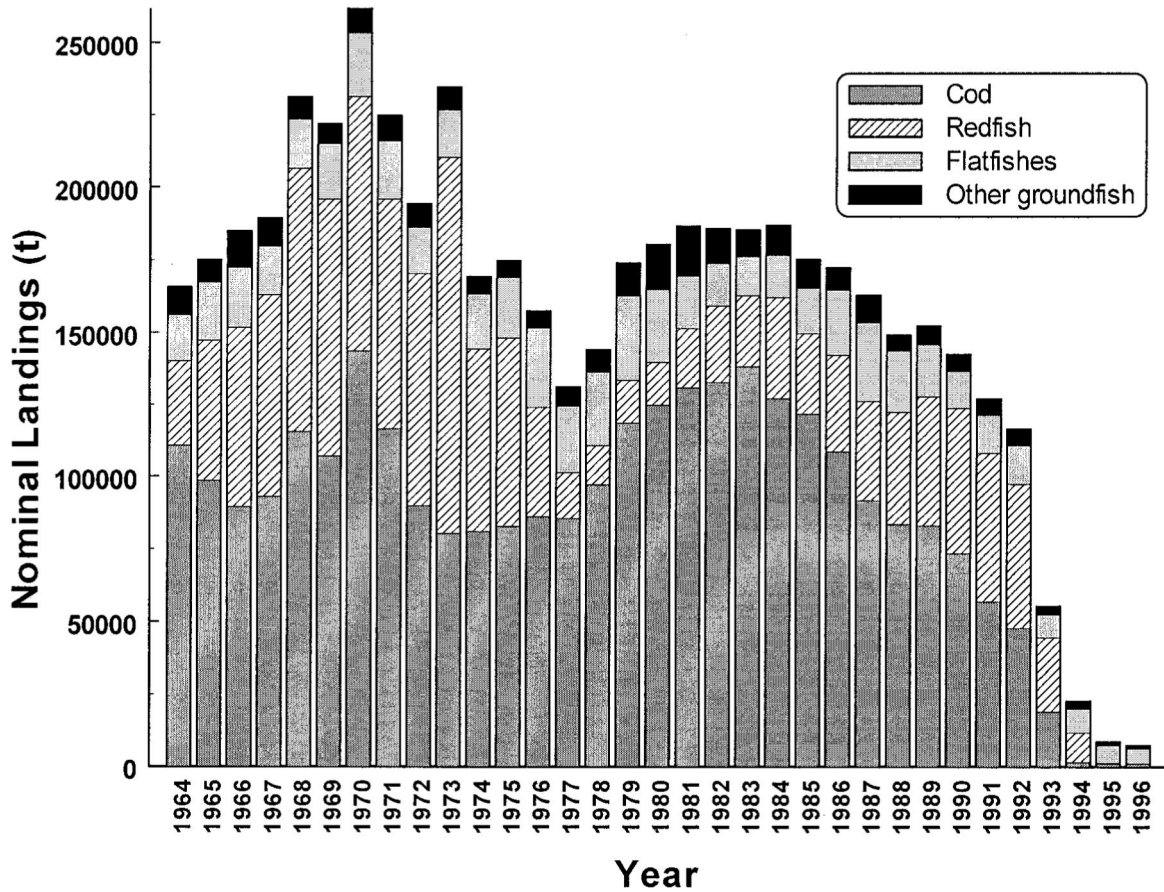


Figure 5. Nominal landings of groundfishes from the Gulf of St. Lawrence during the 1964-1996 period. The category "other groundfish" is primarily made of white hake.

were allowed to cover by-catches in other fisheries, and catches in both experimental projects and sentinel fisheries.

The abundance of cod in the Gulf has followed a trend similar to that of most other Northwest Atlantic stocks, particularly the more northerly ones. In the Gulf, cod was particularly abundant in the late 1960s and in the early 1980s. Exploitation rates have been high, reaching 35 to 45% a year, greatly exceeding the management target ($F_{0.1}$) of 16%. As the stocks were declining prior to closure, the exploitation rates increased substantially. Excessive harvests and poor fishing practices are clearly the main factors responsible for the decline of

cod stocks, although other factors have also played a significant role. For both stocks, growth declined starting in the late 1970s. This along with lower recruitment has contributed to low biological production of cod observed since the mid-1980s. The cod stocks were thus replenishing themselves at much lower rates, at the same time as exploitation was intensifying. Although cod growth has increased very slightly recently, indications are that recruitment is still low. The recovery of cod abundance to average levels will take several years.

Redfish

The redfish stock is made up of two separate species (*Sebastes fasciatus* and *Sebastes*

mentella). Effective methods of distinguishing the species have been developed in recent years, and biological differences are beginning to be recognised (distribution, reproduction), but the impact of the presence of two species on the management of this "stock" has not yet been established. Redfish in the Gulf appear to be closely linked to those of the Laurentian Channel (Unit 2, NAFO Divisions 3P4V4Wfg). This stock, and thus its fishery, have been dominated by the sporadic appearance of strong year-classes (particularly those born around 1946, 1956-58, 1970 and 1980), while recruitment was practically nil during other years. The succession of these year-classes in the population has resulted in significant variations in catches. The last year-class to recruit in abundance to the fishable population was born in the early 1980s, and since then, no significant year-classes have been produced. In the absence of recruitment, the redfish biomass has decreased considerably under the heavy exploitation to the point that all directed fishery was forbidden in 1995. As redfish take seven to 10 years to reach commercial size, a significant recovery of this stock can only occur seven or eight years after significant recruitment has been produced.

American Plaice

The most abundant flatfish in the Gulf of St. Lawrence is the American plaice which is predominantly found in the southern Gulf of St. Lawrence. After a period of relatively high abundance in the mid-seventies, this population has declined and is presently at its lowest level. Growth and recruitment have been low since the late 1970's. The American plaice fishery has always been characterised by a high proportion of discards of small plaice.

Greenland Halibut

The Greenland halibut differs from other species of flatfish by its substantial fluctuations in abundance, linked to marked variations in recruitment. Harvesting of this population is intense, and fishing success depends essentially on recruitment. Recent stringent conservation measures (reduction in effort, increase in minimum fish and mesh size) have been put in place in the last three years. A series of abundant year-classes born in the late 1980s are responsible for the increase in biomass observed in the last two or three years. There are indications that the recent year-classes are probably also above average in abundance.

Witch flounder

Witch flounder has declined considerably over the recent time period, particularly in the northern Gulf of St. Lawrence, and its abundance is considered to be low.

Winter flounder

The decrease in cod TACs has increased fishing pressure on winter flounder in the southern Gulf. This species occupies primarily coastal habitats and there are probably several separate populations in the Gulf. In the southern Gulf (4T). The abundance of this species does not appear to vary widely, although declines have been noted in certain locations (particularly in the Magdalen Islands).

Atlantic Halibut

Atlantic halibut is a rare but highly valuable species. Recent reported landings have been very low (between 100 and 200 t), but in the first half of the twentieth century, landings in the Gulf were significantly higher (between 1,500 t and 4,000 t steadily over 60 years) indicating that this stock could produce much higher yields. Immature fish still represent a large proportion of the catches, but a more stringent application of conser-

vation measures to release immature fish (less than 82 cm) were put into place in 1997.

Yellowtail flounder

Recently, there has been increased interest in the exploitation of yellowtail flounder, particularly around the Magdalen Islands. This species, which is also found nearshore in the waters off Prince Edward Island and northeastern New Brunswick, appears to be at intermediate abundance.

White hake

The fishery for white hake has yielded an average catch of over 5,000 t since 1960. However, the abundance and distribution range of white hake in the southern Gulf has declined markedly since the early 1990s. The stock is at its lowest abundance and recruitment appears to be poor. The directed fishery was closed in 1997 but 500 t were allowed for by-catches in other fisheries.

Spiny dogfish

Spiny dogfish have become more abundant in the southern Gulf of St. Lawrence since 1987. In 1995, almost 500 t of dogfish were taken in a directed fishery. In the past (1920s and 1950s), there have also been occurrences of dogfish in the Gulf. These fish are considered to constitute a single stock on the Atlantic Coast. Dogfish spend the winter in the deep waters off the coast of New England where they are also exploited. The occurrence of dogfish in the Gulf is thought to be due to an expansion of their range concurrent with an increase in their abundance.

Marine mammals

Four species of seal (harbour, hooded, grey and harp) are abundant in the Gulf of St. Lawrence. No information is available on the number of harbour seals in the Gulf.

The grey seal population of the Gulf is growing at the rate of about 8% a year, and grey seals also breed on Sable Island outside the Gulf. The production of young seals in the latter population was about 10,000 newborns in 1990, and is increasing at the rate of 12.6% per year. Some Gulf seals spend part of the year outside the Gulf, while a few Sable Island animals spend part of the year in the Gulf. Information on diet and distribution are incomplete. Some information has been available from the northern Gulf (May-September) since the mid 1980s, and from 4VsW throughout the year in recent years. Information on the diet is not available for other regions including the southern Gulf, 4X, 3P, and 2J3KL. Grey seal consumption of cod in eastern Canada is estimated to have increased from approximately 14,000 t in the early 1980s to an estimated 62,000 t in Atlantic Canada in 1996. This consumption comprises 19,000 t in 4VsW, 35,000 t in the Gulf of St. Lawrence and 8,000 t in other areas. In earlier samples (before 1988), the majority of cod consumed by grey seals consists of pre-recruits. However, in a sample of 250 seals collected in 1992, 50% of the cod consumed were of a commercial size (more than 40 cm). Surveys were carried out to estimate grey seal pup production during January 1997. The results of these surveys should be available by the spring of 1998 and will be used to update both the population models and consumption models. It must be emphasised that the current estimates of consumption are on information from the period 1984-1990 that have been extrapolated to the present. The current information does not allow us to assess the impact of this consumption by grey seals in the Gulf of St. Lawrence on Gulf cod stocks.

Harp seals are the most abundant pinniped in the Northwest Atlantic. In March 1994, an aerial survey was conducted to estimate harp seal pup production in the Gulf of St. Lawrence and off the east coast of New-

foundland. The results of this survey indicate that pup production has increased from 580,000 ($\pm 78,000$) in 1990 to 703,000 ($\pm 127,000$) in 1994. The 1994 population is estimated to be between 4.1-5.5 million.

Cod consumption by harp seals in the Gulf of St. Lawrence was estimated using information on individual energy requirements of seals, population size, diet and the seasonal distribution of animals. In 1994, it was estimated that Gulf harp seals consumed 39,000 t of cod. If the population has continued to grow as expected, the cod consumption may have increased to as much as 43,000 t. The majority of the cod consumed were juveniles (10-20 cm long), too small to be taken by the commercial fishery. The wide range in current estimates of consumption is due to uncertainties in diet composition and the distribution of animals in the Gulf of St. Lawrence. The proportion of cod in the diet of harp seals along the west coast of Newfoundland varies between 9% and 20% while it is less than 2% in the Magdalen Islands and upper estuary. Uncertainties in this proportion for the Gulf population in each of these areas while the seals are in the Gulf will have a major effect on cod consumption estimates.

Little information is available on the size of the hooded seal population. Production of young hooded seal in 1993 in the Gulf of St. Lawrence was approximately 3,000 new-borns. No information is available on the diet of hooded seal in the Gulf. Information from the "Front" (the area northeast of Newfoundland) indicates that these animals feed mainly on capelin, turbot and redfish. Little is known about the relationship between the hooded seal in the Gulf and those of the "Front", or on the proportion of juveniles returning to the Gulf in winter. Based on diet data from outside the Gulf, an attempt has been made to model hooded seal fish consumption. If they have a diet similar to hooded seals off the eastern Newfoundland

Coast, then in 1995, they may have consumed 2,800 t to 4,100 t of Greenland halibut, 1,300 t to 1,900 t of redfish, 70-100 t of cod and 20-30 t of capelin in the Gulf. Fifty percent of the fish consumed are less than 30 cm, and only 10% of the Greenland halibut and 10% of the redfish are greater than 40 cm.

Conclusion

The status of the fisheries in the Gulf of St.-Lawrence varies considerably depending on which species group is considered. Summary information on the selected stocks from each species group is presented in Table 1. The status of invertebrate stocks is variable. Shrimp stocks are abundant and still increasing. Snow crab stocks have fluctuated over time in a more or less cyclical fashion. They are currently at low to medium abundance, but it is expected that they will increase in the near future. Finally, lobster is source of some concerns. Although abundance is probably still above average, it has declined steadily in the last 6 or 7 years.

The status of fish stocks is also quite variable. Pelagic stocks are only lightly to moderately exploited, and their abundance is at, or above average levels. On the other hand, groundfish stocks are, with few exceptions, at very low abundance levels, and despite stringent conservation measures (closure of the 2 cod, white hake and redfish fisheries) implemented in the last four years, there are few signs of recovery for these stocks.

Table 1. Summary information on selected stocks from the Gulf of St. Lawrence from each of the species groups for 1996.

Species	Stock or region	Landings (t)	Recruitment	Decline in size since 1975	Exploitation rate relative to target	Abundance	Status 1996 vs. 1995
Molluscs							
Giant scallop	Southern Gulf	3328	Low	No	Above	Low	↓
Icelandic scallop	Northern Gulf	3436	Med	No	OK	Average	→
Crustaceans							
Lobster	Gulf	21,606	Declining	No	High	High	↓
Rock crab	Gulf	3,804	?	No	?	High	↑
Snow crab	Southern Gulf	18,625	Low	No	OK	Med	↓
	Northern Gulf	8,322	Low	No	OK	Low	↓
Shrimp	Gulf	18,474	High	No	OK	High	↑
Pelagic							
Herring	4T	71,807	Low	Yes	OK	Med	↓
	4R	14,661	Med	No	Below	Med	↑
Capelin	4RST	6,609	?	No	?	?	?
Mackerel	NW Atlantic	13,771 ¹	High	No	Below	High	→
Groundfish							
Cod	4TVn[N-A]	1,142	Low	Yes	Closed	Very Low	→
	3Pn4RS	294	Low	Yes	Closed	Very Low	→
White hake	4T	154	Low	Yes	Closed	Very Low	→
Redfish	Unit 1	51	Nil	No	Closed	Very Low	→
Greenland halibut	4RST	1,944	High	No	Likely above	Med to high	↑
Atlantic halibut	4RST	208	?	No	?	Low	?
American plaice	4T	1,381	Low	Yes	Likely above	Low	↓
Winter. flounder	4T	745	?	Yes	?	Med	→
Witch	4RST	493	?	?	Above	Low	↓
Dogfish	NW Atlantic	365 ²	?	?	?	High	↑
Seals							
Harp seals			High	Yes	Below	High	↑
Grey seals			High	No	Below	High	↑

Notes:

1. Landings for 4RST only. There is only one stock in the Northwest Atlantic. Total landings for stock were 32,752 t
2. Landings for 4RST only. There is only one stock in the Northwest Atlantic.

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