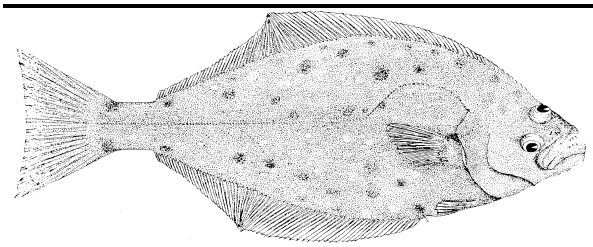

Atlantic Halibut of the Gulf of St. Lawrence (Divisions 4RST)

Background

The Atlantic halibut of divisions 4RST can be found throughout the Estuary and Gulf of St. Lawrence. In the northern Gulf, they are more abundant in the Esquiman, Laurentian and Anticosti channels, at depths of 200 m and over. In the southern Gulf, the highest concentrations are found in shallower water (less than 100 m) near the Miscou Bank, north of Prince Edward Island, northwest of Cape Breton Island and around the Magdalen Islands. This species grows fast and continuously, at a mean rate of about 7.5–8.5 cm per year (Figure 2). The growth rate for males and females is comparable, although female halibut reach a larger maximum size than males. Based on observations made during scientific trawl surveys conducted in January and May, it appears that the Gulf halibut is able to spawn during those periods.

The high landings of Atlantic halibut made during the first half of the 20th century indicate that the Gulf stock was under very strong fishing pressure at the time. Catches during this period fluctuated between 1000 t and 2000 t. Halibut landings totalled about 650 t in the early 1960s, but subsequently stabilized at a level below 500 t, with a record low of 91 t recorded in 1982. Since then, catches have rarely exceeded the 300 t mark, which is equivalent to the precautionary total allowable catch (TAC) established in 1988. Since 1995, landings of Atlantic halibut have risen substantially, and this is thought to be due primarily to the increased fishing effort by the fixed gear fleet, notably longliners.

The current Atlantic halibut management unit for the Gulf, which corresponds to divisions 4RST, was defined in 1987 in light of tagging-recapture results inside and outside the Gulf, and taking into consideration additional biological data such as size and growth rate. A second management unit, 3NOPs4VWX5Zc, applies to the Canadian Atlantic coast halibut stock.

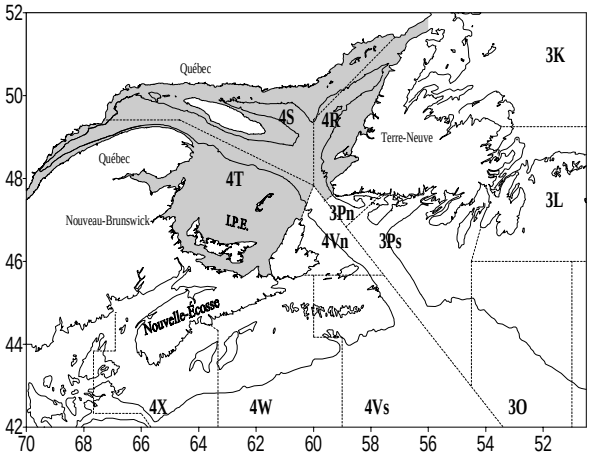

Figure 1. Map of the Gulf of St. Lawrence and adjacent regions showing NAFO divisions 4RST.

Summary

- Since 1995, mean annual landings of Atlantic halibut have been around 275 t, twice the mean annual landings for 1992–95 (135 t), but comparable to those of the late 1980s. They are still well below the values of 1000 t and over regularly recorded during the first half of the century.
- Despite an increase in the TAC to 350 t in 1999, total halibut landings have not risen above 1998 levels.
- Since 1995, the fixed gear fleet has steadily increased its share of total landings, accounting for over 94% of the total in 1999. Longliners alone take more than 80% of the total catch.
- The length distributions of fish caught with fixed gear have always been quite broad compared with those observed in the catches made by the mobile gear fleet.
- In 1999, the proportion of halibut less than 81 cm long, the minimum legal size for the fishery, in by-catches of trawlers and gillnets dropped sharply; at about

15%, it was comparable to that in longliner catches.

- Recent data on the sexual maturity of the Atlantic halibut stock living in Canadian Atlantic waters (unit 3NOPs4VWX5Zc), for which L_{50} (length at which 50% of individuals have reached sexual maturity) is 75 cm for males and approximately 115 cm for females, suggest that there are grounds for questioning the validity of using a legal size limit of 81 cm as a management tool. New research into the maturity of the Gulf halibut stock would help arrive at a more appropriate value.
- Although landings in the last few years have been higher than those recorded in the early 1990s, the Atlantic halibut stock of the Gulf still appears to be at a very low level if fishery data going back over a longer period are considered. In the first half of the 20th century, annual landings often exceeded 1000 t, which indicates that the stock was capable in the past of supporting much larger catches than those taken in the last few decades.

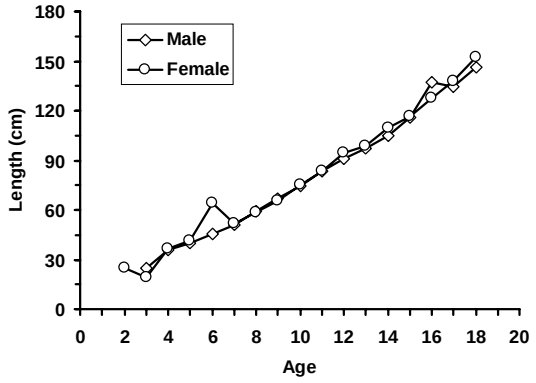

Figure 2. Mean length (cm) at age, Atlantic halibut from the Gulf of St. Lawrence.

Biology

Atlantic halibut (*Hippoglossus hippoglossus* L.), the largest of the flatfishes, is also one of the largest marine fish species in Canadian Atlantic waters. The species is demersal, living on or near the sea bottom. Atlantic halibut are found on both sides of the North Atlantic in cold boreal and subarctic waters at temperatures close to 5°C. In the Northwest Atlantic, the species ranges from the coast of Virginia to Disko Bay, located up the west coast of Greenland.

Information on **the geographic range and abundance** of Atlantic halibut in the Gulf is derived mainly from scientific trawl surveys and commercial fishing data (Figure 3). In the northern Gulf, Atlantic halibut are especially abundant in the Esquiman, Laurentian and Anticosti channels, northeast and northwest of Anticosti Island, at depths of 200 m or more. Concentrations of halibut at shallower depths of 100 m or less have been observed in the southwestern Gulf, around the Miscou Bank, north of Prince Edward Island, northwest of Cape Breton and around the Magdalen Islands.

Halibut catches are very sporadic in the course of a scientific survey. When halibut are caught, rarely are there more than two or three per tow. It should be noted that, unlike cod or redfish, Atlantic halibut are not a schooling species. Nonetheless, since 1996 the total number of halibut caught has increased significantly. About 20 fish are taken on each scientific cruise, compared with half a dozen in previous years.

Although little is known about the spawning of Gulf Atlantic halibut, data on halibut in the second Atlantic management unit indicate that 50% of males are sexually mature at 75 cm, while 50% of females reach this reproductive milestone at about 115 cm. Based on data from scientific trawl surveys conducted in the Gulf in January and May, it appears that the Atlantic halibut of the Gulf are able to spawn during those periods. According to the literature, the species spawns at depths greater than 180 m.

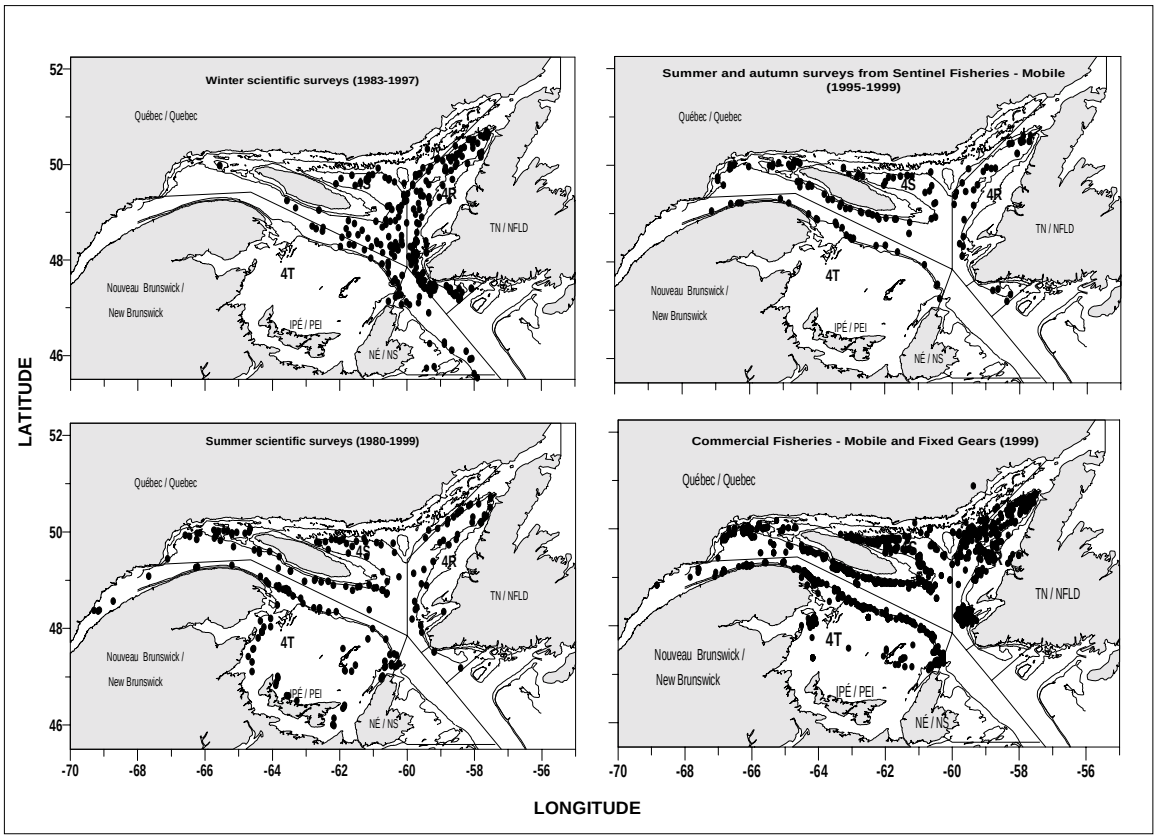

Figure 3. Atlantic halibut catch sites, scientific trawl surveys and commercial fishery.

The pelagic phase of the egg and larva lasts an estimated 6–7 months, a period favourable to dispersal of the species by currents. Scientific surveys conducted in the Estuary and Gulf of St. Lawrence to study zooplankton and juvenile fish have provided data which helped to confirm the presence of Atlantic halibut larvae in the northeastern and southwestern Gulf, between May and August. Larvae were most abundant along the eastern and northeastern coast of Prince Edward Island. The depths at which the larvae were caught ranged from a dozen metres to more than 100 m. Metamorphosis to flatfish form occurs at a size of about 35–45 mm, after which Atlantic halibut become demersal.

Atlantic halibut are voracious, and until they reach a length of about 30 cm, they feed almost exclusively on invertebrates, including krill, small crabs and shrimp. Between 30 and 70 cm, halibut eat both invertebrates and small fish, such as sand lance and gadoids. Individuals over 70 cm long feed mainly on other fishes, including plaice, redfish and gadoids. Because of their large size, active lifestyle and burrowing habit, adults are not subject to notable predation by other marine species. In areas inhabited by both Atlantic halibut and seals, however, such as the Magdalen Islands, seals have been known to attack halibut caught on a longline hook.

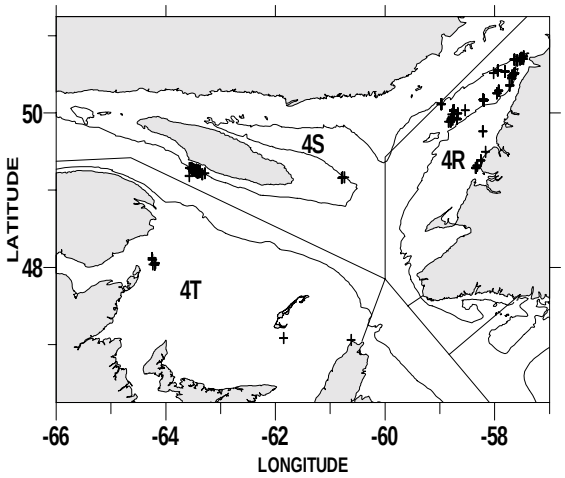

Figure 4a. Halibut tagging sites, 1998 and 1999.

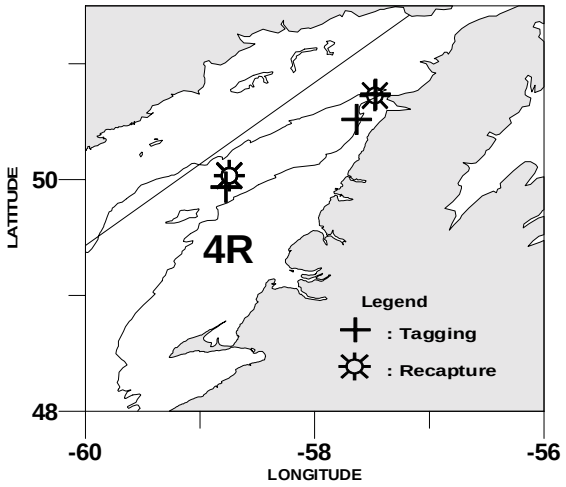

Figure 4b. Halibut recapture sites, 1999.

Tagging studies done on Gulf Atlantic halibut from 1940 to 1950 showed that most fish were recaptured within the Gulf. However, research has also shown that halibut are capable of travelling up to a thousand of kilometres, with the distance travelled being inversely proportional to the size of the individual. Migration by large, sexually mature fish is thought to represent an annual return to spawning grounds.

Tagging Project

When it became mandatory in 1995 to throw back all halibut under 81 cm, industry stakeholders from the west coast of Newfoundland who were involved in the sentinel fisheries decided that it would be a good idea to carry out a tagging project to learn more about the movements and growth rates of these fish and the biological link between the Atlantic halibut of 3Pn and the adjacent stocks of the Gulf (4RST) and Atlantic coast of Canada (3NOPs4VWX5Zc). A tagging project, set up jointly by DFO and the FFAW (Fishermen, Food and Allied Workers), therefore began in the summer of 1998 with a training session on the tagging method to be used. The method is based on the one used by the International Pacific Halibut Commission (IPHC) to tag Pacific halibut.

In the fall of 1998, five fishers from the west coast of Newfoundland tagged 89 halibut, which were returned to the water in the Esquiman Channel or off Trout River (Figure 4a). The tagged fish were between 48 and 80 cm long (Table 1). The tagging project continued in 1999, with the addition of new participants from the southwestern Gulf (4) and the northern Gaspé Peninsula (1) participating in the sentinel fisheries of other areas. A total of 202 halibut less than 81 cm long were tagged in the Esquiman Channel, the area around Anticosti Island, the Miscou Bank, the Magdalen Islands and Cape Breton (Table 1). The size range of the tagged halibut was comparable from region to region, but the mean size differed significantly. In seeking to address the problem of determining to which stock 3Pn halibut belong, a fisherman had been designated to carry out tagging there in 1999. Unfortunately, poor weather conditions during the fishing season prevented him from doing the tagging.

In the summer of 1999, three fish tagged in the Esquiman Channel in the fall of 1998 were recaptured in the Channel near the tagging sites, at depths similar to those where the tagged fish had been caught (Figure 4b). The growth of these fish was

Table 1. Overview of 1998–99 tagging operations.

	Region	Dates	Depths (m)	Number	Length (cm)		
					Minimum	Maximum	Mean
1998							
Newfoundland	Esquiman North	09/26-11/12	232-256	63	48	80	72.14
	Esquiman Center	10/11-10/18	220-234	22	56	79	72.45
	Trout River	08/29-09/01	20-31	4	65	72	67.75
	All	8/29-11/12	20-256	89	48	80	72.02
1999							
Moncton	Miscou	08/16-09/14	27.6	10	44	53	47.80
	Magdalen Islands	09/03	-	1	48		48.00
	Cape Breton	09/21	146.4	1	72		72.00
	All	08/16-09/21	38.4	12	44	72	49.83
Quebec	Anticosti South	07/22-07/29	221.4	53	39	76	55.96
	Anticosti East	07/29	192.8	3	69	71	69.67
	All	07/22-07/29	219.8	56	39	71	56.70
Newfoundland	Esquiman North	7/27-10/2	134.6	46	40	80	69.11
	Esquiman Center	04/20-10/21	132.6	88	47	80	67.57
	Trout River	06/17-09/11	33.4	11	44	66	55.00
	All	04/20-10/21	125.7	134	40	80	67.10

approximately 4–5 cm over a period of 8.5 months at sea.

In a parallel research project, scientists at the National Research Council in Nova Scotia have undertaken studies using genetic markers on Atlantic halibut in Canadian waters. The results of this research will hopefully improve our knowledge of the exchanges between the stocks in the two units as well as with 3Pn.

The Fishery

Data on **landings** of Atlantic halibut in the Gulf of St. Lawrence, divisions 4RST, go as far back as 1893. A review of historical fishing statistics shows that the species was heavily exploited during the first half of the 20th century: catches of over 1000 t were frequently recorded, with peak landings of 4774 and 4160 t observed in 1893 and 1950 respectively. Until the early 1930s, Americans made all of the catches, with mean landings totalling about 1315 t. At the time, the fishery was conducted from schooners and dories using hook-and-line gear, such as jiggers and longlines. In 1933, the Quebec and Maritime fleets began the first Canadian commercial fishery targeting Atlantic halibut in the Gulf. Over the next 20 years, the Canadian fleet made the highest annual landings in its history. From 1933 to 1941, mean annual landings stood at 1665 t. During the postwar period, from 1947 to 1952, the mean annual catch was 2125 t. At that time, American catches were gradually declining, falling to just a few dozen tonnes during the 1950s and finally to nothing in the early 1960s.

During the second half of the century, Atlantic halibut catches in the Gulf never returned to the high levels recorded earlier. Landings remained below 500 t, except in the 1960s. They reached their lowest level on record, 91 t, in 1982 (Figure 5). Catches rose slightly from 1986 to 1991, with landings close to the new precautionary TAC of 300 t, introduced in 1988. However, another sharp drop in landings occurred in 1992. From 1992 to 1995, mean annual landings were 135 t. This drop in landings was chiefly a result of a reduction in fishing effort within the fixed gear fleet, moratoria on cod and redfish fishing and the use of the Nordmore grate by shrimpers. Since then,

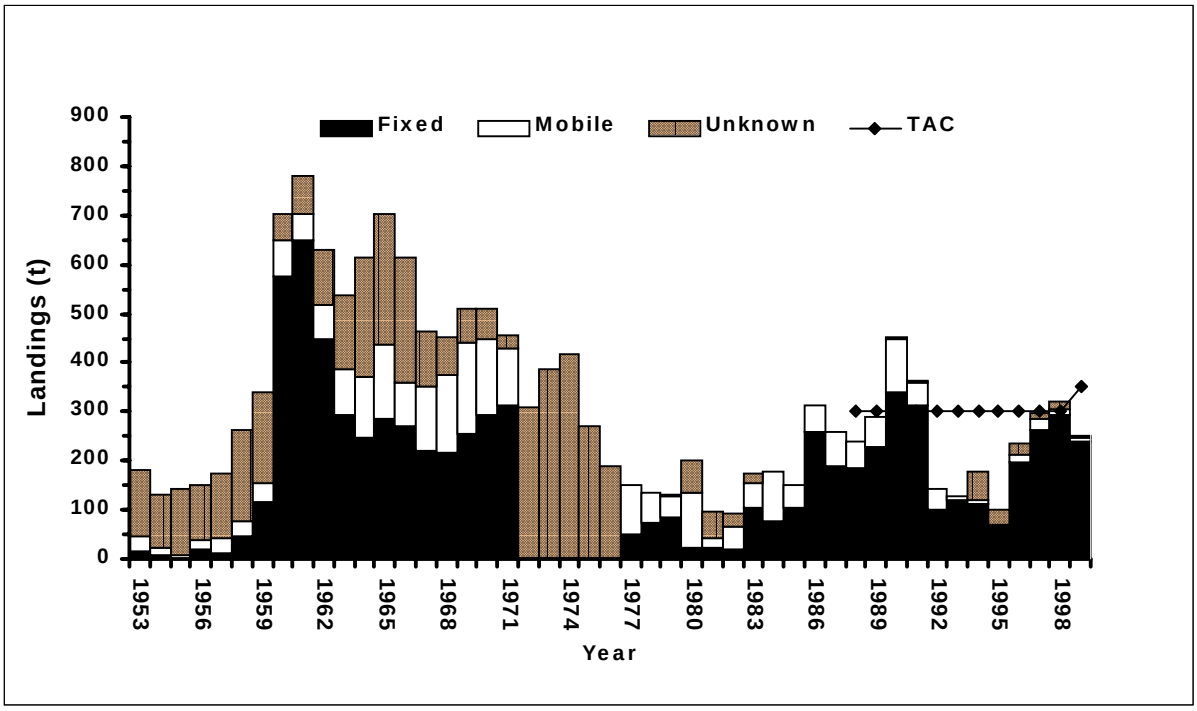

Figure 5. Historical series of commercial landings of Gulf Atlantic halibut, 1953–99.

catches of Atlantic halibut have virtually doubled to reach levels (around 275 t) comparable to those observed in the late 1980s (Table 2). This trend may be due to the redirection of the fishing effort within the fixed gear sector to this species, particularly in 1997, when larger by-catches of cod and white hake were authorized.

Table 2. Gulf of St. Lawrence Atlantic halibut landings (t).

Division	Year						
	1953-1987[1]	1988-1994[1]	1995	1996	1997	1998	1999[2]
TAC	n.a.	300	300	300	300	300	350
4R	144	88	65	198	263	294	238
4S	108	71	3	14	23	13	10
4T	84	97	31	22	10	14	5
Unknown	45	0	0	0	0	0	0
Total	337	256	99	234	296	321	253

n.a. Not applicable

[1] *Average*

[2] *Preliminary data*

Until the early 1980s, more than 70% of the total annual catch came from divisions 4R and 4S. Since then, catches have been divided more or less evenly among the three divisions. However, the landings contributed by the different fleets vary from one division to another and from year to year. The Newfoundland fleet accounts for most of the catches made in division 4R. In divisions 4S and 4T, Atlantic halibut is fished primarily by the Maritime and Quebec fleets, but Quebec is the dominant player by far. The most intensive fishing period is generally from April to September. Most catches are made with longlines and, to a lesser extent, with gillnets and trawls (as by-catches).

The Fishery in 1999

A number of changes were made to the management plan in 1999. Following the recommendations of the Fisheries Resource Conservation Council (FRCC) in 1999, the TAC for the period from April 1, 1999, to April 1, 2000, was raised to 350 t, 7 t of which are set aside for the tagging program.

In addition, in an effort to make access to the resource fairer for all fishers in the under-65-foot fixed gear fleet, quota allocation has been spread across three periods covering the whole year. An important fact to note is that the new 1999 groundfish management plan extends until May 14, 2000.

According to preliminary figures, total landings in 1999 were close to 250 t, which is 100 t below the authorized TAC for 1999 (Table 3). Ninety percent of the catch was taken between April and August, primarily with longlines and, to a lesser extent, with gillnets and bottom trawls.

Table 3. Gulf of St. Lawrence Atlantic halibut landings (t), 1999 (preliminary data).

Division	Gear type	Fleet			Total
		Newfoundland	Maritimes	Quebec	
4R	Fixed	64.8	0	13.4	78.2
	Mobile	0.2	1.2	0.3	1.7
	Total	65.0	1.2	13.7	79.9
4S	Fixed	9.0	0	0.6	9.6
	Mobile	0	0.6	65.0	65.6
	Unknown	0	0	3.4	3.4
	Total	9.0	0.6	69.0	78.6
4T	Fixed	0	20.8	5.2	26.0
	Mobile	0	1.5	65.2	66.7
	Unknown	0	0	1.1	1.1
	Total	0	22.3	71.5	93.8
Total		74.0	24.1	154.2	252.3

As in 1998, 40% of the annual halibut catch was made in division 4T, with the rest divided fairly evenly between divisions 4R and 4S. The Quebec fleet accounted for 61% of total landings, while the Newfoundland fleet took 29% and the Maritime fleet 10%. The Quebec fleet contributed more than 75% of the catches made in divisions 4S and 4T.

Description of Catches

In 1995, the FRCC recommended that halibut under 81 cm be returned to the water, by both commercial and recreational fishers. An examination of the **length composition** of halibut catches clearly indicates that it took some time for this recommendation to have an effect, as the percentage of fish of less than 81 cm in length did not drop significantly until 1998. Furthermore, an examination of the mean and median lengths for this length group indicates that they have steadily increased since the recommendation was implemented (Table 4). In contrast, the mean and median sizes of halibut over 81 cm in length appear to have remained relatively stable for the last three years.

Year	Length group	Sized Fish (N)	Length (cm)			
			min.[1]	max.[2]	mean	median
1990	< 81cm	25	47	79	67.0	68
	> 81cm	7	82	103	87.0	84
1991	< 81cm	87	36	80	70.2	73
	> 81cm	190	81	203	104.4	97
1992	< 81cm	17	25	78	60.4	60
	> 81cm	24	86	202	113.1	100.5
1993	< 81cm	153	34	80	59.5	59
	> 81cm	229	81	190	103.4	98
1994	< 81cm	415	19	80	52.7	49
	> 81cm	352	81	192	106.7	102.5
1995	< 81cm	279	34	80	56.1	54
	> 81cm	245	81	210	119.0	114
1996	< 81cm	217	16	80	67.2	67
	> 81cm	434	81	223	115.0	109
1997	< 81cm	330	10	80	69.1	71
	> 81cm	511	81	242	105.2	98
1998	< 81cm	190	10	80	71.9	74
	> 81cm	851	81	240	104.1	97
1999	< 81cm	66	42	80	74.4	78
	> 81cm	394	81	209	105.9	97

[1] minimum
[2] maximum

Table 4. Commercial catches of Atlantic halibut, by size class, 1990–99.

An examination of size structures for the last five years reveals a clear difference in selectivity in the types of gear used. Since 1997, the size range of halibut fished commercially by mobile gear has shrunk and now runs from 70 to 110 cm (Figure 6a). From 1995 to 1999, mean size rose from 50 cm to 85 cm.

Table 5. Sizes of Atlantic halibut caught with fixed gear, 1991–99.

Year	Gear type	Sized Fish (N)			Length (cm)		
		Total	< 81cm (%)	> 81cm (%)	min.[1]	max.[2]	mean
1991	Lines	208	25.0	75.0	57	200	96.8
1992	-	-	-	-	-	-	-
1993	Gillnets	41	70.7	29.3	34	143	66.6
	Lines	110	4.6	95.5	73	169	102.2
1994	Gillnets	110	94.5	5.5	32	121	49.9
	Lines	385	24.2	75.8	42	192	97.4
1995	Gillnets	71	91.5	8.5	37	117	54
	Lines	367	35.4	64.6	43	210	102.2
1996	Lines	651	33.3	66.7	16	223	99
1997	Gillnets	54	81.5	18.5	38	120	67.9
	Lines	740	33.6	66.4	48	242	94.1
1998	Gillnets	16	81.3	18.8	72	85	78.3
	Lines	1012	16.7	83.3	10	240	98.8
1999	Lines	452	14.4	85.6	42	240	101.7

[1] minimum

[2] maximum

In fixed gear, longlines are far less selective than gillnets, and so a far broader size range of fish is caught with them (Table 5). From 1995 to 1998, the mean size of the halibut measured in commercial gillnet catches varied between 55 and 80 cm, whereas it remained over 90 cm for longline catches. Over the last nine years, the smallest minimum sizes have generally been found in gillnet catches, while the largest maximum sizes have been found in catches taken with lines.

The size frequency distribution curves illustrate the current situation. The left side of the distribution curves represents the smallest fish caught by gillnet whereas larger halibut, taken with lines, are concentrated on the right side (Figure 6b). Since 1998, the greater abundance of individuals measuring between 75 and 110 cm has been associated with increased catches by longlines, which, as mentioned earlier, catch larger specimens.

Industry Comments

As in 1998, the main comments made by fishers in the advisory committees chiefly concerned the validity of the statistics compiled and the management criteria for the stock. Aside from the fact that some by-catches may not be reported, some observers say that young Atlantic halibut are being landed and sold as black turbot (Greenland halibut), which means that official figures are underestimating the total catch of Atlantic halibut.

The effectiveness of making it compulsory to throw back individuals less than 81 cm caught as by-catch by trawls and gillnets was deemed to be questionable. The chances of survival of fish taken by these gear types is very low, owing to their poor condition when landed. Because of the scarcity of groundfish and the high market value of Atlantic halibut at present, fishers are unhappy about having to throw back fish whose chances of survival are almost nil. Fishers are particularly bothered by this because in the last two years they have seen a significant increase in small halibut in their catches.

Longline fishers from the Magdalen Islands who target this species have reported that their catches are subject to intensive predation by seals. Frequently when they haul up their lines, close to half the halibut on the hooks have been largely devoured by seals that pursue their prey right up to the boat.

Nevertheless, the overall perception of fishers is positive: the Gulf of St. Lawrence Atlantic halibut stock appears to be healthy, especially in terms of recruitment.

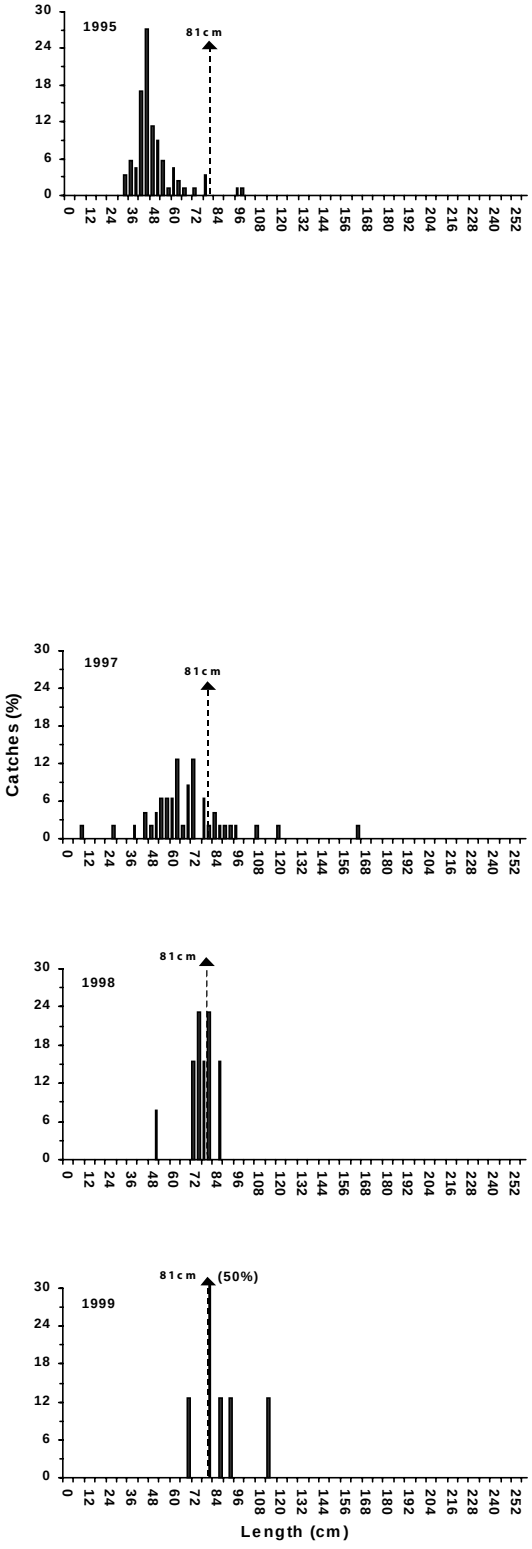

Figure 6a. *Size frequency distribution of Atlantic halibut in commercial catches made with mobile gear (minimum legal size of 81 cm is shown).*

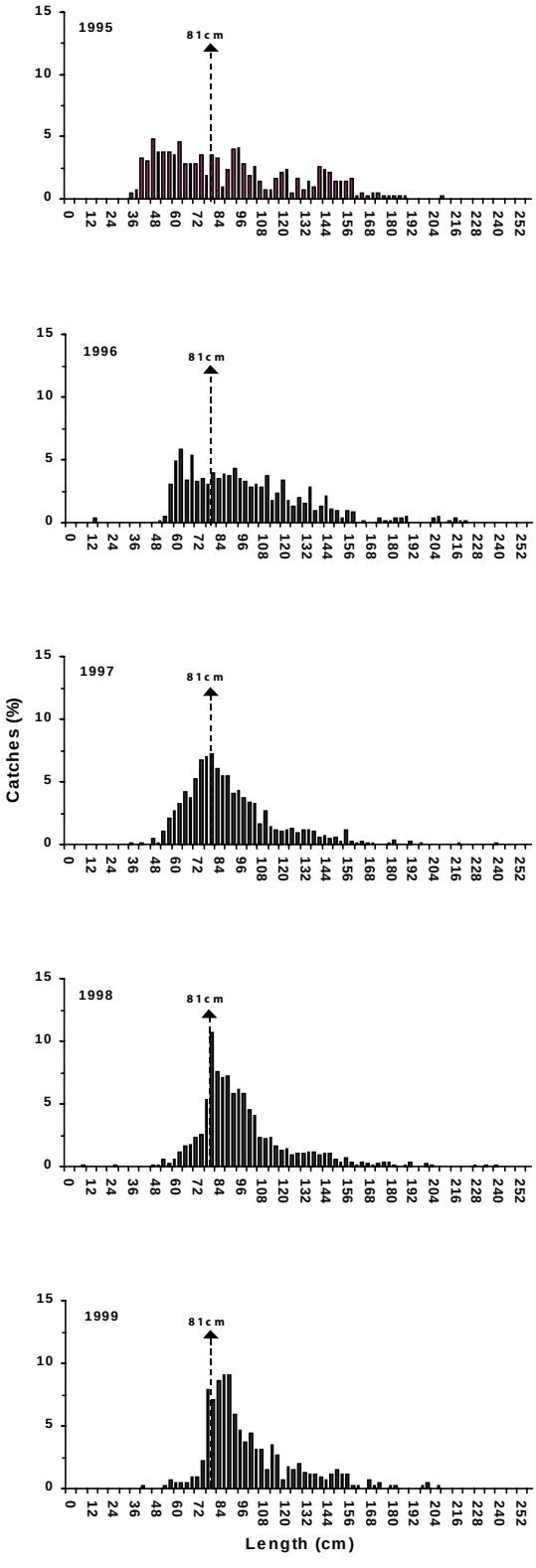

Figure 6b. Size frequency distribution of Atlantic halibut in commercial catches made with fixed gear (minimum legal size of 81 cm is shown).

Resource Status

An examination of size structures shows that smaller halibut, between 75 and 100 cm, accounted for an increasing share of catches from 1995 to 1999, even though large fish (over 120 cm) are still taken. This could be a sign of good recruitment to the fishery. However, the lack of data on catch per unit of effort (CPUE) means that it cannot be confirmed. The other possible explanation would be that there are fewer and fewer large halibut.

Outlook

Although landings in the last few years have been higher than those recorded in the early 1990s, the Atlantic halibut stock of the Gulf still appears to be at a very low level if fishery data going back over a longer period are considered. In the first half of the 20th century, annual landings often exceeded 1000 t, which indicates that the stock was capable in the past of supporting much larger catches than those taken in the last few decades.

The sketchy information available on the stock appears to show, however, that it has maintained some stability. The size structure derived from commercial catch data, notably fixed gear landings, still indicates a broad range, which means that the fish can still live to be quite old.

The minimum legal size was set at 81 cm based on old biological data on growth rates and tagging studies for all Atlantic halibut in Canadian waters. New data on halibut in Canadian Atlantic waters indicate that 50% of females reach sexual maturity at around 115 cm, while 50% of males reach maturity at around 75 cm. The lack of recent data on sexual maturity for the Gulf's halibut stock makes it impossible to confirm whether the minimum legal size of 81 cm is adequate to protect the spawning stock. This current management measure will likely provide good protection to males, but insufficient protection to females.

Management Considerations

In 1988, the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) recommended that halibut under 81 cm be thrown back into the sea in order to reduce the mortality rate of immature fish. In 1995, the FRCC reiterated this recommendation for the Atlantic halibut stock in the Gulf. But it was not implemented until 1996, and then only partially. Depending on the areas, licences and gear used, fishers could or had to throw back any halibut under 81 cm, whether alive or dead. This partial application of the recommendation explains why a relatively high proportion of fish under 81 cm in length were seen in commercial landings from 1996 to 1998, especially in commercial catches of gillnets and mobile gear, and even though shrimpers have had to use the Nordmore grate since 1994.

In 1999, the proportion of halibut under 81 cm in the catches of these two kinds of gear fell sharply and is comparable to that observed for longlines. This improvement is the result of the FRCC's 1998 reiteration of the recommendation that fishers throw back all halibut under 81 cm, including by-catches, and of its additional recommendations regarding adequate monitoring of landings and stricter enforcement of the small fish protocol.

As it is still not known whether Atlantic halibut caught in division 3Pn belong to management unit 4RST or unit 3NOPs4VWX5Zc, management and assessment of these fish remain a concern. As things stand now, fishers have unrestricted access to the resource in this area.

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