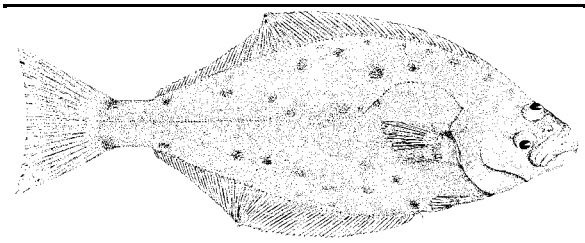

Atlantic halibut of the Gulf of St. Lawrence (Divisions 4RST)

Background

*The Atlantic halibut of the Gulf of St. Lawrence can be found throughout the Estuary and Gulf of St. Lawrence, although they are more abundant in the Esquiman, Laurentian and Anticosti channels, at depths of 200 m and over. This species grows at a fast and continuous rate (about 7.5-8.5 cm per year). Whereas the growth rate for males and females is comparable during the first 10 years of life, sexual dimorphism appears to occur in the 11th year, when females start growing at a faster rate. Female halibut reach a larger maximum size than males (*Scott and Scott, 1988*). A 20-year-old specimen can measure over 2 m in length. Based on observations gathered during scientific trawl surveys conducted in January and May, it appears that the Gulf halibut are able to spawn during those periods.*

The high landings of Atlantic halibut made during the first half of the century indicate that the Gulf of St. Lawrence 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 TAC established in 1988. Since 1996, landings of Atlantic halibut have risen substantially, which is thought to be due primarily to the increased fishing effort by the fixed gear fleet, notably longliners.

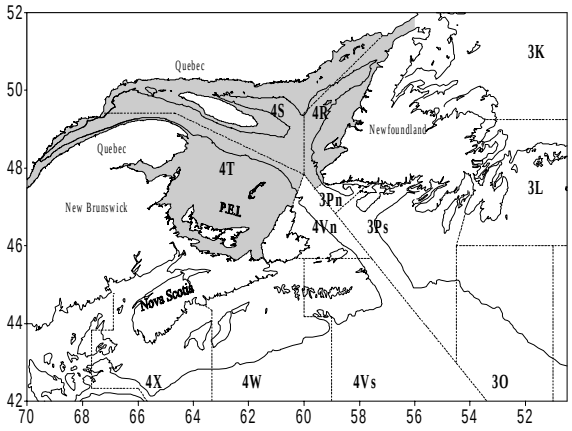

Figure 1. Map of the Gulf of St. Lawrence and adjacent regions showing NAFO Divisions 4RST.

Summary

- Since 1996, total landings of Atlantic halibut have more than doubled and are now close to the precautionary TAC of 300 t; however, they are well below the values of 1000 t and over regularly recorded during the first half of the century.
- During the same period, the fixed gear fleet has steadily increased its contribution to total landings, reaching over 99% of the total in 1998. More than 90% of the fixed gear catches are made by longliners.
- The length distributions of fish caught with fixed gear have always been quite broad, compared to those computed for catches made by the mobile gear fleet. Since 1995, this fleet's catches have consisted almost exclusively of individuals under 100 cm in length.
- Although catches of halibut less than 81 cm long, which is the minimum size limit for the fishery, have declined over the past few years, undersized specimens are still present in catches, notably in mobile gear landings and in gillnet

catches. In gillnet catches, halibut under 81 cm in length account for 50% of the specimens sampled.

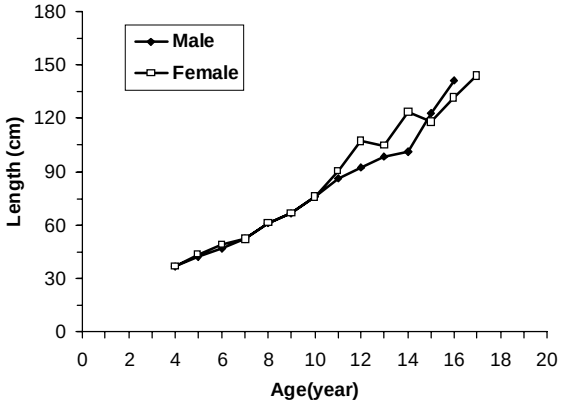

Figure 2. Length at age in male and female Gulf halibut.

Introduction

Atlantic halibut (*Hippoglossus hippoglossus* L.), the largest of the flatfishes, is also one of the largest marine fish species in Canadian Atlantic waters. This species is demersal, living on or near the sea bottom. Atlantic halibut are found on both sides of the Atlantic in cool 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, situated halfway up the west coast of Greenland. Although Atlantic halibut occur throughout the Estuary and Gulf of St. Lawrence, they are especially abundant in the Esquiman, Laurentian and Anticosti channels, northeast of Anticosti Island, at depths of 200 m or more.

Although little is known about Atlantic halibut reproduction in the Gulf, it has been shown that these fish reach sexual maturity at around 10-11 years of age and at sizes varying between 70 and 100 cm, depending on the sex. According to some studies, 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 January and May, it appears that the Atlantic halibut of the Gulf are able to spawn during these periods. According to the literature, this species spawns at depths greater than 180 m. The pelagic phase of the egg and larva lasts an estimated 6-7 months, a period favourable to dispersal of the species by the current. 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, 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. Tagging studies have shown that Atlantic halibut are capable of travelling thousands of kilometres, with the distance travelled being inversely proportional to the size of the individual. Migration by large, sexually mature individuals is thought to represent an annual return to spawning grounds. Tagging studies were done on the Atlantic halibut of the Gulf during the period 1940-1950, with the majority of recaptures occurring within the Gulf of St. Lawrence.

The current management unit for Gulf halibut, corresponding to Divisions 4RST, was defined in 1987 based on the findings from mark-and-recapture studies of individuals tagged within and outside the Gulf, and taking into account additional biological information, such as size and growth rates. A precautionary TAC of 300 t, introduced in 1988, governs the total landings of Atlantic halibut in this

management unit. Another management unit, 3NOPs4VWX5Zc, covers the halibut stock of the Atlantic Coast of Canada (Zwanenburg *et al., 1997*).

Additional biological information

Information on the **abundance** and the **geographic range** of the Gulf halibut are derived mainly from scientific surveys carried out with trawls and from commercial fishing data. Halibut catches are very sporadic during the course of a given scientific survey. When catches are made, the number of individuals caught per tow rarely exceeds two or three. It should be noted that, in contrast with cod or Greenland halibut, Atlantic halibut do not form schools. Nonetheless, since 1996 the total number of halibut caught has increased significantly. Roughly 15 individuals are taken on each scientific cruise, compared with a half dozen specimens in previous years.

From catch data, it is evident that the Atlantic halibut harvested in the Gulf are located primarily in the Esquiman, Laurentian and Anticosti channels at depths of 200 m or over. Whereas in summer, these fish are found mainly near the 200 m isobath, in winter catches are made in the deeper channel waters as well.

Scientific surveys conducted in the Estuary and Gulf of St. Lawrence to study zooplankton and young stages of fish have provided data which helped to confirm the presence of Atlantic halibut larvae in the northeastern and southwestern Gulf, between May and August. The largest abundance of larvae was recorded 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.

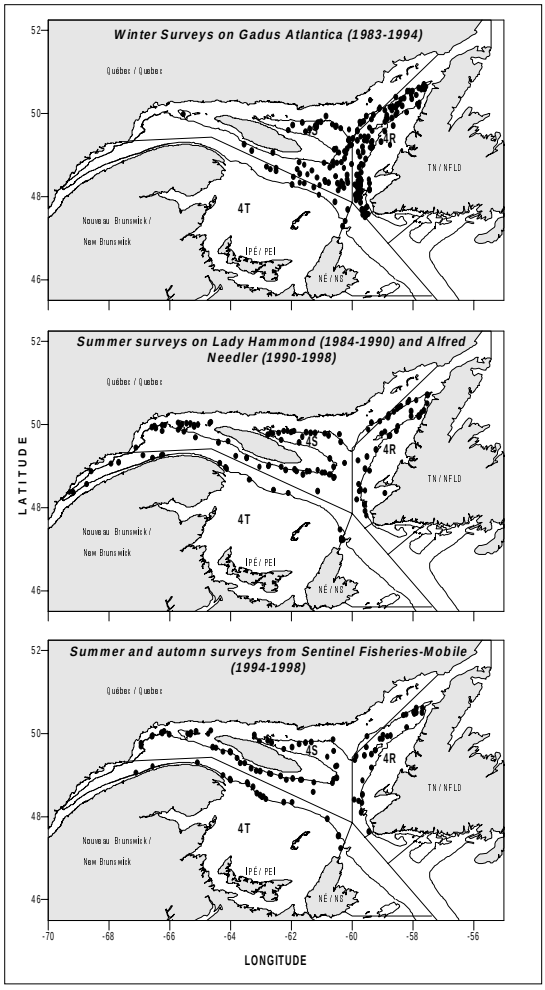

Figure 3. Location of Atlantic halibut catches made during scientific trawl surveys.

The fishery

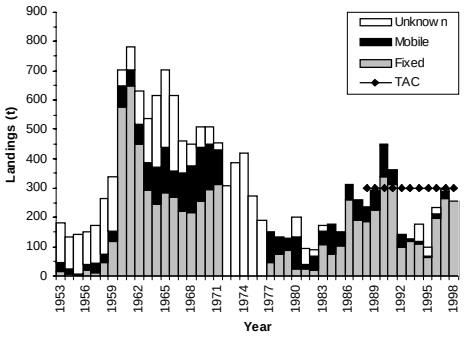

Figure 4. Historical series of commercial landings of Gulf halibut, between 1953 and 1998.

Data are available on **landings** of Atlantic halibut in the Gulf of St. Lawrence, Divisions 4RST, as far back as 1893. A review of historical fishing statistics shows that the species was heavily exploited during the first half of the 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 average 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 fleets from Quebec and the Maritimes began the first Canadian commercial fishery targeting Atlantic halibut, in the Gulf. During this period, the first trawlers also appeared on the scene. Over the following 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 post-war period, from 1947 to 1952, the average annual catch was 2125 t. At this time, American catches were gradually moving downward, reaching just a few dozen tonnes during the 1950s and then zero in the early 1960s.

Landings (tonnes)

Year	1953-1987[1]	1988-1993[1]	1994	1995	1996	1997	1998[2]
TAC	n.a.	300	300	300	300	300	300
4R	144.5	95.0	44	17	79.8	104.7	105.1
4S	107.9	73.8	53	22	95.2	108.1	72
4T	83.7	99.8	80	60	59.7	83.3	80.1
nk	1.2	0	0	0	0	0	0
Total	337.3	268.7	177	99	234.7	296.1	257.2

n.a. Not applicable
nk Not known
[1] Average
[2] Preliminary data

During the second half of the century, Atlantic halibut catches in the Gulf never rose back to the high levels recorded earlier. Landings remained below 500 t, except in the 1960s, and rarely exceeded the precautionary TAC of 300 t. In the early 1990s, Atlantic halibut catches declined considerably, particularly within the mobile gear sector. From 1992 to 1995, average annual landings stood at 135 t. The sharp drop in landings stems largely from the decrease in fishing effort within the fixed gear sector, the moratoria on cod and redfish fishing and the use of the Nordmore grate by shrimpers. However, since 1996 Atlantic halibut catches have nearly doubled, attaining levels comparable to those observed in the late 1980s (about 260 t). 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

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 Maritimes and Quebec fleets, but Quebec is the dominant player by far. The most intensive fishing period is generally from May to September, although fishing sometimes begins as early as April in Division 4R.

The majority of catches are made with longlines and, to a lesser extent, with gillnets and trawls (by-catches). Until now, the effort data for the fixed gear fleet have been sketchy, precluding reliable computation of the catch rate.

The amount of biological data on Gulf halibut collected from the commercial fishery was insufficient until the early 1990s. An examination of the **length**

composition of halibut catches for the past five years revealed a sharp difference in size structures for the different fleets (gear sectors) involved. The size distribution of halibut caught by fixed gear has always been very broad, with a range from 30 to 245 cm. More than two thirds of halibut caught with lines (longlines and handlines) were larger than the minimum legal size of 81 cm; the average size of specimens caught with lines was about 100 cm. By contrast, less than a third of halibut caught with gillnets measured over 81 cm; the average size of the fish varied between 50 and 80 cm. The smallest sizes of fish were generally found in gillnet catches, whereas the largest individuals were recorded for catches made with lines. The shape of the length frequency distribution curves illustrates this very clearly. The left-hand portion of the distributions encompasses the smallest fish caught with gillnets, whereas larger halibut, caught with lines, are concentrated in the right-hand portion (Figure 5a). In 1997 and 1998, the largest abundance of specimens between 70 and 100 cm long is associated with the higher catches made with longlines, which, as mentioned above, catch larger halibut.

Until 1994, the size range of the halibut harvested with mobile gear was basically 20 to 200 cm. From 1995 to 1998, the range of sizes caught declined considerably, and the largest individuals rarely exceeded 100 cm (Figure 5b). During this four-year period, the average size of halibut caught using mobile gear has varied between 50 and 80 cm.

The fishery in 1998

Total landings in 1998 were close to the precautionary TAC of 300 t. Landings have climbed back up to levels comparable to those recorded in the late 1980s. More than

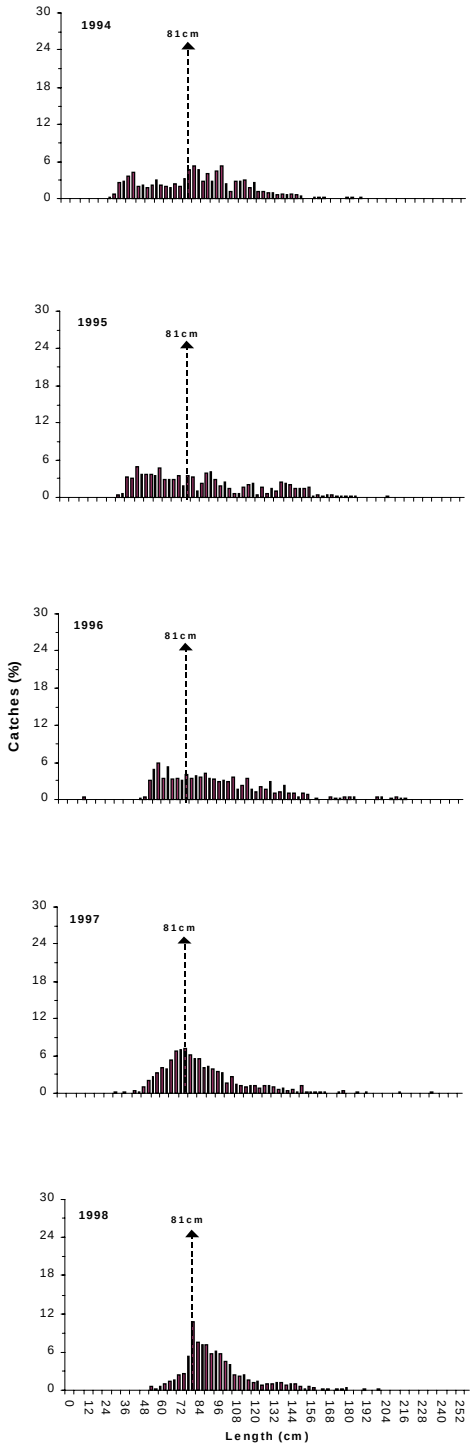

Figure 5a. Size frequency distribution of Atlantic halibut in commercial catches made with fixed gear (The minimum legal size of 81 cm is shown).

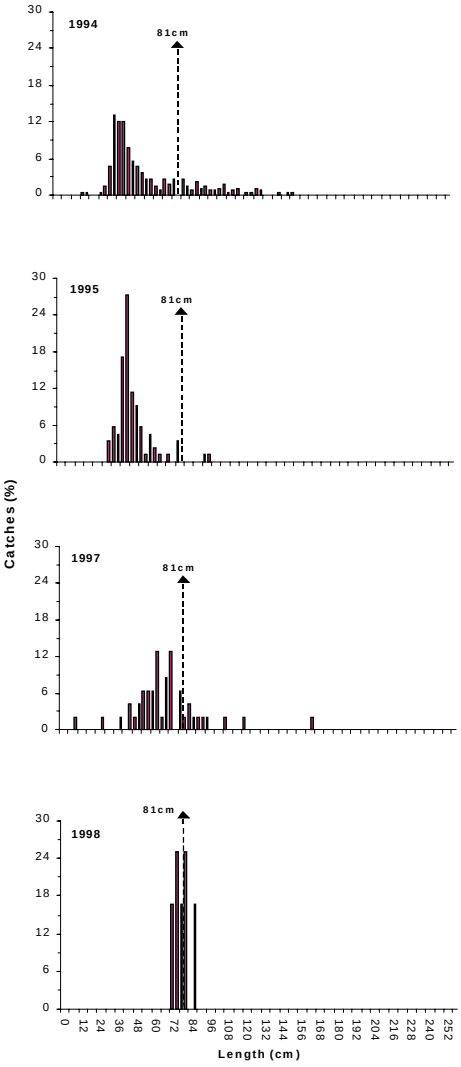

Figure 5b. Size frequency distribution of Atlantic halibut in commercial catches made with mobile gear (The minimum legal size of 81 cm is shown).

40% of catches come from Division 4R, with the rest divided fairly equally between Divisions 4S and 4T. The Newfoundland fleet accounted for over 90% of the landings in Division 4R. The Quebec fleet contributed more than 75% of the catches made in Divisions 4S and 4T. Nearly all of the catches were made between April and August using fixed gear, primarily longlines and, to a lesser extent, gillnets.

Resource status

In 1988, the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) recommended that halibut less than 81 cm be returned to the water, in order to reduce mortalities of immature fish. Although the inshore fleet targeting Atlantic halibut outside the Gulf followed this recommendation as of 1994, it was not officially implemented until 1996, and at that time it was applied only partially, to the Gulf stock. Depending on the region, type of licence and fleet sector, fishers could or were required to return to the water all halibut under 81 cm long, whether alive or dead. This partial implementation of the recommendation explains why a number of specimens less than 81 cm in length were still present in commercial landings of recent years.

An assessment of the length distribution of halibut caught with fixed gear shows that the size distribution is still broad. The survival rate of halibut therefore appears to be quite good, at least once they reach a size of 80-90 cm. It is possible that these large individuals are not very vulnerable to trawls and gillnets. They are believed to be moderately vulnerable to longlines. An analysis of the range of sizes caught with longlines over the past few years shows that the ranges are still as broad as before.

Evaluation and outlook

Industry comments

The main comments made by fishers concerned aspects of management, including the validity of the statistics compiled, fishing practices in the different regions and the management criteria for the Gulf stock.

Aside from the fact that some by-catches may not be reported, fishers on the west coast of Newfoundland mentioned the possibility that young Atlantic halibut are being landed and sold as Greenland halibut (FRCC, 1998). Total catches of Atlantic halibut may therefore be greater than the official data indicate, particularly with respect to halibut less than 81 cm.

According to some fishers, the obligation to throw back individuals less than 81 cm, whether alive or dead, should be imposed on the recreational fishery as well, not just on the commercial fishery. Moreover, it seems that this rule has not been complied with rigorously in all the Gulf regions, or by all fleets. Other industry members stated that they found this measure more or less valid for halibut by-catches made by trawls and gillnets. The chances of survival of fish taken by these gear types is very low, owing to their poor condition upon being 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 from the Magdalen Islands who conduct directed fishing for this species have asked that certain changes be made to the allocation of quotas, by region and/or by period of year. Indeed, it is very difficult to catch halibut with longlines in August. The quotas have almost been attained, either because of the high landings of Atlantic halibut associated with other fleets' by-catches of halibut, or because of large catches of halibut earlier in season by other divisions.

Some fishery stakeholders asked what management unit the Atlantic halibut caught in Division 3Pn belong to. It appears that, when the two management units were established in 1987, subdivision 3Pn was not included in either of the adjacent units; hence the questions about management and assessment for that area.

Finally, the overall perception of fishers is positive: the Gulf of St. Lawrence Atlantic halibut stock is healthy and improvements are occurring especially in terms of recruitment.

Tagging project

In view of the fact that is now mandatory to throw back all halibut less than 81 cm, industry stakeholders from the west coast of Newfoundland who are involved in the Sentinel fisheries pointed out 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. A tagging project, set up jointly by DFO and FFAW, was therefore initiated at the beginning of summer 1998 with a training session on the tagging method to be used. This method is based on the approach used in routine tagging of Pacific halibut carried out by the International Pacific Halibut Commission. It basically consists in inserting a spaghetti tag (a thin steel wire covered with plastified vinyl) through the operculum. Tagging is done only on halibut less than 81 cm taken with longlines.

In fall 1998, five fishers from the west coast of Newfoundland tagged 89 halibut, which were captured and then returned to the water in the northern part of the Esquiman Channel. The size of the tagged fish varied between 48 and 80 cm. The tagging project will continue in 1999 thanks to the collaboration of stakeholders participating in the Sentinel fisheries. In addition to tagging more fish in Division 4R, an effort will be made to tag halibut from Divisions 3Pn and 4T, in the northern Gulf.

Outlook

In 1995, catches of Gulf halibut reached a record low level of less than 100 t. This low

value is largely attributable to the decrease in fishing effort within the fixed gear sector, the cod and redfish moratoria and mandatory use of the Nordmore grate by shrimpers. However, catches have doubled since 1996 and they now are close to the precautionary TAC (300 t). This increase is thought to have occurred owing to the redirection of fishing effort to this species within the fixed gear sector. However, from a historical standpoint, the stock appears to be at a very low level. During the first half of the century, landings often exceeded 1000 t, which indicates that the stock used to have the capacity to support much larger catches than those made over the past few decades.

The sketchy information available on the stock appears to show that it has maintained some stability. The size structure derived from commercial catch data, notably fixed gear landings, still shows a broad range. It includes many fish less than 81 cm in length; they are likely to contribute to reproduction.

Although the proportion of Atlantic halibut less than 81 cm long declined in 1998, the percentage of undersized fish in trawl and gillnet by-catches is still high. More than half of the individuals caught with mobile gear and more than three quarters of those caught with gillnets are believed to be less than 81 cm. While the regulations require that halibut of this size be thrown back, their survival rate does not appear to be very high, particularly for individuals caught with trawls as opposed to longlines (Neilson *et al., 1989*).

If current fishing practices are maintained, the stock is unlikely to rebuild soon to levels comparable to those seen in the first half of the century. Consequently, it would be wise to endeavour to reduce the number of fish under 81 cm present in the by-catches of mobile gear and gillnets. This approach would give sexually mature halibut the opportunity to contribute to the spawning stock.

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