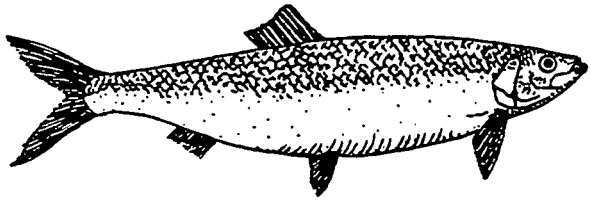
STOCK STATUS REPORT

LAURENTIAN REGION

Maurice Lamontagne Institute
P.O. Box. 1000, Mont-Joli, Québec, G5H 3Z4, CANADA

DFO, Atlantic Fisheries, Stock Status Report 96/39 March 1996

ATLANTIC HERRING IN THE NORTHERN GULF OF SAINT-LAWRENCE (4R)



INTRODUCTION

Herring (Clupea harengus) are found throughout the waters of the northwest Atlantic from Labrador to Cape Hatteras. In Canada, they are fished mainly within the Gulf of St. Lawrence, in eastern and southern Newfoundland, and in southwestern Nova Scotia and the Bay of Fundy.

The herring is a migratory species which, over the course of a year, will travel extensively throughout its area of distribution from spawning areas, to feeding and overwintering areas. These migration patterns are repeated year after year with considerable regularity. They are found nearshore in the spring and fall where they congregate around traditional spawning beds to reproduce. They also typically assemble in large concentrations in the late fall in preparation for their departure to over-wintering areas where the water temperatures are more stable.

Within most of the distributional range of northwest Atlantic herring, we can find populations which spawn either in the spring (April to June) or in the autumn (August to October). Each seasonal-spawning population is considered to be a separate stock for fisheries management. In addition, within each seasonal-spawning stock, there are local spawning components associated with specific spawning areas. The interrelationship between these local components has yet to be clearly established, although most evidence suggests that once an individual spawns in a given area, it will return to spawn in that area year after year. Therefore, the repeat spawners of a local spawning component are subject to over-exploitation if fishing effort is concentrated on them disproportionately to the rest of the stock. Furthermore, a

local component may not rebuild at the same rate as the overall stock if the recruitment to that component is not in proportion to the overall recruitment to the stock.

The herring found along the west coast of Newfoundland are comprised of both spring and autumn spawners. These seasonal-spawning stocks are fished both together in mixed schools and singularly in spawning aggregations. The major spring-spawning areas are located at the southern end of the coast in and around St. George's Bay (4Rd) and Port-au-Port Bay (4Rc) although several other spawning sites are known along the coast towards the north (Figure 1). Mature herring arrive and congregate in these areas from the end of April to the middle

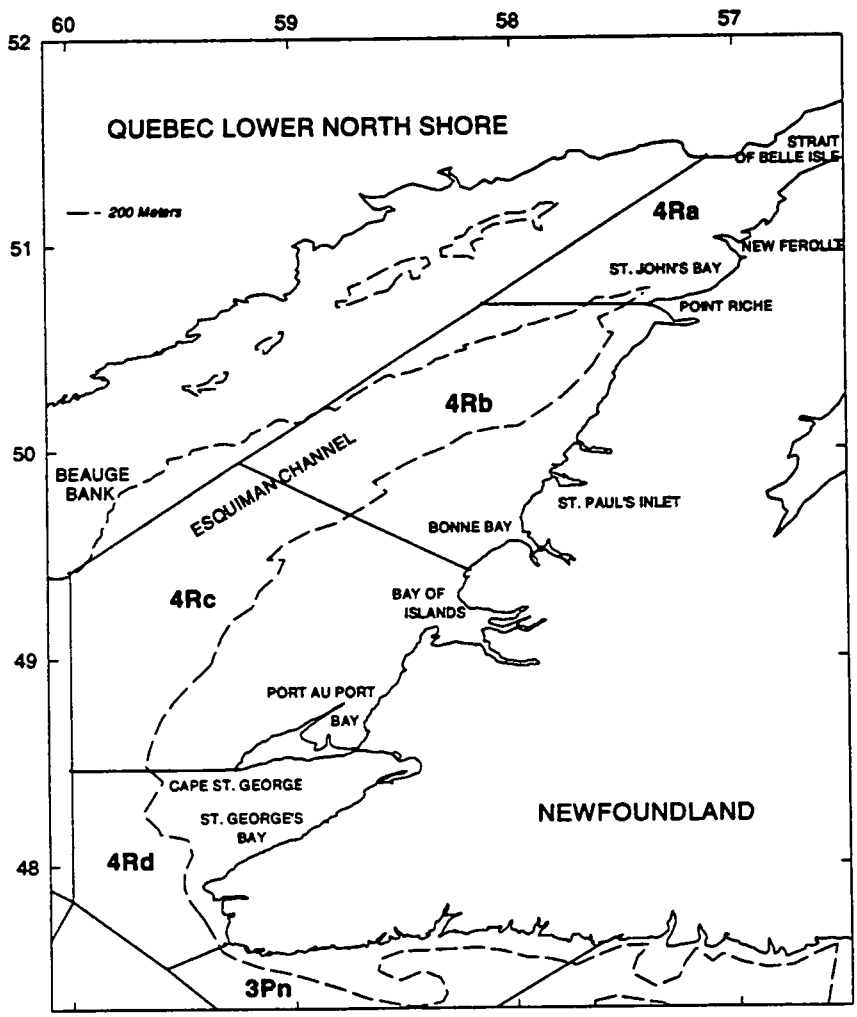


Figure 1. West coast of Newfoundland (NAFO division 4R) herring management units.

of June, spawning on several traditional grounds before dispersing. Autumn spawning is concentrated mainly north of Point Riche (4Ra) from mid-July to mid-September. At other times of the year, these two spawning stocks are mostly found in mixed schools in either feeding or overwintering areas. The major feeding areas (off St. George's Bay in the spring, off Point Riche and in the Strait of Belle Isle in the summer and off Bonne Bay in the fall) are associated with concentrations of copepods (red-feed) and/or euphausiids (krill) which are their main food items. They are believed to overwinter in the deeper waters of the Esquiman Channel (Figure 2).

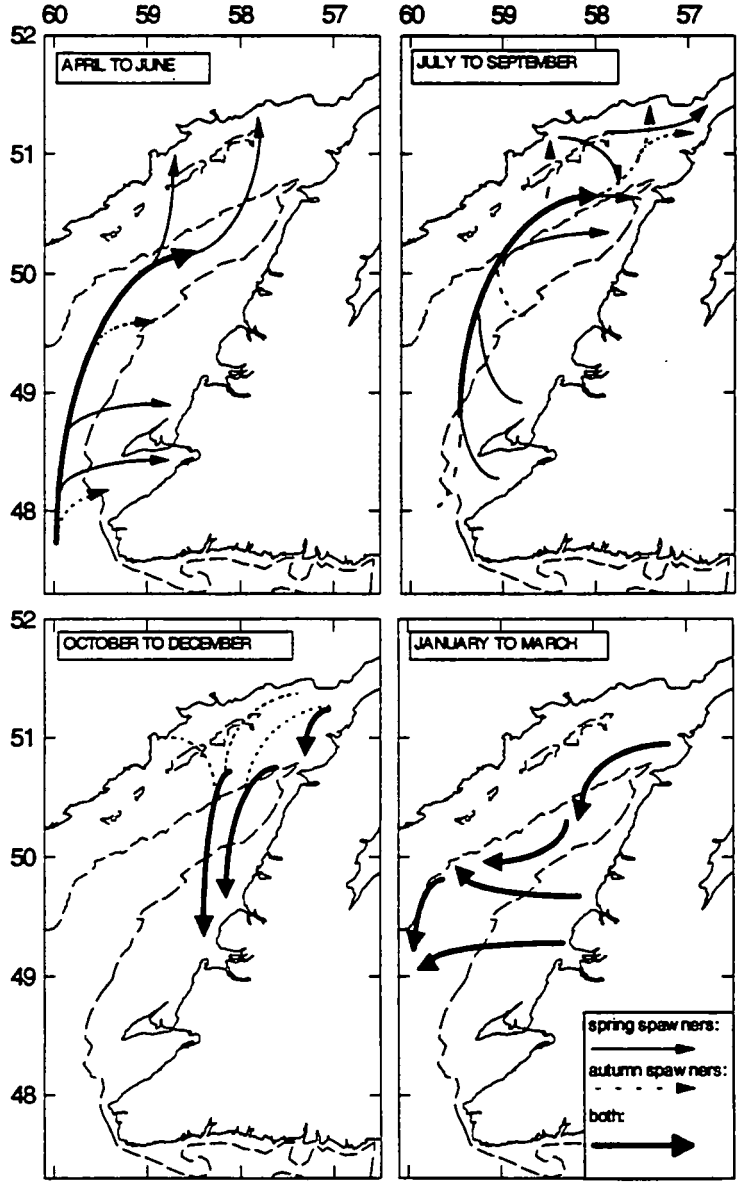


Figure 2. Probable annual migration pattern of northern Gulf spring- and autumn-spawning herring.

You will find in the following sections specific information concerning the 4R herring stocks which was prepared, presented and reviewed during a meeting of the Regional Working Group of scientific experts held between March 5-8 in Mont-Joli, Quebec.

DESCRIPTION OF THE FISHERY

Nominal catches

The herring stocks in 4R are exploited mainly by large (>85') purse seiners, small (<65') purse seiners and to a lesser extent by fixed gillnetters from April to December. Since 1985, the proportion of the total catch taken by all purse seines has been in excess of 80%, and even reached 98% in 1993.

Over the past decade, total herring landings from the west coast of Newfoundland averaged 17,512 t (from 12,400 t to 26,400 t) as compared to 14,100 over the previous decade (Figure 3).

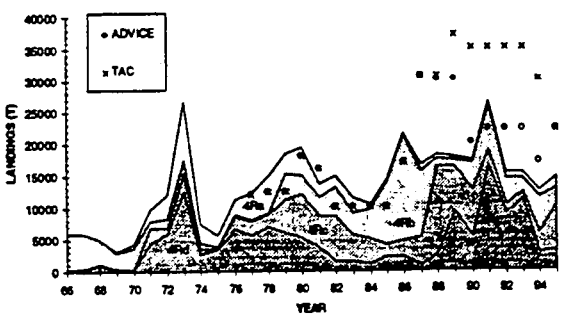


Figure 3. Cumulative commercial herring landings (t) by unit area in NAFO Division 4R from 1966 to 1995 (TAC and assessment advice are indicated).

In 1995, total landings were limited to 14,500 t (Table 1) due mainly to the closure of the St. George's Bay spring fishery, and to poor fishing conditions in the fall (e.g. herring close to bottom and high winds).

Table 1. West coast of Newfoundland herring landings (t) by gear sector since 1988.

	Year							
Gear	1988	1989	1990	1991	1992	1993	1994	*1995
Purse seine	16353	16660	16301	25594	14667	15061	11488	13173
Gillnet	1792	1027	983	842	669	247	893	1376
Total	18145	17687	17284	26437	15336	15308	12380	14549

* Preliminary statistics

The Purse Seine Fleet

From 1984 to 1987, up to 80% of the purse seine catches were taken in areas 4Rb and 4Rc from October to December from over-wintering concentrations of herring. Since 1988, the development of a spring fishery contributed to a considerable increase in landings from 4Rc and 4Rd, from approximately 2,000 t in 1987 to 12,400 t in 1991. The spring purse seine fishery accounted for over 70% of the total catch in 1990 and 1993 (Figure 4).

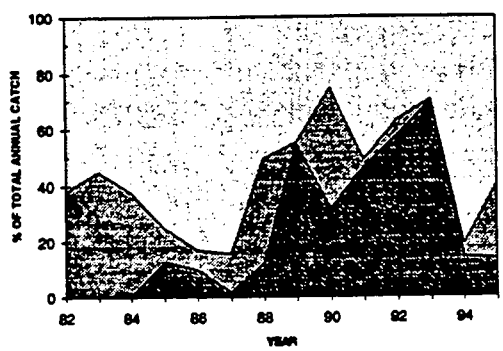


Figure 4. Proportion of total annual catch taken by purse seines in fishing areas 4Rc and 4Rd in the spring between 1982 and 1995.

This proportion has diminished to below 40% since 1994 when St. George's Bay was closed to commercial fishing for the spawning season.

Concurrent with changes to the fishing pattern of the large purse seine fleet has been an increase in the activity of the smaller purse seiners along the west coast since 1989. Annual landings from this gear sector had not exceeded 800 t until 1992, when they landed 2,200 t. From 1993 to 1995, this fleet has landed from 3,100 t to 3,800 t per year.

The Gillnet Sector

Due to a limited market demand for gillnetted herring, reported landings from the fixed gear sector have generally been below 10% of the total 4R landings since 1985. Since 1991, the late fall (October-December) fishery has been extremely limited, accounting for less than 200 t annually.

Spawning Stock Proportions in the Catch

In the spring, herring schools in and around the major bays in the south (near the spawning beds) are typically dominated by spring spawners, while the autumn spawners are more prevalent in deeper waters outside of St. George's Bay or north of Cape St. George. In the summer and fall, autumn spawners dominate nearshore towards the north. In the late-fall purse seine fishery, catches are approximately 50/50 spring and autumn spawners.

Spring spawners have dominated the catch in every year since at least 1973, averaging 72% of the catch in numbers. This percentage increased to over 80% between 1988 and 1990 due to the active spring fishery in St. George's Bay, which exploited mainly pre-spawning and spawning herring. With the closure of St. George's Bay to commercial fishing in 1994, the percentage of spring spawners in the total catch decreased to under 60%.

Age Composition of the Catch

Since the mid-1980's, the 1980 and 1982 spring-spawner year-classes have been important contributors to the total catch (Figure 5).

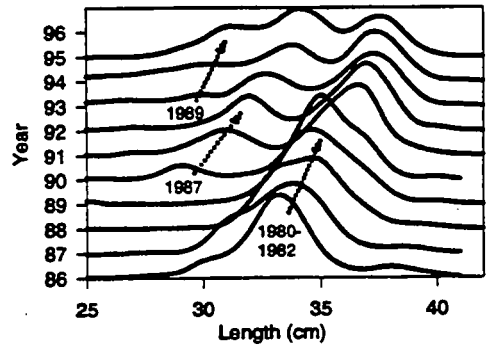


Figure 5. Annual length frequencies of spring-spawning herring from the 4R commercial fishery between 1986 and 1995 (major year-classes are indicated).

In 1991, the 1987 year-class recruited strongly to the purse seine fishery. From 1993 to 1995, the 1989 and even the 1991 year-classes have also become more important in the overall spring-spawner catch. However, it was noted last year that the 1987, 1989 and 1991 year-classes were more abundant in the fall fishery in the more northerly areas and were of only minor importance on the southern spawning grounds in the spring. In 1995, these recruiting year-classes were seen in the purse seine catches outside of St. George's Bay in the spring and all along the coast in the fall. Biological samples

supplied by the index fishermen in St. Georges Bay (4Rd) and Port-au-Port Bay (4Rc) showed that in 1995, the 1987 year-class was for the first time as important on the spawning beds as the 1980 and 1982 year-classes (Figure 6).

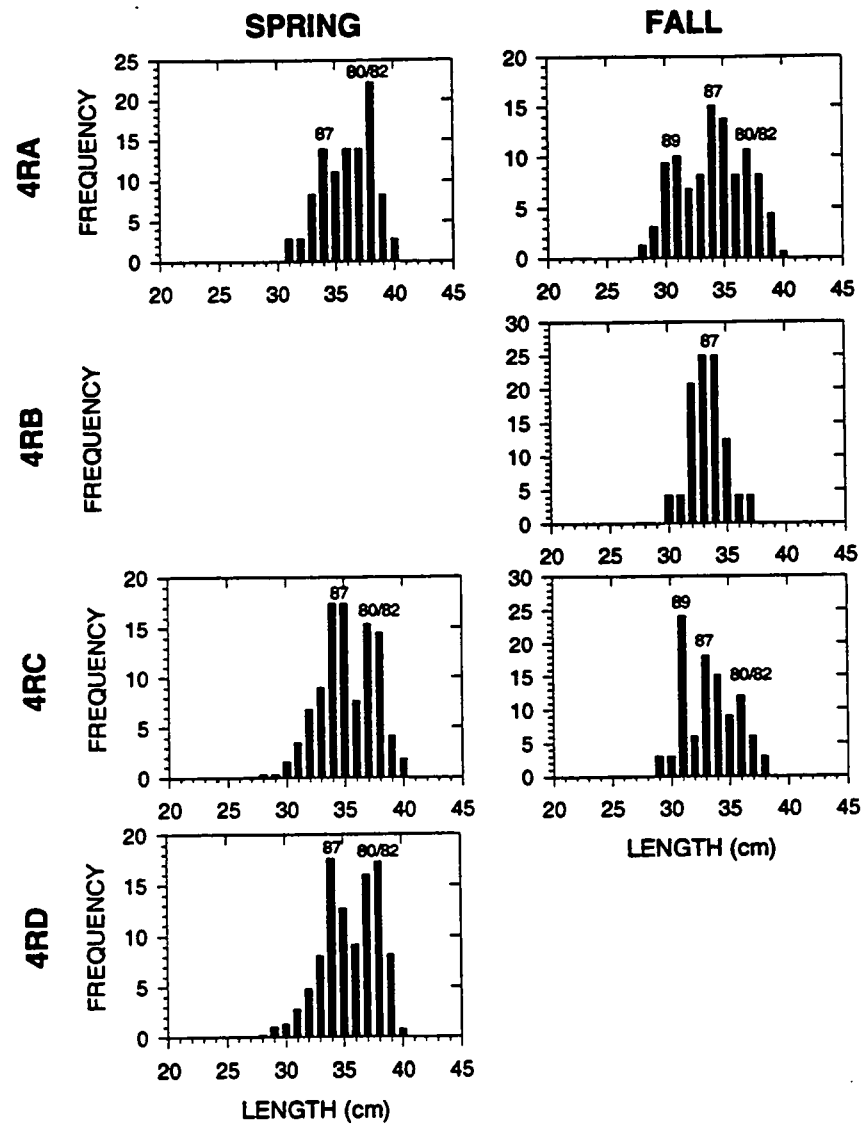


Figure 6. Length frequencies of spring-spawning herring from the spring and fall gillnet fisheries (major year-classes are indicated).

Since 1983, the 1979 autumn-spawning year-class has been the most important contributor to the fishery from this stock (Figure 7) and is still dominant in some areas.

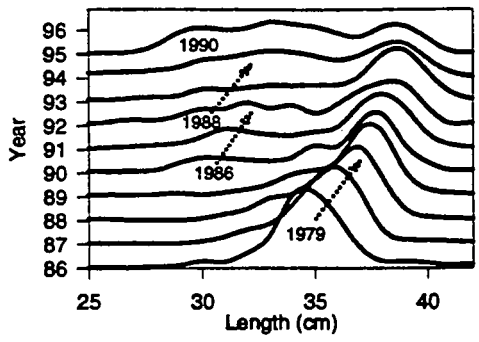


Figure 7. Annual length frequencies of autumn-spawning herring from the 4R commercial fishery between 1986 and 1995 (major year-classes are indicated).

Since 1990, the 1986 year-class has strongly recruited to the autumn-spawner purse-seine catch. Since 1992, the 1988 year-class has also contributed significantly to the total autumn-spawner catch, with the 1990 year-class also appearing to be above average in recent years. These three year-classes have gradually increased in importance in the gillnet fishery since 1992.

ABUNDANCE INDICES

Index-Fisherman Catch Rates

Detailed logbooks of daily catch and effort data from index gillnet fishermen were analysed to generate abundance indices for both the spring- and the autumn-spawning stocks. These fishermen set their nets in the vicinity of either the major spring-spawning sites around St. George's Bay and Port-au-Port Bay or the autumn-spawning areas north of Point Riche. The standardized spring-spawner catch rates indicated that the 1987 year-class was not sufficiently abundant in the southern bays to rebuild this local spawning component given the heavy fishing effort exercised on it in the early 1990s. This catch-rate index declined again in 1995 to its lowest historical level (Figure 8).

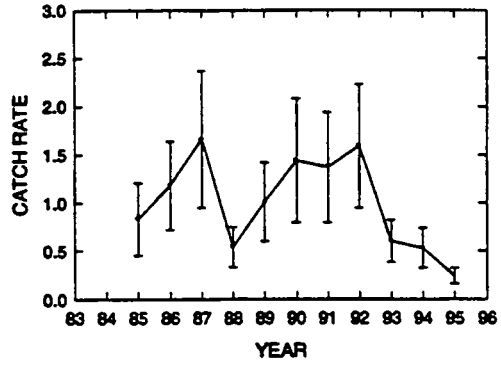


Figure 8. Standardized gillnet catch per unit effort calculated for spring-spawning herring in 4Rd from index-fisherman logbook data.

The 1986 autumn-spawning cohort appeared quite strong in the index-fisherman catch rates in 1992 and seemed at that time to be well above the 10-year average. However, it declined sharply in 1992 and 1993 and has now stabilized at a low level (Figure 9).

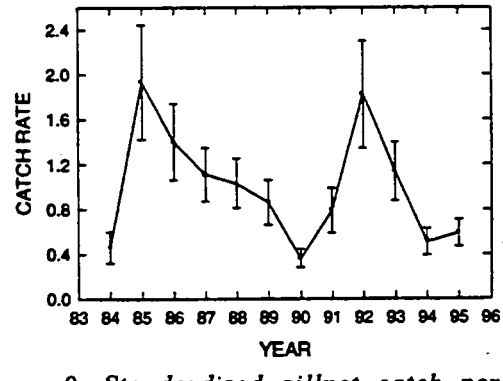


Figure 9. Standardized gillnet catch per unit effort calculated for autumn-spawning herring in NAFO division 4R from index-fisherman logbook data.

Although this catch rate index seemed to reflect the strong recruitment of the 1986 year-class, its sharp decline was unexpected given the low fishing effort on the autumn-spawning stock. In addition, the recent recruitment of the 1988 year-

class has not been reflected in the index, which puts in doubt its usefulness as a measure of abundance. It is possible that this index is more a reflection of a change in availability, since it is known that autumn herring spawn farther offshore and are less available to inshore fixed gear than are the spring spawners.

Acoustic Surveys

Fall acoustic surveys have been conducted biannually since 1989. The 1995 survey was undertaken in close collaboration with the west coast large seiner fleet. A scientific staff was invited aboard four of these seiners over a two week period to take temperature profiles and to collect biological samples while our research vessel, the F.G. Creed, collected the acoustic data. This survey included the entire west coast of Newfoundland from St. George's Bay to St. Barb Bay covering 7,100 km^2 (Figure 10).

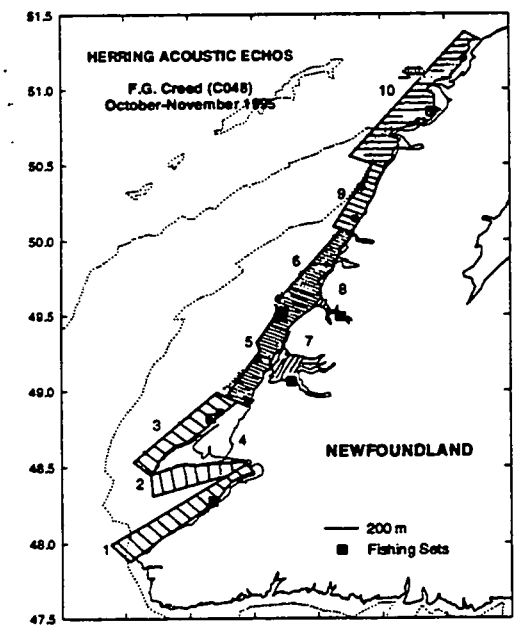


Figure 10. Locations of survey transects, herring acoustic echos (proportional circles)and fishing sets for the 1995 fall 4R acoustic survey.

The 1995 acoustic minimum biomass estimate of 83,500 t (37,500 t of spring spawners and 46,000 t of autumn spawners) was an increase over the 1993 estimate of 66,000 t (31,000 t of spring spawners and 35,000 t of autumn spawners). However, as was stated in last years' report, the 1993 estimate is considered to be low as two northern strata were not surveyed due to bad weather, and fishing activity at that time confirmed the presence of herring schools in these strata. In 1995, 64% of the herring biomass surveyed was in these two northern strata. The distribution of herring in the remaining strata was similar from 1993 to 1995, even though the survey was conducted three weeks earlier in 1995.

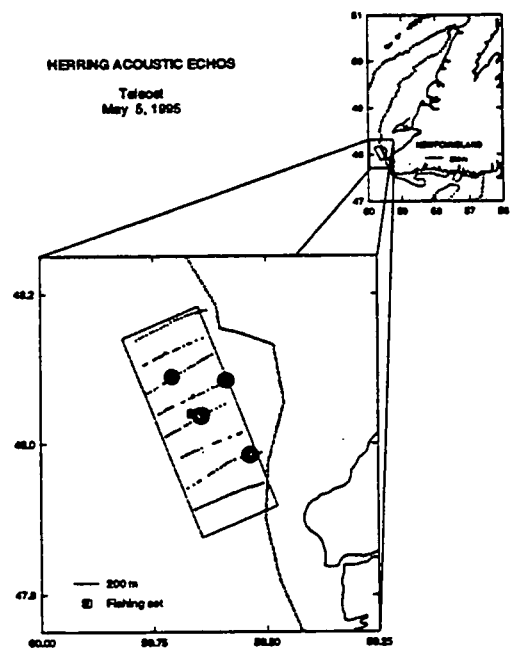


Figure 11. Locations of survey transects, herring acoustic echos (proportional circles) and fishing sets during the 1995 spring acoustic survey off St. George's Bay.

An additional acoustic survey was conducted in the first week of May, 1995 aboard the CSS Teleost (Figure 11). This survey was undertaken during a single night to locate schools of autumn-spawning herring outside of St. George's Bay (the bay itself was closed to commercial fishing). The survey strata was defined from information supplied to us by purse seine operators fishing in this area as well as from our own explorations. In addition, a purse seine captain was aboard the Teleost to assist in the design of the survey. This survey estimated the presence of approximately 12,400 t of herring (8,000 t of autumn spawners and 4,400 t of spring spawners) within a 390 km^2 area. Other herring schools were seen northward along the coast during that same week, although their abundance and composition were not estimated.

Industry Input

Comments collected from written questionnaires sent to all licensed inshore herring fishermen in 4R as well as from our index fishermen indicated a slight improvement in spring-spawning activity. The index fishermen noted that in several areas, notably around Port-au-Port Bay, the main spawning period was again later than usual this year (first of June). This period corresponds to when the 1987 year-class was dominant in the samples and when the catch rates were the highest for the season. However, in St. George's Bay, spawning activity was again quite weak this year, and consisted mainly of a mixture of older (1980 and 1982 year-classes) and younger (1987 year-class) fish. This suggests that the 1987 year-class has not replaced the 1980 and 1982 year-classes in St. George's Bay, as it has done elsewhere, and therefore cannot be counted upon to rebuild this spawning component. The 1989 year-class, which has been captured in the fall gillnet fishery since 1994, has yet to be seen in large numbers in these southern bays. These observations are consistent with the catch rate data from index-fishermen in these areas.

North of Point Riche in 4Ra, the general opinion is that the abundance of herring is average to good especially in the summer and fall. Biological samples showed a predominance of younger (1986 and 1988 year-classes) fish in these areas at that time. Spawning in the fall was noted mainly around Ferolle Point, but was not considered by our index fishermen to be extensive in this area nor around Forresters Point. They suggested that unfavourable winds from the southwest which dominated the season had moved the autumn herring offshore into deeper water, where they were less available to their gear.

Comments from the purse seine logbooks suggested that there was an abundance of herring along the coast throughout the year, but that they were often difficult to catch. In the spring, the herring outside of St. George's Bay were assembled into schools but were often too deep to fish (160-200 m). In the fall, the herring were found in shallower water, but were generally too thinly aggregated and too close to the bottom for purse seining. Both of these observations were confirmed during our two acoustic surveys.

ASSESSMENT

Spring Spawners

Acoustic abundance estimates indicated a spring-spawning minimum stock biomass of approximately 37,000 t in October-November of 1995. In 1993, the acoustic survey found 31,000 t of spring spawners. However as stated earlier, this latter survey undoubtedly underestimated a significant portion of the stock since commercial catch data showed that herring were in the two northern strata which were unsurveyed.

The spring-spawner catch-rate data indicated that the mature biomass in the southern spawning grounds had dropped dramatically in 1993, primarily due to (1) the lack of strong recruiting year-classes to this area over the past 10 years combined with (2) the concentration of fishing effort on this local spawning component between 1989 and 1993. In 1995, this catch-rate index suggested that this major component of the spring-spawning stock continues to be at a very low level.

Comments received from index fishermen and from the written questionnaires suggest little improvement over 1994 in St. George's Bay, although there are signs of more intensive spawning by the 1987 year-class around Port-au-Port Bay.

The present analyses support last years' conclusion that special measures must be taken concerning the St. George's Bay/Port-au-Port Bay spawning grounds to protect the spring spawners in these areas. The closure of these bays in 1995 had the desired affect of concentrating fishing on the autumn spawners outside of St. George's Bay, of decreasing the quantity of spring spawners in the total catch and of allowing these fish to spawn undisturbed.

Autumn Spawners

The 1995 acoustic estimate placed the minimum autumn stock biomass at 46,000 t. The majority of these herring were located in the northern strata, which normally are not heavily fished at this time of the year. These herring were not formed into schools, but rather were in a relatively thick, dense layer close to the bottom. Although the 1993 estimate was considerably lower (35,000 t), the missed northern strata in this survey may well account for the difference, as the commercial fishery was catching mostly autumn spawners in these strata at that time.

The spring acoustic survey was able to measure a significant amount of herring (65% autumn spawners) outside St. George's Bay, which were concentrated into schools in the mid-water (160-200 m) and which were dominated by older (1979 year-class) fish. Most of the spring purse seine fishery was localized on these schools.

The logbook catch-rate data indicated strong recruitment by the 1986 year-class in 1992, although the index has declined sharply since then. This trend is in contradiction with other indices which show this stock to be in relatively good condition: (1) the fall acoustic survey estimate of at least 46,000 t, (2) the light exploitation of this stock over the past decade, i.e. less than 28% of the total catch and (3) responses to a written questionnaire indicating that the situation with this spawning component north of Point Riche is relatively good but that the

market for gillnetted herring is very limited. It is quite possible that the index-fisherman catch-rate series has become less reliable due to (1) a decrease in participation in the program (four logbooks in 1993 and three in 1994) and (2) the decrease in availability to inshore gillnets as the herring have moved farther offshore.

PROGNOSIS

Northern Gulf Herring Stock Status

The present analyses of the available commercial and research data has allowed us to confirm last years' assessment that the status of these herring stocks is generally healthy. Relatively young year-classes continue to dominate among both the spring- and autumn-spawning herring in both the purse seine fishery and in the research surveys. The 1995 fall acoustic survey estimated the total abundance of herring available along the west coast at that time at approximately 83,500 t.

St. George's Bay/Port-au-Port Bay

Although the status of the northern Gulf herring is generally good, the fishing effort had been high on the spring spawners in St. George's Bay and Port-au-Port Bay between 1988 and 1993 and, at present, the biomass of this local component is low. Without a strong recruitment pulse, the abundance of the spring-spawning herring in the St. George's Bay/Port-au-Port area will continue to decline in the short term. Since the 1987 and 1989 year-classes are now fully recruited in other areas, it is unlikely that they will contribute significantly to this local spawning component.

The 1995 closure of the spring commercial fishery (January 1- June 15) in St. George's Bay and Port-au-Port Bay has limited the targeting of these spawners and has increased the proportion of fall spawners in the total catch. Although covering a very small area (390 km^2), the spring survey, undertaken in co-operation with the large purse seine fleet, showed that a good quantity (12,400 t) of mainly autumn-spawning herring were present in May at the mouth of St. George's Bay. This confirmed the observations made by both commercial and research fishing in 1993 and 1994 that St. George's Bay spring spawners can be avoided to a large extent by restricting fishing to outside of the bay in the spring.

The situation in St. George's Bay must be watched closely. Fishing effort must continue to be restricted in these areas until there are indications of improvement in this local component. The continuation of the index-fisherman program in this area is essential for the monitoring of spawning activity and as a local abundance index.

Given that the spring closure of St. George's Bay and Port-au-Port Bay has effectively limited directed catches of this spring-spawning component, and that several recruiting year-class have entered the fishery elsewhere along the coast, the current TAC of 22,000 t of spring- and autumn-spawning herring outside the closed area would not appear to be excessive.

For further information:

McQuinn, I.H. and L. Lefebvre. 1996. A review of the West Coast of Newfoundland (NAFO Division 4R) Herring Fishery Data (1973 to 1995). DFO Atlantic Fisheries Res. Doc. (In preparation)

McQuinn, I.H. and L. Lefebvre. 1996. Acoustic backscatter of herring along the West Coast of Newfoundland (NAFO Division 4R) in October 1995. DFO Atlantic Fisheries Res. Doc. (In preparation)

Prepared by:

Ian McQuinn
Tel: (418) 775-0627
Fac: (418) 775-0740
EMail: I_McQuinn @ qc.dfo.ca

This report is available:
Stock Assessment Regional Office
Laurentian Region
Department of Fisheries and Oceans
Maurice-Lamontagne Institute
P.O. Box 1000, Mont-Joli
Québec
G5H 3Z4

La version française de ce document est disponible à l'adresse ci-dessus.