Quebec North Shore Herring (Division 4S)

Background

*Herring (*Clupea harengus harengus*) is a pelagic fish found in cold Atlantic waters. Its distribution in Canada extends from the coasts of Nova Scotia to the coasts of Labrador. It travels in tight schools, feeding primarily on plankton (copepoda and euphausiacea), spawning near the coast and wintering in deeper waters. Most herring reach sexual maturity at 4 years, at a length of about 25 cm. During spawning, eggs are released and attach to the bottom at specific locations that are visited every year. Compared with other pelagic species, each herring population is characterized by two spawner components or stocks. The spring component generally lay eggs in April and May and the fall component in August and September.*

Herring are harvested commercially during their annual migrations. In Canadian waters, the main fishing grounds are southwest of Nova Scotia, the Bay of Fundy, the southern Gulf of St Lawrence and off Newfoundland. Some catches are also made on the North Shore of Quebec. This region, associated with NAFO Division 4S, more specifically extends from unit area 4Sz in the west to areas 4Sv and 4Sw in the east (Figure 1). The main gear used is the gillnet, in the spring in area 4Sz, then later in fall in areas 4Sv and 4Sw. Declared herring landings for the entire North Shore of Quebec average 707 t per year, a figure which for now does not warrant management based on TAC (Total Allowable Catch).

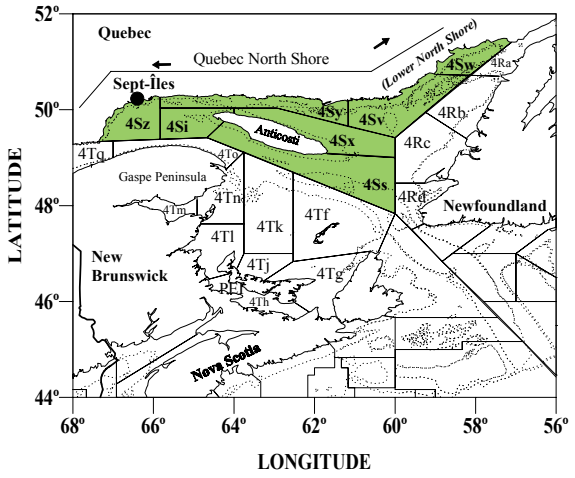

Figure 1. Map of unit areas of NAFO divisions 4R, 4S and 4T in the Gulf of St Lawrence (Division 4S is defined by the grey area).

Summary

- In 2001, herring catches on the North Shore of Quebec stood at 252 t, an increase of 90 t over 2000. However, the catch level for the last four years remains well below the average of 707 t calculated for the period of 1979-2000.
- The demographic structure of the two spawner components of Quebec North Shore herring has been characterized since 1984 by the presence of three dominant year-classes. Certain of these classes have been observed in the gillnet fishery for many years.
- Despite low catches per tow, Quebec North Shore herring is a regular catch of the bottom-trawl science surveys conducted annually in this region by the *Alfred Needler*. During these surveys, herring catches are generally distributed throughout the area sampled.
- Between 1990 and 1998, mean weights of herring catches per tow by the bottom-trawl science surveys were stable at under 0.5 kg/tow; they then rose to 0.75, 1.21 and 0.77 kg/tow in 1999, 2000 and 2001.

- Given the size of the region and the current catch level relative to other regions of Eastern Canada, herring catches on the North Shore of Quebec could certainly be higher. However, the information presently available does not allow us to accurately determine the level to which catches might be raised.

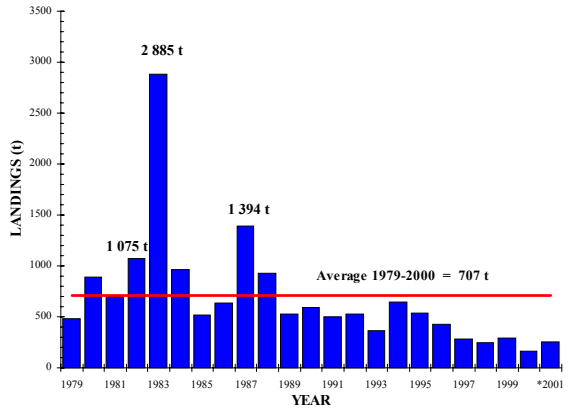

Figure 2. Commercial herring landings (t) for NAFO Division 4S, 1979 to 2001 (Preliminary data).*

The fishery

Nominal catches

Landings of Quebec North Shore herring (NAFO Division 4S; Figure 1) saw rapid expansion through the 1970s. From less than 80 t per year for the 1960-1970 period, landings attained an average annual value of 707 t for 1979-2000. Peaks of 1,075 t, 2,885 t and 1,394 t were even reached in 1982, 1983 and 1987 (Figure 2). Herring landings also post substantial inter-annual variations due to fluctuating market demand, and the largest market is for bait. Despite the size of the Quebec North Shore region, most herring landings are concentrated in three unit areas, namely 4Sz of Division 4S **WEST**, and 4Sv and 4Sw of Division 4S **EAST** (Figures 1 and 3), with average annual landings of 279 t, 153 t and 97 t respectively (Table 1). Between 1984 and

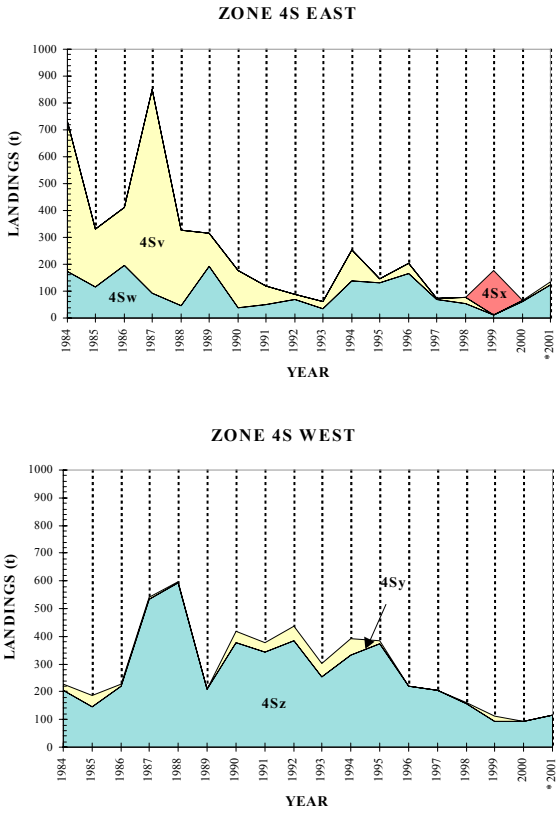

*Figure 3. Commercial herring landings (t) for NAFO Division 4S, **EAST** and **WEST** areas, 1984 to 2001 (* Preliminary data).*

1993, the proportion of landings in Division 4S **WEST** gradually increased relative to that in Division 4S **EAST** (Figure 4); since

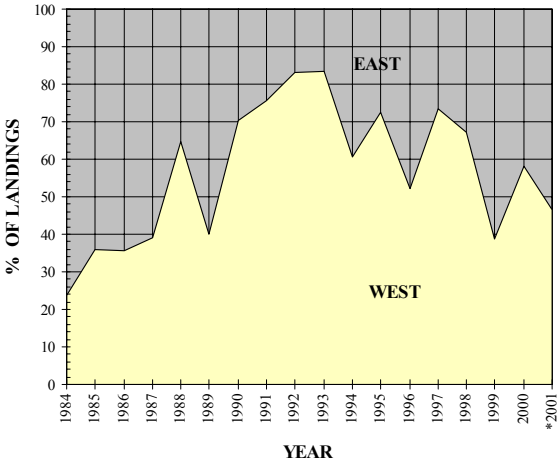

*Figure 4. Percentages of herring landings between the **EAST** and **WEST** areas of NAFO Division 4S, 1984 to 2001 (* = Preliminary data).*

then, the trend has been reversed.

The main fishing gear used to catch herring on the North Shore of Quebec is the gillnet. Average annual herring landings using this gear are 500 t (Table 2). The second most important gear is the purse seine, with annual average landings of 46 t, followed by the trap and trawl ("other" category) with only 14 t per year.

Table 1. Annual herring catches (t) in the main unit areas of the North Shore of Quebec, NAFO Division 4S.

UNIT AREA	YEAR												AVERAGE
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*	(1984-2000)
WEST													
4Sz	376	345	383	252	333	372	219	205	158	94	93	117	**279**
4Si								1	4	1			**0.5**
4Ss					1				1	1	1	1	**1**
4Sy	41	31	52	51	58	13	3		1	20			**21**
Total	**417**	**376**	**435**	**303**	**392**	**385**	**222**	**206**	**164**	**116**	**94**	**118**	**300**
EAST													
4Sw	39	50	70	35	139	131	164	69	55	10	63	124	**97**
4Sv	137	71	18	25	116	16	39	5	23	3	5	10	**153**
4Sx										164			**10**
Total	**176**	**121**	**88**	**60**	**255**	**147**	**203**	**74**	**78**	**177**	**68**	**134**	**260**
GRAND TOTAL	**593**	**497**	**523**	**363**	**647**	**532**	**425**	**280**	**242**	**293**	**162**	**252**	**560**

* Preliminary data

Table 2. Annual herring catches (t) for the main types of fishing gear used on the North Shore of Quebec, NAFO Division 4S.

FISHING GEAR TYPE	YEAR												AVERAGE
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*	(1984-2000)
EAST													
Gillnet	176	105	88	56	225	147	203	28	65	13	25	129	**242**
Purse Seine				4	30			45		164			**15**
Other		16						1	13		43	5	**2**
WEST													
Gillnet	360	198	256	275	391	385	222	206	160	113	87	117	**260**
Purse Seine	32	171	165	28							6		**31**
Other	25	7	14		1				4	1	1	2	**9**
TOTAL													
Gillnet	536	303	344	331	616	532	425	234	225	126	112	246	**500**
Purse Seine	32	171	165	32	30			45		164	6		**46**
Other	25	23	14		1			1	17	1	44	7	**14**
GRAND TOTAL	**593**	**497**	**523**	**363**	**647**	**532**	**425**	**280**	**242**	**291**	**162**	**253**	**560**

* Preliminary data

Biology of the resource

The gillnet fishery has been sampled annually since 1984. The data collected are given laboratory analysis after the fishing season. The main parameters used to describe the biology of Quebec North Shore herring are length, weight, age, condition and gonad size relative to fish size (gonadosomatic index).

Length frequencies

In most cases, the annual length frequencies of herring sampled on the North Shore of Quebec are characterized by a primary mode associated with a dominant year-class. Since 1984, for the spring spawner component in unit area 4Sz, these year-classes have been those of 1980, 1990 and 1994; for the fall spawner component sampled in unit areas

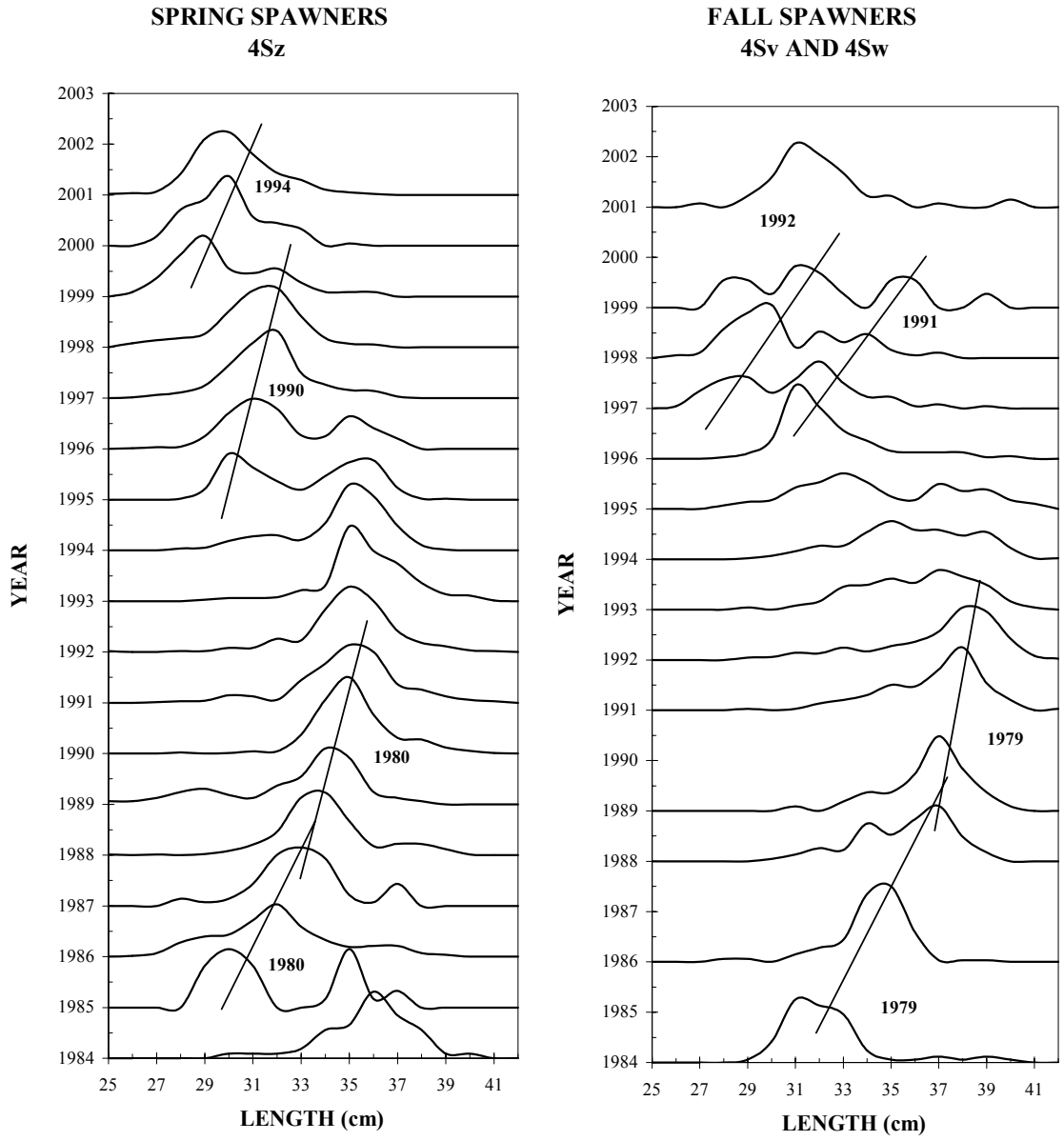

Figure 5. Length frequencies of spring and fall herring from samples from the gillnet fishery between 1984 and 2001 (the dominant year-classes are illustrated).

4Sv and 4Sw, they have been those of 1979, 1991 and 1992 (Figure 5).

Length at age

Because of the selectivity of gillnets, the commercial samples contain very few herring aged three years and none aged two or under (Figure 6). The maximum age observed is 11 years for the spring spawner component and 12 for the fall spawner component. Between 5 and 12 years, the growth in length of these herring is almost linear, and faster for fall spawners. The mean length of a 4-year-old spring herring is 322 mm, compared with 378 mm for an 11-year-old. For fall herring, mean lengths at 4 years and 12 years are 293 mm and 388 mm respectively.

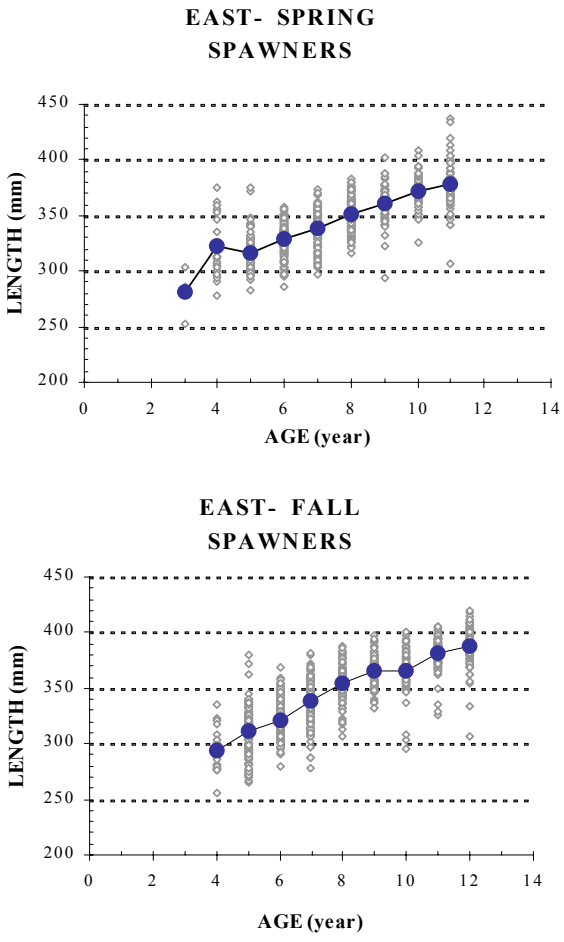

*Figure 6. Length-at-age for spring and fall herring spawner components in NAFO Division 4S, **EAST** portion only (circles represent mean lengths at age).*

Gonadosomatic index

In the spring, the two spawner components are distinguished by the degree of maturity of their gonads and by their gonadosomatic indices. For spring spawners, the gonadosomatic index is around 15% between the end of April (day 110 of the year; Figure 7) and the end of June (day 175 of the year). After spawning, which takes place quickly, the index remains at under 5% through July and August before gradually increasing in September (day 244 and later in the year). For the fall spawner

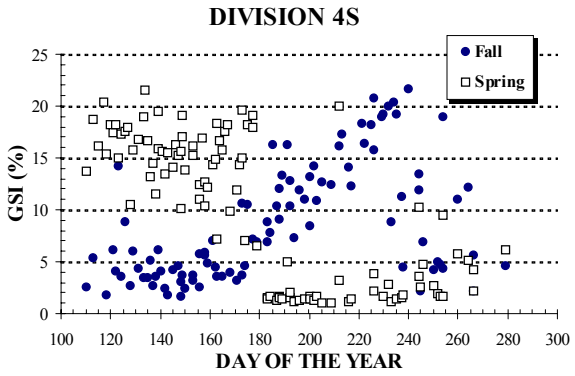

Figure 7. Mean gonadosomatic index calculated by day for the period of 1984 to 2000 (calculations are done for each spawning component).

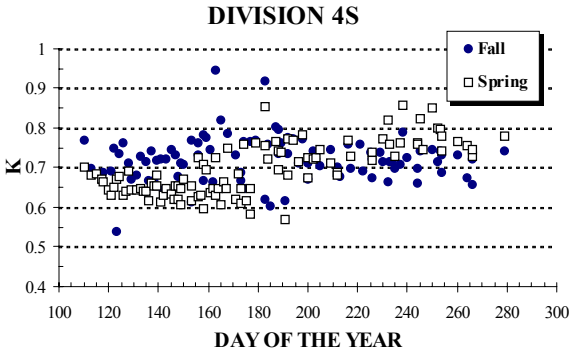

Figure 8. Mean condition factor calculated by day for the period of 1984 to 2000 (calculations are done for each spawning component).

component, the gonadosomatic index is generally below 5% until late June before increasing in July and reaching values of 15% and higher in August. This component spawns in late August and September. For both spawner components, condition is at its lowest when the gonadosomatic index is at its highest (Figure 8).

Comments of the industry

Industry representatives have indicated that for a few years there has been very substantial spring spawning of herring on the south coast of Anticosti. Over the same time period, they have also observed increasingly less spawning on the traditional Chaleur Bay spawning grounds. They say that these two events are related to a change in the migration of herring from Division 4T. Its presence in Anticosti could be verified by obtaining samples and comparing certain biological parameters with those from samples collected further south in Division 4T.

Resource status

Abundance index

At the moment there is no scientific survey specifically directed to Quebec North Shore herring. However, herring is a regular catch of the *Alfred Needler* bottom-trawl abundance survey, which is conducted annually throughout the northern Gulf of St Lawrence. While catches per tow are low (15 kg or less), herring are caught in almost all tows (Figure 9). Between 1990 and 1998, mean weights (kg) of herring catches per standardized 24-minute tow were less than 0.5 kg/tow (Figure 10A). They subsequently increased, reaching annual values of 0.75, 1.21 and 0.77 kg/tow in 1999, 2000 and 2001. Up until 1997, mean annual weights of the herring catch per tow for the North Shore of Quebec were below those calculated for Division 4R, ie, the west coast of Newfoundland (Figure 10B). However

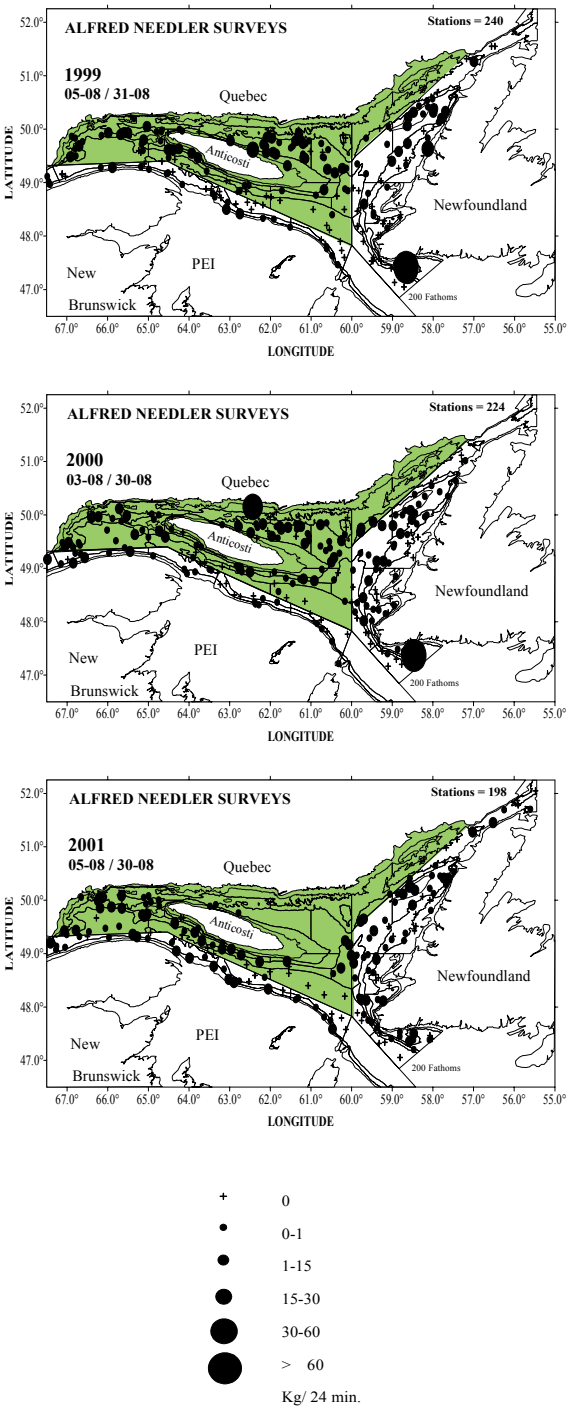

Figure 9. Herring abundance distributions (kg/24-minute tow) for the last three bottom-trawl surveys of the Alfred Needler (the grey area represents NAFO Division 4S).

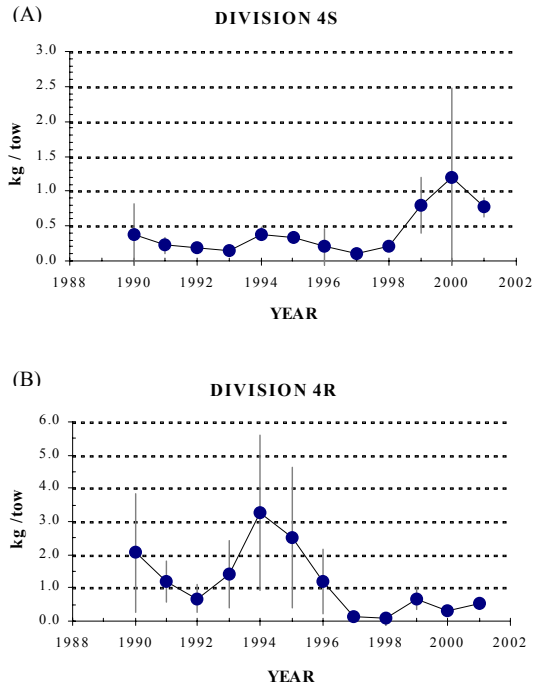

Figure 10. Annual herring abundance index for bottom-trawl surveys of the Alfred Needler conducted in Divisions 4S (A) and 4R (B) between 1990 and 2001 (the vertical bars represent standard errors).

the reverse situation has been observed since 1998.

Outlook

Given the size of the region and the current catch level relative to other regions of Eastern Canada, herring catches on the North Shore of Quebec could certainly be higher. However, the information presently available does not allow us to accurately determine the level to which catches might be raised. In terms of abundance, the bottom-trawl survey index must be interpreted with caution, since it is not designed for a pelagic species such as herring. Furthermore it does not cover the entirety of Division 4S because of the presence of certain uneven bottoms on which no trawling is done. There is a lack of knowledge not only about the abundance of herring on the North Shore of Quebec, but also about the number, location and size of its spawning grounds. There is also very little information about migration patterns.

The information presently available does not allow us to establish a **TAC** (**T**otal **A**llowable **C**atch). Furthermore, in light of the current catch level, it is difficult to justify the organization of research projects or implementation of abundance surveys specifically for this species. However the landings situation will continue to be monitored on an annual basis.

Reference:

Grégoire, F., L. Lefebvre and M. Beaudoin. 2002. Mise à jour des débarquements et des données biologiques du hareng (*Clupea harengus harengus* L.) de la division 4S de l'OPANO [Update on landings and biological data for NAFO Division 4S herring (*Clupea harengus harengus* L.)]. CSAC-DFO. Research Document 2002/019. 40 p.

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