



Capelin of the Estuary and Gulf of St. Lawrence (4RST) in 2004

Background

This report presents the main data concerning the fishery, biology and distribution of capelin (*Mallotus villosus*) of the Estuary and Gulf of St. Lawrence (NAFO divisions 4RST; Figure 1) in 2004. This is a supplement to the 2004/001 Stock Status Report published in February 2004 resulting of a complete assessment of the capelin of the Estuary and Gulf of St. Lawrence.

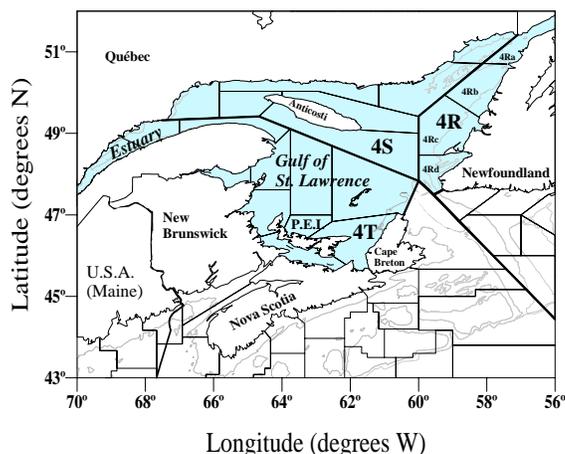


Figure 1. Map of NAFO Divisions 4RST and unit areas of the west coast of Newfoundland associated with the capelin fishery.

Summary

- Preliminary **landings** for capelin of NAFO Divisions 4RST increased from 5,032 t in 2003 to 6,089 t in 2004. Most of these landings were made by purse seiners in unit areas 4Ra, 4Rb and 4Rc on the west coast of Newfoundland.
- On the west coast of Newfoundland, capelin **size** has shown a clear upward trend since 1999. In 2004, average lengths for females and males were 148 mm and 166 mm respectively. These values are similar to those recorded in 2003 but remain inferior to those observed during the 1980s.
- Compared to the 1980s, capelin fishing and spawning seasons began later in the 1990s. A relative stability in fishing periods has been observed since 2001. However, median fishing dates are still **later** than those observed during the 1980s.
- The geographical distribution of capelin in the Estuary and Gulf of St. Lawrence is assessed using a **dispersion index**. This index had been showing an upward trend since 1990. However, lower

dispersion of capelin was measured in 2004 on the west coast of Newfoundland (Division 4R) and the southern Gulf (Division 4T) compared to 2003.

- Although it is well known that commercial fishery only harvests a very small proportion of the total biomass, any TAC **increase** should be made **progressively** due to capelin's prominent role in the marine ecosystem, and the lack of knowledge regarding the species' ecology and biology.

Description of the fishery

In the Estuary and Gulf of St. Lawrence, the capelin fishing season is short and corresponds to the pre-spawning period in the purse seine fishery and to the spawning period in the trap fishery. In both cases, the fishery mainly targets mature females for the roe market. The emergence of a Japanese market for roe-bearing females is responsible for the sharp increase in capelin landings, up from 700 t/year between 1960 and 1976 to approximately 10,000 t in 1978, 1979, 1989, 1992 and 1998 (Figure 2).

The largest landings for the entire Gulf of St. Lawrence are made on the west coast of Newfoundland, i.e. in NAFO (Northwest Atlantic Fisheries Organization) Division 4R (Figure 1). In Divisions 4R and 4S, the most

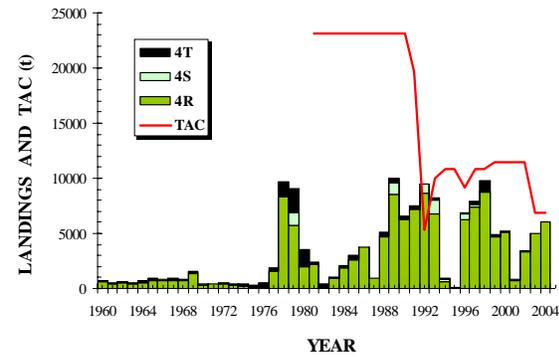


Figure 2. Capelin landings and TAC (t) for NAFO Divisions 4RST (Estuary and Gulf of St. Lawrence) between 1960 and 2004.

intensive fishing occurs in June and July. In Division 4T, the fishing season sometimes begins as early as April, but the largest landings occur in May and June. Purse seines, traps, and weirs are the most commonly used fishing gear in the Estuary and Gulf of St. Lawrence.

The fishery in 2004

In 2004, preliminary data on capelin landings in NAFO Divisions 4RST totalled 6,089 t, an increase of 1,057 t compared to 2003 (Table 1). These landings all occurred in Division 4R and correspond to 95% of the 6,420 t TAC. Of the 6,089 t landed in 2004, 4,639 t (76%) were made by a purse seine

Table 1. Estuary and Gulf of St. Lawrence: Capelin landings (t) by NAFO Division and by fishing gear from 1990 to 2004.

DIVISION AND GEAR	YEAR															AVERAGE (1990-2003)
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*	
4R	6 205	7 166	8 605	6 739	592	15	6 265	7 399	8 764	4 735	5 129	741	3 295	5 032	6 089	5 049
TAC 4R	18 000	4 025	9 025	10 000	10 000	8 400	10 000	10 000	10 700	10 700	10 700	10 700	10 700	6 420	6 420	9 955
4S	164	59	856	1 263	208	90	461	252	141	10	69	66	77	0	0	265
4T	153	247	56	236	166	47	172	238	893	166	18	5	20	0	0	173
TAC 4ST	5 000	3 300	1 725	1 725	1 725	1 725	1 450	1 725	1 725	1 725	1 725	1 725	1 725	1 035	1 035	
Beach seine	458	149	12	0	13	15	0	0	0	0	0	0	0	0	0	46
Purse seine	4 215	7 014	7 517	6 827	649	0	5 479	6 511	7 232	4 791	5 129	741	3 295	4 654	4 639	4 575
Trap	1 720	181	1 921	1 283	210	103	1 306	1 203	2 509	11	1	0	7	379	1 450	774
Weir	129	127	56	128	94	34	113	175	57	0	0	0	0	0	0	65
Trawl	0	1	0	0	0	0	0	0	0	110	0	0	2	0	0	8
Other	0	0	11	0	0	0	0	0	0	0	87	0	87	0	0	13
TOTAL	6 522	7 472	9 517	8 238	966	152	6 898	7 889	9 799	4 911	5 217	811	3 392	5 032	6 089	5 487

* Preliminary

Table 2. West coast of Newfoundland (4R): Capelin landings (t) by NAFO unit area from 1990 to 2004.

UNIT AREA	YEAR															AVERAGE (1990-2003)
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*	
4Ra	1 959	154	1 554	73	10	15	605	734	1 827	29	0	0	115	513	3 181	542
4Rb	479	82	1 506	469	265	0	1 841	2 480	3 814	1 675	356	0	856	1 070	599	1 064
4Rc	925	4 907	4 675	4 264	245	0	3 364	4 171	2 541	3 031	4 773	605	2 323	3 450	2 220	2 805
4Rd	104	2 023	117	1 933	72	0	430	14	581	0	0	136	0	0	89	386
NK**	2 739	0	754	0	0	0	25	0	0	0	0	0	0	0	0	251
TOTAL	6 205	7 166	8 605	6 739	592	15	6 265	7 399	8 764	4 735	5 129	741	3 295	5 032	6 089	5 049

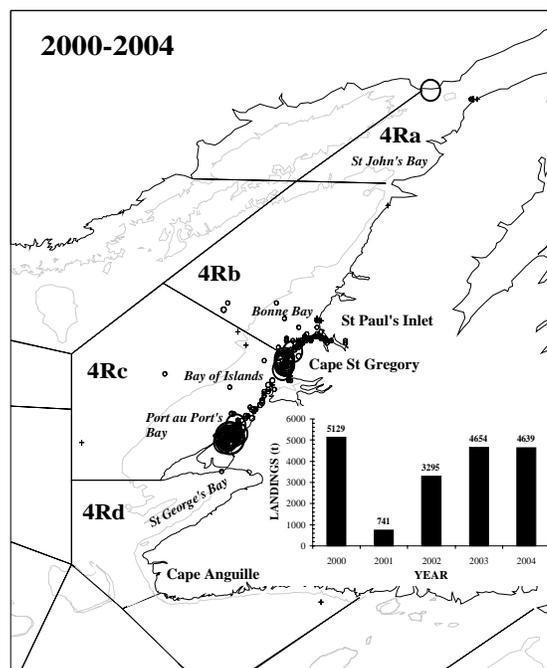
* Preliminary; ** Not known

fishery and 1,450 t (24%) by a trap fishery, both of them mostly occurring in unit areas 4Ra, 4Rb and 4Rc (Figure 1; Table 2). Between 1990 and 2003, estimates show that the mean annual landings associated with the purse seine fishery are 4,575 t (Table 1). This fishery occurs near the coast, between Bonne Bay and Port Au Port (Figure 3).

Between the late 1980s and the mid-1990s, capelin fishing and spawning seasons occurred at increasingly later dates (Figure 4). Since 2001, a relative stability in fishing periods has been observed. However, median fishing dates are still later than those observed during the 1980s.

Description of catches

A constant reduction in female and male mean size has been observed on the west coast of Newfoundland since the late 1980s (Figure 5). As a result, the fishery was cut short in 1994, and almost completely closed in 1995. Capelin size stabilized between 1996 and 1998, before decreasing again in 1999. However, an upward trend has been observed ever since 1999. In 2004, average lengths for females and males were 148 mm and 166 mm respectively. These lengths are similar to those recorded in 2003, but remain inferior to those observed during the mid-1980s. These fluctuations in capelin size are also noted in the observation of the annual length frequencies (Figure 6), which in most cases consist of a single mode value as a result of



Legend :

· 0 - 10 · 10 - 50 ◦ 50 - 100 ◊ 100 - 150 ○ > 150 t

Figure 3. Capelin catches (t) positions between 2000 and 2004 on the west coast of Newfoundland (total annual catches are presented in the bar graph).

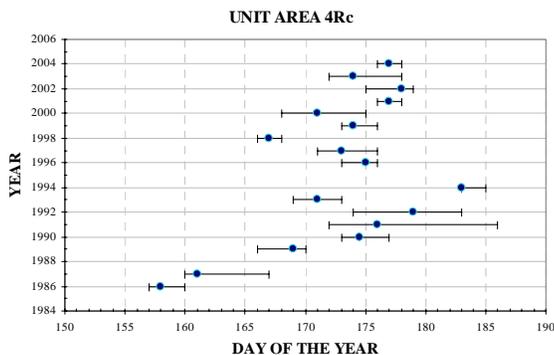


Figure 4. Temporal pattern of the capelin purse seine fishery in unit area 4Rc (Symbol = median landing dates; lines = dates by which 25% and 75% of the landings have been made).

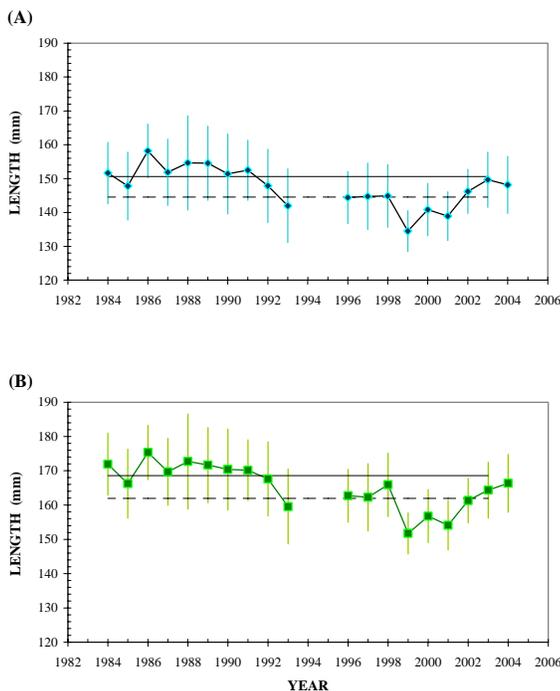


Figure 5. Mean length (mm) of female (A) and male (B) capelin caught with purse seines in NAFO Division 4R since 1984. The horizontal lines indicate upper and lower limits of the confidence interval (95%) of the mean of years 1984 to 2003 (the vertical lines represent the standard deviations).

lengths overlapping among the various age groups.

Status of the resource

Distribution and indices of dispersion

A dispersion index is calculated through indicator kriging using data on the presence and absence of capelin per tow for the bottom trawl surveys conducted in the northern and southern Gulf of St. Lawrence. This index, which represents the mean probability of finding capelin in the Estuary and Gulf of St. Lawrence, shows a clear upward trend since 1990 (Figure 7). However, a decrease in dispersion was measured in 2004 for the west coast of Newfoundland (Division 4R) and in the southern Gulf (Division 4T) (Figure 8). This reduction can also be observed on surface maps showing very high probabilities of capelin occurrence (Figure 9).

Assessment and outlook

Fishing mortality does not appear to have a noticeable effect on the population at the current landing levels, even though it is currently impossible to evaluate it. According to the results from a model (Figure 10), the main causes of capelin mortality in the mid-1980s stem from predation by large cod and redfish, and by cetaceans, harp seals and Greenland halibut during the mid-1990s and the early 2000s. In the mid-1980s, annual capelin consumption by its main predators totalled approximately one million tonnes. In the early 2000s, although a strong decrease in abundance of its predators (cod, redfish), nearly 400,000 t of capelin per year was still being consumed by predators, making this small fish the most important prey in the northern Gulf of St. Lawrence ecosystem over the last twenty years.

It is currently impossible to estimate the impact that a significant increase in landings would have on the capelin population and the rest of the ecosystem because changes in capelin abundance are first and foremost

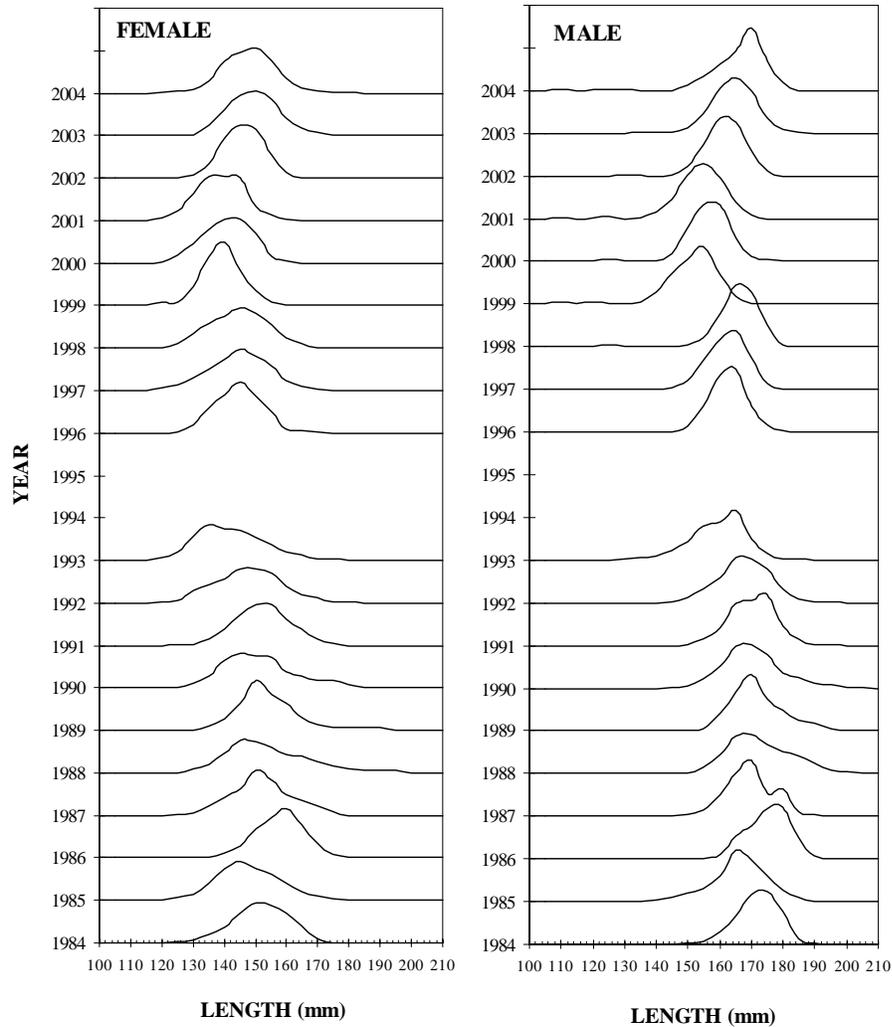


Figure 6. Size (mm) composition (%) of females and males caught with purse seines in NAFO Division 4R between 1984 and 2004 (except 1994 and 1995).

the result of natural factors. As capelin has a short lifespan, its abundance is subject to sharp changes because the population consists of only a few age groups. To satisfy market demand, fishing effort is strongly correlated to the size of female capelin. The industry has a greater interest in regions where environmental conditions are more favourable to capelin growth, which explains the weak capelin demand in Divisions 4S and 4T.

Even if fishery appears to have very few impacts on capelin abundance, we recommend that any TAC **increase** be made **progressively** due to capelin's

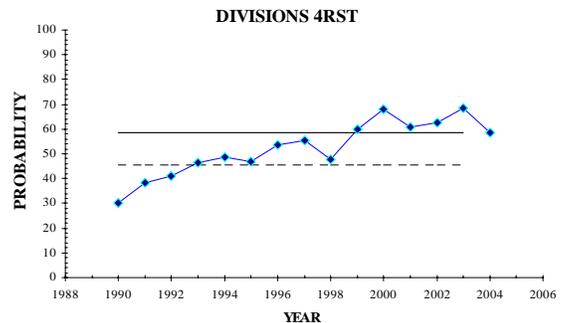


Figure 7. Mean capelin occurrence probabilities in the Estuary and Gulf of St. Lawrence. The horizontal lines indicate upper and lower limits of the confidence interval (95%) of the mean of years 1990 to 2003.

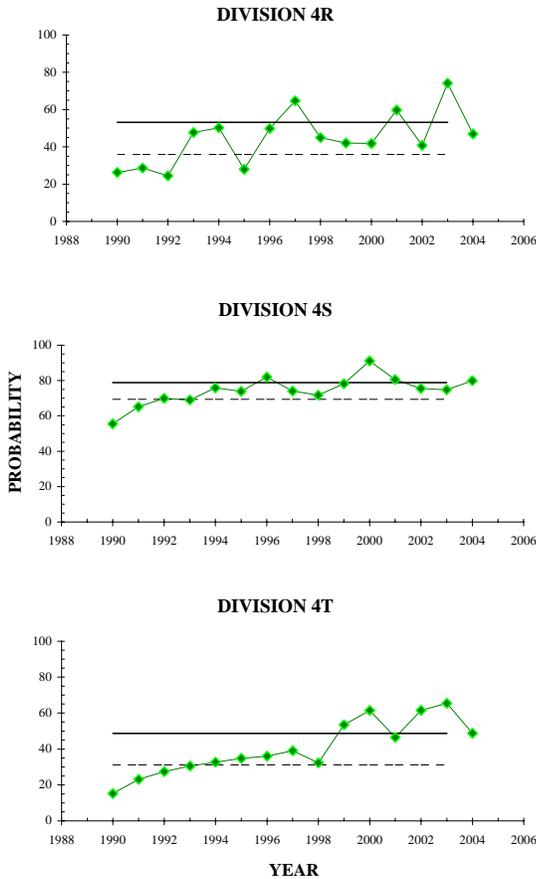


Figure 8. Mean capelin occurrence probabilities in NAFO Divisions 4RST. The horizontal lines indicate upper and lower limits of the confidence interval (95%) of the mean of years 1990 to 2003.

prominent role in the marine ecosystem, the lack of knowledge regarding its biology, and the absence of an abundance assessment survey for this species.

Precautionary approach

The Canadian precautionary approach framework was developed during national workshops held over the last few years. During these workshops, various limit reference points were studied and for the time being, a reproductive biomass target value (B_{LIM}) was chosen. According to the conservation principles defined in the precautionary approach, the reproductive biomass of a stock should not drop any

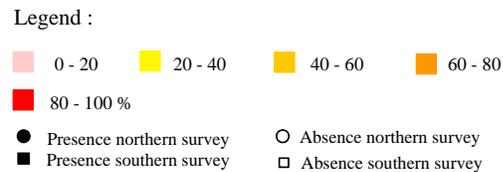
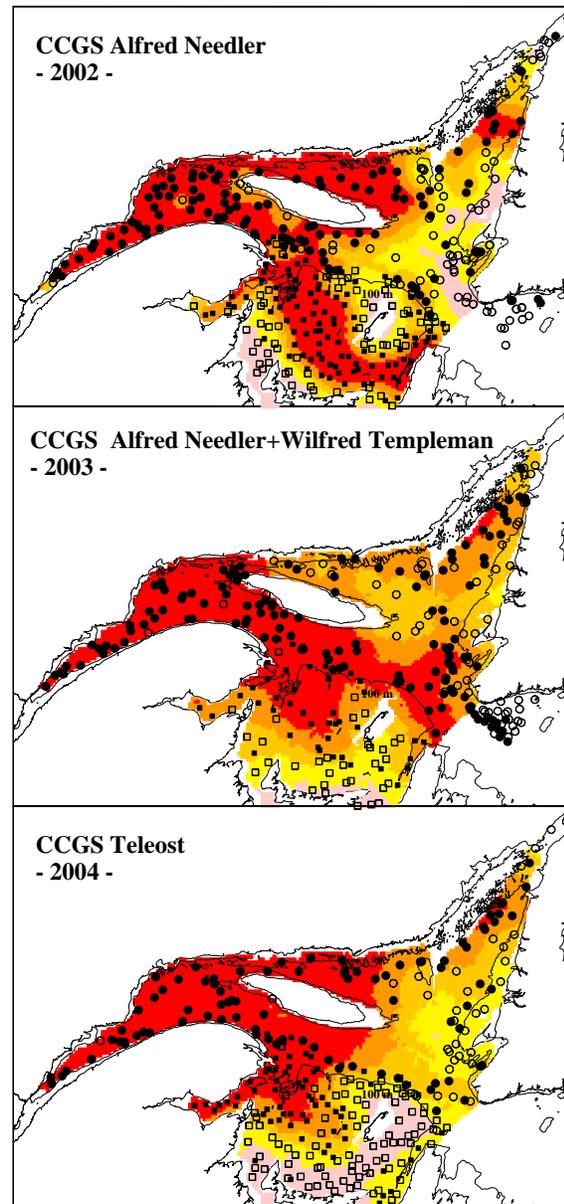


Figure 9. Perimeters of capelin occurrence probability area (%) for surveys conducted in the Estuary and Gulf of St. Lawrence in 2002, 2003 and 2004. Station positions, capelin occurrence and the 100 m isobath are indicated.

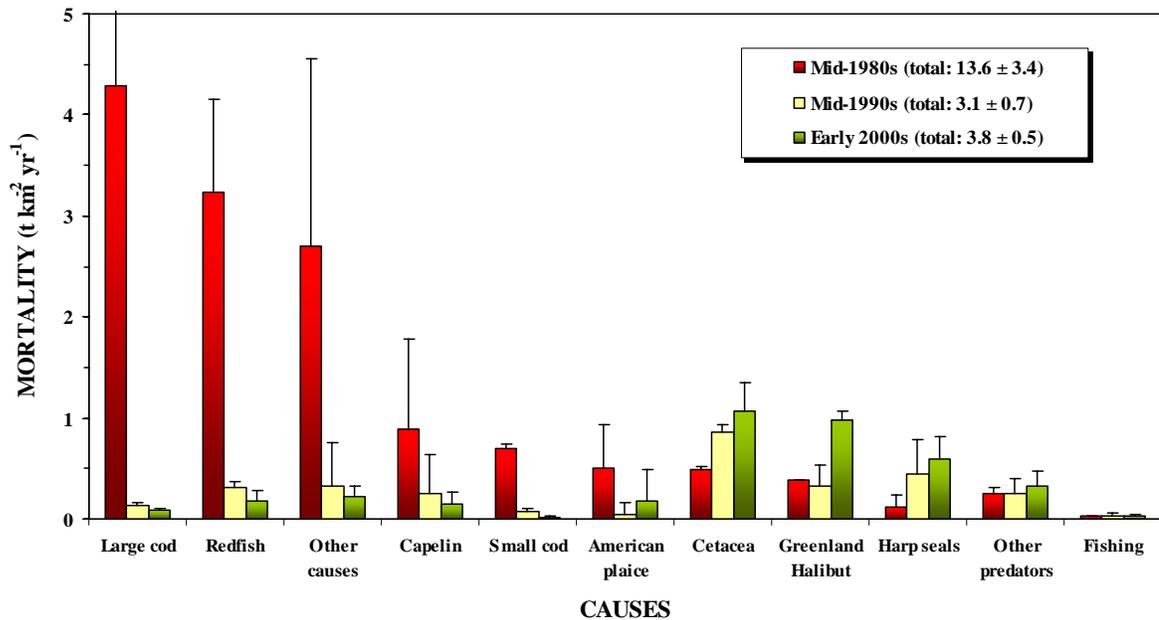


Figure 10. Main causes of capelin mortality ($t\ km^{-2}\ yr^{-1}$) in the northern Gulf of St. Lawrence calculated according to a model of the marine ecosystem from the mid-1980s to the early 2000s.

lower than this target and should also remain well above it. In the case of the groundfish species studied so far, different methods have been recommended for calculating B_{LIM} . However, these methods only apply to the stocks for which a defined stock-recruitment relationship was established using a Sequential Population Analysis or SPA, which is currently not the case.

Because this type of analysis is not used for capelin and biomass is not being assessed, other possibilities will have to be considered. Indicators such as species dispersion, length and fecundity could be used as a starting point in developing a management strategy that would correspond with the conservation principles defined within the precautionary approach. This strategy could be based upon levels of concern defined according to existing values of each indicator, and according to upper and lower average limits from previous years.

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