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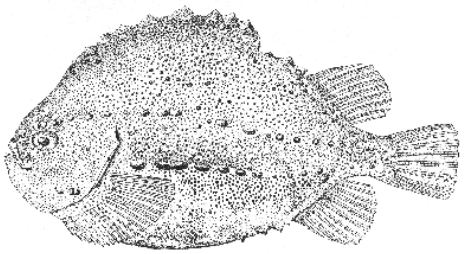
Science Advisory Report 2006/034

ASSESSMENT OF LUMPFISH IN THE GULF OF ST. LAWRENCE (3Pn, 4RST) IN 2005



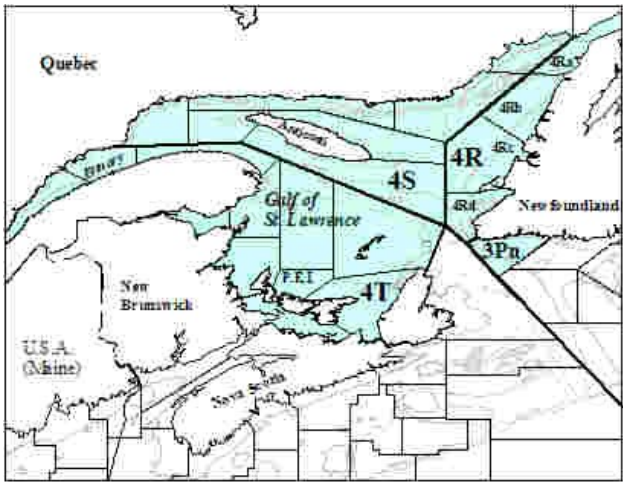


Figure 1. Map of the NAFO divisions in the Estuary and Gulf of St. Lawrence. The unit areas of division 4R are identified as well as subdivision 3Pn.

Context

Although lumpfish fishery (or henfish) (Cyclopterus lumpus) is of very short duration in the spring, it represents a significant extra income for the coastal fishermen who practice it. This fishery is primarily directed at females for the caviar market. Whole lumpfish are landed in division 4T, whereas only gonads (roe) are landed in the Northwest Atlantic Fisheries Organization (NAFO) subdivision 3Pn and divisions 4R and 4S. Scientific knowledge on lumpfish of the Gulf of St. Lawrence is limited. However, researches were made in 2004 and 2005 through the Fisheries Science Collaborative Program (FSCP). This work focused on fecundity, oocyte development (histological examination) and displacements (tagging survey).

Lumpfish fishery management is not based on Total Allowable Catch (TAC), but rather on a series of conditions (mesh size, number of nets and fishing season) that all fishing license holders harvesting groundfish with fixed gear observe.

SUMMARY

Note: Referring to fishing areas 3Pn and 4RST in this report does not necessarily imply a management unit, but rather the areas of interest for this update.

- Lumpfish fishery for caviar strongly depends on market conditions. Certain recent constraints concerning the exploitation of sturgeon caviar could lead to additional pressures on this resource.

- There is very little information on the Gulf of St. Lawrence lumpfish biology and fishery. The implementation of the Fisheries Science Collaborative Program in 2004 made it

possible to launch specific research on histology and fecundity, as well as a tagging program. Some improvements are suggested to enhance the follow-up of this fishery and to remedy this situation.

- Without abundance index and sufficient biological data, it is not possible to assess the status of lumpfish in NAFO subdivision 3Pn and divisions 4RST. It is thus recommended to establish a commercial fishery follow-up and sampling program. Moreover, data on life cycle characteristics could be collected on an opportunist basis during scientific surveys.

- Lumpfish seem to move little from one fishing season to the other, which would indicate that the species is rather sedentary. This could also indicate that the resource is distributed into several small units, which makes it more vulnerable to local overexploitation. As lumpfish fishery pressure could increase, it will be necessary to closely watch any increase in landings and take actions if it is estimated that landings exceed the capacity of the resource to support such a level of exploitation.

INTRODUCTION

This update on the status of lumpfish is based on commercial fishery statistics and on by-catches in other fisheries as well as on data on catches made by the mobile gear sentinel fisheries (July) and DFO surveys in the north and south of the Gulf of St. Lawrence.

Species biology

Lumpfish (*Cyclopterus lumpus*) are generally considered as groundfish of the Atlantic cold and temperate waters living on rocky or stony bottoms. However, several studies indicate that lumpfish would stay in the offshore pelagic area for most of their mature life. Lumpfish are found on both sides of the Atlantic. In Northwest Atlantic, lumpfish occur from Greenland, James Bay and Hudson Bay waters, in the North, to Chesapeake Bay, in the South.

During their early life stages, lumpfish can be found under floating algae or attached with their pelvic adhesive disc to rocks, lobster traps, or other solid objects. Lumpfish feature a significant sexual dimorphism, and males are much smaller than females.

Early in the spring, lumpfish undertake a coastal migration for spawning, which takes place in May and June, and then return to deeper waters late in the summer and early in the fall. Males, which are of a reddish color during the spawning period, arrive in the spawning grounds before females to establish their territory. Females lay from 2 to 3 egg masses at intervals ranging from 8 to 14 days, and then return to deep waters leaving the males there to guard the eggs. It was suggested that spawning off the East coast of Newfoundland was temperature dependent and would begin when water reaches 4°C. Eggs are laid in large spongy masses that adhere to the rocks. A mass can contain more than 140,000 eggs. An egg measures approximately 2 mm in diameter, has only one oil globule, and is of a light green to yellowish color, becoming darker according to the stage of development. At release, larvae are approximately 5 mm long. At their third year, individuals reach 11 cm approximately, and around 30 cm at five years.

Lumpfish feed on a variety of invertebrates including euphausiid shrimps, pelagic amphipods, copepods and other shellfish, jellyfishes and anemones, as well as small fish such as herring and sand lance. Lumpfish are eaten by grey seals (*Halichoerus grypus*). They have also been found in stomachs of Greenland sharks (*Somniosus microcephalus*).

Fecundity

A study on lumpfish fecundity was made in 2004 and 2005 based on samples collected in the northern Gulf of St. Lawrence (division 4S), the West coast of Newfoundland (division 4R), and NAFO subdivision 3Pn (Figure 1). According to this study, the average fecundity of lumpfish would vary between 100,000 and 130,000 eggs for individuals of which the length and the somatic weight ranged between 300 and 480 mm and 1,200 and 3,600 g, respectively. The relation between the number of eggs and the weight of ovaries is of a linear type (Figure 2). The average number of eggs per weight of ovary is approximately 150 eggs/g (Figure 3). The average size of the vitelline oocytes is 1.63 mm, with minimal and maximum values of 0.79 and 2.23 mm. No relation was established between the size of oocytes and that of females. The histological examination of ovaries has also made it possible to determine that the maturation of ovocytes is synchronous.

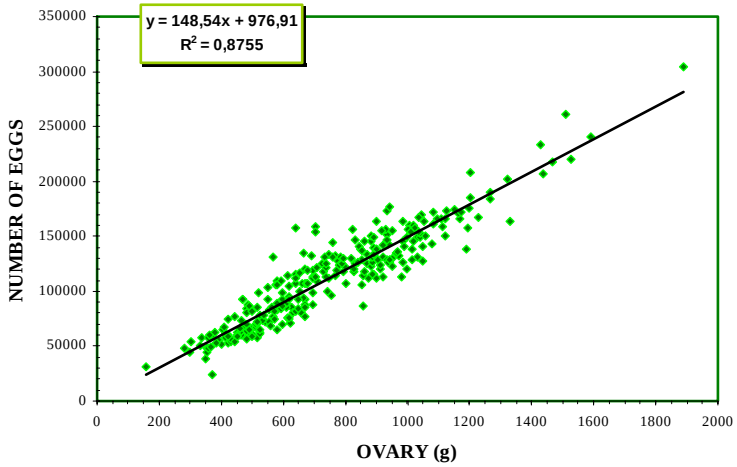


Figure 2. Relationship between the number of eggs and the weight of the ovaries that were collected in 2004 and 2005 in the northern Gulf of St. Lawrence (division 4S), the West coast of Newfoundland (division 4R), and NAFO subdivision 3Pn.

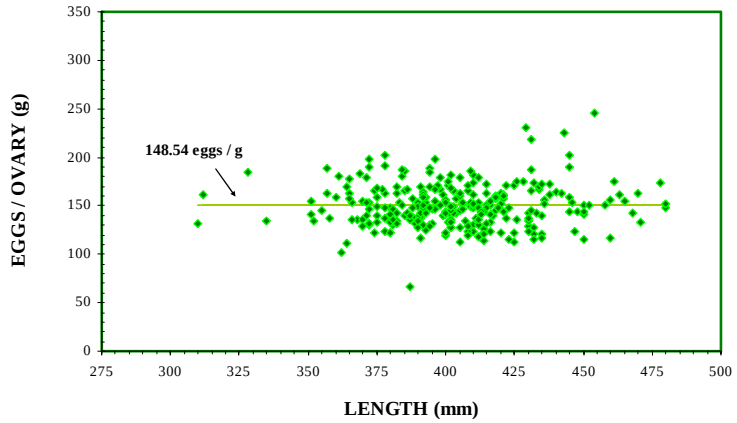


Figure 3. Relationship between the average number of eggs per weight of ovary (g) and the length of the lumpfish sampled in 2004 and 2005 in the north of the Gulf of St. Lawrence (division 4S), the West coast of Newfoundland (division 4R), and NAFO subdivision 3Pn. The horizontal line represents the average number of eggs per weight of ovary for all the individuals sampled in 2004 and 2005.

Fishery

Lumpfish fishery is primarily directed at females for the caviar market. The weak demand for flesh is due to its high water contents and low fat and protein levels. This fishery, which starts in the spring and extends from April to July in shallow inshore waters, is mainly carried out with boats of less than 35 feet. Gillnet with minimum mesh size of 10 ½ inches are used. The fishery only span over a few weeks, and its intensity is largely dependent on economic factors.

Whole lumpfish is landed in division 4T, whereas only gonads (roe) are landed in the Northwest Atlantic Fisheries Organization (NAFO) subdivision 3Pn and divisions 4R and 4S (Tables 1 and 2). The annual average of whole lumpfish landings from 4T between 1980 and 2004 is 2,5 tons. A peak was reached in 1997, with nearly 7 tons. Landing data for 4T are not yet available for 2005.

Table 1. Lumpfish from 3Pn, 4RST: Landings of whole lumpfish (t) by fishing area.

	Fishing area				
Year	**3Pn**	**4R**	**4S**	**4T**	**Total**
1993	0.19	0.03	0	8.90	9
1994	0.75	0.05	0.007	2.83	4
1995	0	0	0	3.54	4
1996	0	0	0	3.55	4
1997	78.16	61.93	0	6.90	147
1998	0	4.15	0	1.11	5
1999	0.004	0.002	0	1.21	1
2000	0	0.37	0	1.67	2
2001	0	0	0	0.35	0.35
2002	0	0	0	0.15	0.15
2003	0	0	0	0.24	0.24
2004	0	0	0	0.03	0.03
2005*	0	0	0	ND	0

*Preliminary data

Since the beginning of the fishery in 1969, there have been two major peaks in lumpfish roe landings from subdivision 3Pn and divisions 4R and 4S (Figure 4); a first peak at the end of the 1980s, and a second at the end of the 1990s. In Newfoundland, lumpfish exploitation began in 1969. This fishery is carried out on all the coasts of the island, but mainly the northern and southern coasts. On the West coast of Newfoundland (4R), the annual average of roe landings for the 1969-2005 period is 163 tons. Roe landings reached a maximum of 673 tons in 1999 (Table 2), and preliminary catches for 2005 add up to 62 tons. On the southern coast of Newfoundland (3Pn), the annual average of roe landings is 144 tons for the 1980-2005 period. Maximum landings were recorded in 1997, with 478 tons, while they only reached 54 tons in 2005 (Table 2). Lumpfish exploitation on the Lower North Shore of Quebec (4S) began in 1986. Roe landings peaked at 115 tons in 1987. Average landings for the 1986-2005 period is 29 tons, and they were of 63 tons in 2005 (Table 2).

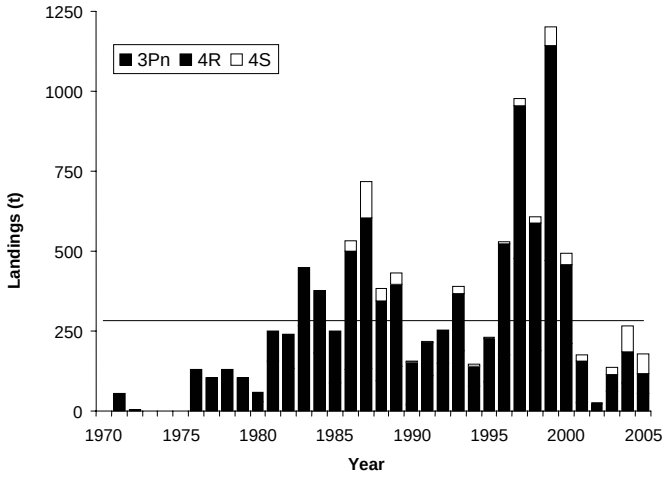


Figure 4. Lumpfish roe landings (t) by fishing area.

Table 2. Lumpfish from 3Pn, 4RST: Lumpfish roe landings (t) by fishing area.

	Fishing area				
Année	3Pn	4R	4S	4T	Total
1970		1			1
1971		56			56
1972		3			3
1973		0			0
1974		0			0
1975		0			0
1976		129			129
1977		105			105
1978		131			131
1979		103			103
1980	29	30			59
1981	156	93			249
1982	132	108			240
1983	266	182			448
1984	181	197		3	381
1985	88	162			250
1986	131	369	34		534
1987	134	470	115		719
1988	95	250	39		384
1989	140	257	36		433
1990	20	131	6		157
1991	111	104	2		217
1992	150	103			253
1993	189	179	21		389
1994	77	63	4	0.4	145
1995	89	139	1		229
1996	176	347	5		528
1997	478	477	22		977
1998	188	402	18		608
1999	471	673	59		1203
2000	212	246	36		494
2001	26	131	20		177
2002	1	22	3		25
2003	61	53	23		137
2004	89	96	81		266
2005*	54	62	63		179

* Preliminary data

The annual average of roe landings for these three zones is 284 tons. Between 1986 and 2002, roe landings from 4S averaged 6% of subdivision 3Pn and divisions 4R and 4S landings. In 2004 and 2005, this proportion shifted to 33%.

ASSESSMENT

Abundance

Several sources of information were reviewed in an attempt to identify a trend in the abundance of this resource. Data used came from the northern Gulf sentinel fishery program for fixed and mobile gears, and from DFO surveys. Lumpfish catches in the fixed gear sentinel fishery are rare. As the mobile gear surveys of the sentinel fishery program and of DFO are conducted during the summer, and as lumpfish is in shallower waters during this period, these surveys do not provide relevant information on lumpfish abundance. In the winter, yields of more than 100 kg per haul of 30 minutes were already recorded by the scientific vessel Gadus Atlantica in 3Pn in January 1990 with low catches in 4R. However, lumpfish catches of the recent surveys of January 2002 to 2006 (no survey was carried out in 2003) never exceeded 30 kg per haul of a half hour.

Several data sources for commercial fishery were also reviewed, i.e. logbooks, the observer database, and commercial data from dockside weighing. This last source is the only one containing sufficient data to draw certain information on the performance of the lumpfish directed fishery between 1993 and 2005 in subdivision 3Pn and divisions 4R and 4S (Figure 5). The trends in annual yields (kg of lumpfish roe/number of activities) are similar in the three divisions, with a peak in 1999-2000 followed by a low in 2002, and then by an increase until 2005. Since lumpfish fishery performance is greatly affected by the market conditions, it is possible that these annual yields do not reflect the abundance of the resource.

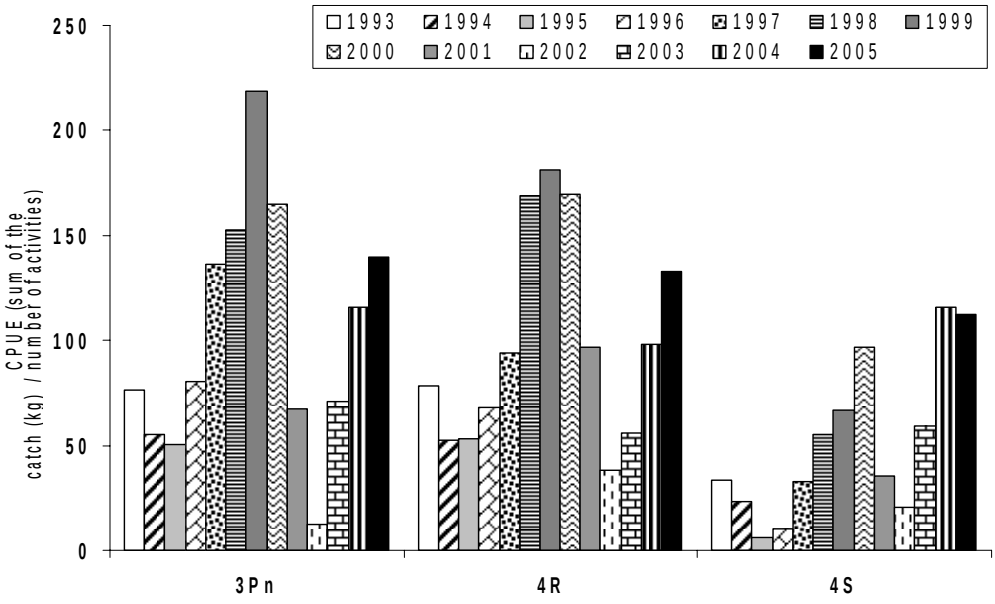


Figure 5: Yields (kg of roe per activity) for the lumpfish directed fishery between 1993 and 2005 in NAFO subdivision 3Pn and divisions 4R and 4S.

Movements

A tagging study was financed by the Fisheries Science Collaborative Program (FSCP). A total of 1,873 lumpfish were tagged in May and June 2004 and 2005 (approximately 300 individuals per year and fishing area 3Pn, 4R and 4S). Tagging was carried out at the end of the fishing season in order to avoid immediate recapture. The fishery in which tagging was carried out was made by commercial fishermen at depths ranging from 10 to 40 m, and tagging was executed by qualified technicians using Peterson type labels. Generally, lumpfish were larger in 3Pn (Figure 6).

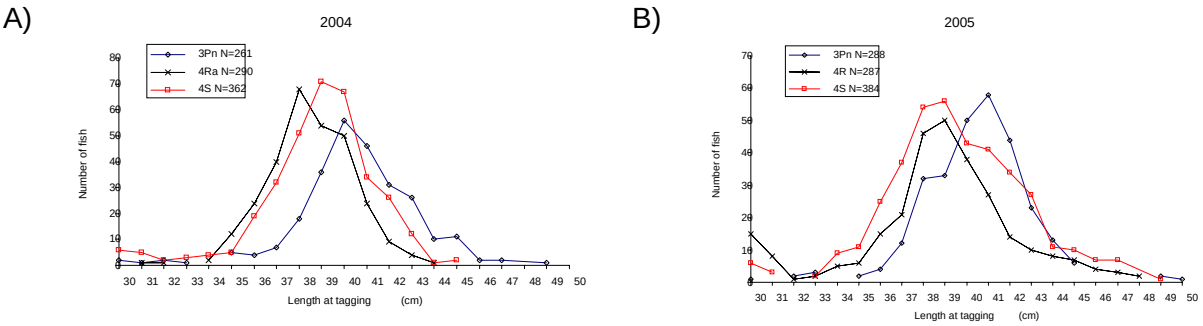


Figure 6: Sizes of lumpfish by NAFO fishing area at tagging in 2004 (A) and 2005 (B)

There is no commercial sampling of this species, but such a follow-up is recommended in each fishing area (3Pn, 4RST).

As the directed fishery is seasonal and very short in duration, there is very little recaptures during the year, and there are uncertainties about the total migration range. However, it is possible that lumpfish move towards greater depths than those observed at spawning because of the presence of cold water at the surface during the winter. 51 of the 60 recaptures occurred within less than 40 km from the place of tagging, and only 9 fish had traveled more than 40 km between the tagging and recapture points. The longest distance covered by a lumpfish was around 300 km between 3Pn and Fortune Bay in three months (Figure 7). Only 37 of the 914 lumpfish tagged in 2004 were recaptured the following year, which is insufficient to calculate an exploitation rate.

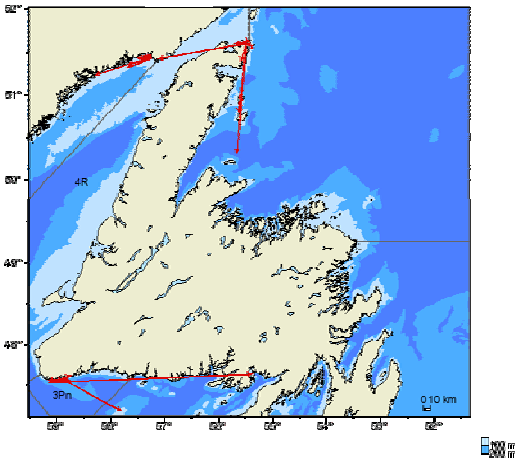


Figure 7: Distance traveled by lumpfish that were tagged in 2004 and 2005.

Additional stakeholder perspectives

Despite its limited history compared to more historical groundfish fisheries (i.e. cod, Atlantic halibut), the lump 'roe' harvest has been an extremely important one in Newfoundland and Labrador with that significance equally as prominent in 3Pn and 4R. Being a fishery that has been greatly influenced by market conditions, landings have fluctuated in accordance to demand and price factors on an annual basis. It is important to note the more recent period has seen very low landings, from 2001-2003 despite significant effort followed by the last two years (2004-2005) where landings have been very high. This observation follows a pattern with other groundfish, in particular cod and indicates to harvesters that environmental factors, specifically the very cold period observed in the early 1990's influenced the distribution and noted abundance of these species with a current return to more normal patterns. With basically no science conducted on this stock, in recent years harvesters have promoted specific initiatives to obtain baseline data on this species. While these efforts have been effective, it is recognized that such initiatives need continuance and expansion before any management inferences can be examined.

CONCLUSION AND ADVICE

This update allowed us to identify some gaps regarding the follow-up of lumpfish fishery that should be filled to correctly assess the status of the resource. According to areas, landings are expressed either in round fish weight, or in gonad weight. Currently, no conversion factor is used to convert gonad weight into round fish weight. Moreover, fishermen do not all complete their logbooks, and those which are completed are not necessarily compiled, which is limiting the potential of analyzing fishery data (mesh size used, fishing effort adjusted yields, numbers of nets, etc). Moreover, there are only very few observer data due to limited deployment on this fleet. It is thus recommended to establish a follow-up and sampling program for the commercial fishery. Lastly, data on life cycle characteristics could be collected on an opportunist basis during scientific surveys.

According to the tagging program, lumpfish make very few displacements from one fishing season to the other. This could indicate that the resource is distributed into several small units, and that spawners would be rather sedentary. They could thus be vulnerable to overexploitation if the effort is concentrated geographically. One of the prime research objectives should relate to the identification of the components that are present in the Gulf. The continuation of the tagging program in 2006 in Newfoundland waters is an initiative that could clarify some aspects of this issue.

Lumpfish fishery is strongly dependent on caviar international prices. In January 2006, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which is the organization responsible for establishing quotas for the various species of sturgeon, required from the countries adjacent to the Caspian Sea, Black Sea, and the Danube River as well as the boundary areas between China and Russia to demonstrate the sustainability of this fishery before issuing exportation quotas. This recent decision should support the development of alternate markets like that for lumpfish. It is thus possible that the pressure of fishery on lumpfish increases. As the fishery carried out in the Gulf is not controlled by a quota, it will be necessary to closely watch any increase in landings and take actions if it is estimated that landings exceed the capacity of the resource to support such a level of exploitation. Average landings over the last 35 years was of almost 300 tons.

SOURCES OF INFORMATION

Davenport, J. 1985. Synopsis of biological data on the lumpsucker *Cyclopterus lumpus* (Linnaeus, 1758). FAO Fish. Synop., 1470: 31 pp.

Scott, W.B., et M.G. Scott. 1988. Atlantic fishes of Canada. Can. Bull. Fish. Aquat. Sci. 1030: iv + 66 pp.

Stevenson, S.C., and J.W. Baird. 1988. The fishery for lumpsfish (*Cyclopterus lumpus*) in Newfoundland waters. Can Tech. Rep. Fish. Aquati. Sci. 1595, iv + 25 pp.

Chouinard, G.A., T. Hurlbut, B. Morin, J. Baird, and C. Bishop. 1992. The lumpfish (*Cyclopterus lumpus*) resource in Atlantic Canada. CAFSAC Research document; 92/106; CSCPCA Document de recherche; 92/106 19 pp.

Grégoire, F. 1998. Débarquements commerciaux et prises accessoires de baudroie (Lophius americanus) et de grosse poule de mer (*Cyclopterus lumpus*) dans l'estuaire et le golfe du Saint-Laurent. Can Tech. Rep. Fish. Aquati. Sci.; 243: 63 pp.

Grégoire, F., J. Gauthier, A. Fréchet, C. Tournois, J.F. Lussier and L. Pageau. 2007. Fécondité et histologie de la lompe (*Cyclopterus lumpus*) dans le nord du golfe du Saint-Laurent, la côte ouest de Terre-Neuve et la sous-division 3Pn de l'OPANO en 2004 et 2005. Can Tech. Rep. Fish. Aquati. Sci. (under preparation).

Fréchet, A., J. Gauthier, P. Schwab, F. Collier and J. Spingle. 2007. Marquage de la lompe (*Cyclopterus lumpus*) dans le nord du golfe du Saint-Laurent de 2004 à 2006. Canadian Science Advisory Secretariat, Research Document 2007 (under preparation).

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