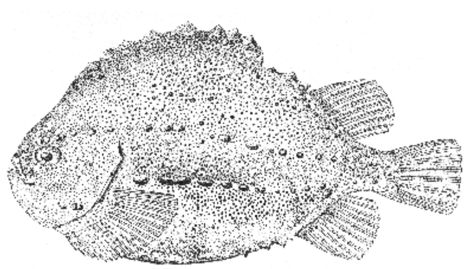
ASSESSMENT OF LUMPFISH IN THE GULF OF ST. LAWRENCE (3Pn, 4RST) IN 2010



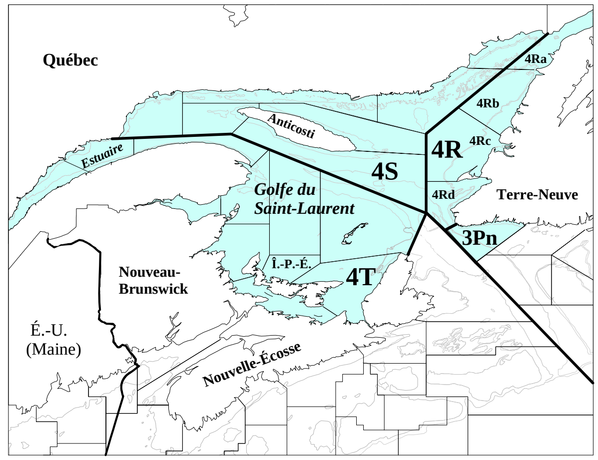


Figure 1. Map of the NAFO divisions in the Estuary and Gulf of St. Lawrence. The unit areas of division 4R are identified as well as subdivision 3Pn.

Context

Although the 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. Scientific knowledge on lumpfish of the Gulf of St. Lawrence is limited. However research work was conducted between 2004 and 2008 through the Fisheries Science Collaborative Program (FSCP). This work focused on fecundity and displacements.

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.

Lumpfish assessments in 3Pn, 4RST are carried out every five years in order to determine whether changes in resource status warrant adjustments to the conservation approach and management plan. The main indicators used for this assessment stem from data from fisheries statistics, commercial catch samples and research projects.

SUMMARY

- Lumpfish in the Gulf are managed by two separate management plans, one in 3Pn and 4R and the other in 4S. There is no plan in 4T. The biological structure of populations and the relevance of these units are unknown. Therefore, this assessment represents an overall update for the areas of interest in the Gulf.

- Traditionally, the lumpfish caviar fishery was highly dependent on market conditions. However, since 2005, landings have declined sharply despite a lucrative market.

- Landings dropped from 264 t in 2005 to 11 t in 2009 and then increased slightly to 36 t in 2010. The 2009 value was the lowest since 1993. This decline by 95% occurred over a four-year period.

- The absence of an abundance index makes it difficult to assess the status of lumpfish. Following the 2006 assessment, a lumpfish size frequency sampling program in the commercial fishery was introduced in 4S.

- The tagging program indicates that 72% of lumpfish are recaptured within 25 km of where they were tagged the previous year. Laboratory studies suggest that the tags could corrode and detach from tagged individuals. It is therefore not currently possible to determine the population structure and levels of mortality.

- The sharp decline in landings, effort and yields suggests a significant decline in resource abundance. The long-term effects on egg production resulting from spawners being caught are unknown. The exploitation rate is also unknown. Despite the uncertainties, this assessment indicates that the status of this resource is very weak and likely overexploited.

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 the monitoring of commercial sizes and the tagging program.

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 occur 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 sexual dimorphism as males are smaller than females.

In early spring, lumpfish undertake a coastal migration for spawning, which takes place in May and June, and then return to deeper waters in late summer and early 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 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 approximately 11 cm and measure around 30 cm at age five.

Lumpfish feed on a variety of invertebrates including euphausiid shrimps, pelagic amphipods, copepods and other shellfish, parts of jellyfish 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*).

Fishery

The 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. The fishery spans over a few weeks. The fishery is carried out with a maximum of 50 gillnets of 50 fathoms (91 meters) with a minimum mesh size of 10 ½ inches. Fishing intensity is largely dependent on economic factors.

Lumpfish landing data are presented in roe weight (t) (Figure 2 and Table 1).

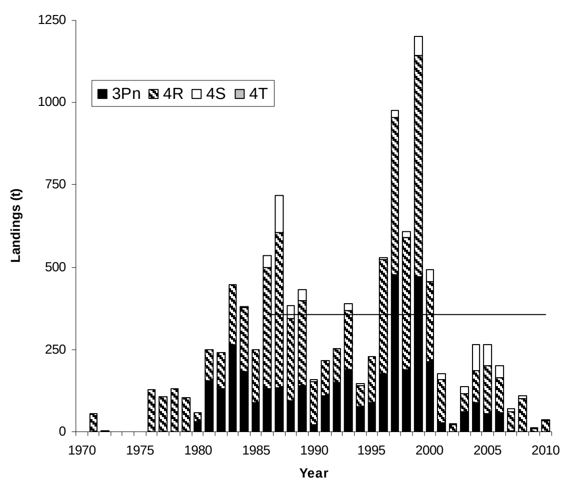


Figure 2. Lumpfish roe landings (t) by fishing area. The horizontal line represents the average landings for the 1986-2009 period.

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; a first peak at the end of the 1980s, and a second at the end of the 1990s. 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 was 163 tons. Roe landings reached a maximum of 673 tons in 1999. Roe landings in 2009 were only 11 t whereas the preliminary values for 2010 total 36 t. The maximum landings in 3Pn were recorded in 1997 and totalled 478 t, and reached 1 t in 2010. Lumpfish exploitation on Quebec's Lower North Shore (4S) began in 1986. Roe landings peaked at 115 t in 1987 and dropped to 4 t in 2010. Average annual roe landings for these four areas were 355 t. Since 2007, 88% of landings stem from 4R.

Table 1. Lumpfish from 3Pn, 4RST: lumpfish roe landings (t) by fishing area.

	NAFO Division				
Year	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	55	145	63		264
2006	59	106	35		201
2007	4	57	9		71
2008		102	8		109
2009		10	1		11
2010*	1	32	4		36

** Preliminary data*

ASSESSMENT

Abundance

Commercial data from dockside weighing is the only data source containing sufficient data to provide some information on the yields from the lumpfish directed fishery between 1993 and 2010 in subdivision 3Pn and divisions 4R and 4S (Figure 3). Trends in annual yields (kg lumpfish roe/number of activities) are similar in the three divisions, peaking in 1999-2000, followed by a low in 2002 and then an increase until 2005 and 2006, and it has dropped again since. The three fishing areas showed minimum values in 2009 and 2010. Since the lumpfish fishery yield is affected by market conditions, it is possible that these annual yields do not only reflect the abundance of the resource.

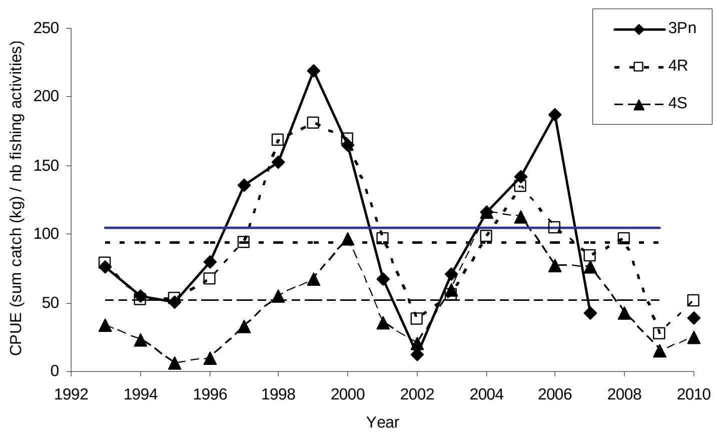


Figure 3: Yields (kg of roe per activity) for the lumpfish directed fishery between 1993 and 2010 in NAFO subdivision 3Pn and divisions 4R and 4S. The horizontal lines represent the average yields of roe per division for the 1993-2009 period.

A monitoring and sampling program of the commercial fishery was introduced in 2006 in 4S. The fishery is directed at females and the sizes selected by these 10½'' gillnets (26.67 cm) range from 350-450 mm (Figure 4).

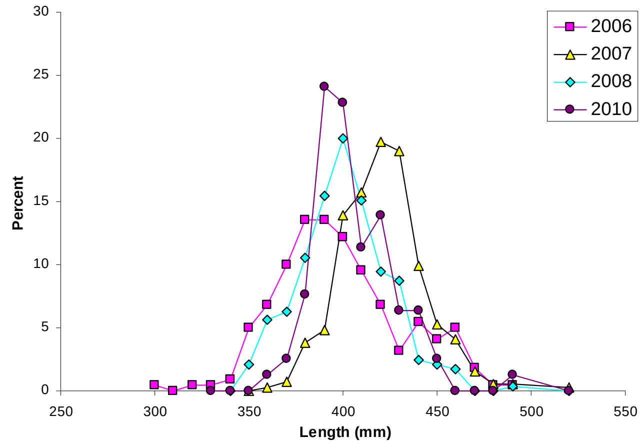


Figure 4: Size frequencies recorded since 2006 (expect 2009) in fishing area 4S.

<u>DFO surveys</u>

Lumpfish catches during trawl surveys are generally low but overall, the data shows some trends. The 2005-2009 period indicated increased lumpfish catches (Figure 5).

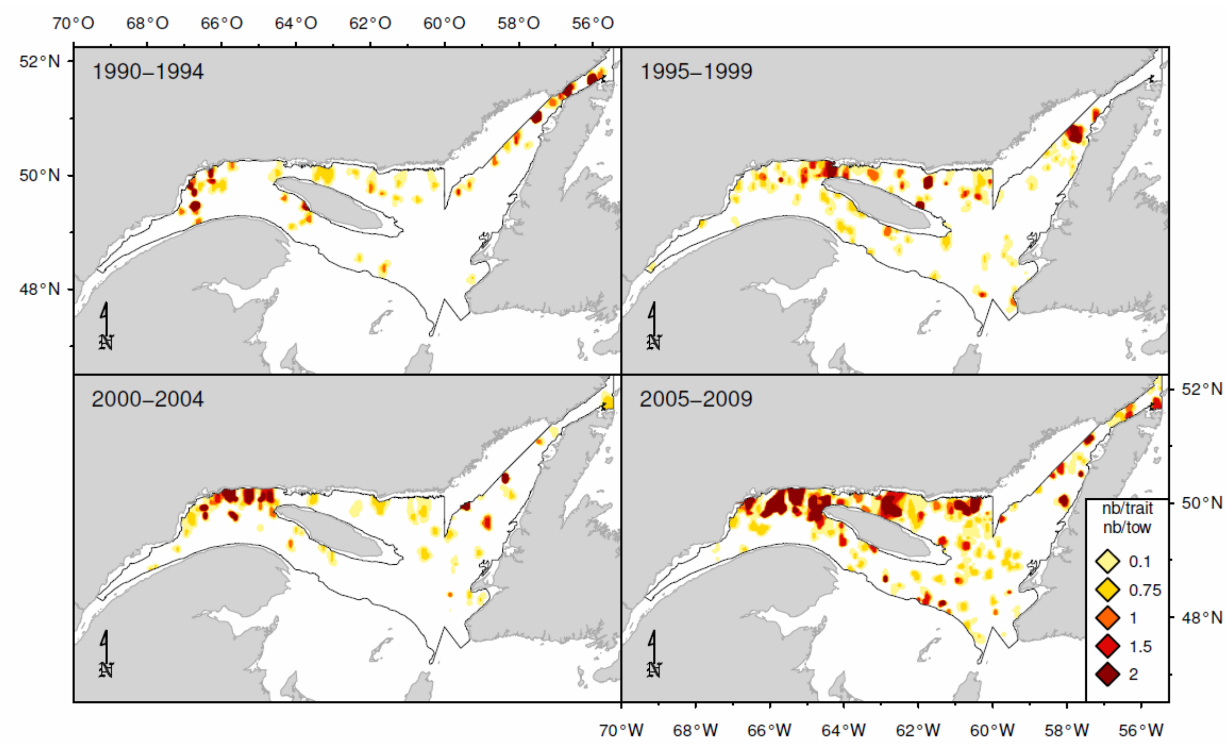


Figure 5. Distribution of lumpfish catches (numbers/tow) during the DFO surveys.

Length frequencies for the 2005-2009 period indicated there were more individuals in the 10-15 cm range as well as the 20-35 cm range (Figure 6).

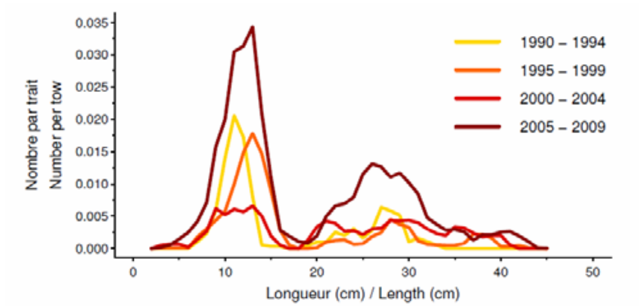


Figure 6. Length frequency distributions for lumpfish caught during the DFO surveys.

Tagging

A tagging study was funded by the Fisheries Science Collaborative Program (FSCP). A total of 3,288 lumpfish were tagged in May and June from 2004 to 2008. The tagging was carried out near the end of the season to avoid immediate recapture during the tagging year. Tagging fishing activities were carried out by commercial fishermen at depths of 10 and 40 meters and the tagging was done by trained technicians for applying Peterson tags. Tagged lumpfish were females ranging in size between 35 cm and 45 cm (Figure 7). The lumpfish from 3Pn were larger compared to those from 4R and 4S.

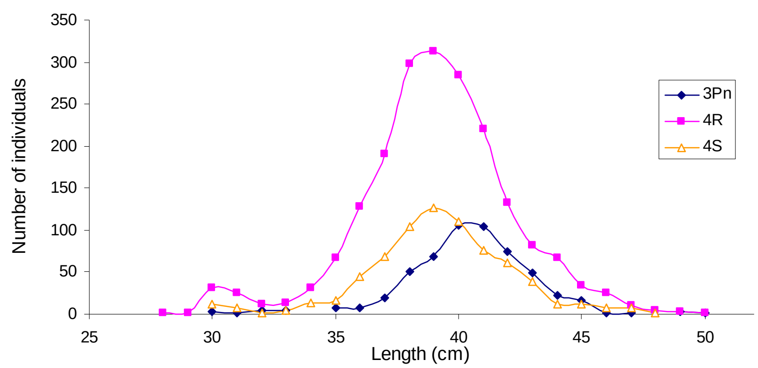


Figure 7: Lumpfish sizes according to NAFO fishing area from tagging activities between 2004 and 2008.

Recaptures from the tagging year are not included in the analysis because individuals do not have time to disperse and the fishery in the current year may be biased. Very few lumpfish are recaptured the year after tagging and almost none thereafter (Table 2). These results could be interpreted as reflecting high levels of natural mortality and fishing mortalities. However, it was suggested that the nickel pins used corrode and fall (photographs and experience from staff responsible for the tanks). To validate this hypothesis, experiments were conducted with these pins (intact or bent) by immersing them in seawater and freshwater. The results indicate that after about 30 days of immersion, rust can already be spotted and after about 60 days, some pins split (Figure 8). Until this possibility is confirmed, it is impossible to draw any conclusion regarding mortalities (natural or fishing) from the tagging data.

Table 2: Summary of tagging and lumpfish recaptures in the Gulf of St. Lawrence.

		Year of recapture							
Tagging year	Individuals tagged	2004	2005	2006	2007	2008	Missing date	TOTAL	% of tagged individuals
2004	914	20	34	2	0	0	3	59	6.46
2005	959		3	21	0	1	4	29	3.02
2006	573			0	2	0	0	2	0.35
2007	243				3	0	0	3	1.23
2008	599					64	0	64	10.68
TOTAL	3288	20	37	23	5	65	7	157	4.77

As the directed fishery is seasonal and very short in duration, there are very few 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 surface waters during the winter. Lumpfish do not demonstrate significant movements, 72% of recaptures were made within 25 km of the tagging site. The longest distance covered by a lumpfish was around 300 km between 3Pn and Fortune Bay over a three-month period (Figure 9).

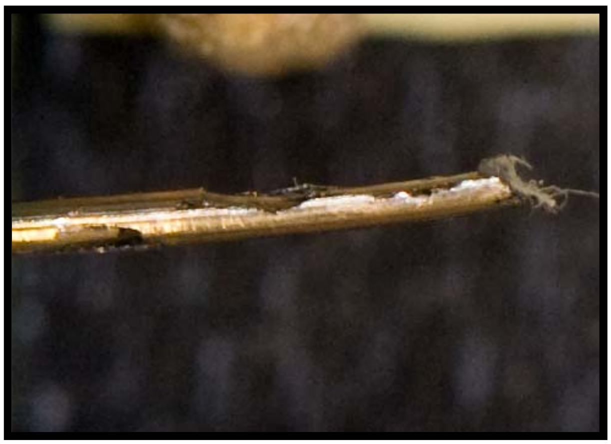


Figure 8. Photograph of a corroded nickel pin after 18 weeks of immersion in seawater.

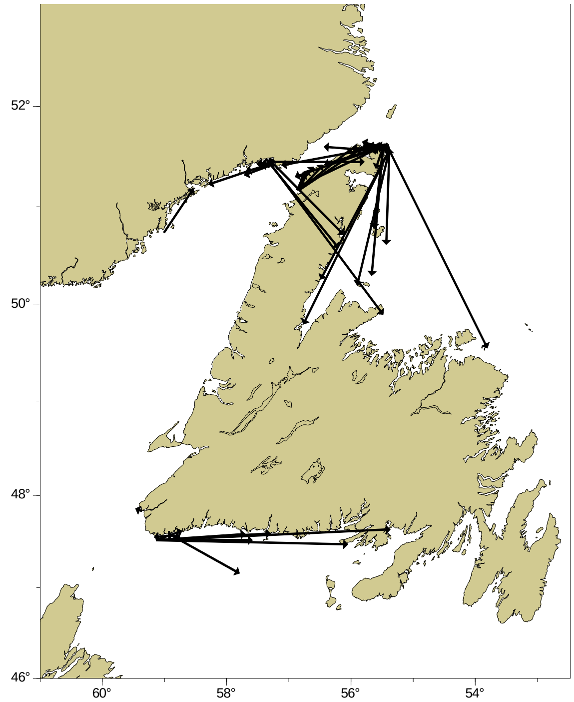


Figure 9: Distance travelled by lumpfish tagged between 2004 and 2008.

Additional Stakeholder Perspectives

This industry remains an important source of income, especially for the inshore groundfish fishermen from the Lower North Shore (4S) and the west coast of Newfoundland (4R, 3Pn). Landings from 4R and 4S come exclusively from the edge of the Strait of Belle Isle. Landings have fluctuated significantly over time, high values in 2007 to very low values in 2009. However, landings increased in 2010. This fishery is heavily influenced by market conditions, and annual landings vary according to demand and prices. Recent landings in 3Pn have been very low. It is important however to note that lobster landings in this region have greatly increased over the same period, reducing fishing effort for lumpfish. There have been periods of low abundance during the short history of this fishery followed by periods of higher abundance. Even if our knowledge of this stock is very limited, fishermen firmly believe that the species is cyclical and its abundance is greatly influenced by environmental factors.

There is a need for further research on the behaviour and reproductive capacity of this species. We must recognize that the market for this species is caviar. We must also share information with the Newfoundland and Labrador industry to better understand how this species compares with other groundfish species.

Sources of uncertainty

Several sources of information have already been reviewed in an attempt to identify a trend in the abundance of this resource. These data are from the fixed gear sentinel fisheries program for the northern Gulf. Lumpfish catches in the fixed gear sentinel fishery are rare.

CONCLUSION AND ADVICE

The tagging program indicates that lumpfish are recaptured very close to sites where they were tagged the previous year. Two types of behaviour could explain this occurrence. Either lumpfish are sedentary and remain in one place throughout the year, or they migrate an indefinite distance and return to the same spawning site each year. This homing behaviour is observed in several fish species. Since the fishing season lasts a very short period, it is difficult to adjudicate between these two hypotheses. However there are several references to observations of concentrations of migrating lumpfish. Assuming lumpfish have a homing behaviour; this would make them susceptible to overexploitation if the effort is concentrated geographically. The continuation of the tagging program is conditional on the corrosion analysis and the use of a plastic material to attach the tag is recommended. This project is no longer funded and the fishermen associations involved from 2004 to 2008 have not shown any intention of continuing so long as the corrosion issue has not been clarified.

The 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 sturgeon species, 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 fishing pressure on lumpfish may increase based on prices as has been observed in the Gulf. The price increased from $2 per kilo in 2006 to $10 per kilo in 2010. As the fishery in the Gulf is not limited by a quota, close monitoring of increases in landings is necessary in order to intervene should they exceed the capacity of the resource to support a fishery of this magnitude.

The sharp decline in landings, effort and yields despite the highest market prices in the history of this fishery ($10/kg in 2010) suggests a significant decline in the abundance of the resource. The long-term effects of removing spawners on egg production are unknown. The exploitation rate is also unknown. Despite the uncertainties, this assessment indicates that the status of this resource is very weak and likely overexploited.

SOURCES OF INFORMATION

This Science Advisory Report is from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, regional advisory meeting of February 14, 2011 on Assessment of Lumpfish in the Gulf of St. Lawrence (3Pn, 4RST). Additional publications from this process will be posted as they become available on the DFO Science Advisory Schedule at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm

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.

Fréchet, A., J. Gauthier, P. Schwab, F. Collier and J. Spingle. 2006. Tagging of lumpfish (*Cyclopterus lumpus*) in the Northern Gulf of St. Lawrence from 2004 to 2006. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/084.

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ISSN 1919-5079 (Print)
ISSN 1919-5087 (Online)

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

CORRECT CITATION FOR THIS PUBLICATION:

DFO. 2011. Assessment of Lumpfish in the Gulf of St. Lawrence (3Pn, 4RST) in 2010. DFO Can. Sci. Advis. Sec., Sci., Advis. Rep. 2011/005.