



Preliminary Report on the July 2009 Mobile Sentinel Survey in the Northern Gulf of St. Lawrence

November 2009

Sentinel Fisheries Program

Each year, biologists from Fisheries and Oceans assess the status of commercially exploited fish and invertebrate stocks. In order to perform these evaluations, scientists use data provided, in part, by mobile gear sentinel fishers (trawlers). The surveys performed by the mobile sentinel fishers cover almost the entire northern Gulf of St. Lawrence. Once analysed, the collected data are used to calculate abundance indices that are used to estimate the status of various stocks.

The mobile gear Sentinel Fisheries Program follows a depth-stratified random survey plan. The northern Gulf is divided into depth strata because depth is known to have an influence on the distribution of fish and invertebrate species. The following strata have been defined: 10-20, 20-50, 50-100, 100-150, 150-200 and over 200 fathoms (1 fathom = 1.83 meters = 6 feet). The mobile survey generally consists of 300 stations randomly selected within those strata. All strata are sampled because results from this survey are used for many species that have different depth preferences. It is also important to find the limits of distribution of a specie and to monitor any potential shifts in time. Nine trawlers, five from Newfoundland and four from Quebec perform the entire survey. At each predetermined station, the vessel performs a standard 30 minutes tow at 2,5 knots. The nine boats participating in the survey use the same trawl, a 300 Star Balloon mounted on a Rock Hopper footgear. The trawl mesh size is 145 mm with a liner of 40 mm in the codend. The use of a liner allows the sampling of fish as young as age 2 for cod but also requires the presence of an observer or a trained technician aboard each vessel. The observers are from Biorex in Quebec and Seawatch in Newfoundland. In spite of the fact that all nine boats use the same trawl, a study showed a 25% variability in wing spread opening during trawling activities. The use of a restrictor cable allows to reduce this variability from 25% to 6 % without bias due to depth and thus to compare the catches from all vessels.

The sentinel surveys require a great deal of thoroughness in collecting a variety of data. With the help of crewmembers, observers or technicians are responsible for the collection of numerous data according to a scientific protocol. At each set, the total catch is sorted by species and weighed. Then the length, weight, sex, and maturity of a number of fish of each species are recorded. For specific demands, some samples (otoliths, liver, gonads, stomach etc.) may also be taken on some fish. Moreover, fish samples are collected and frozen for diverse studies. Finally, water temperature and fishing depth data are collected using a Vemco sensor installed on the trawl. These biological and oceanographic data yield valuable information on the size, growth, condition and diet of various species, as well as stock abundance and water temperature.

The Department of Fisheries and Oceans (DFO) has primary responsibility for the administration of the sentinel program. The implementation of the program is the responsibility of the Capitaines-Propriétaires de

la Gaspésie inc. (ACPG) for mobile gear fisheries in Divisions 4S and 4T, and of the Fish, Food and Allied Workers (FFAW) of Newfoundland in Subdivision 3Pn and Division 4R.

July 2009 Survey

The 15th annual July sentinel survey was conducted in the northern Gulf of St. Lawrence between June 30 and July 19, 2009. A total of 282 fishing stations were successfully carried out (Figure 1), including 21 stations in 3Pn, 129 in 4R (including 10 tows in the 10 to 20 fathoms strata), 102 in 4S and 30 in 4T. Those 282 stations represent 93% of the sampling target.

- From July 1st to July 19th, four Quebec trawlers sampling 4ST completed 132 out of a planned 152 stations (Figure 1). On the west coast of Newfoundland (3Pn, 4R), five trawlers carried out all 150 planned stations from June 30th to July 4th (Figure 1).
- The 30 tows done in the 4T Division are conducted to complement the assessment of Unit 1 redfish, Greenland halibut (turbot) and Atlantic halibut stocks of the management unit 4RST. **The cod catches in 4T are not included in the estimation of abundance of the northern Gulf of St-Lawrence cod stock (3Pn, 4RS).**
- Since 2003, 10 tows have been carried out each year in the three coastal strata in 4R (10 - 20 fathoms). The relevance for adding these strata to the calculation of the index of minimum trawlable biomass for cod was discussed and approved during the cod assessment in February and March 2009. Therefore, catches from these coastal tows are now included in the index of minimum trawlable biomass for cod.
- Cod, redfish, turbot and Atlantic halibut catches for the 282 successful tows of the 2009 July survey are presented in table 1. This table also shows the total catches including the unsuccessful and the discretionary tows. It is important to note that following the Larocque case, no discretionary tows have been allowed since 2006. In 2009, the fish composing the main proportion of the other fish species category are herring, American plaice and white hake.

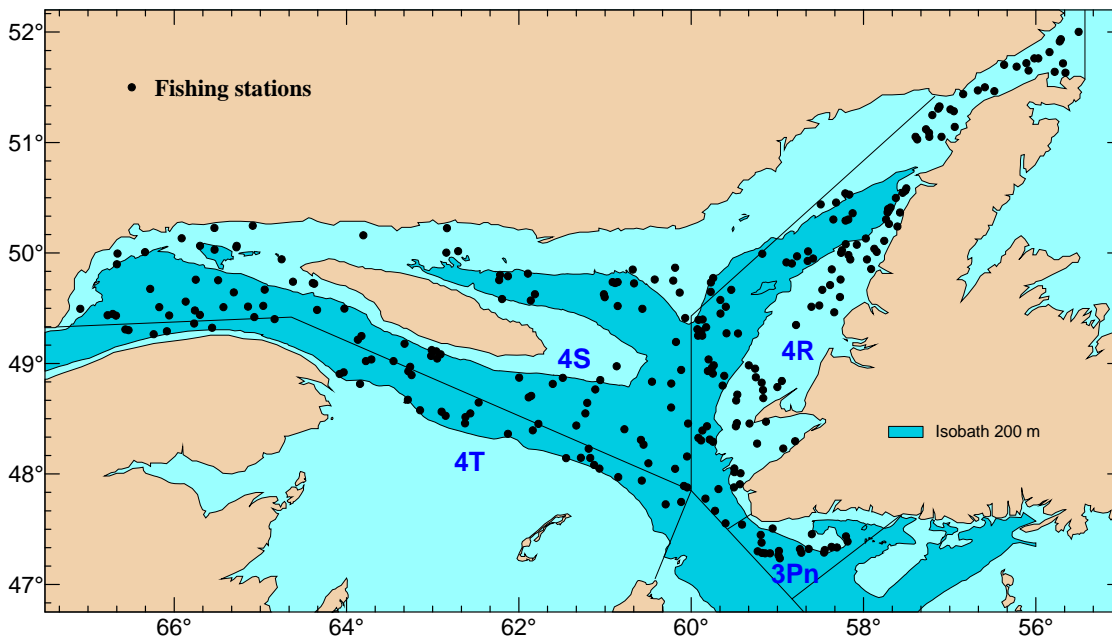


Figure 1: Distribution of stratified random tows performed during the July 2009 survey.

Table 1: Cod, redfish, turbot and Atlantic halibut catches for the successful tows and total catches including unsuccessful and discretionary tows for the July 1995-2009 surveys (3Pn, 4RST).

Year	Sets	Survey Catches (kg)				Sets Total	Total Catches (kg)				
	Survey	Cod	Redfish	Turbot	Halibut		Cod	Redfish	Turbot	Halibut	Other Species
1995	311	6 477	11 457	649	84	326	6 598	11 662	675	84	4 716
1996	272	7 254	16 921	1 300	114	332	12 108	27 169	1 502	150	8 593
1997	285	8 642	12 358	1 206	27	313	11 271	13 582	1 397	80	5 848
1998	289	7 719	16 154	1 472	17	320	12 196	36 231	1 668	113	7 198
1999	294	5 487	12 623	1 703	42	335	19 396	17 177	2 079	129	4 031
2000	291	7 893	7 574	1 583	97	324	16 963	10 486	1 932	126	5 454
2001	275	10 238	7 603	1 342	120	317	16 476	14 421	1 814	208	4 194
2002	261	7 729	8 101	1 486	113	293	18 551	8 849	3 090	160	4 155
2003	296	13 741	6 400	1 693	44	326	14 040	6 616	3 512	72	3 590
2004	280	14 072	8 245	2 015	216	317	15 655	13 295	2 567	271	6 670
2005	285	9 662	6 785	2 977	226	303	10 023	7 802	3 649	402	8 652
2006	295	13 174	5 106	2 748	335	325	15 332	5 963	3 624	577	6 647
2007*	291	6 431	6 797	2 976	382	297	6 435	6 836	2 977	399	3 905
2008*	289	9 931	4 310	2 594	456	293	9 931	4 341	2 604	456	2 743
2009*	282	8 939	3 605	1 701	521	285	8 940	3 605	1 716	521	3 921

* No discretionary tows

1. Biomass and Distribution of Groundfish

Cod

The July sentinel survey series for water deeper than 20 fathoms (1995-2009) suggests an increase in the minimum trawlable biomass for cod between 1995 and 2001 with a rather stable period up to 2006. After an important decrease in 2007 and 2008, the biomass index shows a marked increase in 2009, bringing back the index level to values observed in the late 90s. The minimum trawlable biomass estimate for 2009 in Subdivision 3Pn and Divisions 4RS (more than 20 fathoms) is 68 861 tons.

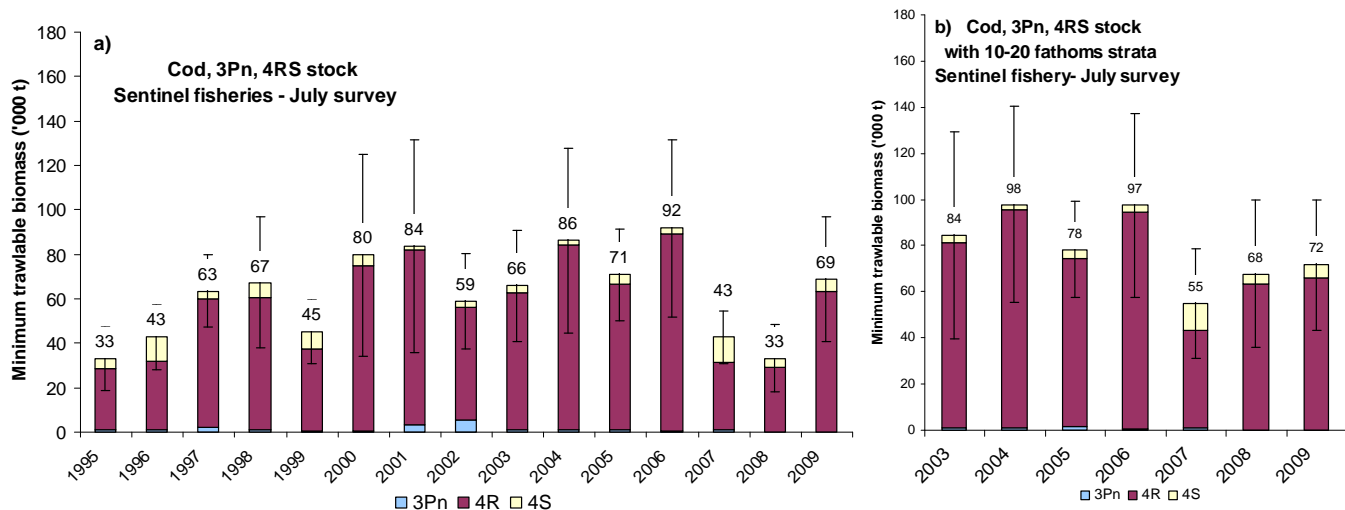


Figure 2: Minimum trawlable biomass index for cod based on the stratified random tows of the July sentinel mobile survey in Subdivision 3Pn and Divisions 4RS (1995 – 2009). a) For strata of depth greater or equal to 20 fathoms (1995 - 2009) b) Including the three strata in 10-20 fathoms (2003 - 2009).

In 2009, for waters deeper than 20 fathoms, the minimum trawlable biomass for 4S shows an increase of 30% compared to 2008, going from 4 264 tons to 5 540 tons. However, it still remains much lower than that

observed in 2007 (11 468 tons). For the 4R Division, the biomass estimate for 2009 is 63 207 tons which is almost double the value observed in 2008 (28 931 tons). The 3Pn estimate in 2009 is the second lowest of the 1995-2009 series with 114 tons.

Since 2003, three inshore strata with depth range of 10 to 20 fathoms are sampled in the 4R Division. The purpose of adding those strata was, in part, to look for the presence of cod outside the zone previously sampled by trawlers in the July mobile gear sentinel survey. The location of the strata are as follows: one on both side of the strait of Belle Isle; one north of the 49th parallel; and a third one south of the 49th parallel. Ten tows were done in these strata by four trawlers during the July 2009 survey. The cod catches varied between 0 and 202 kg for a 30 minutes standard tow. Seven of the ten tows reached the 30 minutes duration while the other three lasted less than 30 minutes because of bad bottom (trawl hooked at the bottom). The global biomass index (including the 10-20 fathoms strata) is 71 528 tons for 2009 (Figure 2b). This value is comparable to the 2008 estimate and is lower than the mean value for this short series.

As in the past, the catch distribution shows that cod is located primarily in 4R Division along the west coast of Newfoundland (Figure 3). In 2009, the cod concentration remains low in 4S Division and 3Pn Subdivision. Of the 282 tows performed in this survey, 7 had catches of cod of more than 400 kg and they were all located in the 4R Division. However, contrary to previous years, none of those large catches were done in the 10 to 20 fathoms strata. The largest catches for 4S and 3Pn are 93 and 5 kg respectively.

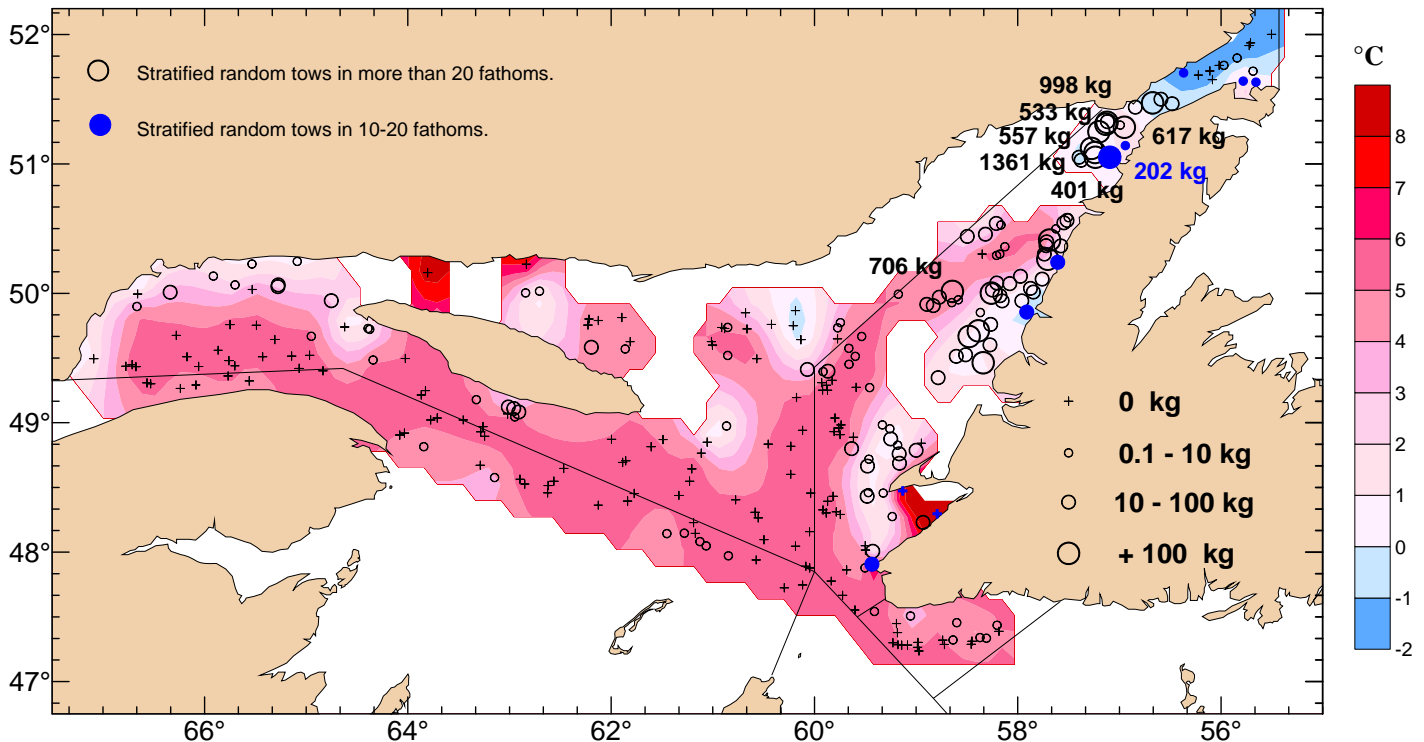


Figure 3: Bottom temperature and observed catch rate (kg / standard tow) distribution of cod for the July 2009 stratified random survey in 3Pn Subdivision and 4RST Divisions. Catches greater than 400 kg are identified on the map.

Redfish

For Unit 1 redfish stock (4RST Divisions), the July sentinel survey series (1995-2009) indicates a higher minimum biomass estimate between 1996 and 1999 (Figure 4). In 2000, there is a decrease in the minimum trawlable biomass index which is relatively stable up to 2007. The estimate of 2008 and 2009 show another slight decrease, leading to an estimate of 30 021 tons in 2009, which is the lowest value of the series.

As in earlier years, the redfish was concentrated for the most part in the channels of the Northern region of the Gulf (Figure 5). In July, good concentrations of redfish were found in the 3Pn Subdivision. This area is not part of the redfish stock of Unit 1 management (4RST) between the months of June to December.

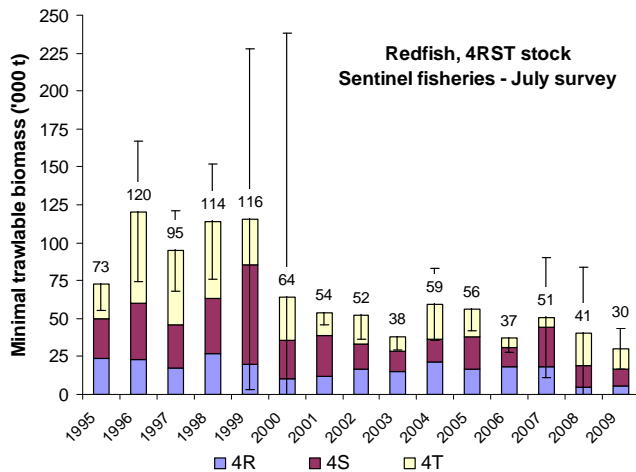


Figure 4: Minimum trawlable biomass index for redfish in 4RST based on the July stratified random survey (1995 – 2009).

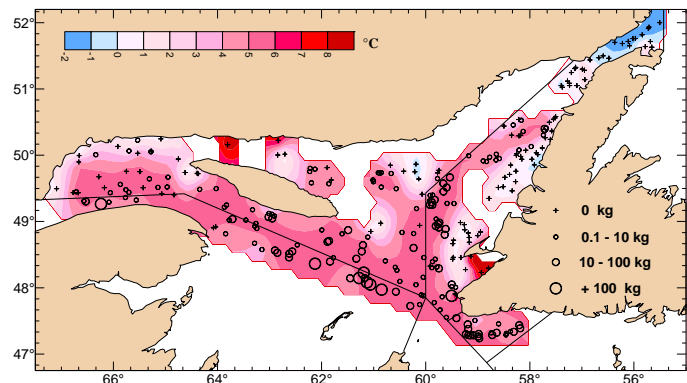


Figure 5: Bottom temperature and catch rate (kg / standard tow) distribution of redfish for the July 2009 stratified random survey in 3Pn and 4RST.

Turbot (Greenland Halibut)

For the Gulf of St. Lawrence turbot stock (4RST Divisions), the July sentinel survey series (1995 – 2009) shows a general increase in biomass from 1995 to 2005 with a relative stability up to 2008 (Figure 6). However, the biomass estimate shows an important decrease in 2009 and is close to the values observed between 1999 and 2004. The total minimum trawlable biomass estimated for 2009 is 21 236 tons.

Turbot was concentrated mostly in the Estuary and in the Laurentian Channel, around Anticosti Island and in the Northern portion of the Esquiman Channel (Figure 7). The distribution of Greenland halibut is overall similar to those of earlier years. The mobile sentinel survey does not sample the Estuary where turbot is found in abundance in the August DFO's annual scientific survey and in the commercial fishery.

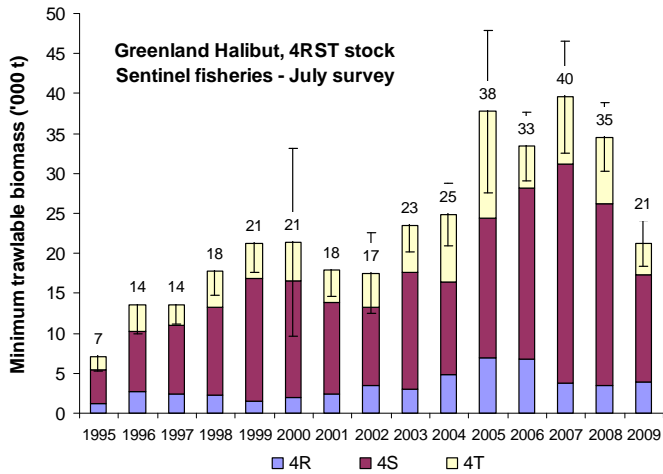


Figure 6: Minimum trawlable biomass index for Greenland halibut based on the July stratified random survey (1995–2009).

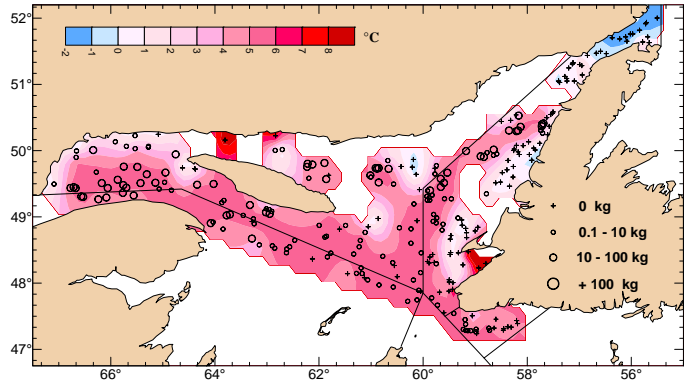


Figure 7: Bottom temperature and catch rate (kg/standard tow) distribution of Greenland halibut for the July 2009 stratified random survey in area 3Pn, 4RST.

Atlantic Halibut

The minimum trawlable index for Atlantic halibut based on the sentinel survey shows a low and stable biomass between 1995 and 2003 with a gradual increase up to 2009. The biomass estimate is 5 327 tons in 2009 and represents the highest value of the series (Figure 8).

The catch distribution map of Atlantic halibut shows its presence in the Esquiman, Laurentian and Anticosti channels (Figure 9).

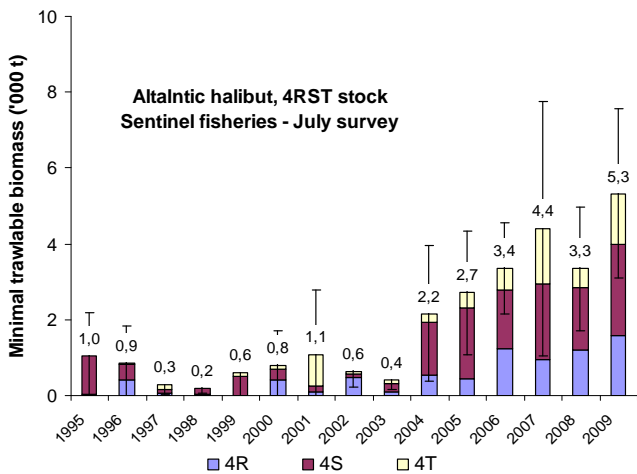


Figure 8: Minimum trawlable biomass index for Atlantic halibut based on the July stratified random survey (1995–2009).

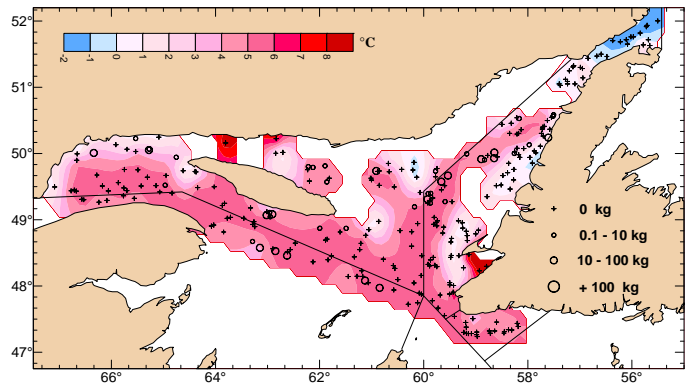


Figure 9: Bottom temperature and catch rate (kg/standard tow) distribution of Atlantic halibut for the July 2009 stratified random survey in area 3Pn, 4RST.

2. Sampling and Analysis

The catches were sorted by species, weighted and/or counted. The sampling of biological data (length, sex and weight) was completed for cod, redfish, Greenland halibut, Atlantic halibut and witch flounder.

Otoliths

Otoliths were taken from cod in area 3Pn, 4RS. The otoliths are used to determine the age of individual specimens and these data will be included in the next cod stock assessment to be held in winter of 2010. Age is one of the key parameter in the study of fish population dynamics and in the evaluation of the abundance for the northern cod of St. Lawrence (3Pn, 4RS). The abundance is actually assessed with a model that has age-structured data as inputs. Such models allow a better monitoring of the evolution of the stock dynamic. These models are named Sequential Population Analysis models (SPA).

Stomachs

Cod and Atlantic halibut stomachs were collected to study fish diet. Frozen samples were sent to the Maurice Lamontagne Institute where Denis Chabot's group will analyse stomach contents.

Witch Flounder

In addition to the total weight per set, length frequencies per sex were collected for the witch flounder's assessment. Douglas Swain of the Gulf Fisheries Center in Moncton (DFO) is the scientist responsible for the stock assessment of that specie.

Acknowledgements

We wish to acknowledge the dedicated work of all the skippers, crewmembers, observers, technicians, and coordinators who contributed in reaching the objectives of the 15th annual July sentinel survey.

Table 2. List of the skippers (*boat name*), crewmembers, technicians, and observers (company) who contributed to the July 2009 sentinel survey:

3Pn, 4R			4S, 4T		
Skipper	Crew	Observer	Skipper	Crew	Observer
Winsor Hedderson (<i>Northern Tip</i>)	Derrick Pittman Anthony Pilgram Jason Saunders	Brent Hedderson(FFAW) Angus Fillier (Seawatch)	Albert English pour Jean-Pierre Élément (<i>Rémy Martin</i>)	Rémy Élément Martin Élément	André Rioux (Biorex)
Garfield Warren (<i>885-77</i>)	Leonard Warren Enos Gaulton Ephrim Smith	Monty Way (FFAW)	Clément Samuel (<i>Sciène</i>)	Normand Samuel Michel Campion Sylvain Bujold	Hélène Larivée (Biorex)
Dereck Coles (<i>Tracey Martina</i>)	Bob Campbell Gorvin Williams Abe Coles Keith Thatchell	Wade Saunders(FFAW) Angus Fillier(Seawatch)	Marcel Roy (<i>Sextan</i>)	Jean-Guy Côté Paul-René Clavet	Christian Girard (Biorex)
Murray Lavers (<i>Sylvia Lynn II</i>)	Warren House Barry Ryan Philip Ryan	Loomis Way(FFAW)	Jean-Marc Legault (<i>Franche-Mer</i>)	Sony Poirier Loic Parent	Marcel Boucher (Biorex)
Dan Genge Jr. (<i>NFLD Storm</i>)	Kevin Genge Hank Poole Jamie Genge Daniel Genge Steadman Genge Jr.	Jim Marsden (Seawatch)			

For more information:

- Bérubé, M. and A. Fréchet. 2001. Summary of the northern Gulf sentinel tagging program with emphasis on recaptures from adjacent management units. CSAS, Res. Doc. 2001/002. 24p.
http://www.dfompo.gc.ca/csas/csas/DocREC/2001/RES2001_002b.pdf
- Bourdages, H., D. Archambault, B. Bernier, A. Fréchet, J. Gauthier, F. Grégoire, J. Lambert and L. Savard. 2008. Preliminary results from the groundfish and shrimp multidisciplinary survey from August 2007 in the northern Gulf of St. Lawrence. CSAS, Res. Doc. 2008/046. 77p
http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/ResDocs-DocRech/2008/2008_046_e.pdf
- Campana, S., G. Chouinard, M. Hanson and A. Fréchet. 1999. Mixing and migration of overwintering Atlantic cod stocks near the mouth of the Gulf of St. Lawrence. Can. J. Fish. Aquat. Sci. 56 : 1873-1881.
<http://article.pubs.nrc-cnrc.gc.ca/RPAS/rpv?hm=HInit&calyLang=eng&journal=cifas&volume=56&afpf=f99-083.pdf>
- DFO, 2009. Assessment of cod stock in the Northern Gulf of St-Lawrence (3Pn, 4RS) in 2008. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/010.
http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/SAR-AS/2009/2009_010_e.pdf
- Dutil, J.-D., J. Gauthier, A. Fréchet, M. Castonguay, Y. Lambert, and P. Ouellet. ICES. 2005. Spawning and life history information for North Atlantic cod stocks. Ices Cooperative Research Report, No. 274.152 p
<http://www.ices.dk/pubs/crr/crr274/crr274.pdf> (large report)
- Dutil, J.-D., J. Gauthier, Y. Lambert, A. Fréchet and D. Chabot. 2003. Cod stocks rebuilding and fish bioenergetics : low productivity hypothesis. CSAS, Res. Doc. 2003/060. 43p.
http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2003/RES2003_060_E.pdf
- Fréchet, A. 2005. Changes in biological characteristics of the fisheries of the Gulf of St. Lawrence (NAFO Divisions 4RST) since 1960. CSAS, Res. Doc. 2005/088. 34p.
http://www.dfo-mpo.gc.ca/csas/csas/publications/resdocs-docrech/2005/2005_088_e.htm
- Fréchet, A., J. Gauthier, P. Schwab, H. Bourdage, C. Tournois, J. Spingle, M. Way and F. Collier. 2007. The status of cod in the Northern Gulf of St. Lawrence (3Pn, 4RS) in 2006. CSAS, Res. Doc. 2007/068. 89p.
http://www.dfo-mpo.gc.ca/csas/Csas/Publications/ResDocs-DocRech/2007/2007_068_e.htm
- Fréchet, A., R. Butler, E. Hussey, J. Kennedy and G. Ross. 2003. Quality at landing in relation to gears used in the 3Pn, 4R cod fishery, 2000-2002. CSAS, Res. Doc. 2003/066. 13p.
http://www.dfo-mpo.gc.ca/csas/csas/DocREC/2003/RES2003_066_B.pdf
- Fréchet, A., 1997. Standardization of otter trawlers participating in the sentinel fisheries in the northern Gulf of St. Lawrence. DFO, CSAS, Res. Doc. 97/72. 10 p.
- Fréchet, A., 1996. Intercalibration of eight otter-trawlers participating in the sentinel fisheries in the northern Gulf of St. Lawrence (3Pn, 4RS) in 1995 through the use of SCANMAR sensors. DFO, Atlantic Fisheries, Res. Doc. 96/67. 15 p.
- Gillis, D. J. 2002. Workshop on the Groundfish Sentinel Program. Moncton, New Brunswick, November 7- 9 2001. CSAS, Proceedings Series 2002/003. 93p.
http://www.dfo-mpo.gc.ca/csas/Csas/Proceedings/2002/PRO2002_003e.pdf
- Grégoire, F., and A. Fréchet. 2005. Calculation of Northern Gulf of St. Lawrence cod (*Gadus morhua*) natural mortality for the 1990 to 2004 period. CSAS, Res. Doc. 2005/019. 25p.
http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2005/RES2005_019_b.pdf

Hammill, M.O. and G.B. Stenson. 2000. Estimated prey consumption by harp seals (*Phoca groenlandica*), grey seals (*Halichoerus grypus*), harbour seals (*Phoca vitulina*) and hooded seals (*Cystophora cristata*). J. Northw. Atl. Fish. Sci. 26: 1-23, 2000.

<http://journal.nafo.int/J26/vol26.html>

Le Bris A., Fréchet A. and J.-C. Brêthes. 2009. Estimation of the exploitation rate of the northern Gulf of St. Lawrence (3Pn, 4RS) Atlantic Cod (*Gadus morhua*) stock, based on tagging data. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/012. v+35p.

http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/ResDocs-DocRech/2009/2009_012_B.pdf

Rice, J.C., P.A. Shelton, D. Rivard, G.A. Chouinard and A. Fréchet. 2003. Recovering Canadian Atlantic Cod Stocks : The Shape of Things to Come?. ICES C.M., 2003/U:06.

<http://www.ices.dk/products/CMdocs/2003/U/U0603.PDF>

Savenkoff, C., M. Castonguay, D. Chabot, A. Fréchet, M.O. Hammill, and L. Morissette. 2006. Main prey and predators and estimates of mortality of Atlantic cod (*Gadus morhua*) in the northern Gulf of St. Lawrence during the mid-1980s, mid-1990s, and early 2000s. Can. Tech. Rep. Fish. Aquat. Sci. 2666: vi+ 32 pp.

<http://www.dfo-mpo.gc.ca/Library/325175.pdf>

Shelton, P.A., J.C. Rice, D. Rivard, G.A. Chouinard and A. Fréchet. 2003. Recent progress on the implementation of the precautionary approach on Canadian cod stocks leading to the re-introduction of the moratorium. ICES C.M., 2003/Y:15.

<http://www.ices.dk/products/CMdocs/2003/Y/Y1503.PDF>

Smedbol, R.K., P.A. Shelton, D.P. Swain, A. Fréchet and G.A. Chouinard. 2002. Review of population structure, distribution and abundance of cod (*Gadus morhua*) in Atlantic Canada in a species-at-risk context. CSAS. Res. Doc. 2002/082. 134p.

http://www.dfo-mpo.gc.ca/csas/csas/DocREC/2002/RES2002_082e.pdf

Stenson, G.B. and M.O. Hammill. 2004. Quantifying uncertainty in estimates of Atlantic cod (*Gadus morhua*) consumption by harp seals (*Phoca groenlandica*). Secr. can. consult. sci. du MPO. Doc. Rech. 2004/089 p.32.

http://www.dfo-mpo.gc.ca/csas/csas/publications/resdocs-docrech/2004/2004_089_f.htm

Yvelin, J.-F., A. Fréchet, and J.-C. Brêthes. Migratory routes and stock structure of cod from the Northern Gulf of St. Lawrence (3Pn, 4RS). CSAS. Res. Doc. 2005/055. 50 p.

http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2005/RES2005_055_e.pdf

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