Length structures and maturity ogive for Atlantic Halibut (*Hippoglossus hippoglossus*) from St-Pierre et Miquelon fishery in NAFO subdivision 3Ps in 2014.

Working Document to Atlantic Halibut 3NOPs4VWX5Zc stock assessment working group

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Context

St-Pierre et Miquelon (SPM) fishing for Atlantic halibut in 3Ps is partly opportunistic and partly a target species for the autumn fisheries, when Atlantic halibut aggregate for spawning. The total catches by SPM per fishing season is given in the table below.

Fishing season	Catches (tons)
2006/07	27
2007/08	11
2008/09	16
2009/10	35
2010/11	31
2011/12	125
2012/13	94
2013/14	69
2014/15	39

Table 1: Historic catches of Atlantic halibut by St-Pierre et Miquelon in 3Ps
(source DTAM St-Pierre et Miquelon)

The Atlantic halibut stock area comprises the subdivisions 3NOPs4VWX5Zc where total international catches has increased to about 2300 tonnes in 2013 (DFO, 2015) and the TAC for 2014 has been set to 2563 tonnes. The SPM uptake of the overall quota varies between 2 to 6 % over the last 10 years.

In 2014, responding to a demand for improving the scientific cooperation, by the Canada France Consultative Committee (CFCC) for 3Ps management, SPM began the monitoring of the autumn fishery by on-board observer. The objectives were to provide the stock assessment working group with information on maturity given that the fishery is fishing on a spawning ground.

Methodology

The 4 journeys conducted by the vessel specialised into this targeted fishery were monitored. For 3 of them, length, sex, individual weight and maturity were collected on every fish at sea. Due to a problem in the protocol specification, the individual weights are not usable (i.e. not linked to the length and sex of the fish), but this will be fixed for future monitoring. The maturity coding was given by DFO (Table 2).

Stage	Code	Male	Female
1	1	Immature	Immature
2	3	Mature	Pre-Spawning
3	5	Spawning	Spawning
4	6		Post-spawning

Table 2 : Maturity codingTable 2 : Maturity coding

The maturity ogives were derived using a logistic equation (Rickey, 1995, ICES 2008)

$$Y = \left(\frac{1}{1+\exp^{(a+bx)}} \right) \quad (1)$$

where: Y = percentage of the number of mature specimens, X = length class, and a and b are constant coefficients of the equation initially calculated from a linearisation (2) of the formula (1).

$$\log\left(\frac{1 - Y}{Y} \right) = \log(a) + b \,.\, X \quad (2)$$

The length at which 50% of the fish population achieved first sexual maturity was calculated by solving equation (2) with Y = 0.5

Results

Voyage	Date	Positions (SO / NE)	Depth range (fathoms)	Fishing sets	Nb hooks	Catches halibut (kilos)	Nb halibuts	nb halibut / 1000 hooks
1	25 Oct. - 2 Nov. 2014	44°32'N - 56°12'W 44°46'N - 56°26'W	212 - 580	24	63600	6805	427 310 males 107 females	6.7
2	12-20 nov 2014	44°32'N ï 56°16'W 44°48'N - 56°24'W	360 - 560	23	55620	4663	292 229 males 56 females	5.2
3	26 Nov - 6 Dec 2014	44°32N - 56°12'W 44°48"N - 56°24'W	215 - 600	31	80340	5353	345 229 males 114 females	4.3
4	xx - 22 Dec 2014					7639	428	

Table 3 : Description of the fishing trips targeting Atlantic halibut in the autumn 2014 by SPM fisheries.

The 3 voyages monitored by the on-board observer occurred between the end of October and the end of December. The fishing positions varied little, the vessel operating mainly in the 3Psg in a rectangle defined by the SO position 44°32'N ï 56°12'W and the NE position 44°48'N ï 56°26'W within the SPM EEZ. The depths are ranging from 212 to 600 fathoms. The vessel is operating about 3 to 4 sets of 2000 ï 3000 hooks per day. The 4th voyage was monitored on-shore, and only individual weight was collected. In total 1492 individuals were caught for a total of 24.46 tonnes.

Length distribution of the catches combined with maturity status is given figure 1. A large sexual dimorphism is observed with males almost all mature displaying a smaller length structure than the females, which mature at a length where there is almost no more male

(>125 cm). This dimorphism translates in the length where 50% are mature (figure 2), with the estimate for female (126.7 cm) being double from the male estimate (63.9 cm).

The raised estimates (figure 3 and table 4) use the ratio of the total number of individuals caught over the total number of individuals sampled (table 3).

The maturity stages per trip (Figure 4) show that pre-spawning was the principal stage for female until the end of November, then in the third trip (26 Nov. 6 Dec.) immature stage prevailed and post-spawning appeared. For the males, the spawning stage was steadily the principal stage followed by the mature stage, meaning that these fish were going to spawn later during the year.

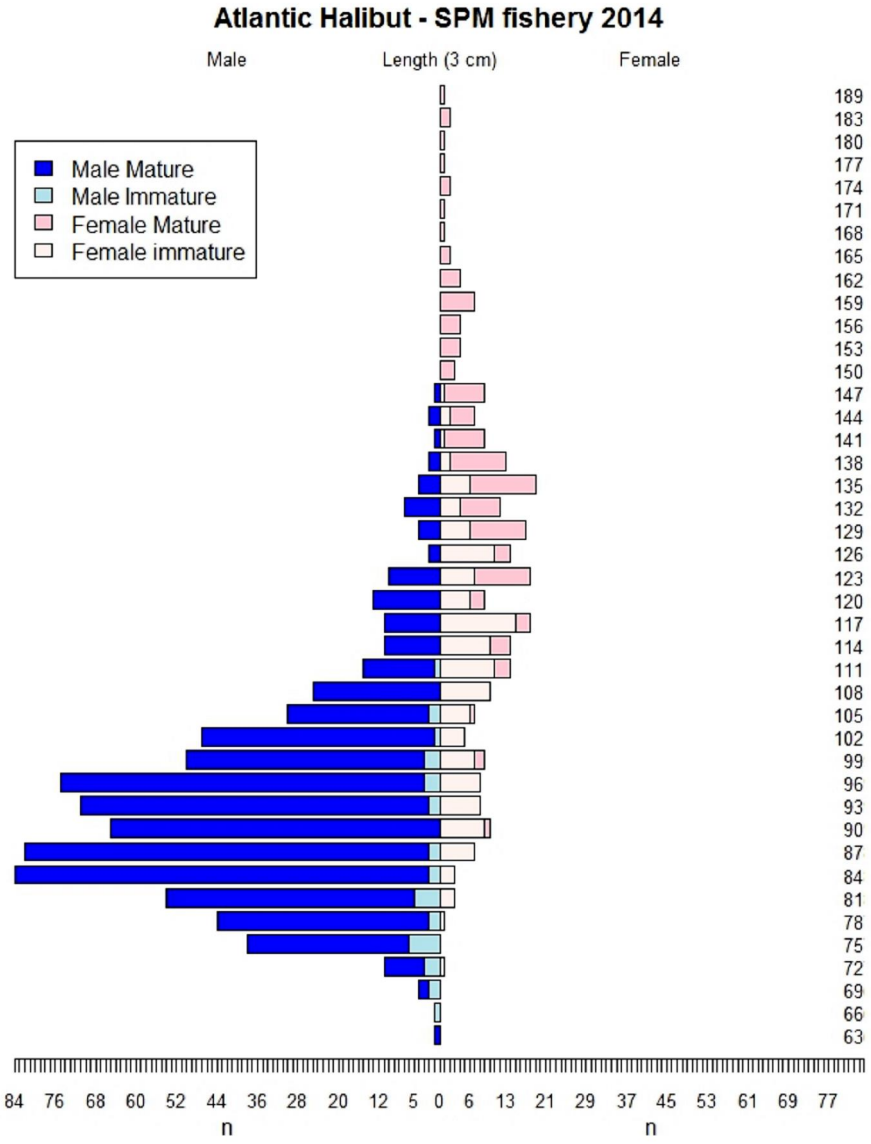

Figure 1 : Length distribution and maturity status of Atlantic halibut catches in 3Ps by SPM monitored fishery

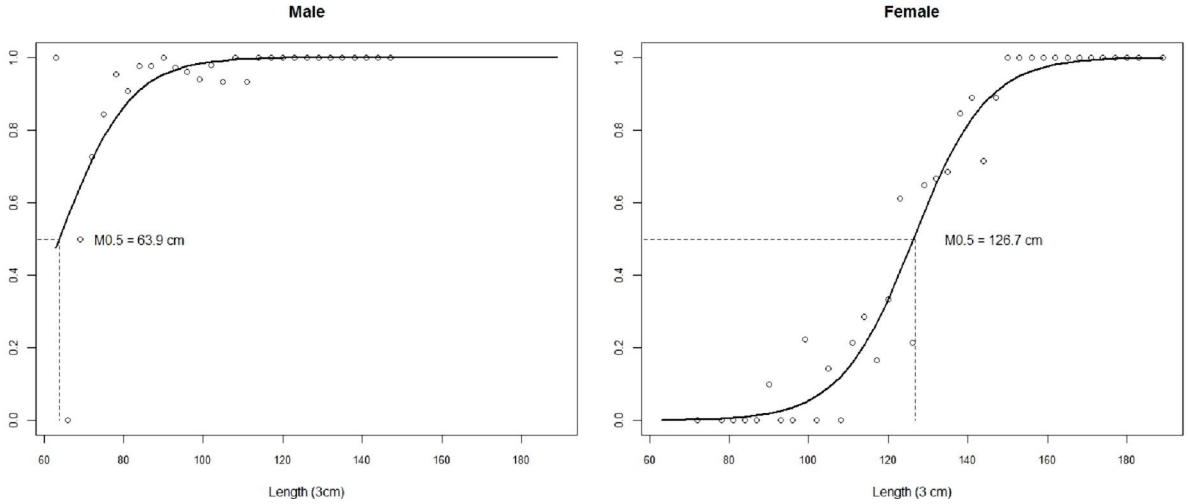

Figure 2 : Maturity ogive for Atlantic halibut catches in 3Ps by SPM monitored fishery.

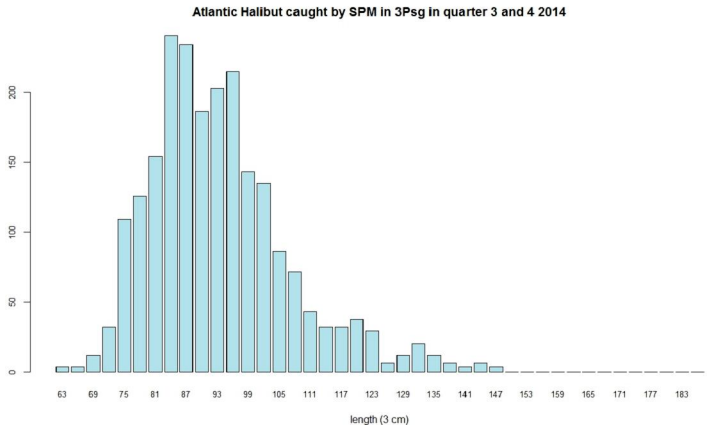

Figure 3 : Length Frequency Distribution for Atlantic halibut caught by SPM fishery in 3Psg in Quarter 3 & 4 2014.

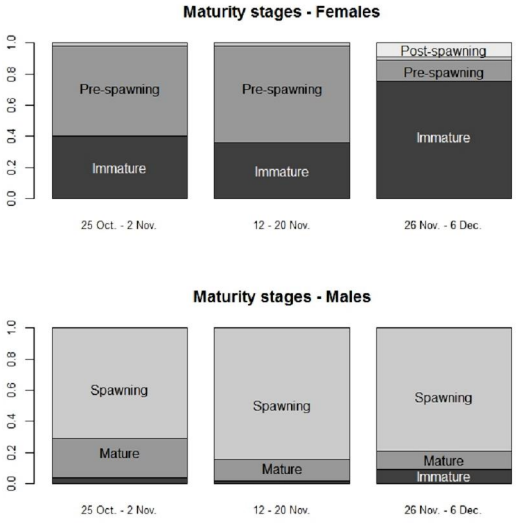

Figure 4 : Proportion of maturity stages per trip

length	sampledM	sampledF	matM	matF	totM	totF
63	1	0	100%	-	1,4	-
66	1	0	0%	-	1,4	-
69	4	0	50%	-	5,7	-
72	11	1	73%	0%	15,7	1,4
75	38	0	84%	-	54,4	-
78	44	1	95%	0%	62,9	1,4
81	54	3	91%	0%	77,2	4,3
84	84	3	98%	0%	120,2	4,3
87	82	7	98%	0%	117,3	10,0
90	65	10	100%	10%	93,0	14,3
93	71	8	97%	0%	101,6	11,4
96	75	8	96%	0%	107,3	11,4
99	50	9	94%	22%	71,5	12,9
102	47	5	98%	0%	67,2	7,2
105	30	7	93%	14%	42,9	10,0
108	25	10	100%	0%	35,8	14,3
111	15	14	93%	21%	21,5	20,0
114	11	14	100%	29%	15,7	20,0
117	11	18	100%	17%	15,7	25,7
120	13	9	100%	33%	18,6	12,9
123	10	18	100%	61%	14,3	25,7
126	2	14	100%	21%	2,9	20,0
129	4	17	100%	65%	5,7	24,3
132	7	12	100%	67%	10,0	17,2
135	4	19	100%	68%	5,7	27,2
138	2	13	100%	85%	2,9	18,6
141	1	9	100%	89%	1,4	12,9
144	2	7	100%	71%	2,9	10,0
147	1	9	100%	89%	1,4	12,9
150	0	3	-	100%	-	4,3
153	0	4	-	100%	-	5,7
156	0	4	-	100%	-	5,7
159	0	7	-	100%	-	10,0
162	0	4	-	100%	-	5,7
165	0	2	-	100%	-	2,9
168	0	1	-	100%	-	1,4
171	0	1	-	100%	-	1,4
174	0	2	-	100%	-	2,9
177	0	1	-	100%	-	1,4
180	0	1	-	100%	-	1,4
183	0	2	-	100%	-	2,9
189	0	1	-	100%	-	1,4

Table 3 : Number of individuals sampled, maturity and raised numbers per sex.

Conclusions

Monitoring maturity during the spawning season is highly relevant to understand the spawning behaviour and quantifying precisely the proportion of fish mature. SPM monitoring should continue, since this first series of data needs to be confirmed and the stability of the maturity status and dates of the spawning period is important to evaluate. Moreover, SPM maturity monitoring provide samples during the spawning period, and constitutes thus an important input to the assessment of the stock.

Individual weights could not be processed, since they were not linked to the length and sex of the fish. The protocol has been updated so as to enable the processing of the data and establish length weight relationship of the SPM catches, from the next sampling periods.

References

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