10.3 Atlantic salmon from North America

10.3.1 Summary of the advice for 2016 to 2018

Because the NASCO Framework of Indicators of North American stocks for 2015 (run in January 2016) did not indicate the need for a revised analysis of catch options, the management advice provided in the multiyear advice from 2015 for 2016 and 2017 remains unchanged. In the 2015 advice, there were no mixed-stock fishery catch options for 2015 to 2018 on 1SW non-maturing and 2SW salmon in North America consistent with the management objectives defined for this stock complex. Management advice in the form of catch options is only provided by ICES for the non-maturing 1SW and maturing 2SW components, as the maturing 1SW component is not fished outside of home waters.

10.3.2 NASCO has asked ICES to describe the key events of the 2015 fisheries (including the fishery at St Pierre and Miquelon)

Three groups exploited salmon in Canada in 2015: aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. Mandatory catch and release of small salmon was implemented in the 2015 recreational fishery for the Gulf region, and mandatory release of large salmon continued. Fishing regulations changed in Québec prior to the 2015 season to limit the retention of large salmon for 16 additional rivers. The dramatic decline in harvested tonnage since 1980 (Table 10.3.2.1 and Figure 10.3.2.1) is in large part the result of the reductions in commercial fisheries effort, with closure of the insular Newfoundland commercial fishery in 1992, closure of the Labrador commercial fishery in 1998, and closure of the Quebec commercial fishery in 2000. All commercial fisheries for Atlantic salmon remained closed in Canada in 2015. In the recreational fishery, about 64 000 salmon (about 40 000 small and 24 000 large) were caught and released, representing about 64% of the total number caught (including retained fish). France (Islands of Saint-Pierre and Miquelon) reported a total harvest of 3.5 t in the professional and recreational fisheries in 2015 (Table 10.3.2.1). There are no commercial or recreational fisheries for Atlantic salmon in USA (Table 10.3.2.1).

	Canada					St Pierre & Miquelon	USA
	Commercial	Aboriginal	Labrador resident	Recreational	Total		
2015 reported nominal catch (t)	0	62.3	2.0	69.2	134	3.5	0
% of NAC total	-	45	1	51	97	3	-

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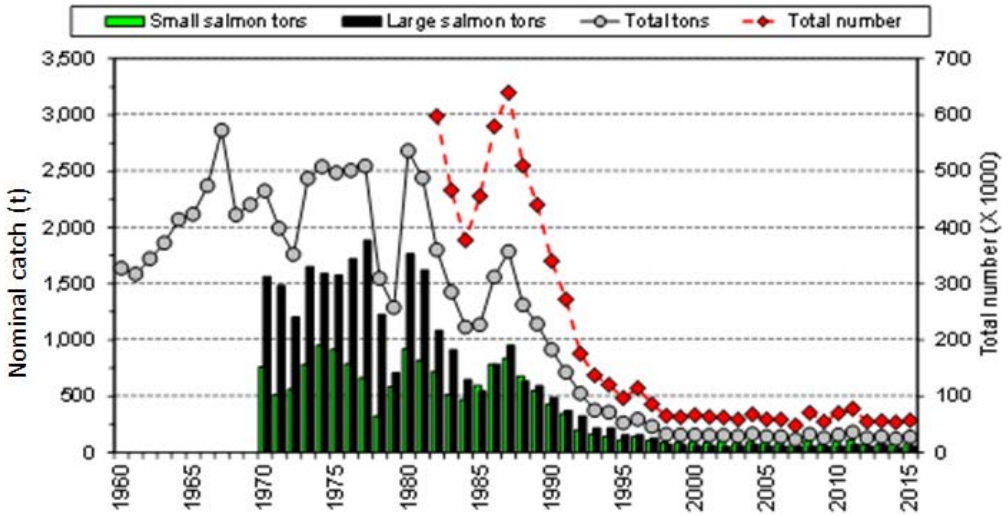

Figure 10.3.2.1 Nominal catch (harvest; t) of salmon in Canada (combined catches in USA and St Pierre and Miquelon are ≤ 6 t in any year).

Table 10.3.2.1 Total reported nominal catch of salmon in homewaters by country (in t, round fresh weight), 1980–2015 (2015 figures include provisional data).

Year	Canada			USA	St. P&M
	Lg	Sm	Total	Total	Total
1980	1,763	917	2,680	6	
1981	1,619	818	2,437	6	
1982	1,082	716	1,798	6	
1983	911	513	1,424	1	3
1984	645	467	1,112	2	3
1985	540	593	1,133	2	3
1986	779	780	1,559	2	3
1987	951	833	1,784	1	2
1988	633	677	1,310	1	2
1989	590	549	1,139	2	2
1990	486	425	911	2	2
1991	370	341	711	1	1
1992	323	199	522	1	2
1993	214	159	373	1	3
1994	216	139	355	0	3
1995	153	107	260	0	1
1996	154	138	292	0	2
1997	126	103	229	0	2
1998	70	87	157	0	2
1999	64	88	152	0	2
2000	58	95	153	0	2
2001	61	86	148	0	2
2002	49	99	148	0	2
2003	60	81	141	0	3
2004	68	94	161	0	3
2005	56	83	139	0	3
2006	55	82	137	0	4
2007	49	63	112	0	2
2008	57	100	157	0	4
2009	52	74	126	0	3
2010	53	100	153	0	3
2011	69	110	179	0	4
2012	52	74	126	0	3
2013	66	72	138	0	5
2014	41	77	118	0	4
2015	54	80	134	0	4

10.3.3 NASCO has asked ICES to review and report on the development of age-specific stock conservation limits

There were no changes to the conservation limits in North America. Reference points for the North American regions are based on the conservation limits for 2SW salmon. The management objective for Scotia–Fundy is based on an increase of 25% in returns of 2SW salmon from the mean return in the base years 1992 to 1996. For USA, the management objective is to achieve 2SW adult returns of 4549 or greater.

Country and Commission area	Stock area	2SW conservation limit (no. of fish)	Management objective (no. of fish)
Canada	Labrador	34746	34746
	Newfoundland	4022	4022
	Gulf of St. Lawrence	30430	30430
	Quebec	29446	29446
	Scotia–Fundy	24705	10976
	Total	123349	
USA		29199	4549
North American Commission		152548	

10.3.4 NASCO has asked ICES to describe the status of the stocks

Stock status is presented for six regions (Figure 10.3.4.1) and overall for North America.

Estimates of recruitment (pre-fishery abundance (PFA), defined as the number of 1SW salmon on 1 August of the second summer at sea), suggest continued low abundance of North American salmon (Figure 10.3.4.2). The total PFA in the North-west Atlantic has oscillated around a generally declining trend since the 1970s, with a period of persistent low abundance since the early 1990s. This is largely driven by the decline in the non-maturing 1SW salmon.

In 2015, 2SW spawners (median estimates) for Labrador and Newfoundland were above the conservation limits (CL), while 2SW spawners were below the CL in all other regions and for the North American Commission overall (Figure 10.3.4.3). Particularly large deficits are noted in the Scotia–Fundy and USA regions. Egg depositions by all sea-ages combined in 2015 exceeded or equaled the river-specific CLs in 41 of the 64 assessed rivers and were less than 50% of CLs in ten rivers (Figure 10.3.4.4).

Nominal catch of salmon decreased strongly from the early 1980s to the late 1990s, and has remained very low since then (Figure 10.3.2.1). Exploitation rates of both large salmon (2SW, 3SW, and previous spawners) and small salmon (mostly 1SW) remained relatively stable until 1984 and 1992, respectively, when they declined sharply with the introduction of restrictive management measures (Figure 10.3.4.5). Declines continued in the 1990s. In the last few years, exploitation rates have remained at the lowest in the time-series.

Despite major changes in fisheries management two to three decades ago, and increasingly more restrictive fisheries measures since then, returns have remained near historical lows except for returns to Labrador and Newfoundland. Many populations, particularly those in the southern regions, are currently threatened with extirpation. The continued low abundance of salmon stocks in the USA and three regions of Canada (Scotia–Fundy, Gulf, and Québec), despite significant fishery reductions and generally sustained smolt production, strengthens the conclusions that factors acting on survival in the first and second years at sea are constraining abundance of Atlantic salmon.

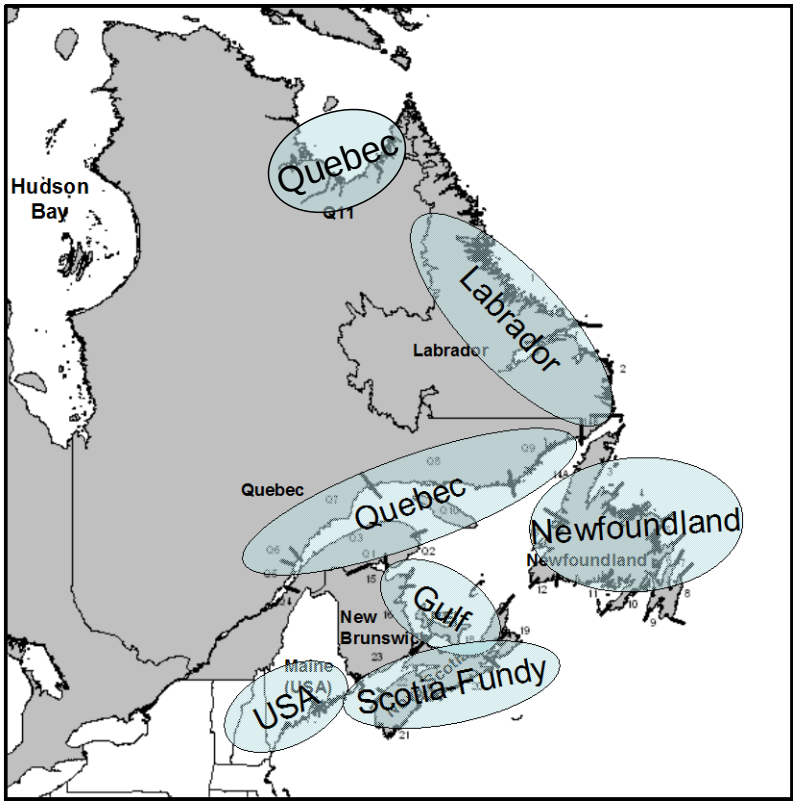

Figure 10.3.4.1 Regional groupings of Atlantic salmon in the North American Commission.

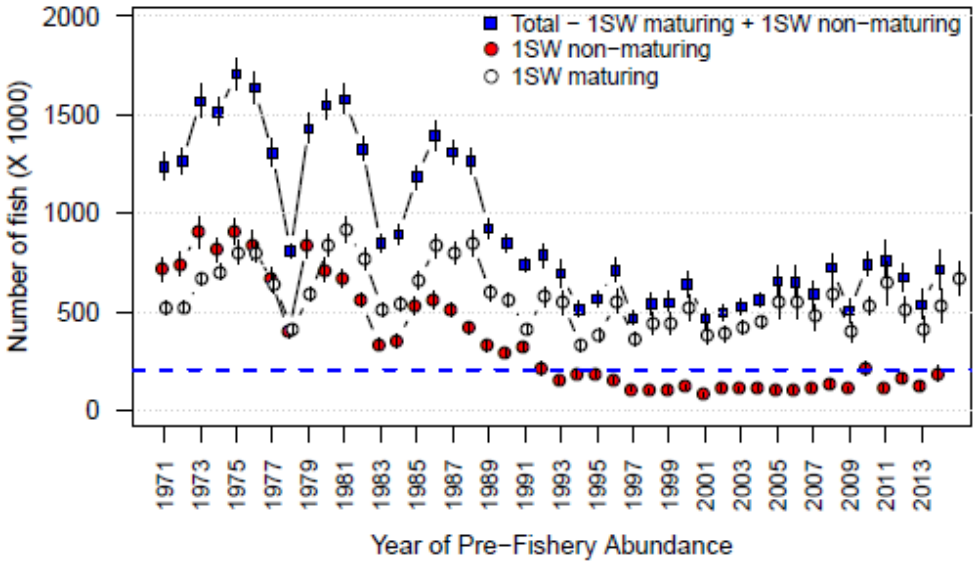

Figure 10.3.4.2 Estimated (median, 5th to 95th percentile range) pre-fishery abundance (PFA) for 1SW maturing, 1SW non-maturing, and total cohort of 1SW salmon for North America. The dashed blue horizontal line is the corresponding sum of the 2SW conservation limits for NAC, corrected for 11 months of natural mortality.

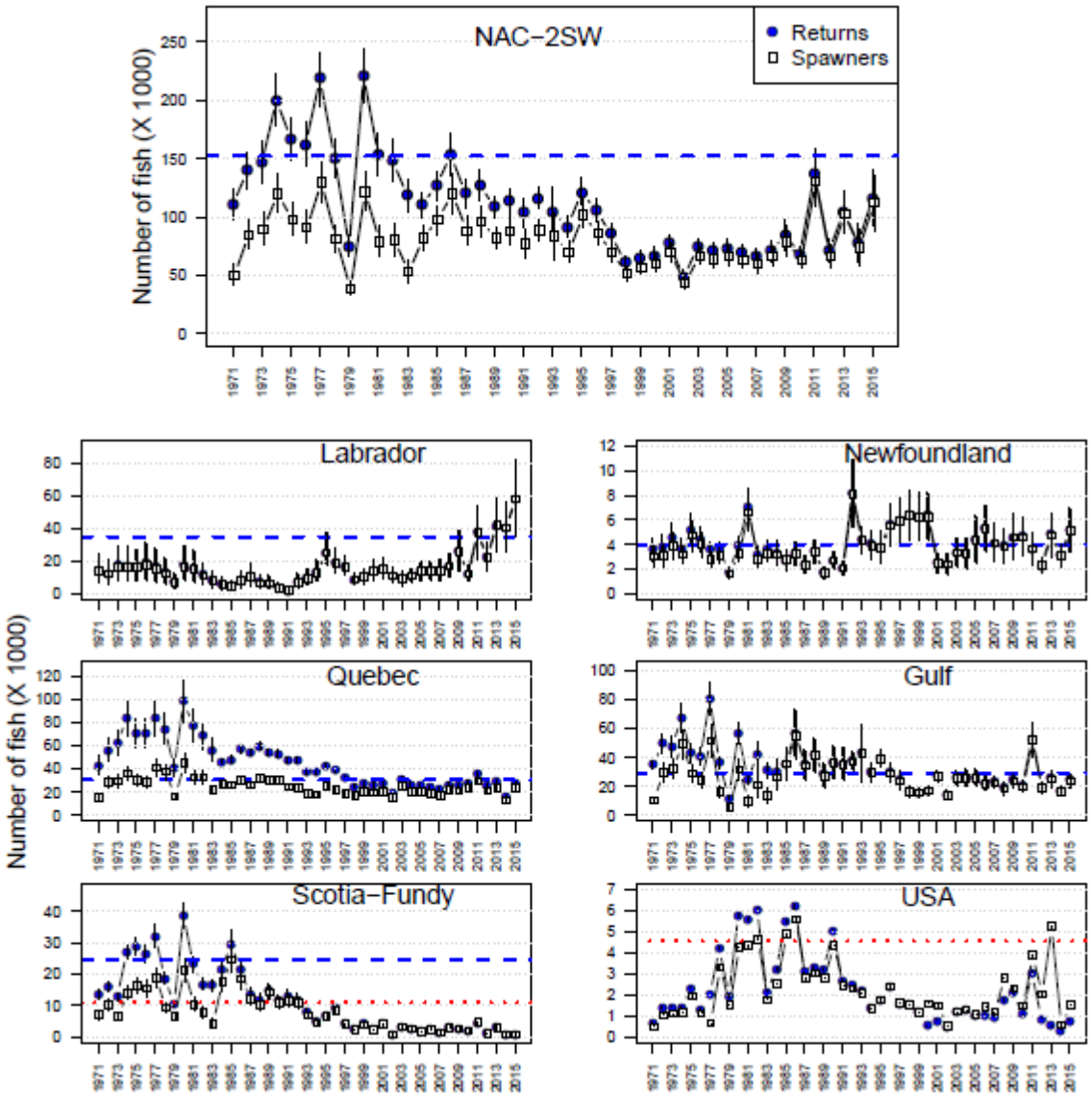

Figure 10.3.4.3 Estimated (median, 5th to 95th percentile range) returns (shaded circles) and spawners (open squares) of 2SW salmon for NAC overall and for each of the six regions. The dashed line is the corresponding 2SW CL; the 2SW CL (29 199 fish) is off scale in the plot for the USA. The dotted lines in the Scotia–Fundy and US panels are the region-specific management objectives. Returns and spawners for Scotia–Fundy do not include those from salmon fishing area (SFA) 22 and a portion of SFA 23. For USA, estimated spawners exceed the estimated returns in some years due to adult stocking restoration efforts.

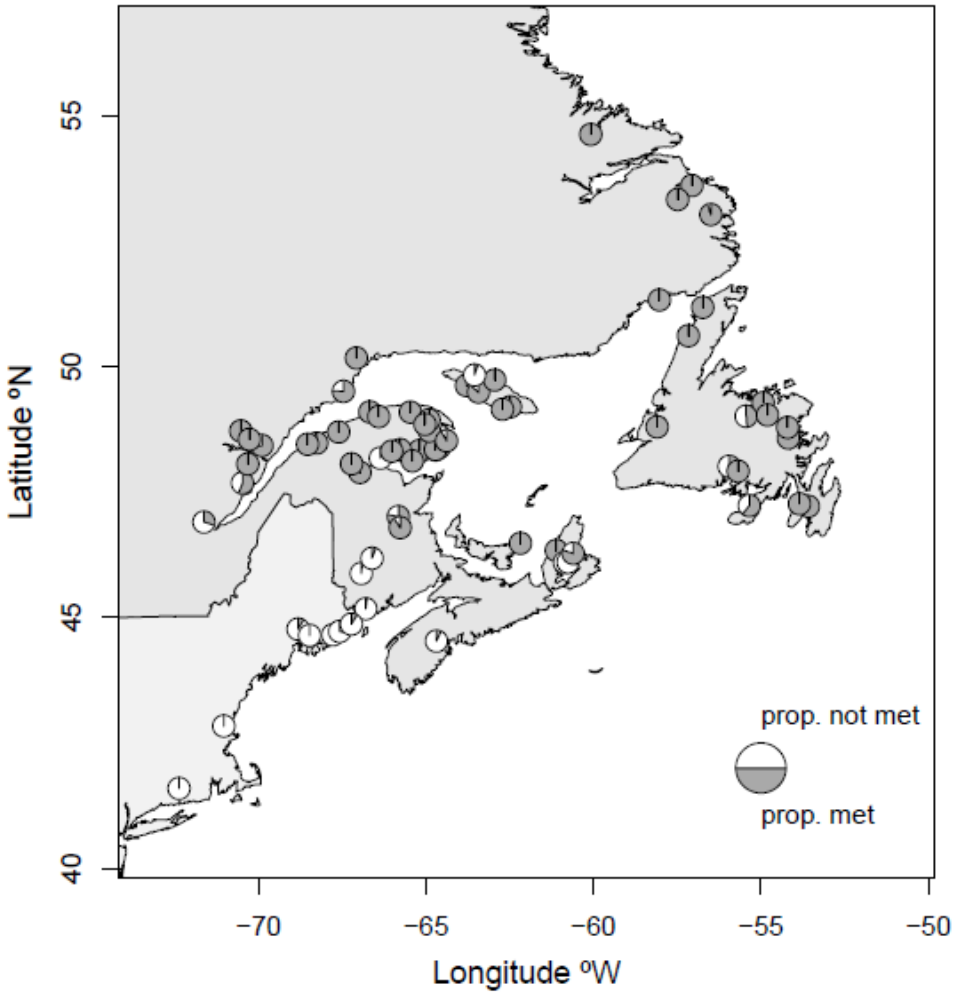

Figure 10.3.4.4 Proportion of the conservation egg requirement attained in the 64 rivers of the North American Commission area assessed in 2015.

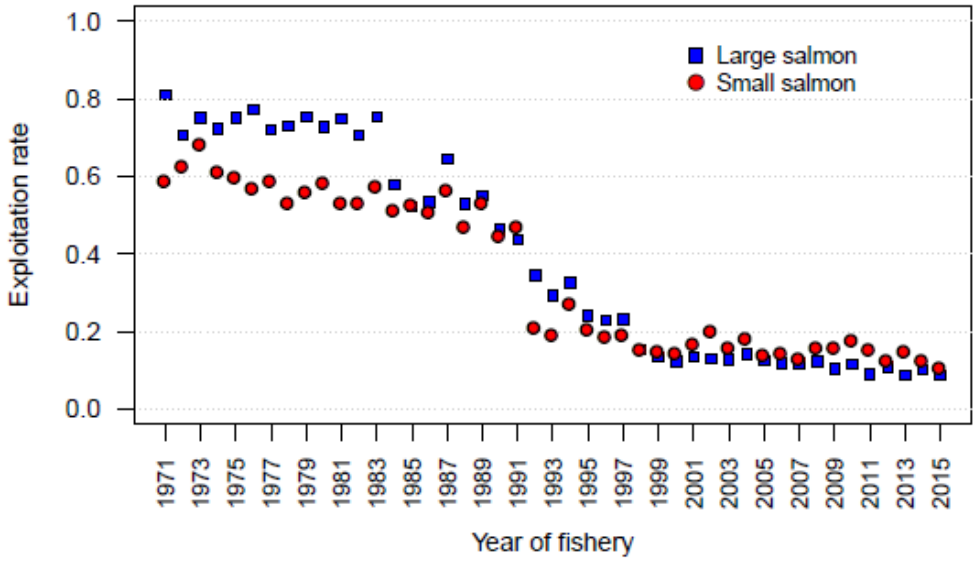

Figure 10.3.4.5 Exploitation rates in North America on small (mostly 1SW) and large (2SW, 3SW, and repeat spawners) salmon.

Origin and composition of catches

In the past, salmon from both Canada and the USA were taken in the commercial fisheries of eastern Canada. Sampling programmes of current marine fisheries (Labrador subsistence and Saint Pierre & Miquelon (SPM)) are used to monitor salmon interceptions from other areas of North America.

Recent genetic stock identification efforts provide an opportunity to identify the origin of North American salmon caught in the Labrador and SPM fisheries. The stock composition and variation in composition of salmon harvested in these mixed-stock fisheries has been determined based on a recently developed North American genetic baseline for Atlantic salmon, which allows assignment to regional reporting groups (Bradbury *et al.*, 2014a; Moore *et al.*, 2014). For North America, twelve regional groups can be reliably identified using 15 microsatellite loci and these largely approximate regional clusters identified in landscape analyses of population structure (Dionne *et al.*, 2008; Bradbury *et al.*, 2014b).

Assignment to the 12 North American reporting groups was based on mixture analysis using the Bayesian mixture model from Pella and Masuda (2001) as implemented in cBAYES (Neaves *et al.*, 2005). The accuracy of assignment (94.5%) in these analyses was very high. The power of the baseline to resolve rare contributions was examined using simulations; accurate estimation of the rare stock contributions was possible when these represented from 0.5% to 1.0% and above. It should be noted that the regional groups from the genetic assignments do not correspond directly to the regions used by ICES to characterize stock status and to provide catch advice.

Labrador fishery origin and composition of the catches

Tissue samples from salmon sampled from the Labrador subsistence fisheries during 2006 to 2015 were genetically typed to the twelve regional groups. In 2015, a total of 880 samples (5.8% of the harvest by number) were collected from the Labrador aboriginal fisheries, 212 from northern Labrador (salmon fishing area (SFA) 1A), 204 from Lake Melville (SFA 1B), and 464 samples from southern Labrador (SFA 2). Based on the interpretation of the scale samples, 77% were 1SW salmon, 19% were 2SW, one sample was a 3SW salmon (<1%), and 4% were previously spawned salmon. The majority (98%) of salmon sampled were river ages 3 to 5 years (modal age 4). No river age 1 and few river age 2 (0.5%) salmon were sampled, suggesting, as in previous years (2006 to 2014), that very few salmon from the southernmost stocks of North America (USA, Scotia–Fundy) were exploited in these fisheries. The Labrador Central (LAB) regional group represents the majority (almost 92–96%) of the salmon caught in the Labrador subsistence fishery up to 2014, with minor contributions from all the other regional groups (Bradbury *et al.*, 2014a; ICES, 2015). Genetic analyses of 2015 tissue samples are planned and will be reported accordingly to ICES when completed.

Percentage of samples by river age within the three sampled areas in 2015

Area	Number of samples	River age						
		1	2	3	4	5	6	7
Northern Labrador (SFA 1A)	212	0.0	0.0	17.5	59.9	20.8	0.9	0.9
Lake Melville (SFA 1B)	204	0.0	1.0	30.4	53.9	14.7	0.0	0.0
Southern Labrador (SFA 2)	464	0.0	0.4	14.4	55.2	27.6	2.4	0.0
All areas	880	0.0	0.5	18.9	56.0	23.0	1.5	0.2

Saint Pierre and Miquelon (SPM) fishery origin and composition of the catches

Sampling of the salmon catches was conducted in 2004, 2011, 2013, 2014, and 2015. The number of tissue samples collected for these years was 138, 73, 71, 71, and 109, respectively, for a total of 462 individual samples over the five years. Estimates of stock composition based on genetic analysis up to 2014 showed consistent dominance of three regions: Gulf of St. Lawrence, Gaspé Peninsula, and Newfoundland (Bradbury *et al.* 2014a; ICES, 2015). Genetic analyses of 2015 tissue samples are planned and will be reported accordingly to ICES when completed. Continued analysis of additional years will be informative of the characteristics of the salmon age and size structure, the origin of the fish, and variation in the stock-specific characteristics of the catches.

Sea age	River age				
	2	3	4	5	Total
1SW	22	39	13	3	77
2SW	11	16	1	0	28
Previous spawners	1	0	0	0	1
Total	34	55	14	3	106

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Annex 1 Glossary of acronyms and abbreviations

1SW *(one-sea-winter).* Maiden adult salmon that has spent one winter at sea.

2SW *(two-sea-winter).* Maiden adult salmon that has spent two winters at sea.

3SW *(three-sea-winter).* Maiden adult salmon that has spent three winters at sea.

CL, i.e. S_{lim} *(conservation limit).* Demarcation of undesirable stock levels or levels of fishing activity; the ultimate objective when managing stocks and regulating fisheries will be to ensure that there is a high probability that undesirable levels are avoided.

ICES (*International Council for the Exploration of the Sea*)

LAB (The Labrador Central) regional group, Canada.

NASCO (*North Atlantic Salmon Conservation Organization*).

PFA *(pre-fishery abundance).* The numbers of salmon estimated to be alive in the ocean from a particular stock at a specified time. In the previous version of the stock complex Bayesian PFA forecast model two productivity parameters are calculated, for the *maturing* (PFAm) and *non-maturing* (PFAnm) components of the PFA. In the updated version only one productivity parameter is calculated and used to calculate total PFA, which is then split into PFAm and PFAnm based upon the *proportion of PFAm* (p.PFAm).

SPM (Saint Pierre & Miquelon)