SAG(08)6

Proposal submitted to the International Atlantic Salmon Research Board relative to furthering the knowledge on marine ecology of Atlantic salmon.

June 2008

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Gérald Chaput, Tim Sheehan, and Brian Dempson
SALSEA North America

Inferring temperature history of Atlantic salmon at sea based on oxygen isotope ratios in otoliths

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In addition to tissue samples to evaluate the trophic ecology of salmon, we propose to analyze oxygen isotopes that are deposited in otoliths. Because oxygen isotopes are deposited in equilibrium with the environmental waters in which the fish live, they can provide a temperature history experienced by the fish. Measurement of thermal habitat use relies on temperature dependent fractionation of δ^{18} oxygen isotopes during the formation of otoliths and established otolith δ^{18} oxygen–temperature relationships for conversion between the two. Ideally, insight into the thermal habitat use of salmon across various life-history stages from analyses of oxygen isotopes will be coupled with ecological information on smolt size and age and corresponding food web data as inferred from carbon and nitrogen signatures. Collectively, these analyses may shed additional insight into respective productivity differences among stocks throughout much of the natural distribution of salmon in the North West Atlantic Ocean ranging from Nova Scotia, New Brunswick, Quebec, Newfoundland and possibly southern Labrador.

This proposal complements the stable isotope research and uses the same material sources as for the stable isotope project. As such, the costing of this proposal is for analysis purposes only. A water sample is to be collected at every location where fish are collected.

SFA/Zone	River	Tributary	Smolts	1SW	2SW	Water sample
23	Nashwaak		X			X
21	LaHave		X			X
18	Margaree		X			X
16	Miramichi	Southwest	X	X	X	X
		Northwest	X	X	X	X
15	Restigouche	Kedgwick	X	X		X
		Upsalquitch	X	X		X
Q2	St-Jean		X	X		X
Q7	De la Trinite		X	X		X
11	Conne		X	X		X
9	Rocky		X	X		X
4	Campbellton		X	X		X
4	Exploits		X	X		X
14A	Western Arm		X	X		X
2	Sand Hill		X	X		X
			Post-smolt and West Greenland			
Post-smolt			X			X
West Greenland			X			X

Table 2. *Schedule of samples to be collected by life stage.*

	2008					2009					2010				
	May	June	July	August	September	May	June	July	August	September	May	June	July	August	September
Smolt	X	X				X	X								
Post-smolt				X					X						
1SW salmon							X	X				X	X		
1SW non-maturing (WG)				X	X				X	X				X	X
2SW salmon							X	X				X	X		
Water sample	X	X		X	X	X	X	X	X	X				X	X

Estimated cost of analysis over the next three years (2008 to 2010)

As the number of life stages sampled varies with the year, the cost of analysis also varies. Otolith analysis of oxygen isotopes costs $20 (Cdn) per sample. For 2008, the proposed cost of analysis is $17,900 (Cdn).

Life stage	**Number of locations**	**Tissues**	**Number of samples per tissue**	**Total**
Smolt	15 index rivers	Otoliths	30	$9,000
Post-smolt	Labrador Sea	Otoliths	150	$3,000
1SW non-maturing (WG)	West Greenland	Otoliths	150	$3,000
Water samples	20 locations (15 rivers + 3 Labrador Sea + 2 WG)	Water	1	$400
Labour for laboratory preparations				$2,500
Funding for analysis for 2008				**$17,900**

Smolt	15 index rivers	Otoliths	30	$9,000
Post-smolt	Labrador Sea	Otoliths	150	$3,000
1SW salmon	12 index rivers	Otoliths	30	$7,200
1SW non-maturing (WG)	West Greenland	Otoliths	150	$3,000
2SW maturing	Miramichi River (2 sites)	Otoliths	30	$1,200
Water samples	20 locations (15 rivers + 3 Labrador Sea + 2 WG)	Water	1	$400
Labour for laboratory preparations				$5,000
Funding for analysis for 2009				**$28,800**

1SW salmon	15 index rivers	Otoliths	30	$9,000
1SW non-maturing (WG)	West Greenland	Otoliths	150	$3,000
2SW salmon	Miramichi River (2 sites)	Otoliths	30	$1,200
Water samples	2 locations (WG)	Water		$40
Labour for laboratory preparations				$2,000
Funding for analysis for 2010				**$15,240**

Timelines for the tissue collections and analysis

For 2008

The otolith collections from smolts from the index rivers began in May 2008 and will be completed by the end of June 2008. The post-smolt survey for the Labrador Sea is anticipated for August 2008 with tissue collection occurring on the vessel. The West Greenland samples would be collected in August and September and be available for analysis by the end of October 2008. The otoliths will be extracted from the same fish sampled for tissues for C and N stable isotopes.

All the laboratory analyses would be conducted between September 2008 to February 2009 with preliminary analyses and interpretation available for the ICES Working Group meeting in April 2009 and the NASCO meeting of June 2009.

Timelines for other years would follow a similar schedule.

Coordination, data analysis and interpretation

Tissue and otolith collections from the index rivers and for post-smolts is being coordinated by Gerald Chaput (DFO Gulf Region).
Otolith collections from West Greenland are coordinated by Dr. Tim Sheehan (NMFS, NOAA, US).
Isotope analyses will be coordinated by Dr. Michael Power and conducted at the Environmental Isotope Laboratory, University of Waterloo (Canada).
Data analysis and interpretation will be lead by Brian Dempson (DFO NL, Canada) and Dr. Michael Power (U. of Waterloo, Canada).