West Greenland Commission

WGC(08)7 (rev)

SALSEA West Greenland

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The current state of Atlantic salmon in the ocean and the need for a coordinated marine research programme (SALSEA) has been previously well documented and justified (ICR(05)2). The marine survey aspect of the SALSEA programme was developed to concentrate sampling upon areas where stocks from many rivers co-occur since the declines in marine survival are experienced by large groups of stocks. Considering that both Southern European and North American stocks co-occur at West Greenland as non-maturing 1SW fish, it was suggested that an additional survey programme be developed for the West Greenland area (SAL(06)3). The intention is to increase the nature and extent of the current sampling programme at West Greenland and integrate it with marine research survey programmes in other oceanic areas.

Parties to North Atlantic Salmon Conservation Organization's (NASCO) West Greenland Commission (WGC) have worked cooperatively over the past three decades to collect biological data on Atlantic salmon harvested at West Greenland. In 2007 (WGC(07)5), the European Union contributed 3 individuals (from England & Wales, Scotland and Ireland) to the sampling programme. Both Canada and the United States contributed 2 samplers each. Each sampler sampled in Greenland for approximately 2 weeks during which time they collected biological samples from the West Greenland harvest across 5 NAFO Divisions and 11 statistical weeks. Additionally, Greenland Nature Institute staff provided support and additional samples on an *ad hoc* basis. In 2007 approximately 1,100 salmon were sampled providing important information on various biological characteristics (length, weight, and age), continent of origin, and in some cases, river of origin via tag recoveries. This sampling programme provides critical input data for the annual stock assessment activities completed by the International Council for the Exploration of the Sea (ICES) Working Group on North Atlantic Salmon (WGNAS).

An expanded West Greenland sampling programme would conduct extensive and detailed sampling on a set number of fish harvested from the waters off West Greenland. This sampling will be in addition to the standard sampling programme. Arrangements would be made with individual fishermen for the delivery of fresh whole fish to the individual samplers on an agreed upon schedule. Sampling will be organized in both time and space across the fishing season and the coast of West Greenland to maximize the temporal and spatial resolution of the data collected.

The detailed sampling programme will provide biological data related to the health and status of all sampled individuals. Paramount to the sampling programme will be the ability to identify the origin of each individual with a high level of precision to large stock complex groupings through genetic analysis. Once the data can be collated by stock complex groupings, comparisons between complexes can be made and inferences can be developed related to stock complex performance (i.e. marine survival). Data obtained from the expanded West Greenland sampling programme will greatly enhance our understanding of marine phase Atlantic salmon when combined with similar data collected during the concurrent oceanic surveys in both the eastern and western North Atlantic and the similar data collected by in-river monitoring programmes (smolts and adults). This expanded sampling programme will greatly maximize the benefits obtained from the current

government sponsored sampling programme making this effort an extremely cost effective option to collect detailed biological information on marine phase Atlantic salmon.

This expanded sampling programme, SALSEA West Greenland, is recognized as complementary to SALSEA-Merge and SALSEA North America, which collectively hold promise in providing insights into the critical marine portion of the salmon's life cycle. The intention is that the whole fresh fish required for scientific analysis (e.g. stomach content, isotope analysis) would be fish that are part of the existing internal use fishery. Strong coordination and cooperation with the Greenland Home Rule Government and the KNAPK in carrying out this scientific research programme is required to fully integrate the sampling programme into the internal use fishery. ICES, the International Atlantic Salmon Research Board and its Scientific Advisory Group, and NASCO all endorse the SALSEA West Greenland sampling programme.

DETAILS FOR AN EXPANDED SALSEA WEST GREENLAND PROGRAMME

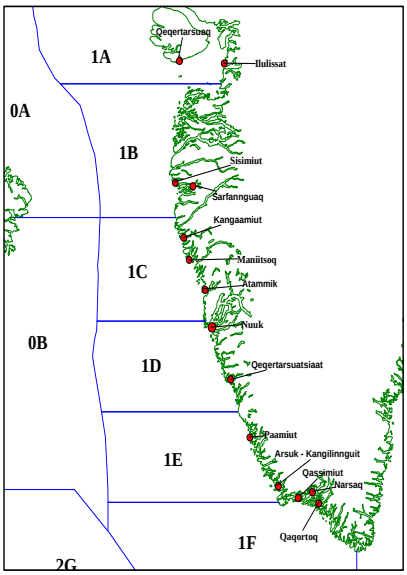
Goal

- To conduct an expanded sampling programme of salmon harvested off the west coast of Greenland in 2008, 2009 and 2010 and combine these data with data collected on these same cohorts of salmon sampled during concurrent oceanic surveys and subsequent in-river sampling programmes in home waters to make inferences related to the causal mechanisms behind stock-specific performance in the ocean (i.e. marine survival).

Investigator and Collaborators

- NOAA Fisheries Service (USA) – Project Coordinator
- United States Geological Survey (USA)
- Greenland Nature Institute (Greenland)
- Greenland Home Rule Government (Greenland)
- Department of Fisheries and Oceans (Canada)
- The Marine Institute (Ireland)
- Fisheries Research Services (UK (Scotland))
- Center for Environment, Fisheries and Aquaculture Science (UK (England & Wales))
- North Atlantic Salmon Fund and the Atlantic Salmon Federation (Iceland, Canada, USA)
- NASCO's International Atlantic Salmon Research Board (UK(Scotland))

SALSEA West Greenland sampling programme



- Expanded sampling will be coordinated and occur concurrently within the standard sampling programme WGC(08)6.
- Samplers will be restricted to NAFO Divisions 1B (Sisimiut), 1D (Nuuk) and 1F (Qaqortoq) to efficiently provide spatial coverage of the fishery with the resources available.
- Over the course of the fishing season, in accordance with the landing dynamics for each division, 2 samplers will be deployed per division.
- Coordination with the Greenland Home Rule Government and KNAPK will occur for the delivery of fresh whole fish to the individual samplers for the purposes of collecting detailed biological and tissue samples within the expanded sampling programme.
- A total 50-300 whole fish per division (150-900 total) over the course of the fishing season will be delivered for sampling. The rate of delivery will be determined by the individual sampler's ability to properly sample each fish.

SALSEA WEST GREENLAND SAMPLING AGENDA

Characteristic	**Data or tissue**	**Equipment**	**Laboratory overseeing processing**	**Reason**
External characteristics	fork length (mm), whole weight (kg), gutted weight (kg), presence of external marks/tags (clips, external tags), presence of external natural marks (scars, scrapes, bites, wounds, fin conditions), photographs of feature of interest	Measuring board, balances, CWT detector	NOAA Fisheries Service (Northeast Fisheries Science Center)	Basic biological characteristics data
	Sea lice	Vials (RNA Later)	To be determined	Preserve samples for future genetic mapping
Stock origin	Fin clips	Vials (RNA Later)	NOAA Fisheries Service (Northeast Fisheries Science Center)	It is essential that fish captured at sea be identified as to their river/region of origin to compare and contrast all results obtained
Determination of age and growth characteristics	Scales from standard location	Forceps and scale envelopes (dry storage)	DFO Canada (Northwest Atlantic Fisheries Centre) and NOAA Fisheries Service (Northeast Fisheries Science Center)	River age, sea age, inter-circuli spacing to quantify growth rate at different stages. To be compared with adult survivors of those stocks to test hypothesis of growth-mediated survival

Characteristic	Data or tissue	Equipment	Laboratory overseeing processing	Reason
Disease Sampling	gill filaments, spleen, pyloric caeca, kidney	Whirl pack (freeze)	DFO Canada (Gulf Fisheries Centre)	Prevalence of disease in marine salmon may provide insights into stock-specific performance
Feeding	Stomach contents	Sample jars (formaldehyde)	NOAA Fisheries Service (Northeast Fisheries Science Center)	Basic information to describe prey relative to size of salmon, location captured, period captured
Condition (using relative lipid content)	Muscle tissue	Whirl pack (freeze)	To be determined	Energy reserves may determine age at maturity and ability to survive, as well as describe previous feeding history
Trophic Ecology (using stable isotopes)	liver, dorsal muscle, caudal tissue and scales	Vials (freeze)	To be determined	Trophic state of salmon in the North Atlantic will inform researchers of the feeding ecology history of sampled fish. Questions related to comparing and contrasting the trophic state of different origins, maturity states, and at different times for migrating Atlantic salmon may help identify critical stages in the marine life cycle of salmon.
	stomachs	Bags (freeze)	To be determined	Stable isotope samples from the prey that Atlantic salmon have recently eaten will provide a baseline for researchers to compare the stable isotope signatures obtained from the tissue samples that represent the recent feeding history.
Sea Age at maturity	Ovary and gonad weights	Vial (Bouins)	DFO Canada (Gulf Fisheries Centre)	Information on gonadal development of ovaries from 1SW non-maturing at West Greenland will provide baseline information for comparisons of ovary samples taken at different life stages.
Parasites	intestines, pyloric caeca, gill arch, liver, spleen and kidney	Bottles (formaldehyde)	To be determined	Parasite loads of sampled salmon will provide insights to the health of salmon at West Greenland.
Indicators of ocean distribution, elemental analysis	Otoliths	Vials (dry storage)	To be determined	Variability in elemental composition reflects ocean chemistry in which salmon are distributed and grow. Compare among stocks.

THE SALSEA CONCEPT

The SALSEA concept consists of a coordinated international effort studying the marine dynamics of Atlantic salmon across the North Atlantic. The SALSEA Programme provides an outline for a fully integrated research program studying freshwater effects on marine survival, additional work on advance technologies, coordinated marine surveys and effective communication. The coordinated marine survey aspect of SALSEA currently consists of three main projects: SALSEA-Merge, SALSEA North America and SALSEA West Greenland. When completed, these 3 projects may provide a comprehensive overview of marine phase Atlantic salmon in the North Atlantic. SALSEA West Greenland is unique in the fact that both European and North American origin salmon will be sampled and the results will provide a critical link tying all SALSEA projects together.

SALSEA West Greenland is dependant on the continued participation of Parties to the West Greenland Commission. SALSEA West Greenland is also dependant on the in-kind contributions of the Parties to fund the coordination of the programme and the analysis of the collected data and samples.

The coordination of SALSEA West Greenland is being undertaken by the US. All the Parties to the West Greenland Commission have obligated significant funds in support of this programme. The total estimated and confirmed obligated funds for SALSEA West Greenland 2008 is approximately $359,263 (USD). In addition, further funding for sample processing is presently being sought and may be contributed by the participating NASCO Parties. Funds have been allocated for the purchase of fish from the individual fishermen; however, investigations toward alternate arrangements for the delivery of fresh whole fish are still ongoing.

		Standard (2007)	Expanded (2008)
USA	coordination	$24,000	$36,000
	samplers[a]	$19,867	$19,867
	purchase of whole fresh fish[b]	$6,000	$45,000[c]
	miscellanious sampling supplies	$4,000	$12,000
	Genetic Analysis (origin)	$24,000	$24,000
	disease sample analysis	$4,500	-
	stomach content analysis[c]	$3,600	$21,600
	parasites analysis	$3,500	-
	scale image analysis	-	$36,000
	in-country (Greenland) coordinator position	-	$25,000
	USA total	**$89,467**	**$219,467**
Canada	samplers[a]	$19,867	$19,867
	Scales	$40,000	$40,000
	disease sample analysis	-	$10,000
	Canada total	**$59,867**	**$69,867**
UK(Scotland)	sampler[a]	$19,867	$19,867
UK(England & Wales)	sampler[a]	$19,867	$19,867
Ireland	sampler[a]	$12,317	$12,317
Denmark (in respect of Greenland)	sampler(s)[a]	$17,880	$17,880
	Grand Total	**$219,263**	**$359,263**

[a] estimated travel and salary cost
[b] estimated amount spent annually
[c] according to maximum number of samples allocated for SALSEA West Greenland (n=900)

In addition to the funds outlined above, all the Parties to NASCO have contributed significant amounts of resources to the SALSEA Programme in support of investigations towards freshwater effects on marine survival as well as direct investigations into marine survival in the ocean. As outlined in inventory of marine research (ICR(08)2), the Parties to NASCO expended 6.7 million pounds on researching marine mortality related issues in 2007. Of particular note is the 4.4 million pounds in support of SALSEA Merge and 0.4 million pounds dedicated for SALSEA North America.

Additional funds have been dedicated to the SALSEA Programme since the publishing of ICR(08)2. Of particular note is the obligation of funds by the United States and Canada in support of SALSEA West Greenland noted in the table above. These funds are additional to the ongoing and recently completed and ongoing research activities investigating marine mortality issues outlined in ICR(08)2. These projects are highlighted in the table below. In addition to ongoing research into marine mortality of salmon, the US granted a total of $150,000 (USD) to the International Atlantic Salmon Research Board in 2004 to further support the Board's work.