SAG(09)3

Research proposals submitted to the International Atlantic Salmon Research Board

SAG(09)3

Research proposals submitted to the International Atlantic Salmon Research Board

1. At the International Atlantic Salmon Research Board's (IASRB) last meeting in Gijón, Spain, it was agreed that the Parties should be invited to submit to the Secretariat, by 1 September 2008, proposals for research that might be funded by the Board or for which the Board may support the proposer in seeking funds from other sources. The SAG was asked to evaluate and prioritise these proposals using the guidance developed previously by the IASRB (Annex 1).

2. Two new proposals were received by the Secretariat before 1 September 2008. These were as follows:

   SAG(08)7: Food availability of Atlantic salmon post-smolt during their marine phase.

   SAG(08)8: A study of the relationship between ocean climate and inter-annual variation in adult summer migration distribution patterns of Atlantic salmon in Irish coastal waters over three decades.

3. Furthermore, at its Annual Meeting the Board had received a proposal, SAG(08)6, that it did not fund and a second proposal for a three year study the first year of which the Board agreed to fund (£20,000), SAG(08)5. These proposals are as follows:

   SAG(08)5: Changes in trophic levels of Atlantic salmon through the marine phase of their life-cycle.

   SAG(08)6: Inferring temperature history of Atlantic salmon at sea based on oxygen isotope rations in otoliths.

4. These projects, which are contained in Annex 2 were sent to members of the SAG by its Chairman, Dr Lars Hansen, on 16 October 2008 seeking feedback on the priority to be afforded to them. It was stressed, however, that the Board had limited available funds but that it may be able to support applications to other funding sources. The Chairman received very limited feedback from SAG members and he noted that this may have been related to the fact that some SAG members were involved in some of the projects. For this reason the Chairman had referred to the possible benefits of an independent evaluation of the projects in future. He, therefore, wrote again to SAG members on 17 February suggesting that the projects be reviewed further by the SAG at its meeting in Molde, Norway on 31 May 2008.

5. Since this last communication from the Chairman, a further proposal (Annex 3) has been received by the Secretariat. This research proposal is as follows:

   SAG(09)4: Application to NASCO's International Atlantic Salmon research Board (IASRB) to support research on salmon post-smolts in the Irminger Sea, Southwest of Iceland.

6. The SAG will be asked to evaluate these five projects and develop its recommendations to the Board on the priorities for support by the Board.

Secretary
Edinburgh
5 May 2009

Annex 1

ICR(03)14

CALL FOR PROPOSALS FOR RESEARCH

The North Atlantic Salmon Conservation Organisation's (NASCO's) International Cooperative Salmon Research Board (ICSRB), hereinafter referred to as "the Board", invites calls for proposals for **"Research into the migration, distribution and survival of North Atlantic salmon at sea**" focusing primarily on:

- *practical studies of the distribution and migration of salmon in the sea (including studies of by-catch in pelagic fisheries)*

- *studies of biological processes (e.g. environment, food, predation, growth, parasites and diseases) relating to the marine phase of the life-cycle.*

Within these broad areas the Board has identified the following sub-headings which are of particular interest:

Tagging
Large-scale marking or tagging (external, coded wire tags (CWT), PIT tags) - release and recovery programmes;
Tagging of adults, kelts, post-smolts or smolts with Data Storage Tags (DSTs);
Sonic tagging and active tracking of salmon movements;
Developments in electronic tag and data acquisition systems and technology.

By-catch
By-catch of salmon in near-surface pelagic trawling in the Norwegian Sea and elsewhere;
Identification of practical measures to reduce by-catch of post-smolts in these fisheries;
Development of sampling gears;
Inter-calibration of survey methods;
Practical methods to reduce by-catch.

Other
Oceanographic influences on migration and distribution and life-history of salmon;
Impacts of diseases, predators and parasites on salmon populations at sea;
Synergistic effects of predation/competition/food availability/freshwater influences on subsequent marine survival.

The Board will give priority to major multi-disciplinary and collaborative (multi-country) projects but will also consider smaller projects and proposals relevant to the topics above for:

Knowledge inventory studies;
Symposia and workshops;
Fellowships and studentships.

Funding may be provided in full or on a partial or matching basis.

An application form is available from the NASCO website or on request from the NASCO Secretariat.

The deadline for receipt of completed applications is: XX/XX/XX

The application form could include the following, as an example:

1. Project title

Give the application a brief title which describes the work to be done.

2. Applicant – Institution/company responsible for the project

As a general rule, an institution or company should be the formal applicant, with legal responsibility for ensuring that the conditions attached to an allocation of funds are met.

3. Project Leader

This should be the name of the technical expert responsible for the project.

4. Project summary

Provide a brief summary of the project description, with an emphasis on describing the objectives of the project, the most important R & D challenges and the potential for application of the project results. The project summary will be made publicly available via the Board's inventory. For this reason, the text should be capable of being understood by non-experts, and should not exceed 200 words.

5. Principal goal and sub-goals

Describe the results that are expected to be obtained in the course of the project period. Formulate individual demonstrable sub-goals which lead to the principal objective.

6. Milestones – timetable

Indicate milestones for the principal activities that fulfil the main objectives and sub-goals of the project (e.g. data-acquisition, field-work, main activities in study plan and final report). Check off these milestones by date (or possibly include a calendar or time grid). Use keywords – maximum of 45 characters. A more detailed timetable may be provided in the project description.

7. Cost plan

The cost plan for the project should be summarized and preferably broken down into sub-costs (e.g. capital costs, contracts or services, consumables, travel and subsistence).

Personnel costs and indirect costs

Personnel costs and indirect costs cover salary, social security and indirect costs such as rent, secretarial help, telecommunications and computing costs, etc.

The "Project total" should show the same amount each year as the total in section 8: "Finance plan".

The Board should consider fixed rates for fellowships and certain types of positions. Companies or institutions may also calculate personnel costs and indirect costs on the basis of their own employees' hours of work on the project and their hourly rates. Consider only work done by their own R & D personnel, i.e. the project manager and research and technical personnel.

8. Finance plan

The finance plan should show how the costs shown in the cost plan are to be financed and the amount sought from the Board.

Own funding

This refers to the applicant's institution's input of own resources such as cash, personnel, infrastructure/goods/equipment into the project.

Other public-sector funding

This refers to public-sector grants such as direct support from ministries, the grants from the State Fund for Regional and Industrial Development, regional support schemes, funds from agricultural or fisheries agreements, local authority industrial development funds, etc.

Other private funding

This includes financial support from cooperating companies, trade organizations, private funds, etc. State-owned companies that operate as commercial concerns are also regarded as sources of private funding in this respect.

9. Active partners

Enter national and international partners who will participate actively in the project. Provide names of persons, universities, institutes, companies, programmes, bodies, etc. Confirmation provided by such partners of their participation in the project should be enclosed with the application. Enter the name of the doctoral fellowship or student supervisor if he or she is not the project manager.

10. Project publication plan

The Board considers that dissemination of information about the projects it supports is very important. Provide brief details of goals, target groups and type of information to be provided.

11. List of enclosures

List all documents enclosed with the application as backup and possibly confirmation of the skills and background of the proposers.

12. Signatures

The Board requires the signatures of the project manager and of a representative of the institution or company responsible for the project and may want to further develop the requirements regarding project manager and institution. If possible, candidates for fellowships or research positions should sign when their names have been confirmed.

Project description

The project description should provide more details of individual points in the application form and offer a basis for academic evaluation of the project proposal. The project description must not exceed 10 pages (including the list of references). (Recommended norm: A4 page format, 12pt Times New Roman font, single line spacing and 2cm margins). A distinction should be made between background material and planned activities. For the application to be considered, the project description must provide information on the following topics, where relevant.

Familiarity*:* The applicant must document good familiarity with the field of research concerned, both nationally and internationally.

Problem*:* The problem must be clearly formulated and satisfactorily limited in scope. It must be demonstrated that the project involves an expansion of existing knowledge, and/or that this knowledge provides a basis for further research in the field.

Method*:* It must be demonstrated that the methods and theories to be used are appropriate for the solution of the problem involved, or that there are good prospects of developing the

necessary methods and theory. Analytical methods, including any statistical methods needed to evaluate the significance of the results, should also be described.

***Objectives**:* Concrete, testable main objectives that provide a description of the expected results of the project must be formulated, as well as a set of sub-goals that will lead to the principal objectives.

***Ethics**:* The project description must describe how ethical considerations are taken into account, where appropriate.

***Implications for the environment**:* An assessment must be provided of whether the results of the project will have significant effects (whether positive or negative) on the physical environment. If such is the case, the project description must describe whether there is a need for research related to the environmental consequences, and whether the project has defined objectives or sub-goals that aim to shed light on the environmental implications.

Research Fishing: If the proposal includes research fishing, details should be provided of the purpose of the research fishing; the dates of research fishing; the area in which research fishing will take place; the name, registration, call sign and a description of any participating vessel; the type and amount of gear to be used and the estimated total weight and number of salmon to be retained.

***Timetable**:* A more detailed timetable than that shown in item 6 may be drawn up. At least one milestone must be identified.

***Information**:* Describe plans for information dissemination and user contact, including purpose, target groups and form of information dissemination, and, if appropriate, usefulness and application potential.

***Resources**:* Information should be provided (directly as well as indirectly via the project manager/group of researchers) regarding the resources available to the project.

Professional position: Describe the position of the project with respect to the institution's or company's range of activities, and any co-operation or co-operative agreements with other projects or institutions.

Information regarding professional competence

Project managers should submit their CV with a list of relevant publications for the last 5 years (maximum of four pages).

Specifically named persons for whom fellowships or positions are being sought must document their competence by submitting a CV and a list of publications of a maximum of 4 pages (the applicant should prioritise the information provided if necessary), as well as copies of relevant references and certificates. In applications for doctoral fellowships that are to be dealt with a brief presentation of the supervisor's or project manager's research supervision experience during the previous five years should be provided, stating the number of candidates who have completed their doctoral or master's degree. Similar supervisor

information is required for all applications for studentships. Candidates for post-doctoral fellowships who have not completed their doctorate must provide a list of the articles that will be included in their doctoral dissertations.

Project managers who lack qualifications as senior lecturer/associate professor must document their competence in the same way as the persons for whom studentships are being sought.

Costs and financing
The process of evaluating project applications requires information regarding costs and financing, including the company's or institution's own contribution of resources.

Experts

The Board may wish to be able to consult referees proposed by applicants in addition to their own appointed experts when handling applications.

Please list the names, titles and addresses of three persons with a thorough knowledge of the applicant's field of research, who may be consulted as referees.

Annex 2

SAG(08)5

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

June 2008

By

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

CHANGES IN TROPHIC LEVELS OF ATLANTIC SALMON THROUGH THE MARINE PHASE OF THEIR LIFE CYCLE

The following proposal for funding for 2008 is to analyze tissue samples from Atlantic salmon collected at index rivers in eastern Canada, as post-smolts in the northwest Atlantic, and as non-maturing 1SW salmon at West Greenland.

Costs associated with sample collection are covered by existing and new initiatives independent of this proposal.

Context

While the issue of Atlantic salmon survival is complicated by their complex life cycle requirements, there are various hypotheses regarding survival and production that may pertain to variations in Atlantic salmon abundance. One hypothesis stresses the implications of trophic structure and anthropogenic disturbances of trophic structure that have led to shortened food chains at sea. Hence, the need for investigations of variability in the trophic ecology of salmon. Trophic level can be evaluated by an examination of stomach contents over time, or through stable isotope analysis (SIA). While stomach contents provide a snapshot of recent dietary resource use, stable isotope analyses yield time integrated measures of energy assimilation since analyses are performed on body tissues built from diet assimilated over time. Consequently, SIA has been increasingly used in ecological studies as a reliable means of inferring trophic status and the impacts of anthropogenic disturbance on trophic relationships.

Atlantic salmon are considered opportunistic feeders during their freshwater and marine life-history phases. While in freshwater, juvenile salmon feed on aquatic invertebrates particularly various stages of insect groups. Differences in feeding strategies may occur between systems where parr rear extensively in lacustrine (lake) habitats versus other locations where fluvial (stream) rearing is common. During the marine phase, salmon often target prey in the upper end of the size spectrum with a preference for fish over crustaceans should both be available, but the point in the life cycle when this change happens and the relative importance of these components is poorly understood. Thus, owing to the opportunistic nature of salmon feeding habitats, the species lends itself well to studies

associated with aquatic environmental conditions and food web interactions. This is particularly relevant given the variability in freshwater habitats and differences in smolt size throughout Atlantic Canada, and the potential variation in ocean climate conditions that salmon encounter when first migrating to sea over a geographic range that extends from southern Nova Scotia and New Brunswick to Labrador and into the Ungava region of Quebec.

Variability in the trophic ecology of Atlantic will be examined from analyses of stable isotope signatures of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$). Nitrogen stable isotope analysis provides a quantitative means to determine trophic level since nitrogen signatures from organism tissue are consistently 3 to 5‰ more enriched than dietary sources. In contrast, carbon stable isotopes are conserved up the food chain owing to the slight 0.0 to 1.0‰ enrichment occurring between prey and consumer. Because ^{13}C is conserved during trophic transfer, but varies at the base of the food web, consumer tissue stable isotope signatures will also reflect dietary source information. Various tissues have been used in the analysis of isotopic signatures, including muscle, liver, scales, and fins. Scales tend to provide a longer term perspective of trophic information while analyses of muscle and liver tissue reflect more recent energy assimilation.

We propose to sample salmon at various points in its life cycle and characterize variations and changes in trophic state from the smolt to adult life-stage. This will be accomplished by sampling smolts and adult survivors back to the river from a broad geographic range in eastern North America. Smolt information will provide information on river-specific variability in freshwater feeding strategies. Intermediate marine life-history stages will be investigated from samples obtained at West Greenland as non-maturing one-sea-winter salmon, coupled with the proposed marine research survey intended to target the early post-smolt phase.

Study design

Variability in the trophic ecology of Atlantic will be examined from analyses of stable isotope signatures of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$) with comparisons among populations at the freshwater-smolt stage, as well as between life-history stages from post-smolts caught at sea, non-maturing 1SW salmon feeding at West Greenland, and with adults that return to respective rivers in the following year.

We propose to analyze isotope signatures from muscle, liver, scales and adipose fin tissue. In situations where lethal sampling of salmon is not an option (e.g., catch-and-release angling fisheries, populations at low abundance), scales and adipose fins provide non-lethal alternatives. As noted earlier, this approach will yield information on ontogenetic differences in isotope signatures across life-history stages (smolt, post-smolt, adult) across a broad geographic area.

Samples from West Greenland and from the proposed research cruise will be obtained on an opportunistic basis with a target of approximately 150 specimens from each but with potentially more samples from the marine research cruise should they be available; this, however, would increase the estimated costs of analysis. The potential river sampling locations and the respective tissues identified for stable isotope analyses are identified in Table 1.

To complement salmon trophic information, isotope analyses will also be carried out on a subset of other species that may be captured in the pelagic trawl, or obtained from stomach contents of salmon at sea. These data will provide insight into key dietary items of the food web structure within which salmon operate. Thus, five replicate samples of each of the key prey types within the size range consumed would be desirable.

Table 1. *Location, life stage and tissues to be sampled from Atlantic salmon to examine trophic ecology.*

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

Samples will be collected over three years with the objective of tracking changes in trophic ecology of salmon through the marine phase (Table 2). In addition, annual variation in trophic state among 1SW maturing, 1SW non-maturing and 2SW salmon will be examined by sampling these stages even if some of the data on smolts or early post-smolt stages are not available. The samples from West Greenland will also provide inter-continental comparisons of trophic ecology for that life stage.

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						
Marine prey (post-smolt)				X					X						
1SW salmon							X	X				X	X		
1SW non-maturing (WG)				X	X				X	X				X	X
Marine prey (WG)				X	X				X	X				X	X
2SW salmon							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. Stable isotope analysis for C and N costs $10 per tissue sample. For 2008, the proposed cost of analysis is $39,000 (Cdn).

Life stage	Number of locations	Tissues	Number of samples per tissue	Total
Smolt	15 index rivers	Muscle, liver, scales, adipose	30	$18,000
Post-smolt	Labrador Sea	Muscle, liver, scales, adipose	150	$6,000
Marine prey	Labrador Sea, Two locations	20 prey item types	5	$2,000
1SW non-maturing (WG)	West Greenland	Muscle, liver, scales, adipose	150	$6,000
Marine prey	West Greenland	20 prey item types	5	$2,000
Labour for laboratory preparations				$5,000
Funding for analysis for 2008				**$39,000**

Smolt	15 index rivers	Muscle, liver, scales, adipose	30	$18,000
Post-smolt	Labrador Sea	Muscle, liver, scales, adipose	150	$6,000
Marine prey	Labrador Sea, Two locations	20 prey item types	5	$2,000
1SW salmon	15 index rivers	Scales, adipose	30	$9,000
1SW non-maturing (WG)	West Greenland	Muscle, liver, scales, adipose	150	$6,000
Marine prey	West Greenland	20 prey item types	5	$2,000
2SW salmon	9 index rivers	Scales, adipose	30	$5,400
Labour for laboratory preparations				$7,500
Funding for analysis for 2009				**$55,900**

1SW salmon	15 index rivers	Scales, adipose	30	$9,000
1SW non-maturing (WG)	West Greenland	Muscle, liver, scales, adipose	150	$6,000
Marine prey	West Greenland	20 prey item types	5	$2,000
2SW salmon	9 index rivers	Scales, adipose	30	$5,400
Labour for laboratory preparations				$4,000
Funding for analysis for 2010				**$26,400**

Timelines for the tissue collections and analysis

<u>For 2008</u>

The tissue 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.

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 collection from the index rivers and for post-smolts is being coordinated by Gerald Chaput (DFO Gulf Region).
Tissue collection and prey items 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).

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

By

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

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).

SAG(08)7

Proposal submitted to the International Atlantic Salmon Research Board on the food availability of Atlantic salmon post-smolts during their marine phase.

August 2008

By

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Institute of Marine Research
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Jan Arge Jacobsen
Faroese Fisheries Laboratory
The Faroe Islands

Niall O'Maoileidigh
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Ireland

SALSEA-Merge

FOOD AVAILABILITY OF ATLANTIC SALMON POST-SMOLT DURING THEIR MARINE PHASE

The following proposal for funding for 2009 to 2011 will be an integral part of SALSEA-Merge to analyse zooplankton, chlorophyll and nutrient samples collected during 6 international SALSEA-Merge cruises to the salmon post-smolt habitats of the Northeast Atlantic.

Costs associated with sample collection are covered by SALSEA-Merge, but the analyses and reporting of plankton and other key environmental samples lack funding.

Background

Below is the ABSTRAC of the SALSEA-Merge proposal to the EU quoted:
"Over the past two decades, an increasing proportion of North Atlantic salmon are dying at sea during their oceanic feeding migration. The specific reasons for the decline in this important species are as yet unknown, however, climate change is likely to be an important factor. In some rivers in the southern part of the species range, wild salmon now face extinction. This is in spite of unprecedented management measures to halt this decline. Arguably the greatest challenge in salmon conservation is to gain insight into the spatial and ecological use of the marine environment by different regional and river stocks, which are known to show variation in marine growth, condition, and survival. Salmon populations may migrate to different marine zones, whose environmental conditions may vary. To date it has been impossible to sample and identify the origin of sufficient numbers of wild salmon at sea to enable this vital question to be addressed. SALSEA-Merge will provide the basis for

advancing our understanding of oceanic-scale, ecological and ecosystem processes. Such knowledge is fundamental to the future sustainable management of this key marine species. Through a partnership of 9 European nations the programme will deliver innovation in the areas of: genetic stock identification techniques, new genetic marker development, fine scale estimates of growth on a weekly and monthly basis, the use of novel high seas pelagic trawling technology and individual stock linked estimates of food and feeding patterns. In addition, the use of the three-dimensional Regional Ocean Modelling System, merging hydrography, oceanographic, genetic and ecological data, will deliver novel stock specific migration and distribution models. This widely supported project, provides the basis for a comprehensive investigation into the problems facing salmon at sea. It will also act as an important model for understanding the factors affecting survival of many other important marine species."

In the SALSEA-Merge proposal it was stated that studying the food availability is an integral and important part of the research undertaken by SALSEA-Merge. Food availability, modulated by competition with other pelagic fish species, is important to post-smolt survival, through growth and predation processes. Further, food availability may influence distribution by active swimming of the post-smolts during the search for higher prey densities. Prey species abundances will also serve as major descriptors of post-smolt habitats throughout the SALSEA-Merge sampling areas.

During the process of adjusting the SALSEA-Merge application budget to the available funding it was decided to include sampling of potential food organisms during the cruises, while the analyses of these samples were excluded from the budgets because of the time and personnel consuming nature of such analyses.

Sampling design (by SALSEA-Merge)

The main prey of post-smolts at sea are macrozoooplankton organisms and juvenile fish. Prey abundance and distribution during SALSEA-Merge cruises are observed by macroplankton trawls, traditional plankton nets and multi-frequency acoustics. The macroplankton trawl is equipped with a multiple opening and closing codend to facilitate vertically resolved sampling. The traditional plankton net used during the first three cruises was a WP-2 net. This will probably be adjusted during the next year's cruises to facilitate better near surface sampling and also vertically resolved sampling. Probably, a MOCNESS sampler will be used. Table 1 summarises the anticipated number of samples from the six planned SALSEA-Merge surveys of the Northeast Atlantic and the costs involved in sample analyses.

Table 1. *Available zooplankton samples from six SALSEA-Merge cruises (Fig. 1) during 2008 (cruises 1, 2 and 3) and 2009 (cruises 4, 5, 6) and costs of analyses. Norwegian trawl samples are worked up at sea and need no extra funding. Hours of analysis per sample are 4.*

					Costs of sample analyses				
			Number of samples		Hours		Costs Euros		Total costs
Cruises	**Gear**	**Nation**	**2008**	**2009**	**2009**	**2010**	**2009**	**2010**	**Euros**
1 and 4	Macroplankton trawl	Ireland	0	0	0	0	0	0	
	Plankton net		10	30	40	120	3520	11040	
2 and 5	Macroplankton trawl	Faroe Islands	2	10	8	40	366.4	1832	
	Plankton net		13	30	52	120	2381.6	5496	
3 and 6	Macroplankton trawl	Norway	22	60	0	0	0	0	
	Plankton net		31	160	124	640	10912	58880	
Total			**78**	**290**	**224**	**920**	**17180**	**77248**	**94428**

Analyses and scientific interpretation

Norwegian samples of the macroplankton trawl are sorted, organisms identified, body length measured and weighed at sea. Plankton net samples are stored on formalin and analysed subsequently in the lab. In the present proposal we apply for funding of the analyses of macroplankton trawl samples not analysed at sea and net samples. Further we apply for funding of a Post Doc position over 18 months for analysis of multi-frequency acoustic data, the scientific interpretation of plankton data and for the participation in analyses and publication of results under SALSEA-Merge. See Work packages 4 and 5 of SALSEA-Merge proposal below. The Post Doc period will start 1. July 2010 to facilitate sufficient overlap with the work in SALSEA-Merge WPs 4 and 5:

Work package 4 S&T Objective: Biological Analysis of Samples

- analyse and rank available food items
- analysis of archival scale material
- analysis of scale samples collected in Work package 2
- establish digital scale library
- determine fine scale growth rates
- undertake dietary analysis and assessment of condition

Work package 5 S&T Objective: Merge and analyse genetic, biological and oceanographic data

- map spatial distribution of specific regional stocks or populations
- integrate distribution and migration of salmon with biological and oceanographic data
- develop models to integrate stock specific distribution and migration patterns, with patterns of growth, dietary differences and oceanographic conditions

The total costs of analyses of plankton samples and scientific interpretation, including Post Doc salary over 18 months, are given in Table 2.

Table 2. Total costs of plankton samples analyses and Post Doc salary.

Cost categories	**2009**	**2010**	**2011**	**All years**
Sample analyses	17180	77248	0	94428
Post Doc salery	0	52500	105000	157500
Consumables and travels for Post Doc		3750	3750	7500
Total	**17180**	**133498**	**108750**	**259428**

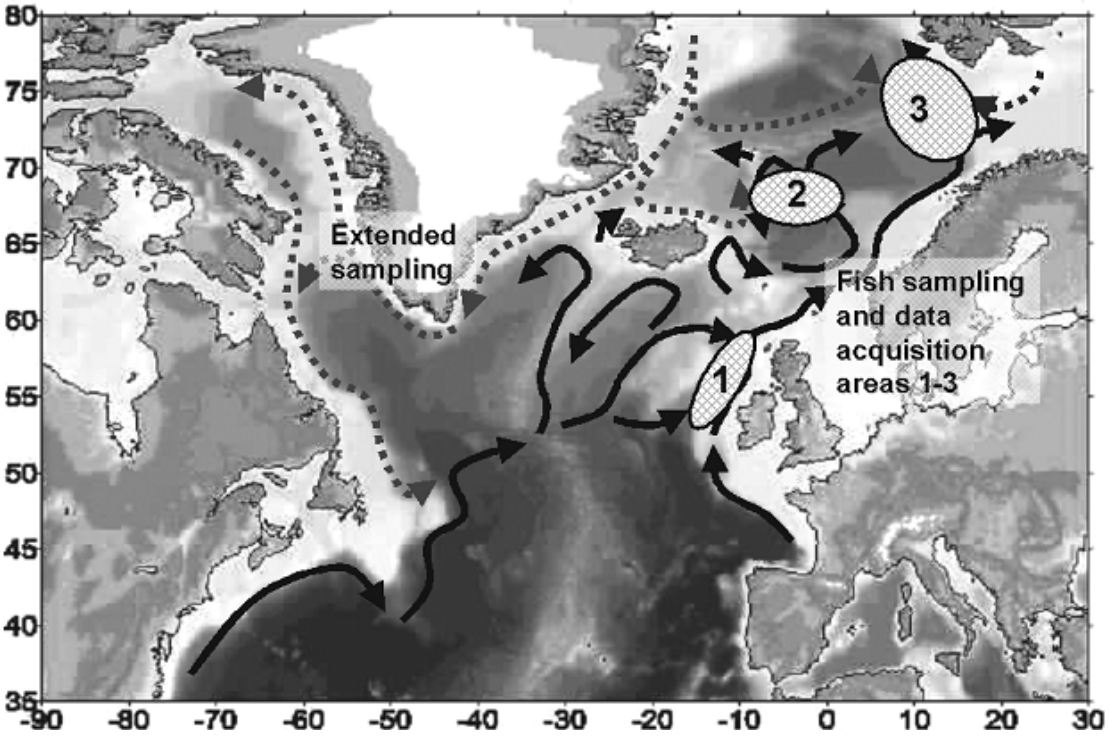

Figure 1. Proposed sampling areas during SALSEA-Merge

Timelines for the samples analysis

Samples will be collected at sea during 6 international cruises during the summers 2008 and 2009 (see above). Samples will be available for analyses after the cruise in the autumn 2008 and 2009. Sample analyses can be completed early 2009 and 2010 for samples collected in 2008 and 2009, respectively. Results of speciation and enumeration of potential food organisms will be disseminated to SALSEA-Merge (WPs 4 and 5) and for inclusion in SALSEA-Merge database immediately after completion of analyses.

Coordination, data analysis and interpretation

The sample transfer between laboratories, analyses and dissemination of results will be coordinated by Dr. Webjørn Melle (IMR, Norway). Scientific interpretation will be an integral part of SALSEA-Merge with additional help by the Post Doc.

List of Partners

Dr. Webjørn Melle, Institute of Marine Research, Norway
Dr. Marianne Holm, Institute of Marine Research, Norway
Dr. Jan Arge Jacobsen, Faroese Fisheries Laboratory, The Faroe Islands
Dr. Dr. Niall O'Maoileidigh, Marine Institute, Newport, Ireland

SAG(08)8

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

August 2008

By

Phil McGinnity, Niall Ó Maoileidigh, Jamie Coughlan, Eleanor Jennings and Tom Cross.

A STUDY OF THE RELATIONSHIP BETWEEN OCEAN CLIMATE AND INTER-ANNUAL VARIATION IN ADULT SUMMER MIGRATION DISTRIBUTION PATTERNS OF ATLANTIC SALMON IN IRISH COASTAL WATERS OVER THREE DECADES.

Objectives

1. To determine, using genetic stock identification, the region and river of origin of fish captured and sampled in the Irish commercial drift net fisheries since 1980.
2. To determine the relationship between regional stock complex and individual population distribution (including survivorship, growth, timing) and key descriptors of the marine environment such as sea surface temperatures, NAO, Gulf Stream Index.
3. To predict regional population response to future marine climate scenario projections

Background

New data emerging from a genetic analysis of the Irish coastal drift net fisheries in 2005 and 2006 (National Atlantic Salmon Genetic Stock identification Programme) suggests occurrence of salmon populations from wide range of Irish and other southern European stock complex salmon populations. These data also suggest that salmon from many rivers aggregate off the west coast of Ireland before continuing their migration northwards and southwards from the area where they amass (Figure 1). Furthermore, and significantly from the perspective of understanding salmon response during their ocean migration to climate variability, the distribution or centre of this aggregation is variable among years. We hypothesise that the west coast of Ireland is an important migration route for most contributing populations that constitute the ICES defined southern population complex. The proximity of the continental shelf to Irelands coast (at it narrowest for Europe is off Irelands North West) and its significant influence on thermal and current regimes, in addition to the substantial influence of the Gulf Stream, provide strong geographical support for the hypothesis of a migratory 'funnelling point' or 'way mark' for returning adult salmon. We further hypothesise that the variation in salmon migration patterns revealed by the recent genetic analyses and consequent impact on the fishes ocean ecology is a response to both cyclical (Gulf Stream index, NAO) and stochastic (directional climate change) changes in the marine environment between and among years. It is possible that an understanding of these

oceanic processes will provide important new insights into those factors controlling marine survival in Atlantic salmon.

This proposal would seek to exploit the very significant Trans-European Genetic Stock Identification baseline being developed under the EU sponsored SALSEA-Merge Project. In addition we would seek to deploy the suite of new state of the art genetic markers also being advanced in the SALSEA-Merge Project. The proposed project would also endeavour to utilise a unique, long term, high resolution, biological archive representing of salmon scale collected systematically from the Irish drift net fisheries over three decades. There are approximately 15,000 scales in the collection. Accompanying the biological archive are data on capture location, time of capture and size at capture. It is proposed to supplement these data with information on fish age and growth rates acquired using latest methodological developments in scale imaging. Elemental isotope analysis of scales would be used to garner further biological information on the history of individual fish. Finally, both hind-casting and forecasting of oceanic climate environments would be undertaken to model fish distribution response.

This proposal is complimentary to the work being undertaken under SALSEA-Merge. Moreover the temporal component represents a significant additional element to SALSEA-Merge which aims primarily to ascertain salmon stock represents distribution at a single moment in time. The data derived from consistent (28 years) and directed sampling of a large number of fish will provide an opportunity for a significant advance in our knowledge.

We are cognisant that an opportunity exists to replicate the approach and methodology outlined above for the Greenland fishery. The Greenland fishery also represents and important long term biological archive that should represent the inter-annual temporal distribution of Atlantic salmon populations from North America and Europe and is representative of salmon at a different stage in their life cycle, specifically their winter feeding grounds. Studies of the distribution of salmon off Irelands west coat and off Greenland would be complimentary. It should be possible at some future date to integrate these studies, with the current SALSEA-Merge project to provide a broad trans-oceanic perspective of the distribution of Atlantic salmon.

Materials & Methods

The project will comprise of three work packages. As the project will be based on archive material and does not depend on collection of new seasonally dependent biological material the start date for the project is flexible. A start date of January 2009 is assumed. The data generated from the three work packages below will be combined to provide an analysis of the historical distribution of individual river and region Atlantic salmon populations in Irish waters over three decades. Also, based on future marine and freshwater climate projections an attempt will be made to predict the distribution and migration patterns of adult Atlantic salmon on their summer spawning migrations.

Genetic analysis of archive scale collection

A representative sample of 5,000 scales will be selected from the archive scale collection. These will be assigned genetically to river and region of origin using mixed stock analysis and individual assignment methods.

Work Package Leader – Dr. Philip McGinnity, University College Cork.
Duration - January 2009 to December 2009
PDF – 6 months
Technician – 12 months
Estimated cost of work package including direct and indirect costs - €100,000

Acquisition of life history data from scales
Each set of individual scales is accompanied by information on the date of capture, location of capture, size of capture. In this work package information from the fisheries and age and growth information acquired using state of the art scale imaging will be combined to construct a detailed life history and migration distribution map for individual fish within each population as they move through the commercial fisheries.

Work package leader – Dr. Niall Ó Maoileidigh, Marine Institute, Newport, Co Mayo
Duration - July 2009 to December 2009
Technician – 6 months
Estimated cost of work package including direct and indirect costs - €25,000

Synthesis of freshwater and marine climate data
Both freshwater and marine environmental information will be synthesised in this work package. Long term data from 1980-2006 on size and timing of freshwater discharges (processed at national, regional and individual river levels) from the island of Ireland into the ocean, including information on temperatures will be collated. Data on the important indices of the marine environment which are likely to have an important bearing on adult fish migration will also be investigated, e.g. regionally specific sea surface temperatures, NAO, Gulf stream strength index. The leader for this work package has worked extensively with the Rossby Climate Research Institute in Sweden and the Hadley Climate Centre in the UK on providing climate projection information. This work package will seek to acquire freshwater and marine environment projections that could be used to predict future distribution patterns and trends of adult salmon in Irish coastal waters.

Work package leader – Dr. Eleanor Jennings, Dundalk Institute of Technology, Dundalk, Co. Louth.
Duration - July 2009 to December 2009
Technician – 6 months
Estimated cost of work package including direct and indirect costs - €25,000

Total Estimated Cost of Project - €150,000

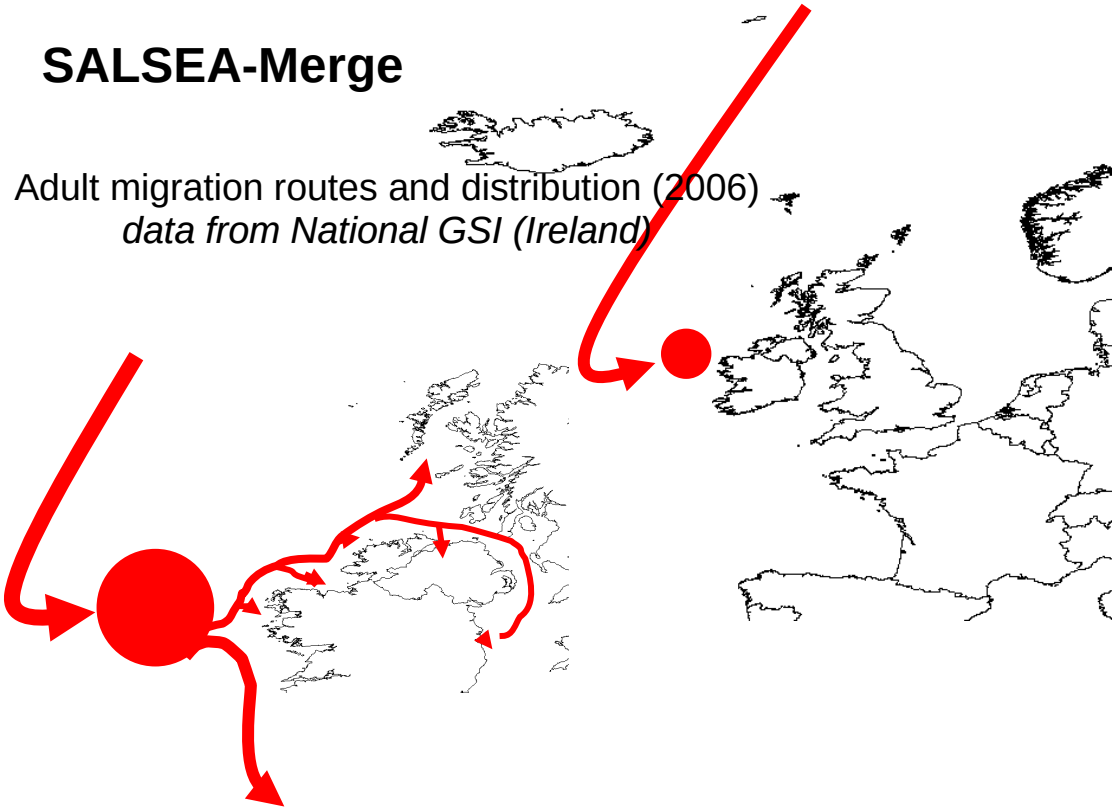
SALSEA-Merge
Adult migration routes and distribution (2006)
data from National GSI (Ireland)

Figure 1

Annex 3

SAG(09)4

Application to NASCO's International Atlantic Salmon Research Board (IASRB) to support research on salmon post-smolts in the Irminger sea southwest of Iceland

Sigurður Már Einarsson
Sigurður Guðjónsson

The research ship Arni Fridriksson

Institute of Freshwater Fisheries
Freshwater Fisheries • Freshwater Biology • Research • Consulting

Introduction

For the last two decades Atlantic salmon in the North Atlantic has seriously declined in abundance. This decline in catches has been attributed to increased mortality during the oceanic part of their life cycle. The decline is generally more pronounced with multi-sea-winter fish, but severe decline has also been observed in many one-sea-winter stocks. This trend is especially evident in some southern rivers, on both sides of the Atlantic where wild salmon face extinction. Arguably the greatest challenge in salmon conservation is to increase knowledge on spatial and ecological use of the marine habitat by different regions and river stocks, which are known to show variation in marine growth, condition and survival. Different stocks may be predisposed to use different marine areas where environmental condition may vary and differently affect growth, condition and survival. Until recently it has been impossible to sample and identify the origin of sufficient numbers of wild salmon caught at sea to enable this vital question to be addressed.

The year 2008 marked the initiation of the SALSEA-Merge project, on the marine ecology of Atlantic salmon, through a partnership of ten European nations. The project is funded under the EU 7th framework. The overall objective of SALSEA-Merge is, by merging ecological and genetic research, to advance understanding of stock specific migration and distribution patterns and overall ecology of the marine life of Atlantic salmon and gain insights in increases in marine mortality of the species.

In SALSEA-Merge an important part of the project is to acquire samples of post-smolts and associated critical oceanographic information in key marine areas of the North Atlantic. In 2008 three cruises were taken to areas in the Northern Atlantic (Figure 1) that were considered to be on the migratory route for post-smolts from Europeean salmon stocks (Jacobsen et.al 2008, Holm et.al 2008, Maoiléidigh et.al 2008).

Initial proposal of SALSEA-Merge sampling of post-smolts included sampling of the Irminger Sea southwest of Iceland, but due to insufficient funding, the area was not included in the project. The Irminger area is on the junction of warm Gulf stream and the cold Greenland current and the area is rich in nutricients (Greene et.al. 2003). Toledano (2006) found relationships between the runs of Icelandic salmon from the west coast of Iceland and SST at certain times and location as well as to abundance of certain groups of zooplankton in the Irminger Sea southwest of Iceland. Recently several salmon, tagged with DST tags were recaptured in a small river in west Iceland, with continuous hourly temperature records and depth regime recorded from the smolt stage until entry in freshwater as 1 SW fish

(Guðjónsson et.al 2008). During the winter months the fish stayed in the surface layers of the sea in temperatures around 8°C. Comparison with SST from satellites indicates a strong possibility that the Irminger gear is the main habitat for Icelandic salmon at least from the south and west Iceland (Guðjónsson et.al. 2008). Furthermore the area may also been utilized by North American stocks and some European stocks.

The Marine Institute of Iceland is planning 2 cruises to the Irminger area in the summer of 2009, in cooperation with Germany and Russia due to research effort on redfish. This cruise creates a unique opportunity to include sampling of salmon post-smolts to the cruise program. However the cruise must be extended by some days to be able to include sampling of salmon. Funding of the project is still unclear, but applications have been sent to the Ministry of Fisheries and Agriculture in Iceland.

Research proposal

The main objective of the proposal is to acquire samples from salmon post-smolts and other oceanographic information in the Irminger area. The cruise will start late in June and will last almost through July 2009. The largest research vessel of Marine Research Institute, Arni Fridriksson will be used. Personnel from Institute of Freshwater Fisheries will be on board throughout the cruise. Another shorter cruise is planned in the autumn if sufficient funding will be obtained. Furthermore, sampling of salmon is possible in some cruises in the east and south of Iceland during the summer and autumn. The SALSEA methodology created for previous cruises for the sampling will be followed in the project and same type of sampling gear will be used.

Research cost

The prospects of getting some additional funding from the Icelandic government are reasonable good. However, further funding is needed. Therefore, we ask the *N*ASCO's International Atlantic Salmon Research Board (IASRB) to support this research work by ***25.000 €. (Euros)*** to be able to complete all the work in the cruise that is need.

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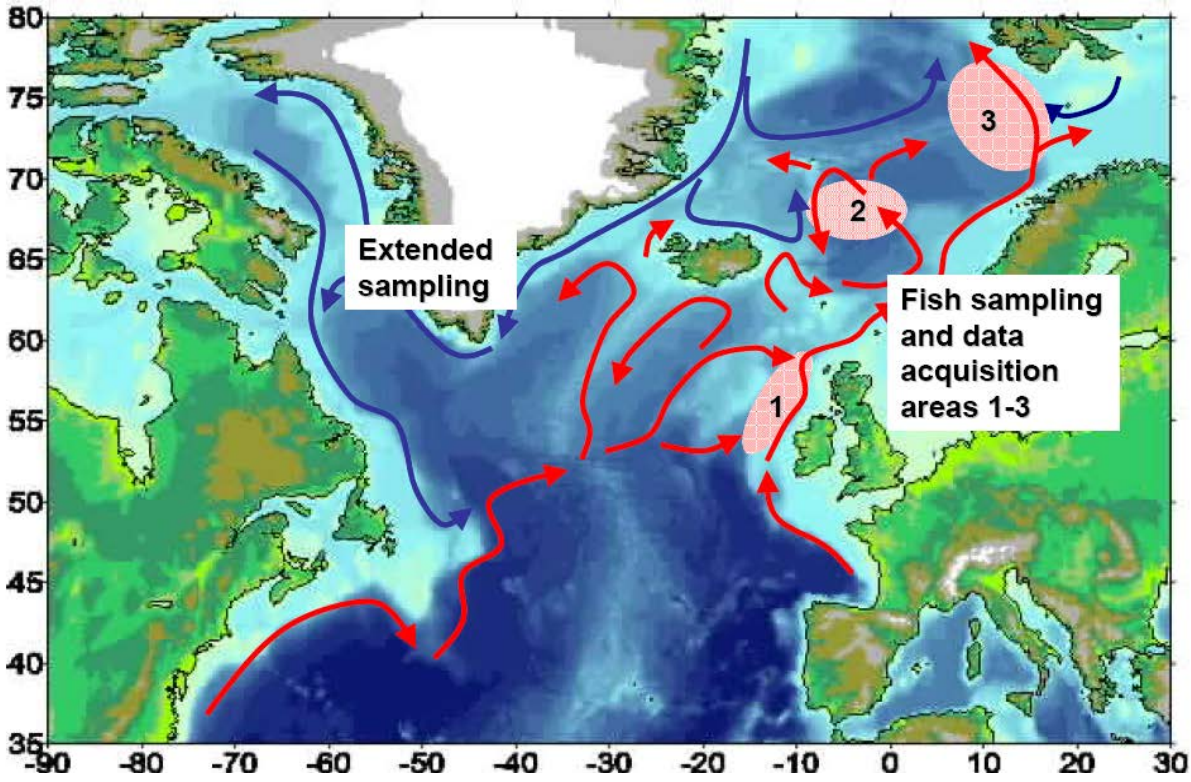

Figure 1.Location of key marine areas for sampling of post smolts, in the North Atlantic in 2008 and 2009 (Jacobsen et. al 2008).