



**International Atlantic Salmon Research Board**

**ICR(08)2**

*Inventory of Research Relating to Salmon Mortality in the Sea*



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#### *Summary*

1. The Board's inventory of research relating to salmon mortality in the sea was established in 2002 and has been updated annually since then. It is an essential tool in the development of research priorities for potential funding and in better coordinating existing research efforts. Maintaining the inventory involves updating it as new projects are approved (including those commencing in the current year and for which funding has been confirmed), existing projects are changed, and projects are completed. In order to achieve this the Members of the Board were asked to provide to the Secretariat by 15 February 2008, updated information for inclusion in the inventory. As agreed by the Board at its 2005 meeting, projects for which no updates were provided have, following consultations with the Parties concerned, been removed from the inventory of on-going projects.
2. Having reviewed gaps in the information included in earlier inventories the Board agreed that its initial research priority was studies of the distribution and migration of salmon at sea in relation to feeding opportunities and predation. In 2005, the Board adopted a comprehensive and innovative programme of research, the SALSEA Programme, designed to improve understanding of the distribution and migration of salmon at sea. Its three main workpackages concern the development of supporting technologies, early migration through the inshore zone and marine surveys. The Board recognised that studies of the early migration through the inshore zone were largely nationally funded but the Board might play a role in coordinating such research. Last year the inventory included new studies on the establishment of genetic baselines and on gear trials to test pelagic trawls in support of the marine surveys envisaged under SALSEA. As this latest inventory update shows there has been major progress since last year with funding for marine surveys in both 2008 and 2009 in the North-East Atlantic and in 2008 in the Northwest Atlantic. These marine surveys been achieved through a public-private partnership in which the Atlantic Salmon Trust and the TOTAL Foundation have been major private sector contributors. There has, therefore, been very significant progress in implementing the SALSEA programme.
3. Table 1 provides details of expenditure on research by topic area for each Party. For the first time since the inventory was established all on-going projects have been costed. In Table 2, on-going projects are listed according to the five research topic areas agreed by the Board on the basis of the main focus of the research, although some projects could have been allocated to a number of these research areas. The total annual expenditure on the 55 on-going projects included in the inventory amounts to approximately £6.7 million approximately 32% higher than in 2008 due largely to two major new projects involving marine surveys of the distribution of salmon at sea. Last year, the Board asked that information for inclusion in the inventory be requested from France in relation to the sampling programme at St Pierre and Miquelon. We have requested this information but at the time of preparation of

the paper, no response had been received. A report on the St Pierre and Miquelon fishery is contained in document CNL(08)19.

4. As requested by the Board at its 2006 meeting, those projects that fall within the SALSEA programme have been allocated to the relevant work package in Table 3. Most significantly, there will be major dedicated research surveys for salmon in both 2008 and 2009. Last year the Board agreed that studies involving acoustic tags and DSTs should be listed under work package 3. There are a number of ongoing genetic studies which will contribute to developing a baseline or genetic atlas of stocks to facilitate genetic stock identification of salmon caught in research surveys at sea.
5. Table 4 provides summary information on both the on-going (Table 4a) and completed projects (Table 4b) and full details of these projects are contained in Annexes 1 and 2 respectively. In total, 55 ongoing projects are included in the inventory, the same as last year, although several of these ongoing projects are in their final stages. 9 projects have been completed since last year. The completed projects are:

Canada:

- Integrated field and laboratory assessment of the effects of endocrine-disrupting substances on Atlantic salmon smolts;
- Use of stable isotopes to assess long-term changes in marine trophic ecology of Atlantic salmon (*Salmo salar*);
- Effective population size, gene flow and population structure of Atlantic salmon in Newfoundland and Labrador.

European Union:

- Early distribution and migration of Atlantic salmon smolts off the West of Ireland;
- Cardiff Bay Fisheries Monitoring Programme.

Norway:

- The importance of early marine feeding on the growth and survival of Atlantic salmon post-smolts in Norwegian fjords;
- Distribution and ecology of post-smolts and salmon at sea;
- Dispersal of salmon lice in Norwegian fjords.

Russia:

- Assessment of by-catch of post-smolts of Atlantic salmon in pelagic fisheries in the Norwegian Sea.

In addition, Norway had reported on the completion of a project to investigate the behavior of 'escaped' farmed salmon that had been tagged prior to release in Scotland and Norway. This project was not previously included in the inventory.

6. In total, 9 new projects have been included in the inventory, as follows:

Canada:

- Pelagic ecosystem survey of the Northwest Atlantic;
- Miramichi River kelt movements and survival;

- Stable isotope ratios and lipid content of tissues from non-maturing 1SW Atlantic salmon at West Greenland relative to continent of origin and age at maturity.

European Union:

- SALSEA-Merge: Advancing understanding of Atlantic salmon at sea: merging genetics and ecology to resolve stock-specific migration and distribution patterns (*Note: Norway and the Faroe Islands are also major contributors to this project which involves a consortium of twenty organizations*);
- The marine life of Atlantic salmon: evidence from the microchemistry of scales;
- Size and condition of returning grilse (1SW) and MSW salmon;
- Atlantic salmon metapopulation investigation in Normandy rivers;

Norway:

- Population-limiting mechanisms for Atlantic salmon during early estuarine and coastal migration (SALPoP);
- The Hardangerfjord salmon lice project.

7. The Board is asked to review the latest update of the inventory and decide on any appropriate action.

Secretary  
Edinburgh  
6 May 2008

**Table 1: Approximate Annual Expenditure on Research in Relation to Salmon Mortality at Sea by Topic Area and Party**

	Canada	Denmark (Faroe Islands and Greenland)	European Union	Iceland	Norway	Russia	United States of America	<b>Totals by Topic Area</b>
Long-term monitoring	£564,500 1	-	£976,660 10	£146,000 2	£134,000 1	£80,000 1	£14,000 1	<b>£1,915,160 16</b>
Distribution/ migration in the sea	£892,500 8	£84,800 1	£2,254,200 8	£308,000 4	£298,200 2	-	£143,000 4	<b>£3,980,700 27</b>
Life history/ biological processes	£9,500 1	-	£319,000 4	-	-	-	-	<b>£328,500 5</b>
Development of methods	-	-	-	£4,000 1	-	-	-	<b>£4,000 1</b>
Specific natural and anthropogenic factors	-	-	£229,000 3	-	£226,000 2	-	£16,000 1	<b>£471,000 6</b>
<b>Totals by Party</b>	<b>£1,466,500 10</b>	<b>£84,800 1</b>	<b>£3,778,860 25</b>	<b>£458,000 7</b>	<b>£658,200 5</b>	<b>£80,000 1</b>	<b>£173,000 6</b>	<b>£6,699,360 55</b>

*The figures shown are in pounds sterling. The number of projects is shown below the expenditure figure. The costs have been allocated on the basis of the NASCO Party coordinating the research project. However, in many cases the projects involve collaboration with other Parties or with NGO partners who may have made financial contributions to the projects (some details of these contributions have been provided and are given in Annex 1).*

**Table 2: Inventory of research relating to salmon mortality in the sea – allocation of projects by topic area**

Topic Area	Objective/Issue	Comments/examples	Projects	Potential for cooperation among Contracting Parties	Priority for access to 'Fund'
1. Long-term monitoring	a. Time-series of marine survival/growth estimates	Essential on-going tagging/monitoring programmes; require long-term national funding.	C3, E4, E8, E9, E10, E15, E17, E20, E23, E25, I1, I4, N2, R1, U4	Medium	Low
	b. Time series of marine survival in relation to environmental parameters (e.g. SST)	Desk studies on time series.	E11	Medium	Medium
2. Distribution/migration in the sea	a. Distribution of salmon in the sea	Marine surveys of post-smolt distributions in NEAC and NAC areas; identification of fish caught (e.g. tagging, genetics).	C1, E1, U5	High	High
	b. Migratory behaviour of individual fish	Active smolt tracking; automated data collection by DSTs.	C2, C4, C5, C6, C7, E16, E22, I3, I5, I6, N4, U1, U2, U3	High	High
	c. Origin of catches in directed fisheries	Catch sampling in distant water fisheries; genetic analysis and scale analysis, etc; changes over time.	C8, C9, D1, E6, E13, E18, E21, E24, I7, N3	High	Low
	d. Migration and bioenergetic models	Desk studies based on data obtained from other studies.		Medium	Medium
	e. By-catches in pelagic fisheries	Can be conducted as part of marine surveys of post-smolt distributions; sample commercial pelagic catches.		High	High
3. Life history/biological processes	a. Freshwater factors	Age, growth, migration timing, etc.	E3	Low	Low
	b. Pre-fishery recruitment marine factors	Environment, food, predation, growth, parasites and diseases, etc.		High	High
	c. Post-fishery recruitment marine factors	Environment, food, predation, maturation processes, growth, etc.	C10, E5, E7, E14	High	High
4. Development of methods	a. Post-smolt survey methods	Development of trawls with cameras, tag detection, etc.		Medium	Medium
	b. Electronic tag technology	Development of smaller/smarter/cheaper tags.	I2	Medium	High
5. Specific natural and anthropogenic factors	a. Fish farms	Increased sea lice infestations.	E19, N1, N5	Low	Low
	b. Predation	Predation by seals, birds, fish, etc. in estuaries/coastal areas.	E12, U6	Low	Low
	c. Obstructions to fish movements	Barrages, etc.		Low	Low
	d. Pollutants	Acidification; freshwater contaminants.	E2	Low	Low

*Note: The priorities of low, medium and high assigned to the topic areas in this table are those currently considered appropriate for international cooperation and funding. The Board will keep them under review. They are not intended to reflect overall importance of these topics.*

**Table 3: Expenditure on ongoing projects in the inventory of research of relevance to the SALSEA programme**

<b>SALSEA Work Packages</b>	<b>Ongoing Projects</b>
<p><b><i>Work Package 1: Supporting Technologies</i></b>                      Task 1: Genetic tagging to determine stock origin</p> <p>Task 2: Sampling equipment evolution</p> <p>Task 3: Signals from scales</p>	<p>C8, C9, D1, E6, E13, E18, E21, E24, I7, N3</p> <p>-</p> <p>E7, E11</p>
<p><b><i>Work Package 2: Early Migration through the Inshore Zone: fresh waters, estuaries and coastal waters</i></b>                      Task 1: Investigate the influence of biological characteristics of Atlantic salmon smolts on their marine mortality</p> <p>Task 3: The impacts of physical factors in fresh water on marine mortality of Atlantic salmon</p> <p>Task 3: Preparing to migrate – investigate the influence of freshwater contaminants on the marine survival of Atlantic salmon</p> <p>Task 4: The part played by key predators</p> <p>Task 5: The impact of aquaculture on mortality of salmon</p>	<p>C3, E4, E8, E9, E10, E17, E20, E23, E25, I1, N2, R1, U4</p> <p>E3</p> <p>E2</p> <p>E12, U6</p> <p>E19, N1, N5</p>
<p><b><i>Work Package 3: Investigating the distribution and migration of salmon at sea</i></b>                      Task 1: Distribution and migration mechanisms – develop theoretical migration models</p> <p>Task 2: A common approach – refine the plans for a large-scale marine survey</p> <p>Task 3: Salmon at sea – carry out a comprehensive survey - marine surveys                      - acoustic tagging surveys                      - data storage tags                      - others</p> <p>Task 4: Distribution and migration – analyse and collate data</p>	<p>-</p> <p>-</p> <p>C1, E1, U5                      C2, C4, C5, C6, C7, E16, E22, N4, U1, U2, U3                      I3, I5, I6                      C10, E14</p> <p>-</p>
<p><b><i>Appendix 1: Supporting technologies, further development of which will support the SALSEA programme</i></b>                      1. Novel trawl sampling technologies</p> <p>2. Data storage tags</p> <p>3. Coded wire tagging</p> <p>4. Sonic tags and sonic detector arrays</p>	<p>-</p> <p>I2</p> <p>E15, I4</p> <p>-</p>

**Table 4: Summary of ongoing and completed research projects relating to salmon mortality in the sea**

**Table 4(a) ONGOING PROJECTS (see Annex 1 for details)**

<b>Project No. and Title</b>	<b>Summary of objectives</b>	<b>Topic Area</b>	<b>Date of research</b>	<b>Area of research/ Collaborating countries</b>	<b>Coordinating Scientist(s)</b>	<b>Annual expenditure (Pounds Sterling – approx.)</b>	<b>Main research methods</b>
<b>CANADA</b>							
<b>C1:</b> Pelagic ecosystem survey of the Northwest Atlantic	Sample the upper pelagic ecosystem during the period corresponding to the early post-smolt phase (August). Determine relative abundance of salmon at selected locations and times along hypothesised ocean migration route. Obtain data on relative abundance of other species including macroplankton aggregations to provide information on the role of salmon in the pelagic ecosystem.	Distribution/migration in the sea.	<b>New entry</b> 2008 23 day period during end of July to beginning of September	North West Atlantic  <i>Collaborating countries:</i> USA	Gerald Chaput ChaputG@dfo-mpo.gc.ca Dave Reddin reddind@dfo-mpo.gc.ca Tim Sheehan Tim.Sheehan@noaa.gov	£350,000	Surface pelagic trawl, oceanographic and plankton samplers.
<b>C2:</b> Miramichi River kelt movements and survival	Document the spring movements and survival of kelts from the Miramichi River as they return to the sea. Use pressure sensitive tags to record the depths used by kelts.	Distribution/migration in the sea	<b>New entry</b> 2008 - 2010	Miramichi River estuary and Gulf of St Lawrence	F Whoriskey asfres@nb.aibn.com	£12,500	Acoustic tags and receiver arrays
<b>C3:</b> Marine survival of Canadian Atlantic salmon stocks: long-term monitoring	Long-term monitoring of smolt production and adult return estimates from a number of rivers in Newfoundland region, Maritimes region, Gulf region and Quebec.	Long-term monitoring	April – November, annually	Canadian rivers in Newfoundland region, Maritimes region, Gulf region and Quebec	Contact for information: Gerald Chaput Chaputg@dfo-mpo.gc.ca	£564,500	Smolt and adult traps, fences, trap nets, rotary screw smolt traps.
<b>C4:</b> Atlantic salmon smolt migration and survival within Canadian rivers, estuaries and during the marine life stage	Provide a time-series of stage specific estimates of mortality rates for smolts at various points of their at-sea migration, including for their transitions through fresh water, the estuary and to various points in the ocean; examine the relation between biological characteristics of the fish and survival rates to attempt to isolate mortality causes; document the migration pathways and speeds of smolts from different rivers.	Distribution/migration in the sea	2003-2008 (spring/summer)	Miramichi River and estuary; Restigouche River and Baie des Chaleurs; Cascapedia River and estuary; St-Jean (Côte-Nord) River and estuary; Western Arm Brook, Strait of Belle Isle, Cabot Strait, Labrador.  <i>Collaborating countries:</i> USA	Fred Whoriskey asfres@nb.aibn.com	£300,000	Acoustic tags and receivers, smolt wheels, small boats and chartered fishing vessel.

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<b>C5:</b> Integrated modelling of juvenile Atlantic salmon movement and physical habitat in fluvial and estuarine environments	Develop and apply an approach capable of relating the behaviour of smolts, during their migration, to physical habitat characteristics in rivers and estuaries. Apply this approach to analysis of smolt migration. Detect potential changes in the migration pattern of smolts in response to the planned presence of sea cages in Baie de Gaspé.	Distribution/ migration in the sea	2005-2008 (spring/ summer)	York River and Baie de Gaspé, Quebec  <i>Collaborating countries:</i> UK	Julian Dodson julian.dodson@bio.ulaval.ca	£150,000	Acoustic tags and receivers, smolt wheels, small boats and chartered fishing vessel.
<b>C6:</b> River and extended estuary acoustic tracking of Atlantic salmon ( <i>Salmo salar</i> ) kelts and bright salmon	Track and document migratory behaviour of Atlantic salmon kelts as they leave the river for the open ocean and bright salmon as they return; identify possible critical habitat sites utilised by kelts and bright salmon during their migration; examine mortality rates of kelts and bright salmon during migration.	Distribution/ migration in the sea	2006 – 2008	LaHave River and estuary, Nova Scotia	Peter G. Amiro AmiroP@mar.dfo-mpo.gc.ca A Jamie F Gibson Gibson AJF@mar.dfo-mpo.gc.ca	£30,000	Acoustic tags and receivers.
<b>C7:</b> Estuary acoustic tracking of Atlantic salmon ( <i>Salmo salar</i> ) smolts and kelts – Conne River, Little River and Bay d'Espoir, Newfoundland	Tag and track migratory behaviour of salmon smolts and kelts leaving the Conne River; determine the movements and migration patterns through the Bay d'Espoir fjord; provide insight into the initial survival and residency of smolts and kelts migrating through the fjord.	Distribution/ migration in the sea	2006-2008	Conne River and estuary, Little River and Bay d'Espoir fjord, Newfoundland	J Brian Dempson dempsonb@dfo-mpo.gc.ca Keith Clarke clarkekd@dfo-mpo.gc.ca	£15,000	Acoustic tags and receivers.
<b>C8:</b> Spatio-temporal distribution of Atlantic salmon stocks and the impact of the West Greenland fishery	Provide knowledge about the river of origin of the salmon catch in the commercial fishery, particularly at West Greenland; estimate the impacts of fishing on these populations.	Distribution/ migration in the sea	2006-2008	Samples from West Greenland	Louis Bernatchez louis.bernatchez@bio.ulaval.ca	£15,000	Genetic analysis.
<b>C9:</b> Genetic population structure of Atlantic salmon in Eastern Canada and its implications for conservation	Elucidate the genetic population structure of Atlantic salmon from a small (river) to a large (Eastern Atlantic coast) spatial scale and propose conservation units for the Canadian distribution range.	Distribution/ migration in the sea	2004-2008	Rivers in Quebec, Gulf of St Lawrence and Labrador	Louis Bernatchez louis.bernatchez@bio.ulaval.ca Melanie Dionne melanie.dionne@giroq.ulaval.ca	£20,000	Genetic analysis.

Project No. and Title	Summary of objectives	Topic Area	Date of research	Area of research/ Collaborating countries	Coordinating Scientist(s)	Annual expenditure (Pounds Sterling – approx.)	Main research methods
<b>C10:</b> Stable isotope ratios and lipid content of tissues from non-maturing 1SW Atlantic salmon at West Greenland relative to continent of origin and age at maturity.	Improve understanding of marine ecology of salmon at West Greenland through status of trophic state and condition. Questions to be addressed include: <ul style="list-style-type: none"> <li>- are trophic states of 1SW non-maturing fish similar between NAC and NEAC origin salmon;</li> <li>- are trophic states of 1SW non-maturing fish different from those of maturing 1SW fish of the same cohort;</li> <li>- has there been a trophic state change between West Greenland and return to home rivers as 2SW salmon.</li> </ul>	Life history/ biological process	<b>New entry</b> 2007-2008	West Greenland and from salmon returning to the Miramichi River  <i>Collaborating countries:</i> Greenland	Gerald Chaput Chaputg@dfo-mpo.gc.ca Tim Sheehan Tim.Sheehan@noaa.gov	£9,500 (excludes cost of purchase of samples (See Project D1))	Lipid and stable isotope analyses.
<b>DENMARK (FAROE ISLANDS AND GREENLAND)</b>							
<b>D1:</b> West Greenland Salmon Fishery Sampling Programme	Continue time series of data on the continent of origin and biological characteristics of salmon in the fishery. Provide data on mean weight and length and continent of origin for input to models. Collect information from internal and external tags. Collect information on diseases and parasites. Collect samples for stable isotope and lipid analyses (new in 2007).	Distribution/ migration in the sea	Annually during the fishing season, (August – October)	West Greenland  <i>Collaborating countries:</i> USA, UK, Ireland, Canada	Helle Siegstad helle@natur.gl	£84,800 in 2007	Catch sampling, scale analysis, genetic analysis, disease and parasite screening. Lipid and stable isotope analyses.
<b>EUROPEAN UNION</b>							
<b>E1:</b> SALSEA-Merge: Advancing understanding of Atlantic salmon at sea: Merging genetics and ecology to resolve stock – specific migration and distribution patterns.	Merge genetic and ecological investigations to advance understanding of stock specific migration and distribution patterns and overall ecology of the marine life of Atlantic salmon and gain an insight into the factors resulting in recent significant increases in marine mortality.	Distribution/ migration in the sea	<b>New Entry</b> April 2008 – April 2011	North-East Atlantic with marine surveys off coast of Ireland and UK, around the Faroes and in the Northern Norwegian Sea and Barents Sea  <i>Collaborating countries:</i> Denmark, Finland, France, Faroes, Iceland, Ireland, Norway, Spain, UK	Jens Christian Holst jens.christian.holst@imr.no	£1.5 million	Pelagic live capture trawls, pelagic trawls, genetic analysis, oceanographic data analysis

<b>Project No. and Title</b>	<b>Summary of objectives</b>	<b>Topic Area</b>	<b>Date of research</b>	<b>Area of research/ Collaborating countries</b>	<b>Coordinating Scientist(s)</b>	<b>Annual expenditure (Pounds Sterling – approx.)</b>	<b>Main research methods</b>
<i>UK – England and Wales</i>							
<b>E2:</b> Diffuse pollution and freshwater fish populations	Investigate the role of diffuse aquatic contaminants in regulating populations of freshwater fish with particular reference to salmonid stocks and fisheries.	Specific natural and anthropogenic factors	April 2005 – March 2010	England and Wales	Andrew Moore a.moore@cefas.co.uk	£139,000	Integrated research programme involving ecotoxicological studies, telemetry and literature review, etc.
<b>E3:</b> The influence of the freshwater environment on salmonid populations	Investigate the impact of environment change on juvenile salmon production and ecology. One aspect of the research directly related to marine survival is the potential role of assessment techniques (trapping, anaesthetisation tagging) in influencing marine survival.	Life history/ biological processes	April 2005 – March 2010	England and Wales	Andrew Moore a.moore@cefas.co.uk	£123,000	Large-scale microtagging and PIT tagging.
<b>E4:</b> Deriving estimates of marine survival and exploitation for monitored river stocks in England and Wales	Establish ‘monitored’ rivers where estimates of marine survival and exploitation in marine fisheries can be derived and compared with other North Atlantic stocks.	Long-term monitoring	Ongoing annual monitoring programme	River Dee (North Wales), River Tamar (SW England)	Ian Davidson ian.davidson@environment-agency.wales.gov.uk Simon Toms simon.toms@environment-agency.gov.uk Ian Russell i.c.russell@cefas.co.uk	£120,000	Rotary screw traps, microtagging, adult traps and counters.
<b>E5:</b> Factors affecting the distribution and behaviour of salmonid populations	Investigate the habitat requirements of adult salmonids within the estuarine and freshwater environments. One key element of the research is to investigate how changes in prey availability within the marine environment may influence recruitment of stocks between years.	Life history/ biological processes	April 2005 – March 2010	England and Wales	Andrew Moore a.moore@cefas.co.uk	£144,000	Integrated research programme involving physiological studies, analysis of stable isotopes, telemetry, literature review, etc.

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<b>E6:</b> Atlantic salmon Arc Project, ASAP	Define exploitation at sea on a regional basis using genetic tools. Create a long-term database for these studies and create an international management tool to inform decision-making.	Distribution/migration in the sea	May 2004 – July 2008	Europe, North Atlantic  <i>Collaborating countries:</i> Spain, France, Ireland, Scotland, USA, Iceland	Dylan Bright dylan@wrt.org.uk	£555,000	Genetic analysis.
<b>E7:</b> The marine life of Atlantic salmon : evidence from the microchemistry of scales	The objectives include measuring the stable isotope and trace element compositions from salmon scales in relation to variations in the marine environment and develop a model to predict impacts of changes in the marine environment on return rates of salmon.	Life history /biological processes	<b>New Entry</b> 2007 - 2010	England and Wales	Clive Trueman trueman@noc.soton.ac.uk	£22,000	Stable isotope and trace element analysis.
<b>UK – Northern Ireland</b>							
<b>E8:</b> The marine survival of Atlantic salmon from the River Bush, Northern Ireland	Investigate factors influencing the survival at sea of salmon smolts migrating from the River Bush until their return as adults.	Long-term monitoring	1973 – 2011	River Bush, N. Irish/Irish coastal waters and distant-water fisheries  <i>Collaborating countries:</i> Ireland (tag recovery programme)	Gersham Kennedy gersham.kennedy@afbini.gov.uk Richard Kennedy Richard.kennedy@afbini.gov.uk	£47,460	Microtagging, traps, run-reconstruction models.
<b>E9:</b> Development of conservation limits, pre-fishery abundance and management of the Foyle salmon fishery	To build upon the existing Foyle salmon management system, to develop it into a precautionary catch advice framework that fully takes account of biological data on stock abundance and which fulfils all the main requirements of the Precautionary Approach.	Long-term monitoring	2005-2008	Foyle area, Ireland  <i>Collaborating countries:</i> Ireland, France, Scotland	Patrick Boylan p.boylan@loughs-agency.org	£41,700	Modelling study.
<b>UK - Scotland</b>							
<b>E10:</b> Post-smolt mortality of Atlantic salmon	Assess post-smolt mortality rates of Atlantic salmon from three Scottish rivers, and the contribution of these salmon to fisheries that exploit them.	Long-term monitoring	Ongoing	North Esk, Western catchment of River Dee, River Conon salmon fishery district	Julian Maclean (N. Esk) j.c.maclea@marlab.ac.uk Alan Youngson (River Dee) a.youngson@marlab.ac.uk John Armstrong (River Conon) j.armstrong@marlab.ac.uk	Approximately £50,000	Traps, counters, rotary screw traps, electro-fishing, PIT tags and detectors.

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<b>E11:</b> Analysis of post-smolt life history by scale reading	Investigate the relationship between growth and mortality, particularly during the marine phase, by analysis of scale growth patterns.	Long-term monitoring	Continuing project under longer-term remit	Samples from around Scotland but North Esk and Gironck Burn in particular  <i>Collaborating countries:</i> USA and Canada	Julian Maclean j.c.maclea@marlab.ac.uk	Approximately £10,000	Scale analysis.
<b>E12:</b> Protecting salmonid fisheries from seal damage	Develop and apply new molecular tools for discriminating among species of fish in the diets of seals from their remains in scats. Test the possibility of using molecular tools to quantify the occurrence of diet components. Identify factors influencing salmon migration routes in estuaries and relate to presence of predators. Examine occurrence of seal-damaged salmon on a wide geographic scale.	Specific natural and anthropogenic factors	April 2003 - March 2008	Principally North-East Scotland (Cromarty Firth). Possible work in other estuaries and extension into West Coast	John Armstrong j.armstrong@marlab.ac.uk	£80,000 in 2007/08	DNA analysis, acoustic tags and receivers, inflatable craft.
<b>E13:</b> Fisheries-induced evolution	Determine the incidence and extent of heritable genetic changes in salmon stocks due to fishery programmes.	Distribution/ migration in the sea	2007-2010	Scotland and across European species' distribution, including marine migration routes.  <i>Collaborating countries:</i> Austria, Norway, France, Denmark, Belgium, UK, Netherlands, Finland, Germany	Ulf Dieckman dieckman@iiasa.ac.at Alan Youngson A.Youngson@marlab.ac.uk	£52,000 (FRS cost)	Case studies, genetic analyses and modelling.
<b>E14:</b> Size and condition of returning grilse (1SW) and MSW salmon	Investigate decadal trends in the size and condition of adult salmon returning to Scotland.	Life history/ biological processes	<b>New entry</b> 2007 -	Six locations in Scotland, in particular North Esk.	Philip Bacon P.J.Bacon@MarLab.ac.uk	£30,000	Collection of biometric data.
<b>Ireland</b>							
<b>E15:</b> National coded wire tagging and tag recovery programme	Provide information on marine survival and exploitation rates by commercial fisheries; estimate contribution of individual river stocks to catches; examine performance of selected experimental groups; and evaluate potential for salmon ranching.	Long-term monitoring	Ongoing programme initiated in 1980	Tag recovery from around North Atlantic  <i>Collaborating countries:</i> Norway, UK, Faroes, France, Spain, Germany, Denmark	Niall O'Maoileidigh niall.omaileidigh@marine.ie	£300,000	Micro-tagging and tag recovery programmes.

<b>Project No. and Title</b>	<b>Summary of objectives</b>	<b>Topic Area</b>	<b>Date of research</b>	<b>Area of research/ Collaborating countries</b>	<b>Coordinating Scientist(s)</b>	<b>Annual expenditure (Pounds Sterling – approx.)</b>	<b>Main research methods</b>
<b>E16:</b> Migration of salmon in estuarine and coastal waters	Investigate the timing, route of migration and aspects of the biology of migrating ranched salmon smolts in comparison to the native wild smolt migration.	Distribution/ migration in the sea	2005-2008	Burrishoole catchment, Newport and Clew Bay, Co. Mayo  <i>Collaborating countries:</i> UK	Russell Poole, russell.poole@marine.ie Deirdre Cotter deirdre.cotter@marine.ie Niall O'Maoileidigh niall.omaileidigh@marine.ie	£24,000	Acoustic tags, receiver arrays, echo sounders.
<b>E17:</b> Marine survival of wild Atlantic salmon from the Burrishoole River, Ireland	Investigate factors influencing the survival at sea of salmon smolts migrating from the Burrishoole River until their return as adult salmon.	Long-term monitoring	1960 -	Burrishoole River	Russell Poole russell.poole@marine.ie	£72,000	Upstream and downstream traps.
<b>E18:</b> National Development Plan - National Genetic Stock Identification Project	Identify and map discrete spawning areas within tributaries of Irish salmon rivers and collect juveniles for establishment of genetic baseline for mixed sample analysis. Undertake molecular genetic analysis of juvenile salmon tissue and adult scales to determine relative contributions of different baseline river populations within mixed samples.	Distribution/ migration in the sea	2006-2007 Dissemination of results only in 2008	All Irish rivers  <i>Collaborating countries:</i> UK, Spain	Tom Cross t.cross@ucc.ie Paddy Gargan paddy.gargan@cfb.ie Philip McGinnity phil.mcginny@marine.ie	0 (in 2008)	Genetic analysis.
<b>E19:</b> Interactions between aquaculture and wild salmonid fish	Assess efficacy of prophylactic treatments for salmon smolts migrating through aquaculture bays.	Specific natural and anthropogenic factors	2003-2008	Burrishoole, Shannon, Lee and Screebe, and drift net fishery around Irish coast	D Jackson dave.jackson@marine.ie	£10,000	Traps, microtagging, commercial fishery.
<b>France</b>							
<b>E20:</b> The sea survival of Atlantic salmon from the River Scorff, Brittany	Estimation and long-term monitoring of survival at sea in the southern part of the European distribution range of the species.	Long-term monitoring	1994 on	River Scorff (Southern Brittany)	Etienne Prévost eprevost@st-pee.inra.fr	£52,000	Adult and smolt trapping facilities.
<b>E21:</b> Atlantic salmon metapopulation investigation in Normandy rivers	Estimate exchanges between rivers flowing into the Mont Saint-Michel Bay and the impact on management of salmon populations.	Distribution/ migration in the sea	<b>New entry</b> 2007-2010	Rivers flowing into Mont Saint-Michel Bay, Normandy	Jean-Luc Bagliniere Jean-Luc.Bagliniere@rennes.inra.fr	£40,000	Standard sampling equipment and genetics laboratory equipment traps.

Project No. and Title	Summary of objectives	Topic Area	Date of research	Area of research/ Collaborating countries	Coordinating Scientist(s)	Annual expenditure (Pounds Sterling – approx.)	Main research methods
<b>Denmark</b>							
<b>E22:</b> Mortality of Atlantic salmon smolts during estuary migration	Estimate mortality of salmon smolts during migration through estuaries and compare the return ratio of wild, stocked ½- and one-yearlings.	Distribution/ migration in the sea	April 2000 to June 2008 Analysis and publication of results in 2008	River Skjern Å and River Stor Å (North Sea) and River Guden Å (Kattegat) and their estuaries	Anders Koed ak@difres.dk Kim Aarestrup kaa@difres.dk	£30,000 in 2008	Rotary screw traps, radio and acoustic telemetry equipment.
<b>Finland</b>							
<b>E23:</b> Long-term variation in population dynamics, life history characteristics, sea growth and origin (wild/reared) of salmon in the rivers Teno (Tana) and Näättäjäjoki (Neidenelva)	Collect long-term data on variation in the stock components, life histories, sea growth and abundance of escaped farmed salmon in the salmon stocks of the rivers Teno and Näättäjäjoki. Relate the population dynamics of the juvenile salmon and returning adult salmon in preceding and subsequent generations	Long-term monitoring	Long-term ongoing	Northern Finland and Norway  <i>Collaborating countries:</i> Norway	Jaakko Erkinaro jaakko.erkinaro@rktl.fi	£275,000	Collection of catch statistics and sampling. Analysis of scale samples (2,000-8,000 annually). Electro-fishing.
<b>E24:</b> Towards sustainable fishing and biodiversity preservation of north-west Russian salmonid stocks by using molecular genetic techniques for stock and parasite monitoring	Collect and analyse genetic and ecological data; establish a sound biological basis for monitoring and management; understand susceptibility and resistance to parasites such as <i>G. salaris</i> .	Distribution/ migration in the sea	1999-2010	NW Russia  <i>Collaborating countries:</i> Russia	Craig Primmer craig.primmer@utu.fi	£53,200	Genetic techniques.
<b>Sweden</b>							
<b>E25:</b> Long-term variation in population dynamics, life-history and exploitation of salmon stocks in monitored rivers	Estimate long-term variation of survival in different life-stages, life-history characteristics and growth of wild salmon in the River Åtran and its major tributary. Estimate sea survival, growth and exploitation for wild fish in the River Åtran and wild and reared fish in the rivers Lagan and Nissan.	Long-term monitoring	Ongoing	Rivers Åtran, Lagan and Nissan	Lars Karlsson lars.karlsson@fisheriverket.se	£8,500	Adult and smolt traps. Carlin tags.

<b>Project No. and Title</b>	<b>Summary of objectives</b>	<b>Topic Area</b>	<b>Date of research</b>	<b>Area of research/ Collaborating countries</b>	<b>Coordinating Scientist(s)</b>	<b>Annual expenditure (Pounds Sterling – approx.)</b>	<b>Main research methods</b>
<b>ICELAND</b>							
<b>I1:</b> Return rate of salmon in three index rivers in Iceland in relation to population and environmental factors	Monitor status of, and trends in, salmon stocks in three index rivers.	Long-term monitoring	Ongoing for the last 10 years and will continue	Iceland and surrounding ocean <i>Collaborating countries:</i> Through ICES	Thorolfur Antonsson thorolfur.antonsson@veidimal.is	£96,000	Traps, tagging, scale sampling, electro-fishing.
<b>I2:</b> Tagging mortality and the time of recovery related to internal tagging of hatchery-reared salmon smolts with DST micro-tags (Star-Oddi)	Investigate the mortality and time of recovery associated with different handling and tagging techniques with dummy DSTs.	Development of methods	2004-2008 (Report preparation only in 2007, 2008)	Islandlax hatchery	Ingi Runar Jonsson ingi.runar.jonsson@veidimal.is Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is	£4,000 in 2008	DSTs (Star-Oddi).
<b>I3:</b> DST tagging of reared salmon smolts	Record the temperature and depth of water experienced by salmon from the west of Iceland during the first year at sea.	Distribution/migration in the sea	2005-2008	South-West Iceland	Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is	£170,000	DSTs (Star-Oddi), oceanographic information.
<b>I4:</b> Survival of salmon during the first and second year at sea	Evaluate the survival of hatchery-reared smolts during the first and second year at sea.	Long-term monitoring	2005-2009	South-West Iceland	Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is	£50,000	Release site, traps, microtagging, oceanographic information.
<b>I5:</b> Distribution and behavioural ecology of salmon at sea	Investigate the temporal and spatial distribution of DST-tagged salmon at sea. Investigate diurnal depth distribution, growth in relation to environmental parameters and by-catch in pelagic fisheries.	Distribution/migration in the sea	2005-2011 (pre-phase in 2003 and 2004)	Tagging site: River Tungfljot and River Hafnara Salmon Ranching Station (smolts) and River Botnsa and River Skoga (recovered kelts). Study area: North Atlantic  <i>Collaborating countries:</i> Faroe Islands, Norway	Johannes Sturlaugsson johannes@laxfiskar.is	£50,000 (varying from £35,000 - £150,000 per annum)	DSTs (Star-Oddi).
<b>I6:</b> Orientation and navigation of salmon at sea	Investigate the orientation and navigation of salmon at sea during their spawning migration using compass DSTs.	Distribution/migration in the sea	2006-2009	Tagging site: River Hafnara Salmon Ranching Station Study site: Icelandic waters  <i>Collaborating countries:</i> Sweden	Johannes Sturlaugsson johannes@laxfiskar.is	£53,000	DSTs (Star-Oddi).

<b>Project No. and Title</b>	<b>Summary of objectives</b>	<b>Topic Area</b>	<b>Date of research</b>	<b>Area of research/ Collaborating countries</b>	<b>Coordinating Scientist(s)</b>	<b>Annual expenditure (Pounds Sterling – approx.)</b>	<b>Main research methods</b>
<b>I7:</b> Mapping genetic diversity of Icelandic Atlantic salmon	Obtain baseline information on the genetic diversity of Icelandic Atlantic salmon.	Distribution/migration in the sea	2003-2008	Iceland	Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is	£35,000	Genetic analysis.
<b>NORWAY</b>							
<b>N1:</b> Significance of salmon lice for growth and survival of salmon in the sea	Estimate the effects of salmon lice on post-smolt growth and survival, dependent on release site and time and year of release.	Specific natural and anthropogenic factors	2006-2008	Western Norway, River Dale, Matre Aquaculture Station	Ove Skilbrei ove.skilbrei@imr.no	£75,000	Smolt trap, tags, SLICE.
<b>N2:</b> Marine survival, growth and exploitation of salmon from the Rivers Figgjo, Imsa, Drammenselv and Halselv	Estimate marine survival, marine growth and changes in marine exploitation of salmon from four rivers in Norway. Develop predictive models.	Long-term monitoring	Long-term ongoing monitoring project	Rivers Figgjo, Imsa, Drammenselv and Halselv with tag recovery programme in fisheries along Norwegian coast and elsewhere	Lars Petter Hansen l.p.hansen@nina.no Nina Jonsson Nina.jonsson@nina.no Arne Johan Jensen Arne.jensen@nina.no	£134,000	Fish traps, electro-fishing.
<b>N3:</b> Individual assignment of salmon caught in the ocean to region of origin	Investigate genetic variation in Norwegian salmon populations on different spatial scales. Provide calibrated data from micro-satellite markers for a database. Analyse samples caught in the ocean and assign to country/region of origin.	Distribution/migration in the sea	January 2006 – December 2008	Norway  <i>Collaborating countries:</i> Finland	Oystein Skaala oystein.skaala@imr.no Vidar Wennevik vidar.wennevik@imr.no	£107,000	Electro-fishing equipment, genetic analysis.
<b>N4:</b> Population-limiting mechanisms for Atlantic salmon during early estuarine and coastal migration (SALPoP)	Map migratory behaviour and quantity where, when and why mortalities occur; correlate data on migration and mortalities with health status and major population-limiting factors; develop improved mitigating actions and management strategies to contribute to sustainability of salmon populations.	Distribution/migration in the sea	<b>New entry</b> 2008 - 2012	Eresfjord in Møre and Romsdal, mid Norway  <i>Collaborating countries:</i> Sweden, UK, Canada	Bengt Finstad bengt.finstad@nina.no	£191,200 in 2008	Acoustic telemetry, external tags, fish health screening.
<b>N5:</b> The Hardangerfjord salmon lice project	Improve sea lice monitoring and management, evaluate success of sea lice management strategies; quantify the abundance and distribution of salmon lice in the Hardangerfjord area; analyse data sets for possible risk factors associated with varying lice infection pressure.	Specific natural and anthropogenic factors	<b>New entry</b> 2007 - 2010	Hardangerfjord on the Norwegian west coast  <i>Collaborating countries:</i> Canada, UK	Bengt Finstad bengt.finstad@nina.no	£151,000 in 2008	Lice monitoring, models

Project No. and Title	Summary of objectives	Topic Area	Date of research	Area of research/ Collaborating countries	Coordinating Scientist(s)	Annual expenditure (Pounds Sterling – approx.)	Main research methods
<b>RUSSIAN FEDERATION</b>							
<b>R1:</b> Monitoring of the stock status, abundance assessment and provision of advice on the allowable level of harvest of Atlantic salmon	Estimate survival of juveniles and adult return rates; estimate natural and fishing mortality; study population dynamics; assess population sizes and spawning escapement and estimate allowable catch.	Long-term monitoring	Annual monitoring programmes (May to October)	Atlantic salmon rivers of the Kola Peninsula, Archangel Region and Karelian Republic	Alexander Zubchenko zav@pinro.ru, salmon@pinro.ru Igor Studenov igor@sevpinro.ru	£80,000	Barrier fences, nets, electro-fishing, smolt traps, external tagging.
<b>USA</b>							
<b>U1:</b> Penobscot hatchery versus wild smolt telemetry	Evaluate migration timing and pathways in the Penobscot Estuary and Bay and estimate survival of migrating smolts and post-smolts.	Distribution/ migration in the sea	2005-2009	Penobscot Estuary Penobscot Bay  <i>Collaboration Countries:</i> Canada	James Hawkes James.Hawkes@noaa.gov	£43,000 (public funding)	Ultrasonic tags and receivers. Small research boats and leased commercial vessels.
<b>U2:</b> Ultrasonic telemetry of smolts and post-smolts in the Narraguagus River and Narraguagus Bay	Evaluate migration timing and pathways in the lower Narraguagus River and Narraguagus Bay and estimate survival of migrating smolts and post-smolts.	Distribution/ migration in the sea	2002-2008 (Fieldwork April-June 2002-2005, data analysis and publication 2005-2008)	Narraguagus River and Narraguagus Bay (2002-2005) Gulf of Maine (2002-2004)  <i>Collaborating countries:</i> Canada	James Hawkes James.Hawkes@noaa.gov	£49,000 (public funding)	Ultrasonic tags and receivers. Small research boats and leased commercial vessels.
<b>U3:</b> Comprehensive evaluation of marine survival of hatchery-stocked smolts: migration behaviour and success of Dennys River smolts	Evaluate migration speed and behaviour from lower river release sites through estuarine habitat; estimate survival of migrating smolts and identify areas where mortality may be occurring.	Distribution/ migration in the sea	April – June, 2001-2008 (Data analysis and publication 2005-2008)	Dennys River, Cobscook Bay, Gulf of Maine  <i>Collaborating countries:</i> Canada	James Hawkes James.Hawkes@noaa.gov	£28,000 (public funding)	Ultrasonic tags and receivers. Electro-fishing gear. Small research boats and leased commercial vessels.
<b>U4:</b> Comprehensive evaluation of marine survival of hatchery-stocked smolts: Dennys River smolt stocking assessment	Evaluate smolt-to-adult survival rates based on temporal and spatial patterns of release; determine optimal stocking levels to achieve stock rebuilding objectives.	Long-term monitoring	May – October, 2001-2008	Dennys River, Cobscook Bay, Gulf of Maine  <i>Collaborating countries:</i> Recovery of marked fish through NASCO West Greenland sampling programme	Greg Mackey greg.mackey@maine.gov	£14,000 (public funding)	Elastomer marks, rotary smolt traps, weir-based smolt and adult traps.

<b>Project No. and Title</b>	<b>Summary of objectives</b>	<b>Topic Area</b>	<b>Date of research</b>	<b>Area of research/ Collaborating countries</b>	<b>Coordinating Scientist(s)</b>	<b>Annual expenditure (Pounds Sterling – approx.)</b>	<b>Main research methods</b>
<b>U5:</b> Evaluation of estuary and nearshore marine distributions of Atlantic salmon post-smolts in Penobscot Bay and the Gulf of Maine	Evaluate nearshore distribution and migration pathways of smolts and post-smolts; estimate the relative contribution of stocked hatchery smolts to overall post-smolt populations; evaluate the relative contribution of spatially and temporally distinct smolt releases on post-smolt populations; evaluate the physiological condition of post-smolts in marine environments.	Distribution/ migration in the sea	May – June, to 2008	Penobscot Bay, Gulf of Maine	Tim Sheehan Tim.Sheehan@noaa.gov	£23,000 (public funding)	Post-smolt trawl, oceanographic instruments, commercial trawlers.
<b>U6:</b> Cormorant harassment in the Narraguagus River/Narraguagus Bay	Reduce predation on migrating salmon smolts by excluding double-crested cormorants from the Lower Narraguagus River and Bay, and assess the efficiency of non-lethal predator exclusion as a means of reducing predation on migrating salmon smolts.	Specific natural and anthropogenic factors	2005-2008 (Data analysis and publication only in 2005-2008)	Lower Narraguagus River, Estuary and Narraguagus Bay, Maine	James Hawkes James.Hawkes@noaa.gov	£16,000 (public funding)	Shotguns with firecracker and screamer shells, laser, small boat, cameras.

Note: Germany and the Netherlands had previously indicated that they do not carry out research on the marine phase of salmon. No information was provided by other EU Member States (Portugal and Spain) with salmon interests.

**Table 4(b) COMPLETED PROJECTS (see Annex 2 for details)**

<b>Party</b>	<b>Project Title and Details of Coordinating Scientist(s)</b>	<b>Summary of Objectives</b>	<b>Year removed from inventory</b>
Canada	Marine migration and survival of post-smolt Atlantic salmon from Bay of Fundy rivers <i>Coordinating scientist:</i> Gilles L Lacroix LacroixG@dfo-mpo.gc.ca	Provide knowledge about marine habitat (migration routes and feeding grounds) used by salmon post-smolts from Bay of Fundy rivers. Determine the location, timing and extent of salmon post-smolt mortality at sea. Investigate the causes and mechanisms of marine mortality of salmon post-smolts. Provide information to fuel the recovery programme for inner Bay of Fundy salmon stocks.	2003
Canada	Distribution, health and condition of Atlantic salmon from Bay of Fundy rivers while at sea <i>Coordinating scientist:</i> Gilles L Lacroix LacroixG@dfo-mpo.gc.ca	Provide knowledge about marine habitat and health of salmon post-smolts from Bay of Fundy rivers. Investigate the causes and mechanisms of marine mortality of salmon post-smolts. Provide information to fuel the recovery programme for inner Bay of Fundy salmon stocks.	2004
Canada	Marine migration and survival of post-smolt Atlantic salmon from the Saint-Jean River (Gaspé) <i>Coordinating scientist:</i> Julian Dodson julian.dodson@bio.ulaval.ca Francois Caron francois.caron2@mrnf.gouv.qc.ca	Provide knowledge of the marine habitat (migration routes and feeding grounds) used by salmon post-smolts from Bay of Gaspé rivers. Determine the location, timing and extent of salmon post-smolt mortality at sea. Investigate the causes and mechanisms of marine mortality of salmon post-smolts.	Not previously included (completed in 2005)
Canada	Marine migration and survival of kelt Atlantic salmon from the Saint-Jean River (Gaspé) <i>Coordination scientist:</i> Francois Caron francois.caron2@mrnf.gouv.qc.ca	Provide knowledge of the marine habitat (migration routes and feeding grounds) used by salmon kelts from Bay of Gaspé rivers. Determine the location, timing and extent of kelt mortality at sea. Investigate the causes and mechanisms of marine mortality of salmon kelts.	Not previously included (completed in 2006)
Canada	Tracking experimentally 'escaped' farmed salmon <i>Coordinating scientist:</i> Fred Whoriskey asfres@nb.aibn.com	Determine the course tracks and fates of sonically tagged farmed salmon released in winter and spring.	2006
Canada	Atlantic salmon distribution and abundance at sea <i>Coordinating scientist:</i> David Reddin reddind@dfo-mpo.gc.ca	Determine salmon distribution and abundance at sea, particularly post-smolts in the Labrador Sea and Northern Grand Banks; collect biological and other data; investigate the relationship between salmon and their prey; investigate the relationship between oceanographic parameters and salmon abundance; tag and release salmon.	2006
Canada	Integrated field and laboratory assessment of the effects of endocrine – disrupting substances on Atlantic salmon smolts. <i>Coordinating scientist:</i> Wayne Fairchild Fairchildw@mar.dfo.mpo.gc.ca	Laboratory tests of the effects of endocrine-active substances in municipal, and industrial effluents; field tests of the effects of endocrine-active substances in municipal and industrial effluents; field tests on caged smolts near sites with potential for significant agriculture run-off; ocean field tests of link between exposure of smolts to endocrine - disrupting substances and subsequent lower adult returns.	2008

Party	Project Title and Details of Coordinating Scientist(s)	Summary of Objectives	Year removed from inventory
Canada	Use of stable isotopes to assess long-term changes in marine trophic ecology of Atlantic salmon ( <i>Salmo salar</i> ) <i>Coordinating scientist:</i> J Brian Dempson dempsonb@dfo-mpo.gc.ca	Assess trophic and dietary information through analysis of stable isotope signatures of carbon and nitrogen from previously compiled scale samples from various salmon stocks; compare isotopic signatures within and among stocks to various differences in feeding ecology in time and space; examine evidence of environmental influences on trends in isotopic signatures; examine linkings of stable isotope signatures with trends in abundance.	2008
Canada	Effective population size, gene flow and population structure of Atlantic salmon in Newfoundland and Labrador <i>Coordinating scientist:</i> Daniel Ruzzante daniel.ruzzante@dal.ca	Document population structure and connectivity (gene flow) among Newfoundland and Southern Labrador rivers. Test for temporal stability of the structure over the past 50 years.	2008
European Union	SALMODEL Concerted Action – A co-ordinated approach towards the development of a scientific basis for management of wild Atlantic salmon in the north-east Atlantic <i>Coordinating scientist:</i> Walter Crozier walter.crozier@dardni.gov.uk	Improve our ability to set salmon conservation limits (CLs), addressing transportability and dynamic change issues, also taking into account underlying stock structure, and;  Examine methods of estimating pre-fishery abundance (PFA) for north-east Atlantic (NEAC) salmon stocks and to determine whether and how PFA estimates can be used to give catch advice.	2003
European Union – Denmark	Estuarine migration of smolts in the Rivers Skjern Å (North Sea) and River Guden Å <i>Coordinating scientist:</i> Gorm Rasmussen gr@dfu.min.dk	To assess the effect of restoration of habitat in the River Skjern Å on the smolt runs of salmon and sea trout, in particular with regard to predation by piscivorous birds. To investigate the migration of salmon smolts in the River Guden Å.	Not previously included
European Union – France	Evolution of biological characteristics in Atlantic salmon from all the Armorican massif rivers (Brittany and Low-Normandy, France) <i>Coordinating scientist:</i> Jean-Luc Baglinière Jean-Luc Bagliniere:rennes.inra.fr	Examine relationships between the cumulative effects of climate warming and other anthropogenic stresses and changes in biological features in populations in the Southern part of the European distribution range of the species.	2005
European Union – Ireland	Assessment of the levels of the parasite <i>Lepeophtheirus salmonis</i> on Atlantic salmon post-smolts in salmon aquaculture bays along Ireland's western seaboard <i>Coordinating scientist:</i> Paddy Gargan paddy.gargan@cfb.ie	Determine whether sea lice from marine salmon farms are a contributory factor in increased marine mortality of salmon post-smolts migrating from bays with salmon aquaculture. Gather information on salmon post-smolt migration patterns.	2003
European Union – Ireland	Oceanic factors influencing marine survival of Irish salmon stocks <i>Coordinating scientists:</i> Niall O'Maoileidigh niall.omaileidigh@marine.ie Kevin Friedland friedlandk@forwild.umass.edu	Provide information on marine survival at various stages of ocean migration.	2006

<b>Party</b>	<b>Project Title and Details of Coordinating Scientist(s)</b>	<b>Summary of Objectives</b>	<b>Year removed from inventory</b>
European Union – Ireland	Sustainable management of interactions between aquaculture and wild salmonid fish (EU SUMBAWS project – Irish component of project only) <i>Coordinating scientist:</i> Paddy Gargan paddy.gargan@cfb.ie Niall O'Maoileidigh niall.omaileidigh@marine.ie	To assess efficacy of prophylactic treatments for salmon smolts migrating through aquaculture bays.	2007
European Union –Ireland	Early distribution and migration of Atlantic salmon smolts off the West of Ireland <i>Coordinating scientist:</i> Niall O'Maoileidigh niall.omaileidigh@marine.ie	Test new pelagic trawl in open waters off Irish coast; train and familiarise staff on the operation and development of the trawl for further surveys in 2008 and 2009; obtain samples of post-smolts for background and genetic analysis; relate run-timing, timing of migration, swimming speed, growth, etc to oceanographic parameters.	2008
European Union – United Kingdom (England and Wales)	Salmonid migration and climate change <i>Coordinating scientist:</i> Andrew Moore a.moore@cefas.co.uk	Describe and model the environmental factors affecting the migration of salmonids and investigate the effects of climate change on salmonid migration and survival both in fresh water and the sea.	2005
European Union - United Kingdom (England and Wales)	Impacts of agricultural contaminants on wild salmonids <i>Coordinating scientist:</i> Andrew Moore a.moore@cefas.co.uk	Identify and describe the effects of environmental levels of agricultural pesticides on salmonid embryo survival, smolt emigration and marine survival and model their potential impacts at the population level. In addition, the role of pheromones in sea trout biology was investigated in order to predict the effects of water quality on sea trout reproduction.	2005
European Union - United Kingdom (England and Wales)	Impact of intensive in-river aquaculture on wild salmonids <i>Coordinating scientist:</i> Andrew Moore a.moore@cefas.co.uk	Describe the nature and extent of the impact of aquatic contaminants derived from intensive freshwater aquaculture (effluents, pesticides, antibiotics and hormones) on reproduction and migration of wild salmonids.	2007
European Union - United Kingdom (England and Wales)	Modelling the bioenergetics of Atlantic salmon migration <i>Coordinating scientist:</i> Douglas Booker dobo@ceh.ac.uk	Model the energetic requirements of salmon during their marine migrations and predict the effects of environmental and oceanographic changes on smolt growth and survival.	2007
European Union - United Kingdom (England and Wales)	Cardiff Bay Fisheries Monitoring Programme <i>Coordinating scientist:</i> Peter Gough peter.gough@environment-agency.wales.gov.uk	Assess the impact of Cardiff Bay barrage on salmon stocks of the rivers Taff and Ely.	2008

<b>Party</b>	<b>Project Title and Details of Coordinating Scientist(s)</b>	<b>Summary of Objectives</b>	<b>Year removed from inventory</b>
European Union - United Kingdom (Scotland)	Testing and development of Institute of Marine Research (IMR), Bergen, Norway, salmon trawl gear <i>Coordinating scientist:</i> Julian MacLean j.c.maclea@marlab.ac.uk Jens Christian Holst jens.christian.holst@imr.no Dick Shelton freda.shelton@bopenworld.com	Test a prototype trawl developed by IMR, Bergen, Norway, which, rather than capturing post-smolts, records, by use of CCTV, their passage as they pass through an open-ended trawl net. A supplementary objective, dependent on the success of the gear trials, was to conduct a post-smolt survey at the shelf edge.	2006
Iceland	Migration of smolts through the estuary of the River Ellidaar, Iceland <i>Coordinating scientist:</i> Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is	Monitor the migratory behaviour of smolts.	2004
Iceland	Survival at sea of 1- and 2-sea-winter salmon in relation to oceanic conditions. <i>Coordinating scientist:</i> Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is	Study changes in the ratio of 1SW:2SW salmon and in the annual number of salmon caught in rivers in south-west Iceland in relation to oceanic climate.	2006
Iceland	Variation in growth and return rates of Atlantic salmon from three Icelandic rivers <i>Coordinating scientist:</i> Thorkell Heidarsson Thorkell@veidimal.is Thorolfur Antonsson thorolfur.antonsson@veidimal.is	Increase knowledge of growth and environmental factors influencing return rates and life-history of different salmon stocks in Iceland.	2006
Iceland	Growth of Atlantic salmon in the River Hofsa, north-east Iceland, in relation to ocean and in-river conditions. <i>Coordinating scientist:</i> Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is Sigurdur Mar Einarsson sigurdur.mar@veidimal.is	Investigate the use of salmon growth, back-calculated from scale samples, in relation to ocean conditions and the size and age composition of the salmon run.	2007
Norway	Identification of salmon by geochemical signatures; further development and testing of methods <i>Coordinating scientist:</i> Peder Fiske peder.fiske@nina.no	The main objectives of this project were to: <ul style="list-style-type: none"> <li>• test if geochemical signatures are stable from year to year</li> <li>• test if geochemical signatures of salmon scale samples can be used to discriminate among fish from different rivers</li> <li>• develop analytical procedures (otolith core sampling, chemical and statistical analyses) for application of this method in ecological studies on Atlantic salmon.</li> </ul>	2003
Norway	Development of models to predict marine survival and return of salmon to Norway <i>Coordinating scientist:</i> Lars Petter Hansen l.p.hansen@nina.no	Identify and examine feasibility of applying time series of marine environmental data, ecoplankton productivity, productivity of pelagic fish and salmon life-history information for model development. Develop appropriate models.	2006

<b>Party</b>	<b>Project Title and Details of Coordinating Scientist(s)</b>	<b>Summary of Objectives</b>	<b>Year removed from inventory</b>
Norway	By-catch in pelagic fisheries as a population-regulating factor in wild salmon stocks <i>Coordinating scientist:</i> Jens Christian Holst jens.christian.holst@imr.no	Investigate the extent of by-catch and develop management advice to reduce by-catch while maintaining catch rates in the mackerel fishery.	2006
Norway	Sea lice as a population-regulating factor in Norwegian salmon: status, effects of measures taken and future management <i>Coordinating scientist:</i> Jens Christian Holst jens.christian.holst@imr.no	Further clarify the effects of sea lice on wild salmon populations and propose measures to reduce sea lice infections in wild salmon and develop alternative measures in critically affected stocks.	2006
Norway	Distribution of salmon in relation to environmental parameters and origin in the North Atlantic – capture, tagging and release of salmon with data storage tags (DSTs) <i>Coordinating scientist:</i> Marianne Holm marianne.holm@imr.no	Investigate the temporal and spatial distribution of DST-tagged salmon in the Norwegian Sea and adjacent areas, with emphasis on spatial distribution and temperature preferences; growth in relation to environmental parameters; and diurnal vertical distribution.	2007
Norway	Temporal variation in abundance of the northern-most populations of Atlantic salmon with emphasis on the River Tana <i>Coordinating scientist</i> Martin Svenning martin.svenning@nina.no	Examine the influence of ocean climate, predation, marine fisheries and smolt production on the abundance of salmon in the River Tana	2007
Norway	The importance of early marine feeding on the growth and survival of Atlantic salmon post-smolts in Norwegian fjords. <i>Coordinating scientist:</i> Bengt Finstad bengt.finstad@nina.no	Analyse spatial variation in early marine post-smolt feeding and growth along a north-south geographical scale; investigate how post-smolt feeding and growth is associated with timing of smolt descent, marine prey availability, parasite infection, fjord migration and abiotic factors.	2008
Norway	Distribution and ecology of post-smolts and salmon at sea. <i>Coordinating scientist:</i> Marianne Holm marianne.holm@imr.no	Analyse age, growth and migratory paths in relation to environmental conditions and competitors so as to expand understanding of salmon marine life-history in order to explain observed variations in salmon survival.	2008
Norway	Dispersal of salmon lice in Norwegian fjords <i>Coordinating scientist:</i> Karen Boxaspen karinb@imr.no	Estimate and describe to what extent free-living salmon lice larvae disperse from wild and farmed sources within and between areas.	2008
Norway	Experimental tagging programme for investigating the behaviour of escaped farmed salmon: pilot study <i>Coordinating scientist:</i> Lars Petter Hansen l.p.hansen@nina.no	Examine the migration of escaped large farmed salmon and test if they are transported with the currents and appear in Norwegian waters.	Not previously included in the inventory but reported in 2008
Russian Federation	Assessment of by-catch of post-smolts of Atlantic salmon in pelagic fisheries in the Norwegian Sea. <i>Coordinating scientist:</i> Boris Prischepa pboris@pinro.ru Alexander Zubchenko zav@pinro.ru	Assess occurrence of post-smolts in catches by Russian vessels engaged in the pelagic fisheries for mackerel, blue whiting and herring.	2008

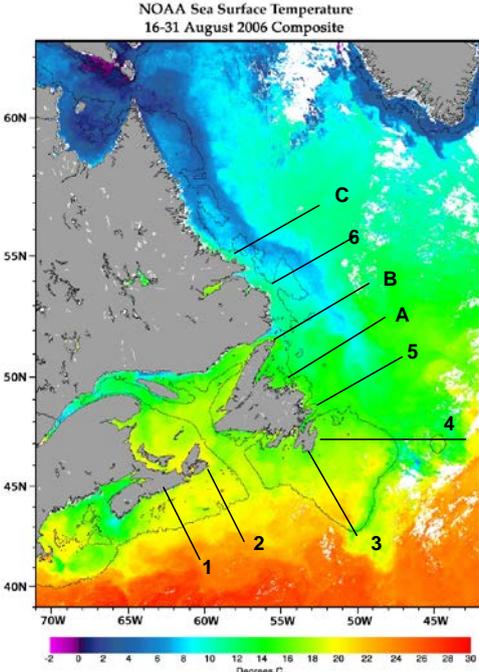
Party	Project Title and Details of Coordinating Scientist(s)	Summary of Objectives	Year removed from inventory
United States	Forecasts of Atlantic salmon transoceanic migration: climate change scenarios and anadromy in the North Atlantic <i>Coordinating scientist:</i> Kevin Friedland friedlandk@forwild.umass.edu	Develop and evaluate marine migration models for Atlantic salmon from North America and Europe; evaluate the potential effects of climate change on migration patterns of Atlantic salmon.	2005
United States	Stable isotope composition of Atlantic salmon scales <i>Coordinating scientist:</i> Kevin Friedland friedlandk@forwild.umass.edu	Develop a retrospective time series of stable isotope ratios to evaluate feeding patterns over time.	2005

## **Annex 1**

### **Inventory of Research relating to Salmon Mortality in the Sea – Project Details**

# 1. CANADA

**Project No.** C1                      **Status:**            **New entry**

Party or relevant jurisdiction	Canada
Title of project	Pelagic ecosystem survey of the Northwest Atlantic
Objective of research project	A marine pelagic trawl survey will sample the upper pelagic ecosystem during the period corresponding to the early postsmolt phase (August) of Atlantic salmon. The survey design would address hypotheses of post-smolt distribution (mixing of stocks, mixing of maturing and non-maturing components) and oceanographic features. Catches of post-smolts will provide information on distribution and relative abundance of salmon at selected locations and times along the hypothesized ocean migration route. Data on relative abundance of other species, including macroplankton aggregations, will provide information on the role of salmon within this larger pelagic ecosystem.
Brief description of research project	A research vessel will tow a pelagic surface trawl to sample the ecosystem components within the upper 20 m of the water column. Catches of salmon will be related to geographic (latitude, longitude) and oceanographic (fronts, temperature, salinity) characteristics. These data will provide information on preferences and/or selection of the physical characteristics by salmon size / age groups. Catches and relative abundance of other species, including macroplankton aggregations, will provide information on the role of salmon within this larger pelagic ecosystem.
Dates during which research will take place	Research will occur within a 23 day period between the last week of July and the first week of September 2008.
Area in which research will take place	 <p>NOAA Sea Surface Temperature 16-31 August 2006 Composite</p> <p>Proposed transects to be sampled. SST map available from <a href="http://www.mar.dfo-mpo.gc.ca/science/ocean/ias/seawifs/seawifs_1.html">www.mar.dfo-mpo.gc.ca/science/ocean/ias/seawifs/seawifs_1.html</a></p>
Estimated number and weight of salmon to be retained	Unknown but based on other surveys in the North Atlantic, expectations are for several hundred but less than one thousand

	postsmolts and few adult salmon. Approx. weight would be in the range of 500 kg of salmon.
<b>Resources</b>	
Estimated cost of the research project	Total estimated cost excluding any analysis: <b>£350,000</b> £230,000. Fisheries and Oceans Canada Research vessel cost excluding science personnel (23 days @ £10,000) Science personnel costs (salary, overtime, operations) £70,000 Fisheries and Oceans Canada £10,000 MRNF Province of Québec (Canada) £40,000 US NOAA
Number of participating scientists	4 scientists one from each of the three Atlantic DFO regions (Gulf, Maritimes, Newfoundland and Labrador), one from US NOAA
Name and e-mail address of coordinating scientist in charge of project	Gerald Chaput <a href="mailto:Chaputg@dfo-mpo.gc.ca">Chaputg@dfo-mpo.gc.ca</a> Dave Reddin <a href="mailto:Reddind@dfo-mpo.gc.ca">Reddind@dfo-mpo.gc.ca</a> Tim Sheehan <a href="mailto:tsheehan@mercury.wh.who.edu">tsheehan@mercury.wh.who.edu</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	To be confirmed CCGS Alfred Needler Ottawa, CG2683 50.3 m, 958.9 grt research trawler
Type and amount of gear and other equipment to be used	Surface pelagic trawl, oceanographic samplers, zooplankton and macroplankton samplers
Details of any collaborating countries	US NOAA
<b>Summary of Progress:</b>	
New entry	

**Project No. C2**

**Status: New entry**

Party or relevant jurisdiction	Canada. Joint project of the Miramichi Salmon Association, Atlantic Salmon Federation, with collaboration from the Department of Fisheries and Oceans
Title of project	Miramichi River kelt movements and survival
Objective of research project	Document the spring movements and survival of post-spawning kelts from the Miramichi River system as they return to the sea. Use pressure-sensitive tags to record the depths used by the kelts.
Brief description of research project	Sonic telemetry will be used to document the movements and survival of salmon kelts as they move back to the ocean and across the Gulf of St. Lawrence.
Dates during which research will take place	1 April 2008 to March 31 2010.
Area in which research will take place	Miramichi River, estuary, and Gulf of St. Lawrence
Estimated number and weight of salmon to be retained	Thirty kelts to be sonically tagged and released
<b>Resources</b>	
Estimated cost of the research project	£25,000 (\$50,000 Canadian) direct costs for tags, student salary, operating expenses. Receiver deployment and other costs are covered under other projects.
Number of participating scientists	4
Name and e-mail address of coordinating scientist in charge of project	Dr. F. Whoriskey <a href="mailto:asfres@nbnet.nb.ca">asfres@nbnet.nb.ca</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	
Type and amount of gear and other equipment to be used	Sonic telemetry arrays and charter/coastal vessels as described in Canada ongoing project C2 <i>Atlantic salmon smolt migration and survival within Canadian rivers, estuaries and during the marine life stage</i> . Anticipate seasonal deployment of an additional 20 VR2 sonic receivers specifically for this project..
Details of any collaborating countries	
<b>Summary of Progress:</b>	
New entry	

**Project No. C3**

**Status: Ongoing**

Party or relevant jurisdiction	Canada
Title of project	Marine survival of Canadian Atlantic salmon stocks: long-term monitoring
Objective of research project	<p>Smolt production and adult return estimates are available for many salmon populations in Canada, from rivers (wild) and from hatcheries. In some cases, these time series extend to 30 years.</p> <p>Spatial and temporal trends in freshwater smolt production and in marine survival are monitored at the following sites:</p> <p>In DFO's Newfoundland Region, five (5) facilities: Campbellton River; Northwest River (Trepassey) and Rocky River; Conne River; and Western Arm Brook</p> <p>In DFO's Maritimes Region, three (3) facilities: Nashwaak River, Mactaquac dam on Saint John River, and LaHave River (wild and hatchery)</p> <p>In DFO's Gulf Region, four (4) facilities: two on the Miramichi River (Northwest and Southwest tributaries), Restigouche River, Margaree River</p> <p>In Quebec, Ministère des Ressources Naturelles et de la Faune (MRNF) has two (2) facilities on Rivière de la Trinité and Rivière St-Jean (Gaspé); in addition, stocked salmon survival is monitored on three (3) rivers: Rivière aux Rochers, Rivière a Mars, and Rivière Malbaie, the latter two in collaboration with CIRSA.</p>
Brief description of research project	<p><i>Newfoundland:</i> Smolt and adult Atlantic salmon abundance is monitored by fish-counting fences or mark-recapture (Conne River smolts). Survival is determined both for smolt to small (&lt; 63 cm) and MSW adult salmon returns. Biological characteristics (e.g. length, weight, condition, age etc.) of both life-stage components are collected along with additional information on run timing and environmental conditions. These data are periodically examined in relation to patterns of annual variation in marine survival of wild smolts.</p> <p><i>Maritimes:</i> Continuation of a 30- and 25-year time series of marine survival for hatchery smolts released to the Saint John (Mactaquac) and LaHave River. Continuation of 6-year data series for wild smolt survival on the Saint John (Nashwaak trib) and LaHave River.</p> <p><i>Gulf:</i> Smolt production and adult return estimates are obtained from the two branches of the Miramichi River. Biological characteristics are described and survival rates assessed relative to size of smolts, age, and sex of returning adults. Programme began in 1998 for the Northwest Miramichi and was extended to include the Southwest Miramichi in 2001. Smolt production is obtained from the Restigouche River and Margaree River. Biological characteristics are described including size of smolts, age, and sex ratios. Programme began in 2001 in Margaree River and 2002 in the Restigouche River.</p>

	<p><i>Quebec:</i> Smolt trap to estimate smolt run by mark-recapture, counting adult return in a fishway (de la Trinité) or direct observation (St-Jean), characteristics of adult returns using recreational catch.</p> <p>For the MRNF projects, stocked smolt returns are determined by scale analysis of all returning adult salmon. This data permits estimation of sea survival of the stocked fish. For the CIRSA project stocked fish returns are determined by scale analysis (smolts) and genetic analysis (fry). Reproductive success is determined by genetic analysis.</p>
Dates during which research will take place	April – November, annually
Area in which research will take place	On Canadian rivers named in ‘objectives’ section
Estimated number and weight of salmon to be retained	Generally not applicable, although in some studies a few smolts are retained (less than 500 overall) for biological sampling
<b>Resources</b>	
Estimated cost of the research project	<p>Newfoundland (£287,000 sub-total): DFO - £209,000 per year, including overheads NGO Partners - £78,000 per year</p> <p>Maritimes (£27,000 sub-total): DFO - £21,500 per year, incl overheads NGO Partners - £5,500 per year (including Atlantic Salmon Federation for purchase of smolt wheels in Nashwaak River)</p> <p>Gulf (£109,000 sub-total): DFO - £73,000 per year (includes DFO operating costs, capital investment and salaries, incl overheads) Partners: £36,000 spent in 2001/02 by NGO partners (Atlantic Salmon Federation, Northumberland Salmon Protective Association, Miramichi Salmon Association, First Nations) for capital acquisitions, and O&amp;M for assistance. Same level of support anticipated in 2006-2007</p> <p>Quebec (£141,500 sub-total): MRNF - £41,500 per year, incl overheads Hydro Quebec – £22,200 per year CIRSA - £77,800 per year</p> <p>-----</p> <p><b>Canada Total - £564,500 per year</b></p>
Number of participating scientists	Newfoundland (5), Maritimes (3), Gulf (2), Quebec (10)
Name and e-mail address of coordinating scientist in charge of project	C. Bourgeois (Rocky River), B. Dempson (Conne River; Northeast Brook, Trepassey), G. Veniott (Western Arm Brook), D. Reddin (Campbellton River), T. Goff, R. Jones, P. Amiro J. Gibson (Maritimes), G. Chaput (Gulf), J. Dodson (CIRSA, U.Laval) For information, contact: G. Chaput, Chaputg@dfo-mpo.gc.ca
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear	Smolt and adult traps in fishways and fences, trap nets, rotary screw

and other equipment to be used	smolt traps.
Details of any collaborating countries	
<p><b>Summary of Progress</b></p> <p><i>Newfoundland:</i>  Smolt production in 2007 increased in three of five monitored stocks by comparison with 2006. Increases ranged from a high of 80% more smolts at Conne River, owing to the anomalously low smolt run in 2006, to a 7% increase at Campbellton River. Decreases occurred at Rocky River and Western Arm Brook where numbers of smolts fell by 6% and 21%, respectively. At Campbellton River, numbers of smolts are still low by comparison with earlier years. Where smolt production declined in 2007, returns of small salmon in 2008 are expected to be lower unless there is a compensatory increase in marine survival.</p> <p>Marine survival, corresponding to adult small salmon returns in 2007, averaged 3.3% across all five rivers, ranging from a high of 5.6% at Campbellton River to a low of only 1.3% at Rocky River. In all cases, survival was lower than the previous year declining by 75% at Western Arm Brook with values 40 to 50% lower at Rocky, Campbellton and Northeast Brook, Trepassey relative to 2006. Survival of salmon returning to Rocky River was the lowest ever recorded while at Northeast Brook, Trepassey, marine survival was the second lowest ever. With a few exceptions, there marine survival rates have been declining in recent years.</p> <p><i>Maritimes:</i>  Simultaneous monitoring of both wild and hatchery smolt migrations and adult returns since 1996 at two locations, Nashwaak and LaHave rivers, provide data necessary for the interpretation of the 30-year time series of hatchery return rates. This data indicates a major downward shift occurring after 1990 that has affected both wild and hatchery salmon and differs by sea age. The information collected also provides data for age structured stock and recruitment models. Interpretations of changes in these life history factors provides critical information to assess persistence and recovery strategies for threatened or endangered salmon stocks worldwide. These data are regularly contributed to the ICES WGNAS and conversion of working papers to research documents is proceeding.</p> <p><i>Gulf:</i>  Smolt production from the Southwest Miramichi River in 2007 was estimated at 1.7 million fish, twice the levels of the previous three years. The return rate of smolts in 2006 to 1SW salmon in 2007 was 1.9%, compared to levels as high as 8% in previous years. Freshwater production estimates in most rivers indicate that freshwater production rates are not the factor constraining adult salmon abundance in this region.</p> <p><i>Quebec:</i>  Wild smolt production increased by 31% from the previous 5 years on river Saint-Jean and decreased 55% on Rivière de la Trinité. Sea survival on river Saint-Jean from smolt (year class 2004) to adult is similar as year class 2003, being 1.79% vs 2.06% , the 1992-2005 average being 1.24%. On Rivière de la Trinité, sea survival has increased to 1.72% from 0.82% the year before, 1992-2005 average being 1.25%.</p>	

**Project No. C4**

**Status: Ongoing**

Party or relevant jurisdiction	Canada NGO (Atlantic Salmon Federation), DFO (Gulf and Newfoundland Regions) and Province of Québec collaboration
Title of project	Atlantic salmon smolt migration and survival within Canadian rivers, estuaries and during the marine life stage
Objective of research project	Provide a time series of stage-specific estimates of mortality rates for smolts and post-smolts at various points of their at-sea migration, including for their transitions through fresh water, the estuary and to various points in the ocean.  Examine the relation between biological characteristics of the fish and survival rates to attempt to isolate mortality causes.  Document the migration pathways and speeds of smolts from different rivers.
Brief description of research project	Smolts are captured in smolt wheels in fresh water and fitted with acoustic tags. Acoustic receiving arrays are positioned in rivers, at the head of tide, and at the exit of the estuary and in the Strait of Belle Isle. Additional receivers will be placed at points of opportunity. In 2008 this may include the first stages of the placement of an acoustic line across the Cabot Strait in the Gulf of St. Lawrence, and along the Atlantic continental shelf to the East of Halifax, Nova Scotia. These latter lines are being funded by the Ocean Tracking Network (OTN) based out of Dalhousie University, and should be fully installed by 2009. Additional funding has also been requested to install two seasonal receiver lines off the coast of Labrador between the Strait of Belle Isle, and Makkovik. These could become operational in 2008.
Dates during which research will take place	2003 – present (spring/summer)
Area in which research will take place	Miramichi River and estuary; Restigouche River and Baie des Chaleurs; Cascapedia River and estuary; St-Jean (Côte-Nord) River and estuary; Western Arm Brook, Strait of Belle Isle, Cabot Strait, Labrador.
Estimated number and weight of salmon to be retained	250 smolts, tagged and released
<b>Resources</b>	
Estimated cost of the research project	Approx. £125,000 for operations, salaries and acoustic tags Approx. £75,000 for receiver arrays Approx. £100,000 for smolt wheels (Partner contribution: 8 wheels and their operation)  <b>Total Approx. £300,000 per annum</b>  Principal Supporting Partners: DFO Miramichi Salmon Association Bowater US NOAA Fisheries
Number of participating scientists	8
Name and e-mail address	Fred Whoriskey

of coordinating scientist in charge of project	asfres@nb.aibn.com
Details of research vessels, e.g. name, registration, call sign and description of vessel	Small boats (20 feet in length) Chartered fishing vessel (approx 35 feet) for gear deployment
Type and amount of gear and other equipment to be used	Up to 100 VR 2 acoustic receivers 200 acoustic tags
Details of any collaborating countries	Data sharing underway with US NOAA Fisheries tracking programs.
<p><b>Summary of Progress</b></p> <p>The study now encompasses five rivers spanning a south-to-north latitudinal difference of about 700 km. This provides the opportunity for a test of the hypothesis that early smolt survivals in southern rivers where populations are most depressed are worse than those rivers further north. For the Miramichi and Restigouche Rivers, five and four years of data respectively have been collected, whereas three or less years of data are available for the other sites. Results for the Miramichi and Restigouche have been consistent among years. In the Miramichi system, smolt survival through freshwater is generally high (about 90%), with about 50% of the tagged smolts surviving to exit the estuary to the sea. In the Restigouche River, mortality in fresh water was higher than in the Miramichi River, and heavy losses occurred in the estuary, resulting in about 30% of the smolts surviving to exit the river and its associated estuary to the sea. Significant fractions of the post-smolts from the Miramichi, Restigouche and Cascapedia Rivers have now been documented using the Strait of Belle Isle to exit the Gulf of St. Lawrence.</p>	

**Project No. C5****Status:****Ongoing**

Party or relevant jurisdiction	Canada Québec, MRNF University Laval, Mc Gill, UQARimouski, UQAMontreal, INRS NGO (Atlantic Salmon Federation)/DFO collaboration
Title of project	Integrated modelling of juvenile Atlantic salmon movement and physical habitat in fluvial and estuarine environments
Objective of research project	(1) To develop an innovative geomatic approach capable of relating the behaviour of smolts during their migration to the characteristics of the physical habitat in rivers and estuaries. (2) To apply this approach to the analysis of the migration of smolts through the estuaries of the St. Jean, Dartmouth and York rivers and down the Baie de Gaspé. (3) In the case of aquaculture development planned in the Baie de Gaspé, to detect potential changes in the migration pattern of smolts in response to the presence of sea cages.
Brief description of research project	The spatial and temporal distribution of smolts will be assessed by tagging smolts with coded transmitters during their downstream migration. We plan to release 60 tagged smolts during years 1, 2 and 3. These smolts will be monitored by (a) a boat-mounted directional hydrophone and receiver to track their migration in the estuaries (b) an array of fixed, GPS geo-referenced, hydrophones moored across the Baie de Gaspé. Particle image velocimetry and image analysis techniques and passive acoustic drifters will be used to determine surface flow velocity fields within the estuaries and Baie de Gaspé.
Dates during which research will take place	Spring/summer 2005 to 2008
Area in which research will take place	York River and Baie de Gaspé, Québec, Canada
Estimated number and weight of salmon to be retained	50 smolts, tagged and released
<b>Resources</b>	
Estimated cost of the research project	<p>Approx. £100,000 for operations, salaries and acoustic tags</p> <p>Approx. £30,000 for receiver arrays</p> <p>Approx. £20,000 for smolt wheels</p> <p><b>Total Approx £150,000 per annum</b></p> <p><b>Principal Supporting Partners:</b> Atlantic Salmon Federation, Fred Whoriskey Centre Interuniversitaire de Recherche sur le Saumon Atlantique (CIRSA) Fédération Québécoise du Saumon Atlantique Fondation pour le saumon du Grand Gaspé Génivar Hydro-Québec Ministère des Ressources Naturelles et de la Faune BC Ministry of Sustainable Resource Management, Information Services Division, Evert Kenk</p> <p><b>Principal investigators</b> Normand Bergeron, INRS-Eau, Terre et Environnement. Deputy</p>

	<p>leader  Thomas Buffin-Bélanger, Université du Québec à Rimouski  François Caron, Ministère des Ressources naturelles et de la Faune  Michael Church, University of British-Columbia  Stuart Lane, University of Leeds, UK  Michel Lapointe, McGill University</p>
Number of participating scientists	10
Name and e-mail address of coordinating scientist in charge of project	Julian Dodson julian.dodson@bio.ulaval.ca
Details of research vessels, e.g. name, registration, call sign and description of vessel	Small boats (less than 20 feet in length) Chartered fishing vessel (approx. 35 feet) for gear deployment
Type and amount of gear and other equipment to be used	Up to 50 VR 2 acoustic receivers 50 acoustic tags
Details of any collaborating countries	Canadian and UK collaboration (University of Leeds)
<p><b>Summary of Progress</b></p> <p>Smolt tagging and tracking was conducted as planned. Data are being processed. Project may be repeated in 2008. Additionally in 2006 and 2007, salmon kelts were tagged and tracked through the estuary and will be tracked to the Strait of Belle Isle transect (see project C2).</p>	

**Project No. C6****Status:****Ongoing**

Party or relevant jurisdiction	Canada
Title of project	River and extended estuary acoustic tracking of Atlantic salmon ( <i>Salmo salar</i> ) kelts and bright salmon
Objective of research project	<ol style="list-style-type: none"> <li>1) To track and document migratory behaviour of Atlantic salmon kelts as they leave the river for the open ocean and bright salmon as they return to rivers;</li> <li>2) To identify possible critical habitat sites utilized by kelts and bright salmon during their migration;</li> <li>3) To examine the mortality rates of kelts and bright salmon during migration.</li> </ol>
Brief description of research project	The population of Atlantic salmon in the LaHave River on the Atlantic coast of Nova Scotia has been in decline in the 1990s and continues to decline because of low marine survival of both smolts and post-spawning adult salmon (kelts). Reasons could include poor physiological condition, interference with migration or increased predation. In this study acoustic tags and receivers are being used to provide evidence on the migration, timing and fate of migrating adult salmon. Thirty kelts were captured and implanted with the acoustic tags, including 5 tags that transmit depth data. Continuous recording acoustic receivers have been placed in the river 15 km above tide to 24 km below tide at the outer limits of the estuary to monitor the passage of tagged fish. Active searches are also being used to locate marine summer holding habitat and to locate missing tags that may indicate mortalities. The array will remain in place from May to October. Environmental data are also being collected at each receiver location on a periodic basis and temperature is being continuously recorded at some receiver locations.
Dates during which research will take place	Project began in April 2006. Based on the success to date, there is interest in continuing the study in 2008.
Area in which research will take place	LaHave River, and estuary, Lunenburg, Nova Scotia, Northwest Atlantic Ocean, Canada. 44°23' N, 64°32' W
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£30,000 per annum. Project is funded by Fisheries and Oceans Canada, LaHave River Salmon Association and affiliates.
Number of participating scientists	Three scientists are participating directly in this study from DFO Maritimes Region. Also one graduate student and scientist from Acadia University, Wolfville Nova Scotia, Canada.
Name and e-mail address of coordinating scientist in charge of project	Peter G. Amiro AmiroP@mar.dfo-mpo.gc.ca A Jamie F. Gibson GibsonAJF@mar.dfo-mpo.gc.ca
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Vemco VR2 and VR60 receivers, Vemco V13 transmitters
Details of any collaborating countries	N/A

### **Summary of Progress**

Method has a low mortality and a high success rate.

Kelts survive at high rates and migrate out of the coastal area.

Kelts migrate at variable rates and routes.

Consecutive spawning kelts return after a short marine sojourn and increase in body mass by 50%

Estuarial use had a most frequent pattern but diversity in the use of the estuary was documented and included peripheral areas.

Hubley, P.B., Amiro, P.G., Gibson, A.J.F., Lacroix, G.L., and Redden A. 2008 [submitted]. Survival and behaviour of migrating Atlantic salmon (*Salmo salar* L.) kelts in river, estuarine and coastal habitat. ICES Journal of Marine Science.

Feasibility for tagging of bright salmon was conducted in 2007 on 10 salmon. Results indicate that bright salmon captured 24km upriver implanted with acoustic tags and released in the estuary survive at a high rate and will re-ascend the river. Movements in the estuary during low flow and high flow periods were recorded and suggest that behaviour and survival of adult salmon in the estuary during low flow periods could be examined using this method.

**Project No. C7****Status:****Ongoing**

Party or relevant jurisdiction	Canada (Fisheries and Oceans Canada – Newfoundland Region)
Title of project	Estuary acoustic tracking of Atlantic salmon ( <i>Salmo salar</i> ) smolts and kelts – Conne River, Little River, and Bay d’Espoir, Newfoundland
Objective of research project	<ol style="list-style-type: none"> <li>1) To tag and track migratory behaviour of Atlantic salmon smolts and kelts as they leave the Conne River, Newfoundland;</li> <li>2) To determine the movements and migration patterns throughout the Bay d’Espoir fjord;</li> <li>3) To provide insight into the initial survival and residency of smolts and kelts migrating through the fjord.</li> </ol>
Brief description of research project	<p>The population of Atlantic salmon in the Conne River on the south coast of Newfoundland has, with few exceptions, been in decline since the early 1990s and continues to remain at relatively low levels of adult abundance. Marine survival has fallen from 7 - 10% estimated in the mid-to-late 1980s, to 3-4% during much of the past decade. Reasons for the decline in marine survival are not known.</p> <p>Fifteen (15) kelts and 49 smolts were captured and implanted with the Vemco acoustic tags as they migrated out of the Conne River in the spring of 2006. Twenty-one (21) VR2 Vemco receivers were deployed throughout Bay d’Espoir to track migrating fish. Manual tracking in nearshore areas was also carried out to complement the arrays of acoustic receivers. This project was expanded in 2007 with whereby 38 receivers (2 subsequently lost) were placed throughout the Bay d’Espoir fiord, with 30 kelt and 62 smolt tagged and released from Conne River. In addition, the Miawpukek (Conne River) First Nation provided funding and participated with the tagging and tracking of twenty (20) smolts that were released from Little River, another system in the Bay d’Espoir area.</p>
Dates during which research will take place	The project began in April 2006 and receivers were recovered by the end of July or early August. The project is expected to continue in 2008 with fewer receivers throughout the fiord itself, but with more perhaps placed at the extreme outer part of the fiord where it empties to the open ocean. It is hoped that the Miawpukek First Nation will also continue in this cooperative project with the tracking of more smolt from Little River.
Area in which research will take place	Conne River, and estuary, Little River, and the Bay d’Espoir fjord, south coast Newfoundland, SFA 11.
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£15,000 per annum. Project is funded by Fisheries and Oceans Canada, the Miapukek First Nation, and is also a joint initiative between the Experimental Sciences Section and Salmonid Research Section.
Number of participating scientists	This project involves several scientists and technical staff with expertise in salmonid research and telemetry investigations and staff from the Miawpukek First Nation.
Name and e-mail address of coordinating scientists in charge of project	J. Brian Dempson dempsonb@dfo-mpo.gc.ca Keith Clarke

	clarkekd@dfo-mpo.gc.ca
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Vemco VR2 receivers, V7-2L and V9-6L transmitters
Details of any collaborating countries	N/A
<p><b>Summary of Progress</b></p> <p>Thirty (30) kelts and 62 smolt were tagged and released from the Conne River with twenty (20) smolts released from Little River in April or early May 2007. Five (5) kelt returned to the general area of the mouth of the Conne River after an absence of 60 – 84 days. The remaining kelts spent an average of about 10 days (range = 2 to 22 days) in Bay d’Espoir before exiting the fjord. Most kelts appear again exited Bay d’Espoir via Lampidoes Passage as they did in 2006. With respect to Conne River smolts, 53 of 62 (85%) provided tracking information. Most smolts exited the fjord by way of Lampidoes Passage (61%) with 31% using the main channel. The residency time of smolts that were successfully tracked to the outer fiord was in the general range of 14 to 18 days. Little River smolts spent 1 to 2 weeks in the immediate estuary before migrating into the fjord. At that time most (71%) used the main channel with only 18% migrating out through Lampidoes Passage. Little River smolt took approximately 10 days longer to exit the fjord than did Conne River fish. Results from these initial studies indicate that immediate survival of tracked smolts appeared to be relative high by comparison with studies carried out in other areas. This project is to be continued in 2008 with emphasis on better coverage of the outer section of the Bay d’Espoir Fiord as both kelt and smolt tend to congregate there for various periods of time.</p>	

**Project No. C8****Status:****Ongoing**

Party or relevant jurisdiction	Canada
Title of project	Spatio-temporal distribution of Atlantic salmon stocks and the impact of the West Greenland fishery.
Objective of research project	Provide knowledge about the river origin of the salmon catch in the commercial fishery, particularly at West Greenland.
Brief description of research project	To evaluate the spatio-temporal distribution of North American Atlantic salmon on the coast of West Greenland, tissue samples were obtained as part of the international salmon monitoring initiative. Tissue will be analysed and population origins assigned to reference populations from Québec, the Maritimes and Maine, using 13 microsatellites markers. The impacts of fishing will then be estimated by evaluating the contribution of each of these base populations to the annual landings in Greenland. The project is a research thesis for a Masters program.
Dates during which research will take place	2006-2008 Project began in early 2006 with samples collected during August and September 2006 and 2007.
Area in which research will take place	Samples from West Greenland, analysis at Laval University, Quebec, Canada
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£15,000 per annum. Project is funded by research grants to Université de Laval (Bernatchez). Salaries for a sampler were provided by Quebec MNRF. Travel expenses for samplers to collect data were provided by Fisheries and Oceans Canada.
Number of participating scientists	2
Name and e-mail address of coordinating scientists in charge of project	Louis Bernatchez (Supervisor); Tim King (Co-supervisor) louis.bernatchez@bio.ulaval.ca
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	N/A
<b>Summary of Progress</b>	
Samples were collected from the West Greenland fishery in August and September, 2006 and 2007. Analysis for genetic characterization is ongoing into 2008.	

**Project No. C9****Status:****Ongoing**

Party or relevant jurisdiction	Canada
Title of project	Genetic population structure of Atlantic salmon in Eastern Canada and its implication for conservation.
Objective of research project	This project aims at elucidating the genetic population structure of Atlantic salmon from a small (river) to a large (Eastern Atlantic coast) spatial scale and proposing conservation units for the Canadian distribution range.
Brief description of research project	Samples from over 55 rivers in Quebec with additional sampling from rivers in the southern Gulf of St. Lawrence and Labrador have been obtained and their characteristics evaluated at multiple microsatellite loci. Further work is ongoing on the variability in major histo-compatibility complexes and its association with exposure to pathogens.
Dates during which research will take place	The project began in 2004 with sample collections. Analysis is continuing in 2008 and is the PhD project of Mélanie Dionne (Université de Laval, Québec).
Area in which research will take place	Rivers from Québec, Canada
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£60,000. Project is funded by research grants to Université de Laval (Bernatchez and Dionne) with support from Quebec MNRF. About £20,000 per annum
Number of participating scientists	2
Name and e-mail address of coordinating scientists in charge of project	Louis Bernatchez louis.bernatchez@bio.ulaval.ca Mélanie Dionne melanie.dionne@giroq.ulaval.ca
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	N/A
<b>Summary of Progress</b>	
<p>This project aims at elucidating the genetic population structure of Atlantic salmon from a small (river) to a large spatial scale (Eastern Atlantic coast) and proposing conservation units for the Canadian distribution range. Preliminary results suggest that most of the rivers are genetically differentiated from one another (mean <math>F_{st} = 0.05</math>, <math>p &lt; 0.001</math>). The magnitude of the genetic differentiation varies between the different geographical regions studied (AMOVA : <math>p &lt; 0.001</math>), with the Gaspésie and the Anticosti regions having the most genetically homogeneous pools of salmon rivers.</p> <p>These results suggest that most of the rivers in Eastern Canada represent distinct populations, even though the magnitude of the differentiation varies with the geographical region studied. In general, management actions should use a Precautionary Approach and favor a 'river by river' conservation orientation. Analysis is ongoing in 2008. Publications have been prepared and submitted.</p>	

**Project No. C10**

**Status: New entry**

Party or relevant jurisdiction	Canada, US
Title of project	Stable isotope ratios and lipid content of tissues from non-maturing 1SW Atlantic salmon at West Greenland relative to continent of origin and age at maturity
Objective of research project	<p>One-sea-winter salmon from both North America and the northeast Atlantic migrate to feeding grounds at West Greenland during their second year at sea. Marine ecology of these fish could be advanced through studies of trophic state and condition. The questions to be addressed include:</p> <ol style="list-style-type: none"> <li>1. Are trophic states of 1SW non-maturing fish similar between NAC and NEAC origin salmon?</li> <li>2. Are trophic states of 1SW non-maturing fish different from that of 1SW maturing of the same cohort? Can this tell us anything about when these different maturity groups separate in the North Atlantic?</li> <li>3. Has there been a trophic state change between West Greenland and when these fish finally return to home rivers as 2SW salmon?</li> </ol>
Brief description of research project	The present sampling program at West Greenland includes the purchase of whole fish specifically for disease sampling. Additional tissue sampling of these fish would be conducted including muscle, liver and caudal fin punches. Liver and muscle samples would be analysed for lipid and stable isotope ratios. Caudal punches would be analysed for stable isotope ratios. Caudal punches can be collected without lethal sampling and would therefore be collected from sacrificed fish to permit calibration to the other tissues to allow sampling of survivors of 1SW and 2SW salmon back in home waters.
Dates during which research will take place	West Greenland samples collected in August and September 2007, 2008. Home water samples collected in August and September 2007 and June to August 2008.
Area in which research will take place	Sampling will occur at West Greenland and from salmon returning to the Miramichi River (Canada).
Estimated number and weight of salmon to be retained	Sampling program at West Greenland includes the purchase of whole fish specifically for disease sampling. Additional tissue sampling of these fish would be conducted and therefore no additional fish are to be retained. Tissue samples from 1SW and 2SW salmon in the Miramichi will be collected preferentially from First Nations food fisheries. Target sample size for tissue sampling is 50 fish per age group.
<b>Resources</b>	
Estimated cost of the research project	<p>Purchase of fish at West Greenland accounted for in ongoing project D1 (Denmark)</p> <p>Laboratory analysis in winter 2008: £8,000, funded by International Atlantic Salmon Research Board £1,500 funded by Fisheries and Oceans Canada under the International Governance of High Seas Fisheries program. Funding request (£10,000) will be made to International Atlantic Salmon Research Board for analysis of samples collected in 2008.</p>
Number of participating scientists	<p>Lead scientists: Gerald Chaput (DFO Canada) Tim Sheehan (US NOAA)</p>

Name and e-mail address of coordinating scientist in charge of project	Gerald Chaput : chaputg@dfo-mpo.gc.ca Tim Sheehan : tsheehan@mercury.wh.who.edu
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	Denmark (in respect of the Faroe Islands and Greenland)
<p><b>Summary of Progress</b></p> <p>In August and early September 2007, liver, dorsal muscle and caudal fin tissue samples were obtained from 150 salmon purchased for disease analysis as part of the international West Greenland collaborative sampling program. The tissues were frozen in scintillation vials, transferred to the Woods Hole laboratory, catalogued and verified and subsequently transferred to the DFO laboratory in Moncton (Canada). In September 2007, 13 1SW salmon returning to the Miramichi River were similarly autopsied for disease analysis and muscle from three regions on the body (ventral, dorsal, caudal), liver and caudal fin tissues were collected and frozen. Tissues from West Greenland and Miramichi River were delivered to the Stable Isotopes in Nature Laboratory at the University of New Brunswick at Fredericton (Canada). Laboratory analysis is ongoing. Age of fish, length, weight, continent of origin and sex from sampled fish will be matched with the stable isotope and condition data. Preliminary analysis and interpretation of results will be presented at the ICES Working Group on North Atlantic Salmon in April 2008 and subsequently at the Scientific Advisory Group meeting of IASRB in June 2008.</p>	

## 2. DENMARK (IN RESPECT OF THE FAROE ISLANDS AND GREENLAND)

### Faroe Islands

The Faroese Fisheries Laboratory is collaborating in a number of projects detailed in the returns made by other Parties.

### Greenland

**Project No. D1                      Status:                      Ongoing**

Party or relevant jurisdiction	Greenland
Title of project	West Greenland Salmon Fishery Sampling Programme
Objective of research project	<ol style="list-style-type: none"> <li>1. Continue the time series of data (1969-2006) on the continent of origin and biological characteristics of the salmon in the West Greenland Fishery;</li> <li>2. Provide data on mean weight, length and continent of origin for input to the North American and European run-reconstruction models;</li> <li>3. Collect information on the recovery of internal and external tags;</li> <li>4. Collect information on fish diseases and parasites of salmon and other special samples as requested.</li> </ol>
Brief description of research project	<p>One of the key data inputs to international stock assessments of Atlantic salmon is the origin of Atlantic salmon harvested in mixed stock fisheries. The Parties to the West Greenland Commission of NASCO have, therefore, worked cooperatively over the past three decades to collect biological data on Atlantic salmon harvested at West Greenland. The sampling programme collects biological data, scale and tissue samples, and information on tags and marks from Atlantic salmon caught in the commercial fishery at West Greenland.</p> <p>Under the NASCO 2007 West Greenland Sampling Agreement (WGC(07)5), Parties to the NASCO West Greenland Commission agreed to provide staff to sample catches of Atlantic salmon in the West Greenland fishery during the 2007 fishing season.</p> <p>The sampling programme collects:</p> <ul style="list-style-type: none"> <li>• Meristic data including lengths and weights of landed fish;</li> <li>• Information on tags, fin clips and other marks;</li> <li>• Scale samples to be used for age and growth analyses;</li> <li>• Tissue samples to be used for genetic analyses;</li> <li>• Tissue samples to be used for disease sampling for the detection of ISAv and other disease and parasite organisms as requested;</li> <li>• Tissue samples to be used for stable isotope and lipid analyses (new in 2007 – see project (C10));</li> <li>• Other biological data requested by the ICES scientists and NASCO co-operators.</li> </ul> <p>Both scale and genetic samples are used to characterise the continent-of-origin of captured salmon.</p>
Dates during which research	Annually during the fishing season, usually August – October

will take place	
Area in which research will take place	Ilulissat, Maniitsoq, Nuuk, Paamiut, and Qaqortoq, Greenland
Estimated number and weight of salmon to be retained	
<b>Resources</b>	
Estimated cost of the research project	Greenland - approximately £9,000 per annum (includes salaries, travel, lodging and equipment) Canada - £10,000 per annum (excludes costs of scale sample and data analyses) EU (United Kingdom) - £24,000 per annum EU (Ireland) - £6,200 per annum USA - £35,600 per annum <b>£84,800</b> (excludes IASRB contribution of £8,000 for stable isotope and lipid analyses – see project C10)
Number of participating scientists	2 technicians and 1 scientist from Greenland working with scientists from Canada (2), USA(2) , UK (2) and Ireland (1)
Name and e-mail address of coordinating scientist in charge of project	Helle Siegstad helle@natur.gl
Details of research vessels, e.g. name, registration, call sign and description of vessel	None
Type and amount of gear and other equipment to be used	Standard sampling equipment Standard genetics laboratory equipment
Details of any collaborating countries	Collaborative project with investigators from US (T. Sheehan), the United Kingdom (T. Potter and J. MacLean), Ireland (N. Ó Maoiléidigh) and Canada (D. Reddin and L. Bernatchez). The work is coordinated via NASCO and is reported to ICES (Working Group on North Atlantic Salmon).
<b>Summary of Progress</b>	
<p>In 2007, the sampling programme included sampling teams from Greenland, United States, Canada, Scotland, England and Wales and Ireland. Teams were in place at the start of the fishery on 1 August and continued until 31 October. In total, approximately 1,100 specimens were sampled for presence of tags, fork length, weight, scales, and tissue samples for DNA analysis. Tissue samples (muscle, liver and candal fin) were collected in 2007 for stable isotope and lipid analyses. Samples were obtained from five landing sites: Ilulissat (NAFO Division 1A), Maniitsoq (1C), Nuuk (1D), Paamiut (1E), and Qaqortoq (1F). The sampled salmon were measured, scales were removed for ageing, and gutted weight recorded. Approximately 1,100 scale samples were collected and aged by Canadian collaborators and approximately 1,100 tissue samples were removed and preserved for DNA analysis with US collaborators.</p>	

### 3. EUROPEAN UNION

**Project No. E1                      Status:                      New Entry**

Party or relevant jurisdiction	European Union - (consortium of 20 partners)
Title of project	SALSEA-Merge - Advancing understanding of Atlantic salmon at sea: Merging genetics and ecology to resolve stock-specific migration and distribution patterns.
Objective of research project	The overall objective of SALSEA-Merge is, by merging genetic and ecological investigations, to advance understanding of stock specific migration and distribution patterns and overall ecology of the marine life of Atlantic salmon and gain an insight into the factors resulting in recent significant increases in marine mortality.
Brief description of research project	SALSEA-Merge comprises seven work packages including: development of genetic identification methodology; marine data acquisition through a series of marine surveys in the north-east Atlantic; genetic identification of stock origin of samples collected; biological analysis of samples including analysis of scale samples (historic and contemporary), diet analysis and assessment of condition; merging and analysis of genetic, biological and oceanographic data.
Dates during which research will take place	April 2008 – April 2011 (marine surveys in 2008 and 2009)
Area in which research will take place	North- East Atlantic with marine surveys conducted west of Ireland and the UK, around the Faroes and in the northern Norwegian Sea and Barents Sea. Laboratory analysis of contemporary and historic samples.
Estimated number and weight of salmon to be retained	All salmon sampled during the marine surveys will be retained. Number and weight unknown.

<b>Resources</b>																																																																
Estimated cost of the research project	Euro 5.5million (£4.4million) over 3 years with Euro 3.5million (£2.8million) funded through the EU Seventh Research Framework Programme (FP7) and Euro 2million (£1.6million) contributed by the programmes scientific and private sector partners. The Atlantic Salmon Trust is funding the scientific coordinator's post (Euro62,500 (£50,000) per annum) and the TOTAL Fondation is contributing Euro 100,000 (£80,000) to the Faroese marine surveys in both 2008 and 2009.																																																															
Number of participating scientists																																																																
Name and e-mail address of coordinating scientist in charge of project	Scientific Coordinator - Jens Christian Holst <a href="mailto:jens.christian.holst@imr.no">jens.christian.holst@imr.no</a> Project Coordinator – Emmanuel Babatunde <a href="mailto:emmanuel.babatunde@imr.no">emmanuel.babatunde@imr.no</a>																																																															
Details of research vessels, e.g. name, registration, call sign and description of vessel	RV Celtic Explorer, RV Celtic Voyager, RV Magnus Heinason, RV Johan Hjort																																																															
Type and amount of gear and other equipment to be used	Pelagic trawls, Pelagic Live Capture Trawls, oceanographic equipment, genetic analysis.																																																															
<b>Details of any collaborating countries</b>	The SALSEA-Merge consortium comprises 20 partners as follows: <table border="1" data-bbox="576 1039 1385 1895"> <thead> <tr> <th>Participant No.</th> <th>Organization Name.</th> <th>Country.</th> </tr> </thead> <tbody> <tr> <td>1 (Co-ordinator).</td> <td>Institute of Marine Research (IMR).</td> <td>Norway.</td> </tr> <tr> <td>2.</td> <td>Marine Institute (MI).</td> <td>Ireland.</td> </tr> <tr> <td>3.</td> <td>Fisheries Research Services (FRS).</td> <td>UK.</td> </tr> <tr> <td>4.</td> <td>Norwegian Institute for Nature Research (NINA).</td> <td>Norway.</td> </tr> <tr> <td>5.</td> <td>University of Exeter (UE).</td> <td>UK.</td> </tr> <tr> <td>6.</td> <td>National University of Ireland, Cork (NUIC).</td> <td>Ireland.</td> </tr> <tr> <td>7.</td> <td>Queen's University Belfast (QUB).</td> <td>UK.</td> </tr> <tr> <td>8.</td> <td>University of Wales, Swansea (UWS).</td> <td>UK.</td> </tr> <tr> <td>9.</td> <td>Danish Institute for Fisheries Research (DIFRES).</td> <td>Denmark.</td> </tr> <tr> <td>10.</td> <td>Institute of Freshwater Fisheries (IFL).</td> <td>Iceland.</td> </tr> <tr> <td>11.</td> <td>University of Turku (UT).</td> <td>Finland.</td> </tr> <tr> <td>12.</td> <td>University of Oviedo (UO).</td> <td>Spain.</td> </tr> <tr> <td>13.</td> <td>Geneindex (GENI).</td> <td>France.</td> </tr> <tr> <td>14.</td> <td>Finnish Game and Fisheries Research Institute (FGFRI).</td> <td>Finland.</td> </tr> <tr> <td>15.</td> <td>*Faroese Fisheries Laboratory (FFL).</td> <td>Faroes.</td> </tr> <tr> <td>16.</td> <td>*Atlantic Salmon Trust (AST).</td> <td>UK.</td> </tr> <tr> <td>17.</td> <td>* NASCO's International Atlantic Salmon Research Board (IASRB).</td> <td>UK.</td> </tr> <tr> <td>18.</td> <td>*Total Fondation (TOTAL).</td> <td>France.</td> </tr> <tr> <td>19.</td> <td>*Conservatoire National du Saumon Sauvage (CNSS).</td> <td>France.</td> </tr> <tr> <td>20.</td> <td>*Loughs Agency.</td> <td>UK.</td> </tr> </tbody> </table> <p>* Non-contracting Partners</p>	Participant No.	Organization Name.	Country.	1 (Co-ordinator).	Institute of Marine Research (IMR).	Norway.	2.	Marine Institute (MI).	Ireland.	3.	Fisheries Research Services (FRS).	UK.	4.	Norwegian Institute for Nature Research (NINA).	Norway.	5.	University of Exeter (UE).	UK.	6.	National University of Ireland, Cork (NUIC).	Ireland.	7.	Queen's University Belfast (QUB).	UK.	8.	University of Wales, Swansea (UWS).	UK.	9.	Danish Institute for Fisheries Research (DIFRES).	Denmark.	10.	Institute of Freshwater Fisheries (IFL).	Iceland.	11.	University of Turku (UT).	Finland.	12.	University of Oviedo (UO).	Spain.	13.	Geneindex (GENI).	France.	14.	Finnish Game and Fisheries Research Institute (FGFRI).	Finland.	15.	*Faroese Fisheries Laboratory (FFL).	Faroes.	16.	*Atlantic Salmon Trust (AST).	UK.	17.	* NASCO's International Atlantic Salmon Research Board (IASRB).	UK.	18.	*Total Fondation (TOTAL).	France.	19.	*Conservatoire National du Saumon Sauvage (CNSS).	France.	20.	*Loughs Agency.	UK.
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New Entry.																																																																

**Project No. E2****Status: Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (England and Wales)
Title of project	Diffuse pollution and freshwater fish populations
Objective of research project	The main objective of the research is to investigate the role of diffuse aquatic contaminants in regulating populations of freshwater fish with particular reference to salmonid stocks and fisheries.
Brief description of research project	There is increasing evidence from studies carried out in Europe and North America that contaminants derived principally from intensive agriculture may have significant effects on salmonids at specific periods during the life-cycle, particularly during the parr-smolt transformation and during entry into salt water at concentrations frequently found in the environment. Initial modelling from these laboratory-based studies has indicated that exposure at these critical stages may affect productivity at the population level. The present research programme has two principal aims. Firstly, to validate the results from previous laboratory-based studies carried out at CEFAS and determine whether exposure to these contaminants within river systems in England and Wales are affecting populations in the wild. The proposed research will test the conclusions made about the effects on populations of wild salmon by the retrospective analyses of the relationship between specific declining stocks and land management changes resulting in the occurrence of target contaminants in the aquatic environment. The proposed research will therefore determine the potential impacts of these contaminants on fish at both the individual and population level in order to support both the advice on the regulation of contaminants within aquatic ecosystems and the conservation and management of fish populations.
Dates during which research will take place	April 2005 – March 2010
Area in which research will take place	England and Wales
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£694,680 (over 5 years)
Number of participating scientists	3
Name and e-mail address of coordinating scientist in charge of project	Andrew Moore a.moore@cefas.co.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	N/A

**Summary of Progress**

A study was carried out on the west Coast of Ireland to examine the impact of brominated flame retardants on the ability of Atlantic salmon smolts to adapt to and survive in the marine environment. Smolts exposed to the contaminant were subsequently tagged with acoustic transmitters and their migration behaviour monitored during the transition from the freshwater and into the marine environment

**Project No. E3****Status: Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (England and Wales)
Title of project	The influence of the freshwater environment on salmonid populations
Objective of research project	This is a large research project examining the impact of environmental change on juvenile salmon production and ecology
Brief description of research project	One aspect of the research that is directly related to marine survival examines the potential role of assessment techniques in influencing marine survival of salmonid smolts. Assessment methodologies such as trapping, anaesthetisation and tagging of wild/hatchery fish could affect the ability of smolts to adapt and survive in fresh or saline water and there is a need to identify any such effects in order to ensure best possible practice in assessment programmes. The proposed research will critically assess the techniques routinely used as the tools for population assessments and that provide the basis for the provision of advice to managers on biological reference points, the status of stocks and management measures for specific fisheries.
Dates during which research will take place	April 2005 – March 2010
Area in which research will take place	England and Wales
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£615,350 (over 5 years)
Number of participating scientists	3
Name and e-mail address of coordinating scientist in charge of project	Andrew Moore a.moore@cefas.co.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	N/A
<b>Summary of Progress</b>	
<p>A research programme has been carried out on the River Frome to assess the impact of tagging studies on the survival of salmon smolts by comparing the survival of previously tagged 0+ parr captured with a Rotary screw trap and coded wire tagged with the survival of those fish allowed to migrate unimpeded.</p>	

**Project No. E4****Status****Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (England and Wales)
Title of project	Deriving estimates of marine survival and exploitation for monitored river stocks in England and Wales
Objective of research project	The objective of this programme is to establish ‘monitored’ rivers in England and Wales where estimates of marine survival and exploitation in marine fisheries can be derived and compared with other North Atlantic stocks.
Brief description of research project	<p>For a number of indicator stocks around the North Atlantic there is evidence that the marine survival of salmon is highly variable and is currently well below previous levels. However, there are no long-term data sets for stocks in England and Wales. It is recognised that data needs to be collected in a consistent manner from year to year in order to provide a reliable time series of data and to allow trends to be identified. It has also been agreed that information on more than one stock would be preferable to allow for possible spatial differences. Two stocks have therefore been selected for investigation in the first instance; these are the River Dee (North Wales) and the River Tamar (SW England). Both these stocks have a reasonable proportion of MSW salmon.</p> <p>Smolt tagging programmes (with wild smolts) have been initiated at both sites and trapping methods (rotary screw traps) are used on both rivers that enable the trapping and tagging of wild fish on the main stems of these rivers. Both rivers also have facilities (counters/traps) for estimating the adult run. The investigations are being run on a collaborative basis by the Environment Agency and the Centre for Environment, Fisheries and Aquaculture Science (Cefas).</p>
Dates during which research will take place	Ongoing annual monitoring programme (subject to annual review).
Area in which research will take place	River Dee (North Wales) River Tamar (SW England)
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	Approximately £120,000 per annum
Number of participating scientists	~10 – involves staff from the Environment Agency’s Fisheries Policy, Technical and Science Teams and regional offices, and personnel from the Cefas Salmon & Freshwater Team
Name and e-mail address of coordinating scientist in charge of project	<p>Ian Davidson (Environment Agency – Dee) ian.davidson@environment-agency.gov.uk Simon Toms (Environment Agency – Tamar) simon.toms@environment-agency.gov.uk Ian Russell (CEFAS) ian.russell@cefas.co.uk</p>

Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Rotary screw fish traps, coded wire microtagging equipment, adult fish traps and fish counters.
Details of any collaborating countries	N/A
<p><b>Summary of Progress</b></p> <p>The Environment Agency and Cefas have continued the joint programmes on the Rivers Dee (North Wales) and Tamar (SW England) to monitor marine survival of these salmon stocks and obtain information on their exploitation outside home waters. Smolt trapping with rotary screw traps has continued, with around 4,000 smolts tagged on both rivers in 2007 and upstream traps were also operated to monitor the adult run throughout the year.</p>	

**Project No. E5****Status: Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (England and Wales)
Title of project	Factors affecting the distribution and behaviour of salmonid populations
Objective of research project	The main objective of the research is to investigate the habitat requirements of adult salmonids within the estuarine and freshwater environments. However, one key element of the study is to investigate how changes in prey availability within the marine environment may influence recruitment of stocks between years.
Brief description of research project	Potential changes in the marine environment such as suitable water temperature and changes in oceanographic circulation patterns may influence the migration routes, growth, run-timing and survival of salmon in the sea and these changes will be influenced further by modifications to the climate. It has also been hypothesised that these changes in marine conditions may regulate salmon populations through modifying the distribution and abundance of key prey items. Therefore, variations in the numbers of returning adults may be directly correlated to previous feeding conditions in the open sea. One potential method to test this hypothesis is to retrospectively measure the stable isotopic composition of salmon scales, which reflect the isotopic composition of the prey items. Changes in the abundance or availability of specific food items may show up as changes in the stable isotopes within salmon scales. The purpose of the research is to investigate using this method whether “poor” years in terms of adult recruitment can be related to changes in productivity and the availability and quality of key prey species within the marine environment. This study will also form part of the programme of research on salmon in the sea being co-ordinated by NASCO.
Dates during which research will take place	April 2005 – March 2010
Area in which research will take place	England and Wales
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£721,830 (over 5 years).
Number of participating scientists	4
Name and e-mail address of coordinating scientist in charge of project	Andrew Moore a.moore@cefas.co.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	N/A

**Summary of Progress**

The research has continued to examine salmon scale microchemistry in order to determine the potential role of climate/environmental change in regulating populations within the marine environment.

**Project No. E6****Status: Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (England and Wales)
Title of project	Atlantic Salmon Arc Project, ASAP
Objective of research project	Define exploitation at sea on a regional basis using genetic tools. Create a long-term database for these studies and create an international management tool to inform decision-making.
Brief description of research project	<p>A Europe-wide collaboration to define tools methods for genetic metapopulation studies culminating in a Europe-wide effort to collect samples from all the regions and genotype using defined methods and take first steps to assess proportional stock exploitation at sea. Microsatellite analysis will be the method used. The genetic laboratories directly involved are Exeter University and Oviedo University.</p> <p>There are many associated partners in the study helping to collect salmon samples from the rives of the North Atlantic; however, the funded partners in the study are:  Central Fisheries Board of Ireland  Westcountry Rivers Trust (Lead partner)  Association of West Coast Fisheries Trusts  Oviedo University  Asturias Government  Galician Government  Exeter University.</p>
Dates during which research will take place	May 2004 – July 2008
Area in which research will take place	Europe, North Atlantic
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£2.2 million Approximately £550,000 per annum
Number of participating scientists	12
Name and e-mail address of coordinating scientist in charge of project	Dylan Bright dylan@wrt.org.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	Spain, France, Ireland, Scotland, USA, Iceland

### **Summary of Progress**

The ASAP project has successfully completed its first phase. A database of salmon population genotypes has been defined for Spain, France the UK and Ireland. The database has been blind tested and shows a very good level of discrimination in assigning salmon from different regions to their correct population of origin and destination. The database has been tested with samples from small inshore net fisheries in the UK and it has been demonstrated that in most cases these fisheries are exploiting multiple populations. The database has been used in collaboration with the Marine Institute to examine the destination and origin salmon represented by an extensive suite samples from Irish Inshore and Offshore fisheries. The findings from this study are in press. Details of each population used in the database and the details of each of the rivers of origin are available online in an interactive, multilingual web based GIS. Data is only partially uploaded to the data base at present.

**Project No. E7**

**Status: New entry**

Party or relevant jurisdiction	European Union – United Kingdom (England and Wales)
Title of project	The marine life of Atlantic salmon: evidence from the microchemistry of scales
Objective of research project	<ol style="list-style-type: none"><li>1. To identify existing Atlantic salmon scale libraries in England and Wales.</li><li>2. Refine and improve existing methods to stable isotope ratios and trace elements in salmon scales.</li><li>3. Measure the stable isotope composition (C and N) from salmon scales in relation to variations in the marine environment.</li><li>4. Measure trace element compositions from salmon scales in relation to variations in the marine environment.</li><li>5. Develop a model to predict the impact of changes in the marine environment (e.g. productivity) on return rates of salmon from specific populations.</li><li>6. Assess the suitability of stable isotope and trace element analysis to understand the distribution of other keystone fish species (e.g. European eel).</li></ol>
Brief description of research project	The research will focus on scale microchemistry using scales from existing libraries together with scales taken from grilse and MSW salmon sampled in the ocean to develop a model to predict the impact of changes in the marine environment (e.g. productivity) on return rates of salmon from specific populations using scale microchemistry.
Dates during which research will take place	1 April 2007 – 31 March 2010
Area in which research will take place	England and Wales
Estimated number and weight of salmon to be retained	N/A

<b>Resources</b>	
Estimated cost of the research project	£66,709 over 3 years
Number of participating scientists	3
Name and e-mail address of coordinating scientist in charge of project	Dr Clive Trueman School of Ocean and Earth Sciences, University of Southampton National Oceanography Centre, Southampton European Way Southampton SO14 3ZH  trueman@noc.soton.ac.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	
<b>Summary of Progress</b>	
New entry.	

**Project No. E8****Status:****Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (Northern Ireland)
Title of project	The marine survival of Atlantic salmon from the River Bush, Northern Ireland
Objective of research project	Investigate factors influencing the survival at sea of salmon smolts migrating from the River Bush until their return as adult salmon
Brief description of research project	This long-term project centres on enumerating numbers of migrating wild smolts and returning adults to the River Bush, by means of trapping facilities, in order to assess return rates and maturation schedules. A programme of microtagging wild and hatchery-origin smolts provides detailed information on exploitation levels and patterns in coastal and distant-water fisheries. Run-reconstruction modelling provides information on return rates to Irish homewaters, which provides an index of natural survival at sea.
Dates during which research will take place	Started in 1973. Project renewed in 2006 for 5 further years.
Area in which research will take place	River Bush, N. Irish/Irish coastal waters and distant-water fisheries.
Estimated number and weight of salmon to be retained	None retained, as tag recovery based on already-captured fish. Tagged adults at River Bush retained alive as broodstock for hatchery programme.
<b>Resources</b>	
Estimated cost of the research project	Total annual cost: £47,460 Breakdown: Staff £37,000 Consumables £7,900 Travel and Subsistence £1,960
Number of participating scientists	2 project scientists and 3 technical staff
Name and e-mail address of coordinating scientist in charge of project	Gersham Kennedy <a href="mailto:gersham.kennedy@afbini.gov.uk">gersham.kennedy@afbini.gov.uk</a> Richard Kennedy <a href="mailto:Richard.kennedy@afbini.gov.uk">Richard.kennedy@afbini.gov.uk</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	Not applicable
Type and amount of gear and other equipment to be used	Not applicable
Details of any collaborating countries	Ireland (tag recovery programme)
<b>Summary of Progress</b>	
<p>The marine survival project continues to provide annual data on marine survival and exploitation of R. Bush wild and hatchery-origin salmon. These data are made available to ICES. The River Bush programme involves the microtagging of wild and hatchery-origin smolts and provides detailed annual information on exploitation levels and patterns in coastal and distant-water fisheries. Run-reconstruction modelling provides information on return rates to Irish homewaters, which provides an index of natural survival at sea.</p>	

**Project No. E9****Status:****New entry**

Party or relevant jurisdiction	European Union – United Kingdom (Northern Ireland) and Republic of Ireland (Loughs Agency is a statutory cross-border body).
Title of project	Development of conservation limits, pre-fishery abundance and management of the Foyle salmon fishery
Objective of research project	To build upon the existing Foyle salmon management system, to develop it into a precautionary catch advice framework that fully takes account of biological data on stock abundance and which fulfils all the main requirements of the Precautionary Approach.
Brief description of research project	To strengthen the basis of the existing in-season management system, by revising the conservation requirements, estimating abundance of cohorts before any fishing takes place and by providing explicit assessment of the uncertainties and risks involved in management decisions on safe levels of catches.
Dates during which research will take place	October 2005-October 2008
Area in which research will take place	Foyle area, Ireland
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£125,000 over three years (£41,700 per annum) Staff £110,000 Equipment £15,000 (funded by Loughs Agency)
Number of participating scientists	10
Name and e-mail address of coordinating scientist in charge of project	Dr. Patrick Boylan <a href="mailto:p.boylan@loughs-agency.org">p.boylan@loughs-agency.org</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	This is a collaborative project between Loughs Agency (ROI and N Ireland – cross-border Agency), AFBNI (N Ireland), Marine Institute (ROI), Institut National de la Recherche Agronomique (INRA) (France) and the University of Glasgow (Scotland)
<b>Summary of Progress</b>	
Preliminary models have been developed; these continue to be developed and refined. The project is due to report in 2008.	

**Project No. E10****Status: Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (Scotland)
Title of project	Post-smolt mortality of Atlantic salmon
Objective of research project	Assess post-smolt mortality rates of Atlantic salmon from the rivers North Esk, Aberdeenshire Dee (two tributaries) and Conon (a river harnessed for hydro-electricity generation) and their contribution to fisheries that exploit them.
Brief description of research project	<p>North Esk: Project started in 1964. Annual smolt production estimates are made using stratified mark-recapture models. Fish are tagged using coded-wire microtags or modified Carlin tags. An alternative method using river flow characteristics is currently being developed. Age distribution and sex ratio data are collected by sampling trap catches of smolts. Analysis of recapture data yields information on post-smolt mortality levels and contribution of North Esk salmon to fisheries.</p> <p>River Dee: Juvenile surveys by electro-fishing and traps have been operated in the Girnock Burn since 1966, and in the Baddoch Burn since 1989. Fish are tagged using coded-wire microtags. Salmon and grilse entering the tributaries to spawn are trapped and age and length distribution data are collected. Stock-recruitment relationships are investigated. Analysis of recapture data yields information on post-smolt mortality levels and contribution of Upper Dee salmon to fisheries. Both tributary populations are driven by early-running salmon (2SW plus a minor proportion of early-running grilse). Return rates have declined markedly in recent years. Smolt production from the streams has altered qualitatively, as a result, with a shift to younger smolt age. Statistical analysis strongly associates return rates of adults to the traps with the size of the annual spring fishery in the main River Dee, suggesting that the monitored sites typify a wider area of production. The Dee fishery, in turn, is strongly correlated with the Scottish fishery as a whole, indicating generalised effects of marine mortality across river catchments.</p> <p>River Conon: Collaborative project with Conon District Salmon Fishery Board and Scottish and Southern Energy started in 1996. Juvenile salmon are captured by electro-fishing and trapping exercises in selected parts of the River Conon catchment. The fish are tagged using a variety of tags including coded-wire microtags (occasionally) and PIT tags (annually). Returning adults are registered automatically as they pass through a Borland lift in Torr Achilty Dam. Occasional surveys and trapping exercises have recorded the proportion of tagged fish in the net-and-coble and rod-and-line fisheries. Work is also being undertaken to provide information on the contribution of seals to the marine mortality of Conon salmon (see E12).</p>
Dates during which research will take place	Ongoing
Area in which research will take place	North Esk, Western catchment of River Dee, River Conon salmon fishery district
Estimated number and weight of salmon to be retained	N/A

<b>Resources</b>	
Estimated cost of the research project	Approximately £50,000 per annum
Number of participating scientists	North Esk - 7 (also employed on other projects) River Dee - 5 (also employed on other projects) River Conon - 6 (includes non-FRS staff, and all are also employed on other projects)
Name and e-mail address of coordinating scientist in charge of project	North Esk - Julian MacLean j.c.maclean@marlab.ac.uk River Dee - Alan Youngson a.youngson@marlab.ac.uk River Conon - John Armstrong j.armstrong@marlab.ac.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	North Esk - Purpose-built smolt trap and resistivity counter on the lower reaches of the North Esk. One additional resistivity counter and two rotary screw traps deployed to assess trends in sub-catchment populations. Electrofishing gear used for juvenile surveys.  River Dee - Purpose-built traps, electro-fishing. River Conon - Electro-fishing gear, traps, PIT tagging equipment and detectors.
Details of any collaborating countries	N/A
<b>Summary of Progress</b>	
Results from the surveillance monitoring continue to be provided to the Working Group for consideration in their on-going modelling work.	

**Project No. E11****Status: Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (Scotland)
Title of project	Analysis of post-smolt life history by scale reading
Objective of research project	Investigate the relationship between growth and mortality in Atlantic salmon, particularly during the marine phase, by analysis of scale growth patterns
Brief description of research project	Scale samples of fish of known age (recaptures from smolt tagging operations) and from salmon catches generally are examined to assess growth characteristics. Associations between growth performance and independent measures of mortality are examined with the aim of identifying the periods crucial to survival.
Dates during which research will take place	Continuing project under longer-term remit.
Area in which research will take place	Samples from around Scotland and from the North Esk and Girnock Burn (Aberdeenshire Dee) in particular
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	Approximately £10,000 per annum
Number of participating scientists	3 (also employed on other projects)
Name and e-mail address of coordinating scientist in charge of project	Julian MacLean j.c.maclea@marlab.ac.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	USA and Canada
<b>Summary of Progress</b>	
Factors affecting early marine mortality and its possible causes continue to be investigated. Growth patterns across Europe are being examined in collaboration with colleagues from other organisations. Fine scale data relating to growth checks have been collected for further analysis.	

**Project No. E12****Status: Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (Scotland)
Title of project	Protecting salmonid fisheries from seal damage
Objective of research project	<p>Develop and apply new molecular tools for discriminating among species of fish in the diets of seals from their remains in scats. Test the possibility of using molecular tools to quantify the occurrence of diet components.</p> <p>Identify factors influencing the migration routes of salmon in estuaries and relate to the presence of predators.</p> <p>Examine the occurrence of seal-damaged salmon on a wide geographic scale.</p>
Brief description of research project	<p>Further development and application of a molecular tool to identify and distinguish between salmon and sea trout DNA in seal scats collected in the Moray Firth.</p> <p>A study was undertaken in 2004 and 2005 tracking salmon in the Cromarty Firth. Migration routes were mapped in relation to topographical features, and examined in relation to a seal haul-out site. An additional aspect of this project, where direct observations of behavioural interactions between predators and prey was to be made using acoustic observations, visual observations and side-scan sonar, but was dependent upon successfully obtaining external funding, which was not obtained. Survival of the fish in the upper Firth was also examined. Tracking of sea trout post-smolts was also undertaken in Loch Torridon in 2005 and 2006 to examine habitat use and survival.</p> <p>A scheme to categorise damage to salmon was constructed in conjunction with Aberdeen University and the Atlantic Salmon Trust. This will be used to determine the number of salmon that are damaged, and the proportion that is attributable to seals, from data collected by Fisheries Trust biologists throughout Scotland.</p>
Dates during which research will take place	April 2003-March 2008
Area in which research will take place	Principally north-east Scotland (Cromarty Firth). Possible work in other estuaries as required, and extension into the West Coast.
Estimated number and weight of salmon to be retained	Estimate not yet available
<b>Resources</b>	
Estimated cost of the research project	<p>2004/05 - £142,000</p> <p>2005/06 - £100,000 (+ £7,000 from the Atlantic Salmon Trust)</p> <p>2006/07 - £105,000 (plus an estimated £10,000 from the Spey DSFB)</p> <p>2007/08 - £80,000</p>
Number of participating scientists	Multi-disciplinary work will involve scientists from a number of teams within Fisheries Research Services and with staff from SMRU, and the Spey District Salmon Fishery Board
Name and e-mail address of coordinating scientist in charge of project	<p>John Armstrong</p> <p>j.armstrong@marlab.ac.uk</p>

Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Laboratory – DNA analysis Field work – Acoustic tags and receivers, inflatable craft.
Details of any collaborating countries	N/A
<p><b>Summary of Progress</b></p> <p>Work has continued to refine DNA-differentiation of salmon and trout in seals' diets. This has now been expanded to trial the technique on scats collected in the wild. A paper reporting on the technique has been accepted for publication in the Journal of Applied Ecology. Movements of 42 returning salmon were tracked through the Cromarty Firth in 2004 and 2005. A paper reporting on this work has been submitted for publication. Returns of damage to salmon from the Rivers Spey and Conon in 2004-2006 are currently being analysed in collaboration with the Sea Mammal Research Unit. Tracking work with sea trout smolts leaving the Rivers Shieldaig and Balgy, Wester Ross, was conducted in 2005 and 2006. Data on the habitat use and survival of smolts, together with the occurrence of predators, have been analysed and a paper is expected to be submitted for publication in the near future. AST, FRS and SNH funding has enabled continued development of a seal-mounted PIT tag detector.</p>	

**Project No. E13**

**Status:**

**Ongoing**

Party or relevant jurisdiction	European Union – United Kingdom (Scotland)
Title of project	Fisheries-induced Evolution
Objective of research project	<p>The Specific Targeted Research Project on Fisheries-induced Evolution will analyze the prevalence and consequence of fisheries-induced adaptive changes in exploited salmon (and other fish) stocks. This objective will be realized through a carefully selected set of empirical phenotypic case studies, the investigation of salient adaptive genetic variation, and through the development of new quantitative models for understanding trends and evaluating management options. The FinE project will deliver insights and recommendations for addressing the overlooked evolutionary dimension of modern fisheries.</p> <p>The FinE project aims at combining fields of expertise as diverse as population genetics and quantitative genetics, life-history theory, population dynamics, evolutionary theory, and fisheries science. The project will ensure a close integration of both empirical and theoretical lines of development in our understanding of evolutionary processes in exploited populations. The FinE project will thereby provide the scientific basis required for designing policies and implementing management measures that can cope with fisheries-induced adaptive changes.</p>
Brief description of research project	<p>The project's overall objective can be broken down into three main lines of research:</p> <p>1) Phenotypic case studies will aim at documenting phenotypic trends in life-history traits relevant for the demography and productivity of exploited salmon populations, thus focusing on maturation, reproductive effort, and growth. In order to assess the ubiquity of fisheries-induced adaptive changes, various exploited stocks from European and North American waters will be investigated. The studies will be based on long-term time series of field data, mostly hosted by national organizations responsible for fish stock assessment and advising for fisheries management. The general principle of the analyses will be to disentangle the plastic component of observed phenotypic trends from a potentially underlying evolutionary component, in order to assess the degree of reversibility of the fisheries-induced changes. The use of specifically tailored statistical methods, like probabilistic maturation reaction norms, will be critical in this respect.</p> <p>2) Genetics analyses will aim to elucidate the genetic basis of fisheries-induced evolutionary changes suggested by phenotypic analysis. The work will be based on a two-pronged approach, thereby developing two complementary lines of research: (i) adaptive genetic changes affecting life-history traits under fisheries-induced selection will be assessed at the DNA level (candidate genes) and in terms of quantitative genetics using historical collections of biological tissues (otoliths) sampled in the field; (ii) artificial fisheries-induced selection experiments on a model species (<i>Poecilia reticulata</i>, the guppy) will be set up in order to corroborate molecular and quantitative genetic results in the wild. These studies will rely on the development of innovative molecular and statistical methodologies allowing tackling temporal adaptive genetic changes,</p>

	<p>instead of only investigating the neutral genetic differentiation that customarily was at the focus of previous genetics work.</p> <p>3) Eco-genetic models will be designed for evaluating alternative hypotheses advanced to explain observed data; for assessing the ecological consequences of fisheries-induced evolution in terms of exploited stock dynamics, viability and recovery, as well as fisheries yield; and for comparing various management scenarios. These analyses will address features and dimensions that are particularly difficult to cover in empirical analyses: multi-trait evolution, sex-specific fisheries-induced evolution, and economic drivers of fishery dynamics. Models will be constructed by carefully integrating relevant genetic, ecological, and environmental details, so as to attain sufficient degrees of realism for predicting the speed of evolutionary changes, while also properly describing population dynamics and fishery dynamics. The following specific topics will be addressed:</p> <ul style="list-style-type: none"> <li>• Evolutionary determination of maturation reaction norms</li> <li>• Fisheries-induced multi-trait evolution</li> <li>• Evolutionary vulnerability of prototypical life histories</li> <li>• Sex-specific dimensions of fisheries-induced evolution</li> <li>• Fisheries-induced evolution of neutral and selected genetic markers</li> <li>• Fisheries-induced evolution of specific stocks</li> <li>• Implications for stock stability and recovery potential</li> <li>• Economic models of fisheries-induced evolution</li> <li>• Evolutionarily enlightened stock management</li> </ul>
Dates during which research will take place	2007-2010
Area in which research will take place	FRS will focus on Scottish and Irish salmon stocks; however, fisheries data will be collected from across Europe, including along marine migration routes.
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	FRS cost: £155,000
Number of participating scientists	FRS: 6 Total: 40+
Name and e-mail address of coordinating scientist in charge of project	<p><i>EU Project co-ordinator:</i> Ulf Dieckman dieckman@iiasa.ac.at</p> <p><i>FRS project leader:</i> Alan Youngson A.Youngson@marlab.ac.uk</p>
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A

<p>Details of any collaborating countries</p>	<p>Austria: International Institute for Applied Systems Analysis (IIASA); Norway: Institute of Marine Research (IMR); France: French Research Institute for the Sustainable Exploitation of the Sea (Ifremer); Denmark: Danish Institute for Fisheries Research (DIFRES); Belgium: Catholic University of Leuven (KUL); UK: University of Wales (UW); UK: Fisheries Research Services (FRS); Norway: University of Tromsø (UT); Netherlands: Netherlands Institute for Fisheries Research (RIVO); Norway: University of Oslo (UO); Spain: Spanish National Research Council (CSIC); Finland: Finnish Game and Fisheries Research Institute (FGFRI); Germany: Federal Research Centre for Fisheries (BFAF).</p>
<p><b>Summary of Progress</b></p> <p>The first meeting of the FinE project was held near Bergen, Norway in September 2007. A follow-up meeting dedicated to salmon issues was held at Pitlochry, Scotland in March, 2008. This second meeting was devoted to mustering data sets, discussing preliminary analyses and planning the way forward for the main data analyses.</p>	

**Project No. E14                      Status:                      New entry**

Party or relevant jurisdiction	European Union – United Kingdom (Scotland)
Title of project	Size and condition of returning grilse (1SW) and MSW salmon
Objective of research project	Investigate decadal trends in the size (length, weight) and condition (weight/length <sup>3</sup> ) of adult salmon returning to Scotland.
Brief description of research project	Biometric data spanning a forty year period at the North Esk, and shorter periods for 5 other sites, are being analysed to document fluctuations in the size and condition of age at return to breed. Complicated trends are evident, which differ between 1SW and MSW fish.
Dates during which research will take place	June 2007 – ongoing.
Area in which research will take place	Six locations in Scotland, in particular the North Esk
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£30,000 per annum
Number of participating scientists	4 (also employed on other projects)
Name and e-mail address of coordinating scientist in charge of project	Philip Bacon P.J.Bacon@MarLab.ac.uk
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	Atlantic Salmon Trust
<b>Summary of Progress</b>	
<p>Data from the North Esk show that recent reports by anglers of high proportions of thin grilse (1SW salmon) in their catches were an extreme of a longer term (five year) trend (<i>see also Smith et al 2007; Todd et al 2008</i>). However, the situation for MSW fish is dissimilar, and for both sea age classes, the trends since 2000 need interpreting in the light of former, decadal, fluctuations. The work is currently being extended to five other Scottish sites (with less complete data sets) to investigate the generality of the findings. Very weak correlations, probably indicating only indirect effects, are apparent with a variety of marine environmental data.</p> <p>Smith, G.W., MacLean, J.C. and Whyte, B.D.M. (2007). The presence of "small grilse" in the 2006 Scottish salmon catches: a historical perspective. ICES Working Group on North Atlantic Salmon. Working Paper No. 30/2007. Copenhagen 11<sup>th</sup> to 20<sup>th</sup> April 2007.</p> <p>Todd, C.D., Hughes, S.L., Marshall, C.T., MacLean, J.C., Lonergan, M.E. and Biuw, E.M. 2008. Detrimental effects of recent ocean surface warming on growth condition of Atlantic salmon. <i>Global Change Biology</i> (2008) 14, 1–13 (pages refer to online version only).</p>	

**Project No. E15****Status:****Ongoing**

Party or relevant jurisdiction	EU – Ireland
Title of project	National coded wire tagging and tag recovery programme
Objective of research project	The programme was initiated in 1980 to: Provide information on marine survival and exploitation rates by commercial fisheries; Estimate the contribution of individual river stocks to catches; Examine the performance of selected experimental groups; Evaluate the potential of a salmon ranching industry in Ireland.
Brief description of research project	Up to 500,000 salmon smolts are tagged with coded wire tags and released from 9 Irish rivers annually. Tag recovery takes place in scanning programmes in Greenland and Faroes and in experimental trawling in the Norwegian Sea and north of Scotland. Subsequently, tags are recovered from homewater fisheries at over 40 locations in Ireland. Between 40 and 50% of the total declared catch of salmon is examined for tags. With the imposition of the carcass tagging scheme, and the district quotas tag recovery has dropped to about 35% of the total catch. With the closure of the Irish mixed stock salmon fishery, returns are now being generated principally from river catches (commercial and recreational) and broodstock returns.
Dates during which research will take place	Tagging November to April. Recovery Post-smolts - May to July (Norwegian Sea), September to November (Faroes) Grilse – May to November MSW – January to November
Area in which research will take place	Tag recovery Post-smolts Norwegian Sea, Wyville Thompson Ridge, North of Scotland, North of Faroes Grilse: West Greenland, Irish estuarine and river fisheries, Irish rivers MSW: North of Faroes, Irish estuarine and river fisheries, Irish rivers
Estimated number and weight of salmon to be retained	Up to 200,000 adults may be examined and cored to retrieve tags. Approximately 40,000 in recent years with mixed stock fisheries and approximately 10,000 in 2007 in the absence of MSF. Up to 40 post-smolts may be recovered in high-seas experimental fisheries of Faroes and Norwegian Sea
<b>Resources</b>	
Estimated cost of the research project	£300,000 per annum nationally funded (does not include sampling in experimental fisheries in high seas, etc.) Staff approx. €200,000 Equipment (including tags) €100,00
Number of participating scientists	5
Name and e-mail address of coordinating scientist in charge of project	Niall O' Maoileidigh <a href="mailto:niall.omaoidigh@marine.ie">niall.omaoidigh@marine.ie</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	

Type and amount of gear and other equipment to be used	
Details of any collaborating countries	Norway, UK, Faroes, France, Spain, Germany, Denmark
<p><b>Summary of Progress</b></p> <p>Distribution of Irish and international tagged salmon in the drift net fisheries has clearly demonstrated the mixed stock nature of these fisheries and has been a key element in the Irish government's decision to close this fishery on the precautionary principle. In the absence of the landings of salmon at major ports, the tag recovery programme will concentrate on key areas with remaining single stock fisheries in estuaries, bays and rivers and the information will continue to be used for the management of the individual and district river stocks. Following the closure of the Irish Mixed Stock salmon fishery in 2007, while tag returns from commercial fisheries were as anticipated extremely low relative to other years, there was a significant increase in the recovery of tags in riverine brood stock collections reflecting the absence of this previously significant fishery.</p>	

**Project No. E16****Status: Ongoing**

Party or relevant jurisdiction	EU – Ireland
Title of project	Migration of salmon in estuarine and coastal waters
Objective of research project	Investigate the timing, route of migration and aspects of the biology of migrating ranched salmon smolts in comparison to the native wild smolt migration.
Brief description of research project	<p>There are three main elements to the project:</p> <p>a) <i>Timing of wild smolt migration</i> The downstream traps will be monitored for the wild salmon smolt migration and this will be related to environmental, lunar and tidal conditions.</p> <p>b) <i>Tracking of wild smolts by acoustic sounding and ranched smolts by acoustic pinger tags and remote receivers</i> Wild and ranched smolts will be tracked using acoustic echosounders to ascertain migration patterns within fresh water and the upper estuary. Acoustic Vemco V8SC-6L-4K pingers will be inserted into 40 ranched smolts. A series of 13 automatic listening stations installed throughout the estuary and Clew Bay will monitor the seaward movements of these fish, recording timing, direction of movement, temperature and tide.</p> <p>c) <i>Biological Sampling</i> Samples of migrating smolts will be collected in the coastal waters by gill net and surface otter trawling. Analysis will include scales (growth), diet and parasite load (internal and external).</p>
Dates during which research will take place	2005-2008
Area in which research will take place	The Burrishoole Catchment, Newport, and Clew Bay, Co. Mayo
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£24,000 per annum
Number of participating scientists	3 Marine Institute (Irl), 2 CEFAS (UK)
Name and e-mail address of coordinating scientist in charge of project	Russell Poole russell.poole@marine.ie Deirdre Cotter deirdre.cotter@marine.ie Niall O'Maoileidigh niall.omaoidigh@marine.ie
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	40 Acoustic Vemco V8SC-6L-4K pingers. A series of 13 automatic listening stations. Echo sounders.

Details of any collaborating countries	UK (Andrew Moore, CEFAS)
<b>Summary of Progress</b>	
No new application since 2006 as equipment is being upgraded. It is hoped to repeat the project in 2008.	

**Project No. E17****Status: Ongoing**

Party or relevant jurisdiction	EU - Ireland
Title of project	The marine survival of wild Atlantic salmon from the Burrishoole River, Ireland.
Objectives of research project	Investigate factors influencing the survival at sea of salmon smolts migrating from the Burrishoole river until their returns as adult salmon
Brief description of research project	This long-term project centres on enumerating numbers of migrating wild smolts and returning adults to the Burrishoole river, by means of trapping facilities, in order to assess return rates and maturation schedules. Return rates to Irish homewaters, which provides an index of natural survival at sea.
Dates during which research will take place	1960 on
Area in which research will take place	Burrishoole River, Furnace , Newport, Co. Mayo
Estimated number and weight of salmon to be retained	None
<b>Resources</b>	
Estimated cost of the research project	£72,000 per annum
Number of participating scientists	2 project scientists and 1 technical staff, 2 field staff
Name and e-mail address of coordinating scientist in charge of project	Russell Poole russell.poole@marine.ie
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Upstream and downstream trapping facilities
Details of any collaborating countries	
<b>Summary of Progress</b>	
Long-term monitoring programme. One of three facilities in NEAC area with total trapping. River specific stock and recruitment available for period 1970-2007.	

**Project No. E18****Status: Ongoing**

Party or relevant jurisdiction	EU - Ireland
Title of project	National Development Plan - National Genetic Stock Identification Project
Objectives of research project	<p>To identify and map discrete spawning areas within tributaries of the salmon-bearing rivers in Ireland (approximately 149) and to collect juvenile Atlantic salmon from these rivers at locations close to the principal spawning areas for establishment of genetic baseline for mixed sample analysis.</p> <p>To undertake the molecular genetic analysis (genotyping) of juvenile salmon tissue samples and adult salmon scales using a pre-determined panel of microsatellite markers. To use the genotype data obtained above, using appropriate statistical packages to identify and characterise river populations as a basis for determining the relative contributions of different baseline river populations within mixed samples.</p>
Brief description of research project	<p>Genetic Stock Identification (GSI), the use of genetic markers for identifying the proportions of different contributing populations in salmon fisheries and new developments in GSI such as individual assignment (IA) methodologies, have been demonstrated to be powerful and valuable tools for the management of fisheries.</p> <p>As part of ongoing efforts to improve the salmon stock assessment programme, the Marine Institute will commence, in addition to the microtag recovery programme, a genetic stock identification (GSI) project in 2005.</p>
Dates during which research will take place	2006-2008 Data analysis only in 2008
Area in which research will take place	Comprehensive survey of all Irish salmon rivers
Estimated number and weight of salmon to be retained	None.
<b>Resources</b>	
Estimated cost of the research project	£270,000 per annum in 2006 and 2007 is being provided under Ireland's National Development Plan. Analysis of results in 2008.
Number of participating scientists	2 project scientists and 1 technical staff, 2 field staff
Name and e-mail address of coordinating scientist in charge of project	Tom Cross t.cross@ucc.ie Paddy Gargan paddy.gargan@cfb.ie Philip McGinnity, Chairman of Scientific Steering Committee) phil.mcginny@marine.ie
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A

Type and amount of gear and other equipment to be used	Instream electrofishing equipment
Details of any collaborating countries	Links to ASAP Interreg Programme UK and Spain
<p><b>Summary of Progress</b></p> <p>Preliminary results for both “offshore” and “inshore” confirmed the results using other tagging methods over the years and showed the highly mixed stock nature of the marine fisheries whether some distance offshore or even within estuaries and bays. These fisheries, despite being restricted to specific geographic districts and fishing season (June and July), will comprise of salmon destined not just for that particular district but also comprise salmon from neighbouring and even distant districts, sometimes in high proportions relative to the proportion of “own district” salmon. Also, the fisheries are indiscriminate in that they will not exclusively target only those stocks which are above Conservation Limits.</p> <p>In general, the original objectives of the programme are being achieved and the results, although preliminary at this stage, supported the contention that the operation of mixed stock salmon fisheries posed particular threats to stocks below Conservation Limits and to the sustainability of other stocks.</p>	

**Project No. E19****Status: Ongoing**

Party or relevant jurisdiction	EU - Ireland
Title of project	Interactions between aquaculture and wild salmonid fish
Objectives of research project	To assess efficacy of prophylactic treatments for salmon smolts migrating through aquaculture bays
Brief description of research project	Two treated and control fish groups of salmon, differentially micro-tagged (5,000 fish in each group), released from several freshwater river systems' fisheries, between 2002 to 2006 (Burrishoole, Shannon, Lee, Delphi, Screebe). Survivors in experimental groups being recaptured in commercial fisheries and freshwater traps.
Dates during which research will take place	2003-2008: Final release groups due back summer 2007.
Area in which research will take place	Burrishoole, Shannon River, Lee River, Screebe and associated interceptory drift net fisheries around the Irish coast
Estimated number and weight of salmon to be retained	N/A. Hatchery-reared only
<b>Resources</b>	
Estimated cost of the research project	£50,000 approx.
Number of participating scientists	3
Name and e-mail address of coordinating scientist in charge of project	D. Jackson dave.jackson@marine.ie
Details of research vessels, e.g. name, registration, call sign and description of vessel	
Type and amount of gear and other equipment to be used	Traps, Microtagging, Commercial fishery
Details of any collaborating countries	
<b>Summary of Progress</b>	
<p>Project commenced October 2003 and is due to finish September 2007 with recovery of final release groups. Preliminary results – No difference in return rates of treated and untreated fish. Final analyses are being carried on brood stock returns collected from October 07 to January 08. Full results expected by Mid 2008.</p>	

**Project No. E20****Status: Ongoing**

Party or relevant jurisdiction	European Union - France
Title of project	The sea survival of Atlantic salmon from the River Scorff, Brittany
Objective of research project	Estimation and long-term monitoring of survival at sea in the southern part of the European distribution range of the species
Brief description of research project	This project centres on quantifying smolt production and adult returns, by means of trapping and mark-recapture techniques, to enable estimation of sea survival. The Scorff is an index river which provides management-oriented scientific information at the regional (Brittany) and international (ICES) levels. It is the only stock in the Southern European part of the species distribution range (France and Spain) for which both smolts and adults are enumerated at the mouth of the river. In addition, no coastal or estuarine commercial fishery targeting Atlantic salmon is currently operating. Thus, the Scorff provides a unique opportunity for assessing marine survival of salmon in an area for which such information is virtually lacking. The project is operated jointly by the National Institute for Agronomical Research (INRA), the Conseil supérieur de la pêche (CSP) and Angling Associations.
Dates during which research will take place	1994 on
Area in which research will take place	The River Scorff (Southern Brittany)
Estimated number and weight of salmon to be retained	No fish are retained, all animals trapped for tagging or mark control are released
<b>Resources</b>	
Estimated cost of the research project	~ £52,000 per annum
Number of participating scientists	2 scientists + 2 technicians
Name and e-mail address of coordinating scientist in charge of project	Etienne Prévost eprevost@st-pee.inra.fr
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Adult and smolt trapping facilities specially designed to minimize impacts on wild fish due to handling
Details of any collaborating countries	None
<b>Summary of progress</b>	
First estimates of sea survival are indicative of higher marine mortality than for more northern stocks (UK, Scandinavia, Iceland). Combined with information on freshwater survival, they reveal the precarious status of the stock. The stock is still able to maintain itself at a reasonably high level of abundance, but may not stand any additional increase in fishing or marine mortality.	

**Project No. E21**

**Status: New entry**

Party or relevant jurisdiction	European Union - France
Title of project	Atlantic salmon metapopulation investigation in Normandy rivers
Objective of research project	Estimate exchanges between rivers flowing into the Mont-Saint-Michel-Bay and impact on the management of salmon populations
Brief description of research project	<p>Straying salmon and river proximity lead to individual exchanges and genes flow between populations and can result in a metapopulation structure.</p> <p>Salmon populations of rivers from the Mont-Saint-Michel bay (Couesnon, Sélune, Sée, Thar, Sienne) have been well studied. Preliminary studies demonstrated possible high exchanges rates of salmon between 2 main populations of this system. Such exchanges can lead to metapopulation functioning.</p> <p>We propose to explore two questions relating to the functioning of this metapopulations: 1- Characterize the functioning of the metapopulation by investigating salmon and gene flows between the four rivers and 2-. Assess the consequences for management, including habitat and exploitation.</p> <p>We are coupling three approaches:</p> <ul style="list-style-type: none"><li>- Molecular genetics using microsatellite markers to describe the pattern of genetic exchange and isolation of Atlantic salmon populations among rivers.</li><li>- Otoliths microchemistry to discriminate natal origin of returning adult salmon</li><li>- Modelling together the two types of data and capture-recapture data to understand the functioning of the populations and provide a useful tool for management.</li></ul>
Dates during which research will take place	2007 to 2010
Area in which research will take place	5 rivers flowing into the Mont-Saint-Michel Bay, Normandy, France
Estimated number and weight of salmon to be retained	<p>No adult fish are retained; all fish trapped are released. Genetic analyses are performed mainly from scales of adult salmon caught by angling.</p> <p>100 juveniles have been caught and killed for removing otoliths and for microchemistry analysis.</p>

<b>Resources</b>	
Estimated cost of the research project	£120,000 (Euro150,000) i.e. £40,000 per annum
Number of participating scientists	1 PHD, 8 scientists, 2 technicians
Name and e-mail address of coordinating scientist in charge of project	Jean-Luc Baglinière Jean-Luc.Bagliniere@rennes.inra.fr
Details of research vessels, e.g. name, registration, call sign and description of vessel	none
Type and amount of gear and other equipment to be used	Standard sampling equipment Standard genetics laboratory equipment LAICPMS (Laser Ablation Inductively Coupled Plasma-Mass Spectrometer) for microchemistry analysis Trapping
Details of any collaborating countries	none
<b>Summary of Progress</b>	
New entry.	

**Project No. E22****Status:****Ongoing**

Party or relevant jurisdiction	EU – Denmark
Title of project	Mortality of Atlantic salmon smolts during estuary migration
Objective of research project	The main objective of the research is to estimate mortality of salmon smolts during migration through estuaries and to compare the return ratio of wild, stocked ½- and one-yearlings.
Brief description of research project	<p>Since 2001 all salmon stocked (30,000 ½- and 62,000 1-yearlings annually) in River Skjern Å are microtagged and adipose fin clipped, in order to distinguish between wild and hatchery-reared smolts in a planned study in 2005 (using rotary screw traps). Since 1996, the spawning run has been estimated yearly (mark-recapture method). Thus in the future it will be possible to distinguish between wild and hatchery-reared fish. A similar programme is planned in the River Storå in 2007.</p> <p>Previously high smolt mortalities during estuarine migration through the Skjern Å estuary have been demonstrated for both sea-trout and salmon by radio telemetry. The total mortality during estuarine migration will be estimated in 2005 by acoustic telemetry.</p> <p>In Guden Å estuary, a project has been started in 2002 where wild salmon smolts are caught in a trap, and tagged with acoustic transmitters and followed through the estuaries by data-loggers at fixed stations and manual tracking. The preliminary results are promising and the project will be continued and combined with feeding studies of post-smolt and DST (data storage tags) tagging of smolt and/or spent fish.</p>
Dates during which research will take place	April 2000 to December 2008
Area in which research will take place	River Skjern Å and River Stor Å (North Sea) and River Guden Å (Kattegat) and their estuaries.
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	<p>River Skjern Å: £143,184 (total in years 2005-08)</p> <p>River Guden Å: £152,594 (total in years 2005-08)</p> <p>River Stor Å: £104,350 (2008)</p> <p>Publications (i.e. three rivers): £30,000 (2008)</p>
Number of participating scientists	4
Name of coordinating scientist in charge of project	<p>Anders Koed (River Skjern Å and River Stor Å) ak@difres.dk</p> <p>Kim Aarestrup (River Guden Å) kaa@difres.dk</p>
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to	Rotary screw traps, radio and acoustic telemetry equipment

be used	
Details of any collaborating countries	None
<b>Summary of Progress</b>	
<p>Year 2004. Salmon and sea trout smolts and mature eel were trapped and numbered in River Guden Å and tagged with acoustic transmitters and followed during their migration through the estuary to the Kattegat. The migration speed of salmon exceeded the speed of sea trout smolts. The project continues in 2005 when the salmon and sea trout smolt project in River Skjern Å and the Ringkøbing estuary commences.</p> <p>Year 2005. The project continued in 2005 and the results are being analysed. A report and paper will be published in year 2008.</p> <p>Year 2005 and 2006. In River Skjern Å salmon and sea trout smolts were caught in a rotary screw trap in the river and acoustic tagged and followed on their downstream migration in the river and through the estuary, i.e. the Ringkøbing Fjord. The total mortality of salmon smolts in river and estuary was 54 % and was caused by predation from pike and birds (mostly cormorants) in the river and cormorants in the fjord; that means that 46 % of the salmon smolts entered the North Sea. Because of the low wild salmon population in River Skjern Å, each year ½- and one-year-old parr are stocked (F1 offspring from wild salmon). In 2005 about 27,300 smolts migrated out from the river, of which about 30 % were wild smolts from spawning in the river and 70 % were from stocking. It is concluded that because of bird predation, mostly from cormorants, the natural wild salmon in River Skjern Å is threatened. The data also showed that relatively the ½- and one-year-old parr give the same number of smolts, but the reason is uncertain; maybe it has something to do with a longer stay in hatchery of the one-year-old parr and therefore less adaptability in the river after release.</p> <p>The results was analyzed and published in 2006 (Research on the smolt run of Atlantic salmon from River Skjern Å and mortality during migration through Ringkøbing Fjord, DFU-rapport nr. 160-06, in Danish) and internationally in 2008.</p> <p>Year 2007. In River Stor Å salmon and sea trout smolts were caught in a rotary screw trap in the river and acoustic tagged and followed on their downstream migration in the river and through the estuary, i.e. the Nissum Fjord.(to the North Sea) . The salmon smolt production was about 17,800 smolts. The total mortality of salmon smolts in river and estuary was about 64 % and was caused by predation from pike and birds (mostly cormorants) in the river and cormorants in the fjord; that means that about 36 % of the salmon smolts entered the North Sea. The results will be published in 2008.</p>	

**Project No. E23****Status: Ongoing**

Party or relevant jurisdiction	European Union - Finland
Title of project	Long-term variation in population dynamics, life-history characteristics, sea growth and origin (wild/reared) of salmon in the rivers Teno (Tana) and Näätämöjoki (Neidenelva)
Objective of research project	Collect long-term data on variation in the stock components, life histories, sea growth and abundance of escaped farmed salmon in the salmon stocks of the rivers Teno and Näätämöjoki.  Relate the population dynamics of the juvenile salmon and returning adult salmon in preceding and subsequent generations.
Brief description of research project	The wild Atlantic salmon stocks of the Rivers Teno (Tana) and Näätämöjoki (Neidenelva) have been subject to long-term monitoring programme since the 1970s in cooperation between Finnish and Norwegian research institutes and authorities. Catch statistics and samples have been collected in the freshwater salmon fisheries since 1972 covering all user groups, seasons and gear types. Typically, some 2,000-8,000 adult salmon scales have been collected yearly. Long-term electrofishing at permanent sampling sites has been carried out in the Teno since 1979 and in the Näätämöjoki since 1990.
Dates during which research will take place	Long-term ongoing programme
Area in which research will take place	Northern Finland and Norway
Estimated number and weight of salmon to be retained	N/A
<b>Resources</b>	
Estimated cost of the research project	£275,000 per annum
Number of participating scientists	5
Name and e-mail address of coordinating scientist in charge of project	Jaakko Erkinaro jaakko.erkinaro@rktl.fi
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	N/A
Details of any collaborating countries	Norway
<b>Summary of progress</b>	
Long-term monitoring programmes. Analyses have indicated relationships between the yearly stock fluctuation and the environmental conditions, especially the Barents Sea temperatures. In addition, positive correlations between the catch fluctuations and the preceding and subsequent juvenile salmon production have been documented. Special emphasis has been allocated to the monitoring of possible escaped farmed salmon in the river catches of the Rivers Teno and Näätämöjoki.	

**Project No. E24****Status: Ongoing**

Party or relevant jurisdiction	EU - Finland
Title of project	Towards sustainable fishing and biodiversity preservation of northwest Russian salmonid stocks by using molecular genetic techniques for stock and parasite monitoring
Objective of research project	<ul style="list-style-type: none"> <li>- To promote the sustainable management of fisheries and fishing tourism in northwest Russia through the collection and analysis of genetic and ecological data from salmonid populations in the region.</li> <li>- to establish a sound biological basis for the monitoring and management of northwest Russian salmonid stocks prior to human induced population declines</li> <li>- to understand the processes that may be involved in different populations being susceptible or resistant to parasites such as <i>Gyrodactylus</i>.</li> </ul>
Brief description of research project	<ul style="list-style-type: none"> <li>- Elucidation of the post-glacial colonisation routes of Atlantic salmon in Northern Europe</li> <li>- Characterisation of within-river population genetic structure for several salmonids in northwest Russian river systems</li> <li>- Identification of loci potentially involved in local adaptations in Russian Atlantic salmon populations</li> <li>- Detailed elucidation of the evolution of host preferences in <i>Gyrodactylus</i></li> <li>- Annual field expeditions to regions important for fishing tourism for collection of ecological data and baseline samples for genetic stock identification</li> <li>- Establishment of a website and biological database</li> <li>- Establishment of a molecular analysis laboratory in a collaborator research institute in Petrozavodsk</li> <li>- Training of Russian specialists in laboratory monitoring techniques in Finland. The ultimate aim is to enable the Russian partners to take over the molecular analyses and continue regularly monitoring salmonid stocks in their own laboratories.</li> </ul>
Dates during which research will take place	1999 -2010
Area in which research will take place	NW Russia
Estimated number and weight of salmon to be retained	-
<b>Resources</b>	
Estimated cost of the research project	<p>Staff costs: £260,000  Travel: £68,000  Laboratory expenses: £179,000  Overheads: £78,000</p> <p>Total 1999-2010: £585,000 i.e. approximately £53,200 per annum</p>
Number of participating scientists	12
Name and e-mail address of coordinating scientist in charge of project	Craig Primmer craig.primmer@utu.fi

Details of research vessels, e.g. name, registration, call sign and description of vessel	-
Type and amount of gear and other equipment to be used	-
Details of any collaborating countries	Department of Biology, University of Turku, Finland Department of Biology, University of Oulu, Finland Finnish Game and Fisheries Research Institute Institute of Biology, Karelian Research Centre, Russia Academy of Science, Petrozavodsk, Russia Knipovich Polar State Research Institute of Lake and River Fisheries (GosNIORKh), St. Petersburg, Russia Research Institute of Marine Fisheries and Oceanography (PINRO), Murmansk, Russia
<b>Summary of Progress</b>	
<p>Lehtonen PK, Tonteri A, Sendek D, Titov S &amp; Primmer CR (2008). Spatio-temporal genetic structuring of brown trout (<i>Salmo trutta</i> L.) populations within in the River Luga, northwest Russia. <b>Conservation Genetics</b> (in press).</p> <p>Kuusela J, Holopainen R, Meinilä M, Anttila P, Koski P, Ziętara MS, Veselov A, Primmer CR and Lumme J (2008) Clonal structure of salmon parasite <i>Gyrodactylus salaris</i> on a co-evolutionary gradient on Fennoscandian salmon (<i>Salmo salar</i>) <b>Annales Zoologici Fennici</b> (in press)</p> <p>Ryynänen HJ, Tonteri A, Vasemägi A and Primmer CR A (2007) A comparison of bi-allelic markers and microsatellites for the estimation of population and conservation genetic parameters in Atlantic salmon (<i>Salmo salar</i>). <b>Journal of Heredity</b> 98: 692-704.</p> <p>Tonteri A, Veselov A, Titov S, Lumme J and Primmer CR (2007) The effect of migratory behavior on genetic diversity and population divergence: a comparison of anadromous and freshwater Atlantic salmon (<i>Salmo salar</i> L.) <b>Journal of Fish Biology</b> 70C: 381-398.</p> <p>Primmer CR, Veselov AJ, Zubchenko A, Poututkin A, Bakhmet I &amp; Koskinen MT (2006) Isolation by distance within a river system: genetic population structuring of Atlantic salmon, <i>Salmo salar</i>, in tributaries of the Varzuga River in northwest Russia. <b>Molecular Ecology</b> 15: 653-666.</p> <p>Ziëtara, M. S., Kuusela J. and Lumme, J. (2006). Escape from an evolutionary dead-end: a triploid clone of <i>Gyrodactylus salaris</i> is able to revert to sex and switch host (Platyhelminthes, Monogenea, Gyrodactylidae). - <b>Hereditas</b> 143 84-90</p> <p>Ryynänen HJ &amp; Primmer CR (2006) Single nucleotide polymorphism (SNP) discovery in duplicated genomes: intron-primed exon-crossing (IPEC) as a strategy for avoiding amplification of duplicated loci in Atlantic salmon (<i>Salmo salar</i>) and other salmonid fishes. <b>BMC Genomics</b> 7: 192</p> <p>Vasemägi A, Nilsson J and Primmer CR (2005) Expressed sequence tag (EST) linked microsatellites as a source of gene associated polymorphisms for detecting signatures of divergent selection in Atlantic salmon (<i>Salmo salar</i> L.). <b>Molecular Biology and Evolution</b> 22: 1067-1076.</p> <p>Tonteri A, Titov S, Veselov A, Zubchenko A, Koskinen MT, Lesbarrères D, Kaluzhin S, Bakhmet I, Lumme J &amp; Primmer CR (2005) Phylogeography of anadromous and non-anadromous Atlantic salmon (<i>Salmo salar</i>) from northern Europe <b>Annales Zoologici Fennici</b> 42: 1-22.</p> <p>Ziëtara, M. Lumme, J (2004) Comparison of molecular phylogeny and morphological systematics in fish parasite genus <i>Gyrodactylus</i> Nordmann, 1832 (Monogenea, Gyrodactylidae). – <b>Zoologica Poloniae</b> 49: 5-28.</p> <p>Meinilä, M., Kuusela, J., Ziëtara, M.S. and J. Lumme (2004) Initial steps of speciation by geographic isolation and host switch in salmonid pathogen <i>Gyrodactylus salaris</i> (Monogenea: Gyrodactylidae). <b>Int. J. Parasitol.</b> 34: 515-526</p> <p>Ryynänen HJ and Primmer CR (2004) Distribution of genetic variation in the growth hormone 1 gene in Atlantic salmon (<i>Salmo salar</i>) populations from Europe and North America. <b>Molecular Ecology</b> 13: 3857-3869.</p> <p>Ryynänen HJ and Primmer CR (2004) PCR-based molecular markers for detecting genetic variation in the Atlantic salmon (<i>Salmo salar</i>) growth hormone 1-gene. <b>Molecular Ecology Notes</b> 4: 664-667.</p> <p>Asplund T, Veselov A, Primmer CR, Bakhmet I, Potutkin A, Titov S, Zubchenko A, Studenov I, Kaluzhin S and Lumme J (2004) Origin of maternal lineages of anadromous Atlantic salmon (<i>Salmo salar</i>L.) in the Barents Sea and White Sea rivers. <b>Annales Zoologici Fennici</b> 41: 465-475.</p>	

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Nilsson J, Gross R, Dove O, Jansson H, Kohlmann K, Löytynoja A, Nielsen EE, Paaver T, Penttilä H, Primmer CR, Vasemägi A, Veselov A, Öst T and Lumme J. (2001) Matrilinear phylogeography of Atlantic salmon (*Salmo salar* L.) in Europe and postglacial colonization of the Baltic Sea area. **Molecular Ecology** 10: 89-102.

Primmer CR, Koskinen MT and Piironen J. (2000) The one that did not get away: individual assignment using microsatellite data detects a case of fishing competition fraud. **Proceedings of the Royal Society of London. Series B.** 267: 1699-1704.

Koskinen MT, Ranta E, Piironen J, Veselov A, Titov S, Haugen TO, Nilsson J, Carlstein M and Primmer CR. (2000) Genetic lineages and postglacial colonization of the grayling (*Thymallus thymallus*, Salmonidae) in Europe, as revealed by mitochondrial DNA analyses. **Molecular Ecology** 9: 1609-1624.

**Project No. E25****Status: Ongoing**

Party or relevant jurisdiction	European Union – Sweden
Title of project	Long-term variation in population dynamics, life history and exploitation of salmon stocks in monitored rivers
Objective of research project	The objective is to estimate long-term variation of survival in different life stages, life history characteristics and growth of wild salmon in the River Ätran with its major tributary Högvadsån. Estimates of sea survival, growth and exploitation are provided from annual Carlin taggings of wild fish in River Ätran and fish from reared stocks in the Rivers Lagan and Nissan.
Brief description of research project	The wild salmon stock in River Ätran has been subject to monitoring since the 1950s with annual recording of the number of ascending fish in the tributary Högvadsån since 1954 and partial smolt trapping since 1959. Present monitoring programmes include electrofishing surveys, smolt trapping, adult counters in the main stem of River Ätran and in Högvadsån, catch sampling and scale reading, Carlin tagging and collection of catch statistics. As the river Ätran is infected by <i>Gyrodactylus salaris</i> , there is an annual monitoring of the parasite infection. In addition to the major programme in River Ätran there is a tagging programme for the reared stocks in the rivers Lagan and Nissan. This gives data on sea survival and exploitation of reared stocks. A new by-pass combined with a smolt trap is being installed at a hydro-electric power plant at the lower part of the main river Ätran in 2005-06.
Dates during which research will take place	Long-term ongoing project (subject to annual review).
Area in which research will take place	Sweden
Estimated number and weight of salmon to be retained	No adult fish are retained. Up to 100 parr/smolt are retained in sampling programmes.
<b>Resources</b>	
Estimated cost of the research project	£8,500 in 2008 dedicated to the project. Other parts of project in larger monitoring programmes or part of compensatory programme after hydro-electric power development.
Number of participating scientists	2-4 (also participating in other projects)
Name and e-mail address of coordinating scientist in charge of project	Lars Karlsson lars.karlsson@fiskeriverket.se
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Adult and smolt trapping facilities.
Details of any collaborating countries	N/A

### **Summary of Progress**

Although River Ätran was infected by *Gyrodactylus salaris* somewhere around 1990, this river still supports the most substantial salmon angling of any of the wild salmon rivers on the Swedish west coast. An analysis of the effect of the parasite on all wild salmon stocks indicated a negative influence, as the densities of parr were lower in infected rivers. The decrease in densities was particularly pronounced in River Ätran. A co-ordinated monitoring program of the parasite in 2001-2005 has not indicated any trends in abundance of the parasite in any of the infected rivers. All monitoring programs continue.

## 4. ICELAND

**Project No. I1                      Status:                      Ongoing**

Party or relevant jurisdiction	Iceland Institute of Freshwater Fisheries, Reykjavik
Title of project	Return rate of salmon in three index rivers in Iceland in relation to population size and environmental factors
Objective of research project	Monitor the status of, and trends in, salmon stocks in Iceland
Brief description of research project	Complete study of all life stages in 3 index rivers of 3 main salmon regions in Iceland. Adult count, catch statistics, spawning and juvenile surveys, smolt count and microtagging, return rate of 1- and 2SW salmon. Comparison to environmental factors at sea and in river as well as to population factors. Less extensive research done in more rivers in the regions.
Dates during which research will take place	Ongoing for the last 10 years and will continue
Area in which research will take place	Iceland and surrounding ocean
Estimated number and weight of salmon to be retained	Some 100s of smolts are being sacrificed every year
<b>Resources</b>	
Estimated cost of the research project	£96,000 per annum (includes all electrofishing surveys, operation of smolt traps, tagging, counting of adult fish, scale sampling and data analysis)
Number of participating scientists	5
Name and e-mail address of coordinating scientist in charge of project	Thorolfur Antonsson thorolfur.antonsson@veidimal.is
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Traps, tagging, etc.
Details of any collaborating countries	Within ICES WGNAS

### Summary of Progress

This project involves three Index rivers providing extensive information on the freshwater phase of salmon stocks in these rivers, smolt numbers, adult migration and survival at sea. Results are reported to ICES and partly included in the WGNAS annual report. Results have also been reported and used in the EU-funded SALMODEL project (refer to the SALMODEL final report: Crozier *et al.* 2003). Data sampled in the project was the basis for the following published papers:

Antonsson Th. and Gudjonsson G., 2002. Variability in timing and characteristics of Atlantic salmon smolt in Icelandic Rivers. Transactions of the American Fisheries Society, 131: 634-655.

Antonsson, Th., Arnason, F., and Einarsson, S.M., 2005, Comparison of density, mean length, biomass and mortality of Atlantic salmon (*Salmo salar* L.) juveniles between regions in Iceland. Icel. Agric. Sci. 18:59-66.

Arnason, F., Antonsson, Th., and Einarsson, S.M. 2005, Evaluation of single-pass electric fishing to detect changes in population size of Atlantic salmon (*Salmo salar* L.) juveniles. Icel. Agric. Sci. 18:67-73.

Progress in 2007 includes providing information for the ICES Working Group on North Atlantic Salmon

**Project No. I2      Status:      Ongoing**

Party or relevant jurisdiction	Iceland Institute of Freshwater Fisheries
Title of project	Tagging mortality and the time of recovery related to internal tagging of hatchery-reared salmon smolts with DST Micro tags (Star-Oddi).
Objective of research project	Investigate the mortality and the time of recovery associated with different handling and tagging techniques with DST tags (dummy). The study will be carried out in a hatchery and in fresh water.
Brief description of research project	A total of 310 smolts will be tagged internally with DST micro tags. The same number of fish will be held in control groups and subjected to the same handling but will not be tagged. Different handling techniques include the use, or not, of antibiotics and vitamins, location of the tag in the body cavity, size and location of injection hole, etc.
Dates during which research will take place	2004-2008 (Preparation of report only in 2007 - 2008)
Area in which research will take place	Islandslax hatchery
Estimated number and weight of salmon to be retained	
<b>Resources</b>	
Estimated cost of the research project	Approximately £4,000 in 2008.
Number of participating scientists	2
Name and e-mail address of coordinating scientist in charge of project	Ingi Runar Jonsson ingi.runar.jonsson@veidimal.is Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	DST tags (Star-Oddi) (dummy) Hatchery and tagging equipment etc.
Details of any collaborating countries	
<b>Summary of Progress</b>	
<p>Hatchery studies were completed in 2005 and the project is in the phase of data analysis and report drafting that will be finished in 2007. Preliminary results indicate that there is a minimum size of smolts needed to carry the DST micro tags. Smaller smolts showed lower growth and higher mortality than larger smolts. Injections of antibiotics and vitamins improved the smolt survival significantly in the experiment. This project was a base study for I3 to explore mortality and growth of smolts of different size and handling after being tagged with DST micro tags. The project has finished and a report will be written by 2007 - 2008.</p>	

**Project No. I3      Status:      Ongoing**

Party or relevant jurisdiction	Iceland Institute of Freshwater Fisheries
Title of project	DST tagging of reared salmon smolts
Objective of research project	Record the seawater temperature and depth experienced by salmon from West Iceland during the first-year migration at sea.
Brief description of research project	300 hatchery-reared salmon smolts were released that had been internally tagged with DST micro tags. Tagged smolts were released from an ocean ranching release site in spring 2005 and 2006. The information will be compared to environmental parameters, to indicate the location of the fish during the ocean migration.
Dates during which research will take place	2005-2008
Area in which research will take place	South-west Iceland
Estimated number and weight of salmon to be retained	
<b>Resources</b>	
Estimated cost of the research project	Approximately £170,000 per year
Number of participating scientists	5
Name and e-mail address of coordinating scientist in charge of project	Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is
Details of research vessels, e.g. name, registration, call sign and description of vessel	None
Type and amount of gear and other equipment to be used	DST micro tags (Star-Oddi) Release site Oceanographic information etc.
Details of any collaborating countries	None
<p><b>Summary of Progress</b></p> <p>In spring 2005 and 2006 a total number of 300 hatchery smolts were tagged each year with DST micro tags (producer Star-Oddi). The tags record temperature and depth at one-hour intervals. Of the smolts tagged in 2005, 5 adult 1SW fish were recovered in 2006. Of these tags 4 had recordings throughout the whole year at sea. One of the five tags ceased recording in January after 7 months at sea. During winter the fish were in areas with temperature of 7-8°C that might indicate the Irminger Sea to the south-west of Iceland. In the later period of the ocean migration the fish undertook frequent dives to 600 m depth.</p> <p>Recoveries of 2SW fish from the 2005 release are anticipated in 2007 as well as 1SW of the 2006 release.</p> <p>In 2007 2 DST tagged fish were recovered with information on depth and temperature measured throughout the whole sea migration. No 2SW fish were recaptured in 2007.</p> <p>The data sampled are being analysed and a draft report is to be written in 2008.</p>	

**Project No. I4****Status: Ongoing**

Party or relevant jurisdiction	Iceland Institute of Freshwater Fisheries
Title of project	Survival of salmon during the first and the second year at sea
Objective of research project	To evaluate the survival of salmon during the first and the second year at sea.
Brief description of research project	20,000 hatchery-reared, micro-tagged salmon smolts with known sex-ratio were released from an ocean ranching release site in spring 2005 and 2006. The returns are expected after one and two years at sea from 2006-2008. Sex and size of each returning fish will be recorded. Scale samples will be analysed for age and growth from each fish. The so called Murphy's method will be used to calculate the survival and mortality during the first and the second year at sea. This information will be compared to environmental parameters at the likely location of the fish at sea during the ocean migration.
Dates during which research will take place	2005-2009
Area in which research will take place	South-west Iceland
Estimated number and weight of salmon to be retained	
<b>Resources</b>	
Estimated cost of the research project	Approximately £50,000 per year
Number of participating scientists	5
Name and e-mail address of coordinating scientist in charge of project	Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is
Details of research vessels, e.g. name, registration, call sign and description of vessel	None
Type and amount of gear and other equipment to be used	Release site, ocean ranching site, traps. Oceanographic information etc.
Details of any collaborating countries	None
<b>Summary of Progress</b>	
The project is ongoing and relies on the returns of 1SW fish in 2006 and 2SW in 2007 and 2008. No tagged 2SW fish were recaptured in 2007 from the 2005 releases. With low return rate, as observed in 2007, the project will fail to give information on mortality rate in the sea phase.	

**Project No. I5****Status: Ongoing**

Party or relevant jurisdiction	Iceland Salmon and Trout Research, Hradastadir 1, P.O.Box 280, IS - 270 Mosfellsbaer, Iceland
Title of project	Distribution and behavioural ecology of salmon at sea
Objective of research project	To investigate the temporal and spatial distribution of DST-tagged salmon during their migrations in the North Atlantic. The whole migration, from their home estuary to the feeding grounds and back home to spawn, will be mapped, giving information on: <ul style="list-style-type: none"> <li>- spatial distribution of salmon and temperature pattern/preferences</li> <li>- diurnal depth distribution of salmon</li> <li>- salmon growth in relation to environmental parameters</li> <li>- by-catch of salmon in pelagic fisheries.</li> </ul>
Brief description of research project	<p>2005-2011, with the main taggings during 2005-2009. Small-scale pre-phase taggings were carried out in 2003 and 2004.</p> <p>Salmon smolts and recovered kelts are tagged internally with DSTs, prior to sea migration, in order to measure fish depth (pressure) and the corresponding temperature. Large smolts are tagged internally with DSTs in the spring prior to their sea migration. Smolts tagged with DSTs are released at 2 release sites above trap facilities (in a salmon ranching station and in a river) in order to allow every salmon returning from the sea to be checked for tags.</p> <p>The DST data enables determination of migration patterns including depth preference in relation to time and environmental conditions. Also it enables geographic distribution of salmon in the sea to be estimated, based on surface temperature data from DSTs and temperature data from measurements of sea surface temperature by satellite and other sources. The DST data from migrating salmon also gives a valuable insight into the relationship between salmon growth and corresponding ambient temperatures during the marine phase.</p> <p>In April 2005 a total of 160 smolts were tagged with DSTs. A small-scale pre-phase smolt tagging of 39 smolts was carried out in 2003 with dummy and active DSTs. The scheduled plan was thereafter to tag smolts annually with DSTs during 2006-2009 but funding progress has not enabled that in 2006 - 2008 but instead funding has enabled tagging of salmon kelts with DSTs.</p> <p>Kelts are tagged annually with DSTs in order to obtain information from that phase of the salmon's life-cycle. The study will be continued with the same setup for tagging and recaptures during the tagging period up to 2009 and during final recaptures during 2010-2011. Analyses and reporting will be carried out concurrently.</p>
Dates during which research will take place	The study period is 2005-2011, with the main taggings during spring in the period 2005-2009, but small-scale pre-phase taggings were carried out in spring-early summer 2003 and 2004.
Area in which research will take place	Release sites (in Iceland): River Tungufljot and River Hafnara Salmon Ranching Station (smolts) and River Botnsa and River Skoga (recovered kelts). Additional tagging/release sites might be included later depending on available funds. Study area: the North Atlantic.
Estimated number and weight of salmon to be retained	All fish will be tagged and released.

<b>Resources</b>	
Estimated cost of the research project	In addition to the contribution of companies and Institutes participating in the project, the Icelandic Research Council and the Fish Enhancement Fund in Iceland, and also the Icelandic state fund based on approval of the Icelandic government, are supporting the project. Additional funding will be applied for from other funds later on. The estimated overall cost of the project is heavily dependent on funding and based on progress so far and scheduled aims it will be close to £300,000 within the period 2005-2011 (annual expenditure £35,000-150,000).
Number of participating scientists	5 (the number might increase later as scientific participation from other countries may benefit the project).
Name of coordinating scientist in charge of project	Johannes Sturlaugsson johannes@laxfiskar.is
Details of research vessels, e.g. name, registration, call sign and description of vessel	
Type and amount of gear and other equipment to be used	A total of 300-350 DSTs will be used for tagging of salmon in the period 2005-2009, but the total number will increase if funding for continued DST smolt tagging will be established within the period. The DSTs will provide information on fish depth, water temperature, salinity, compass direction and fish position.
Details of any collaborating countries	The study is carried out in co-operation with the Marine Research Institute, Star-Oddi, Lax-A and Nordlingur in Iceland, the Faroese Fishery Laboratory, and the Institute of Marine Research, Norway.
<b>Summary of Progress</b>	
<p><b>In 2005</b> the first DST tagged salmon in the project were recaptured, both from tagging of smolts and recovered kelts (a total of 5 recaptured salmon). The whole sea migration of Atlantic salmon from their home estuary to the feeding grounds in the ocean and back home to spawn has therefore been mapped successfully, as planned, in relation to both behavioural and environmental parameters. This was the first time that such data on fish depth have being sampled throughout the sea migration of salmon. <b>In 2006</b> an additional 3 kelts recorded their whole sea migration, one of them with a DST that had a salinity sensor in addition to the fish depth (pressure) and temperature sensor. <b>In 2007</b>, continued releases of DST tagged kelts in River Skoga and River Botnsa.</p> <p>Sampling has resulted in much useful information from recovered DSTs. Part of the data were recorded with high sampling rate, down to 1 minute for post-smolts and down to 10 seconds for recovered kelts. The analysis of the data are ongoing but have already shown that the combined DSTs recordings of fish depth (pressure), temperature and salinity, together with available data on environmental parameters for comparison (SST + survey data), are giving very valuable information on both the feeding and spawning migration, and on both the highly pelagic behaviour and dives down to 600 m depths.</p>	

**Project No. I6****Status: Ongoing**

Party or relevant jurisdiction	Iceland Salmon and Trout Research, Hradastadir 1, P.O.Box 280, IS - 270 Mosfellsbaer, Iceland
Title of project	Orientation and navigation of salmon at sea
Objective of research project	To investigate the orientation and navigation behaviour of salmon during their homing migration through oceanic and coastal area.
Brief description of research project	A migration study of the homing of Atlantic salmon ( <i>Salmo salar</i> L.) in oceanic and coastal waters west of Iceland by sampling data on behaviour and environment using data storage tags (DSTs). New DSTs that measure and store information on compass directions (earth magnetic field) are used to provide new information on salmon orientation. By double tagging the salmon with DSTs, parallel recording of other parameters is possible, such as pitch and roll as well as fish depth (pressure) and corresponding environmental temperature and salinity.  Salmon that enter their home estuary are captured in a trap, tagged and transported by vessel to coastal/ocean area where they are released. Sampled information and data from other resources is compared (e.g. on sun position and on sea temperature distribution both horizontally and vertically) and will enable new insight into the mechanism involved in orientation and navigation of salmon in the sea.
Dates during which research will take place	2006-2009 with tagging during summer and the corresponding recaptures during same summer-autumn.
Area in which research will take place	Tagging site is the estuary of the salmon ranching station in River Hafnara, West Iceland. Release sites of transplanted salmon are in Icelandic coastal and oceanic waters.
Estimated number and weight of salmon to be retained	All fish will be tagged and released.
<b>Resources</b>	
Estimated cost of the research project	In addition to the contribution of companies and Institutes participating in the project, funds has being received. The estimated overall cost of the project is heavily dependent on funding and based on progress to date and future plans it is estimated that it will be close to £160,000 within the period 2006-2009 (annual expenditure £30,000-50,000).
Number of parti-cipating scientists	4 (the number might increase later as scientific participation from other countries may benefit the project).
Name of coordinating scientist in charge of project	Johannes Sturlaugsson johannes@laxfiskar.is
Details of research vessels, e.g. description of vessel	Releases are based on using small boats (10-100 tonnes) and/or the research vessels of the Marine Research Institute in Iceland.
Type and amount of gear and other equipment to be used	It is estimated that a total of 100-120 expensive large-memory DSTs will be used for tagging salmon in the period 2006-2009. The DSTs will provide information on compass directions (earth magnetic field), on fish positions (pitch and roll), fish depth (pressure) and corresponding environmental temperature and salinity. Recapture rates are high at average.
Details of any collaborating countries	The study is carried out in co-operation with the Marine Research Institute, Star-Oddi and Nordlingur in Iceland and Hakan Westerberg

	at the Board of Fisheries in Sweden.
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**Summary of Progress**

**In 2006 and 2007** the first DST-tagged salmon in the project were released and recaptured. The DST recordings gave valuable information on compass directions (earth magnetic field), fish positions (pitch and roll), fish depth (pressure) and corresponding environmental temperature and salinity. The analysis of the data are ongoing and have already shown very interesting information on orientation patterns and behaviour with a sampling rate as frequent as 2 seconds. This data set together with similar data sampled in 2008-2009 will give new insight into the navigation of salmon in the sea.

Results has being introduced in Star-Oddi newsletter in November 2007 at their web site ([http://star-oddi.com/Newsletters/Issue\\_3\\_07/](http://star-oddi.com/Newsletters/Issue_3_07/)) in the following article:  
"Orientation and navigation of salmon in sea studied by use of DSTs – Preliminary data"

**Project No. I7**

**Status: Ongoing**

Party or relevant jurisdiction	Iceland - Institute of Freshwater Fisheries
Title of project	Mapping genetic diversity of Icelandic Atlantic salmon
Objective of research project	Obtain baseline information on the genetic diversity of Icelandic Atlantic salmon
Brief description of research project	Samples have been taken from many (30-40) Icelandic populations of Atlantic salmon. Using DNA microsatellites these populations are being analysed. We are using the 15 microsatellites systems as agreed on at the meeting in Virginia.
Dates during which research will take place	2003-2008
Area in which research will take place	Iceland
Estimated number and weight of salmon to be retained	
<b>Resources</b>	
Estimated cost of the research project	£176,000 (£35,000 per annum)
Number of participating scientists	4
Name and e-mail address of coordinating scientist in charge of project	Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	
Details of any collaborating countries	N/A
<b>Summary of progress</b>	
New entry.	

## 5. NORWAY

**Project No.** N1                      **Status:** Ongoing

Party or relevant jurisdiction	Norway, Institute of Marine Research, P.O. Box 1870 Nordnes, N-5817 Bergen, Norway
Title of project	Significance of salmon lice for growth and survival of salmon in the sea
Objective of research project	To estimate the effects of salmon lice on post-smolt growth and survival, dependent on release site, and time and year of release.
Brief description of research project	Cultured smolts have been treated against salmon lice, tagged with microtags and released in the River Dale, western Norway, each year from 2002 to 2007. The effect of the time of "escape" is studied by releasing T-bar anchor tagged smolts and post-smolts from May to August from Matre Research Station in 2005 and 2007. A comparison of the effect of salmon lice in fjord versus coastal areas is done by releasing smolts in both environments; from Matre and at the nearby coast in 2006 and 2007, and from Dale River and at the coast in 2007. Further releases will occur in 2008.
Dates during which research will take place	Fish released during 2006-2008.
Area in which research will take place	Western Norway; River Dale, Matre Aquaculture Station and nearby coast.
Estimated number and weight of salmon to be retained	Catch of adult tagged fish: 50-300 fish each year.
<b>Resources</b>	
Estimated cost of the research project	Total: £75,000 per annum; overheads: £25,000; salary: £33,000; equipment: £13,000; other costs: £4,000
Number of participating scientists	3
Name and e-mail address of coordinating scientist in charge of project	Ove Skilbrei, ove.skilbrei@imr.no
Details of research vessels, e.g. name, registration, call sign and description of vessel	No vessels
Type and amount of gear and other equipment to be used	Smolt trap in River Dale Tags; 16,000 microtags, 16,000 T-bar anchor tags
Details of any collaborating countries	
<b>Summary of Progress</b>	
<p>Returns of grilse to the River Dale were sufficient for statistical analysis in 2002 and 2003 and an effect of salmon lice was observed. The marine survival of smolts seems to have been very low in the following years (especially in 2007), with no differences between treated and control groups. Small or no differences in survival with time of release have been observed after the 2005 Matre releases.</p> <p>New releases of smolts treated against sea lice are planned in 2008 from the Dale River and from Matre Research Station in Masfjorden.</p>	

**Project No. N2****Status: Ongoing**

Party or relevant jurisdiction	Norway
Title of project	Marine survival, growth and exploitation of salmon from the Rivers Figgjo, Imsa, Drammenselv and Halselv.
Objective of research project	<ol style="list-style-type: none"> <li>1. Estimation of marine survival</li> <li>2. Estimation of marine growth</li> <li>3. Estimation of marine exploitation</li> <li>4. Data input in predictive models</li> <li>5. Monitoring</li> </ol>
Brief description of research project	Maintain time series of smolt taggings (wild and hatchery-reared) and tag returns in index rivers. Use the information to study fluctuations in marine survival and growth as well as describe changes in marine exploitation.
Dates during which research will take place	Long-term ongoing monitoring project
Area in which research will take place	Tagging in rivers Figgjo, Imsa, Drammenselv and Halselv with tag recovery programme in fisheries along Norwegian coast and elsewhere
Estimated number and weight of salmon to be retained	
<b>Resources</b>	
Estimated cost of the research project	Approximately £134,000 per annum
Number of participating scientists	5
Name and e-mail address of coordinating scientist in charge of project	Lars P. Hansen <a href="mailto:l.p.hansen@nina.no">l.p.hansen@nina.no</a> Nina Jonsson <a href="mailto:nina.jonsson@nina.no">nina.jonsson@nina.no</a> Arne Johan Jensen <a href="mailto:Arne.jensen@nina.no">Arne.jensen@nina.no</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	
Type and amount of gear and other equipment to be used	Fish traps, electric fishing
Details of any collaborating countries	
<b>Summary of Progress</b>	
<p>The long-term monitoring of salmon from the four rivers has revealed that marine survival has improved compared with the poor survival in the late 1990s. Survival rates of wild and hatchery-reared salmon are correlated. Survival rates of 1SW fish are correlated with survival rates of 2- and 3SW fish from the same smolt cohort. There is a significant relationship between growth and survival, and slow-growing individuals tend to become sexually mature at a higher sea age than fast-growing individuals. The marine exploitation rates have continued to decrease. In the River Halselv a significant correlation has been found between return rates of first-time migrants of sea trout and sea charr, and return rates of salmon of the same smolt year class.</p>	

**Project No. N3****Status: Ongoing**

Party or relevant jurisdiction	Norway
Title of project	Individual assignment of salmon caught in the ocean to region of origin
Objective of research project	Investigate genetic variation in Norwegian Atlantic salmon populations on different spatial scales; national, regional and within-river. Provide calibrated data on microsatellite markers for a database. Conduct genetic analysis of samples of ocean-caught salmon and attempt assignment of these samples to country/region of origin.
Brief description of research project	Samples will be collected from approximately 30 Norwegian salmon rivers, spanning all geographical regions. One region will be investigated in more detail, with sampling of all major rivers in the region and one river system will also be sampled in more detail, covering all tributaries. All samples will be analysed for the set of 15 SALMAN microsatellites. The variation in these markers on three spatial scales will be investigated, to see if composite genetic signatures of rivers and regions can be built by aggregating data from individual components. The data will be calibrated and made available for a common database of salmon populations. A collection of ocean samples of salmon will also be analysed, and assignment of these samples to country, region or river of origin will be attempted.
Dates during which research will take place	January 2006 – December 2008
Area in which research will take place	Norway, nationwide
Estimated number and weight of salmon to be retained	3,000 parr, 30 kg
<b>Resources</b>	
Estimated cost of the research project	Total cost: £320,000 Staff costs (including overheads): £258,000 Overheads: £88,000 Consumables, field work, meetings, and equipment: £55,000 Purchase R&D services: £7,000
Number of participating scientists	2
Name and e-mail address of coordinating scientist in charge of project	Øystein Skaala <a href="mailto:Oystein.Skaala@imr.no">Oystein.Skaala@imr.no</a> Vidar Wennevik <a href="mailto:Vidar.Wennevik@imr.no">Vidar.Wennevik@imr.no</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	
Type and amount of gear and other equipment to be used	Electrofishing equipment. Molecular biology laboratory at the Institute of Marine Research, Bergen, Norway
Details of any collaborating countries	Finland (Craig Primmer and Anti Vasemägi, University of Turku, Finland. Investigation of variation in EST-markers in Norwegian salmon populations)

### **Summary of Progress**

During 2007, sampling of Norwegian salmon rivers for genetic analysis and construction of a genetic baseline continued. By February 2008, samples from more than 60 rivers have been collected. Partly through own collection trips, but samples have also been collected by contracting biology companies. The Norwegian Institute of Water Research (NINA) has also kindly provided samples from several rivers. Around 35 of the rivers have now been analyzed for 15 microsatellite markers, and analysis of the remaining rivers will be completed in the first half of 2008. Also 1500 to 2000 samples from the Atlantic ocean will be analyzed in this period. The data collected in the project, will be entered into the common database that will be set up for the EU project SALSEA-Merge, and thus form part of the pan-European genetic baseline for Atlantic salmon that will be constructed for the purposes of this project.

**Project No. N4: Status: New entry**

Party or relevant jurisdiction	Norway
Title of project	Population-limiting mechanisms for Atlantic salmon during early estuarine and coastal migration (SalPoP)
Objective of research project	The main objectives of the project are to: <ul style="list-style-type: none"> <li>○ Map migratory behaviour and quantify where, when and why mortalities of Atlantic salmon post-smolt occur.</li> <li>○ Correlate data on migration and mortalities with health status and major population-limiting factors.</li> <li>○ Significantly contribute to the future sustainability of Atlantic salmon populations by developing improved mitigating actions and management strategies.</li> </ul>
Brief description of research project	The proposed project consists of five integrated workpackages (WPs). The first four WPs are aimed at examining specific population limiting factors, while WP5 is aimed at summarising the results in order to evaluate actions and management strategies for maintenance and re-establishment of wild Atlantic salmon populations. Groups of smolt will be exposed to various contaminants using a common protocol to establish dose response relationships affecting smolt health. Fish health will be assessed on basis of physiological, immunological and morphometric measurements. Movements, behaviour and survival will be studied with both acoustic telemetry methodology for smaller sub-samples and with external tagging methodology for some larger sub-samples. The use of telemetry will provide more detailed and comprehensive knowledge regarding survival and behaviour of the post-smolt than has been possible in earlier large scale external tagging studies.
Dates during which research will take place	January 2008 – January 2012
Area in which research will take place	Eresfjord in Møre and Romsdal, middle Norway
Estimated number and weight of salmon to be retained	Wild and farmed salmonids

<b>Resources</b>	
Estimated cost of the research project	Funding from the Norwegian Research Council, Statkraft Energy AS and The Norwegian Directorate for Nature Management: 2008: £191,200 (NOK 1,950 000) 2009: £209,800 (NOK 2,140 000) 2010: £200,000 (NOK 2,040 000) 2011: £124,500 (NOK 1,270 000)
Number of participating scientists	15
Name and e-mail address of coordinating scientist in charge of project	Bengt Finstad bengt.finstad@nina.no
Details of research vessels, e.g. name, registration, call sign and description of vessel	
Type and amount of gear and other equipment to be used	
Details of any collaborating countries	<ul style="list-style-type: none"> <li>○ Prof. Thrandur Björnsson and Dr. Ingibjörg E. Einarsdottir - Göteborg University (GU)</li> <li>○ Dr. Andy Moore – Centre for Environment, Fisheries and Aquaculture Science (CEFAS)</li> <li>○ Prof. Robert Scott McKinley - University of British Columbia (UBC)</li> </ul>
<b>Summary of Progress</b>	
New entry.	

**Project No. N5: Status: New entry**

Party or relevant jurisdiction	Norway
Title of project	The Hardangerfjord salmon lice project
Objective of research project	<p>Even though strategies for lice treatment in fish farms have been greatly improved during recent years there still remain episodes of high lice infestation on wild salmonids in the Hardangerfjord system. Therefore, there is a need to extend the time series to cover more combinations of environmental and management factors which influence salmon lice levels on the different salmonid populations. This will enable us to obtain a better understanding of the fjord system by:</p> <ol style="list-style-type: none"> <li>1. Improving sea lice monitoring and management on individual farms and the region in general by fjord integrated pest management and synchronized delousing processes.</li> <li>2. Evaluating the success of sea lice management strategies in the Hardangerfjord through investigation of the infection level on farmed and wild fish.</li> <li>3. Quantifying the abundance and distribution of salmon lice in the Hardangerfjord area based on the physical oceanographical and meteorological conditions for a given salmon lice production.</li> <li>4. Analyzing data sets being collected at the Hardangerfjord for possible risk factors associated with varying lice infection pressure with the aim of developing a mathematical population model for the Hardangerfjord system.</li> </ol> <p>Results obtained in this project can also be used for other fjord systems globally in management schemes aimed at minimising the risk of salmon lice infestation on wild and farmed fish stocks.</p>
Brief description of research project	<p>This three-year research effort will focus on the interactions of salmon lice between farmed and wild salmonids in the Hardangerfjord and will be a continuum of the project which was initiated in 2004 (see: <a href="http://www.nina.no">http://www.nina.no</a> and the attachment to the present application; NFRProgressReportHardanger2005). The applied project consists of four closely linked workpackages: 1) Salmon lice abundance on wild and escaped salmonids; 2) Optimised salmon lice monitoring and control strategies in farms; 3) Understanding the physical oceanographical factors on salmon lice abundance and distribution in the Hardangerfjord and 4) Development of a mathematical population model for the Hardangerfjord system.</p> <p>The Hardangerfjord has the largest density of fish farms in Norway. However, even though strategies for lice treatment in fish farms have been greatly improved during the present project, we still experience episodes of high lice infestation on wild salmonids in this fjord. Therefore, there is a great need to extend the time series to cover and understand more of the different combinations of environmental and managerial factors which influence salmon lice levels on the different salmonid populations.</p> <p>By using and combining the long-time results from the project our overall goal is to develop a mathematical population model for the Hardangerfjord system which can be used in management schemes aimed at minimising the risk of salmon lice infestation on wild and farmed fish stocks. Epidemiological models in combination with lice dispersal models is vital to understand the complex relationship between hosts, parasites,</p>

	environment and measures taken in fish farms. Modelling will also give advice to the industry for optimal placement of fish farms within a fjord system. The degree of international collaboration also shows that results obtained in this project can be used for other fjord systems globally in management schemes aimed at minimising the risk of salmon lice infestation on wild and farmed fish stocks.
Dates during which research will take place	January 2007- January 2010
Area in which research will take place	Hardangerfjord at the Norwegian West Coast
Estimated number and weight of salmon to be retained	Wild- and farmed salmonids
<b>Resources</b>	
Estimated cost of the research project	Funding from The Norwegian Fisheries and Aquaculture Research Fund and the Norwegian Research Council: 2007: £143,600 (NOK 1,465 000) 2008: £151,000 (NOK 1,540 000) 2009: £149,000 (NOK 1,520 000)
Number of participating scientists	14
Name and e-mail address of coordinating scientist in charge of project	Bengt Finstad bengt.finstad@nina.no
Details of research vessels, e.g. name, registration, call sign and description of vessel	
Type and amount of gear and other equipment to be used	
Details of any collaborating countries	Prof. Robert Scott McKinley, University of British Columbia (UBC) Dr. Crawford Revie and Prof. George Gettinby, University of Strathclyde
<b>Summary of Progress</b>	
New entry.	

## 6. RUSSIAN FEDERATION

**Project No. R1                      Status:                      Ongoing**

Party or relevant jurisdiction	Russian Federation
Title of project	Monitoring of the stock status, abundance assessment and provision of advice on the allowable level of harvest of Atlantic salmon.
Objective of research project	Derive estimates of survival of juveniles and adult return rates, estimates of natural and fishing mortality, study the dynamics of population characteristics, assess population sizes and spawning escapement, estimate allowable catch.
Brief description of research project	Research fishing is conducted. Data is collected on the Atlantic salmon population characteristics (age structure, size distribution, sex composition, fecundity, proportion of various salmon groups in the spawning run). Adults and smolts are marked with tags to assess population size and survival rates. The dynamics of the smolt migration and the spawning run, and the behaviour of adults are studied. The quality of Atlantic salmon spawning habitat and the impact of human activities on the habitat are assessed.
Dates during which research will take place	Annual monitoring programmes (May-October).
Area in which research will take place	Atlantic salmon rivers of the Kola Peninsula, Archangel Region and Karelia Republic.
Estimated number and weight of salmon to be retained	About 6,500 salmon and 5,500 parr and smolts
<b>Resources</b>	
Estimated cost of the research project	Approximately £80,000 for 2008
Number of participating scientists	~ 25 scientists from PINRO
Name of coordinating scientist in charge of project	Alexander Zubchenko (PINRO) <a href="mailto:zav@pinro.ru">zav@pinro.ru</a> <a href="mailto:salmon@pinro.ru">salmon@pinro.ru</a> Igor Studenov (PINRO) <a href="mailto:igor@sevpinro.ru">igor@sevpinro.ru</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Barrier fences, nets, electrofishing units, smolt traps, external tags
Details of any collaborating countries	N/A
<b>Summary of Progress</b>	
<p>Adult returns in 2007 to home waters were assessed. Estimates of natural and fishing mortality of salmon were derived. The level of attainment of spawning requirements was determined, the condition and success of spawning was assessed, and estimates of parr density were derived. The harvestable surplus was determined. Recommendations on TACs and quotas for 2008-2009 have been given to the State Committee for Fisheries of the Russian Federation.</p>	

## 7. UNITED STATES OF AMERICA

**Project No.** U1                      **Status:** Ongoing

Party or relevant jurisdiction	United States of America
Title of project	Penobscot hatchery versus wild smolt telemetry
Objective of research project	1) Evaluate migration timing and pathways in the Penobscot Estuary and Bay 2) Estimate survival of migrating smolts and post-smolts
Brief description of research project	Telemetry data was first collected on hatchery-reared out-migrating Atlantic salmon smolts in the Penobscot River, Maine, in 2005, and this research effort is continuing. Atlantic salmon smolts are surgically implanted with ultrasonic tags. Automated fish identification receivers are deployed throughout the estuary and near-shore marine arrays in Penobscot Bay. The array identifies the migration pathways of smolts as they exit the system between release groups.  In 2005, 180 hatchery-reared smolts were tagged and released. In 2006, 25 hatchery and 25 naturally reared smolts were tagged and released.
Dates during which research will take place	2005-2009
Area in which research will take place	Penobscot Estuary Penobscot Bay
Estimated number and weight of salmon to be retained	It is anticipated that no Atlantic salmon will be retained during this project.
<b>Resources</b>	
Estimated cost of the research project	Approximately £43,000 per annum (public funding)
Number of participating scientists	~5
Name and e-mail address of coordinating scientist in charge of project	James Hawkes <a href="mailto:James.Hawkes@noaa.gov">James.Hawkes@noaa.gov</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	Equipment deployed from small research boats and leased commercial vessels. Vessel use is subject to change annually.
Type and amount of gear and other equipment to be used	Ultrasonic Telemetry Tags (~150-250 annually) Automated Pinger Detection Units (50-70 annually)
Details of any collaborating countries	Automated Pinger Detection arrays deployed by Canadian investigators were capable of detecting and recording tagged fish. Automated Pinger Detection arrays deployed for this study were capable of detecting and recording Canadian tagged fish.
<b>Summary of Progress</b>	
Field activities and preliminary analysis are currently ongoing. No salmon were tagged in 2007, although the array was put in place and maintained in cooperation with the University of Maine and the U.S. Geological Survey (other species are being tracked with the array – e.g., shortnose sturgeon). Tagging of salmon smolts is planned for 2008.	

**Project No. U2                      Status:                      Ongoing**

Party or relevant jurisdiction	United States of America
Title of project	Ultrasonic telemetry of smolts and post-smolts in the Narraguagus River and Narraguagus Bay
Objective of research project	1) evaluate migration timing and pathways in the lower Narraguagus River and Narraguagus Bay 2) estimate survival of migrating smolts and post-smolts
Brief description of research project	Telemetry data was collected on wild outmigrating Atlantic salmon smolts from 1997-1999 and 2002-2005 in the Narraguagus River, Maine, USA. During these years, 60-100 wild Atlantic salmon smolts annually were surgically implanted with ultrasonic tags. In 2005, Automated Pinger Detection Units (APDU) were deployed through the Narraguagus River (5), Estuary (10), Bay and nearshore environment (6), excluding the coastal arrays established in 2002 to evaluate the number of smolts passing ecological transition zones.
Dates during which research will take place	2002-2008 Fieldwork April – June 2002-2005. Data analysis and publication in 2005-2008.
Area in which research will take place	Narraguagus River (1997-1999, 2002-2005) Narraguagus Bay (1997-1999, 2002-2005) Gulf of Maine (2002-2004)
Estimated number and weight of salmon to be retained	It is anticipated that no Atlantic salmon will be retained during this project.
<b>Resources</b>	
Estimated cost of the research project	Approximately £49,000 per annum (public funding)
Number of participating scientists	~3
Name and e-mail address of coordinating scientist in charge of project	James Hawkes <a href="mailto:James.Hawkes@noaa.gov">James.Hawkes@noaa.gov</a>
Details of research vessels, e.g. name, registration, call sign and description of vessel	Equipment deployed from small research boats and leased commercial vessels. Vessel use is subject to change annually.
Type and amount of gear and other equipment to be used	Ultrasonic Telemetry Tags (~60-100 annually) Automated Pinger Detection Units (20-60 annually)
Details of any collaborating countries	Automated Pinger Detection arrays deployed by Canadian investigators were capable of detecting and recording tagged fish. Automated Pinger Detection arrays deployed for this study were capable of detecting and recording Canadian tagged fish.
<b>Summary of Progress</b>	
Telemetry efforts on the Narraguagus River on wild fish concluded in 2005. Detailed analyses are ongoing and were presented at the 2nd International Symposium on Diadromous Fishes (18-21 June 2007, Halifax, Nova Scotia, Canada). A peer-reviewed manuscript is scheduled to be submitted for publication as part of the symposium proceedings.	

**Project No. U3****Status: Ongoing**

Party or relevant jurisdiction	United States of America
Title of project	Comprehensive evaluation of marine survival of hatchery-stocked smolts: Migration behaviour and success of Dennys River smolts
Objective of research project	1) evaluate migration speed and behaviour from lower river release sites through estuarine habitat 2) estimate survival of migrating smolts and identify areas where mortality may be occurring
Brief description of research project	An experimental evaluation of river-specific Atlantic salmon smolt stocking in the Dennys River was developed. The program is scheduled to run for a minimum of five years (2001-2006). Ultrasonic telemetry investigations were used to evaluate the migration success, nearshore marine mortality and nearshore migration routes of these stocked smolts. Approximately 50,000 smolts are released annually and, of these, approximately 70-150 fish are released with surgically implanted ultrasonic pingers.
Dates during which research will take place	April – June, 2001-2008. Data analysis and publication only in 2005-2008.
Area in which research will take place	Dennys River Cobscook Bay Gulf of Maine
Estimated number and weight of salmon to be retained	It is anticipated that no Atlantic salmon will be retained during this project.
<b>Resources</b>	
Estimated cost of the research project	Approximately £28,000 per annum (public funding)
Number of participating scientists	~3
Name and e-mail address of coordinating scientist in charge of project	James Hawkes James.Hawkes@noaa.gov
Details of research vessels, e.g. name, registration, call sign and description of vessel	Equipment deployed from small research boats and leased commercial vessels. Vessel use is subject to change annually.
Type and amount of gear and other equipment to be used	Ultrasonic Telemetry Tags (70-200 annually) Automated Pinger Detection Units (20-40 annually) Electro-fishing gear for juvenile assessments
Details of any collaborating countries	Automated Pinger Detection arrays deployed by Canadian investigators were capable to detecting and recording tagged fish. Automated Pinger Detection arrays deployed for this study were capable to detecting and recording Canadian tagged fish.
<b>Summary of Progress</b>	
<p>Ultrasonic telemetry efforts on the Dennys River were discontinued in 2005. Preliminary results suggest that emigrating smolts pass through the freshwater zone quickly, experiencing low mortality. However, once fish entered the near-shore environment, mortality markedly increased and large variations were observed in the timing of emigration. Low numbers of smolts were detected entering the Gulf of Maine. Detailed analysis and development of peer-reviewed manuscripts are ongoing.</p>	

**Project No. U4**

**Status: Ongoing**

Party or relevant jurisdiction	United States of America
Title of project	Comprehensive evaluation of marine survival of hatchery-stocked smolts: Dennys River smolt stocking assessment
Objective of research project	1) evaluate smolt-to-adult survival rates of Atlantic salmon smolts based on temporal and spatial patterns of release 2) determine optimal stocking levels to achieve stock rebuilding objectives
Brief description of research project	The Maine Atlantic Salmon Technical Advisory Committee (TAC) developed, and fishery managers supported, the experimental evaluation of river-specific Atlantic salmon smolts in the Dennys River for a minimum of five years (2001-2006). Stocking rates were developed based on retrospective analysis of Penobscot River stocking and adult return data during the period from 1973 to 1995. Model results indicated that a range of 32,000 (low) to 56,000 (high) would result in a 75% probability of achieving 2SW Atlantic salmon returns of at least 67 (low) or 117 (high) adults. Approximately 50,000 smolts will be released annually. All stocked fish will receive an elastomer mark and adipose fin clip to allow quantitative evaluation of survival in relation to release location and time. Returning adults will be enumerated and identified at a weir-based adult trap.
Dates during which research will take place	May – October, 2001-2008
Area in which research will take place	Dennys River Cobscook Bay Gulf of Maine
Estimated number and weight of salmon to be retained	It is anticipated that no Atlantic salmon will be retained during this project.
<b>Resources</b>	
Estimated cost of the research project	Approximately £14,000 per annum (public funding)
Number of participating scientists	~3
Name and e-mail address of coordinating scientist in charge of project	Greg Mackey greg.mackey@maine.gov
Details of research vessels, e.g. name, registration, call sign and description of vessel	None
Type and amount of gear and other equipment to be used	Elastomer Marks and Marking Equipment Rotary Screw Smolt Trap Weir-Based Smolt Trap Weir-Based Adult Trap
Details of any collaborating countries	Elastomer marks may be recovered during the NASCO international cooperative sampling programme at West Greenland.

**Summary of Progress**

Monitoring of hatchery-origin smolts on the Dennys River was performed from 2001 to 2005. Stocking groups of Visual Implant Elastomer marked smolts are released at different times and from different stocking sites. An adult weir trap is used to monitor the contribution of each stocking group. Preliminary results indicate extremely low numbers of returning adults have been documented, indicating very low marine survival levels. Analysis is ongoing.

**Project No. U5**

**Status: Ongoing**

Party or relevant jurisdiction	United States of America
Title of project	Evaluation of estuary and nearshore marine distributions of Atlantic salmon post-smolts in Penobscot Bay and the Gulf of Maine
Objective of research project	<ol style="list-style-type: none"><li>1) evaluate nearshore distribution and migration pathways of smolts and post-smolts</li><li>2) estimate the relative contribution of stocked hatchery smolts to overall post-smolt populations</li><li>3) evaluate the relative contribution of spatially and temporally distinct smolt releases on post-smolt populations</li><li>4) evaluate the physiological condition of post-smolts in marine environments</li></ol>
Brief description of research project	Synchronous declines in the survival of Atlantic salmon smolts throughout North America indicate a sharp decline in marine survival. Many investigators hypothesize that this decline occurs early in the marine phase, as Atlantic salmon smolts transition from freshwater to marine environments. A surface pelagic trawl survey was initiated in 2001 in the Penobscot Bay estuary and nearshore waters of the Gulf of Maine to sample hatchery- and naturally reared Atlantic salmon smolts in the marine environment. A Norwegian-designed pelagic net with a modified aquarium cod end is towed through the surface waters enabling live capture and release. Biological data including size, scale samples, genetic samples, physiology samples, and diet composition are collected from a subsample of fish.
Dates during which research will take place	May-June to 2008
Area in which research will take place	Penobscot Bay Gulf of Maine
Estimated number and weight of salmon to be retained	Although project objectives and methodology strive to minimize mortality of Atlantic salmon, immediate trawl and or sampling induced mortality is estimated to be approximately 5%.
<b>Resources</b>	
Estimated cost of the research project	Approximately £23,000 per annum (public funding)
Number of participating scientists	2
Name of coordinating scientist in charge of project	Tim Sheehan Tim.Sheehan@noaa.gov
Details of research vessels, e.g. name, registration, call sign and description of vessel	F/V Nobska and F/V Morue 30-m commercial trawler
Type and amount of gear and other equipment to be used	Post-smolt trawl Standard oceanographic instruments
Details of any collaborating countries	No direct collaboration

**Summary of Progress**

The post-smolt trawl survey in Penobscot Bay was conducted from 2001-2005 on an annual basis. Preliminary data have been compiled and are currently being analysed to estimate contribution by stocking group, survival estimates, emigration patterns of post-smolts, and feeding habitats in Penobscot Bay. Preliminary analyses of scale samples indicate a low proportion of naturally-reared fish among captured fish. Preliminary analyses also indicate that fall parr stocking may be contributing to a larger proportion of the smolt run than previously expected. Data from blood and gill samples collected are currently being analysed to assess the physiological status of Atlantic salmon post-smolts as they make the transition from fresh to marine waters. Detailed analysis and development of peer-reviewed manuscripts are ongoing.

**Project No. U6**

**Status: Ongoing**

Party or relevant jurisdiction	USA
Title of project	Cormorant harassment in the Narraguagus River/Narraguagus Bay
Objective of research project	To reduce predation on migrating Atlantic salmon smolts by excluding double-crested cormorants from the lower Narraguagus River and Narraguagus Bay, and to assess the efficacy of non-lethal predator exclusion as a means of reducing predation on migrating Atlantic salmon smolts.
Brief description of research project	<p>U.S. Department of Agriculture (USDA) Wildlife Services professionals will use non-lethal methods to exclude cormorants from the lower Narraguagus River and Narraguagus Bay. These professionals will use fire-cracker shells, “screamers”, and other non-lethal methods to displace foraging cormorants anywhere they are encountered within the study area. Effort will be focused within areas in which substantial amount of smolt mortality occurs.</p> <p>Observational data on the frequency and occurrence of cormorants in Narraguagus Bay during the smolt migration will also be collected. These data will be useful for comparing smolt movements with the occurrence of cormorants before, during, and after cormorant exclusion. USDA personnel will fill out a data sheet each day they are in the field. Additionally, cormorant abundance will be documented using two automated digital cameras.</p> <p>Telemetry arrays, already in place in the Narraguagus system, will allow us to assess the efficacy of the cormorant harassment by providing mortality data at each telemetry array.</p>
Dates during which research will take place	May-June 2005. This research will expand upon similar work that was done in May-June 2004. Data analysis and publication of findings in 2005-2008.
Area in which research will take place	Lower Narraguagus River, Estuary and Narraguagus Bay, Maine
Estimated number and weight of salmon to be retained	It is anticipated that no Atlantic salmon will be retained during this project.
<b>Resources</b>	
Estimated cost of the research project	£16,000 (public funding)
Number of participating scientists	Approximately five, representing Federal and State resource management agencies
Name and e-mail address of coordinating scientist in charge of project	James Hawkes James.Hawkes@noaa.gov
Details of research vessels, e.g. name, registration, call sign and description of vessel	N/A
Type and amount of gear and other equipment to be used	Small boat, digital cameras, shotguns with fire-cracker and screamer shells, laser.
Details of any collaborating countries	None

**Summary of Progress**

Cormorant harassment activities concluded in 2005 and analysis is being performed to determine what effect was observed as a result. Ultrasonic telemetry data collected during the harassment period is used to determine success of the project. Preliminary results suggest that emigrating smolts pass through the fresh water with a high rate of success. However, once fish enter the estuary, mortality increases, specifically during daylight hours. Detailed analysis and development of peer-reviewed manuscripts are ongoing.

## **Annex 2**

### **Inventory of Completed Research Projects relating to Salmon Mortality in the Sea**

## CANADA

<b>Party</b>	Canada
<b>Title</b>	Marine migration and survival of post-smolt Atlantic salmon from Bay of Fundy rivers
<b>Coordinating Scientist</b>	Gilles L Lacroix LacroixG@dfo-mpo.gc.ca
<b>Summary of Objectives</b>	Provide knowledge about marine habitat (migration routes and feeding grounds) used by salmon post-smolts from Bay of Fundy rivers. Determine the location, timing and extent of salmon post-smolt mortality at sea. Investigate the causes and mechanisms of marine mortality of salmon post-smolts. Provide information to fuel the recovery programme for inner Bay of Fundy salmon stocks.
<b>Year removed from inventory/completed</b>	2003
<b>Summary of Findings</b>	
<p>Atlantic salmon smolts were tagged in the spring of 2002 (n=378) and released from inner and outer Bay of Fundy rivers (241 inner bay, 137 outer bay). Two lines comprising 132 receivers (VR-2, Vemco Ltd.) were deployed for tracking inner and outer bay movements of post-smolt salmon. Data is being analyzed to publish in 2004.</p> <p>Field components of this post-smolt tracking project were completed in 2002. Results from the 1999, 2001, and 2002 tracking of tagged smolts were combined in an overall analysis which took place during 2003. The results of these analyses will be summarized in a series of manuscripts to be completed during 2004. At this stage, all results are preliminary. Results will be made available as soon as manuscripts have been completed and approved by the Department for submission and distribution.</p> <p>No resources were allocated to this project in 2003, and no resources will be allocated in 2004. The project represented the first phase of research to define the migration and early marine survival of post-smolts from rivers of the Bay of Fundy, and it has now been completed.</p> <p>Findings from this project will be made available as soon as the draft manuscripts are completed (in 2004) and they receive approval for submission and release. In the interim the summary of findings submitted last year can be used since no new research was conducted during 2003.</p>	

<b>Party</b>	Canada
<b>Title</b>	Distribution, health and condition of Atlantic salmon from Bay of Fundy rivers while at sea
<b>Coordinating Scientist</b>	Gilles L Lacroix LacroixG@dfo-mpo.gc.ca
<b>Summary of objectives</b>	Provide knowledge about marine habitat and health of salmon post-smolts from Bay of Fundy rivers. Investigate the causes and mechanisms of marine mortality of salmon post-smolts. Provide information to fuel the recovery programme for inner Bay of Fundy salmon stocks.
<b>Year removed from inventory/completed</b>	2004
<b>Summary of Findings</b>	
<p>Atlantic salmon <i>Salmo salar</i> post-smolts migrating through the Bay of Fundy and Gulf of Maine were surveyed and sampled in 2001-2003 by trawling in surface waters. Post-smolts were aggregated in several areas while in the Bay of Fundy and then dispersed over a broader area in the Gulf of Maine, and their distribution reflected major surface current patterns. There was considerable spatial and temporal overlap between migrating post-smolts and the herring fishery. Post-smolt origin (e.g., wild vs. hatchery, inner vs. outer Bay of Fundy) did not affect their distribution. The low density of post-smolts indicated that they were too scarce to form large schools that offer protection from pelagic predators. The recapture rate of marked post-smolts was higher for wild than for hatchery fish, but it was nil for wild fish from the salmon farming area. The health and condition of post-smolts was excellent; they had no bacterial or viral pathogens and no salmon sea lice. Environmental conditions and food supply apparently did not limit growth of post-smolts; new circuli on scales and their spacing indicated that growth at sea had started and was accelerating. Post-smolts had shifted to a pelagic foraging behaviour, feeding opportunistically on different prey depending on location; the main food items were amphipods, euphausiids, and fish larvae. Post-smolts of hatchery and wild origin consumed the same prey but the larger hatchery fish did so in much greater quantity than the wild post-smolts, possibly giving them a growth and survival advantage.</p> <p>A trawling survey for post-smolts was conducted 4-18 June 2003 in Canadian waters of the outer Bay of Fundy and northern Gulf of Maine. Catches (n = 42 post-smolts) were lower than in the previous two years, and only 24% of the post-smolts captured were wild. They were in good health and free of diseases and sea lice. Analyses of growth and feeding habits were completed. The observed distribution confirmed and extended the distribution and origin data obtained in 2002. Results from surveys conducted in 2001, 2002, and 2003 were combined in a manuscript, "Distribution, origin and health of Atlantic salmon post-smolts migrating through the Bay of Fundy and Gulf of Maine", that has been completed and will be submitted in 2004 pending Departmental approval.</p> <p>No resources will be allocated to this project in 2004. No marine survey will be conducted in 2004 for several reasons; the availability of ship time in the region is severely constrained because of a recent fire aboard the research vessel CCGS Alfred Needler, and the initial goals of the project have been met. The project is therefore considered as completed.</p> <p>The draft manuscript completed for this project will be made available when it receives Departmental approval for submission and release.</p>	

<b>Party</b>	Canada
<b>Title</b>	Marine migration and survival of post-smolt Atlantic salmon from the Saint-Jean River (Gaspé)
<b>Coordinating Scientist</b>	Julian Dodson julian.dodson@bio.ulaval.ca François Caron francois.caron2@mrnf.gouv.qc.ca
<b>Summary of Objectives</b>	Provide knowledge of the marine habitat (migration routes and feeding grounds) used by salmon post-smolts from Bay of Gaspé rivers. Determine the location, timing and extent of salmon post-smolt mortality at sea. Investigate the causes and mechanisms of marine mortality of salmon post-smolts.
<b>Year removed from inventory/completed</b>	Not previously included in the inventory. Completed in 2006.
<b>Summary of Findings</b>	
<p>Migration patterns of wild Atlantic salmon smolts were studied in a coastal embayment (consisting of a partially enclosed inner bay and an open outer bay) in the Gaspé peninsula of Québec, Canada.</p> <p>In 2005 and 2006, 24 and 30 smolts respectively were tagged with coded short-term internal ultrasonic transmitters, and their migration throughout the bay was monitored using an array of fixed hydrophones coupled with a characterization of the physical habitat (current and salinity). The migration patterns were complex, with some smolts taking a direct route through the coastal embayment and other smolts repeatedly changing direction over short spatial and temporal scales.</p> <p>Migration was mainly an active process involving an overall seaward (outward) migration in the face of an inward residual circulation. Smolt swimming direction, as determined from current velocity and smolt ground velocity, was predominantly seaward. Swimming direction was significantly more focussed towards the sea but swimming speed was less during inflowing currents than during outflowing currents. Similarly, swimming direction was significantly more focussed toward the sea but swimming speed was less during the night than during the day. Swimming direction was significantly more focussed towards the sea and swimming speed was greater when there was a positive salinity gradient (salinity increasing towards the sea) than when there was a negative salinity gradient. Exposure to more saline waters resulted in increased migration rates.</p> <p>These observations are consistent with the hypothesis that smolts exploit an innate compass to maintain a preferred bearing and that the speed and direction of swimming is controlled by salinity, residual circulation and the diurnal cycle.</p>	

<b>Party</b>	Canada
<b>Title</b>	Marine migration and survival of kelt Atlantic salmon from the Saint-Jean River (Gaspé)
<b>Coordinating Scientist</b>	François Caron francois.caron2@mrnf.gouv.qc.ca
<b>Summary of Objectives</b>	Provide knowledge of the marine habitat (migration routes and feeding grounds) used by salmon kelts from Bay of Gaspé rivers. Determine the location, timing and extent of kelt mortality at sea. Investigate the causes and mechanisms of marine mortality of salmon kelts. Provide information about migration routes used at sea, using code that can be detected by ASF project (see Fred Whoriskey project) at sea.
<b>Year removed from inventory/completed</b>	Not previously included in the inventory. Completed in 2007
<b>Summary of Findings</b>	
<p>Migration patterns of wild Atlantic salmon kelts were studied in a coastal embayment (consisting of a partially enclosed inner bay and an open outer bay) in the Gaspé peninsula of Québec, Canada. In 2006, 24 kelts were tagged during last week of April with coded short-term (3 months) internal ultrasonic transmitters, and their migration throughout the bay was monitored using an array of fixed hydrophones coupled with a characterization of the physical habitat (current and salinity). Kelts stayed for some days in the upper part of the estuary, staying mainly in a limited range. Migration was an active process involving an overall seaward (outward) migration in the face of an inward residual circulation. Kelt swimming direction, as determined from current velocity and kelt ground velocity, was seaward. Swimming direction was significantly more focussed towards the sea and swimming speed was rapid when there was a positive salinity gradient (salinity increasing towards the sea).</p>	

<b>Party</b>	Canada
<b>Title</b>	Tracking experimentally “escaped” farmed salmon
<b>Coordinating Scientist</b>	Fred Whoriskey asfres@nb.aibn.com
<b>Summary of objectives</b>	Determine the course tracks and fates of sonically tagged farmed salmon released in winter and spring
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	
<p>Winter and spring releases were conducted, although the winter releases were delayed due to unforeseen circumstances and fewer fish were tagged than planned. It appears that survival to exit the Passamaquoddy region to the open sea was higher for winter- than summer-release fish. Seal predation on spring-release fish was apparently heavier than on the winter fish. Some individuals were entrained by tidal currents and cycled within them post-release. Others moved rapidly out to sea. None of the tagged fish were detected entering any of the inner Bay of Fundy or Western Fundy rivers. Signals were found within the plume of the Pleasant River, Maine, in the vicinity of seal haul-out sites. It is not clear if the fish entered the rivers on their own or if the seals caught them elsewhere and defecated the tag in this region. The project is completed and a first paper submitted for publication.</p>	

<b>Party</b>	Canada
<b>Title</b>	Atlantic salmon distribution and abundance at sea
<b>Coordinating Scientist</b>	David Reddin ReddinD@dfo-mpo.gc.ca
<b>Summary of objectives</b>	(1) Determine the distribution and abundance of salmon, particularly post-smolts, in the Labrador Sea and northern Grand Banks; (2) collect biological, meristic, morphometric, and biochemical data on salmon; (3) investigate the relationship between salmon and prey by collecting stomach contents; (4) investigate the relationship between sea temperature and other oceanographic parameters and salmon abundance; (5) tag and release salmon in good condition.
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	
<p>Trip program was reduced due to the need to survey for scallops in St. Pierre-Miquelon area and due to Search and Rescue missions. The Norwegian surface trawl was successfully fished from the Templeman. In total, there were 9 trawl sets with only one salmon post-smolt capture. Comparative fishing with gillnets resulted in the capture of 60 post-smolts. Other species caught in the trawl included billfish, Atlantic mackerel, lantern fish, jelly fish, squid, and amphipods. Two drift net sets were completed in the Labrador sea. Forty-seven post smolt salmon and 11 adult salmon were caught with an average length of each set being approx. 16 hrs. Disease survey on 35 specimens indicated no pathogens present. This trip brings to a close at sea research in the Labrador Sea/Grand Banks area.</p>	

<b>Party</b>	Canada
<b>Title</b>	Integrated field and laboratory assessment of the effects of endocrine-disrupting substances on Atlantic salmon smolts
<b>Coordinating Scientist</b>	Wayne Fairchild Fairchildw@dfo-mpo.gc.ca
<b>Summary of Objectives</b>	This project was based on research conducted over three years under ESSRF/TSRI (DFO projects 95052 and 92548) funding which evaluated the effects of nonylphenol and other endocrine-disrupting substances on growth and survival of Atlantic salmon ( <i>Salmo salar</i> ) during and after smoltification. Concentrations of these compounds occurring presently in the environment have been shown to have endocrine-disruptive effects on fish in rivers and estuaries downstream of municipal sewage treatment works. The current research indicates estrogenic effects on fish at low 4-nonylphenol levels ( $\mu\text{g/l}$ -1 range) raises the potential that pesticide formulations containing nonylphenol ethoxylates and leaving residues in water may be capable of affecting fish due to the presence of nonylphenol ethoxylate degradation products (including 4-NP), and not necessarily due to the presence of the pesticide's active ingredient. Smoltification is a time of great stress for salmon, as they are changing physiologically and adapting to a new environment. Endocrine hormones play an integral part in the smoltification process. Additional stress or modification of endocrine function at this crucial life stage may pose problems for growth and survival of smolts as they enter salt water. This project moved the research out of the laboratory and considered population level effects on smolt survival to the adult stage in nature with survival of cohorts exposed to these compounds compared to those of controls.
<b>Year removed from inventory/completed</b>	2008
<b>Summary of Findings</b> In 2004, smolts were exposed to pesticides (herbicides and nonylphenol) while in fresh water, and subsequent growth and survival was measured in the aquarium at the St. Andrews Biological Station, St. Andrews, NB. In 2003 and 2004, smolts were exposed to nonylphenol and estrogen at the Marine Institute, on the Burrishoole River, County Mayo, Ireland, and were then released to the North Atlantic. Adults were monitored in the returns to the river and in the interceptions in the coastal fisheries. Results from both treatment years (2003 and 2004) indicate variable survival among years and a decrease in sea survival of a cohort exposed to nonylphenol relative to controls. Field operations are complete, data are still being verified and analysed. Publications: Jardine, T.D., MacLatchy, D.L., Fairchild, W.L., Chaput, G. and Brown, S.B. 2005. Development of a short-term in-situ caging methodology to assess long-term effects of industrial and municipal discharges on salmon smolts. <i>Ecotoxicology and Environmental Safety</i> , 62:331-340. Jardine, T.D., MacLatchy, D.L., Fairchild, W.L., Cunjak, R.A. and Brown, S.B. 2004. Rapid carbon turnover during growth of Atlantic salmon ( <i>Salmo salar</i> ) smolts in sea water, and evidence for reduced food consumption by growth-stunts. <i>Hydrobiologia</i> 527:63-75. Arsenault, J.T., Fairchild W.L., Maclatchy, D.L., Burridge, L., Haya, K. and Brown, S.B. 2004. Effects of water-borne 4-nonylphenol and 17 $\beta$ -estradiol exposures during parr-smolt transformation on growth and plasma IGF-I of Atlantic salmon ( <i>Salmo salar</i> L.). <i>Aquatic Toxicology</i> 66:255-265.	

<b>Party</b>	Canada
<b>Title</b>	Use of stable isotopes to assess long-term changes in marine trophic ecology of Atlantic salmon ( <i>Salmo salar</i> )
<b>Coordinating Scientist</b>	J. Brian Dempson dempsonb@dfo-mpo.gc.ca
<b>Summary of Objectives</b>	Examine long-term variability in the trophic ecology of Atlantic salmon using analyses of stable isotope signatures of carbon and nitrogen ( $\delta^{13}\text{C}$ ; $\delta^{15}\text{N}$ ) derived from archived scale samples. Changes in stable isotope signatures will be evaluated for evidence of Pauly's food web hypothesis and also in relation to variation in marine climate conditions in the north Atlantic over the past several decades. These analyses would contribute to further understanding of observed variability in abundance and survival of various stocks of Atlantic salmon.
<b>Year removed from inventory/completed</b>	2008
<b>Summary of Findings</b>	
<p>Paper presented at the American Fisheries Society Diadromous Fish Conference, June 2007. The manuscript (<i>Spatial and temporal variability in the trophic ecology of Atlantic salmon in the north Atlantic inferred from analyses of stable isotope signatures</i>) was submitted for publication in the conference proceedings, reviewed, and a revised version returned in February 2008 that addressed various referee comments.</p> <p>Previous investigations have established linkages between ocean climate conditions and variability in abundance or survival. However, one avenue not previously explored considers whether changes in marine food webs owing to ever increasing and unsustainable levels of exploitation on many marine species – the so called ‘fishing down marine food webs’ hypothesis – could influence survival and abundance of salmon as a result of shifts in trophic position or changes in energy flows. Since Atlantic salmon are opportunistic feeders during the marine life-history phase, the species lends itself well to studies associated with marine environmental conditions and food web interactions. We examined long-term variability in the trophic ecology of Atlantic salmon using analyses of stable isotope signatures of carbon and nitrogen (<math>\delta^{13}\text{C}</math> and <math>\delta^{15}\text{N}</math>). Signatures were extracted from the marine growth portion of scales of maiden one-sea-winter fish. Data were obtained from nine Canadian and one north European river (Teno) covering periods extending over three-to-four decades. Significant differences in <math>\delta^{13}\text{C}</math> and <math>\delta^{15}\text{N}</math> signatures were found to exist among rivers, as well as among years within rivers. Trends over time in either <math>\delta^{13}\text{C}</math> or <math>\delta^{15}\text{N}</math> signatures were evident in only a few situations thus providing little evidence of substantive changes in the trophic ecology of salmon in the North Atlantic. In addition, isotopic signatures were largely invariant in relation to variations in abundance or to various environmental measures characterizing ocean climate conditions in the North Atlantic.</p>	

<b>Party</b>	Canada
<b>Title</b>	Effective population size, gene flow and population structure of Atlantic salmon in Newfoundland and Labrador
<b>Coordinating Scientist</b>	Daniel E Ruzzante Daniel.ruzzante@dal.ca
<b>Summary of Objectives</b>	Objective was to estimate effective population sizes and connectivity (gene flow) among Atlantic salmon populations from Newfoundland and Labrador. Examined genetic variability in a suite of 14 microsatellite DNA loci among ca 3000 individuals from some 20 populations from around Newfoundland and from southern Labrador collected over the period of the last 5 decades starting in the 1950s to the present. The availability of extensive temporal samples allows for tests of changes in effective population size related to the declines and subsequent closure of commercial fisheries. Analyses provide information on the relationship between effective population size and gene flow. Also examining the genetic basis for phenotypic and life history differences by means of common garden experiments with salmon from two populations in Newfoundland.
<b>Year removed from inventory/completed</b>	2008
<b>Summary of Findings</b>	No summary provided.

## EUROPEAN UNION

<b>Party</b>	European Union
<b>Title</b>	SALMODEL Concerted Action - A co-ordinated approach towards the development of a scientific basis for management of wild Atlantic salmon in the north-east Atlantic
<b>Coordinating Scientist</b>	Walter Crozier walter.crozier@dardni.gov.uk
<b>Summary of objectives</b>	<ul style="list-style-type: none"> <li>- Improve our ability to set salmon conservation limits (CLs); addressing transportability and dynamic change issues, also taking into account underlying stock structure, and;</li> <li>- Examine methods of estimating pre-fishery abundance (PFA) for north-east Atlantic (NEAC) salmon stocks and to determine whether and how PFA estimates can be used to give catch advice.</li> </ul>
<b>Year removed from inventory/completed</b>	2003
<b>Summary of Findings</b>	
<ul style="list-style-type: none"> <li>- examined current models used to estimate PFA, including that used by ICES</li> <li>- assessed sensitivity of the ICES model to data types and variation, and tested assumptions of incorporation of natural mortality “m” into PFA models, this resulting in a change to the default value of “m” used at ICES</li> <li>- SALMODEL also evaluated the basis of the NEAC stock groupings being used in the catch advice process</li> <li>- evaluated options for developing a predictive PFA model from the historic time series employing environmental and other data, producing for the first time forecasts of PFA of southern European stocks at West Greenland</li> <li>- investigated predictive PFA models based on smolt production estimates/indices for the NEAC area</li> <li>- examined approaches for model validation and examined scales at which the various model types can be applied</li> </ul> <p>Further details are presented in NASCO document CNL(03)9.</p>	

<b>Party</b>	European Union - Denmark
<b>Title</b>	Estuarine migration of smolts in the Rivers Skjern Å (North Sea) and River Guden Å
<b>Coordinating Scientist</b>	Gorm Rasmussen gr@dfu.min.dk
<b>Summary of objectives</b>	
<b>Year removed from inventory/completed</b>	This project was not previously included in the inventory.
<b>Summary of Findings</b>	
<p>In Skjern Å estuary we have demonstrated very high smolt mortalities during two research seasons caused by cormorants (28 and 44%). European rivers and their floodplains are generally severely affected by human activity. As a consequence, both the water and the river habitat quality have been seriously degraded in numerous European rivers during the twentieth century. In Denmark less than 5% of the rivers have been left in a natural physical state. During the 1960s the lower part of River Skjern Å was regulated and adjacent bogs, ponds, marshes and meanders drained. In the beginning of the 1990s the Danish government decided to restore the River Skjern Å and its floodplain and in 2002 the River Skjern Nature Project was implemented. The project consisted of several parts, including returning the straight, regulated river back to its former meanders and introducing better hydraulic interaction between the river and its meadows. Before implementation of the restoration project the causes of mortality of wild salmon <i>Salmo salar</i> and trout <i>Salmo trutta</i> smolts in River Skjern Å and its estuary Ringkøbing Fjord were investigated in 2000. A follow-up comparable study was performed in the spring of 2002 after the majority of the project was implemented, aimed towards assessing the effect of the restoration project on the salmon and trout smolt runs. This study indicated that the river restoration had an indirect slightly negative effect on the smolt run, mediating bird predation within the river system. As also demonstrated in 2000, bird predation in the estuary had a major adverse effect on the smolt run and jointly the smolt mortality in the river and in the estuary may threaten a self-sustaining salmon population in River Skjern Å.</p> <p>In the River Guden Å and its estuary the migration of salmon smolts was investigated in 2002 and 2003 by acoustic telemetry.</p>	

<b>Party</b>	European Union - Ireland
<b>Title</b>	Assessment of the levels of the parasite <i>Lepeophtheirus salmonis</i> on Atlantic salmon post-smolts in salmon aquaculture bays along Ireland's western seaboard
<b>Coordinating Scientist</b>	Paddy Gargan paddy.gargan@cfb.ie
<b>Summary of objectives</b>	Determine whether sea lice from marine salmon farms are a contributory factor in increased marine mortality of salmon post-smolts migrating from bays with salmon aquaculture. Gather information on salmon post-smolt migration patterns.
<b>Year removed from inventory/completed</b>	2003
<b>Summary of findings</b>	No summary provided.

<b>Party</b>	European Union - Ireland
<b>Title</b>	Oceanic factors influencing marine survival of Irish salmon stocks
<b>Coordinating Scientist</b>	Niall O' Maoileidigh (Ireland) niall.omaileidigh@marine.ie Kevin Friedland (US) friedlandk@forwild.umass.edu
<b>Summary of objectives</b>	The programme was initiated in 1999 to: Provide information on marine survival at various stages of ocean migration.
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	
<p>Evidence was found that the level of marine recruitment of 1SW salmon is linked to growth during the marine residency, and that decreasing growth over the last 30 years explains the observed decrease in salmon recruitment. Furthermore, the work concludes that changes in climate in the northeast Atlantic have affected the salmon via bottom-up effect, by affecting the abundance, distribution and phenology of key zooplankton species in the northern North Sea and southern Norwegian Sea.</p>	

<b>Party</b>	European Union - Ireland
<b>Title</b>	Early distribution and migration of Atlantic salmon smolts off the west of Ireland
<b>Coordinating Scientist</b>	Niall O'Maoileidigh niall.omaileidigh@marine.ie
<b>Summary of objectives</b>	Test a new pelagic trawl in open waters off the Irish coast; train and familiarise technical and support staff on the operational development of the trawl for further surveys in 2008 and 2009; obtain samples of post-smolts for biological and genetic analyses; relate run timing, timing of migration, swimming speed, growth, etc to oceanographic parameters.
<b>Year removed from inventory/completed</b>	2008
<b>Summary of findings</b>	
A summary of the cruise and the catches of post-smolts was provided to NASCO in document CNL(07)35. Specific results from the genetic stock identification work will be available in April 2008.	

<b>Party</b>	European Union - Ireland
<b>Title</b>	Sustainable management of interactions between aquaculture and wild salmonid fish (EU SUMBAWS project – Irish component of project only)
<b>Coordinating Scientist</b>	Paddy Gargan paddy.gargan@cfb.ie Niall O'Maoileidigh niall.omaileidigh@marine.ie
<b>Summary of objectives</b>	To assess the efficacy of prophylactic treatments for salmon smolts migrating through aquaculture bays
<b>Year removed from inventory/completed</b>	2007
<b>Summary of Findings</b>	
Preliminary results – prophylactic-treated fish had statistically higher returns compared to non-treated controls.	

<b>Party</b>	European Union – United Kingdom (England and Wales)
<b>Title</b>	Salmonid migration and climate change
<b>Coordinating Scientist</b>	Andy Moore a.moore@cefas.co.uk
<b>Summary of objectives</b>	Describe and model the environmental factors affecting the migration of salmonids and investigate the effects of climate change on salmonid migration and survival both in fresh water and the sea
<b>Year removed from inventory/completed</b>	2005
<b>Summary of Findings</b>	
<p>The key objectives of the research were to describe and model the environmental factors affecting the migration of salmonids and to investigate the effects of climate change on salmonid migration and survival both in fresh water and the sea.</p> <p>The main findings of the research are as follows:</p> <p><i>Migratory behaviour of salmonid smolts and post-smolts</i></p> <ul style="list-style-type: none"> <li>• The migratory behaviour of the sea trout smolts in the River Fowey was similar to populations of both salmon and sea trout in other river systems in England and Wales.</li> <li>• Smolt emigration in the freshwater section of the river was correlated with increasing water temperature and increasing river flows although no particular threshold was evident for either environmental parameter.</li> <li>• There was a seasonal difference in the time that tagged smolts spent in the freshwater section of the river before entering the estuary. Fish released later in the season spent less time in the river before emigrating into coastal waters. As a result a significant proportion of the sea trout smolts migrated out of the estuary and into coastal waters during a 10-day period that coincided with a spring tide.</li> <li>• Migration through the estuary was principally on a spring ebb tide and in the region of the water column with the highest flows. This is energetically the most advantageous strategy for migration and resulted in the fish being moved rapidly out into coastal waters.</li> <li>• The smolts were pre-adapted in fresh water to the marine environment and as a result there was no requirement to spend long periods acclimating within the estuary during one of the most critical periods in the life-cycle of the sea trout.</li> <li>• A physiological requirement for smolts to leave fresh water and to enter the marine environment is likely to be the major stimulus initiating the emigration of sea trout smolts in spring.</li> <li>• In coastal waters salmon and sea trout post-smolts demonstrated active, directed swimming. Migratory behaviour was initiated when the direction of the prevailing tidal currents was suitable to assist the fish in rapid movement away from the estuary mouth and in the case of the salmon in the general direction of the principal feeding grounds in the Norwegian Sea.</li> <li>• The speed of migrating salmon over the ground was within the range 18-23 cm sec<sup>-1</sup>, which is similar to the migratory speeds recorded in studies on other salmon populations in UK river systems.</li> <li>• The physiological transformation of the emigrating fish to full smolt status was necessary for successful migration within the marine environment. Therefore any factors that operate within the freshwater environment to inhibit smoltification (e.g. contaminants or high water temperatures) or delay migration (e.g. estuarine barrages, amenity constructions) will reduce the survival of the post-smolts in the marine environment.</li> </ul> <p><i>Migratory behaviour of sea trout kelts</i></p> <ul style="list-style-type: none"> <li>• The post-spawning survival of the sea trout was relatively high and over 60% of the tagged kelts emigrated from fresh water and into the coastal zone.</li> </ul>	

- Seaward migration within fresh water was predominantly nocturnal and generally occurred in conjunction with increasing river discharge and rising water temperature. Post-spawning residency within the freshwater zone was highly variable between individuals, ranging from 4 days to over 2 months.
- Measurements of gill ATPase activity in fish sampled soon after spawning indicated that the fish were not yet physiologically adapted to migrate into saline conditions. However, the subsequent movement through the estuary and into coastal waters was rapid and the fish showed no evidence of a requirement to adapt to the increasing salinities. Physiological adaptation after spawning would therefore appear to be rapid prior to the onset of emigration.
- Migration through the estuary was predominantly nocturnal and occurred during an ebbing tide. This ebb tide form of transport is energetically the most favourable method of movement and migration at night would reduce the level of mortality from visual predators.
- Tagged trout were recorded returning to the river after a period at sea and, in the case of one individual, successfully spawned whilst still retaining the tag in the body cavity.
- The high return rates of tagged sea trout suggests that similar techniques using electronic data storage tags would permit longer-term studies such as the thermal habitat requirements of the sea trout in the marine environment.

#### ***Distribution of salmon in the sea***

- Attachment methods have been developed to allow data storage tags (DSTs) to be used as part of large-scale studies to determine the distribution of salmon in relation to marine environmental conditions. Existing DSTs can be placed within the body cavities of adult salmon for long-term monitoring of marine environmental conditions although the exteriorisation of the light sensor to permit the geographical position of the fish to be calculated would be necessary.
- A non-invasive technique for monitoring cortisol levels in tagged fish was developed in order to quantify the effect of electronic tag attachment to fish and their subsequent recovery. The technique measures the level of cortisol excreted into the water by individual tagged fish and allows the recovery rate of the fish to be assessed. The technique will be used to quantify the effects of tags on salmon prior to the long-term studies on the distribution and behaviour of salmon in the sea.
- Collaborative links have been developed with international organisations through the NASCO Working Group on International Cooperative Research held in Norway to study the factors regulating populations of salmon in the sea.
- CEFAS contributed to ***SALSEA – A marine research strategy to determine key factors affecting salmon survival at sea*** presented to the EU in 2004 for funding.
- Other opportunities have continued to be investigated for applying DSTs to salmon in the sea and a variety of approaches have been pursued through this project and related work programmes. These have included membership of the Lotek Wireless - Ocean Technology Fund Committee (funded by Lotek Wireless) and participation in the Census of Marine Life - Pacific Ocean Salmon Tracking Program.
- However, the cost of research programmes has been the main factor in preventing large-scale studies on salmon in the sea.

#### ***The impact of climate change on salmonids***

- A literature review was completed using the available models and scenarios of climate change and organised into a framework with which to predict the impact on the freshwater and marine environments and subsequent effects on populations of salmon and sea trout over the next 20 and 50 years.
- The climatic information on which the study was based was taken principally from the UK Climatic Impacts Programme (UKCIP) Technical Report 1 and from the NOAA-CIRES Climatic Diagnostics Center and the work on the North Atlantic Oscillation (NAO) by CEFAS, Lowestoft.
- In fresh water, the expected increases in winter temperature and precipitation will be greatest in

NW England and in Wales; the highest increase in summer temperatures will occur in SE England where there will be a corresponding reduction in summer and annual rainfall. Warming of rivers should be less than the 1-2°C anticipated for annual mean air temperatures. However, the warming of rivers in winter will probably be more significant for salmonids than increases at other seasons. The frequency of extreme events such as droughts and floods will increase. Increasing abstraction and reduced precipitation will increase the contaminant loading in many rivers and exacerbate their impact on salmonid populations.

- The warming of rivers by 1-2°C will accelerate embryonic and alevin development during the winter, and lead to earlier emergence of fry from the gravels.
- The consequential effects on survival and growth of later stages will depend on a synchronous phenological advancement of food organisms, plant growth and other requirements.
- Survival of eggs and alevins in upland rivers could be reduced should expected higher winter rainfall generate more frequent river spates resulting in wash-out of the embryos.
- Growth rates of salmonid parr will increase significantly as the result of a temperature rise of 1-2°C providing that there is a commensurate increase in their food resources.
- Faster growth could lower the mean age at which parr reach the smolt stage by about 1 year, increasing smolt production for a particular year-class. However, density-dependent regulation would regulate overall smolt production.
- Reduced river flows and lower water temperatures would inhibit or delay the emigration of smolts and their entry into coastal waters. Modification to the timing of the entry of smolts into the marine environment has been shown to affect survival and the return of spawning adults.
- Reduced flows will inhibit and delay the movement of adult spawning salmon into the freshwater environment. Increased temperatures will reduce the amount of suitable thermal habitat for returning salmon. Reproductive success and fecundity may be reduced at higher water temperatures.
- Increases in river flow will facilitate upstream spawning migration and assist the movement around obstacles such as weirs and barrages.
- There are major uncertainties regarding the impact of changes in climate within the marine environment. The various models and predictions indicate either small gradual rises in sea surface temperature, no significant changes, or even slight cooling in those regions occupied by salmon.
- Changes to sea surface temperature and oceanographic features such as currents may modify the distribution and abundance of key prey items of the post-smolts and adult salmon. A mis-match in prey availability during entry into the marine environment may reduce post-smolt survival and growth.
- Changes in sea surface temperatures (SST) will reduce the amount of suitable thermal habitat required for the suitable growth and development of salmon in the sea.
- Changes in oceanographic features such as shelf edge currents may compromise the bio-energetic requirements of the migrating fish and lower survival.

<b>Party</b>	European Union – United Kingdom (England and Wales)
<b>Title</b>	Impacts of agricultural contaminants on wild salmonids
<b>Coordinating Scientist</b>	Andy Moore a.moore@cefas.co.uk
<b>Summary of objectives</b>	Identify and describe the effects of environmental levels of agricultural pesticides on salmonid embryo survival, smolt emigration and marine survival and to model their potential impacts at the population level. In addition, the role of pheromones in sea trout biology was investigated in order to predict the effects of water quality on sea trout reproduction.
<b>Year removed from inventory/completed</b>	2005
<b>Summary of Findings</b>	
<p>The key objectives of the research were to identify and describe the effects of environmental levels of agricultural pesticides on salmonid embryo survival, smolt emigration and marine survival and to model their potential impacts at the population level. In addition, the role of pheromones in sea trout biology was investigated in order to predict the effects of water quality on sea trout reproduction.</p> <p>The main findings of the research are as follows:</p> <ul style="list-style-type: none"> <li>• Exposure of juvenile salmon during the parr-smolt transformation to environmentally relevant levels of the herbicide atrazine inhibited smoltification and reduced the ability of the fish to adapt to salt water conditions. Smolts exposed in fresh water to atrazine demonstrated low survival when transferred to seawater.</li> <li>• Exposure of juvenile salmon during the parr-smolt transformation to environmentally relevant levels of the herbicide atrazine inhibited or delayed downstream migratory behaviour during the spring.</li> <li>• Exposure of juvenile salmon during the parr-smolt transformation to mixtures of environmentally relevant levels of the herbicide atrazine and the endocrine-disrupting chemical 4-nonylphenol inhibited smoltification and reduced the ability of the fish to adapt to salt water conditions. Mixtures of the two contaminants operated synergistically to reduce survival when the fish were transferred to seawater.</li> <li>• Exposure of juvenile salmon during the parr-smolt transformation to mixtures of environmentally relevant levels of the sheep dip insecticides diazinon and cypermethrin had no significant effect on smoltification or reduced the ability of the fish to adapt to salt water conditions.</li> <li>• Exposure of juvenile salmon during the parr-smolt transformation to environmentally relevant levels of the brominated flame retardant PBDE inhibited smoltification and reduced the ability of the fish to adapt to salt water conditions. Smolts exposed in fresh water to PBDE demonstrated low survival when transferred to seawater.</li> <li>• The freshwater environment cannot be considered in isolation from the marine environment. The contaminants that juvenile salmon are exposed to within the freshwater environment can have a direct impact on their subsequent survival within the sea.</li> <li>• Exposure to environmentally relevant levels of the sheep dip insecticides diazinon and cypermethrin for a brief period during fertilisation inhibits or delays the timing of emergence of fry from the spawning gravel. Exposure to the insecticides also reduces the subsequent survival and development of salmonid fry.</li> <li>• Exposure of fertilised salmon and sea trout embryos to sediments containing environmentally</li> </ul>	

relevant levels of the sheep dip insecticides diazinon and cypermethrin reduces survival and inhibits or delays the timing of emergence of fry from the spawning gravel.

- The sea trout has a similar reproductive pheromone system to the Atlantic salmon and is likely to be affected by environmental contaminants in the same way and that has been previously shown for Atlantic salmon. The shared reproductive pheromone system may further explain the occurrence of hybridisation in certain sympatric populations.
- Exposure of mature male trout to mixtures of the pesticides diazinon and cypermethrin inhibited the ability of the fish to detect and respond to the reproductive priming pheromone Prostaglandin  $F_{2\alpha}$ . As a result there was no significant increase in the levels of milt that are required for successful reproduction.
- The life-cycle model developed in order to predict the potential effects of environmental contaminants on Atlantic salmon at the population level predicted that exposure to contaminants during fertilisation, smoltification and reproduction result in a significant decline in the number of returning adult fish, particularly in exploited stocks.

<b>Party</b>	European Union – United Kingdom (England and Wales)
<b>Title</b>	Impact of intensive in-river aquaculture on wild salmonids
<b>Coordinating Scientist</b>	Andrew Moore a.moore@cefas.co.uk
<b>Summary of objectives</b>	The main objective of the research is to describe the nature and extent of the impact of aquatic contaminants derived from intensive freshwater aquaculture (effluents, pesticides, antibiotics and hormones) on reproduction and migration of wild salmonids.
<b>Year removed from inventory/completed</b>	2007
<b>Summary of findings</b>	
<p>The study investigated the effects of trout farms (both rainbow trout farms and brown trout) on both reproduction and smoltification in Atlantic salmon. The research involved laboratory-based studies on the impacts of identified contaminants within the fish farm effluents on salmon reproduction, smoltification and the ability of smolts to adapt to sea water. In addition, field-based studies were carried out where both male salmon and salmon smolts were caged upstream and downstream of rainbow and brown trout fish farms to investigate the impact of the effluents on physiology and survival. The majority of the research was undertaken at an intensive rainbow trout farm on the River Test at Romsey and a brown trout farm at Netheravon on the River Avon. Additional studies were undertaken at a mixed rainbow/brown trout farm at Stockbridge on the River Test. The research has indicated that the effluents from fish farms can have significant impacts on Atlantic salmon particularly during sensitive life-history stages such as reproduction and smoltification. In addition, effluents from rainbow trout farms may also have a deleterious effect on the macro-invertebrate populations, which include many of the prey items of juvenile salmonids.</p>	

<b>Party</b>	European Union – United Kingdom (England and Wales)
<b>Title</b>	Modelling the bioenergetics of salmon migration
<b>Coordinating Scientist</b>	Douglas Booker dobo@ceh.ac.uk
<b>Summary of objectives</b>	The principal objectives of the research are to model the energetic requirements of salmon during their marine migrations and predict the effects of environmental and oceanographic changes on smolt growth and survival.
<b>Year removed from inventory/completed</b>	2007
<b>Summary of findings</b>	
<p>The aim of the research was to develop a numerical model for investigating potential changes in the growth and survival of Atlantic salmon during the marine phase arising from changes in smolt condition or oceanic conditions. A numerical model was designed to calculate growth and survival resulting from spatial and temporal patterns of physical oceanographic conditions, specifically ocean currents, sea surface temperature and prey availability. The results of the different modelling scenarios suggest that, during their oceanic phase, salmon may be capable of adapting to future climate change provided that their migration routes are not inherited and guided by cues other than temperature (e.g. celestial or wave patterns). However, the ability to predict the effects of climate change on salmon populations is limited by a lack of knowledge about migration behaviour, which in turn is due to the paucity of observations of salmon movements and growth in the open sea.</p>	

Party	European Union – UK (England and Wales)
Title	Cardiff Bay Fisheries Monitoring Programme
Coordinating Scientist	Peter Gough Peter.gough@environment-agency.wales.gov.uk
Summary of objectives	Assess the impact of Cardiff Bay barrage on salmon stocks of the rivers Taff and Ely.
Year removed from inventory/completed	2008
<b>Summary of Findings</b>	
No summary provided.	

<b>Party</b>	European Union – United Kingdom (Scotland) in collaboration with Norway and the Atlantic Salmon Trust
<b>Title</b>	Testing and development of Institute of Marine Research (IMR) Bergen, Norway, salmon trawl gear
<b>Coordinating Scientist</b>	Julian MacLean (Fishery Research Services) j.c.maclea@marlab.ac.uk Jens Christian Holst (IMR) jens.christian.holst@imr.no Dick Shelton (Atlantic Salmon Trust) freda.shelton@btopenworld.com
<b>Summary of objectives</b>	Test a prototype trawl developed by IMR, Bergen, Norway, which, rather than capturing post-smolts, records, by use of CCTV, their passage as they pass through an open-ended trawl net. A supplementary objective, dependent on the success of the gear trials, was to conduct a post-smolt survey at the shelf edge.
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	
<p>The trial of the modified pelagic trawl gear was a success with real-time footage of fish passing through the net being obtained and recorded. In total 178 post-smolts, one wild adult and one farmed adult salmon were observed. In addition, the supplementary aim of undertaking survey trawls on the shelf edge and collecting ancillary hydrographical information was also achieved.</p> <p>The successful survey along the shelf edge has shown that the trawl gear is a practical tool for investigating post-smolt distribution at sea. This is extremely relevant with respect to the SALSEA proposal. In summary there are three major advantages of the new gear. First, it is much more cost-effective than using normal pelagic trawls with cod ends. The new trawl can be towed for almost unlimited periods and the fish passing through the net can be observed via the camera link, negating the need to shoot and haul the net every hour or so. Thus, a much greater area of sea can be covered, greatly increasing the efficiency of collecting distribution information. Second, the new trawl provides a non-destructive way in which to observe the distribution of post-smolts. This is a major breakthrough given the high sea mortality rates currently impacting upon salmon in the sea. Third, it is now possible to link the distribution of individual, or shoals of, post-smolts, much more closely to the prevailing hydrographical conditions as the precise location of each observation can be recorded. This was not the case previously when normal pelagic trawls were used and the location of capture could only be recorded relative to the entire area of the particular trawl.</p> <p>While the trial was an undoubted success, there are some areas of development that need to be considered further in order to obtain the maximum benefits from the new trawl system. In particular, the conditions under which the gear was deployed were relatively calm (gale force 3 – 4) and thus the stability of the trawl requires testing under more testing conditions. In addition to a short FRS Internal Report by Julian MacLean, outlining the findings, an article written by Dr Richard Shelton has also been published in the Atlantic Salmon Trust Journal, Winter 2005-06.</p>	

## ICELAND

<b>Party</b>	Iceland
<b>Title</b>	Migration of smolts through the estuary of the River Ellidaar, Iceland
<b>Coordinating Scientist</b>	Sigurdur Gudjonsson Sigurdur.gudjonsson@veidimal.is
<b>Summary of objectives</b>	Monitor the migratory behaviour of smolts
<b>Year removed from inventory/completed</b>	2004
<b>Summary of Findings</b>	<p>The project is finished. A report has been written in Icelandic and further publication is intended. In brief: Smolts tagged with acoustic tags in the River Ellidaar, west Iceland, showed only a short migration delay in the estuary before migrating into the fjord and out into the open ocean.</p>

<b>Party</b>	Iceland
<b>Title</b>	Survival at sea of 1- and 2-sea-winter salmon in relation to oceanic conditions
<b>Coordinating Scientist</b>	Sigurdur Gudjonsson sigurdur.gudjonsson@veidimal.is
<b>Summary of Objectives</b>	Study the changes in the ratio of 1SW:2SW salmon in Iceland and relation of oceanic climate to fluctuation and annual number of salmon caught in rivers in Southwest Iceland.
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	
<p>The project was a part of MSc thesis, "Fluctuations in the rod catch of Atlantic salmon (<i>Salmo salar</i> L.) stocks in west Iceland in relation to oceanographic conditions in the north West Atlantic", submitted by Jorge Fernandes to the University of Iceland in 2006.</p> <p><b>Abstract</b>  Time-series of angler rod catch data (1960-2000) of Atlantic salmon (<i>Salmo salar</i>, L.) from a range of rivers in West Iceland were correlated with sea surface temperature (SST) and Continuous Plankton Recorder (CPR) records from the north-west Atlantic. The aim of the study focused on detecting temporal relationships, which may explain fluctuations in the rod catch indicative of changes in survival and attempt to explain the possible mechanisms of the interactions observed. The results provided indications that Icelandic salmon over-wintering areas are likely located in the Irminger-Iceland basin areas. Evidence of trophic effects of salmon that spend one winter at sea (1SW salmon), affecting their survival, was found. The results suggested that timing of migration of sea-migrating smolts, regulated by local environmental conditions, may also play a critical role by allowing smolts access to abundant resources in neighboring areas. The strength of warm Irminger sea water the year of smolt migration appears to determine the year class strength of 1SW salmon. For multi-sea-winter (MSW) salmon the results indicate that for the period 1960-1990 the year-class strength of MSW salmon was related to good survival of 1SW and possibly good feeding opportunities in the subsequent summer-autumn in the West Greenland. Strong correlations with large-scale environmental variability, in particular SST and parallel changes in zooplankton in time/areas most likely utilized by MSW salmon, indicate that regime shift and ecosystem imbalance in East-West Greenland may be the cause for the observed decline of MSW salmon.</p>	

<b>Party</b>	Iceland
<b>Title</b>	Variation in growth and return rates of Atlantic salmon from three Icelandic rivers
<b>Coordinating Scientist</b>	Thorkell Heidarsson thorkell@veidimal.is Thorolfur Antonsson thorolfur.antonsson@veidimal.is
<b>Summary of Objectives</b>	Increase knowledge of growth and environmental factors influencing return rates and in general life history of different salmon stocks in Iceland.
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	
<p>The project was a part of MSc thesis submitted by Thorkell Heidarson to the University of Iceland in 2005. The ocean growth of the Icelandic Atlantic salmon (<i>Salmo salar</i>).</p> <p><b>Abstract:</b></p> <p><b>Introduction:</b> Studies of smolt emigration, smolt characteristics and return rates indicate that environmental conditions during the sea phase is a key factor in explaining annual variation in rod catches of Atlantic salmon (<i>Salmo salar</i>) populations. In Iceland annual variation in stock size and catches of salmon are greater in the north and north-east than in the south and south-west and the variation in environmental conditions, such as temperature, shows a similar pattern. In the study, scales were used to analyse sea growth patterns of Atlantic salmon in three Icelandic rivers, Ellidaar (SW), Vestura (NW) and Vesturdalsa (NE).</p> <p><b>Methods:</b> Scales were sampled from rod catches during the years 1985-2001. Before studying the growth, two back calculation methods used for the growth estimation were validated utilizing a tagging/recapture program for sampling of smolt and adult scale. Sea growth parameters were compared among the populations and between two sea age groups. The relationship between growth and smolt emigration time as well as return rates was investigated. Finally, the relationship between sea-temperature and growth was studied and the correlation of those factors used to gain information on migration and whereabouts of the salmon during the sea phase.</p> <p><b>Results:</b> On average both back-calculation methods overestimated actual smolt lengths, but Dahl-Lea method gave better results. The freshwater spring growth was seriously underestimated from adult scales. The fact that the spring growth in adult scales was underestimated means that overestimation by back-calculation was actually less than if the spring area in the scale had been correctly determined. Extensive, but similar pattern of inter-annual variation in sea growth was found among the populations. Absolute post-smolt growth from the SW (Ellidaar) to the NE (Vesturdalsa). The opposite pattern was seen in the spring growth. The post-smolt growth in the sea age classes followed the same inter-annual pattern. The inter-annual pattern of second sea year growth was unrelated to post-smolt growth in the subsequent cohort. An inverse relationship was found between emigration day and post-smolt growth on a global scale. Post-smolt growth was positively related to return rates in one-sea-winter salmon from Vestura. Post-smolt growth correlated positively with sea temperature in areas near the home river in the months prior to the smolt run. In Ellidaar, correlations were seen between sea temperature and sea spring growth in coastal areas and in area further to the West on both sides of Southern Greenland.</p> <p><b>Discussion:</b> The results show that the Dahl-Lea method should be favoured over the Fraser-Lee method when back calculating salmon lengths, using scales. The fluctuations in sea growth observed in all three populations are likely results of annual variation in marine environmental conditions in the north-west Atlantic. It appears that the global components have stronger influence on these fluctuations than local factors. The results indicate that the two sea age classes are faced with similar</p>	

environmental conditions during their first year at sea implying that they are staying in the same area. Comparing the sea growth data and annual return rates suggests that mortality is highest in the beginning of the sea phase. The relationship found between sea temperature and post-smolt growth indicates that the salmon is staying in the sea near its home river during this initial period. The correlations found between sea temperatures and growth suggests that the Ellidaar salmon migrate to areas south and west of Greenland.

<b>Party</b>	Iceland
<b>Title</b>	Growth of Atlantic salmon in the River Hofsa, north-east Iceland, in relation to ocean and in-river conditions
<b>Coordinating Scientist</b>	Sigurdur Gudjonsson Sigurdur.gudjonsson@veidimal.is Sigurdur Mar Einarsson sigurdur.mar@veidimal.is
<b>Summary of objectives</b>	Investigate the use of salmon growth, back-calculated from scale samples, in relation to ocean conditions and the size and age composition of the salmon run.
<b>Year removed from inventory/completed</b>	2007
<b>Summary of Findings</b>	
The results are now being analysed and will be written up by the end of 2007.	

## NORWAY

<b>Party</b>	Norway
<b>Title</b>	Identification of salmon by geochemical signatures; further development and testing of methods
<b>Coordinating Scientist</b>	Peder Fiske peder.fiske@nina.no
<b>Summary of objectives</b>	<p>The main objectives of this project were to:</p> <ul style="list-style-type: none"> <li>• test if geochemical signatures are stable from year to year</li> <li>• test if geochemical signatures of salmon scale samples can be used to discriminate among fish from different rivers</li> <li>• develop analytical procedures (otolith core sampling, chemical and statistical analyses) for application of this method in ecological studies on Atlantic salmon.</li> </ul>
<b>Year removed from inventory/completed</b>	2003
<b>Summary of Findings</b>	
<p>Our initial results suggest that salmon parr from different rivers could be differentiated based on the composition of trace elements in their otoliths. However, we could not classify new samples taken at a different time to the correct rivers using the discriminant functions based on the first sample.</p> <p>This suggests that there are year to year variations in the chemical composition of the otoliths, and that if the method should be used to identify salmon of unknown origin one would need year-specific samples from the possible rivers of origin.</p> <p>The usefulness of the method to identify salmon from mixed-stock fisheries to the river of origin therefore seems limited.</p>	

<b>Party</b>	Norway
<b>Title</b>	Development of models to predict marine survival and return of salmon to Norway
<b>Coordinating Scientist</b>	Lars Petter Hansen l.p.hansen@nina.no
<b>Summary of objectives</b>	Identify and examine the feasibility of applying time-series of marine environmental data, ecoplankton productivity, productivity of pelagic fish and salmon life-history information for model development. Develop appropriate models.
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	
<p>A large amount of material of information on time series of hydrography, plankton production, biomass and condition of pelagic marine fish species and of salmon growth and survival indices (e.g. catches, estimated marine survival rates) has been analysed. A method to estimate the number of salmon entering the coast before exploitation (pre-fishery-abundance, or PFA) has been developed.</p> <p>Models were developed to forecast runs and PFA of 2- and 3SW salmon in years <math>i+1</math> and <math>i+2</math> based on the run of 1SW fish in year <math>i</math>. This approach is independent of smolt production. Models to forecast 1SW salmon were developed from environmental variables, plankton production and condition factor and biomass of herring. This approach is based on the assumption that the smolt production is the same every year. The precision of the forecasts were variable, lowest in south Norway and highest in north Norway. This has been the first approach to forecast salmon runs to Norway, and there is a significant potential to improve the predictions by further development of models. Important in this aspect is to maintain, improve and standardise the sampling of data so that the quality of appropriate time series would be less variable.</p>	

<b>Party</b>	Norway
<b>Title</b>	By-catch in pelagic fisheries as a population-regulating factor in wild salmon stocks
<b>Coordinating Scientist</b>	Jens Christian Holst jens.christian.holst@imr.no
<b>Summary of objectives</b>	<p>Concentrated migration paths of post-smolt Atlantic salmon of Norwegian and southern European origin have been described in the North-East Atlantic during the last 10 years. The post-smolts typically migrate northwards in the major slope currents outside the continental shelf in May-June with dispersal over large areas in the Norwegian Sea in July-August. One of the major migration paths described overlaps in time and geography with a pelagic trawl fishery for mackerel harvesting, in total, 50,000 tonnes a year during a short period of the summer. Based on preliminary observations made by the Institute of Marine Research (IMR) research vessels, there is good reason to believe that significant numbers of post-smolt salmon are caught in this fishery.</p> <p>Estimate the extent of such by-catch and, through cooperation with Russian scientists, develop management advice which could reduce by-catch of salmon while, at the same time, maintaining the catch rates in the mackerel fishery.</p>
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	No summary provided.

<b>Party</b>	Norway
<b>Title</b>	Sea lice as a population-regulating factor in Norwegian salmon: status, effects of measures taken and future management
<b>Coordinating Scientist</b>	Jens Christian Holst jens.christian.holst@imr.no
<b>Summary of objectives</b>	Sea lice are currently regarded as the major population-regulating factor in many Norwegian salmon and sea trout stocks, with documented mortality ranging up to over 95% in salmon. This project involves broad cooperation between the leading Norwegian institutions on sea lice/wild salmon interaction studies with the object of further clarifying the effects of sea lice on wild salmon populations, suggesting further actions and measures to reduce sea lice infections in wild salmon and developing alternative methods for critically affected stocks.
<b>Year removed from inventory/completed</b>	2006
<b>Summary of Findings</b>	No summary provided.

<b>Party</b>	Norway
<b>Title</b>	Distribution of salmon in relation to environmental parameters and origin in the North Atlantic - capture, tagging and release of salmon with data storage tags (DSTs)
<b>Coordinating Scientist</b>	Marianne Holm marianne.holm@imr.no
<b>Summary of objectives</b>	Investigate the temporal and spatial distribution of DST-tagged salmon in the Norwegian Sea and adjacent areas with special emphasis on: <ul style="list-style-type: none"> <li>- Spatial distribution and temperature preferences</li> <li>- Growth in relation to environmental parameters</li> <li>- Vertical distribution of salmon during day and night (relating to possibility of intercepting fisheries)</li> </ul>
<b>Year removed from inventory/completed</b>	2007
<b>Summary of Findings</b>	
<p>Within the framework of the Nordic project, 741 large post-smolts (October captures ) and 1-2SW salmon had been captured in the North Atlantic by January 2005. Of these, 478 were captured and 293 were tagged with DSTs and released north of the Faroes, 28 captured and 11 tagged and released south-east of Iceland and 225 captured and 109 tagged and released in the Norwegian Sea. By January 2005, 5 of the tagged fish released in the Norwegian Sea had been recaptured. Two were recaptured in the Namsen fjord in mid-Norway after 18 and 74 days respectively and around 500 km of travel (shortest distance). Another salmon was recovered in the Trondheim fjord in June 2004 after 48 days at sea and ~ 480 km of travel. The fourth recapture was made in the Surna river after 122 days and ~ 500 km. The fifth fish was taken in the river Åtran on the Swedish west coast. This fish had travelled around 1,400 km in 127 days. 5 adipose fin-clipped salmon were found, but none of them carried a microtag. Most fish captured in April 2004 in the Norwegian Sea had entered the sea as 1-2 year-old smolts. The scale material from the Faroese catch will be analysed in 2005. Genetic samples and scales have been taken from most of the fish. In 2003 and 2004 all released salmon had an additional external yellow numbered tag (T-bar anchor) attached under the dorsal fin. In September 2004 the recapture of one such tag was reported from Scotland; unfortunately, however, the DST was either removed with the viscera or it had grown out through the body wall and shed, because it was never found. In 2005 one might expect 1-2 recaptures from DST releases north of the Faroes in November 2004 and possibly also from the DST taggings performed in the Norwegian Sea in April 2004. Data have been analysed in 2005 and two publications are in preparation.</p>	

<b>Party</b>	Norway
<b>Title</b>	Temporal variation in abundance of the northern-most populations of Atlantic salmon with emphasis on the River Tana
<b>Coordinating Scientist</b>	Martin Svenning martin.svenning@nina.no
<b>Summary of objectives</b>	Examine the influence of ocean climate, predation, marine fisheries and smolt production on the abundance of salmon in the River Tana.
<b>Year removed from inventory/completed</b>	2007
<b>Summary of Findings</b>	No summary provided.

<b>Party</b>	Norway
<b>Title of project</b>	The importance of early marine feeding on the growth and survival of Atlantic salmon post-smolts in Norwegian fjords
<b>Coordinating scientist</b>	Bengt Finstad <a href="mailto:bengt.finstad@nina.no">bengt.finstad@nina.no</a>
<b>Summary of objectives</b>	Analyse spatial variation in early marine post-smolt feeding and growth along a north-south geographical scale; investigate how post-smolt feeding and growth is associated with timing of smolt descent, marine prey availability, parasite infection, fjord migration and abiotic factors
<b>Year removed from inventory/completed</b>	2008
<b>Summary of Findings</b>	No summary provided.

<b>Party</b>	Norway
Title of project	Distribution and ecology of post-smolts and salmon at sea
Name and e-mail address of coordinating scientist in charge of project	Marianne Holm marianne.holm@imr.no
<b>Summary of objectives</b>	Analyse age, growth and migratory paths in relation to environmental conditions and competitors so as to expand understanding of salmon marine life-history in order to explain observed variations in salmon survival.
<b>Year removed from inventory/completed</b>	2008
<b>Summary of Progress</b>	
No summary provided.	

<b>Party</b>	Norway
Title of project	Dispersal of salmon lice in Norwegian fjords
Name and e-mail address of coordinating scientist in charge of project	Karin Kroon Boxaspen karinb@imr.no
<b>Summary of objectives</b>	Estimate and describe to what extent free-living salmon lice larvae disperse from wild and farmed sources within and between areas.
<b>Year removed from inventory/completed</b>	2008
<b>Summary of Progress</b>	
No summary provided.	

<b>Party</b>	Norway, Scotland
<b>Title</b>	Experimental tagging programme for investigating the behaviour of escaped farmed salmon: pilot study
<b>Coordinating Scientist</b>	Lars Petter Hansen ( <a href="mailto:l.p.hansen@nina.no">l.p.hansen@nina.no</a> )
<b>Summary of objectives</b>	The objective was to examine migration of escaped large farmed salmon and to test if they are transported with the currents and appear in Norwegian waters.
<b>Year removed from inventory/completed</b>	Not previously included – reported in 2008
<b>Summary of Findings</b>	
<p>Farmed Atlantic salmon reared at Ardmair near Ullapool in Scotland and at Rognaldsvåg outside Florø in Norway were individually tagged with external Lea tags and released from the fish farms in the spring of 2006 (Ardmair: 678 with mean length of 719 mm; Rognaldsvåg: 597 with mean length of 721 mm). Most of the salmon were expected to be sexually mature the autumn of 2006.</p> <p>Five tags from the Scottish release (0.6% of the total number released) have been reported recaptured, one was found on a beach in Scotland a bit north of the release site. Another tag was found on a beach in Shetland. A tagged salmon from the same batch was recaptured on the in the Göta River on the west coast of Sweden, and another was recaptured at the outlet of the Hardangerfjord in south west Norway. The fifth one was recaptured at the Lofoten area in north Norway.</p> <p>Of the fish released from the Norwegian fish farm 42 have been recaptured (7 % of the number released). Most of the fish moved relatively quickly into nearby fjords and entered rivers there, only one individual moved a large distance, and was recaptured in the Drammenfjord in south east Norway.</p> <p>Salmon released from the Norwegian fish farm showed a much higher survival than the fish released at the Scottish farm and their migration pattern was very local. The migration pattern of the salmon released in Scotland can be explained by transport with the currents, and therefore some large salmon escaping from fish farms in this area in the spring may turn up in Norway and west coast of Sweden.</p>	

## RUSSIAN FEDERATION

<b>Party</b>	Russian Federation
<b>Title</b>	Assessment of by-catch of post-smolts of Atlantic salmon in pelagic fisheries in the Norwegian Sea
<b>Coordinating Scientist</b>	Boris Prischepa <a href="mailto:pboris@pinro.ru">pboris@pinro.ru</a> Alexander Zubchenko <a href="mailto:zav@pinro.ru">zav@pinro.ru</a> <a href="mailto:salmon@pinro.ru">salmon@pinro.ru</a>
<b>Summary of objectives</b>	Assess the occurrence of post-smolts in catches by Russian vessels engaged in the pelagic fisheries for mackerel, blue whiting and herring
<b>Year removed from inventory/completed</b>	2008
<b>Summary of Findings</b>	
<p>Results from surveys to map the distribution of post-smolts of Atlantic salmon in the Norwegian Sea conducted by IMR (Institute of Marine Research, Bergen, Norway) on a regular basis since 1995 (Holm et al., 2000) enabled WGNAS to conclude that areas of the distribution of post-smolts and mackerel in the Norwegian Sea in June-August overlap (ICES 2000/ACFM:13). Both species migrate in a surface layer: mackerel in the depth interval 0-50 m (ICES 2002/G:03), while post-smolts are found more frequently between 0 and 1 m (ICES 2002/ACFM:14). Targeted surveys conducted by IMR between 13 and 17 June 2001 in the Norwegian Sea in the vicinity of the area, where an intensive commercial fishery of mackerel took place later, showed simultaneous occurrence of mackerel and post-smolts in catches taken by the salmon survey trawl specifically designed for sampling post-smolts in the surface layer (ICES 2002/ACFM:14). Their findings gave rise to speculations that mackerel fishery in the Norwegian Sea in June-August can be viewed as the most precarious in terms of by-catch of post-smolts of Atlantic salmon.</p> <p>In the light of this, the Russian Federation carried out a programme in 2002-2006 to study the Atlantic salmon post-smolt potential by-catch in the Russian mackerel fishery in the Norwegian Sea.</p> <p>Scientific observers and fisheries inspectors worked onboard Russian fishing vessels that fished mackerel in the Faeroese fishing zone and international waters of the Norwegian Sea. Usually 2-5 Russian inspectors and 5-7 scientific observers stayed permanently onboard the vessels during the season. They checked licenses, logbooks, gear, catches and collected biological samples. Their tasks included also screening of the mackerel catch for potential by-catch of post-smolts and adult Atlantic salmon. The vessel's crew assisted in the work. The catches were screened immediately after retrieval of the trawl, during discharge of the fish into bins and at a ship factory during grading. All Russian trawlers had a factory and every single catch was graded onboard. The entire Russian commercial catch of mackerel was used for human consumption and most vessels froze and stored their products onboard. Consequently all catches were sorted and packed by species in standard boxes. Some of the vessels also produced canned fish. In all cases the catch was loaded from the trawl onto an accumulation conveyor at the vessel's factory immediately and sorted by the crew, which implied that the fish were handled more or less individually before packing or milling.</p> <p>Calculation of the ratio of total number of post-smolts per tonne of mackerel in the international zone gave an estimated of 0.0015 post-smolts per metric tonne captured in the commercial fishery in 2002, and 0.0003 in 2003. The ratio of total number of adults per 1 tonne of mackerel in the international zone was 0.0019 in 2002 and 0.0039 in 2003. No adult salmon or post-smolts were recorded in 2004. Like in 2002 and 2003 the results from 2005 and 2006 suggested very low numbers of post-smolts and adult salmon caught in the mackerel fishery in July-August in the Norwegian Sea.</p>	

Such a low by-catch could, apparently, be explained by two reasons: first, most post-smolts pass the international waters before a large-scale fishery of mackerel starts there, second, commercial pelagic trawl practically does not capture post-smolts, migrating very close to the surface, which can be attributed to both specific features of its design and fishing technique for mackerel, these include the overall size, towing speed, ratios of width to height and the mesh sizes used in the construction, particularly in the fore part of the net.

The main design parameter of concern is the mesh sizes used in the front part of the trawl. The mesh sizes range from 0.8 m for the salmon survey trawl up to 50 m for the largest commercial net. With a commercial pelagic trawl mackerel are fished in the 0-5 m layer and down to 50-70 m from the sea surface. Post-smolts inhabit the upper 10 m of the surface, which is only filtered by the section of the net with the largest meshes. It is thought that the smolts simply pass through the large meshes, while mackerel tend to dive in response to a vessel and are visually herded by the netting bars. The presence of significant quantities of post-smolts in the salmon survey trawl, which only covers the top 10 m of the surface and is designed specifically for the capture of post-smolts, supports this.

As regards the post-smolt run timing, it could be suggested, that the majority of post-smolts among those migrating with the western branch of the Norwegian current pass the international waters before a large-scale fishery of mackerel begins, it usually starts in July. In addition, as the map of distribution of post-smolts in the Norwegian Sea shows (ICES 2002/ACFM:14), the main route of post-smolt northward migration is to the east of the area where the fishery is prosecuted.

All said above suggests a conclusion that the pelagic fisheries in the Norwegian Sea and, of mackerel in particular, cannot be considered as a significant source of post-smolt mortality. This is also supported by assessments undertaken by ICES.

## USA

<b>Party</b>	United States of America
<b>Title</b>	Forecasts of Atlantic salmon transoceanic migration: climate change scenarios and anadromy in the North Atlantic
<b>Coordinating Scientist</b>	Kevin Friedland friedlandk@forwild.umass.edu
<b>Summary of objectives</b>	<ol style="list-style-type: none"> <li>1) develop and evaluate marine migration models for Atlantic salmon from North American and European stocks</li> <li>2) evaluate the potential effects of climate change on migration patterns for Atlantic salmon</li> </ol>
<b>Year removed from inventory/completed</b>	2005
<b>Summary of findings</b>	No summary provided.

<b>Party</b>	United States
<b>Title</b>	Stable isotope composition of Atlantic salmon scales
<b>Coordinating Scientist</b>	Kevin Friedland friedlandk@forwild.umass.edu
<b>Summary of objectives</b>	The objective of this study is to develop a retrospective time series of stable isotope ratios for the DPS in Maine and the mixed stock samples from the continental stock complex to evaluate the feeding patterns of the stocks over time.
<b>Year removed from inventory/completed</b>	2005
<b>Summary of findings</b>	No summary provided.