2004

REPORT OF THE TWENTY-FIRST ANNUAL MEETINGS OF THE COMMISSIONS

REYKJAVIK, ICELAND

7-11 JUNE 2004

NASCO, 11 Rutland Square, Edinburgh EH1 2AS, Scotland, UK
Tel: (Int+44) 131 228 2551, Fax: (Int+44) 131 228 4384, e-mail: hq@nasco.int

TABLE OF CONTENTS

REPORT OF THE

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OF THE

NORTH AMERICAN COMMISSION

7-11 JUNE 2004
REYKJAVIK, ICELAND

Chairman:	Mr Pierre Tremblay (Canada)
Vice-Chairman:	Mr George Lapointe (USA)
Rapporteur:	Ms Kimberly Blankenbeker (USA)
Secretary:	Dr Malcolm Windsor

NAC(04)10

CONTENTS

NAC(04)10

Report of the Twenty-First Annual Meeting of the North American Commission of the North Atlantic Salmon Conservation Organization 7-11 June 2004, Reykjavik, Iceland

1. Opening of the Meeting

1.1 The Chairman, Mr Pierre Tremblay (Canada), opened the meeting and welcomed the participants.

1.2 The Chairman invited opening comments from the Commission members. No statements were made. The Chairman opened the floor for comments by the NGO observers. Mr Chris Poupard (NGO Chairman) expressed regret that no North American NGOs could attend NASCO under the circumstances. He stated that NGOs could be an important asset to NASCO in developing a media campaign to raise public awareness about NASCO's activities.

1.3 A list of participants at the Twenty-First Annual Meeting of the Council and Commissions of NASCO is included on page 293 of this document.

2. Adoption of the Agenda

2.1 The agenda, NAC(04)11 (Annex 1), was adopted without modification.

3. Nomination of a Rapporteur

3.1 Ms Kimberly Blankenbeker (USA) served as rapporteur.

4. Election of Officers

4.1 The current Vice-Chairman, Mr George Lapointe (USA), was unanimously elected Chairman of the North American Commission for the next biennial period. Mr Guy Beaupré (Canada) was unanimously elected Vice-Chairman.

5. Review of the 2003 Fishery and ACFM Report from ICES on Salmon Stocks in the Commission Area

5.1 The representative of the ICES Advisory Committee on Fishery Management (ACFM), Dr Walter Crozier, reviewed the 2003 fisheries in the NAC area and presented scientific advice relevant to the Commission, CNL(04)9. The ACFM report, which contains the scientific advice relevant to all Commissions, is included on page 219 of this document. The presentation overheads are contained in document CNL(04)40.

5.2 The NAC members had no questions on the scientific advice. The Secretary asked why the status of eastern and western Atlantic salmon stocks originating from similar latitudes was so different. Dr Crozier explained that these fish exist in different marine environments in most cases. The exception is non-maturing 1SW fish off West Greenland, which are showing severe declines on both sides of the ocean.

6. Review and Discussion of the 2004 Canadian and US Salmon Management Measures as they relate to the Mandate of the Commission and to the Findings of the ACFM Report from ICES

6.1 A representative of the United States presented a report on US Atlantic salmon management and research activities in 2003, NAC(04)7 (Annex 2).

6.2 Representatives of Canada reviewed Canadian Atlantic salmon management measures for 2004, NAC(04)8 (Annex 3).

7. The St Pierre and Miquelon Salmon Fishery

7.1 The Chairman and the Parties welcomed the participation of the representative from France (in respect of St Pierre and Miquelon). The Chairman referred to two documents available concerning the fishery at St Pierre and Miquelon, CNL(04)26 and NAC(04)5. He noted that a comprehensive discussion of the St Pierre and Miquelon fishery had occurred during the first Council session. He recalled that France (in respect of St Pierre and Miquelon) had indicated its intent to continue its scientific study of the St Pierre and Miquelon fishery, including beginning a genetics study in 2004 with assistance from Canada. The representative of Canada confirmed that Canadian scientists had already been in contact with their counterparts in St Pierre and Miquelon to move ahead with the proposed genetics work.

7.2 The Chairman and the representatives of Canada and the United States expressed appreciation to the representative of France (in respect of St Pierre and Miquelon) for the increased collaboration with NASCO.

8. Salmonid Introductions and Transfers

8.1 The representative of Canada presented a report on the 2003/2004 activities of the NAC Scientific Working Group on Salmonid Introductions and Transfers, NAC(04)6 (Annex 4).

8.2 It was noted that revisions to the NAC Protocols had been pending for a number of years. To address this situation, the Parties agreed to include in the NAC Protocols an acknowledgement that the United States and Canada utilize different methods within their countries for the authorization of introductions and transfers. In Canada, the National Code on Introductions and Transfers of Aquatic Organisms is the mechanism for the approval of introductions and transfers.

8.3 The NAC members noted that there is a requirement for the Parties to report to the NAC annually on any decision made under their respective jurisdictions that has impact on the other jurisdiction. The Parties agreed to consult each other if they receive a proposal for an introduction or transfer that may have such an impact.

8.4 The NAC Working Group shall be convened in 2004 to prepare a revised version of the NAC Protocols to reflect these changes and review the Protocols in light of the Williamsburg Resolution and the latest developments in other areas such as fish health and stocking guidelines. The revision will be distributed to both Parties for review and comment. The United States and Canada will hold a bilateral meeting prior to the 2005 NASCO Annual Meeting to finalize the Protocols.

9. Impacts of Acid Rain on Salmon

9.1 Representatives of the United States and Canada presented a report on cooperative work between the two countries on acid rain, including the results of a workshop, jointly sponsored with the Atlantic Salmon Federation, held in April 2004, NAC(04)9 (Annex 5).

9.2 The Secretary questioned why it could take 50 years or longer to re-establish natural buffering capacities in some rivers. A representative of Canada explained that some watersheds have no buffering capacity left. When this is the case, it takes many years to recover that buffering capacity and for pH to be improved sufficiently. He explained that acid rain has a chronic impact in rivers of Southwest Nova Scotia where the geology does not provide sufficient buffering.

9.3 The Chairman asked how often pH levels in North American rivers are monitored. A representative of Canada replied that Canada used to have an acid rain programme that actively monitored Canadian rivers. This programme gave a good indication of impacted rivers. He noted that funding ended several years ago and, consequently, pH levels of Canadian rivers are no longer checked regularly.

9.4 A representative of the United States commented that, unlike in Southwest Nova Scotia, high acidity is not a chronic problem in the United States. The problem in Maine is more episodic following snow melt and heavy rains. Salmon rivers in the United States still maintain some natural buffering capacity. He also noted that the United States is making an effort to improve its water quality monitoring programme on rivers in Maine with Atlantic salmon populations.

9.5 The Parties welcomed the report and noted the value of the workshop. The representative of the United States stated that NASCO provides an excellent forum for information exchange on issues such as this one. Given the general interest in this matter and the wide-ranging expertise among members of NASCO, she endorsed the recommendation in NAC(04)9 to include acid rain on the Council agenda next year and into the future. The representative of Canada concurred. As recommended in NAC(04)9, the Parties also agreed to continue their cooperative work on acid rain issues and to report back to the NAC in 2005 on the progress of this cooperation, including the status of their pilot liming projects.

10. Sampling in the Labrador Fishery

10.1 The representative of Canada reported that the sampling programme in Labrador would continue in 2004. The representative of the United States noted the importance of this sampling programme and expressed appreciation to Canada for its continuance.

11. Announcement of the Tag Return Incentive Scheme Prize

11.1 The draw for the NAC prize in the NASCO Tag Return Incentive Scheme was made by the Auditor on 24 May 2004. The winning tag was of Canadian origin. The tag was applied on 31 August 2003, in the estuary of the Southwest Miramichi River at Millerton as part of a programme to estimate the number of adult salmon returning to the Miramichi River. It was recaptured in September or October 2003. The winner of the Commission's prize of $1500 was Mr Harry McSheffery of Moncton, New Brunswick, Canada. The Commission offered its congratulations to the winner.

12. Recommendations to the Council on the Request to ICES for Scientific Advice

12.1 The Commission reviewed the relevant section of document SSC(04)2 and agreed to recommend it to the Council as part of the annual request to ICES for scientific advice. The request to ICES, as agreed by the Council, is contained in document CNL(04)13 (Annex 6).

13. Other Business

13.1 The Chairman expressed his gratitude to the members of the Commission for another efficient and productive meeting. He also thanked the NASCO Secretariat and the Rapporteur for their hard work.

13.2 The Parties expressed their appreciation to Mr Tremblay for his excellent leadership of the Commission over the past four years. The Chairman noted that it had been his pleasure to serve.

13.3 There was no other business.

14. Date and Place of the Next Meeting

14.1 The Commission agreed to hold its next meeting at the same time and place as the Twenty-Second Annual Meeting of the Council, 6-10 June 2005, in Vichy, France.

15. Report of the Meeting

15.1 The Commission agreed a report of the meeting, NAC(04)10.

Note: The annexes mentioned above begin on page 15, following the French translation of the report of the meeting. A list of North American Commission papers is included in Annex 7 on page 53 of this document.

NAC(04)10

Compte rendu de la Vingt-et-unième réunion annuelle de la Commission Nord-Américaine de l'Organisation pour la Conservation du Saumon de l'Atlantique Nord, 7-11 juin 2004, Reykjavik, Islande

1. Séance d'ouverture

1.1 Le Président, M. Pierre Tremblay (Canada), a ouvert la réunion et souhaité la bienvenue aux délégués.

1.2 Le Président a invité les membres de la Commission Nord-Américaine à présenter leurs déclarations d'ouverture. Aucune déclaration n'a été faite. Le Président a lancé le débat en demandant aux ONG, présentes à titre d'observateurs, d'offrir leurs commentaires. Dans les présentes circonstances, M. Chris Poupard (Président des ONG) a déploré l'absence des ONG américaines à la réunion de l'OCSAN. Il a indiqué que celles-ci pourraient être d'une grande utilité à l'Organisation lors de l'élaboration de sa campagne médiatique ; l'objectif de cette campagne étant de sensibiliser le public aux activités de l'Organisation.

1.3 Une liste des participants à la Vingt-et-unième réunion annuelle du Conseil et des Commissions de l'OCSAN figure à la page 293 de ce document.

2. Adoption de l'ordre du jour

2.1 L'ordre du jour, NAC(04)11 (annexe 1), a été adopté sans modification.

3. Nomination d'un Rapporteur

3.1 Ms Kimberly Blankenbeker (Etats-Unis) a rempli le rôle de Rapporteur.

4. Election des membres du comité directeur

4.1 Le Vice-président, M. George Lapointe (Etats-Unis), a été élu Président de la Commission Nord-Américaine, à l'unanimité, pour les deux années suivantes. M. Guy Beaupré (Canada) a été élu, à l'unanimité, Vice-président.

5. Examen de la pêcherie de 2003 et rapport du CCGP du CIEM sur les stocks de saumons dans la zone de la Commission

5.1 Le représentant du Comité Consultatif sur la Gestion des Pêcheries (CCGP) du CIEM, Dr Walter Crozier, a passé en revue les pêches effectuées en 2003 au sein de la zone de la Commission Nord-Américaine (CNA). Il a également présenté les recommandations scientifiques pertinentes à la Commission, CNL(04)9. Le rapport du CCGP du CIEM qui présente les recommandations scientifiques intéressant l'ensemble des Commissions, figure à la page 219 de ce document. Le document CNL(04)40 regroupe les diapositives projetées au cours de la présentation.

5.2 Les membres de la Commission Nord-Américaine n'ont posé aucune question sur les recommandations scientifiques. Le Secrétaire a demandé pourquoi il y avait une telle divergence entre l'état des stocks de saumons atlantiques de l'est et l'état des stocks de saumons atlantiques de l'ouest, alors qu'ils provenaient de latitudes similaires. Dr Crozier a expliqué que ces poissons séjournaient, dans la majorité des cas, dans des milieux marins dissemblables, à l'exception des poissons 1HM non matures au large du Groenland occidental. Ceux-ci avaient en effet souffert d'un déclin notable des deux côtés de l'océan.

6. Examen et Discussion des mesures de gestion du saumon, proposées pour l'an 2004 par le Canada et les Etats-Unis, dans le cadre du mandat de la Commission et des conclusions offertes par le rapport du CCGP du CIEM

6.1 Un représentant des Etats-Unis a présenté un rapport sur la gestion du saumon atlantique des Etats-Unis en 2003 et sur les activités de recherche effectuées au cours de la même année, NAC(04)7 (annexe 2).

6.2 Des représentants du Canada ont présenté les mesures de gestion du saumon atlantique proposées pour 2004 par le Canada, NAC(04)8 (annexe 3).

7. Pêcherie de saumons à Saint-Pierre et Miquelon

7.1 Le Président et les Parties ont accueilli favorablement la participation du représentant de la France (pour Saint-Pierre et Miquelon). Le Président s'est reporté à deux documents, à la disposition des délégués, concernant la pêcherie à Saint-Pierre et Miquelon, CNL(04)26 et NAC(04)5. Il a fait remarquer qu'un débat approfondi sur cette question avait eu lieu au cours de la première séance du Conseil. Il a rappelé que la France (pour Saint-Pierre et Miquelon) avait exprimé l'intention de continuer son étude scientifique de la pêcherie à Saint-Pierre et Miquelon, et, notamment, de lancer une étude génétique en 2004, avec l'assistance du Canada. Le représentant du Canada a confirmé que les scientifiques canadiens avaient déjà contacté leurs homologues à Saint-Pierre et Miquelon afin de faire avancer la proposition du travail génétique.

7.2 Le Président et les représentants du Canada et des Etats-Unis ont exprimé leur reconnaissance au représentant de la France (pour Saint-Pierre et Miquelon) pour la coopération accrue de la France avec l'OCSAN.

8. Introductions et transferts de salmonidés

8.1 Le représentant du Canada a présenté un rapport sur les activités de 2003-2004 du Groupe de travail scientifique de la Commission Nord-Américaine, chargé de la question des introductions et transferts, NAC(04)6 (annexe 4).

8.2 Il a été noté que la révision des protocoles de la NAC était restée en suspens depuis plusieurs années. Pour remédier à cette situation, les Parties ont convenu d'inclure, dans les protocoles de la NAC, la reconnaissance des différentes méthodes employées par les Etats-Unis et le Canada pour autoriser, dans leur pays respectif, les introductions et transferts. Au Canada, l'approbation des introductions et transferts était soumise au Code National régissant les Introductions et transferts d'organismes aquatiques.

8.3 Les membres de la NAC ont accepté qu'il importait que les Parties rendent compte, chaque année, des décisions prises dans leur juridiction respective ayant un impact sur l'autre juridiction. Les Parties ont convenu de se consulter les unes les autres si elles recevaient une proposition d'introduction ou de transfert qui pourrait avoir une répercussion de ce genre.

8.4 Le Groupe de travail de la NAC se réunira en 2004 pour préparer un texte amendé des protocoles de la NAC qui tiendra compte de ces changements. Le Groupe de travail réétudiera également les protocoles à la lumière de la Résolution de Williamsburg et des tous derniers développements enregistrés dans d'autres domaines, tel que celui de la santé des poissons ou des lignes directrices de repeuplement. Le texte révisé sera alors distribué aux deux Parties pour étude et commentaires. Les Etats-Unis et le Canada organiseront ensuite une réunion bilatérale, en avance de la Réunion annuelle de l'OCSAN de 2005, pour finaliser le texte des Protocoles.

9. Effets nuisibles des pluies acides sur le saumon

9.1 Les représentants des Etats-Unis et du Canada ont présenté un rapport sur le travail effectué en coopération par les deux pays sur les pluies acides. Ce rapport comprend les conclusions d'un atelier, co-sponsorisé par la Fédération du Saumon Atlantique, qui eut lieu en avril 2004, NAC(04)9 (annexe 5).

9.2 Le Secrétaire a demandé pourquoi, dans certaines rivières, il fallait 50 ans ou plus pour rétablir les capacités de tampon naturelles. Un représentant du Canada a expliqué que certaines lignes de partage des eaux n'avaient plus de capacité tampon. Dans ce cas, il fallait plusieurs années pour récupérer cette capacité et pour noter une amélioration suffisante du pH. Il a expliqué que les pluies acides avaient un effet nuisible chronique dans les rivières du sud-ouest de la Nouvelle-Ecosse où la géologie ne fournissait pas suffisamment de tampon.

9.3 Le Président a demandé avec quelle régularité on contrôlait les niveaux de pH dans les rivières Nord-américaines. Un représentant du Canada a répondu que le programme contre les pluies acides, que le Canada opérait autrefois, avait permis de surveiller activement les rivières canadiennes. On avait ainsi réussi à identifier clairement les rivières touchées. Il a ajouté, toutefois, que le financement de ce programme avait cessé il y a quelques années et que, par conséquent, les niveaux de pH des rivières canadiennes n'étaient plus vérifiés régulièrement.

9.4 Un représentant des Etats-Unis a indiqué, que contrairement au sud-ouest de la Nouvelle-Ecosse, il n'existait pas de problème chronique de haute acidité aux Etats-Unis. Le problème au Maine était plus épisodique et avait lieu après la fonte des neiges et les grandes pluies. Les rivières à saumons des Etats-Unis présentaient toujours une capacité de tampon naturelle. Il a également signalé que les Etats-Unis s'efforçaient à améliorer leur programme de contrôle de la qualité de l'eau dans les cours d'eau du Maine abritant des populations de saumons atlantiques.

9.5 Les Parties ont accueilli favorablement le rapport et ont pris note de l'utilité de l'atelier. Le représentant des Etats-Unis a avancé que l'OCSAN était un excellent forum facilitant l'échange d'informations sur les questions telles que celle des pluies acides. Etant donné l'intérêt général que ce sujet soulevait, et le large éventail de compétences existant parmi les membres de l'OCSAN, elle a approuvé les recommandations contenues dans NAC(04)9 qui visaient à inclure les pluies acides à l'ordre du jour de l'année prochaine et des années à venir. Le représentant du Canada a appuyé cette décision. Conformément aux recommandations du document NAC(04)9, les Parties ont également convenu de continuer à œuvrer en coopération sur la question des pluies acides et de rendre compte à la NAC, en 2005, des progrès réalisés, notamment en ce qui concernait le stade où se trouveraient leurs projets pilotes de chaulage.

10. Echantillonnage au Labrador

10.1 Le représentant du Canada a indiqué que le programme d'échantillonnage au Labrador continuerait en 2004. Le représentant des Etats-Unis a noté l'importance de cette initiative et a exprimé sa reconnaissance au Canada pour la continuation de ce programme.

11. Annonce du Prix du Programme d'encouragement au renvoi des marques

11.1 Le tirage au sort du prix de la Commission Nord-Américaine du Programme d'encouragement au renvoi des marques de l'OCSAN fut effectué par le vérificateur des Comptes au Siège social de l'Organisation, le 24 mai 2004. La marque gagnante était d'origine canadienne. La marque, posée sur un saumon dans l'estuaire de la rivière Miramichi du sud-ouest, à Millerton, le 31 août 2003, faisait partie du programme visant à estimer le nombre de saumons adultes qui revenaient dans cette rivière. Elle fut recouverte en septembre ou octobre 2003. M. Harry McSheffery de Moncton, au Nouveau-Brunswick a remporté le prix de la Commission de 1 500 dollars. La Commission a félicité le gagnant.

12. Recommandations au Conseil en matière de recherches scientifiques dans le cadre de la demande adressée au CIEM

12.1 La Commission a examiné les sections pertinentes du document SSC(04)2 et a convenu de les recommander au Conseil dans le cadre de la demande annuelle de recommandations scientifiques adressée au CIEM. La demande de recommandations scientifiques adressée au CIEM et approuvée par le Conseil figure dans le document CNL(04)13 (annexe 6).

13. Divers

13.1 Le Président a exprimé sa gratitude aux membres de la Commission pour une réunion, qui s'était avérée, encore une fois, efficace et productive. Il a également remercié le Secrétariat de l'OCSAN et le Rapporteur pour leur travail ardu.

13.2 Les Parties ont exprimé leur gratitude à M. Tremblay pour son excellente direction de la Commission au cours des quatre dernières années. Le Président a répondu qu'il avait été un plaisir d'offrir ses services en cette capacité.

13.3 Aucune autre question n'a été traitée.

14. Date et lieu de la prochaine réunion

14.1 La Commission a convenu de tenir sa prochaine réunion en même temps (soit du 6 au 10 juin 2005), et au même endroit (Vichy, France) que la Vingt-deuxième réunion annuelle du Conseil.

15. Compte rendu de la réunion

15.1 La Commission a accepté le compte rendu NAC(04)10 de la réunion.

Note: Une liste des documents de la Commission Nord-Américaine figure à l'annexe 7, à la page 53 de ce document.

ANNEX 1

NAC(04)11

Twenty-First Annual Meeting of the North American Commission Radisson SAS Saga Hotel, Reykjavik, Iceland 7-11 June, 2004

Agenda

1. Opening of the Meeting

2. Adoption of the Agenda

3. Nomination of a Rapporteur

4. Election of Officers

5. Review of the 2003 Fishery and ACFM Report from ICES on Salmon Stocks in the Commission Area

6. Review and Discussion of the 2004 Canadian and US Salmon Management Measures as they relate to the Mandate of the Commission and to the Findings of the ACFM Report from ICES

7. The St Pierre and Miquelon Salmon Fishery

8. Salmonid Introductions and Transfers

9. Impacts of Acid Rain on Salmon

10. Sampling in the Labrador Fishery

11. Announcement of the Tag Return Incentive Scheme Prize

12. Recommendations to the Council on the Request to ICES for Scientific Advice

13. Other Business

14 Date and Place of the Next Meeting

15. Report of the Meeting

ANNEX 2

North American Commission

NAC(04)7

Report on US Atlantic Salmon Management and Research Activities in 2003

NAC(04)7

Report on US Atlantic Salmon Management and Research Activities in 2003

Adult Returns

In 2003, there were a total of 1,396 documented adult Atlantic salmon returns to US rivers; 43.5% more than observed in 2002. The inclusion of estimated returns using redd counts improves this number slightly to 1,436 total returns. Most documented returns (1,112) occurred in the Penobscot River (Maine), which accounted for 77% of the total US returns. Returns to other New England rivers were as follows: Merrimack (145), Connecticut (43), Saco (39), Narraguagus (21), Dennys (9), and less than five returns to each of the remaining rivers. The estimated combined returns to the eight Maine rivers that comprise the endangered distinct population segment (DPS) ranged from 61 to 86 fish, or twice the observed returns for 2002. These estimates for DPS rivers were obtained through a redd-return regression model developed specifically for these rivers. The majority of US returns (89%) were of hatchery-smolt origin, with the remaining 11% as the products of natural spawning or hatchery-fry stocking.

Stock Enhancement Programmes

During 2003, approximately 13,060,600 juvenile salmon were released into 17 river systems in the US. The majority (91.3%) were released as fry into the Connecticut (7.1 million), Merrimack (1.3 million), Saco (0.5 million), and Penobscot (0.7 million) rivers. The 375,000 parr released in 2003 were by-products of smolt production programmes. Smolts were stocked in the Penobscot (547,300), Merrimack (50,600), Connecticut (90,100), Saco (3,200), Dennys (55,200), Pawcatuck (5,200), and St. Croix (3,200) rivers. In addition to juveniles, 4,671 adults (spent/excess broodstock) were released into US rivers to support recreational fisheries where angling is permitted. Egg sources for US salmon culture programmes included sea-run salmon, captive salmon (collected as parr, grown to maturity in hatcheries), domestic broodstock (all lifestages completed within hatcheries), and reconditioned sea-run kelts.

Tagging and Marking Programmes

Tagging and marking programmes facilitated the following research and assessment programmes: 1) identifying the life stage and location of stocking, 2) evaluating juvenile growth and survival, 3) assessing in-stream adult and juvenile movement, and 4) assessing estuarine smolt movement. A total of 502,866 salmon released into US waters in 2003 were tagged or marked using the following types: Floy, Carlin, Passive Integrated Transponder (PIT), radio/ultrasonic, Visual Implant Elastomer (VIE), and fin clips. Approximately 63% of tagged/marked individuals were released into the Penobscot River watershed, 18% into other Maine rivers, 18% into the Connecticut River watershed, and 1% into the Merrimack River watershed.

Description of Fisheries

Commercial and recreational fisheries for sea-run Atlantic salmon are closed in US waters, including freshwater systems, coastal/estuarine systems, and marine waters within the US Exclusive Economic Zone (EEZ). Any incidental catch must be released immediately, alive and uninjured, without being removed from the water. Despite this policy and regulations, there was likely an illegal harvest of five 2SW salmon during 2003. The section of river where this poaching occurred was subsequently closed to all fishing. A controlled recreational fishery for 1,959 stocked adults (spent/excess broodstock) occurred in the Merrimack River during 2003.

Commercial Aquaculture Production

Production of Atlantic salmon by the aquaculture industry in Maine was 6,435 metric tonnes (t) in 2003, a 5% decrease from the 6,804 t produced in 2002. Production in each of the last two years has been approximately half of the 13,154 t produced in 2001. Only 2.5 million smolts were commercially stocked in 2003, compared to almost 4 million in 2002 and 2001. In 2003, the Maine salmon farming industry suffered many setbacks including ISA outbreaks, harmful algal blooms and "superchill" which greatly affected production. ISA outbreaks in June 2003, following 13 months of negative surveillance, were found at two Cobscook Bay sites in Maine. The Maine Department of Marine Resources established new regulations and a Bay Management Programme for Cobscook Bay to address fish health issues, including single year class stocking and site allocation, which contributed to an overall decrease in smolt stocking for the Maine industry.

Habitat Conservation, Enhancement, and Restoration

- The Penobscot River restoration project, announced in October 2003, could result in significantly improved access to over 800 kilometers of habitat for sea-run fish previously blocked by hydropower facilities. This large-scale cooperative effort will re-balance the hydropower production and ecological integrity of the entire Penobscot River system. Cooperators on the project include conservation groups, Tribal groups, hydropower operators, and State/Federal agencies. If sufficient funding is obtained, two major dams (Veazie and Great Works) will be removed and a fish passage channel will be installed at the existing Howland dam. Additionally, upgraded fish passage facilities will be installed at four other hydroelectric facilities. Implementation of this project could occur between 2006 and 2010.
- The Silk Mill dam on Yokum Brook in the Connecticut River watershed was removed in 2003. Two additional dams in this watershed (West Swanzey dam and Fiske Mill dam) on the Ashuelot River, continue to be evaluated for possible removal.
- The New Hampshire River Restoration Task Force continues to work towards identifying dams for removal in the Merrimack River watershed. The Badger Mill dam on the Winnipesaukee River was breached during the fall of 2003.
- A cooperative study of fish passage, habitat connectivity, and non-point source pollution began on Maine Rivers during 2003. This project includes the evaluation of the effects of various structures (bridges, culverts, etc.) on flow, passage, etc. and to recommend improvements where needed.

- The Instream Flow Incremental Methodology (IFIM) study on the Dennys River in 2002 has resulted in the adjustment of water releases at the Meddybemps dam during 2003 to more effectively manage the system's flow regime to benefit salmon.
- In December 2003, a permanent conservation easement of 18,443 acres was established within the riparian zone of the Machias River and several tributaries. A land management plan was also developed for recently acquired land along the Dennys River.
- An effort to mitigate the impacts of acidification on salmon in Maine rivers has been initiated by NOAA-Fisheries. Long-term data in the Northeastern US and Canada has demonstrated that acid deposition has reduced the buffering capacity of many rivers and their watersheds to the point where the low pH, and associated toxicity of aluminum, may be a significant mortality factor of emigrating smolts. In April 2003, a water chemistry enhancement (liming) committee was formed, with representation from various state/federal agencies, universities, and other experts in this field, to serve as an advisory group for the pilot liming project. During 2003, the committee reviewed existing water chemistry data and habitat features of the Dennys, Pleasant, and Narraguagus Rivers for the optimal location of the project and ultimately decided on the Dennys River. The decision of the committee to implement a pilot liming project that will restore a section of the Dennys River's buffering capacity lost to acidification has been reinforced in the NRC report (see *Additional Items of Interest*, below) as a recommended tool towards salmon recovery. The committee decided that a streamside-doser would be the most effective method to apply a calcium-based product (most likely limestone) during episodic acidic pulses resulting from storm events and/or snowmelt. Pre-assessment work has begun on the Dennys River and will continue through 2004. The project is estimated to become fully operational during 2005.

The Endangered Gulf of Maine Distinct Population Segment (DPS)

The federally endangered DPS of Atlantic salmon, as listed in 2000, includes Cove Brook (a tributary to the lower Penobscot River), the Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers. Total 2003 estimated returns (61 to 86 for all rivers) increased markedly since 2002, but were the second-lowest observed for the 1991 – 2003 time-series. Annual returns are estimated using data from traps located on the Dennys, Pleasant, and Narraguagus Rivers, combined with redd count data from the other five DPS rivers. Estimated returns are extrapolated from redd count data using a return-redd regression model based on actual return data from the Narraguagus (1991 to 2000) and the Pleasant (2000) River traps. The regression model is updated tri-annually and is scheduled for another update in 2004; next year's returns will be reflective of this update. NOAA-Fisheries and US Fish and Wildlife Service plan to release a draft version of the Recovery Plan for the Gulf of Maine DPS of Atlantic salmon during 2004. Public comments will be solicited and considered prior to the final approval of the Recovery Plan by both agencies. Presently, a status review is underway to determine the relationship of large river systems (e.g., Penobscot, Kennebec) to the DPS as currently delineated. This review will also determine the status of current salmon populations within these large river systems, as well as any other additional salmon populations present within the geographic range of the DPS. The outcome of this review may have implications for the recovery strategy of Atlantic salmon in Maine.

The use of salmon egg incubators in schools within the Connecticut River watershed continued to expand in 2003. Through the help of various cooperators, this programme reached 5,176 students at 119 different schools in the watershed. In the Merrimack River watershed, 12,750 eggs were shipped to 37 schools for incubation in the classroom and will be released as fry into selected tributaries during the spring. The salmon in schools programme has also spread to a number of schools in Vermont, Rhode Island and Maine. Visitation to the Amoskeag Fishways Visitor & Learning Center on the Merrimack River was approximately 13,010 students and 8,991 adults.

Additional Items of Interest

- Efforts continue in the development and structure of the NASCO habitat database for North American rivers. During 2003, information regarding juvenile production, smolt emigration, aquaculture production, and in-river captures of aquaculture escapees was added to the database. An Atlantic Salmon Information System (AS-IS) database is also being developed for the Maine Atlantic salmon programme to facilitate data sharing between state/federal agencies and other organizations.
- The Atlantic salmon restoration programme for two small New Hampshire coastal rivers has not met its stated objectives and has been discontinued beyond 2003.
- In January 2004, the National Research Council (NRC) released the report "Atlantic Salmon in Maine", which assessed the causes of salmon decline and to suggest strategies for the rehabilitation of Atlantic salmon in Maine. An earlier NRC report (2002) described the unique genetic makeup of Atlantic salmon in Maine. The current report identified the major threats to salmon in Maine as; (1) Habitat obstruction by dams; (2) Mortality of emigrating smolts likely associated with stream acidification; and (3) Adverse genetic and ecological impacts of salmon farming on wild populations. The report recommended the following actions as "urgently needed" to reverse the decline of salmon populations. (1) A programme of dam removal should be implemented; (2) Liming projects should begin on some rivers; (3) Hatchery programmes should continue to supplement wild populations, with some effort to evaluate the relative stocking efficiency for different lifestages. The hard-copy of the full report will be available soon and can be viewed online at: http://www.nap.edu
- The current year and previous annual reports of the US Atlantic salmon assessment committee can be accessed at:http://www.nefsc.noaa.gov/USASAC/

ANNEX 3

North American Commission

NAC(04)8

Review of Atlantic Salmon Management Measures for 2004

(tabled by Canada)

NAC(04)8

Review of Atlantic Salmon Management Measures for 2004

(tabled by Canada)

Introduction

The outlook for Atlantic salmon stocks continues to be generally poor throughout Atlantic Canada. There are few areas where returns and spawners are consistently above conservation requirements, other areas where returns are adequate (or close to being so) for conservation, and many areas where there are serious concerns for conservation of the stocks. Low returns are associated with low marine survival.

Management measures are tailored to the needs of specific areas (rivers and watersheds) while striving for an overall Precautionary Approach.

Aboriginal Food Fisheries

Aboriginal food fisheries for Atlantic salmon take place throughout Atlantic Canada and Quebec. Aboriginal fisheries for food, social and ceremonial purposes are permitted after conservation requirements have been addressed, and take precedence over recreational fishing.

The Canadian Department of Fisheries and Oceans (DFO) seeks to develop food fishery licences with Aboriginal groups that identify allocations, monitoring system requirements (guardians/logbooks, etc.) and scientific projects such as tagging or gear trials (such as the use of trapnets instead of gillnets), where practical.

In the southern Gulf of St. Lawrence rivers, Aboriginal fisheries in 2003 generally occurred in accordance with agreements and communal fishing licences. The quota was negotiated at 2,801 - MSW and 13,212 - 1SW. It is expected that the agreements will be negotiated at approximately the same levels for 2004.

The Labrador Inuit Association (LIA) food fishery is managed under a communal licence. LIA reported landings of 14.6 t (preliminary) compared to 10.1 t in 2002. The increased catch was primarily associated with the implementation of the designation process. Corrective measures have been established for the 2004 fishing season.

The Innu Nation food fishery is managed under a special management plan for Lake Melville. The Innu Nation is allocated a quota of 1,500 salmon, with 2003 reported landings of 1.5 t (preliminary) compared to 1.3 t in 2002.

Both Aboriginal Food Fisheries were strictly monitored by DFO assisted by Aboriginal Guardians. Management measures include tagging and mandatory log returns along with reduced seasons and selected closed areas.

The Resident food fishery programme was implemented in Southern Labrador four years ago following the closure of the commercial salmon fishery in 1998. The fishery is managed under a special management plan, which permits the retention of four salmon as a by-catch in the trout and charr fishery. Recorded landings (preliminary) for 2003 were 6.1 t compared to 5.2 t in 2002.

Similar to management measures imposed on the Aboriginal food fishery, the resident food fishery has reduced seasons to permit early-run (MSW) salmon to escape to the rivers. In addition, tagging and mandatory log returns are part of the management strategy. Guardians employed by the Labrador Métis Nation assist DFO in monitoring and enforcement of the fishery. For 2003 about 95% of the fishing logs were returned to DFO, which is exceptional compared to other commercial and Aboriginal Fisheries.

A communal food fishery for the Labrador Métis Nation may be established in 2004. This will result in a significant reduction in the effort (80-90%) associated with the all resident food fishery. However, a quota of approximately 10 tonnes of salmon may be allocated as part of any communal licence issued to the Labrador Métis Nation.

Commercial Fishery

There are no longer any commercial fisheries for Atlantic salmon on Canada's east coast. The last commercial fishery, a small fishery on Quebec's Lower North Shore, concluded in 1999.

Commercial fisheries moratoria in Labrador and insular Newfoundland remain in place indefinitely.

Recreational Fisheries

Insular Newfoundland

2003 was the second year of a new multi-year (2002-2006) salmon management plan.

The plan features a River Classification and Adaptive Management Strategy for Insular Newfoundland and areas of Southern Labrador. The plan permits different retention limits based on the health of individual river stocks. These limits range from retention of six grilse on a Class I river to catch and release only on a Class IV river. The retention of one MSW salmon is only permitted on selected rivers in Zone 1 and 2 in Labrador.

Other key management measures include the mandatory use of barbless hooks on all scheduled salmon rivers, river closures based on Environmental Protocols (i.e. low water levels or high water temperatures), as well as selected river closures for the entire season for conservation reasons.

In 2002, in response to extremely low returns of salmon to Harry's River and Northwest Port Blanford, DFO in consultation with local stakeholders developed a pilot project for both watersheds, including community involvement in an education and public awareness campaign. This stewardship initiative, including educating the public on conservation and ownership of the resource, led to a significant increase in the salmon returns to both rivers. In 2003 the salmon returns on Northwest River doubled from the previous year along with significant increase on the Harry's River. As a result of the success of this initiative, DFO has expanded the stewardship programme in 2004 to Ragged Hr. River along with several rivers in Bay St. George.

In Insular Newfoundland, 2003 recreational catches included 37,953 salmon, down from 41,946 in 2002. However, angling effort in rod days remained virtually unchanged for both years.

Labrador

Conservation management measures implemented for the past two years in Southern Labrador for the recreational salmon fishery will continue in 2004. These measures include a river classification system for rivers impacted by the construction of the Trans Labrador Highway which have a class three designation (2 grilse seasonal limit). No retention of large fish (greater than 63cm) is permitted on these rivers. For all other salmon rivers in zones 1 & 2 the seasonal bag limit of three grilse and one large salmon will apply.

In Labrador in 2003, recreational catches totaled 9,695, an increase from 8,308 in 2002. Angling effort increased in 2003 by approximately 5,000 rod days.

Maritimes Region

The Maritimes Region consists of five Salmon Fishing Areas (19, 20, 21, 22 and 23). Again in 2003, there were no salmon rivers in the Region that achieved spawning requirements. Rivers in two of these Areas (20 and 21) are negatively impacted by acid rain and are generally of low productivity. Given the stock status and the forecast for similar returns in 2004, management options remain limited. Complete closures are applied to most rivers in the Region with some limited hook and release angling opportunities and Aboriginal harvests limited essentially to hatchery-origin fish. Angling licence sales have declined in Nova Scotia by 74% within the past decade.

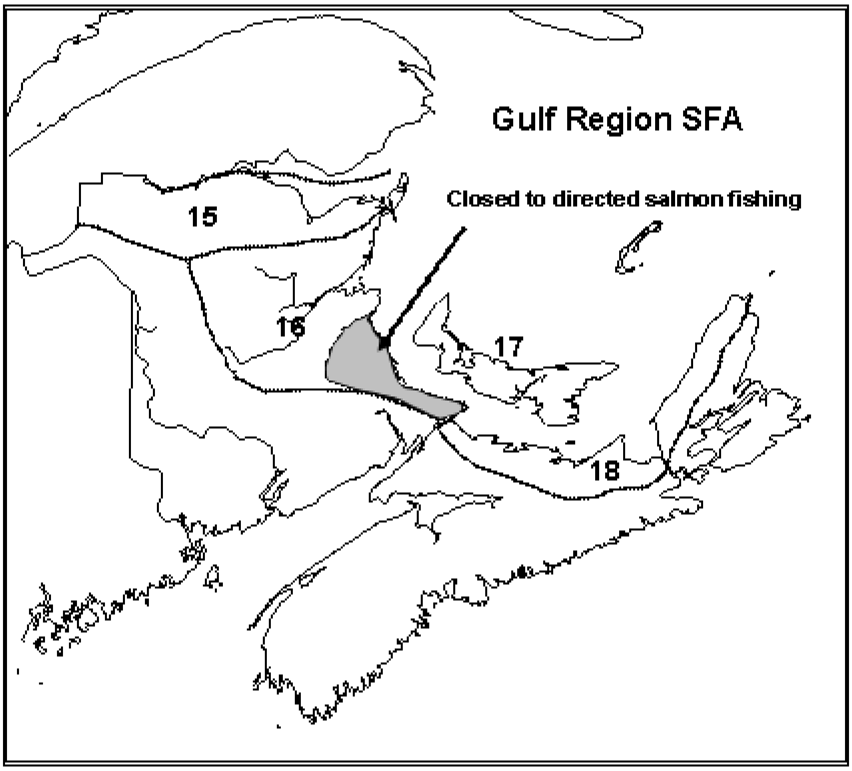
Rivers in the Inner Bay of Fundy portion of Areas 22 and 23 remain closed to salmon fishing (since 1990) and salmon stocks in this area were listed as "endangered" under the Species at Risk Act, promulgated in 2003. The Act prohibits any harm or capture of listed species. A live-gene bank programme for Inner Bay of Fundy salmon stocks was initiated in 1998, and includes the release of smolts. Unfortunately, marine survival of the released fish is such that none are found to return to the rivers. A multi-faceted recovery plan for these stocks has been developed. Portions of this plan have been implemented, i.e. the live gene bank, with full implementation likely in 2005, once the full plan has received final approval.

Gulf Region

The Gulf Region consists of four Salmon Fishing Areas (15, 16, 17 and 18). Overall, large salmon abundance in 2003 was higher than in 2002, which translated into higher large salmon catches than the previous years. Small salmon returns were down from 2002 and in some cases among the lowest observed. Consequently, grilse catches were lower in 2003 than the previous year. All commercial fisheries for Atlantic salmon in the Gulf Region remain closed in 2004.

As in 2003, Atlantic salmon will be harvested by two user groups in 2004: Aboriginal peoples and recreational fishers. Aboriginal peoples are given first access to salmon (after conservation requirements) based on communal needs for food, social and ceremonial purposes.

All angling fisheries for large salmon are mandatory catch and release fisheries. Retention angling fisheries for small salmon (grilse) during 2004 will be allowed in most rivers of the southern Gulf of St. Lawrence with the exception of a southeast corner of SFA 16 which remained closed to all directed salmon fisheries.



The daily grilse retention limit in the Miramichi River (SFA 16), Prince Edward Island (SFA 17) and the Nepisiguit River in SFA 15 is one fish. In the Restigouche River system (SFA 15), and Gulf Nova Scotia, Margaree River system (SFA 18) the daily retention limit of grilse is two fish. The maximum daily catch-and-release limit is four fish of any size for SFA 15, 16, 18 and two fish for SFA 17. The season bag limits of 8 grilse in New Brunswick and Nova Scotia (SFA 15, 16 & 18), and 7 grilse in PEI (SFA 17), remain unchanged from previous years.

As in the past the angling seasons vary on a river-by-river management scheme for 2004. In essence it includes various periods starting with a spring April 15 (black salmon) fishery in the Miramichi and Restigouche river systems to a general summer (bright salmon) fishery on all the salmon rivers with the exception of the southeast corner of SFA 16 that is closed. Some late-run rivers are open until late fall, October 31 in the SFA 18 Rivers of Nova Scotia, and November 30 in the SFA 17 in PEI. As was the case in the fall of 2003, a hook and release experimental fishery will be permitted for one week beyond the end of the season on the Nepisiguit, Mill Stream and lower portion of the Main Southwest Miramichi.

In summary, the 2004 management measures for SFA 15, 16, 17 and 18 – **Status quo**.

Province of Quebec

Quebec has developed a multi-year salmon plan which establishes conservation limits and management targets for each river. Where the conservation limit is not met, catch and release fishing only is permitted for large salmon and to some extent for grilse, if the latter contribute more than 10% to the egg deposition to reach the conservation limit for each river. The fishing of MSW salmon is permitted, with restrictions, on rivers where the conservation limit is exceeded.

Since 1984, the reporting of catches is mandatory in Quebec. In 2003, an on-line catch reporting system has been implemented to provide timely information on catches (date, length, weight, location). Managers will be able to make better management decisions more quickly with this information.

On the Upper and Mid North Shore of the St. Lawrence River, stocks stayed at a low level, but on the south shore, many stocks exceeded their conservation limits. River survival is being maintained and at-sea survival is increasing. For 2004, a small decrease in large salmon is expected.

ANNEX 4

North American Commission

NAC(04)6

NAC Scientific Working Group on Salmonid Introductions and Transfers Report of Activities – 2003/2004

NAC(04)6

NAC Scientific Working Group on Salmonid Introductions and Transfers Report of Activities - 2003 /2004

Members:

Rex Porter (Canada Co-chair)
Shane O'Neil (Canada)
Gilles Olivier (Canada)
Mary Colligan (USA Co-chair)
Dave Bean (USA)

The Scientific Working Group (SWG) did not meet during this past year, but rather conducted its business through correspondence. The NAC did not make any specific request to the SWG in 2003. Thus, the only task conducted by the Working Group was to up-date its three databases: 1) inventory of introductions and transfers; 2) table on the status of disease occurrences within the NAC Area; and 3) occurrences of farmed salmonids in rivers. The SWG is waiting for direction from the NAC, with respect to recommended revisions to the NAC Protocols.

1. Update of the database for the inventory of introductions and transfers of salmonids within the NAC area

Information for the inventory of introductions and transfers of salmonids for 2003 was solicited from federal, state and provincial agencies. To date, we have received information from all of the Canadian agencies, except Prince Edward Island; from the USA, we have only received information on transfers of Atlantic salmon for the State of Maine. No information was received for other species or other States. A summary of the introductions and transfers information for 2001 to 2003 is provided in Table 1; and, a list of the individual shipments for 2003 is provided in Appendix 1. It should be noted those introductions and transfers shown for 2003 are only for shipments that crossed provincial or state boundaries and the US-Canada border; in previous years the shipments shown for USA included within-State shipments. Inventory information for years 1986 to 2002 are in previous reports to the NAC. The database resides at the Department of Fisheries and Oceans office in Dartmouth, Nova Scotia.

There were only four (4) salmonid species reported introduced or transferred in 2003; Atlantic salmon and rainbow trout made up about 90% of the shipments, with brook trout and Arctic char making up the other 10%. Of the total number of eggs or fish shipped about 83% were Atlantic salmon and 16% were rainbow trout. Approximately 85% of all shipments primarily were for aquaculture purposes. The remaining 15% were for research and education or for stock enhancement. Several shipments are noteworthy.

- There was one shipment of Icelandic "Mowi" strain Atlantic salmon eggs from PEI to NB. They are being used in growth performance experiments in land-based facilities, in which the risk of escapement is low. No authorization will be given for these fish to be used in freshwater or marine cage rearing.

- There were 3 shipments of transgenic salmonids (one each of Arctic charr, rainbow trout and Atlantic salmon) from PEI to NF. These transgenic fish are being used by private industry for research, which is being conducted in a land-based facility with very low risk of escape.

- Reproductively viable mixed-sexed diploid rainbow trout continues to be used in some marine aquaculture sites in Atlantic Canada, which is contrary to the NAC Protocols. It is believed that the establishment of one or more reproducing populations of rainbow trout on the west coast of Newfoundland was the result of rainbow trout that escaped from marine aquaculture cages.

2. Update of the databases for fish disease occurrences within the NAC area

The database on the historic occurrences of fish pathogens in the NAC area has been updated and provided in Table 2. This database is incomplete since it only includes disease occurrences reported by the Federal Fish Health Officers; diseases may have been detected by provincial and/or private veterinarians and not reported to Federal agencies.

ISA continues to be of concern in New Brunswick, Nova Scotia and Maine. There is a joint federal, provincial, industry committee overseeing the control and management of the disease. Officials from Canada and the USA are in close communication on the management of this disease.

A New Strain of Infectious Salmon Anemia virus (ISAV) detected

A suspected presence of ISAV was reported at one site near Jonesport, Maine in November 2003. Intensive testing and research was initiated, and results identified an apparently new strain of ISAV. The new strain appears to have different effects on salmon compared to the New Brunswick strain of ISAV that has been detected in recent years at several sites in Maine and Canada. The new strain did not result in any increased mortality of salmon at the Jonesport site.

3. Update database of numbers Atlantic salmon aquaculture escapees and observations of rainbow trout in Atlantic salmon rivers

The SWG compiled the most recent information available to the Group on occurrences of Atlantic salmon and rainbow trout believed to be aquaculture escapees in rivers within Maine, New Brunswick, Nova Scotia, and Newfoundland (Tables 3, 4, and 5). It is recognized that the information is incomplete, considering the difficulty in identifying escaped-farmed fish, and information is primarily obtained from field investigations on a relatively small number of rivers or from reports from anglers.

In 2003, Atlantic salmon aquaculture escapees were reported in four (4) rivers in New Brunswick and Maine (Table 3). The greatest number (22) was reported in the Magaguadavic River with the escapees representing 81% of the salmon entering the river. Although only small numbers of aquaculture escapees were observed in the St. Croix (9) and the Dennys River (2), they represent a 38% and 18% of the salmon run to these rivers respectively. The total number (36) of Atlantic salmon of aquaculture origin observed in 2003 was 36% less than observed in 2002 and 88% less than observed in 2001.

Several salmon (adults and juveniles) with European alleles were identified from samples collected in several rivers in the Bay of Fundy. These salmon were captured in the

Magaguadavic River, one of the most proximate rivers to the aquaculture industry, the Black River, Chamcook stream, and the Upper Salmon River. The presence of these non-indigenous strains is of concern, particularly in the Upper Salmon River, since this River is one of the 32 rivers of the Inner Bay of Fundy in which the population was listed as endangered in May 2001 by the Committee on the Status of Endangered Wildlife in Canada. Some hatchery-origin juvenile Atlantic salmon obtained from the Magaguadavic River were of partial European ancestry (probable North American/European hybrids), suggesting that these fish escaped from a hatchery on the river system.

Likely sources of these European and partial European ancestry salmon found in the Bay of Fundy rivers are escapees from the American aquaculture industries and/or from a Canadian hatchery.

The USA industry has been screening their salmon for European ancestry for several years. Some of the aquaculture industry in the Maritime Provinces has begun screening their broodstock for fish of European ancestry; these analyses are required by the USA before eggs, fry and smolt produced in Canada may be exported to Maine for eventual rearing in sea pens. This genetic screening is based on seven microsatellite loci used by US Fish & Wildlife Services. These analyses will permit detection of European, North American/European hybrids and salmon with lower levels of European ancestry. Additional screening will likely occur in the coming year.

Rainbow trout, believed to be of aquaculture origin or originating from aquaculture escapees, were reported from eight (8) rivers on the west and south coast of Newfoundland in 2003, which is 2 more rivers than in 2002 (Table 4). These rainbow trout were either caught by anglers, or captured or observed during scientific surveys. Both male and female rainbow trout have been confirmed. A research project conducted on Trout River, western Newfoundland, confirmed that successful reproduction has occurred and at least three year-classes were present. Anglers have reported rainbow trout spawning in three (3) other rivers, on the west coast of Newfoundland, but this has not been confirmed. Figure 1 is a map showing the distribution of rivers in which rainbow trout have been observed. The Scientific Working Group reiterates its concern that if rainbow trout becomes established, it could negatively impact on the Atlantic salmon and brook trout populations.

Some information, albeit incomplete, was available on observations of rainbow trout in rivers of New Brunswick and Nova Scotia (Table 5). No information was available as to the origin of these fish. In 2003, rainbow trout were reported in only one (1) river in Nova Scotia and one (1) river in New Brunswick.

There were only two reports of escapements of Atlantic salmon from aquaculture sites in the NAC Area in 2003. One was an escapement of 6,500 market-size fish in Newfoundland in May; and the other was an escapement of approximately 2,000 fin-clipped Atlantic salmon from a Maine site in November. There were no reports of escapements of rainbow trout in 2003.

4. Other Items of Interest

Triploidy:

Triploid Atlantic salmon have been imported into New Brunswick and Nova Scotia for culture trials to examine performance relative to diploid fish. It is anticipated that fish in land-based facilities will be placed in sea-cages in the coming year. Culture of triploid salmon has been encouraged as an alternate means of reducing the risk of negative interactions with wild Atlantic salmon. However, past trials have shown poor performance of triploid compared to diploid salmon.

Containment Measures:

The containment measures currently being used in the marine cage rearing operations in the NAC area appear to have reduced the number of escapements. The Code of Practice implemented in Newfoundland in recent years appears to be working very well, with noticeable improvement in monitoring, enforcement, and a reduction in the number of fish escaping.

Current Status of US Efforts to Protect Wild Salmon from Potential Impacts from Aquaculture

The U.S. Endangered Species Act requires that all federal agencies consult with NOAA Fisheries and/or US Fish and Wildlife Service on any action they intend to carry out, fund, or permit, to evaluate the impacts to threatened and endangered species. The US Army Corps of Engineers issues permits to aquaculture facilities for the placement of their cages in marine waters. In conjunction with the US Fish and Wildlife Service, NOAA Fisheries completed a consultation on the existing aquaculture facilities in Maine and issued a Biological Opinion on November 19, 2003, on the adverse effect that existing aquaculture sites have on endangered wild Atlantic salmon. This Opinion includes special conditions that the Army Corps of Engineers will incorporate as mandatory in permits that they issue authorizing the operation of aquaculture facilities. These mandatory conditions address issues that will improve the operation of aquaculture facilities and reduce threats to wild Atlantic salmon.

These conditions are also included in the Maine Department Environmental Protection Discharge Elimination System (MEPDES) permit. The special conditions in the Biological Opinion and MEPDES permit, include a prohibition on the use of reproductively viable Atlantic salmon originating from non-American stock, a prohibition on the use of transgenic salmonids, a requirement for a marine containment management system at each site and annual audits, mandatory reporting of known or suspected escapes, and mandatory marking of smolt stocked. Additional information on these conditions can be found at either of the following websites:

Biological opinion:
http://www.nmfs.noaa.gov/prot_res/readingrm/ESAsec7/7se_maine_aquaculture_2003.pdf
MPDES Permit: http://www.maine.gov/dep/blwq/docstand/wastepage.htm

The framework for Containment Management System (CMS) plans were developed for both marine sites and freshwater hatcheries. State MEPDES permits require a CMS plan in place prior to placement of fish. Site-specific CMS plans for all active aquaculture sites in Maine are currently being implemented. Each facility is required to develop and utilize a CMS consisting of management and auditing methods to include: inventory control procedures, predator control procedures, escape response procedures, unusual event management, severe weather procedures, and training. The CMS will be audited at least once per year. Containment Management System audits were completed for all active sites in 2003. Non North American Atlantic salmon were used commercially within the U.S. aquaculture industry through 2003. Recently, a court order and injunction pursuant to US Clean Water Act violations, issued in May, 2003, to two large aquaculture companies operating in Maine requires stocking only North American Atlantic salmon in Maine waters. State MEPDES permits require that after July 31, 2004 all reproductively viable Atlantic salmon stocked into Maine waters for the purpose of aquaculture must be of North American origin. All reproductively viable non North American Atlantic salmon must be removed from net pens prior to March 1, 2006.

Table 1. Summary of total numbers of eggs and fish transferred between Provinces and/or States within the NAC Area from 2001 to 2003. USA transfers also includes within state transfers.

	Number of Shipments			Number of Eggs or Fish		
	2001	**2002**	**2003**	**2001**	**2002**	**2003**
Arctic Char						
Canada	2	7	2	20,000	116,300	122,000
USA	N/A	N/A	N/A	N/A	N/A	N/A
Atlantic Salmon						
Canada	60	61	51	31,459,000	43,760,400	30,727,750
USA	27	31	11	8,408,631	16,745,183	3,341,216
Total	87	91	62	39,867,631	60,505,583	34,068,966
Brook trout						
Canada	14	13	12	437,050	225,035	313,500
USA	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout						
Canada	0	1	0	0	10,000	0
USA	N/A	N/A	N/A	N/A	N/A	N/A
Rainbow trout						
Canada	37	40	59	5,003,075	8,679,590	6,482,409
USA	N/A	N/A	N/A	N/A	N/A	N/A

Table 2. Summary of fish disease or agent occurrence for each State and Province within the NAC Area at end of calendar year 2003. See footer for explanation of "occurrence Codes"

State or Province	Bacterial Kidney Disease (BKD)	Ceratomyxosis X	Enteric Redmouth (ERM)	Furunculosis	Infectious Hematopoietic Necrosis (IHN) X	Infectious Pancreatic Necroisis (IPN)	Infectious Salmon Anemia (ISA)	Oncorhynchus Masou Virus X	Viral Hemorrhagic Septicemia (VHS) X	Whirling Disease	Other CPE viruses (except IPN) X	Salmon Swimbladder Sarcoma**
CT	1	0	1	2	0	0	0	0	0	2	0	0
Lab	0	0	0	0	0	0	0	0	0	0	0	0
MA	1	0	1	1	0	1	0	0	0	1	0	1
ME	2	0	1	3	0	2	3	0	0	0	3	1*
NB	3	0	3	3	0	3	3	0	2***	0	3	0
NFLD	1	0	2	2	0	3	0	0	0	0	0	0
NH	1	0	1	2	0	3	0	0	0	1	1	0
NJ	No information for 2003											
NS	3	0	3	3	0	3	3	0	0	0	2	0
NY	1	0	1	3	1	1	0	0	0	2	0	0
ONT	3	0	3	3	0	1	0	0	0	0	2	0
PEI	1	0	0	0	0	1	0	0	0	0	0	0
QUE	3	0	3	3	0	3	0	0	0	0	0	0
RI	No information for 2003											
VT	2	0	0	3	0	1	0	0	0	2	2	0

Occurrence
0 = No known historical occurrence within State/Province
1 = Historical occurrence but no known occurrence within the last 5 years
2 = Has occurred during the past 5 years but not during the last Calendar Year
3 = Verified occurrence during the last Calendar Year within State/Province

X indicates an "EMERGENCY DISEASE" under NAC Protocols for the Introduction and Transfer of Salmonids

*Virus found present, but no disease symptoms ever detected.

** New virus: not currently included in the NAC Protocols

*** "North American Strain", Not "European" or "Salmonid" strain

Table 3. Known occurrences of Atlantic salmon aquaculture escapees in salmon rivers within the NAC area.

River (St/Prov)	Prior to 1990	1990 - 1997	1998	1999	2000	2001	2002	2003	Life Stage
	Number of escapees (escapees as percent of total sample)								
CANADA									
Annapolis (NS)		1		R******	15				MSW
Baddeck (NS)		23 (6)***	5 (3)						1SW & MSW
Bear (NS)	Many angled in early 1990's								1SW & MSW
Big Salmon (NB)	1								1SW & MSW
Conne (NF)		13	2(1)	1(>1)	5(2.3)	0	0	0	1SW & MSW
Conne (NF)		71							smolt
Dennis (NB)	R*****								1SW & MSW
Digdeguash (NB)	below hatchery				0				juveniles
Gaspereau (NS)		5	1 (4)		1(2)				MSW
Indian Brook (NS)					1				1SW & MSW
LaHave (NS)	1 (<1)	0	0						1SW & MSW
Magaguadavic (NB)		2,383	223 (8)	79(77)	30(68)	132(94)	35 (83)	22 (81)	1SW & MSW
Magaguadavic (NB)						35			smolt
Mersey (NS)					1				1SW & MSW
Meteghan (NS)					1				1SW & MSW
Middle (NS)			9 (4)						1SW & MSW
North (NS)		14 (8)***	55 (11)						1SW & MSW
Saint John (NB)		1990, Belle		R******	R******	14	8	3 (<1)	1SW & MSW
Salmon Digby (NS)				2	0				1SW & MSW
St. Croix (NB/ME) *		258	25 (38)	23(64)	30(60)	58(75)	5 (20)	9 (38)	1SW & MSW
Tusket (NS)			2 (<1)						MSW
Waewig (NB)	juvniles below hatch. 1 adult								Juveniles and adults
Stewiacke (NS)		7 (33)							MSW
UNITED STATES									
Penobscot River						1(0.1)			
Dennys (ME)**		69	1(100)		29(94)	65(79)	4 (67)	2 (18)	Sexually mature & immature
Narraguagus (ME)		9****	0	3 (9)	0	0	0	0	
Union (ME)				63(90)*****	6(75)	2(100)	6 (55)	0	
Other Maine Rivers	Unofficial reports of escapes in various eastern coastal rivers, especially Cobscott Bay area								

* 1994-96 aquaculture fish were estimated to be 13-54% of the run.

** Partial counts in Dennys

*** Includes 1995 only; no earlier data

**** includes 1995 and 1996 only.

***** based on scale samples form 11 of 22 adults

R****** escapees reported but number or presence not confirmed

Table 4. Known occurrences of rainbow trout observed in Newfoundland rivers, believed to be aquaculture escapees or progeny of aquaculture escapees.

River (St/Prov)	Number of rainbow trout							Life Stage
	Prior to 1990	1990 - 1998	1999	2000	2001	2002	2003	
Watts Bight Bk (NF)	3							adult
Green Island Cove						1		adult
Western Arm Brook					1		1	adult
River of Ponds (NF)	1+	4+*	24	2****	6			adult
Portland Creek (NF)			1					adult
Parsons Pond (NF)		1						adult
Deer Arm Brook					1	1		adult
Lomond River					1			adult
Trout River (NF)	4	2+	1+**	2***	97+	55+	122	adult+juv
Bay of Islands						1		adult
Hughes Brook							1	adult
Humber River (NF)			3	1**	1	1+	3	adult
Serpentine (NF)	2							adult
Flat Bay Brook (NF)		1*	2				5	adult
Robinsons River (NF)			2				1	adult
Crabbes R (NF)				2				immature
La Poila River (NF)			3					adult
Garia Brook (NF)			3					adult
Grandys River (NF)			2	3*****	3			adult
Unnamed Bk (Bay de Vieux)					1			
White Bear River					1+			
White Bear R Estuary					1+			
Grey River (NF)				1			1	immature
Northwest Bk				3				adult
Jeddore lake				3				juvenile
Conne River (NF)		245	21	45	18+	1	15+	adult
Little River (NF)		5	1					adult
Garnish River (NF)		2+						
Long Harbour R (NF)		1+			2			adult
Grand Bank Bk (NF)		1+						adult
Lawn Bk (NF)				1				adult
Holyrood Pond				3				adult
Biscay Bay Bk (NF)		2						adult

* 1 Male (interally sexed)

** 1 Female (internally sexed)

*** 2 females, immature

**** 1 was a spent female, and 1 was a male

***** 1 was a ripe male

Table 5. Reports of rainbow trout observed in New Brunswick and Nova Scotia rivers. Rainbow trout in some Nova Scotia rivers maybe from directed stocking programs. Table is incomplete.

River (Prov)	Number of Rainbow trout						Life Stage
	1995 - 1998	1999	2000	2001	2002	2003	
Saint John R (NB)	13		1	2			
Nashwaak R (NB)							
Big Salmon R (NB)			18	8		25	
Shepody R* (NB)			1				Juvenile
Upper Salmon R (NB)				1			Juvenile
Sutherlands R (NS)	1						
Salmon R (NS)		2 - 4					immature
Mersey R (NS)		2					
Tusket R (NS)		5+					
Middle R (NS)		2		11		2+	adult
North R (NS)		1+			2		Juveniles
St. Mary's R (NS)		1					Juvenile
River Tillard			1+				
Baddeck R (NS)			8				1adult+Juv
Musquodoboit (NS)				2+			adult
River Philip (NS)				12			~30 cm

* Shepody River has a self sustaining popualtion of rainbow trout. Rainbow trout angled annually.

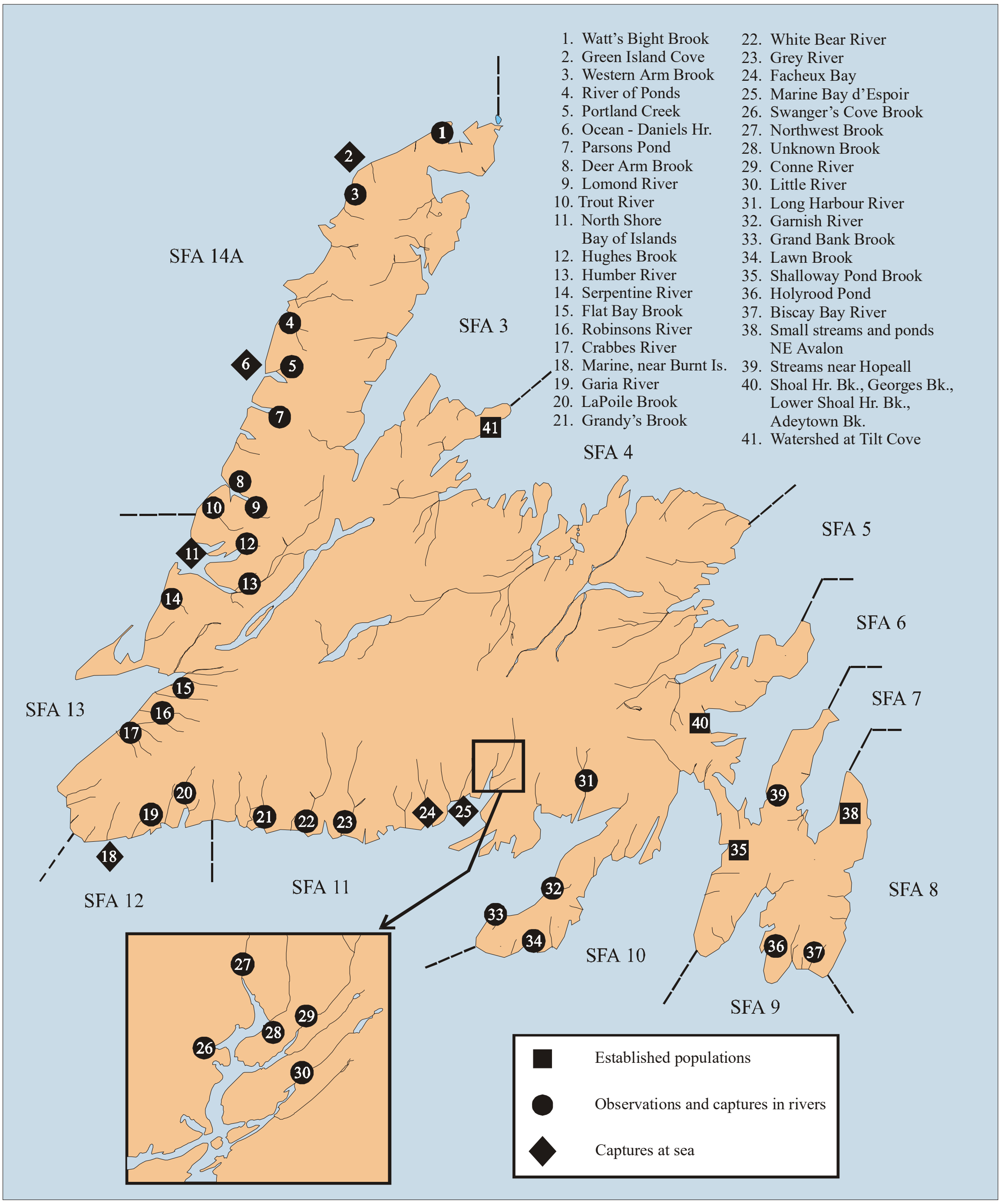


Figure 1 . Locations of Rainbow trout sightings in Newfoundland, 1979-2003..

Appendix 1. Report of Salmonid Introductions and Transfers in NAC Area - 2003

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
MAINE								
ATLANTIC SALMON								
1307	Stolt Sea Farms (NB)	St John R	Smolt	Y	187,957	Private	Aquaculture (sea pen)	N
1304	Digdequash hatchery (NB)	St John R	Fry	Y	247,400	Private	Aquaculture (misc. inland)	N
1305	Chamcook-ASF (NB)	St John R	Fry	Y	82,000	Private	Aquaculture (misc. inland)	N
1306	Digdequash hatchery (NB)	St John R	Smolt	Y	121,532	Private	Aquaculture (sea pen)	N
1300	Connors Bros (NB) Heritage S - Lake Utopia	St John R	Smolt	Y	286,346	Private	Aquaculture (sea pen)	N
1298	Connors Bros (NB) Heritage S - Lake Utopia	St John R	Smolt	Y	296,155	Private	Aquaculture (sea pen)	N
1309	Atlantic Ova Pro Ltd (NS)	St John R	Eggs	Y	1,622,250	Private	Aquaculture (misc. inland)	N
1303	Stolt Sea Farms (NB)	St John Dover	Fry	Y	200,000	Private	Aquaculture (misc. inland)	N
1302	Chamcook-ASF (NB)	St John R	Smolt	Y	4,000	Private	Brood Stock Dev.	N
1308	Chamcook-ASF (NB)	St John R	Smolt	Y	4,042	Private	Brood Stock Dev.	N
1301	Connors Bros (NB) Heritage S - Lake Utopia	St John R	Smolt	Y	289,534	Private	Aquaculture (sea pen)	N
NEW BRUNSWICK								
ATLANTIC SALMON								
1330	Atlantic Salmon Maine Starboard	St John R	Smolt	Y	400	Gov-Federal (Can)	Research/Education	
1345	Gardner Lake Hatchery (ME)	St John R	Fry	Y	600,000	Private	Aquaculture (FW pen)	
1335	Dartek (NS)	St John R	Smolt	Y	100,000	Private	Aquaculture (sea pen)	
1342	AKM Fisheries (NS)	St John R	Adults	Y	600	Private	Brood Stock Dev.	
1331	Aquaculture Acadie (NS)	St John R	Smolt	Y	210,000	Private	Aquaculture (sea pen)	
1328	Dover Hatchery (PEI)	Icelandic mowi	Eggs	Y	90,000	Private	Research/Education	
1350	Bingham Aquaculture Ltd. (ME)	St John R	Eggs	Y	2,000,000	Private	Aquaculture (FW pen)	

May 20, 2004

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1351	Dover Hatchery (PEI)	St John R	Eggs	Y	2,000,000	Private	Aquaculture (FW pen)	
1337	Gardner Lake Hatchery (ME)	St John R	Smolt	Y	200,000	Private	Aquaculture (sea pen)	
1368	Dover Hatchery (PEI)		Eggs	Y	1,000,000	Private	Aquaculture (FW pen)	
1336	Dartek (NS)	St John R	Smolt	Y	160,000	Private	Aquaculture (sea pen)	
1338	Merlin Fish Farms (NS)	St John R	Smolt	Y	145,000	Private	Aquaculture (sea pen)	
1344	Connors Aquaculture (ME)	St John R	Fry	Y	1,000,000	Private	Aquaculture (FW pen)	
1369	Little Harbour Hatchery (NS)		Eggs	Y	500,000	Private	Aquaculture (FW pen)	
1359	Little Harbour Hatchery (NS)		Eggs	Y	380,000	Private	Aquaculture (FW pen)	
1365	Atlantic Sea Smolt (PEI)		Eggs	Y	110,000	Private	Aquaculture (FW pen)	
1363	Atlantic Sea Smolt (PEI)		Parr	Y	100,000	Private	Aquaculture (FW pen)	
1352	Dover Hatchery (PEI)	St John R	Eggs	Y	10,000,000	Private	Aquaculture (FW pen)	
1341	Bingham Aquaculture Ltd. (ME)	St John R	Smolt	Y	208,850	Private	Aquaculture (sea pen)	
1329	Connors Aquaculture (ME)	St John R	Eggs	Y	2,000,000	Private	Aquaculture (misc. inland)	
1348	Bingham Aquaculture Ltd. (ME)	St John R	Fry	Y	950,000	Private	Aquaculture (FW pen)	
1340	Little Harbour Hatchery (NS)	St John R	Smolt	Y	160,000	Private	Aquaculture (sea pen)	
1362	Bingham Aquaculture Ltd. (ME)		Parr	Y	300,000	Private	Aquaculture (FW pen)	
1370	Bingham Aquaculture Ltd. (ME)		Eggs	Y	2,000,000	Private	Aquaculture (FW pen)	
1339	Bingham Aquaculture Ltd. (ME)	St John R	Smolt	Y	582,400	Private	Aquaculture (sea pen)	
1349	Bingham Aquaculture Ltd. (ME)	St John R	Smolt	Y	100,000	Private	Aquaculture (sea pen)	
1364	Atlantic Ova Pro Ltd (NS)		Eggs	Y	10,000	Research/Educ.	Research/Education	
BROOK TROUT								
1366	Pisciculture Alleghanys (QUE)		Eggs	Y	40,000	Private	Aquaculture (FW pen)	
1357	Pisciculture Alleghanys (QUE)		Eggs	Y	50,000	Private	Aquaculture (FW pen)	
1360	Pisciculture Alleghanys (QUE)		Eggs	Y	20,000	Private	Aquaculture (FW pen)	
1355	Pisciculture Alleghanys (QUE)		Juveniles	Y	5,500	Private	Aquaculture (FW pen)	
1361	Pisciculture Alleghanys (QUE)		Juveniles	Y	20,000	Private	Aquaculture (FW pen)	
1347	Pisciculture Alleghanys (QUE)		Eggs	Y	10,000	Private	Aquaculture (FW pen)	

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1356	Pisciculture Alleghanys (QUE)		Eggs	Y	20,000	Private	Aquaculture (FW pen)	
1354	Pisciculture Alleghanys (QUE)		Eggs	Y	20,000	Private	Aquaculture (FW pen)	
1371	Pisciculture Alleghanys (QUE)		Fingerlings	Y	3,000	Private	Aquaculture (FW pen)	
1353	Pisciculture Alleghanys (QUE)		Eggs	Y	50,000	Research/Educ.	Research/Education	

RAINBOW TROUT

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1332	Rainbow Springs Hatchery (ONT)		Fry	Y	16,500	Gov-Federal (Can)	Research/Education	
1367	Pisciculture Alleghanys (QUE)		Eggs	Y	30,000	Private	Aquaculture (FW pen)	
1346	Pisciculture Alleghanys (QUE)		Eggs	Y	10,000	Private	Aquaculture (FW pen)	
1358	Rainbow Springs Hatchery (ONT)		Eggs	Y	200	Research/Educ.	Research/Education	
1334	Cardigan Hatchery (PEI)		Adults	Y	100	Research/Educ.	Research/Education	
1343	Cardigan Hatchery (PEI)		Juveniles	Y	400	Research/Educ.	Research/Education	
1333	Cardigan Hatchery (PEI)		Juveniles	Y	180	Research/Educ.	Research/Education	

NEWFOUNDLAND

ARTIC CHAR

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1278	Aqua Bounty Farms (PEI)	Transgenic	Eggs	Y	12,000	Research/Educ.	Research/Education	N

ATLANTIC SALMON

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1296	Cooke Aquaculture US Inc.	St John R	Eggs	Y	600,000	Private	Aquaculture (Unspecified)	N
1283	North River Fish Farm (NS)		Pre-smolt	Y	80,000	Private	Aquaculture (sea pen)	N
1282	Stolt Sea Farms (NB)		Pre-smolt	Y	300,000	Private	Aquaculture (sea pen)	N
1292	Aqua Bounty Farms (PEI)	Transgenic	Eggs	Y	500	Research/Educ.	Research/Education	N

RAINBOW TROUT

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1289	North River Fish Farm (NS)	All Female	Pre-smolt	Y	400,000	Private	Aquaculture (sea pen)	Y
1290	St Peter's Fish Hatchery (NS)	All Female	Pre-smolt	Y	150,000	Private	Aquaculture (sea pen)	Y
1297	Pisciculture St Damien (QUE)	All Female	Eggs	N	15,000	Private	Aquaculture (misc. inland)	Y

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1274	Pisciculture St Damien (QUE)	All Female	Eggs	N	20,000	Private	Aquaculture (misc. inland)	Y
1284	Big Falls Fish Growers (NS)	All Female	Pre-smolt	Y	400,000	Private	Aquaculture (sea pen)	Y
1295	Big Falls Fish Growers (NS)	All Female	Pre-smolt	Y	400,000	Private	Aquaculture (sea pen)	Y
1286	North River Fish Farm (NS)	All Female	Pre-smolt	Y	315,000	Private	Aquaculture (sea pen)	Y
1279	St Peter's Fish Hatchery (NS)	Silver bullets	Pre-smolt	Y	70,000	Private	Aquaculture (sea pen)	Y
1281	North River Fish Farm (NS)	All Female	Pre-smolt	Y	90,000	Private	Aquaculture (sea pen)	Y
1275	Pisciculture St Damien (QUE)	Triploid	Eggs	N	60,000	Private	Aquaculture (misc. inland)	Y
1285	North River Fish Farm (NS)	All Female	Pre-smolt	Y	70,000	Private	Aquaculture (sea pen)	Y
1280	Big Falls Fish Growers (NS)	Silver bullets	Pre-smolt	Y	70,000	Private	Aquaculture (sea pen)	Y
1294	Cardigan Hatchery (PEI)	Silver bullets	Pre-smolt	Y	64,000	Private	Aquaculture (sea pen)	Y
1293	River Bend Fish Farm (NS)	Silver bullets	Pre-smolt	Y	200,000	Private	Aquaculture (sea pen)	Y
1291	Big Falls Fish Growers (NS)	Silver bullets	Pre-smolt	Y	250,000	Private	Aquaculture (sea pen)	Y
1288	Rainbow Springs Hatchery (ONT)	All Female	Adults	Y	15	Research/Educ.	Research/Education	N
1277	Aqua Bounty Farms	Transgenic	Eggs	Y	12,000	Research/Educ.	Research/Education	N
1276	Pisciculture St Damien (QUE)		Eggs	Y	75,000	Research/Educ.	Research/Education	N
1287	Rainbow Springs Hatchery (ONT)	All Female	Adults	Y	14	Research/Educ.	Research/Education	N
NOVA SCOTIA								
ARTIC CHAR								
1254	Pisciculture Alleghanys (QUE)		Eggs	Y	60,000	Private	Aquaculture (sea pen)	
1246	Icy Waters (YUK)		Eggs	Y	50,000	Private	Aquaculture (sea pen)	
ATLANTIC SALMON								
1258	Atlantic Sea Smolt (PEI)	St John R	Eggs	Y	150,000	Private	Aquaculture (sea pen)	
1239	Thomaston Corner H (NB) - Cooke Aquaculture	St John R	Smolt	Y	200,000	Private	Aquaculture (sea pen)	
1240	Oak Bay Hatchery (NB)	St John R	Smolt	Y	50,000	Private	Aquaculture (sea pen)	
1235	Connors Aquaculture (ME)	St John R	Eggs	Y	1,000,000	Private	Aquaculture (sea pen)	

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1241	Tay Falls Cooke Aquaculture (NB)	St John R	Smolt	Y	50,000	Private	Aquaculture (sea pen)	
1234	Connors Aquaculture (ME)	St John R	Eggs	Y	1,000,000	Private	Aquaculture (sea pen)	
1238	Aqua Fish Farms Penobquis (NB)	St John R	Smolt	Y	170,000	Private	Aquaculture (sea pen)	
1244	Connors Bros (NB) Heritage S - Lake Utopia	St John R	Smolt	Y	20,000	Private	Brood Stock Dev.	
1256	North Water Products Ltd (NF)	St John R	Fingerlings	Y	150,000	Private	Aquaculture (sea pen)	
1243	Oak Bay Hatchery (NB)	St John R	Smolt	Y	50,000	Private	Aquaculture (sea pen)	
1242	Thomaston Corner H (NB) - Cooke Aquaculture	St John R	Smolt	Y	280,000	Private	Aquaculture (sea pen)	
1250	Oak Bay Hatchery (NB)	St John R	Smolt	Y	100,000	Private	Aquaculture (sea pen)	
1248	Thomaston Corner H (NB) - Cooke Aquaculture	St John R	Smolt	Y	100,000	Private	Aquaculture (sea pen)	
1245	Chamcook-ASF (NB)	St John R	Fry	Y	70,000	Private	Aquaculture (sea pen)	
1260	Oak Bay Hatchery (NB)	St John R	Parr	Y	200,000	Private	Aquaculture (sea pen)	
1253	Oak Bay Hatchery (NB)	St John R	Fingerlings	Y	100,000	Private	Aquaculture (sea pen)	
1247	Oak Bay Hatchery (NB)	St John R	Fry	Y	400,000	Private	Aquaculture (sea pen)	
1259	Atlantic Sea Smolt (PEI)	St John R	Eggs	Y	500,000	Private	Aquaculture (sea pen)	
1255	Stolt Sea Farms (NB)	St John R	Fingerlings	Y	150,000	Private	Aquaculture (sea pen)	
1249	Tay Falls Cooke Aquaculture (NB)	St John R	Smolt	Y	100,000	Private	Aquaculture (sea pen)	
RAINBOW TROUT								
1252	Rainbow Springs Hatchery (ONT)		Eggs	Y	100,000	Gov-Provincial	Pop. Enhanc. (Inland)	
1236	Rainbow Springs Hatchery (ONT)		Eggs	Y	20,000	Gov-Provincial	Pop. Enhanc. (Inland)	
1237	Trout Lodge (WA)		Eggs	Y	145,000	Private	Aquaculture (sea pen)	
1251	Rainbow Springs Hatchery (ONT)		Fingerlings	Y	5,000	Private	Aquaculture (sea pen)	
1257	Trout Lodge (WA)		Eggs	Y	375,000	Private	Aquaculture (sea pen)	
ONTARIO								
BROOK TROUT								
1271	Pisciculture St Damien (QUE)		Eggs	Y	60,000	Private	Aquaculture (misc. inland)	

May 20, 2004

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1273	Pisciculture St Damien (QUE)		Eggs	Y	15,000	Research/Educ.	Research/Education	
RAINBOW TROUT								
1269	Troutsprings (WA)		Eggs	Y	27,000	Gov-Federal (Can)	Pop. Enhanc. (Inland)	
1270	Troutsprings (WA)		Eggs	Y	173,000	Gov-Federal (Can)	Pop. Enhanc. (Inland)	
1262	Troutsprings (WA)		Eggs	Y	150,000	Gov-Provincial	Aquaculture (FW pen)	
1267	Troutsprings (WA)		Eggs	Y	440,000	Gov-Provincial	Aquaculture (FW pen)	
1265	Troutsprings (WA)		Eggs	Y	25,000	Gov-Provincial	Pop. Enhanc. (Inland)	
1266	Troutsprings (WA)		Eggs	Y	300,000	Private	Aquaculture (misc. inland)	
1272	Troutsprings (WA)		Eggs	Y	250,000	Private	Aquaculture (misc. inland)	
1261	Troutsprings (WA)		Eggs	Y	220,000	Private	Aquaculture (misc. inland)	
1263	Troutsprings (WA)		Eggs	Y	150,000	Private	Aquaculture (misc. inland)	
1268	Troutsprings (WA)		Eggs	Y	125,000	Private	Unspecified	
1264	Troutsprings (WA)		Eggs	Y	227,000	Private	Aquaculture (misc. inland)	

QUEBEC

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
RAINBOW TROUT								
1321	Trout Lodge (WA)	Triploid	Eggs	N	80,000	Private	Aquaculture (Unspecified)	
1324	Trout Lodge (WA)	Unknown	Eggs	N	100,000	Private	Aquaculture (Unspecified)	
1325	Trout Lodge (WA)	Unknown	Eggs	Y	100,000	Private	Aquaculture (Unspecified)	
1313	Trout Lodge (WA)		Eggs	Y	100,000	Private	Aquaculture (Unspecified)	
1315	Trout Lodge (WA)		Eggs	Y	75,000	Private	Aquaculture (Unspecified)	
1312	Trout Lodge (WA)		Eggs	N	65,000	Private	Aquaculture (Unspecified)	
1323	Trout Lodge (WA)	All Female	Eggs	Y	40,000	Private	Aquaculture (Unspecified)	Y
1322	Trout Lodge (WA)		Eggs	Y	100,000	Private	Aquaculture (Unspecified)	
1310	Trout Lodge (WA)		Eggs	Y	100,000	Private	Aquaculture (Unspecified)	
1311	Trout Lodge (WA)	All Female	Eggs	Y	50,000	Private	Aquaculture (Unspecified)	Y

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use	Monosex
1314	Trout Lodge (WA)		Eggs	Y	10,000	Private	Aquaculture (Unspecified)	
1320	Trout Lodge (WA)		Eggs	Y	60,000	Private	Aquaculture (Unspecified)	
1319	Trout Lodge (WA)	Triploid	Eggs	N	10,000	Private	Aquaculture (Unspecified)	
1318	Trout Lodge (WA)	All Female	Eggs	Y	15,000	Private	Aquaculture (Unspecified)	Y
1316	McKenzie Fish (MIN)		Eggs	Y	5,000	Private	Aquaculture (Unspecified)	
1326	Trout Lodge (WA)	Triploid	Eggs	N	100,000	Private	Aquaculture (Unspecified)	
1317	McKenzie Fish (MIN)		Eggs	Y	22,000	Private	Aquaculture (Unspecified)	

ANNEX 5

North American Commission

NAC(04)9

Report to the NAC on Cooperative Work between the US and Canada on Acid Rain

(tabled by the US and Canada)

NAC(04)9

Report to the NAC on Cooperative Work between the US and Canada on Acid Rain

(tabled by the US and Canada)

At the 2000 NAC meeting, Canada tabled a report (Habitat Status Report on the Effects of Acid Rain on Atlantic Salmon of the Southern Upland of Nova Scotia) arising from a workshop in Dartmouth in March 2000. This report generated discussion at the NAC during subsequent years, with commitments that Canada and the US work together on this issue.

At the 2002 NAC meeting, the US and Canada agreed to endeavor to meet inter-sessionally to consider the causes, effects, and mitigation options of acid rain vis-à-vis Atlantic salmon. At the 2003 NAC meeting, both Canada and the US reported on progress regarding acid rain, with the US noting its interest in conducting a pilot liming project. The NAC Chair urged the US and Canada to work cooperatively on this issue and report back in 2004.

In March 2003, the US and several NGOs hosted a workshop in Orono, Maine on the status and trends of water chemistry in Maine Atlantic salmon watersheds. There were several participants from Canada. The outcome of the workshop was the reaffirmation that pH-related factors may indeed be inhibiting the survival and restoration of salmon in Maine. Atlantic salmon and water quality scientists and managers participating in the forum recommended that the implementation of a pilot liming project should be investigated to determine its potential benefit to Atlantic salmon restoration in Maine.

In April 2004, DFO and ASF hosted a joint US – Canada workshop in St. Andrews, New Brunswick on the impacts of acid rain and on mitigation measures vis-à-vis Atlantic salmon. The proceedings from this workshop are expected to be available by the end of July on the website of the Canadian Stock Assessment Secretariat. Participants agreed to key elements arising from the workshop (Annex 1).

The workshop participants (approximately 40 individuals from Canadian, US, and Norwegian governments and NGOs) concluded that liming of watersheds and watercourses is an acidification mitigation technique that provides benefits to salmon and other species (terrestrial and aquatic), as well as for forestry and agriculture. The participants also concluded that continued cooperation and information sharing between the US and Canada was necessary, particularly as pilot liming projects move forward in Maine and Nova Scotia.

Recommendations:

The US and Canada should continue (and expand, where appropriate) their investigation and use of acid rain mitigation techniques to benefit Atlantic salmon. The US and Canada should continue to work cooperatively on this issue and share information on the effects of acid rain, and on efforts to mitigate acidification. The US and Canada shall report back to the NAC on their progress, including the status of the pilot projects, in 2005.

Several Parties outside the NAC have extensive experience in mitigating the effects of acid rain. The information sharing should be expanded beyond the NAC, and an opportunity to discuss acid rain and mitigation measures more broadly among the NASCO Parties should be explored, possibly as an agenda item for the Council.

Annex 1 of NAC(04)9

Canada-United States
Acid Rain Workshop

Chamcook, NB
19-20 April 2004

Summary of Key Elements

What we have learned/affirmed about the Acid Rain Issue:

- Acid rain, resulting from emission of pollutants from industrial areas of North America, is a serious problem known to cause sub-lethal impacts, premature mortality and in some cases, extirpation of wild Atlantic salmon populations. Areas most impacted are the Southern Upland of Nova Scotia (Canada) and eastern Maine (USA).

- Acid rain induces changes to water chemistry, which results in the loss of ions across the salmon's gill epithelium and, ultimately, death due to the failure of the circulatory system. Smolt and fry are the most sensitive to low pH in fresh water. Mortality of smolts is also believed to be associated with their transition from freshwater to the marine environment.

- Liming of watercourses is recognized as an acidification mitigation technique that provides benefits to salmon, and other aquatic organisms. Liming of watersheds provides benefits to forestry and agriculture as well as fish and other aquatic organisms. Pilot liming mitigation projects on water courses are being planned by stakeholders on the West River, Sheet Harbour and the Salmon River in Nova Scotia, and by government and stakeholders on the Dennys River, Maine. A pilot watershed liming project is also being planned by stakeholders within the Felix Brook sub-drainage of the Salmon River, Nova Scotia.

- There is no clear government policy within Canada and the USA as to the responsible agencies for action to mitigate losses of Atlantic salmon stocks by liming rivers and watersheds in acid rain impacted areas.

- Gene banks offer supportive rearing and breeding to maintain the genetic diversity of a salmon population through periods of critically low abundance. Live gene banks can be conducted in refuges, i.e., designated parts of a river or complete river that still has natural reproducing populations, or in limed sections of acidified rivers where remnant stocks can sustain themselves, or in captivity.

- Several diverse public interest groups are seeking resolution of the problems resulting from acid rain. Governments and the public need to be aware of this and support measures to address this issue.

- The North American Commission of NASCO may provide a forum for discussion of progress on Canada-United States acid rain issues as they affect salmon, as none other seems to exist at this time.

The way forward:

- Governments need to adopt policy and develop programmes that encourage or legislate reduction and elimination of acid rain causing emissions and, as well, support mitigation of the impacts of acid rain. The latter needs to be planned for the long term (up to 50 or more years) that it will take to re-establish natural buffering capacity.

- Government, NGO and industry stakeholder partners should develop a strategy and action plan to elevate public awareness and build support for acid rain abatement and mitigation initiatives.

- An ecosystem approach to addressing the acid rain issue is essential to enable effective action and to build public support groups.

- Cooperation among those interested in resolving acid rain issues and partnerships is important to effectively address the problem. It is especially important to further research the ecological impact and cost-effectiveness of stream and watershed liming techniques as mitigative measures and to share information and findings among the government, NGO and industry stakeholders.

ANNEX 6

CNL(04)13

Request for Scientific Advice from ICES

1. With respect to Atlantic salmon in the North Atlantic area:

   1.1 provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and worldwide production of farmed and ranched Atlantic salmon in 2004;
   1.2 report on significant developments which might assist NASCO with the management of salmon stocks;
   1.3 provide a compilation of tag releases by country in 2004;
   1.4 identify relevant data deficiencies, monitoring needs and research requirements[1].

2. With respect to Atlantic salmon in the North-East Atlantic Commission area:

   2.1 describe the key events of the 2004 fisheries and the status of the stocks; [2]
   2.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
   2.3 further develop the age-specific stock conservation limits where possible based upon individual river stocks;
   2.4 provide catch options or alternative management advice, if possible based on forecasts of PFA for northern and southern stocks, with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding; [3]
   2.5 provide an estimate of by-catch of salmon in pelagic fisheries.

3. With respect to Atlantic salmon in the North American Commission area:

   3.1 describe the key events of the 2004 fisheries and the status of the stocks; [2]
   3.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
   3.3 update age-specific stock conservation limits based on new information as available;
   3.4 provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding; [3]
   3.5 provide an analysis of any new biological and/or tag return data to identify the origin and biological characteristics of Atlantic salmon caught at St Pierre and Miquelon.

4. With respect to Atlantic salmon in the West Greenland Commission area:

4.1 describe the events of the 2004 fisheries and the status of the stocks; [2, 4]
4.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
4.3 provide information on the origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes);
4.4 provide catch options or alternative management advice with an assessment of risk relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding. [3]

Notes:

1. NASCO's International Atlantic Salmon Research Board's inventory of on-going research relating to salmon mortality in the sea will be provided to ICES to assist it in this task.

2. In the responses to questions 2.1, 3.1 and 4.1 ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality, of the salmon gear used, and on the by-catch of other species in salmon gear, and of salmon in any existing and new fisheries for other species is also requested.

3. In response to questions 2.4, 3.4 and 4.4 provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.

4. In response to question 4.1, ICES is requested to provide a brief summary of the status of North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions 2.1 and 3.1.

ANNEX 7

List of North American Commission Papers

Paper No.	Title
NAC(04)1	Provisional Agenda
NAC(04)2	Draft Agenda
NAC(04)3	Election of Officers
NAC(04)4	Draft Report
NAC(04)5	The St Pierre and Miquelon Salmon Fishery
NAC(04)6	NAC Scientific Working Group on Salmonid Introductions and Transfers, Report of Activities – 2003/2004
NAC(04)7	Report on US Atlantic Salmon Management and Research Activities in 2003
NAC(04)8	Review of Atlantic Salmon Management Measures for 2004 (tabled by Canada)
NAC(04)9	Report to the NAC on Cooperative Work between the US and Canada on Acid Rain (tabled by the US and Canada)
NAC(04)10	Report of the Twenty-First Annual Meeting of the North American Commission
NAC(04)11	Agenda

Note: This is a listing of all the Commission papers. Some, but not all, of these papers are included in this report as annexes.

REPORT OF THE

TWENTY-FIRST ANNUAL MEETING

OF THE

NORTH-EAST ATLANTIC COMMISSION

7-11 JUNE 2004
REYKJAVIK, ICELAND

Chairman:	Mr Árni Olafsson (Denmark (in respect of the Faroe Islands and Greenland)
Vice-Chairman:	Mr Steinar Hermansen (Norway)
Rapporteur:	Dr Niall Ó Maoiléidigh (European Union)
Secretary:	Dr Malcolm Windsor

NEA(04)12

CONTENTS

PAGE

NEA(04)12

Report of the Twenty-First Annual Meeting of the North-East Atlantic Commission of the North Atlantic Salmon Conservation Organization 7-11 June, 2004, Reykjavik, Iceland

1. Opening of the Meeting

1.1 In the absence of the Chairman, Mr Arni Olafsson (Denmark (in respect of the Faroe Islands and Greenland)), the Vice-Chairman, Mr Steinar Hermansen (Norway), opened the Twenty-First Annual Meeting of the North-East Atlantic Commission and welcomed delegates to Reykjavik.

1.2 An opening statement was made on behalf of the Non-Government Organizations attending the Annual Meeting (Annex 1).

1.3 A list of participants at the Twenty-First Meeting of the Council and Commissions of NASCO is included on page 293 of this document.

2. Adoption of the Agenda

2.1 The Commission adopted its agenda, NEA(04)11 (Annex 2). The Chairman indicated that under item 10, 'Other Business', he would seek a progress report from Norway on the pilot project for the synchronised release of tagged farmed salmon approved by the Commission at its last Annual Meeting.

3. Nomination of a Rapporteur

3.1 The Commission appointed Dr Niall Ó Maoiléidigh (European Union) as its Rapporteur for the meeting.

4. Election of Officers

4.1 The Commission unanimously elected Mr Steinar Hermansen (Norway) as its Chairman and Mr Andrew Thomson (European Union) as its Vice-Chairman.

5. Review of the 2003 Fishery and ACFM Report from ICES on Salmon Stocks in the Commission Area

5.1 The representative of ICES, Dr Walter Crozier, presented the scientific advice relevant to the North-East Atlantic Commission, CNL(04)9, prepared in response to a request from the Commission at its Twentieth Annual Meeting. The ACFM Report from ICES, which contains the scientific advice relevant to all Commissions, is included on page 219 of this document.

5.2 The representative of Iceland noted that the status of Icelandic multi-sea-winter (MSW) stocks appears to be similar to that of southern MSW salmon stocks and he asked ICES for clarification as to whether they were included in the southern MSW stock grouping. The representative of ICES agreed that the status was more similar to that of southern European stocks, but that Icelandic stocks were included in the Northern stock complex for the purposes of the assessments. However, he suggested that it may be appropriate to reconsider the groupings.

5.3 The representative of Norway expressed his appreciation to ICES for the progress made in relation to assessing the by-catch of salmon in pelagic fisheries which will encourage the development of more reliable estimates in future.

5.4 The representative of Denmark (in respect of the Faroe Islands and Greenland) asked for confirmation that the post-smolts caught in experimental trawls in the Norwegian Sea originate from southern European countries and that pre-fishery abundance estimates for these stocks have been used in the correlations with catches in the pelagic fisheries. The representative of ICES indicated that on the basis of the biological characteristics of post-smolts caught and tag recoveries, the majority of the post-smolts taken in the Norwegian research trawls are believed to originate from southern Europe. He stated that the correlations did not reveal any significant trend and that the comparisons had been with pre-fishery abundance estimates for both stock complexes. The representative of Denmark (in respect of the Faroe Islands and Greenland) noted that while there was a lack of disaggregated catch data for the pelagic fisheries, the current estimate from the catch screening analysis indicated a low level of post-smolt by-catch. The representative of ICES indicated that disaggregated catch data were required to make the estimate of by-catch more reliable although it could still be low. The representative of Denmark (in respect of the Faroe Islands and Greenland) suggested that not only would screening of commercial catches involve costs, it would also be virtually impossible to screen an entire catch of between 80 and 100 tonnes per day of pelagic fish. The representative of ICES agreed that if a high proportion of the catch was to be screened it would not be possible to handle the catch of a commercial pelagic vessel. One option would be to perform one tow of the trawl and screen the entire catch but it might then be necessary to compensate for the lost fishing opportunity.

5.5 The Commission agreed that efforts should be made by the Parties to facilitate improvement in the estimates of by-catch of post-smolts in pelagic fisheries in accordance with the Council's decision on by-catch. The representative of the European Union suggested that the NASCO Parties already co-operate at many levels in addressing the problem of salmon mortality at sea. He proposed that NASCO should write to the North-East Atlantic Fisheries Commission (NEAFC) to seek co-operation in obtaining disaggregated catch statistics from the NEAFC Parties involved in the pelagic fisheries. This was agreed by the Commission. The Chairman tabled a draft letter to the President of NEAFC. After a number of amendments this letter was approved by the Commission, NEA(04)8, (Annex 3).

6. Risk of Transmission of *Gyrodactylus salaris* in the Commission Area

6.1 The Secretary presented the Report of the Workshop on *Gyrodactylus salaris* in the Commission Area, NEA(04)3 (Annex 4), and a draft road map, NEA(04)5, for taking forward the recommendations of this Workshop. The draft road map includes Terms of Reference for a Working Group on *G. salaris.* The representative of Norway indicated that it had been assumed that Baltic salmon were resistant to *G. salaris* on the basis of studies conducted on salmon from the Neva River. However, recently published research indicated that salmon in another Baltic river, the Indalselven, may be susceptible to the parasite.

6.2 The representative of the European Union stated that the report of the Workshop was extremely useful and that it had been circulated to appropriate authorities in Brussels for their consideration. He suggested an amendment to the Terms of Reference for the Working Group. The representative of Norway suggested adding a new Term of Reference to enable the Working Group to consider other fish health issues of relevance to the wild Atlantic salmon. Both proposals were accepted by the Commission. The road map, including the amended Terms of Reference for the *G. salaris* Working Group, as adopted by the Commission, NEA(04)13, is contained in Annex 5. The Working Group will be chaired by Norway.

6.3 The representative of Norway indicated that the European Union is in the process of implementing a Directive on biocides, a consequence of which will be a potential ban on the use of rotenone from 1 September 2006. He pointed out that the use of rotenone is a key tool in Norway for the eradication of *G. salaris.* He noted that the use of rotenone for the treatment of *G. salaris* had been recommended by the Workshop. Rotenone is important in the contingency plans of the Parties, including countries which are free of the parasite. The representative of Norway informed the Commission that Norway will be taking an initiative to the European Commission in order to clarify how rotenone and other control measures can continue to be used after 2006. The representative of the European Union advised the Commission that the proposed regulations were obligatory not just for European Union Member States but for all European Economic Area countries. While he agreed that it was an issue which would need attention, he was not authorised to make any statements on the proposed Directive as it did not form part of the Common Fisheries Policy, which was his area of authority. However, he undertook to bring the Norwegian concern to the attention of the relevant authorities in Brussels. He also suggested that any Party affected by the proposed Directive should also record its concerns in writing to the Health and Consumer Protection Directorate General (Directorate General SANCO) in Brussels.

6.4 The Chairman expressed his gratitude to the participants in the Workshop, many of whom had not previously participated in NASCO meetings.

7. Regulatory Measures

7.1 The representative of the European Union stated that the purpose of NASCO is to regulate the distant-water fisheries in the West Greenland and North-East Atlantic Commission areas. He noted that it had been some time since a regulatory measure had been agreed in the North-East Atlantic Commission and this is a deep concern for the European Union delegation. He asked how the Parties could meet their obligations under various international agreements, including the United Nations Convention on the Law of the Sea and the Straddling Fish Stocks and Highly

Migratory Fish Stocks Agreement (the Fish Stocks Agreement), if regulatory measures were not established. He referred to the Decision adopted by the Commission at its last Annual Meeting. The European Union delegation felt that this Decision did not fulfil the Commission's obligations. It is the function of NASCO to put order into fishing for salmon in areas where it has authority. He indicated that the Fish Stocks Agreement refers to the need to strengthen the role of fishery Commissions and he asked how that could be achieved if regulatory measures are not established. The representative of Denmark (in respect of the Faroe Islands and Greenland) reminded the Commission that there had been no commercial fishery for salmon carried out at Faroes in recent years and that they had been very precautionary.

7.2 The Commission considered a proposal from the Chair for a Decision regarding the salmon fishery at Faroes in 2005. After a number of amendments, the Commission adopted the Decision, NEA(04)10, Annex 6. The representative of the European Union stated that he could accept the Decision but he referred to the European Union position on this matter at last year's Annual Meeting which remained unchanged. He asked that this be reflected in this year's report in order to explain to his authorities why, as head of the European Union delegation and after consulting fully with the European Union Member States in his delegation, he was willing to accept the Decision which was better than having nothing at all.

7.3 The representative of Norway expressed his appreciation that the Faroes had acted in a precautionary manner and in accordance with the scientific advice from ICES. He indicated that he would also have preferred a regulatory measure for the 2005 fishery and expressed a desire to see a research fishery at Faroes with a small quota allocated to it. He could, therefore, accept the Decision as he was convinced that Denmark (in respect of the Faroe Islands and Greenland) would continue to act in a responsible manner.

7.4 The representative of Iceland stated that he could accept the Decision as amended. The representative of Russia also accepted the Decision and emphasised the importance of scientific research fishing. He also drew attention to recent regulations in Russian coastal waters reducing the salmon quota from 60t to 48t.

7.5 The representative of Denmark (in respect of the Faroe Islands and Greenland) thanked the Parties for their supportive words and reiterated that the Faroes have always managed marine resources in a responsible manner and they have no problem in complying with Article 66 of the Law of the Sea Convention.

8. Announcement of the Tag Return Incentive Scheme Prize

8.1 The Chairman announced that the winner of the Commission's $1,500 prize was Mr Jury Alexeevich Evdokimov, from Murmansk, Russia. The Commission offered its congratulations to the winner.

9. Recommendations to the Council on the Request to ICES for Scientific Advice

9.1 The Commission reviewed the relevant sections of document SSC(04)2 and agreed to recommend it to the Council as part of the annual request to ICES for scientific advice. The request to ICES, as agreed by the Council, CNL(04)13, is contained in Annex 7.

10. Other Business

10.1 The representative of Norway indicated that at the Commission's last Annual Meeting it had been agreed that a pilot study involving a simulated escape of farmed salmon should be undertaken to improve understanding of the migration, dispersal and survival of farmed salmon in the North-East Atlantic. Dr Lars Petter Hansen was appointed as the coordinator for the project. It had been agreed that between 500-1,000 tagged farmed salmon would be released by a number of countries in the Commission area. However, some countries had experienced some practical difficulties in carrying out the releases in 2004 so it had been decided to postpone the experiment until 2005.

11. Date and Place of Next Meeting

11.1 The Commission agreed to hold its next Annual Meeting in conjunction with the Twenty-Second Annual Meeting of the Council during 6-10 June 2005.

12. Report of the Meeting

12.1 The Commission agreed a report of the meeting, NEA(04)12.

Note: The annexes mentioned above begin on page 71, following the French translation of the report of the meeting. A list of North-East Atlantic Commission papers is included in Annex 8 on page 177 of this document.

NEA(04)12

Compte rendu de la Vingt-et-unième réunion annuelle de la Commission de l'Atlantique du Nord-Est de l'Organisation pour la Conservation du Saumon de l'Atlantique Nord 7-11 juin, 2004, Reykjavik, Islande

1. Ouverture de la réunion

1.1 En l'absence du Président M. Arni Olafsson (Danemark [pour les Iles Féroé et le Groenland]), le Vice-président, M. Steinar Hermansen (Norvège), a ouvert la Vingt-et-unième réunion annuelle de la Commission de l'Atlantique du Nord-Est et a souhaité aux délégués la bienvenue à Reykjavik.

1.2 Une déclaration d'ouverture a été prononcée au nom des Organisations non gouvernementales présentes à la Réunion annuelle (annexe 1).

1.3 Une liste des participants à la Vingt-et-unième réunion annuelle du Conseil et des Commissions de l'OCSAN figure à la page 293 de ce document.

2. Adoption de l'ordre du jour

2.1 La Commission a adopté son ordre du jour, NEA(04)11 (annexe 2). Le Président a indiqué qu'il s'attendait à ce que la Norvège présente, sous le point 10, « Divers », un rapport sur l'état d'avancement du projet pilote consistant à effectuer un relâchement synchronisé des saumons d'élevages marqués. Ce projet avait été approuvé par la Commission lors de sa dernière Réunion annuelle.

3. Nomination of a Rapporteur

3.1 La Commission a nommé Dr Niall Ó Maoiléidigh (Union européenne), Rapporteur de la réunion.

4. Election des membres du Bureau directeur

4.1 La Commission a élu à l'unanimité M. Steinar Hermansen (Norvège) et M. Andrew Thomson (Union européenne), Président et Vice-président, respectivement.

5. Examen de la pêcherie de 2003 et du rapport du CCGP du CIEM sur les stocks de saumons dans la zone de la Commission

5.1 Le représentant du CIEM, Dr Walter Crozier, a présenté les recommandations scientifiques intéressant la Commission de l'Atlantique du Nord-Est, CNL(04)9, formulées à la suite d'une demande émanant de la Commission lors de sa Vingtième réunion annuelle. Le rapport du CCGP du CIEM contenant les recommandations scientifiques pour l'ensemble des Commissions figure à la page 219 de ce document.

5.2 Le représentant de l'Islande a noté que les stocks islandais, plusieurs hivers en mer (PHM), semblaient être dans un état semblable aux stocks de saumons PHM du sud. Il a par conséquent demandé au CIEM de bien vouloir confirmer si les stocks islandais PHM avaient été amalgamés au groupe de stock PHM du sud. Le représentant du CIEM a convenu que l'état des stocks islandais PHM se rapprochait plus de celui des stocks du sud de l'Europe. Pour ce qui était de l'évaluation, ils avaient néanmoins été inclus dans le complexe des stocks du nord. Le représentant du CIEM a cependant suggéré qu'il serait bon de revoir les groupements.

5.3 Le représentant de la Norvège a exprimé sa gratitude au CIEM pour les progrès réalisés dans l'évaluation des prises accidentelles de saumons au cours des pêches pélagiques. Ceci encouragera en effet le calcul d'estimations plus fiables à l'avenir.

5.4 Le représentant du Danemark (pour les Iles Féroé et le Groenland) a cherché à savoir si les post-smolts capturés dans les chaluts expérimentaux de la mer de Norvège provenaient des pays du sud de l'Europe et si l'estimation de l'abondance pré-pêche de ces stocks avait été établie en corrélation avec les captures des pêches pélagiques. Le représentant du CIEM a indiqué que, sur la base des caractéristiques biologiques des post-smolts capturés et des marques retrouvées, la majorité des post-smolts pris dans les chaluts de recherche norvégiens proviendrait du sud de l'Europe. Il a déclaré que les corrélations n'avaient pas révélé de tendance particulière et que les comparaisons d'estimation d'abondance pré-pêche avec les captures des pêches pélagiques avaient été effectuées pour les deux groupes de stock. Le représentant du Danemark (pour les Iles Féroé et le Groenland) a noté que, bien qu'il y ait un manque de données détaillées sur les captures des pèches pélagiques, l'estimation actuelle, selon l'analyse du dépistage des captures, indiquait peu de captures accidentelles de post-smolts. Le représentant du CIEM a indiqué que des données analytiques de captures étaient nécessaires pour rendre l'estimation des prises accidentelles plus fiables, même si celles-ci continuaient à être réduites. Le représentant du Danemark (pour les Iles Féroé et le Groenland) a suggéré que non seulement un triage des prises commerciales serait coûteux, il serait également quasi-impossible de trier la totalité des prises, soit entre 80 et 100 tonnes de poissons pélagiques par jour. Le représentant du CIEM a convenu que, s'il fallait examiner une grande proportion des prises, il serait impossible d'analyser la totalité des prises d'un vaisseau de pêche pélagique. Une option serait d'effectuer un seul lancer de chalut et d'analyser la totalité des prises. Toutefois, il faudrait peut-être alors verser une compensation pour perte de pêche.

5.5 La Commission a convenu que, conformément à la décision du Conseil concernant les prises accidentelles, les Parties devaient faire des efforts pour faciliter l'amélioration des estimations des prises accidentelles de post-smolts au cours de pêches pélagiques. Le représentant de l'Union européenne a suggéré que les Parties de l'OCSAN coopéraient déjà à plusieurs niveaux pour essayer de résoudre le problème de la mortalité du saumon en mer. Il a proposé que l'OCSAN écrive à la Commission des Pêcheries de l'Atlantique du Nord-Est (CPANE) en vue d'obtenir leur co-opération ; la suggestion étant d'obtenir des statistiques de captures détaillées auprès des Parties de la CPANE concernées par les pêcheries pélagiques. La Commission a approuvé cette proposition. Le Président a présenté un brouillon de lettre adressée au Président de la CPANE. Après y avoir apporté quelques amendements, la Commission a approuvé cette lettre, NEA(04)8, (annexe 3).

6. Risque de Transmission du *Gyrodactylus salaris* dans la zone de la Commission

6.1 Le Secrétaire a présenté le rapport de l'Atelier portant sur le *Gyrodactylus salaris* dans la zone de la Commission, NEA(04)3 (annexe 4), ainsi qu'un avant-projet de la « Road map » (feuille de route), NEA(04)5, pour matérialiser les recommandations de cet atelier. La proposition de « Road map » comprend un mandat destiné à un Groupe de travail sur le *G. salaris.* Le représentant de la Norvège a indiqué que, si l'on se fiait aux études menées sur le saumon de la rivière Neva, le saumon de la Baltique était censé être résistant au *G. salaris*. Cependant, la publication récente de résultats scientifiques indiquait que le saumon dans une autre rivière de la Baltique, la Indalselven, pouvait être enclin à être contaminé par le parasite.

6.2 Le représentant de l'Union européenne a déclaré que le rapport de l'Atelier était fort utile et qu'il avait été circulé aux autorités appropriées de Bruxelles pour leur étude. Il a suggéré qu'une modification soit apportée au mandat du Groupe de travail. Le représentant de la Norvège a proposé d'ajouter un nouveau mandat afin de permettre au Groupe de travail d'examiner d'autres questions sur la santé des poissons qui pourraient être pertinentes au saumon atlantique sauvage. Ces deux propositions ont été acceptées par la Commission. La « Road map », y compris le mandat amendé du Groupe de travail *G. salaris,* tel qu'il a été adopté par la Commission, NEA(04)13, figure à l'annexe 5. Le Groupe de travail sera présidé par la Norvège.

6.3 Le représentant de la Norvège a indiqué que l'Union européenne était en cours de mettre au point une Directive sur les biocides, ce qui pourrait entraîner l'interdiction potentielle de l'utilisation de roténone à partir du 1 septembre 2006. Il a fait remarquer que la roténone était une substance clé utilisée par la Norvège pour éradiquer le *G. salaris.* Il a attiré l'attention sur le fait que l'utilisation de la roténone contre le *G. salaris* avait été recommandée par l'atelier. La roténone jouait un rôle important dans les plans d'urgence des Parties, y compris les pays qui étaient exempts du parasite. Le représentant de la Norvège a avisé la Commission quant à l'intention de son pays de prendre l'initiative de demander à la Commission européenne de clarifier la façon dont on pourrait continuer à utiliser la roténone et d'autres mesures de contrôle après 2006. Le représentant de l'Union européenne a prévenu la Commission que la réglementation proposée serait obligatoire pour tous les pays de la zone économique européenne et non pas uniquement pour les Etats membres de l'Union européenne. Il convenait que ceci était une question qui nécessitait d'être examinée, mais n'était pas autorisé à se prononcer sur la Directive car celle-ci n'entrait pas dans ses compétences ; celles-ci se limitaient à la Politique commune de la pêche. Cependant il s'est chargé de porter les inquiétudes de la Norvège à l'attention des autorités appropriées de Bruxelles. Il a également suggéré que les Parties touchées par la proposition de Directive adressent leurs inquiétudes par écrit auprès de la Direction générale de la santé et de la protection du Consommateur à Bruxelles.

6.4 Le Président a exprimé sa reconnaissance aux participants à l'atelier. Pour plusieurs d'entre eux, ceci avait été leur première participation aux réunions de l'OCSAN.

7. Mesures de réglementation

7.1 Le représentant de l'Union européenne a déclaré que l'objectif de l'OCSAN était de réglementer les pêcheries en haute mer dans les zones du Groenland occidental et de la Commission de l'Atlantique du Nord-Est. Il a noté que cela faisait longtemps qu'une mesure de réglementation n'avait pas été adoptée dans la Commission de l'Atlantique Nord-Est. Ceci suscitait une grande inquiétude auprès de la délégation de l'union européenne. Il a demandé comment les Parties étaient censées remplir leurs obligations, conformément aux accords internationaux, tels que la Convention sur la loi de la mer des Nations Unies et l'Accord sur les stocks de poissons chevauchants et hautement migrateurs (l'Accord sur les Stocks de poissons), si des mesures de réglementation n'étaient pas établies. Il s'est reporté à la Décision adoptée par la Commission, lors de sa dernière Réunion annuelle. La délégation de l'Union européenne considérait que cette Décision ne remplissait pas les obligations de la Commission. C'est à l'OCSAN qu'il revient de « mettre de l'ordre » dans les activités de pêche au saumon dans les zones de ses compétences. Il a indiqué que l'Accord sur les stocks de poissons faisait allusion à la nécessité de renforcer le rôle des Commissions de pêcherie. Comment cela pouvait-il être accompli si l'on n'établissait pas de mesures de réglementation, a-t-il ainsi demandé. Le représentant du Danemark (pour les Iles Féroé et le Groenland) a rappelé à la Commission qu'aucune pêche commerciale au saumon n'avait eu lieu aux Iles Féroé ces dernières années et qu'ils avaient scrupuleusement observé l'approche préventive.

7.2 La Commission a étudié une proposition de décision concernant la pêche au saumon dans les eaux des Iles Féroé en 2005, émise par le Président. Après y avoir apporté quelques amendements, la Commission a adopté la Décision, NEA(04)10, annexe 6. Le représentant de l'Union européenne a déclaré qu'il était en mesure d'accepter la Décision. Il s'est néanmoins reporté à la position de l'Union européenne sur cette question lors de la Réunion annuelle de l'année précédente indiquant que celle-ci demeurait la même. Il a demandé que ce point de vue soit reflété dans le compte rendu de cette année de façon à ce qu'il puisse expliquer aux autorités compétentes pourquoi, en tant que Chef de la délégation de l'Union européenne, et après avoir longuement délibérer avec les Etats Membres de l'Union européenne de sa délégation, il était disposé à accepter la Décision, ce qui était préférable à rien du tout.

7.3 Le représentant de la Norvège a exprimé sa reconnaissance aux Iles Féroé pour avoir agi avec précaution et conformément aux recommandations scientifiques du CIEM. Il a indiqué qu'il aurait également préféré voir l'établissement d'une mesure de réglementation pour la pêcherie de 2005 et a exprimé le désir qu'un petit quota soit alloué à une pêche menée à des fins de recherche scientifique aux Iles Féroé. Il était en mesure d'accepter la Décision puisqu'il était convaincu que le Danemark (pour les Iles Féroé et le Groenland) continuerait à agir avec responsabilité.

7.4 Le représentant de l'Islande a déclaré qu'il pouvait accepter la Décision, telle qu'elle avait été amendée. Le représentant de la Fédération de Russie a aussi accepté la Décision et a souligné l'importance de la pêche menée à des fins de recherche scientifique. Il a également attiré l'attention sur les récents règlements appliqués aux eaux côtières russes qui réduisaient le quota de saumons de 60 à 48 tonnes.

7.5 Le représentant du Danemark (pour les Iles Féroé et le Groenland) a remercié les Parties pour leurs paroles de soutien et a réitéré que les Iles Féroé ont toujours géré les ressources marines avec responsabilité et n'avaient aucun problème à observer l'article 66 de la Convention de la loi de la mer.

8. Annonce du prix du programme d'encouragement au renvoi des marques

8.1 Le Président a annoncé que M. Jury Alexeevich Evdokimov, de Murmansk, Fédération de Russie avait remporté le prix de 1 500 dollars de la Commission. La Commission a offert ses félicitations au gagnant.

9. Recommandations au Conseil s'inscrivant dans le cadre de la demande au CIEM de recommandations scientifiques

9.1 Après avoir passé en revue les sections pertinentes du document SSC(04)2, la Commission a convenu de les recommander au Conseil dans le cadre de la demande annuelle de recommandations scientifiques au CIEM. Le document CNL(04)13 (annexe 7) contient la demande de recommandations scientifiques adressée au CIEM et approuvée par le Conseil.

10. Divers

10.1 Le représentant de la Norvège a indiqué qu'il avait été convenu, lors de la dernière Réunion annuelle de la Commission, d'entreprendre une étude pilote visant à améliorer la compréhension de la migration, dispersion et survie du saumon d'élevage dans l'Atlantique du Nord-Est. Cette étude était censée reposer sur la simulation d'un échappement de saumons d'élevage. Dr Lars Petter Hansen a été nommé coordinateur du projet. On avait convenu que différents pays de la zone de la Commission relâcheraient entre 500 et 1 000 saumons d'élevages marqués. Cependant, certains pays avaient eu quelques difficultés pratiques à entreprendre les relâchements en 2004. Il a par conséquent été décidé de reporter l'expérience à 2005.

11. Date et lieu de la prochaine réunion

11.1 La Commission a convenu de tenir sa prochaine Réunion annuelle lors de la Vingt-deuxième réunion annuelle du Conseil, qui se tiendra du 6 au 10 juin.

12. Compte rendu de la réunion

12.1 La Commission a approuvé le compte rendu NEA(04)12 de la réunion.

Note: L'annexe 8 contient, à la page 177, une liste des documents de la Commission de l'Atlantique Nord-Est.

ANNEX 1

NGO Joint Opening Statement to the North-East Atlantic Commission

Mr Chairman,

The NGOs wish to raise two issues for the attention of this Commission.

The first is the parasite *Gydrodactylus salaris* which, as we all know, has huge ecological, economic and social impacts in many Scandinavian catchments. The NGOs applaud the NASCO initiative in convening the recent Workshop in Oslo, but urge the Governments concerned, and particularly Norway, to commit the necessary measures to eradicate this dangerous parasite.

Can I also take the opportunity to raise NGO concerns with the EU at the attitude of Finland and Sweden to control of this parasite, with particular reference to cross-border rivers. Finland and Sweden are also concerned with management of Baltic salmon, which are tolerant to *Gyrodactylus.* We would be grateful if representatives of those countries would note these concerns.

The second issue is pelagic by-catch. Again, the NGOs applaud the work of NASCO in creating the International Atlantic Salmon Research Board, but urge the Board and Parties to seize the opportunity to undertake research as soon as possible with the aim of providing good information on salmon migration, and providing results for promotion of its work and in fund-raising. Our representative to the Scientific Advisory Group has made one such suggestion and we commend it to you.

ANNEX 2

NEA(04)11

Twenty-First Annual Meeting of the North-East Atlantic Commission Radisson SAS Saga Hotel, Reykjavik, Iceland 7-11 June, 2004

Agenda

1. Opening of the Meeting
2. Adoption of the Agenda
3. Nomination of a Rapporteur
4. Election of Officers
5. Review of the 2003 Fishery and ACFM Report from ICES on Salmon Stocks in the Commission Area
6. Risk of Transmission of *Gyrodactylus salaris* in the Commission Area
7. Regulatory Measures
8. Announcement of the Tag Return Incentive Scheme Prize
9. Recommendations to the Council on the Request to ICES for Scientific Advice
10. Other Business
11. Date and Place of the Next Meeting
12. Report of the Meeting

ANNEX 3

North-East Atlantic Commission

NEA(04)8

Letter to the President of NEAFC Regarding By-catch

CNL34

11 June, 2004

Mr Einar Lemche
President – North East Atlantic Fisheries Commission
22 Berners Street
London
W1T 3DY

In recent years NASCO has become concerned about the potential by-catch of Atlantic salmon post-smolts in pelagic fisheries for mackerel and herring in the North-East Atlantic Commission area. There is also a potential by-catch of Atlantic salmon in pelagic fisheries for blue whiting and capelin. ICES has advised that the southern European stock complex of Atlantic salmon is outside safe biological limits.

Since 2001, this Commission has asked that ICES provide estimates of the by-catch of salmon post-smolts in pelagic fisheries. Information has been derived from research cruises and screening of commercial catches. In its latest advice (attached), the ICES Advisory Committee on Fishery Management has indicated that "it is not possible to provide sound estimates of by-catch for any pelagic fishery" and that "this situation will prevail until there is sufficient monitoring of, and information derived from, commercial fisheries".

Access to weekly disaggregated catch data is essential, but I understand that this information has not been made available to ICES for the fisheries of particular concern to NASCO. Catches of mackerel and herring in ICES divisions IIa, IVa, Vb, VIa, VIb, VIIb, VIIc and VIIj, by rectangle and standard week, are required by ICES to facilitate more reliable estimation of the by-catch of salmon in these fisheries. It may also be useful to have the same catch information for capelin and blue whiting. On behalf of the North-East Atlantic Commission of NASCO, I would be grateful for your assistance in requesting that the NEAFC Parties involved in these fisheries provide any information on this to ICES, if possible before the end of February 2005, for the last five years.

I would be grateful if this letter could be circulated to all Contracting Parties of the North East Atlantic Fisheries Commission. Thank you in advance for your assistance.

Yours sincerely

Steinar Hermansen
Chairman
North-East Atlantic Commission

Enc.

ANNEX 4

North-East Atlantic Commission

NEA(04)3

Report of a Workshop on Gyrodactylus salaris in the Commission Area

NEA(04)3

Report of a Workshop on Gyrodactylus salaris in the Commission Area

1. The parasite *Gyrodactylus salaris* (*G. salaris*) is a very serious parasite that strikes at the very heart of salmon conservation. In Norway the parasite has infected 44 watercourses and the average decline in parr densities in these rivers has been 86%. The parasite has also been identified in 13 of the 23 rivers on the west coast of Sweden, in the rivers Keret and Kem in Karelia, Russia, and in watercourses in northern Finland, although not the two main Atlantic salmon rivers in the region, the Tenojoki (Tana River) and Naatamojoki (Neiden River). Iceland, the UK and Ireland are free of the parasite but it is known that Scottish stocks are as susceptible to the parasite as those in Norway.

2. The Commission accepted an invitation from the Directorate for Nature Management, Norway, to hold a workshop with the intention of:

   - reviewing information on the monitoring programmes for, and on the distribution of, *G. salaris*;

   - reviewing measures implemented and proposed to minimise the threat posed by *G. salaris*, including details of treatment methods employed;

   - developing recommendations on opportunities to enhance cooperation on monitoring, research and exchange of information;

   - developing recommendations on the need for revisions to international guidelines and other measures and for strengthening of national and regional legislation and measures with the objective of preventing the further spread of the parasite.

3. This Workshop was held in Oslo, Norway, during 11-12 February 2004 under the Chairmanship of Mr Steinar Hermansen (Norway) and the report of the meeting is attached. The Workshop was attended by thirty-five delegates from four of the Commission's Member Parties and an observer from the International Baltic Sea Fishery Commission. It was able to make good progress in a short period of time.

4. The Workshop developed a large number of recommendations and these are contained in sections 7.3-7.5 of the report. In order to take these recommendations forward the Workshop asked the Secretary to convene a sub-group to work by correspondence in order to develop a 'road map' proposing responsibilities and a timeframe for action, and Terms of Reference for the international Working Group proposed by the Workshop. A separate report, NEA(04)4, with the sub-group's recommendations, will be presented.

5. The Commission is asked to consider the recommendations arising from the Workshop, together with the proposed 'road map', and decide on future action.

Secretary
Edinburgh
8 April, 2004

GSW(04)5

Report of the North-East Atlantic Commission Workshop on Gyrodactylus salaris in the Commission Area

Radisson SAS Plaza, Oslo, Norway 11-12 February, 2004

1. Opening of the Meeting

1.1 The Secretary of NASCO, Dr Malcolm Windsor, opened the meeting, welcomed participants to the Workshop and made an introductory statement (Annex 1).

1.2 The State Secretary of the Royal Norwegian Ministry of the Environment, Mr Lars Jacob Hiim, welcomed delegates to Oslo and made an opening address (Annex 2).

1.3 A list of participants is contained in Annex 3.

2. Appointment of a Chairman

2.1 Mr Steinar Hermansen (Norway) was appointed Chairman.

3. Adoption of the Agenda

3.1 The Workshop adopted its agenda, GSW(04)4, (Annex 4).

4. Nomination of a Rapporteur

4.1 Dr Peter Hutchinson, Assistant Secretary of NASCO, was appointed Rapporteur.

5. Status reports by Party on monitoring programmes for, and on distribution of, *G. salaris*

5.1 Reports on the status of monitoring programmes for, and on the distribution of, *Gyrodactylus salaris* were made by EU (Finland), EU (Ireland), EU (Sweden), EU (UK), Norway and Russia. These reports are contained in Annex 5. Iceland reported that it does not have a monitoring programme specifically for *G. salaris* in rivers, although there is a monitoring programme for hatcheries. However, on the basis of the absence of the very severe damage to wild salmon stocks seen elsewhere, the authorities are confident that the parasite is not present in Iceland.

5.2 *G. salaris* has infected 44 watercourses in Norway and the average decline in parr densities in these infected rivers has been 86%. The spread of the parasite in Norway is associated with stocking of rivers, movements of fish between hatcheries and movements through brackish water of wild fish between rivers entering the same fjord. *G. salaris* has also been identified in 13 of the 23 rivers on the west coast of Sweden, and has spread north at the rate of one river a year. The parasite is present in the River Keret and in the watershed of the River Kem (on landlocked salmon in one tributary the River Pista) in Karelia. The parasite is also present in watercourses and fish farms in northern Finland but not in the two main Atlantic salmon rivers in the region, Tenojoki (Tana River) and Naatamojoki (Neiden River). Iceland, the UK and Ireland are free of the parasite. *G. salaris* is not thought to be present in North America, and it is not known if Atlantic salmon stocks there are vulnerable to the parasite.

5.3 Identification of gyrodactylids to species level has, until recently, been on the basis of morphological characteristics and is problematic because of the similarity in shape and size of the attachment hooks used to differentiate the many different species, most of which do not cause serious damage to Atlantic salmon. Recent advances in molecular techniques provide a more robust and reliable objective method of species identification and have cast doubt on the status of *G. salaris* in some EU Member States. Cooperation among scientists in Scotland, Norway, Finland, Germany, the Russian Federation and Sweden has allowed exchange of samples across the North-East Atlantic Commission area. Application of molecular techniques suggests that the reports of *G. salaris* in France, Spain and Portugal may be due to misclassification, although the parasite may be present in Germany. Accurate information on the distribution of *G. salaris* is lacking and is essential in defining infected and free zones designated for trade purposes. This uncertainty is a risk factor in operating zones designed to prevent the spread of the parasite.

5.4 The Workshop discussed the apparent difference in pathogenicity of *G. salaris* to Baltic and Atlantic salmon. Although the same species, Baltic salmon appear to be resistant to the parasite while Atlantic salmon are extremely susceptible. These differences may be due to genetic differences between the two strains of salmon. However, it was noted that there had been limited investigations in the Baltic. Research in one regulated Baltic river, the Indalselven, suggests that the salmon from that river are not resistant. In the rivers on the west coast of Sweden the parasite does not result in the very high parr mortality seen in Norway and in the river Keret in the Russian Federation, possibly because there has been mixing of stocks of Baltic and Atlantic origin. Furthermore, some of these Swedish rivers are acidified and may have high aluminium concentrations (see paragraph 6.2). In Norway, electrofishing data indicates reductions in parr densities ranging from 48% to 99% in different rivers. The reasons for these differences are not known but environmental conditions, particularly water quality, may be a factor. There is no evidence that Norwegian salmon have developed resistance to the parasite. In one river, the Vefsna, which has been infected for more than 25 years, a high incidence of Atlantic salmon/brown trout hybrids, which may have a greater degree of resistance to the parasite than salmon, has been observed in recent years. While it may be possible to develop resistance to the parasite through selective breeding programmes this would alter the genetic make-up, that codes for resistance, of the salmon stock concerned.

6. Status reports by Party on measures implemented and proposed to minimise the threat posed by *G. salaris,* including details of treatment methods employed

6.1 Reports on the status of measures implemented and proposed, to minimise the threat posed by *G. salaris* were presented by EU (Finland), EU (Ireland), EU (Sweden), EU (UK), Iceland, Norway and Russia. A Decision of the European Commission of 21 November 2003 (2003/858/EC) was also tabled. This Decision lays down the animal health and certification requirements for imports of live fish, their eggs and gametes intended for farming, and live fish of aquaculture origin and products thereof intended for human consumption. These reports are contained in Annex 6. It was noted that monitoring at rainbow trout farms in Denmark had indicated a high prevalence of the parasite and the view was expressed that it would have been valuable to have had input to the workshop from Denmark. A risk analysis had indicated that in the future, trade in live salmonids may become an important route of introduction depending on patterns of trade. Trade in carcasses (where the fish have been harvested in freshwater and have not been frozen) and mechanical transmission on fishing equipment and well-boats/lorries had also been identified as potential routes of introduction. The UK and Ireland are developing contingency plans to be implemented in the event of the parasite being introduced.

6.2 Twenty-one rivers in Norway have been successfully treated for *G. salaris* by a combination of construction of barriers and treatment with rotenone, although five remain under close surveillance. During treatment the salmon population is maintained in a living gene bank which is used to supplement the recovery which occurs naturally through salmon from the river returning from the sea. Only disinfected eggs are used to supply the gene bank and to re-stock the river. Research is being carried out into the effectiveness of species-specific chemicals such as aluminium which might be an alternative to rotenone. The cost of the treatment programme in Norway since its inception is approximately NOK 250 million (approximately £20 million, Euro 28 million) excluding the losses associated with the loss of income from the fisheries.

7. Development of recommendations

7.1 The Workshop noted that the Council of NASCO has adopted the "Williamsburg Resolution", CNL(03)57, which contains measures designed to minimise the impacts of diseases and parasites. The Workshop developed the following recommendations for research, monitoring, information exchange and measures to protect the wild Atlantic salmon from the threats posed by *G. salaris.* In doing so the Workshop recognised that there are other factors such as trade rules which will also play a role in determining which of the recommendations will finally be implemented. Nevertheless, the Workshop considers that strong measures, consistent with the Precautionary Approach, are necessary and it urges the North-East Atlantic Commission to seriously consider the following and to take appropriate action.

(a) Opportunities to enhance cooperation on monitoring, research and exchange of information

7.2 Greater cooperation in both research and management is needed among the Parties of NASCO and others. This type of cooperation is crucial with respect to effective measures to prevent further spread of the parasite and to eradicate it in areas where it has been introduced.

7.3 The group has identified that further work or investigation is required in the following areas; immediate priorities are shown in **bold.** Some of the following points may be covered within single projects or monitoring programmes.

7.3.1 Standardized targeted monitoring methods in watercourses, lakes and in aquaculture (anticipated to be based on forthcoming OIE recommendations)

(a) Standards of sample size, frequency of sampling, etc. must be developed

- **Seasonal variation, reproductive rate, etc. of parasite**
- **Annual cycle of infestation in natural watercourses and aquaculture**
- **All year-classes of salmonids, including adults, and any other potential transport hosts, should be sampled**

(b) Taxonomy requires ongoing work

(c) Require laboratory (OIE reference laboratory seems obvious choice) to provide advice, testing, confirmation

(d) Biomonitoring in hatcheries, especially where salmonids other than *S. salar* held.

7.3.2 Mapping the present and natural distribution of *Gyrodactylus salaris* in the North-East Atlantic area and adjacent areas (by individual countries or regions, encouraged by NASCO)

(a) Salmonids from both wild and culture environments should be sampled

(b) Mapping should be carried out in countries that have salmonid fish

7.3.3 NASCO should establish an international working group to:

(a) Develop measures and recommendations, e.g. for contingency plans, methods of eradication in farms

(b) Exchange information, particularly on monitoring and control

(c) Promote international cooperation in generating knowledge on eradication measures, e.g. barriers and chemical treatment

(d) Initiate workshops/seminars to exchange information and present results from monitoring and research activities on *G. salaris*

- Bring academic and applied scientists together with managers
- Potential funding sources need to be identified
- Workshop to develop proposals on applied research programme

(e) Cost benefit analysis to justify research, guarantees, policy decisions, publicity, etc.

7.3.4 NASCO should encourage the Parties to conduct research on:

(a) The natural distribution and genetics of the parasite

- What is the natural distribution and origin of the parasite?
- Can the parasite vary in virulence?

(b) The effects of salmon genetics on sensitivity to *G. salaris*

- Sensitivity of different salmon stocks and heritability of this
- Frequency of resistant traits in salmon populations

(c) General biology and spreading mechanisms of the parasite

- Reproductive rate
- Role of salmon/trout hybrids in spread/maintenance of parasite
- Risk analysis for transport/introduction
- Host-parasite relationships

(d) Effects of environmental parameters and ecology on the distribution of *G. salaris*

- Effects of environmental parameters in rivers
- Effect of environmental parameters on concurrent/secondary infections

- Potential for aluminium tolerance in the parasite and alternative treatments
- Ecological impact of the parasite

7.3.5 Publicity/Information

(a) Target high-risk groups for spread (fish movements, transporters, carcasses, anglers, tourists)

(b) How to disseminate information

Cooperation with other authorities

(b) The need for revisions to international guidelines and other measures with the objective of preventing the further spread of G. salaris

7.4 EU fish health legislation is currently under review. Directive 91/67 will be replaced in the next few years. The Office International des Epizooties (OIE) (also known as the World Organisation for Animal Health) guidelines are reviewed annually. NASCO seeks to contribute recommendations for the control of *G. salaris* to the OIE, the European Community and the Russian Federation.

7.4.1 Article 1 of EC Directive 91/67 provides for measures for conservation of species and this should be retained in any replacement legislation.

7.4.2 *G. salaris* should be placed on list II in the new fish health directive since the parasite can cause severe ecological consequences and it is present in parts of the EU and other areas are free.

7.4.3 Diagnosis of *G. salaris* by morphology should be confirmed by the use of molecular techniques.

7.4.4 The minimum approved zone size should be a river catchment, individual farms should not be given *G. salaris* free status.

7.4.5 Surveillance programmes should include all potential host species. On farms with both salmon and rainbow trout both populations should be tested. Since the expected prevalence is lower in rainbow trout higher samples sizes will be required for this species.

7.4.6 The geographic distribution of *G. salaris* should be established with a view to minimising its spread to uninfected areas.

7.4.7 Criteria for diagnosis and establishing *G. salaris* free zones should be based on international standards laid down by OIE.

7.4.8 Trade in live fish should only take place between zones of equal *G. salaris* status or from a higher to lower status zone.

7.4.9 Guidelines on the transportation of fish in the OIE Aquatic Animal Health Code (2003) should be implemented through national and regional legislation.

7.4.10 Trade in gametes is preferable to trade in live fish.

7.4.11 Countries with shared catchments should cooperate in the control and eradication of *G. salaris* and inter-country working groups for the control of *G. salaris* should be encouraged and strengthened.

(c) The need for strengthened national and regional legislation and measures with the objective of preventing the further spread of G. salaris

7.5 The new EU fish health directive will provide guidance on minimum measures for trade and disease control. The recommendations below are additional measures that countries should consider for the control of *G. salaris*.

7.5.1 The geographic distribution of *G. salaris* should be established with a view to minimising its spread to uninfected areas.

7.5.2 Within a country, criteria for diagnosis and establishing *G. salaris* free zones should be based on international standards.

7.5.3 Trade in live fish should only take place between zones of equal *G. salaris* status or from a higher to lower status zone.

7.5.4 Permission to stock fish into infected river catchments should be based on an assessment of the increased risk of transmission of the parasite to non-infected rivers (e.g. through migration and other routes).

7.5.5 In regions where the introduction of the parasite would lead to the extinction of Atlantic salmon population there should be no movement between river catchments of fish from infected farms.

7.5.6 Guidelines on the transportation of fish in the OIE Aquatic Animal Health Code (2003) should be implemented through national and regional legislation.

7.5.7 Countries should have contingency plans in place for treatment, containment or eradication. A legal base for use of rotenone and other treatment, containment and eradication measures should be put in place.[1]

7.5.8 Where possible, routine breaks in production and disinfection on rainbow trout and salmon freshwater sites should be implemented as part of a control programme in infected areas.

7.5.9 There should be good containment to prevent escapees.

7.5.10 Trade in gametes is preferable to trade in live fish.

7.5.11 Physical barriers to fish migration should be considered as a measure to minimise the risk of spread of *G. salaris* within a catchment and to uninfected catchments.

[1] Contingency plans need to be developed on a case-by-case basis and eradication may not always be possible.

7.5.12 Countries with shared catchments should cooperate in the control and eradication of *G. salaris* and inter-country working groups for the control of *G. salaris* should be encouraged and strengthened.

7.5.13 Appropriate steps should be taken to minimise the spread of *G. salaris* through movement of anglers, boats, etc. by use of approved disinfection methods.

7.5.14 All movements of live fish should be recorded so that movements can be traced in the event of an outbreak of *G. salaris*.

7.5.15 The risk of *G. salaris* introduction through the processing of fish carcasses should be assessed and where appropriate mitigated through control of processing.

7.5.16 Countries should ensure that adequate resources are available for the implementation of measures to contain and eradicate *G. salaris*.

7.6 The Workshop agreed that prior to the next Annual Meeting of the North-East Atlantic Commission, a sub-group convened by the Secretary should be established, to work by correspondence, to develop a "road map" proposing responsibilities and a timeframe for taking forward the recommendations from the Workshop and to develop Terms of Reference for the proposed international Working Group referred to in paragraph 7.3.3 above. The Parties agreed to advise the Secretariat of their participants on the sub-group.

8. Other Business

8.1 The Workshop was advised of the intention to hold a NASCO/ICES Symposium entitled "Interactions between aquaculture and wild stocks of Atlantic salmon and other diadromous fish species: science and management, challenges and solutions." The symposium will be held in Bergen, Norway, in early October 2005. The subject is relevant to the Workshop and a preliminary announcement will be sent to all Workshop participants.

9. Report of the Meeting

9.1 The Workshop agreed a report of its meeting.

10. Close of the Meeting

10.1 The Chairman thanked participants for their contributions and closed the meeting.

List of Annexes

Introductory Statement by the Secretary of NASCO

Welcome to this Workshop of the North-East Atlantic Commission of NASCO. I am glad to see that the State Secretary of the Royal Norwegian Ministry of the Environment is with us today, and he will address us shortly.

Today and tomorrow we face a very important issue: how to eradicate from infected areas, and stop the further spread of, the parasite *Gyrodactylus salaris*. NASCO's essence is the conservation of wild Atlantic salmon stocks and here we have a threat that strikes at the very heart of conservation. It kills young salmon.

We know the parasite has had a lethal effect on salmon in certain Norwegian rivers; over 40 were affected, and it still exists in about 25. We know how intense and costly the efforts have been to remove the parasite from infected rivers.

We know that it has also affected rivers in northern Finland, in the Karelian region of the White Sea in Russia and on the west coast of Sweden.

We know that it is very difficult and very costly to eradicate it and stop its spread.

We know that wild stocks in other countries, such as Scotland, are equally vulnerable to the parasite. We know that for those countries that do not have it, the prospect of its occurrence is a fishery manager's worst nightmare.

We also know that there are international pressures to liberalise trade. I suspect that most of us find this valuable; we all want cheaper goods – cheaper videos and freezers through free trade are good for all. But most of us here do not want free trade in, say, fish if the price is the movement of the parasite into areas where it does not exist. We do not want to risk the remaining wild stocks which are already in a weakened state.

So the challenge before us is to emerge from this meeting tomorrow afternoon with firm ideas on:

- how to enhance our cooperation on monitoring, research and information exchange;

- how to adapt national and regional legislation to prevent the spread of the parasite;

- and to consider if we need to develop international guidelines from this Commission, or to amend the Council's Williamsburg Resolution, or possibly to make representations to other bodies, such as OEI, on guidelines.

So your ideas here will go to the North-East Atlantic Commission in June and it will then be asked to decide whether it wishes to refer the matter on to NASCO Council.

Well, this is one interpretation of why we are here that you may or may not agree with. We will soon get to our business. First, however, I would like to invite the State Secretary, Mr Lars Jacob Hiim, to address us.

Opening Address by the State Secretary of the Royal Norwegian Ministry of the Environment

Mr Secretary, Ladies and Gentlemen:

I wish you all welcome to a wintry Oslo and to this NASCO meeting dedicated to international cooperation to minimise the threat to wild salmon from *Gyrodactylus salaris*. This parasite represents one of the most serious threats to the stocks of wild Atlantic salmon, and the effect on Norwegian stocks has been dramatic since the parasite was introduced in 1975. A total of 44 rivers have been infected, and their salmon stocks in most cases have been practically wiped out. In economic terms, estimates show an annual loss of more than 200 million Norwegian Kroner each year, giving a total loss in the range of 3-4 billion Kroner since *Gyrodactylus* was introduced.

The grave threat to the wild stocks of salmon and the associated economic losses make *Gyrodactylus* a serious challenge for Norwegian salmon management. Many resources have been used to control and eradicate the parasite. Most well known – and indeed also most controversial – has been the use of rotenone in infected rivers. This is a dramatic but necessary treatment that has relieved the stocks in 19 infected rivers from the parasite. As a result the number of infected rivers has been reduced to 25.

During the last few years, new and improved methods of fighting *Gyrodactylus* have been developed. The most promising development in recent years, however, is the use of aluminium for treatment of *Gyrodactylus*-infected rivers. This method was successfully tested in a small river system in Western Norway last autumn, and further tests will be conducted in 2004 to reveal the strengths and weaknesses of this method. Another improvement is the use of barriers to migration of anadromous fish in infected rivers.

Apart from <u>getting rid of</u> *Gyrodactylus* in infected rivers, we have spent considerable resources on measures to <u>avoid</u> spreading of the parasite to new areas. A dedicated surveillance programme keeps the proper authorities updated on the distribution of the parasite. In addition, disinfection facilities have been established in a number of rivers to avoid spreading from infected areas. And just the need to avoid further spreading will, I believe, be at the core of your discussions here in Oslo.

I personally want to stress that we must all do whatever can be done to avoid further spreading of *Gyrodactylus* to uninfected countries or regions of NASCO. To achieve this, we should examine all the potential benefits of strengthened cooperation at the scientific and management levels. The aim, of course, should be to improve the overall efficiency of the measures used against the parasite. Furthermore, we need to examine the potential for strengthened legal tools, nationally as well as internationally. I am aware that this may reveal conflicts with other important objectives, but when the conservation of our wild salmon stocks is on the line, no stone should be left unturned. NASCO has a fine tradition of competent work to conserve Atlantic salmon. The Organization has already established guidelines relevant to the battle against *Gyrodactylus*. I am therefore confident that the issues before this meeting are in good hands.

Last, but not least, I wish you all fruitful discussions and a pleasant stay here in Oslo.

List of Participants

EUROPEAN UNION

Ms Carmen Beraldi	Secretaria General de Pesca, Madrid, Spain
Mr Gordon Brown	SEERAD, Edinburgh, UK
Ms Paloma Carballo	Ministerio de Agricultura y Pesca, Madrid, Spain
Dr Carey Cunningham	FRS Marine Laboratory, Aberdeen, UK
Mr Brian Daly	Fisheries Division, Belfast. UK
Dr Paddy Gargan	Central Fisheries Board, Dublin, Ireland
Ms Fiona Geoghegan	Marine Institute, Dublin, Ireland
Dr David Graham	Veterinary Sciences Division, Belfast, UK
Mr Nigel Hewlett	Environment Agency, Huntingdon, UK
Mr Perttu Koski	National Veterinary and Food Research Institute, Oulu, Finland
Mr Pentti Munne	Ministry of Agriculture and Forestry, Helsinki, Finland
Mr Fredrik Nordwall	Swedish National Board of Fisheries, Gothenburg, Sweden
Dr Edmund Peeler	CEFAS, Weymouth, UK
Mr Ole Tougaard	European Commission, Brussels, Belgium
Mr Dave Wyman	SEERAD, Edinburgh, UK

ICELAND

Mr Arni Isaksson	Directorate of Freshwater Fisheries, Reykjavik

NORWAY

Dr Gunnbjørn Bremset	Directorate for Nature Management, Trondheim
Dr Lars Petter Hansen	Norwegian Institute for Nature Research, Oslo
Mr Ivar Hellesnes	Mattilsynet, Steinkjer
Mr Steinar Hermansen	The Royal Ministry of Environment, Oslo
Mr Bjorn Ove Johnsen	Norwegian Institute for Nature Research, Trondheim
Mr Stian Johnsen	The Ministry of Fisheries, Oslo
Mr Finn Erlend Odegaard	Norwegian Salmon Rivers, Oslo
Mr Svein-Harald Salomonsen	Mattilsynet, Sjøvegan
Mr Steinar Sandøy	Directorate for Nature Management, Trondheim
Mr Ketil Skar	VESO Trondheim, Trondheim
Mr Jarle Steinkjer	Directorate for Nature Management, Trondheim
Mr Øyvind Walsø	Directorate for Nature Management, Trondheim

RUSSIAN FEDERATION

Ms Julia Barskaya	Karelian Research Centre of Russian Academy of Sciences, Karelia
Dr Eugeny Ieshko	Karelian Research Centre of Russian Academy of Sciences, Karelia
Ms Natalia Kalinina	Regional Veterinary Service, Murmansk
Dr Svetlana Krylova	Murmanrybvod, Murmansk
Ms Olga Novokhatskaya	Karelian Research Centre of Russian Academy of Sciences, Karelia
Ms Elena Samoylova	PINRO, Murmansk
Dr Alexander Zubchenko	PINRO, Murmansk

OBSERVERS

Dr Walter Ranke	International Baltic Sea Fishery Commission, Warsaw, Poland

SECRETARIAT

Dr Malcolm Windsor	Secretary
Dr Peter Hutchinson	Assistant Secretary

GSW(04)4

North-East Atlantic Commission Workshop on *Gyrodactylus salaris* in the Commission Area

Radisson SAS Plaza, Oslo, Norway
11-12 February, 2004

Agenda

1. Opening of the Meeting
2. Appointment of a Chairman
3. Adoption of the Agenda
4. Nomination of a Rapporteur
5. Status reports by Party on monitoring programmes for, and on distribution of, *G. salaris*
6. Status reports by Party on measures implemented and proposed to minimise the threat posed by *G. salaris,* including details of treatment methods employed
7. Development of recommendations on:
   (a) opportunities to enhance cooperation on monitoring, research and exchange of information;
   (b) the need for strengthened national and regional legislation with the objective of preventing the further spread of *G. salaris;*
   (c) the need for revisions to international guidelines with the objective of preventing the further spread of *G. salaris.*
8. Other Business
9. Report of the Meeting
10. Close of the Meeting

Annex 5 of GSW(04)5

Status Reports by Party on Monitoring Programmes for, and on Distribution of, G. salaris

European Union

FINLAND

Monitoring of *Gyrodactylus salaris* in Finland

Perttu Koski, National Veterinary and Food Research Institute, Oulu Regional Unit

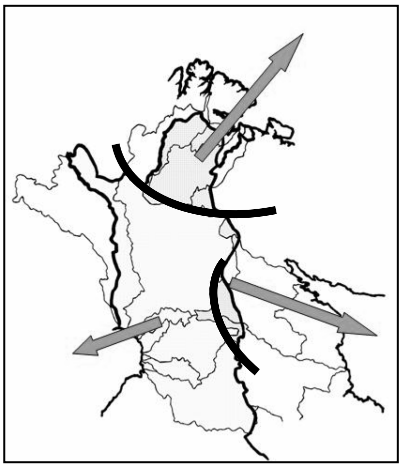


Figure 1:
Three main water catchment areas in northern Finland.

The watersheds between the water catchment areas of the Barents Sea, White Sea and Baltic Sea are partly situated in the territory of Finland (see Fig. 1).

Finland thus forms an important monitoring area for *Gyrodactylus salaris*, which is regarded as an extremely dangerous parasite of the Atlantic form of *Salmo salar*, but harmless to the Baltic form and other fish species.

History

G. salaris was found at approximately 40% of the fish farms in the northern Finland in the period 1990-92 (Koski & Malmberg, 1995). After discovering the widespread and prevalent occurrence of the parasite at fish farms in the Baltic and White Sea catchment areas, monitoring has been less intensive at farms. In the year 2000 the River Tornio wild Baltic salmon was, however, found to be heavily infected, especially in the upper parts of the tributaries in Finland. Since then there has been fairly intensive monitoring in the Finnish parts of this border river between Finland and Sweden.

Koski & Malmberg (1995) also found *G. salaris* at a rainbow trout farm in the River Paats catchment area (Lake Inari), which runs into the Barents Sea. Although this catchment area has no spawning Atlantic salmon population, the farm stock was eradicated. The first attempt to eradicate the infection was in 1992, but its failure was recognised in 1995. The farm was closed in 1996 and has been empty of fish since then. The follow-up of the eradication attempts and *G. salaris* monitoring of the River Paats catchment area is described in Koski & Heinimaa (2001).

Monitoring of the situation in the catchment areas running into the Barents Sea

In accordance with an agreement between Norway and Finland, 150 wild salmon parr per river are sampled from the Rivers Teno (Tana in Norwegian) and Näätämö (Neiden in

Norwegian) each year. Examination of the samples from a particular river is performed in Finland and Norway in alternating years. So far the results have been negative for the presence of *G. salaris*. Monitoring within this framework has been carried out in 1998-2003.

In the River Paats catchment area 60-150 wild salmonids and at least 60 fish at both of the fish farms per year are taken for the monitoring. Usually only the pectoral and dorsal fins are examined as is the general rule applying to fish farm samples in Finland. The results of the monitoring in the period 1993-1999 were reported in Koski & Heinimaa (2001). In 2000-2003 the monitoring has continued but *G. salaris* has not been detected.

The upper parts of the River Tuuloma catchment area are situated in Finland. From one tributary, the River Lutto, pectoral and dorsal fins of 60 wild grayling have been examined annually in the period 1999-2003 but *G. salaris* has not been detected. The small part of the River Uutua in Finland (Munkelva in Norwegian) has not been sampled.

Monitoring of the situation in the catchment areas running into the White Sea

There is no regular official monitoring of *G. salaris* in the two catchment areas, River Kouta and the River Vienan Kem, the upper parts of which are in Finland. Several rainbow trout farms located in these waters in Finland are, however, known to be infected with *G. salaris* (examined irregularly in conjunction with the monitoring of VHS and IHN viruses under the framework of the EU directive 91/67). It is also known that the wild land-locked salmon of Lake Kuittijärvet on the Russian side of the River Vienan Kem are infected with *G. salaris*.

Monitoring of the situation in the catchment areas running into the Baltic Sea

There are at present two wild salmon rivers flowing into the Baltic Sea in Finland, the Rivers Tornio and Simo. *G. salaris* has been found in both these rivers. In the River Tornio catchment area four rapids in different parts of the river system have been monitored. The prevalence and intensity of the *G. salaris* infection in this important Baltic salmon river are monitored by sampling 60 wild salmon parr, every second year, from the rapids. In 2000-2002 the samples were, however, taken annually and no clear time trends were detected.

The fish farms in the Baltic Sea catchment area are monitored for the presence of *G. salaris* only irregularly, as in the White Sea catchment area, or in connection with live fish exportation from Finland. The general situation is not believed to have changed from that reported in Koski & Malmberg (1995).

References

Koski P & Heinimaa P (2001). The hazard of creating a reservoir of *Gyrodactylus salaris* in wild fish in a water catchment area containing an infected fish farm. *Proceedings of an international conference "Risk analysis in aquatic animal health"*, OIE, Paris, France, 8.-10.2.2000, 90-98.

Koski P & Malmberg G (1995). Occurence of *Gyrodactylus* (Monogenea) on salmon and rainbow trout in fish farms in northern Finland. *Bulletin of the Scandinavian Society for Parasitology* 5, 76-88 and 146.

IRELAND

Distribution and Monitoring of *Gyrodactylus salaris* in Ireland

A monitoring programme for *Gyrodactylus salaris* has been in place in Ireland since the mid 1990s. This programme covers both wild and farmed fish. At least 30 fish are examined from each freshwater aquaculture facility in the country each year, and a number of river catchments (at least five) are electro-fished annually in an attempt to gather wild fish samples. Table 1 gives details of all testing which has been carried out over the past 9 years.

G.salaris has not been detected in Ireland either by the statutory monitoring programme, or by any other means.

Table 1: Breakdown of fish sampled for Gyrodactylids from 1995 - 2003

Year	Farmed salmon	Wild salmon	Farmed Brown Trout	Wild Brown trout	Farmed Rainbow trout	Charr	Carp	Total Number sampled	Positive Samples (*G.truttae* & *G.dergavini*)
1995	633	0	0	0	254	0	0	887	1
1996	580	0	0	0	351	40	0	971	19
1997	1319	0	15	16	340	15	0	1705	19
1998	1242	0	15	4	348	15	0	1624	26
1999	549	0	25	0	203	10	4	791	11
2000	775	60	25	56	133	11	0	1060	21
2001	590	95 fins	38	0	260	11	10	909 + 95 fins	19
2002	612	84 fins	10	0	168	0	0	790 + 84 fins	10
2003	380	40	18	0	8	0	0		

Approximately half of the 2003 samples are yet to be read. There are 446 fish examined from the 2003 sampling with 4 confirmations of *G.dergavini*, all positives are from farmed fish.

SWEDEN

Monitoring of *G. salaris* in Sweden

The basic idea behind the monitoring of the parasite *G. salaris* in Sweden is that only **uninfected** rivers on the Swedish west coast are monitored regularly. The reason for this is that there are regulations for stocking fish in uninfected rivers. The parasite is only monitored in a few infected rivers (Table 1). At present (2003), 13 of 23 salmon rivers on the west coast are infected, mostly the rivers located on the southern part of the coast. In other areas in Sweden, i.e. rivers emptying in to the Baltic, the parasite is considered endemic and is therefore not monitored.

Table 1.

River (Fig. 1)	**No. Fish, time of year, no. of sites**
Gyrodactylus salaris **not found**	
Enningdalsälven	40, June, each year
Strömsån	20, end of May-June, 2 sites, every second year (2003)
Örekilsälven	40, June, 3-4 sites, each year
Bäveån	20, end of May-June, 2 sites, every second year (2002, 2004)
Arödsån	20, end of May-June, 2 sites, every second year (2004)
Bratteforsån	20, end of May-June, 2 sites, every second year (2003)
Anråseån	20, end of May-June, 2 sites, every second year (2003)
Kungsbackaån	40, June, 3-4 sites, each year
Rolfsån	40, June, 3-4 sites, each year
Löftaån	40, June, 3-4 sites, each year
Himleån	40, June, 3-4 sites, each year
Tvååkersån	20, end of May-June, 2 sites, every second year (2002, 2004)
Törlan	20, end of May-June, 2 sites, every second year (2002, 2004)
Gyrodactylus salaris **found**	
Säveån	40, June, 3-4 sites, each year
Ätran	40, 3-4 sites, Högvadsån 40, 4 sites, total of 80, autumn, each year
Stensån	40, autumn, 4 sites, each year

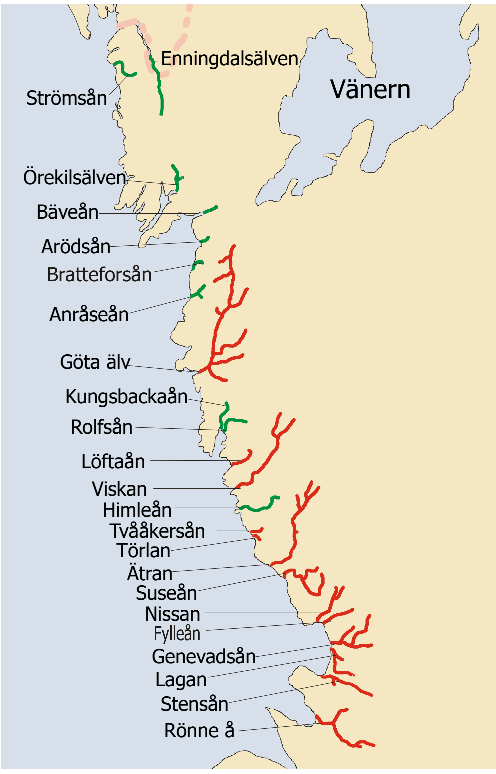


Fig. 1 Rivers monitored on the Swedish West Coast in the programme 2002-2004.

UNITED KINGDOM

Gyrodactylus monitoring and distribution

Carey Cunningham
FRS Marine Laboratory, PO Box 101, 375 Victoria Road, Aberdeen AB11 9DB, Scotland

Monitoring

The severe effects of *G. salaris* on Atlantic salmon in Norway led to great concern that the same situation might arise in the UK. Scientists from Fisheries Research Services (FRS) Marine Laboratory in Aberdeen transported parr from Scottish populations to Norway and exposed them to *G. salaris*. The Scottish fish were found to be equally susceptible to the parasite and, hence, at risk should it ever be introduced (Bakke *et al.*, 1993). The lack of any mass mortality of salmon parr in Scotland comparable to that experienced in Norway due to gyrodactylosis, combined with the knowledge that Scottish fish were susceptible, supports the hypothesis that Scotland has historically been free from *G. salaris*.

Monitoring programmes to establish that the parasite was indeed absent from the UK were instigated in the early 1990s. Shinn *et al.* carried out extensive initial surveys (Platten *et al.*, 1994; Shinn *et al.*, 1995). Routine monitoring of fish farms by FRS commenced in autumn 1994. Since then, the official service, FRS, has continued to monitor both farmed and wild salmonids. Information from this monitoring was vital to obtain the safeguard measures to prevent the movement of salmonid fish from areas that are, or may be, infected with *G. salaris*, to the UK (Commission Decision 96/490/EC). Sustained surveillance continues to demonstrate the parasite is not present in the UK.

Sampling

Freshwater fish farms are sampled once every two years for the presence of *Gyrodactylus* spp. Thirty fish are sampled from each site. Pectoral fins are cut from sacrificed fish and placed in absolute ethanol for transport back to the laboratory. Ideally, the fish would be examined on site, with all fins, the body and pharynx being examined under a binocular microscope immediately after sacrifice. Another procedure recommended for *Gyrodactylus* spp collection is to transport live fish back to the laboratory in the water they have been sampled from and carry out sacrifice and examination there. However, UK fish health inspectors are required to carry out rigorous examinations of facilities, fish and records when on a farm, and take tissues for virological, bacteriological and histological examinations. They are also often in the field for a week at a time, which precludes the collection and transfer of live fish to the main laboratory. This requires the fish to be sampled on the farm and time constraints on both sampling and examination have led to the decision to sample only pectoral fins. As susceptible species are being sampled and it is known that *G. salaris* infections rapidly increase in intensity on these hosts, it is likely that infections would be sufficiently intense to be detected from fin samples alone. Nevertheless, there is a risk that this sampling might not detect very low levels or intensities of infection.

Aquaculture facilities act as sentinel populations in fresh water. Any *G. salaris* infection in local waters that supply the farm will readily transfer to salmon or trout on the site. In a farm environment, the parasite population will rapidly increase until it is noted by the farmer or detected by the monitoring programme. For watercourses without farms, a programme of sampling wild fish has been carried out.

Since 1994, 135 samples of salmonid fish have been found infected with gyrodactylids. To illustrate the type of samples obtained in Scotland; in 2002, 107 cases were examined, representing a total of 3,010 fish. Sixteen cases, containing 397 fish, were examined from wild fish. Two thousand, six hundred and thirteen farmed fish were sampled. Twenty-four of these samples were infected by *Gyrodactylus* spp. *G. salaris* was not found in 2002 or any of the preceding years. *G. derjavini* and *G. truttae* are the species most commonly found in Scotland. *G. teuchis* was first identified from Scottish samples, but appears to be quite rare, as does *G. caledoniensis* (Shinn, Sommerville & Gibson, 1995).

In England and Wales in 2002, 125 salmonid farm sites were tested and a total of 3,595 fish were examined. Generally 30 fish were sampled at each site. 68 sites (55%) were negative for gyrodactylids. *G. derjavini* was found on 53 sites (43%), *G. truttae* was found at only 10 sites (8%), and both *G. derjavini* and *G. truttae* on 7 of these sites. In a 30-fish sample the number of fish with *G. derjavini* varied between 1 and 9. A total of 25 wild salmonids (Atlantic salmon and grayling) from 2 river catchments were sampled. *G. truttae* and *G.lucii* were found on fish from one catchment.

In Northern Ireland in 2003, 21 salmonid farms were sampled, with 1,107 fish examined. 7 farms had *Gyrodactylus* infection, none of these were *G. salaris* and *G. salaris* has never been found in Northern Ireland.

Species identification

Traditionally, *Gyrodactylus* species are discriminated by microscopic examination of the attachment organ, using differences in the size and shape of the attachment hooks to identify and differentiate species. Over 400 different species have been described within the genus *Gyrodactylus*, from fish and amphibians in fresh, brackish and salt water (Bakke *et al.*, 2002). As is frequently the case in taxonomy and systematics, several of these species descriptions require revision and updating. It was suspected that some descriptions of *Gyrodactylus* from different hosts might in fact be the same species. However, the converse has been shown more recently; specimens identified as one species are actually species groups of several morphologically similar types. *G. salaris* and *G. teuchis* are one such example of this phenomenon and are discussed below. The total number of *Gyrodactylus* species may be far higher than 400.

Of the Gyrodactylidae described from salmonid hosts in Europe, *G. salaris* is of obvious concern. *G. derjavini* and *G. truttae* are common in Northern Europe and *G. thymalli* is of interest because of the great similarity to *G. salaris*, although *G. thymalli* has a different natural host: grayling, *Thymallus thymallus*. Therefore monitoring for *G. salaris* in the UK has concentrated on identification of these species and especially the discrimination of *G. salaris* from other types.

Improvements have been made to the methods used to analyse gyrodactylids viewed under microscopic magnification. Measurement of the magnified attachment parts and further analysis of this data can provide more objective species identifications (Shinn *et al.*, 1996; 2000; 2001). However, there is a degree of overlap in measurements from species such as *G.*

salaris and *G. thymalli*, and especially *G. salaris* and *G. teuchis*, that results in a degree of uncertainty.

Since the 1990s, developments in molecular biology have enabled examination of genetic differences between *Gyrodactylus* species and the development of tests to differentiate species. Several tests are available to discriminate *G. salaris, G. derjavini* and *G. truttae*. These have been in routine use at FRS since 1995 and validated alongside microscopic examination. They have proven objective, robust and reliable, and as many diagnostic laboratories now have molecular testing facilities, are readily transferable. The traditional taxonomic study of gyrodactylids using microscopic examination requires long training and practice to develop and maintain expertise. As these skills are dwindling in many countries and molecular methods have become commonplace, the DNA-based tests may become more routine, although they will not replace traditional techniques.

Detailed methods for the identification of *Gyrodactylus* species infecting salmonid fish in Northern Europe are described by Collins *et al.* (2002) in an output from an EC-funded project involving workers from Scotland, Norway and Denmark. This handbook provides comprehensive guidance and methodology for microscopic and molecular analysis and is suitable for laboratories carrying out monitoring and surveillance for *G. salaris*.

Morphological Examination

Once samples have been deposited in the laboratory, fins are examined carefully for the presence of *Gyrodactylus*. These are examined immediately or recorded and placed in ethanol for later examination. *Gyrodactylus* specimens are removed from ethanol and placed on a microscope slide, covered with a coverslip. Examination of the anchors, ventral bar and marginal hooks is used to identify the specimen to species-group or species. Photographs are taken in cases of difficulty in identification.

Ammonium-picrate glycerin (Malmberg, 1957), a superior method for preparing whole mounts of monogenea for microscopic examination, is not used as it may interfere with subsequent molecular analysis. For the same reason, and for operator safety, formaldehyde is also not used. Parasites may be dissected to remove the attachment organ from the body, allowing staining of the attachment organ for microscopy while the body can be retained in ethanol for molecular analysis (Cunningham *et al.*, 1995a). However, there is a higher risk of losing one or both parts of the specimen in this procedure, and so it is not performed routinely in monitoring. Similarly, digestion of the specimen to leave the hard parts for microscopy and a lysate for nucleic acid extraction (Mo *et al.*, 1990; Harris *et al.*, 1999) is also not used in case of loss of one part of the sample.

Molecular examination

Several methods for discriminating *Gyrodactylus* species on the basis of DNA differences have been described (Cunningham *et al.*, 1995a; b; Cunningham, 1997; Cunningham *et al.*, 2001). At present, restriction fragment length polymorphism (RFLP) within the internal transcribed spacer (ITS) region of ribosomal RNA (rRNA) genes is the most straightforward and practical for use in surveillance and monitoring programmes. Individual parasites, once examined microscopically, are digested and part of the rRNA genes amplified by polymerase chain reaction (PCR). PCR products are then digested with enzymes and a different pattern of fragments is produced for each species. These results can then be cross-checked with those from microscopic examination.

The greatest level of detail is obtained by sequencing the DNA from specimens. DNA sequences revealed that although *G. teuchis* is almost identical to *G. salaris* in morphology and cross-hybridises with a DNA probe, it is in fact a separate species, as distinct from *G. salaris* as *G. derjavini*. These two species are an excellent example of the species groups of similar types that can be found within the genus *Gyrodactylus*. It is not cost-effective to apply sequencing as a routine diagnostic method. However, it is useful in cases of uncertainty, and in discriminating *G. salaris* and *G. thymalli*. These species are also extremely alike in morphology and in most DNA sequence, but can be separated and analysed using regions of spacer DNA (Sterud *et al.*, 2002; Cunningham *et al.*, 2003).

This spacer DNA and mitochondrial DNA have been used to begin analysis of population variation in *Gyrodactylus* (Cunningham *et al.*, 2003; Hansen *et al.*, 2003). Further information or methods to study population variation in *G. salaris* may provide information on the epidemiology or potential sources of new infections.

Distribution

Defining the current distribution of *G. salaris* in Europe is complicated by a number of factors. Early records of occurrence should be treated with caution. Potential misidentifications of *G. salaris* are listed by McHugh *et al.* (2000) and the more recent finding that specimens from France, Spain and Portugal are *G. teuchis* and not *G. salaris* raises questions over the distribution of the parasite in Southern Europe (Cunningham *et al.*, 2001). It may be the case that *G. salaris* is not present in these countries. To demonstrate this, evidence of absence is difficult to obtain and requires rigorous and thorough monitoring to verify the absence of the pathogenic species.

Conversely, *G. salaris* may be present in countries where no or small-scale investigations are carried out. If the species is present at low prevalence, or does not cause any pathogenic effects such as those in Norway, it may well go unrecorded until large-scale monitoring is established.

The borderlines between species of *Gyrodactylus* are becoming increasingly blurred. *G. salaris* and *G. thymalli* are extremely similar in morphology but can be separated by molecular methods, endorsing the distinction of these two species on grounds that they have different biological effects, as *G. thymalli* is not pathogenic to salmon (Sterud *et al.*, 2002). Analysis of population differences in *G. salaris* and *G. thymalli* support their separation (Cunningham *et al.*, 2003; Hansen *et al.*, 2003).

Within the species *G. salaris*, distinctions can now be made on the basis of genetic data. A variant of *G. salaris* showing preference for rainbow trout and not Atlantic salmon was identified in Denmark (Lindenstrøm *et al.*, 2003) and shows some genetic variation from the Norwegian form of the species that is pathogenic to salmon. Other studies on *G. salaris* from rainbow trout have found morphological variation and suggested that this form might be different to that from salmon. The differentiation of *G. salaris* from rainbow trout and salmon can be demonstrated using genetic data (Cunningham *et al.*, 2003; Hansen *et al.*, 2003), but at present there is no single reliable marker to distinguish pathogenic from harmless forms of the species (Cunningham *et al.*, 2003). However, with future development in molecular ecology, it is possible that types or strains of *G. salaris* might be identified that have different effects on different host fish.

References

Bakke, T.A., Harris, P.D., Cable, J. (2002) Host specificity dynamics: observations on gyrodactylid monogeneans. *International Journal for Parasitology* 32: 281-308.

Bakke, T.A., MacKenzie, K. (1993) Comparative susceptibility of native Scottish and Norwegian stocks of Atlantic salmon, *Salmo salar* L., to *Gyrodactylus salaris* Malmberg: laboratory experiments. *Fisheries Research* 17: 69-85.

Collins, C.M., Mo, T.A., Buchmann, K., Cunningham, C.O. (2002) Diagnosis of *Gyrodactylus* (Monogenea; Platyhelminthes) infecting salmonid fish in Northern Europe. Aberdeen, FRS Marine Laboratory: 80pp.

Cunningham, C.O. (1997) Species variation within the internal transcribed spacer (ITS) region of *Gyrodactylus* (Monogenea; Gyrodactylidae) ribosomal RNA genes. *Journal of Parasitology* 83: 215-219.

Cunningham, C.O., Collins, C.M., Malmberg, G., Mo, T.A. (2003) Analysis of ribosomal RNA intergenic spacer (IGS) sequences in species and populations of *Gyrodactylus* (Platyhelminthes: Monogenea) from salmonid fish in Northern Europe. *Diseases of Aquatic Organisms* 57: 237-246.

Cunningham, C.O., McGillivray, D.M., MacKenzie, K., Melvin, W.T. (1995a) Discrimination between *Gyrodactylus salaris, G. derjavini* and *G. truttae* (Platyhelminthes: Monogenea) using restriction fragment length polymorphisms and an oligonucleotide probe within the small subunit ribosomal RNA gene. *Parasitology* 111: 87-94.

Cunningham, C.O., McGillivray, D.M., MacKenzie, K., Melvin, W.T. (1995b) Identification of *Gyrodactylus* (Monogenea) species parasitizing salmonid fish using DNA probes. *Journal of Fish Diseases* 18: 539-544.

Cunningham, C.O., Mo, T.A., Collins, C.M., Buchmann, K., Thiery, R., Blanc, G., Lautraite, A. (2001) Redescription of *Gyrodactylus teuchis* Lautraite, Blanc, Thiery, Daniel & Vigneulle, 1999 (Monogenea: Gyrodactylidae), a species identified by ribosomal RNA sequence. *Systematic Parasitology* 48: 141-150.

Hansen, H., Bachmann, L., Bakke, T.A. (2003) Mitochondrial DNA variation of *Gyrodactylus* spp. (Monogenea, Gyrodactylidae) populations infecting Atlantic salmon, grayling, and rainbow trout in Norway and Sweden. *International Journal for Parasitology* 33: 1471-1478.

Harris, P.D., Cable, J., Tinsley, R.C., Lazarus, C.M. (1999) Combined ribosomal DNA amd morphological analysis of individual gyrodactylid monogeneans. *Journal of Parasitology* 85: 188-191.

Lindenstrøm, T., Collins, C.M., Bresciani, J., Cunningham, C.O., Buchmann, K. (2003) Characterisation of a *Gyrodactylus salaris* variant: infection biology, morphology and molecular genetics. *Parasitology* 127: 165-178.

Malmberg, G. (1957) Om forekomsten av *Gyrodactylus* pa svenska fiskar. Skrifter Utgivna av Sodra Sveriges Fiskeriforening, Arsskrift 1956: 19-76.

McHugh, E.S., Shinn, A.P., Kay, J.W. (2000) Discrimination of the notifiable pathogen *Gyrodactylus salaris* from *G. thymalli* (Monogenea) using statistical classifiers applied to morphometric data. *Parasitology* 121: 315-323.

Mo, T.A., Appleby, C. (1990) A special technique for studying haptoral sclerites of monogeneans. *Systematic Parasitology* 17: 103-108.

Platten, M., McLoughlin, M., Shinn, A.P. (1994) Distribution and identification of gyrodactylid species in fish farms and rivers of Northern Ireland. *Veterinary Record* 135: 411-412.

Shinn, A.P., des Clers, S., Gibson, D.I., Sommerville, C. (1996) Multivariate analyses of morphometrical features from *Gyrodactylus* spp. (Monogenea) parasitising British salmonids: Light microscope based studies. *Systematic Parasitology* 33: 115-125.

Shinn, A.P., Gibson, D.I., Sommerville, C. (2001) Morphometric discrimination of *Gyrodactylus salaris* Malmberg (Monogenea) from species of *Gyrodactylus* parasitising British salmonids using novel parameters. *Journal of Fish Diseases* 24: 83-97.

Shinn, A.P., Kay, J.W., Sommerville, C. (2000a) The use of statistical classifiers for the discrimination of species of the genus *Gyrodactylus* (Monogenea) parasitizing salmonids *Parasitology* 120: 261-269.

Shinn, A.P., Sommerville, C., Gibson, D. (1995) Distribution and characterization of species of *Gyrodactylus* Nordmann, 1832 (Monogenea) parasitizing salmonids in the UK, and their discrimination from *G. salaris* Malmberg, 1957. *Journal of Natural History* 29: 1383-1402.

Sterud, E., Mo, T.A., Collins, C.M., Cunningham, C.O. (2002) The use of host specificity, pathogenicity, and molecular markers to differentiate between *Gyrodactylus salaris* Malmberg, 1957 and *G. thymalli* Zitnan, 1960 (Monogenea: Gyrodactylidae). *Parasitology* 124: 203-214.

NORWAY

Monitoring *Gyrodactylus salaris* on Atlantic Salmon and Rainbow Trout in Norway

Ivar Hellesnes, the Norwegian Food Safety Authority

The first detection of the salmon parasite *Gyrodactylus salaris* in Norway was on smolts at a Salmon Research Station in Western Norway in 1975. During the next 5 years it was detected on salmon in 5 rivers along the coastline. It was then recognised as a parasite seriously threatening the salmon populations in the country. A comprehensive study to catalogue the occurrence of *G. salaris* in Norwegian rivers and fish farms was launched. From 1980 to 1982 young salmon from several hundred watercourses were collected and examined. These examinations revealed *G. salaris* in 17 more rivers, bringing the total number of infected watercourses up to 21 by the end of 1982. A number of fish farms were also examined. Indications were found that the parasite had primarily spread to the rivers through stocking of infected fish.

As a consequence of these findings, *G. salaris* was placed on the Ministry of Agriculture's list of B diseases under reporting obligations. This intensified the focus on the parasite significantly, and the monitoring of fish farms was organized. Until the end of the 1990s a large number of reports describing this river monitoring were published. In 1987 it was finally determined that the parasite found the previous year on rainbow trout in a fish farm in Lake Tyrifjorden (the Drammen watercourse near Oslo) was *G. salaris*. During the next three years a comprehensive study of rainbow trout fish farms across South-Eastern Norway was undertaken, the result being that the parasite was found in a total of 26 such fish farms.

Towards the end of the 1990s cooperation was formalised between the Directorate for Nature Management (DN) and the Norwegian Animal Health Authority, which at that time were responsible for the Salmon and Inland Fishing Act and the Fish Diseases Act, respectively. The Animal Health Authority is now incorporated into the Norwegian Food Safety Authority, and the Fish Disease Act is incorporated into the Food Act. The two mentioned acts lay down responsibilities for both agencies with respect to disease problems in wild salmon. In 2000, the DN and the Animal Health Authority drew up a joint Action Plan for measures against *G. salaris* and placed the responsibility for monitoring on the Animal Health Authority. In 2000 the Animal Health Authority, in conjunction with the National Veterinary Institute, implemented the monitoring of salmon and rainbow trout in watercourses and fish farms. From 2001 the monitoring programme for *G. salaris* has been in full operation as far as rivers are concerned, and from 2003 the same has been achieved concerning fish farms.

From 1975 to the end of 2000 *G. salaris* has been found in a total of 41 watercourses. The parasite was found in one and two new rivers, respectively, in 2001 and 2002. In total *G. salaris* has thus been found in 44 Norwegian watercourses.

From 1975 to the end of 2000 *G. salaris* had been found in a total of 37 fish farms. The parasite was found in three new fish farms in 2002, one of which was also infected in 1977. Thus overall, *G. salaris* has been found in 39 Norwegian fish farms, of which 26 are inland facilities producing rainbow trout in South-Eastern Norway and 13 are hatcheries producing smolt along the coast.

At the moment, there are no known existing cases of *G. salaris* in Norwegian fish farms.

There are 23 rivers with known occurrences of *G. salaris*, five rivers are in the process of being declared healthy and 16 rivers have been declared healthy. For tables giving the details about the results from the monitoring programme in 2001 and 2002, see

http://www.vetinst.no/Arkiv/Pdf-filer/NOK-2003/22-2002.pdf
and
http://www.vetinst.no/Arkiv/Pdf-filer/NOK-2001/22_2001_Gyrodactylus.pdf

A more comprehensive description of monitoring and control of *G. salaris* in Norway up to 2003 may be found in the next issue of the Norwegian Veterinary Journal, March 2004. The article will be in Norwegian but with a summary in English.

The results for 2003 are not available, but approximately 12,500 fish have been sampled, of which 8,500 – 9,000 are from fish farms, and the rest from rivers. The testing of all the material from the rivers has not yet been concluded (Tor Atle Mo, *personal communication*, February 2004).

Gyrodactylus salaris in Norwegian rivers

Bjørn Ove Johnsen and Arne Johan Jensen, Norwegian Institute for Nature Research, Trondheim, Norway.

Introduction

In the period 1975-1979, pre-smolt Atlantic salmon were found to be infected by *Gyrodactylus* in an increasing number of Norwegian rivers. Such a mass infection in natural waters was unique, and investigations were initiated to find out the proportions and causes of the problem.

1. The first observations of G*yrodactylus*

G. salaris was discovered for the first time in Norway in a hatchery at Sunndalsøra in 1975. The same year the parasite was found infecting three out of 128 salmon parr sampled in the river Lakselva, a rather small salmon river situated in the northern part of Norway. One year later, in August 1976, *Gyrodactylus* was found parasitizing 159 (95%) out of 168 salmon parr caught at the same five locations in the river. Fish, which were infected with *Gyrodactylus* and fungus, were found dead and dying in the river. In August 1977, the salmon parr population had decreased catastrophically. Only two parr were found and they were both infected with *Gyrodactylus*.

In 1979, *Gyrodactylus* was discovered in three more rivers and as a result of these findings regional investigations were started in 1980.

2. Regional investigations 1980 – 85

Regional research was initiated on juvenile Atlantic salmon in hatcheries and natural waters and approximately 200 rivers were investigated within a few years. By the end of 1982, *G. salaris* had been found in 23 rivers and in 1983 *G. salaris* was declared a notifiable disease.

3. Evidence of introduction

Regional investigations of about 50,000 salmon parr from a large number of rivers (until 1999) show that *G. salaris* is not naturally distributed in Norway. In 139 of the rivers, more than 90 salmon parr have been investigated without finding the parasite. If the parasite had occurred with a prevalence of 5% or more in one of these rivers, there is a 99% probability that it would have been discovered (Johnsen & Jensen 1999).

The introduction hypothesis was strongly supported by Bakke *et al.* (1990). They examined the susceptibility and resistance of salmon parr from two Norwegian rivers (river Alta and river Lone) and one Russian Baltic river (Neva) against *G. salaris* from Norway. In both the Norwegian salmon stocks, the *G. salaris* infrapopulations steadily increased during the experimental period of 5 weeks, in contrast to a decline in the Neva salmon stock. The Baltic Neva stock demonstrated both an innate and an acquired resistance towards *G. salaris* in contrast to the highly susceptible Norwegian Alta and Lone salmon stocks.

Four anthropogenic introductions of *G. salaris* into Norway (Figure 1) along with infected salmonids from hatcheries around the Baltic Sea have been suggested (Johnsen *et al.* 1999). One of these introductions was to a river (Skibotnelv) and the other three were to hatcheries.

1. *G. salaris* was introduced to the river Skibotnelv probably by "dumping" of smolts from a Swedish smolt transport in 1975.

2. *G. salaris* was discovered for the first time in Norway in 1975 at a hatchery at Sunndalsøra, western Norway. This hatchery had imported salmon smolts from Sweden on several occasions in the 1970's. From this hatchery, the parasite was spread through stocking of fish to several rivers distributed over a large part of the country.

3. A hatchery in the Trondheimsfjord area had imported salmon smolts from Sweden several times in the 1980's.

4. *G. salaris* was discovered in a fish farm in Lake Tyrifjorden in 1986. The same parasite was later found infecting rainbow trout in 8 fish farms and on salmon parr in one fish farm, all situated on rivers draining to the Lake Tyrifjord.

Studies of mitochondrial DNA variation of *G. salaris* populations in Norway and Sweden (Hansen *et al*. 2003) showed that the *G. salaris* populations grouped into 3 phylogenetic clades consisting of 6 haplotypes (A – F). The distribution of the different haplotypes clearly indicate Baltic-Sea strains of *G. salaris* as the source for introduction of the parasite into most Norwegian rivers. The occurrence of haplotype F in the rivers Drammenselva and Lierelva as well as in the rainbow trout farm in Lake Bullaren, Sweden, support the suggestion by Mo (1991) of an independent introduction via rainbow trout to these rivers. Haplotype F was also detected in the river Lærdalselva but the source of its infection is unknown (Hansen *et al.* 2003).

A total of 44 rivers have been or are still infected with *G. salaris*. In 38 of these rivers the occurrence of *G. salaris* can be connected to stocking of fish from infected hatcheries, to infected hatcheries situated by the river or to further spread in brackish water from infected rivers (Johnsen & Jensen 1999).

4. Spreading within rivers

The finding of *G. salaris* in the river Vefsna and its tributaries indicate an upstream spread of the parasite. In 1978 the parasite was found in the main river, and in the tributary Svenningdalselva. In 1979 the parasite was found in lower parts of the tributary Austervefsna. In 1980 it was found in upper parts of the Austervefsna, by which time it had spread throughout the entire watercourse. In Vefsna there are many waterfalls in which salmon ladders have been built. The lengths and heights of the 14 salmon ladders in the watercourse indicate that there is only a small chance of upstream migration of pre-smolt salmon, suggesting therefore that adult salmon carried the parasites. Atlantic salmon have access to 126 km of the river. Within 2 years from the first finding of *G. salaris* (1978 - 1980), the parasite had colonized the entire watercourse (Figure 2).

5. Spreading between neighbouring rivers

Several of the infected rivers are situated so close to each other that the occurrence of *G. salaris* may be explained as the result of spreading with fish through brackish water in the fjord area from a neighbouring river. For example, in Romsdalsfjord, stocking of fish from an infected hatchery in the river Henselva took place in 1978. The river was investigated in 1980 and parasites were found infecting most of the salmon parr. The same year the parasite was found in Rauma, which has its outlet 6 km from the outlet of Henselva. In 1982 the small river Skorga, which is situated 1.5 km across the fjord from Rauma, was found to be infected. In the river Måna, which has its outlet approximately 12 km from the outlet of Rauma, young salmon were checked both in 1981 and in 1983, but no *G. salaris* was found. In September 1985, *G. salaris* was found for the first time. In the river Innfjordelva, which is situated in the innermost part of the 4.5 km long Innfjord with its outlet 10 km from the outlet of Rauma, investigations of the young fish population were started in 1983. Yearly investigations were conducted from 1985, but *G. salaris* was found for the first time in 1991 (Figure 3).

6. Pre-smolt populations in infected rivers

Investigations of young fish populations in infected rivers show that *G. salaris* causes great reductions and near-extermination of populations of young salmon. For example, in the river Vefsna where *G. salaris* was discovered on salmon parr collected in 1978, a drastic decrease in the density of salmon parr was observed from 1978 to 1979. This decrease continued, and since 1982 specimens of salmon parr were only sporadically recorded. The density of brown trout varied in the same period, but with no tendency towards increase or decrease (Figure 4). Data from 14 of the infected rivers indicate that the density of salmon parr has been reduced on average by 86%.

7. Salmon fisheries in infected rivers

While the total catch of Atlantic salmon in all Norwegian rivers was constant (around 300 tons) in the first part of the 1980's, the catch of salmon in *G. salaris* infected rivers dropped dramatically in the same period (Figure 5). In infected rivers the catch of salmon was reduced on average by 87%. The total yearly loss in the river fishery caused by *G. salaris* has been estimated to be about 45 tons. Without any measures the *G. salaris* attacks would have reduced the Norwegian salmon fishery by a minimum of 15%.

8. Long-term effects in the river Vefsna

As mentioned earlier, the density of salmon parr in the river Vefsna was strongly reduced as a consequence of the *Gyrodactylus* attack. In the period 1981 - 1997, densities of more than 5 salmon parr/100 m^2 in one locality were rare in the river Vefsna. However, in 1998 and later years such densities have been found in a few localities every year. In the period 1999 – 2001 the prevalence among one- and two-year old salmon sampled in August has been reduced compared to 1998 and earlier years. Data collected in 2003 showed, however, that the population of "salmon" parr mainly consisted of hybrids between Atlantic salmon and brown trout. Out of a total of 65 "salmon" parr collected in the river in 2003, 63 were hybrids between Atlantic salmon and brown trout. Such hybrids are more resistant against attacks from *G. salaris* than Atlantic salmon (Bakke *et al.* 1999).

Introduction of *G. salaris*

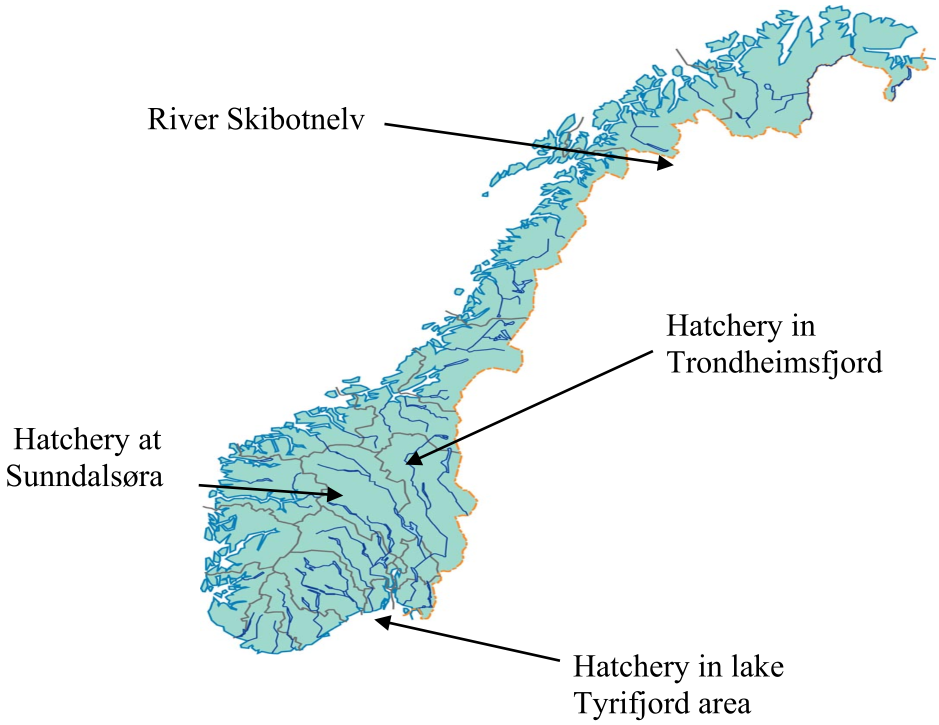


Figure 1. Four suggested introduction routes for *G. salaris* into Norway.

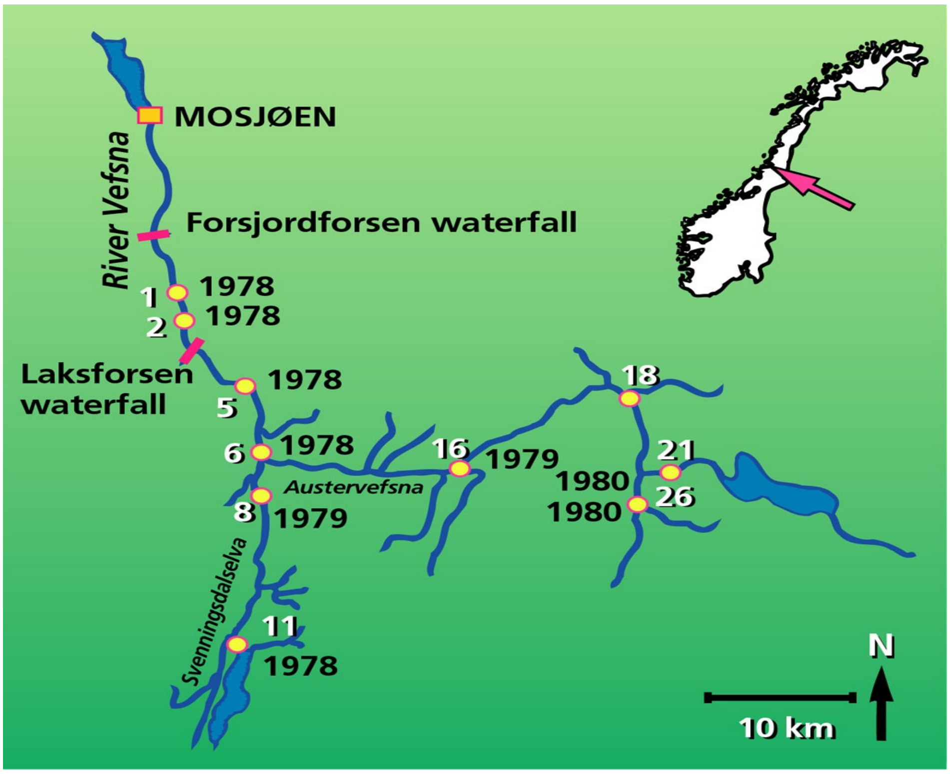


Figure 2. Upstream spread of *G. salaris* in the river Vefsna

Figure 3. Spread of *G. salaris* in the Romsdalsfjord from the river Henselva (1978) to river Rauma (1980) to river Skorga (1982) to river Måna (1985) and to river Innfjordelva (1991).

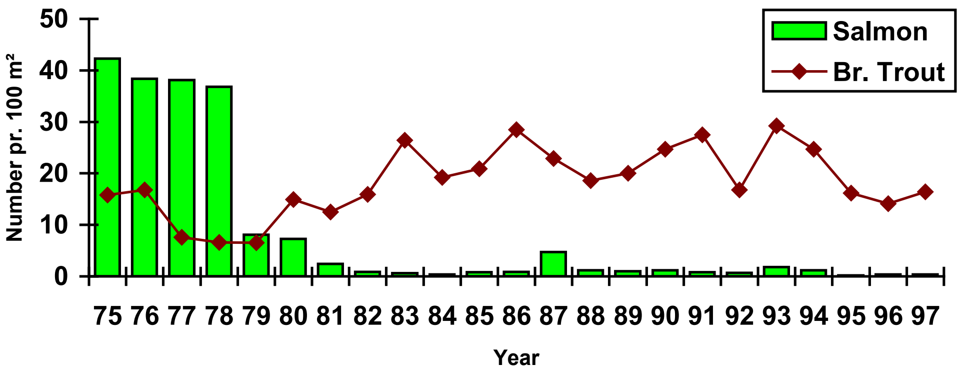


Figure 4. Density of Atlantic salmon and brown trout parr (> 0+) in the river Vefsna in the period 1975 – 1997.

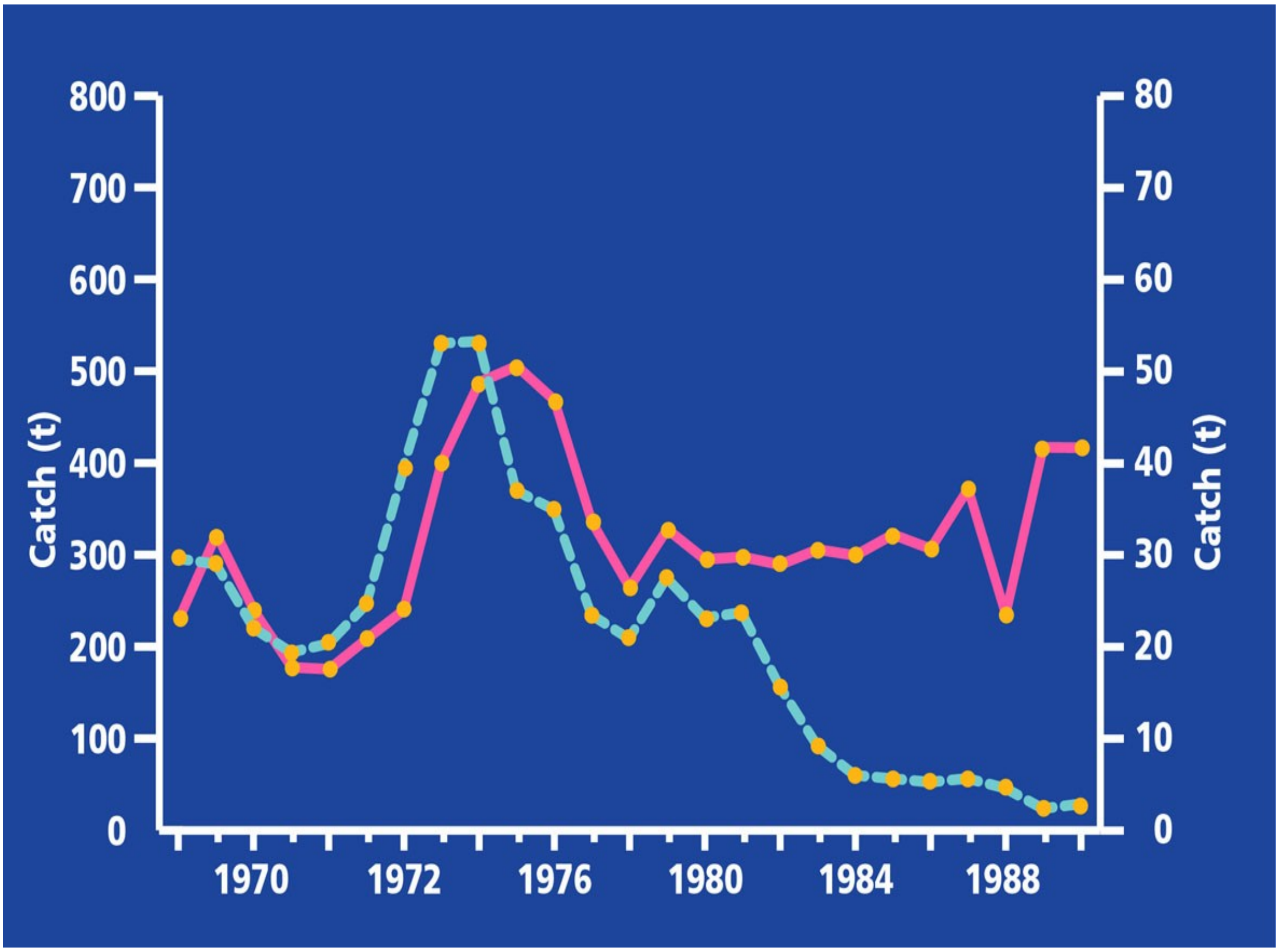


Figure 5. Catch of Atlantic salmon in rivers infected with *G. salaris* (dotted line) compared to total catch of Atlantic salmon in Norwegian rivers.

RUSSIAN FEDERATION

Monitoring Programmes for *G. salaris* in Salmon Rivers of Northwest Russia

Atlantic salmon is found in three regions in northwest Russia: Murmansk and Archangel regions and Karelia. In Russia *G. salaris* was found for the first time in the mid-80s on juvenile freshwater salmon at Petrozavodsk hatchery, Karelia, which had no connection to the sea (E. Rumyantseva, *personal communication*). In 1992 *G. salaris* was found in the Keret river (Karelia), where it caused considerable damage to the salmon population (for instance, parr densities at one of the sites declined from 62 parr/100 m^2 in 1990 to 0.2 parr/m^2 in 1996). The parasite was transmitted into the river during stocking (Ieshko and Shulman, 1994; Shulman *et al.,* 2001), therefore, there is a real risk of its further spread in northwest Russia. The Archangel region and Karelia are connected through a chain of rivers, lakes and canals with the Baltic province, where *G. salaris* is rather widespread. The Murmansk region is bordering Norway, where *G. salaris* caused considerable damage to a number of wild Atlantic salmon populations. Besides, a number of joint Russian-Finnish and Russian-Norwegian projects relating to farming of Atlantic salmon and rainbow trout are currently underway in Karelia and the Murmansk region, which create a potential threat of transmission of *G. salaris* to Russia in the course of their implementation.

For monitoring the distribution of *G. salaris* in Karelia, regular examination of fish from the Keret river for parasites has been carried out annually since 1992. In particular, these studies have shown that parasite numbers declined sharply in 2002-2003 after peak infestation in 2001. This happened during a period of low abundance of salmon and high summer temperatures. Therefore, it can be presumed that conditions have developed contributing to extinction of the parasite.

In addition, over the same period parasitological research to identify the presence of *G. salaris* was conducted on other rivers in Karelia – the Pulonga and Gridina rivers. However, the parasite was not found. A negative result was also shown by studies to assess the potential role of other salmonids in the spread of *G. salaris* in the Keret river. The parasite was not found in other species, including introduced pink salmon (Dr E. Ieshko could give a more detailed report concerning these studies).

In the Murmansk region targeted parasitological research to identify the presence of *G. salaris* was initiated in 1993 and conducted on a yearly basis thereafter. Over that time period, five White Sea rivers (Kovda, Virma, Kanda, Lubche-Savino and Niva), located near the border with Karelia, were surveyed together with three rivers (Sallajoki, Kuolajoki and Tennijoki) in the basin of the Baltic Sea, the Tuloma river with its upper tributaries beginning in Finland, the Kola river system and the Pasvik river in the basin of Inari lake (Finland), where, according to Finnish researchers, monogenea from *Gyrodactylus* genus – *G. lavareti* and *G. salaris*, were found. *G. salaris* was not found in fish sampled from these rivers.

Since 1996 monitoring programmes for parasites on juvenile Atlantic salmon have been carried out at four hatcheries in the same region on a yearly basis. *G. salaris* was not found. Nor was it found on rainbow trout from farms located in the Tuloma river system. This survey was done in 1996.

In addition to scientific monitoring Murmansk Regional Veterinary Service has been implementing a monitoring programme for *G. salaris* since 1996. In accordance with this programme regular examinations, four times a year, of juvenile salmonids for *G. salaris* are conducted at hatcheries and farms in the Murmansk region. In addition, this programme includes monitoring of wild stocks of various species such as Atlantic salmon, brown trout, smelt, grayling, whitefish, etc. The parasite has not been found.

It is intended to continue scientific and sanitary and veterinary monitoring for *G. salaris* in waters in northwest Russia. However, there are some problems with funding this work which could affect its quality.

Effect of parasites on the status of the natural fauna in inland lakes and watercourses exposed to human impact, 2003 Report

Prof. Evgueni Ieshko, Head, Laboratory for Plant and Animal Parasitology, Institute of Biology, Karelian Research Centre of RAS

Summary

Research was carried out to assess the dynamics of the epizootic related to the anthropogenic spread of the parasite in the River Keret. The monogenean *Gyrodactylus salaris* caused mass death of juvenile salmon. Surveys during the year have demonstrated that with low salmon abundance and high summer temperatures, infestation by the parasite dropped sharply and conditions developed under which extinction of the parasite may be anticipated.

Objective: To study the patterns in the dynamics of parasite abundance and distribution as influenced by the natural succession and anthropogenic pollution of aquatic ecosystems.

Four parasite species specific to the genus Salmo are known from Eurasia. Only 3 of them *(Gyrodactylus salaris, Myxidium salmonis* and *Chloromyxum schurovi)* (Shulman, Ieshko; 003) parasitise *S. trutta* and *S. salar* populations in Fennoscandia. The latter two parasites occur on both hosts. *G. salaris* was previously only reported from salmon, but has also been found on brown trout (Bakke, 1991).

Distinguishing features of the parasite fauna of the Far East salmon – the pink salmon, and the consequences of the parasite range expansion for the native fish fauna of the River Keret (White Sea)

This section deals with a comparative study of the parasite fauna of juvenile Atlantic salmon and the consequences of the spread of the dangerous parasite *Gyrodactylus salaris*. The potential role of other salmon species in the spread of the parasite along the River Keret and to neighbouring rivers was investigated. Data representing the patterns in the formation of the parasite fauna of the pink salmon *Oncorhynchus gorbuscha,* a species introduced in northern rivers, were gathered.

In September 2003, 30 juvenile Atlantic salmon (15 from the River Gridina, 15 from the River Pulonga), 15 pink salmon and 15 whitefish (River Keret) specimens were examined using complete parasitological dissection. During July-October, a further 72 juvenile Atlantic salmon from the River Keret (Sukhoi rapid, rapid by the bridge - 1 specimen, Varatskiy rapid – 11 specimens, Morskoi rapid - 50 specimens) were examined for *Gyrodactylus salaris*. The fish were absent from the upper reaches of the river. In all rapids except for the Morskoi rapid, only young-of-the-year salmon were captured.

The Atlantic salmon *Salmo salar* L.

The parasite fauna of juvenile Atlantic salmon from the River Gridina comprises 4 species (Table 1) belonging to the following taxa: Mastigophora - 1, Ciliophora - 1, Trematoda - 1, Nematoda - 1. The most frequent parasite was *Hexamita truttae* (66%). There were single occurences of the infusorian *Capriniana piscium* (13%/0.002) (here and below the first figure is the infestation intensity, %; and the second figure is the abundance index, ind.), metacercaria of *Diplostomum sp*. flukes (13%/0.1) and the nematode *Capillaria salvelini* (13%/0.1).

Table 1: Parasite fauna of juvenile Atlantic salmon from the River Gridina (September 2003)

	E	min	max	AI
Hexamita truttae	67	+	+	+
Capriniana piscium	13	0.03	0.03	0.002
Diplostomum sp.	13	1	1	0,1
Capillaria salvelini	13	1	1	0,1
No of fish dissected			15	
Total no of species			4	

Examination of juvenile Atlantic salmon from the River Pulonga revealed 5 taxa: Myxosporidia - 1, Ciliophora-1, Trematoda - 2, Nematoda – 1, Acariformes - 1 (Table 2). The greatest prevalence was demonstrated by the infusorian *Capriniana piscium* (93%). The flukes *Ichthyocotylurus erraticus* and *Diplostomum volvens,* which actively invade the host, were represented by single occurences.

Table 2: Parasite fauna of juvenile Atlantic salmon from the River Pulonga (September 2003)

Parasite species	E	Min	max	AI
Chloromyxum schurovi	13	+	+	+
Capriniana piscium	93	2	10	1.7
Diplostomum volvens	7	1	1	0.1
Ichthyocotylurus erraticus	7	1	1	0.1
Hydrachnellae gen. sp.	13	1	8	0.6
No of fish dissected			15	
Total no of species			5	

The parasite fauna of juvenile Atlantic salmon from the rivers Gridina and Pulonga comprises a total of 3 species specific to salmoniforms: *Hexamita truttae, Chloromyxum schurovi, Ichthyocotylurus erraticus*, and 5 generalist species: *Capriniana piscium, Diplostomum sp., Diplostomum volvens, Capillaria salvelini, Hydrachnellae gen. sp.*

Until recently, the largest Atlantic salmon stocks had been recorded from the River Keret. In 1992, the hazardous parasite *Gyrodactylus salaris* was introduced into the river with piscicultural activities, causing mass death of juvenile Atlantic salmon (Ieshko, Shulman 1994; Shulman *et al.* 2001). In the 2003 survey of juvenile Atlantic salmon, *G. salaris* was found only in July in the Morskoi rapid (6% and an abundance index of 0.06 specimens per fish) and in the rapid by the bridge (1 parasite specimen). Analysis of the materials from the last decade reflects the dynamics of juvenile fish infestation with the parasite (Figure 1).

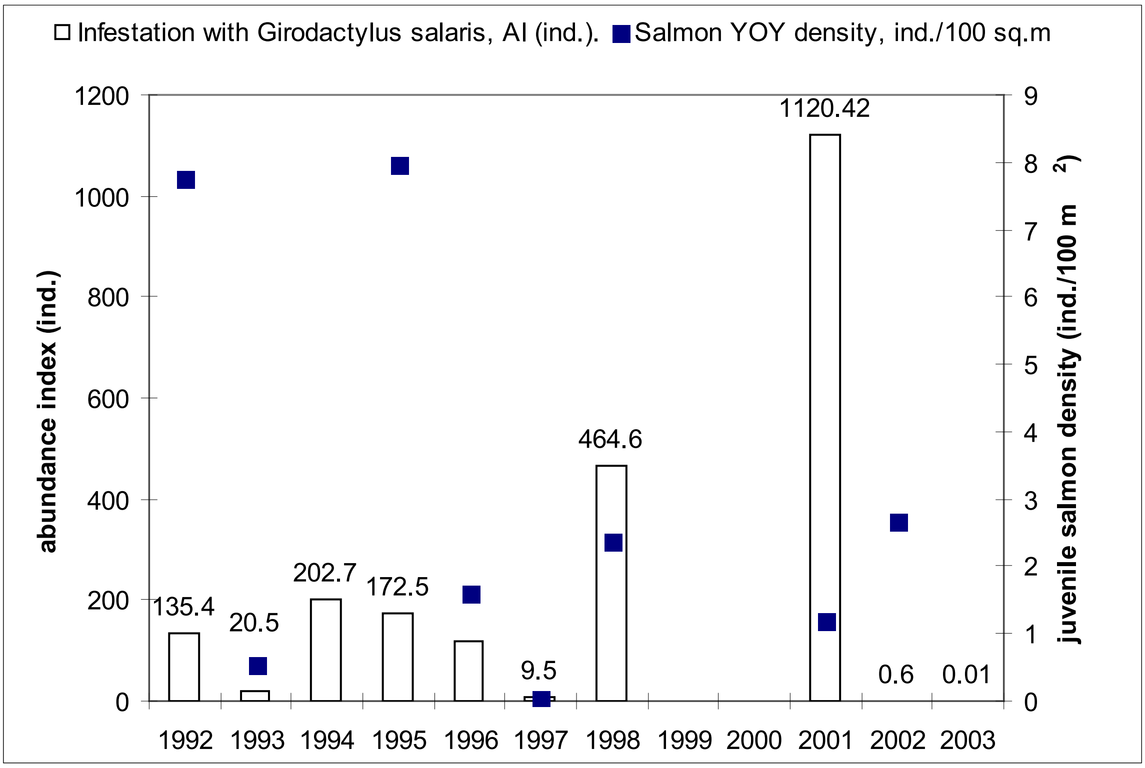


Figure 1: Variations in the infestation and density of the juvenile Atlantic salmon population across years

This and previous years' surveys show an abrupt decline in parasite abundance, which followed peak infestation in 2001. Furthermore, while the survey of July 2003 still yielded several parasite specimens, the surveys repeated in September and October showed a total absence of the parasite from the sections of the River Keret investigated. The density of the juvenile Atlantic salmon population has varied considerably over the past few years, but has been less than 8 individuals/100 sq. m, which is significantly less than the population densities recorded in the pre-infestation period (72 individuals/100 sq. m).

These findings suggest that the temperature conditions in the last two years have played a part. The hot summer ensured a prolonged period of high water temperatures in the river lasting into the autumn months. These conditions, which, of late, have recurred year after year, as well as the low densities of juvenile Atlantic salmon, have created a situation of near extinction of the parasite. More thorough research in the winter and spring-summer periods (2004) is necessary to test this hypothesis and analyse the potential fates of the parasite and the salmon in River Keret.

The Pink salmon *Oncorhynchus gorbuscha (Walb.)*

The pink salmon is an acclimated species from the Far East. The pink salmon spawning migration to the rivers of the White Sea watershed is monitored biennially, from July to September. The fish die soon after spawning. Early in September 2003, we examined pink salmon survivors descending from the spawning grounds. The parasite fauna of the pink salmon comprises 14 species: Saprollegnia – 1, Cestoda – 3, Trematoda – 6, Nematoda – 3, Crustacea – 1 (Table 3). Most of the parasites are marine (10), and only 4 are freshwater species.

The previous survey of the parasite fauna of pink salmon from the River Keret took place in August-September 1961-1962 (Malakhova, 1972). The parasite species composition generally remained the same, but infestation indices decreased for all the parasites, apparently due to the long period the fish had spent in the river.

Table 3: Parasite fauna of the pink salmon from the River Keret

Parasite species	E	min	Max	AI
Saprolegnia sp.	100	+	+	+
Eubothrium crassum	26	1	4	0.7
Scolex pleuronectis	67	1	104	12.7
Cestoda l. gen. sp.	87	1	92	5.7
Brachyphallus crenatus	46	1	18	3.9
Derogenes varicus	66	1	55	7.3
Lecithaster gibbosus	46	1	77	3.0
Podocotyle atomon	13	1	1	0.1
Ichthyocotylurus erraticus	20	1	2	0.3
Diplostomum sp.	33	1	6	0.9
Anisakis simplex	26	1	6	0.8
Pseudoterranova decipiens	26	1	1	0.3
Hysterothylacium aduncum	40	1	10	1.3
Ergasillus sielboldi	7	1	1	0.1
No of fish dissected			15	
Total no of species			14	

The pink salmon examined had heavy skin necrosis and a *Saprollegnia sp.* infection. Pink salmon do not forage when ascending to the spawning grounds and, as a result, freshwater species are represented by metacercaria of *Diplostomum sp., Ichthyocotylurus erraticus*, which invade the fish at the free-swimming cercaria stage, and by the crustacean *Ergasillus sielboldi*, which has a one-host life cycle. The infestation levels were quite low. Marine parasites constituted the bulk of the fauna. These species enter the pink salmon as it feeds on marine benthic organisms, zooplankton and fish.

Conclusion

The studies helped gain an insight into the specific fauna of salmonid parasites and patterns of its formation in the salmon rivers of northern Karelia. Analysis of the parasite fauna of the introduced fishes studied has revealed an impoverished species composition of parasites. Scientifically novel data on the analysis of an epizootic and its consequences are provided using juvenile Atlantic salmon infestation by *Gyrodactylus salaris* as the example. A key theoretical and practical issue is identification of the conditions and factors responsible for the stability of host-parasite relations. It was found that the species composition of parasites of the acclimated pink salmon is poorer than that of other fishes owing to minor infestation by freshwater parasites and the lack of specialist parasites. The monogenean *Gyrodactylus salaris* in the River Keret was recorded from juvenile Atlantic salmon only, and surveys have shown that other species cannot contribute to the spread of this hazardous parasite.

Acknowledgement

This research project, supported by the Nordic Council of Ministers, was implemented by groups of parasitologists (B. Shulman, J. Barskaya, O. Novokhatskaya) and ichthyologists (I. Shchurov, V. Shirokov).

References

Bakke T.A. A review of the inter- and infraspecific variability in salmonid hosts to laboratory infections with *Gyrodactylus salaris* Malmberg // Aquaculture. 1991. Vol. 98. P. 303-310.

Ieshko E.P., Shulman B.S. [The parasite fauna of Atlantic salmon parr of rivers from Karelian part of White Sea // Ecological Parasitology] Petrozavodsk, 1994. P. 45-53. (in Russian)

Malahova R.P. [The parasite fauna of Atlantic salmon (*Salmo salar* L.), brown trout (*Salmo trutta* L.), pink salmon (*Oncorhynchus gorbuscha*, Wabb.), and whitefish (*Coregonus lavaretus n. pidschianoides* Pravdin) in the basin of White Sea // The salmon fish (Salmonidae) in Karelia] Petrozavodsk, 1972. v.1. P. 21-36. (in Russian)

Shulman B.S., Shchurov I.L., Ieshko E.P., Shirokov V.A. The influence of *Gyrodactylus salaris* Malmberg, 1957 (Monogenea: Gyrodactylidae) on Atlantic salmon population in the River Keret' and its possible control measures // Eco-parasitological Research on animals and plants in the European North] Karelian Research Centre, RAS. Petrozavodsk, 2001. P. 40-48. (in Russian).

Shulman B.S., Ieshko E.P. *Chloromyxum schurovi sp. n.* – a new myxosporidian species (Myxosporea: Sphaerosporidae) of salmonids (Salmonidae). Parasitology, 2003. Vol. 37, No 3. P. 246-247. (in Russian).

Status Reports by Party on Measures Implemented and Proposed to Minimise the Threats posed by G. salaris, including Details of Treatment Methods Employed

EUROPEAN UNION

COMMISSION

COMMISSION DECISION
of 21 November 2003

laying down the animal health conditions and certification requirements for imports of live fish, their eggs and gametes intended for farming, and live fish of aquaculture origin and products thereof intended for human consumption

(notified under document number C(2003) 4219)

(Text with EEA relevance)

(2003/858/EC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Council Directive 91/67/EEC of 28 January 1991 concerning the animal health conditions governing the placing on the market of aquaculture animals and products ([1]), as last amended by Council Regulation (EC) No 806/2003 ([2]), and in particular Article 19(1), Article 20(1) and Article 21(2) thereof,

Whereas:

(1) A list of third countries or parts thereof, from which Member States are authorised to import live fish, their eggs and gametes for farming in the Community, should be established.

(2) It is necessary to lay down specific animal health conditions and model certificates for those third countries, taking into account the animal health situation of the third country concerned and of the fish, eggs or gametes to be imported, in order to prevent the introduction of disease agents that could cause significant impact to the fish stock in the Community.

(3) Attention should be paid to emerging diseases and diseases which are exotic to the Community and which could have serious impact on the fish stocks in the Community. Furthermore, the vaccination policy and the disease situation as regards epizootic haematopoietic necrosis (EHN) and the fish diseases referred to in Annex A to Directive 91/67/EEC, at the place or production and where appropriate at the place of destination should be taken into account.

(4) It is necessary that countries or parts thereof from which Member States are authorised to import live fish, their eggs and gametes for farming, must apply conditions for disease control, and monitoring at least equivalent to Community standards as laid down in Directive 91/67/ EEC and in Council Directive 93/53/EC of 24 June 1993 introducing minimum Community measures for the control of certain fish diseases ([3]), as last amended by Commission Decision 2001/288/EC ([4]). The sampling and testing methods used should be at least equivalent to Commission Decision 2001/183/EC ([5]) of 22 February 2001 laying down the sampling plans and diagnostic methods for the detection and confirmation of certain fish diseases and repealing Decision 92/532/EEC, and Commission Decision 2003/466/EC ([6]) of 13 June 2003 establishing criteria for zoning and official surveillance following suspicion or confirmation of the presence of Infectious salmon anaemia (ISA). In cases where sampling and testing methods are not laid down in the Community legislation, the sampling and testing methods used should be in accordance with those laid down in the International Office of Epizootics (OIE) Manual of Diagnostic Tests for Aquatic Animals.

([1])OJ L 46, 19.2.1991, p. 1.
([2])OJ L 122, 16.5.2003, p. 1.
([3])OJ L 175, 19.7.1993, p. 23.
([4])OJ L 99, 10.4.2001, p. 11.
([5])OJ L 67, 9.3.2001, p. 65.
([6])OJ L 156, 25.6.2003, p. 61.

(5) It is necessary that the responsible competent authorities of these third countries undertake to notify by fax, telegram or electronic mail, the Commission and the Member States within 24 hours, of any occurrence of epizootic haematopoietic necrosis (EHN), or diseases referred to in Annex A to Directive 91/67/EEC, as well as any other disease outbreaks causing a significant impact to the fish stock within their territory or parts thereof from which imports covered by this Decision are authorised. In such event, the responsible competent authorities of those third countries must take measures to prevent the disease spreading into the Community. Furthermore and as applicable, the Commission and the Member States should be notified of any alteration in the vaccination policy against such diseases.

(6) In addition, when importing live fish of aquaculture origin and products thereof for human consumption, it is necessary to prevent the introduction into the Community of serious diseases affecting aquaculture animals.

(7) Therefore, it is necessary to supplement the certification requirements relating to the importation of live fish of aquaculture origin and products thereof under Council Directive 91/493/EEC of 22 July 1991 laying down the health conditions for the production and the placing on the market of fishery products ([1]), as last amended by Regulation (EC) No 806/2003, with the animal health certification requirements.

(8) It would reduce the possibility to control and eradicate diseases which are exotic to the Community and which could have serious impact on the fish stocks in the Community, if fish that could carry the disease are released into unenclosed waters in the Community. Live fish, eggs and gametes of aquaculture origin, should therefore be imported into the Community only if they are introduced into a farm.

(9) This Decision should not apply to the importation of tropical ornamental fish kept permanently in aquariums.

(10) This Decision should apply without prejudice to the public health conditions established under Directive 91/493/EEC.

(11) This Decision should apply without prejudice to Community or national provision on the conservation of species.

(12) Council Directive 96/93/EC of 17 December 1996 on the certification of animals and animal products ([2]) lays down standards of certification. The rules and principles applied by third-country certifying officers should provide guarantees, which are equivalent to those laid down in that Directive.

([1]) OJ L 268, 24.9.1991, p. 15.

([2]) OJ L 13, 16.1.1997, p. 28.

(13) The principles laid down in Council Directive 2002/99/EC of 16 December 2002 laying down the animal health rules governing the production, processing, distribution and introduction of products of animal origin for human consumption ([3]), in particular Article 3 of that Directive should be taken into account.

(14) A transitional period of time should be provided for the implementation of the new import certification requirements.

(15) The list of approved countries referred to in Annex I to this Decision should be reviewed no later than 12 months after the date of application.

(16) The measures provided for in this Decision are in accordance with the opinion of the Standing Committee on the Food Chain and Animal Health,

HAS ADOPTED THIS DECISION:

Article 1

Scope

1. This Decision establishes harmonised animal health rules for the importation of:

(a) live fish, their eggs and gametes, intended for farming in the Community;

(b) live fish of aquaculture origin intended for restocking of put-and take fisheries in the Community;

(c) live fish of aquaculture origin and products thereof, intended for immediate human consumption or further processing before human consumption.

2. This Decision shall not to apply to the importation of tropical ornamental fish kept permanently in aquariums.

Article 2

Definitions

1. For the purpose of this Decision, the definitions in Article 2 of Directives 91/67/EEC and 93/53/EEC shall apply.

2. The following definitions shall also apply:

(a) 'aquaculture origin' means fish originating from a farm;

(b) 'approved import centre' means any establishment in the Community where special bio-security measures have been put in place, approved by the competent authority of the Member State concerned, for further processing of imported live fish of aquaculture origin and products thereof;

([3]) OJ L 18, 23.1.2003, p. 11.

(c) ‘coastal zone’ means a zone consisting of a part of the coast or sea water or an estuary:

(i) which has a precise geographical delimitation and consists of a homogeneous hydrological system or a series of such systems, or

(ii) which is situated between the mouths of two water-courses, or

(iii) where there are one or more farms and all farms are surrounded by appropriate buffer zones on both sides of the farm or farms;

(d) ‘continental zone’ means a zone consisting of either:

(i) a part of the territory comprising an entire catchment area from the sources of the waterways to the estuary or more than one catchment area in which fish is reared, kept or caught, as necessary surrounded by a buffer zone in which a monitoring program is carried out without the necessity of obtaining the status of an approved zone, or

(ii) a part of a catchment area from the sources of the waterways to a natural or artificial barrier preventing fish migrating from downstream of that barrier, as necessary surrounded by a buffer zone in which a monitoring program is carried out without the necessity of obtaining the status of an approved zone.

The size and the geographical situation of the continental zone must be such that the possibilities for recontamination e.g. by migrating fish are reduced to a minimum;

(e) ‘designated farm’ means either:

(i) a coastal farm in a third country subject to all necessary measures to prevent the introduction of diseases and to which the water is supplied by means of a system which ensures the complete inactivation of the following pathogens: infectious salmon anaemia (ISA), viral heamorrhagic septicaemia (VHS) and infectious haemorrhagic necrosis (IHN), or

(ii) an inland farm in a third country subject to all necessary measures to prevent the introduction of diseases. The farm is, if necessary, protected against flooding and infiltration of water, and there is a natural or artificial barrier situated down stream, which prevents fish from entering the farm. The water is supplied directly to the farm from a borehole, spring, or well, channelled through a pipe, open channel or a natural conduit, which does not constitute a source of infection for the farm and does not allow the introduction of wild fish. The water channel is under the control of the farm or of the competent authorities;

(f) ‘establishment’ means: any premises approved according to Directive 91/493/EEC, where fishery products are prepared, processed, chilled, frozen, packaged or stored, but excluding auction and wholesale markets in which only display and sale by wholesale takes place

(g) ‘farming’ means: the activity that takes place on any farm or, in general, any geographically defined installation in which fish are reared or kept with a view to their being placed on the market;

(h) ‘fish products of aquaculture origin’ means any products intended for human consumption derived from fish of aquaculture origin, including whole fish (un-eviscerated), eviscerated fish, and filets, and any products thereof;

(i) ‘further processing’ means preparation and processing before human consumption by any kind of measures and techniques, that produces waste or byproducts which could cause a risk of spreading diseases, including: operations affecting the anatomical wholeness such as bleeding, gutting/evisceration, heading, slicing, filleting;

(j) ‘immediate human consumption’ means that the fish imported for the purpose of human consumption do not undergo any further processing within the Community before being placed on the retail market for human consumption;

(k) ‘put and take fisheries’ means ponds, lakes or unenclosed waters that are sustained by the introduction of fish primarily for recreational fishing rather than for conservation or improvement of natural population;

(l) ‘territory’ means either a whole country, a coastal zone, a continental zone or a designated farm, which is authorised by the central competent authority of the third country concerned for exportation to the Community.

Article 3

Conditions for importation of live fish, their eggs and gametes intended for farming, and of live fish of aquaculture origin for restocking of put-and take fisheries, within the European Community

1. Member States shall authorise the importation into their territory live fish, their eggs and gametes for farming only if:

(a) the fish originate in a territory listed in Annex I;

(b) the consignment complies with the guarantees, including those for packaging and labelling and the appropriate specific additional requirements, as laid down in the animal health certificate, drawn up in conformity with the model in Annex II, taking into account the explanatory notes in Annex III;

(c) the fish have been transported under conditions not altering their health status.

2. Member States shall authorise the importation into their territory live fish of aquaculture origin, their eggs and gametes intended for direct restocking of put-and take fisheries only if:

(a) the consignment comply with the rules laid down in paragraph 1;

(b) the put and take fishery do not represent lakes or unenclosed waters.

3. Member States shall ensure that imported fish of aquaculture origin, their eggs and gametes intended for farming or restocking of put-and take fisheries in Community waters, only are introduced into farms or put-and take fisheries representing ponds, and not introduced into unenclosed waters.

4. Member States shall ensure that imported live fish or aquaculture origin, their eggs and gametes are transported directly to the farm or pond of destination, as stated on the animal health certificate.

Article 4

Conditions related to importation of live fish of aquaculture origin for human consumption

Member States shall authorise the importation into their territory live fish of aquaculture origin intended for immediate human consumption or for further processing before human consumption, only if:

(a) the consignment complies with the conditions laid down in Article 3 paragraph 1 and Article 7 paragraph 1 of this Decision; or

(b) the fish are sent directly to an approved import centre to be slaughtered and eviscerated.

Article 5

Conditions related to importation of fish products of aquaculture origin for further processing before human consumption

1. Member States shall authorise the importation into their territory fish products of aquaculture origin intended for further processing before human consumption only if:

(a) the fish originate in third countries and establishments authorised under Article 11 of Directive 91/493/EEC and comply with the public health certification requirements laid down under that Directive; and

(b) the consignment complies with the guarantees, including those for packaging and labelling and the appropriate specific additional requirements, as laid down in the animal health certificate, drawn up in conformity with the model in Annex IV, taking into account the explanatory notes in Annex III.

2. Member States shall ensure that processing of fish products of aquaculture origin takes place in approved import centres unless:

(a) the fish are eviscerated before dispatch; or

(b) the place of origin has a health status equivalent to the place where they are to be processed in particular as regards epizootic haematopoietic necrosis (EHN) and the diseases referred to in lists I and II, column 1, of Annex A to Directive 91/67/EEC.

Article 6

Conditions related to importation of fish products of aqua culture origin for immediate human consumption

Member States shall authorise the importation into their territory of fish products of aquaculture origin intended for immediate human consumption only if:

(a) the fish originate in third countries and establishments authorised under Article 11 of Directive 91/493/EEC and comply with the public health certification requirements laid down under that Directive;

(b) the consignment complies with the guarantees, including those for packaging and labelling as laid down in the animal health certificate, drawn up in conformity with the model in Annex V, taking into account the explanatory notes in Annex III;

(c) the consignment consists of consumer-ready packages of a size suitable for retail sale directly to the end consumer, like

(i) vacuum packed filets,

(ii) hermetically sealed or other heat-treated products,

(iii) frozen blocks of fish meat,

(iv) eviscerated fish frozen or placed on ice.

Article 7

Certification

1. In the case of live fish, their eggs and gametes, the competent authority at the border inspection post in the Member State of arrival shall complete the document referred to in Annex of Commission Decision 92/527/EEC [1] with one of the statements laid down in Annex VI to this Decision as appropriate.

2. In the case of fish products of aquaculture origin, the competent authority at the border inspection post in the Member State of arrival shall complete the document referred to in Annex B to Commission Decision 93/13/EEC [2] with one of the statements laid down in Annex VI of this Decision as appropriate.

Article 8

Preventing contamination of natural waters

1. Member States shall ensure that imported live fish of aquaculture origin and products thereof intended for human consumption are not introduced into, and do not contaminate any natural waters within their territory.

2. Members States shall ensure that transport water from imported consignments does not lead to contamination of natural waters within their territory.

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[1]OJ L 332, 18.11.1992, p. 22.
[2]OJ L 9, 15.1.1993, p. 33.

Article 9

Approval of import centres

1. The competent authority of the Member States shall approve an establishment as an approved import centre provided that it satisfies the minimum animal health conditions of Annex VII to this Decision.

2. The competent authority of the Member State shall draw up a list of approved import centres, each of which shall be given an official number.

3. The list of approved import centres, and any subsequent amendments thereto, shall be communicated by the competent authority of each Member State to the Commission and to the other Member States.

Article 10

Date of application

This Decision shall apply from 1 May 2004.

Article 11

This Decision is addressed to the Member States.

Done at Brussels, 21 November 2003.

For the Commission

David BYRNE

Member of the Commission

ANNEX II

Model animal health certificate for the importation of (1) (live fish, eggs and gametes for farming) (1) (live fish of aquaculture origin for the purpose of (1) (human consumption) (1)(restocking of put and take fisheries)) into the European Community (EC)

Note for the importer: This certificate is only for veterinary purposes and has — in its original — to accompany the consignment until it reaches the border inspection post.

Reference Code No ORIGINAL

1. **Exporting country and authorities involved** 1.1. Exporting country: .... 1.2. Competent authority: .... 1.3. Competent issuing authority:	3. **Destination of the consignment** 3.1. Member State: .... (1) (3.2. Zone or part (3) of the Member State: ....) (1) (3.3. Farm, name: ....) 3.4. Address: .... 3.5. Name, address and phone number of the Consignee: ....
2. **Place of origin of the consignment** 2.1. Code of territory of origin (2): .... (1) (2.2. Farm of origin, name: ....) (1) (2.3. Address or location of farm: ....) 2.4. Name, address and phone number of the Consignor:	4. **Means of transport and consignment identification** (4) 4.1. (1) (Lorry) (1) (Rail wagon) (1) (Ship) (1) (Aircraft): .... 4.2. (1) (Registration number(s)) (1) (Ship name) (1) (Flight number): .... 4.3. Consignment identification details: ....

5. **Description of the consignment**

☐ Farmed stocks ☐ Wild stocks ☐ Live fish ☐ Gametes ☐ Fertilised eggs ☐ Unfertilised eggs ☐ Larvae/fry

Fish specie(s)		Total weight of fish (kg) (Number of fish) (1)	(Volume of eggs) (1) (Volume of gametes) (1)	Age of live fish
Scientific name	Common name			
				☐ >24 months ☐ 12-24 months ☐ 0-11 months ☐ unknown

([15]) Specific additional requirements needed in the case of exports to farms or zones within the EC with Community approved additional guarantees as regards spring viraemia of carp (SVC) (Commission Decision 93/44/EEC).
([16]) Specific additional requirements needed in the case of exports of eggs to regions/zones within the EC with Community approved protective measures with regard to *Gyrodactylus salaris* (GS) (Commission Decision 2003/513/EC). Note that it is not allowed to introduce live salmonids into the regions referred to in this Decision originating from outside these zones.
([17]) Country and territory of origin (code) and of destination; name and telephone number of the consignor and consignee. In case of a transport with well boat, the transport route from the place of loading to the place of destination should be given.

Annex III

EXPLANATORY NOTES

(a) The certificates shall be produced by the competent authorities of the exporting country, based on the appropriate model appearing in Annex II, IV or V to this Decision taking into account the use to which the fish are to be put after the arrival to the EC.

(b) Considering the status of the place of destination as regards viral haemorrhagic septicaemia (VHS), infectious haematopoietic necrosis (IHN), spring viraemia of carp (SVC) and *Gyrodactylus salaris* (GS) in the EC Member State, the appropriate specific additional requirements shall be incorporated and completed in the certificate.

(c) The original of each certificate shall consist of a single page, double-sided, or, where more than one page is required, it shall be in such a form that all pages form part of an integrated whole and are indivisible.

It shall, on the right hand side of the top of each page, be marked as 'ORIGINAL' and bear a specific code number issued by the competent authority. All pages of the certificate shall be numbered – (page number) of (total number of pages).

(d) The original of the certificate and the labels referred to in the model certificate shall be drawn up in at least one official language of the EC Member State in which the inspection at the border post shall be carried out and of the EC Member State of destination. However, these Member States may allow other languages, if necessary, accompanied by an official translation.

(e) The original of the certificate must be completed on the day of loading the consignment for exportation to the EC with an official stamp and signed by an official inspector designated by the competent authority. In doing so, the competent authority of the exporting country shall ensure that the principles of certification equivalent to those laid down in Council Directive 96/93/EC are followed.

The stamp, unless embossed, and the signature shall be in a colour different to that of the printing.

(f) If for reasons of identification of the items of the consignment, additional pages are attached to the certificate, these pages shall be considered as forming part of the original and be signed and stamped by the certifying official inspector on each page.

(g) The original of the certificate must accompany the consignment until it reaches the EC border inspection post.

(h) The certificate shall be valid for 10 days from the date of issue. In the case of transport by ship, the time of validity is prolonged by the time of journey at sea.

(i) The fish, their eggs and gametes, shall not be transported together with other fish, eggs or gametes that, either are not destined to EC, or are of a lower health status. Furthermore, they must not be transported under any other conditions that alters their health status.

(j) The possible presence of pathogens in the water is relevant for considering the health status of live fish, eggs and gametes. The certifying officer should therefore consider the following:

The 'place of origin' should be the localisation of the farm where the fish, eggs or gametes was reared reaching their commercial size relevant for the consignment covered by this certificate.

ANNEX IV

Model animal health certificate for the importation of fish products of aquaculture origin into the European Community (EC) for further processing before human consumption

Reference Code No ORIGINAL

Note for the importer:

The present consignment must be shipped immediately, without breaking, to be retailed for further processing before human consumption.

Processing of fish products of aquaculture origin must take place in approved import centres unless eviscerated before dispatch, or the place of origin has a health status at least equivalent to the place where they are to be processed, in particular as regards the diseases epizootic haematopoietic necrosis (EHN) as well as the diseases referred to in lists I and II, column 1, of Annex A to Directive 91/67/EEC.

This certificate is only for veterinary purposes and has — in its original — to accompany the consignment until it reaches the border inspection post.

General statement

I, the undersigned official inspector, hereby certify that I am aware of the provisions of Council Directives 91/67/EEC and 93/53/EEC and Commission Decision 2003/858/EC (1).

Done at ...., on ....

(Place) (Date)

Official stamp

....

(Signature of official inspector)

....

(Name in capital letter, qualifications and title)

ANNEX V

ANNEX VI

Statements to be issued by the competent authority at the border inspection post to complete the document referred to in the Annex to Decision 92/527/EEC or in the Annex B of Decision 93/13/EEC

The competent authority at the border inspection post in the Member State of arrival shall complete the document referred to in the Annex of Decision 92/527/EEC or of Annex B of Decision 93/13/EEC with one of the following statements as appropriate:

A. **Statements to be added to the document referred to in the Annex of Decision 92/527/EEC as regards live fish, their eggs and gametes intended for farming, and live fish of aquaculture origin for restocking of putand take fisheries, in the European Community**

either:

'(Live fish) ([1]) (and) ([1]) (Eggs) ([1]) (and) ([1]) (Gametes) ([1]) certified for farming in European Community zones and farms except those with a Community approved programme or status, additional guarantees or protective measures with regard to: viral haemorrhagic septicaemia (VHS), and infectious haematopoietic necrosis (IHN), and spring viraemia of carp (SVC), and *Gyrodactylus salaris.'*

or:
'Live fish of aquaculture origin certified for restocking of put-and take fisheries in European Community zones and farms except those with a Community approved programme or status, additional guarantees or protective measures with regard to: viral haemorrhagic septicaemia (VHS), and infectious haematopoietic necrosis (IHN), and spring viraemia of carp (SVC), and *Gyrodactylus salaris.'*

or:

'(Live fish) ([1]) (and) ([1]) (Eggs) ([1]) (and) ([1]) (Gametes) ([1]) certified for farming in European Community zones and farms including those with a Community approved programme or status, additional guarantees or protective measures with regard to: (viral haemorrhagic septicaemia (VHS)) ([1]) (and) ([1]) (infectious haematopoietic necrosis (IHN)) ([1]) (and) ([1]) (spring viraemia of carp (SVC)) ([1]) (and) ([1]) *(Gyrodactylus salaris)* ([1]).'

or:
'Live fish of aquaculture origin certified for restocking of put-and take fisheries in European Community zones and farms including those with a Community approved programme or status, additional guarantees or protective measures with regard to: (viral haemorrhagic septicaemia (VHS)) ([1]) (and) ([1]) (infectious haematopoietic necrosis (IHN)) ([1]) (and) ([1]) (spring viraemia of carp (SVC)) ([1]) (and) ([1]) *(Gyrodactylus salaris)* ([1]).'

B. **Statements to be added to the document referred to in the Annex B of Decision 93/13/EEC as regards fish products of aquaculture origin intended for human consumption**

either:

'Uneviscerated fish products of aquaculture origin certified for export to the European Community (except to zones with Community approved status as regards (VHS) ([1]) (and) ([1]) (IHN) ([1])) ([1]), for further processing (in approved import centres) ([1]) before human consumption.'

or
'Eviscerated fish products of aquaculture origin certified for export to the European Community, for further processing before human consumption.'

or
'Fish products of aquaculture origin certified for export to the European Community for immediate human consumption.'.

([1]) Retain as appropriate.

ANNEX VII

Minimum animal health conditions for the approval of 'approved import centres' for processing of fish of aquaculture origin

A. **General provisions**

1. Member States shall only approve establishments as import centres for further processing of imported live fish of aquaculture origin and products thereof provided that the conditions at the import centre are such that risks of contamination of fish in Community waters, with pathogens capable of causing significant impact to fish stock, via discharges or other waste, or by other means, are avoided.

2. Establishments approved as 'approved import centre', must not be allowed to move live fish out of the establishment.

3. In addition to the appropriate public health provisions laid down under Directive 91/493/EEC for any establishments, as well as health rules laid down by Community legislation concerning animal by-products not intended for human consumption, the minimum animal health conditions as laid down below, shall apply.

B. **Management provisions**

1. Approved import centres must be open to inspection and control by the competent authority at all times.

2. Approved import centres must have an efficient disease control, and monitoring system; in application of Council Directive 93/53/EEC, cases of suspected disease and mortality shall be investigated by the competent authority; the necessary analysis and treatment must be carried out in consultation with and under the control of the competent authority, taking into consideration the requirement in Article 3(1)(a) of Directive 91/67/EEC.

3. Approved import centres must apply a management system, approved by the competent authority, including hygiene and disposal routines for transports, transport containers, facilities, and equipment. The guidelines laid down for disinfection of fish farms in the OIE International Aquatic Animal Health Code, Sixth Edition, 2003, Appendix 5.2.2, should be followed. The disinfectants used must be approved for the purpose by the competent authority and appropriate equipment must be available for cleaning and disinfection. Discharges of by-products and other waste materials including dead fish and their products must be carried out in accordance with Regulation (EC) No 1774/2002 of the European Parliament and of the Council ([1]). The management system at the approved import centre shall be such that risks of contamination of fish in Community waters with pathogens capable of causing significant impact to fish stock, in particular as regards pathogens exotic to the Community and the fish pathogens referred to in list I and II, column 1, of Annex A to Directive 91/67/EEC, are avoided.

4. Approved import centres must keep an updated record of: observed mortality; and of all the live fish, eggs and gametes entering the centre and products leaving the centre including their source, their suppliers and their destination. The record should be open to scrutiny by the competent authority at all times.

5. Approved import centres must be cleaned and disinfected regularly in accordance with the programme described in point 3 above.

6. Only authorised persons may enter approved import centres and must wear protective clothing including appropriate footwear.

FINLAND

Report on measures implemented and proposed to minimise the threat posed by *Gyrodactylus salaris*

Finnish and Norwegian Chief Veterinary Officers made a statement about certain fish health aspects related to the Tenojoki River in 1999. They wrote that "we are not aware of any risk analysis or scientific study to quantify/compare the risk of transmission of *Gyrodactylus salaris* or other serious fish disease with fishing equipment that has been dried and disinfected compared to equipment that has only been dried."

They also wrote that "although there is no evidence of spread of *Gyrodactylus salaris* or other serious fish pathogens with fishing equipment that has not been disinfected, we do acknowledge that the use of a disinfectant could be beneficial to reduce the risk of transmission of pathogenic agents and should be encouraged, particularly if the equipment has been used in a watercourse infected by *Gyrodactylus salaris* or other serious fish disease."

Later they justified that "disinfection of fishing equipment may reduce the risk of transmission of disease-causing agents, like *Gyrodactylus salaris*. Thus disinfection of fishing equipment used in watercourses infected by *Gyrodactylus salaris* or other serious contagious fish disease should be encouraged. This means that the work done concerning disinfection in Norway is highly appreciated, but that, due to the lack of scientific evidence, the benefits of making disinfection of fishing equipment compulsory in Finland too is uncertain. However, we do find it very important that enough information on the possible benefits of disinfection is given and that good possibilities for disinfection are available to encourage disinfection, on a voluntary basis, also in Finland."

After that we have tried to encourage disinfection of fishing equipment and inform the fishermen about the importance of disinfection of fishing equipment, and the possibility for disinfection has been organised in some places.

In the summer of 2001 Norwegians started to require the disinfection of fishing equipment in the case of fishermen who come ashore in Norway even if they do not fish there, and Finland decided to take measures to increase the disinfection facilities. In the summer of 2002 this possibility was available in all locations selling fishing licences to the River Tenojoki (Tana) (15 locations) and to the River Näätämöjoki (Neiden) (2 locations). Disinfection was considered advisable, but it is not obligatory.

In June 2003 the Ministry of Agriculture and Forestry organised a meeting in Rovaniemi in Lapland, on *Gyrodactylus salaris* and invited all the possible stakeholders. At that meeting we made a qualitative risk assessment and planned the tools to reduce the risks. Plans were also made on how to reach all the relevant people who should know about *Gyrodactylus salaris* and we discussed also the need to revise our regulations, for instance concerning disinfection of fishing gears and the use of bait fish.

In autumn 2003 the Food and Health Department and the Department of Fisheries and Game of the Ministry of Agriculture and Forestry started preparation of a new *Gyrodactylus salaris* decree together with the Employment and the Economic Development Centre of Lapland. The plan is to test the procedure next summer and also find out how to reach all fishermen -

also locals. The aim at the moment is that a new national decree will be in force at the end of this year or at the beginning of the year 2005. We do not think that fishing tackle (rods, reels, lines, flies and lures) is a real threat to salmon, as far as *Gyrodactylus salaris* is concerned, but because of the principle of the Precautionary Approach we are ready to implement some measures.

We have first to test the system, because at the moment about 10,000 fishermen visit the River Tenojoki during the summer (from the middle of June to the middle of August) on the Finnish side of the river. We estimate that they have with them about 40,000 rods, 7,000 lifting nets, 8,000 lifting hooks, 20,000 pairs of rubber boots and may be even 1 million flies and 1.5 million lures. Because there are only 15 locations for the purchase of fishing licences and disinfection of fishing equipment, it is impossible to disinfect, wash and dry all that fishing equipment. In summer 2002 about 15% of fishermen disinfected at least part of their fishing equipment. The Ministry of Agriculture and Forestry has the intention to require that fishing equipment is disinfected. This means that, at this time, fishermen must ensure that their fishing equipment is dry / has been dried or they must disinfect their fishing equipment with chemicals. The seller of fishing licences will then give them a certificate of disinfection with chemicals.

Almost all fishermen who come to the Rivers Tenojoki or Näätämöjoki will come through Inari, so we have tried to organise a central disinfection centre there, where fishermen can easily disinfect boats, for example.

We have also prepared some short articles on *Gyrodactylus salaris*, its threats and ways to combat it. These articles have been sent to all sport fishing magazines. We have also developed some press releases, which are distributed by the sellers of fishing licenses for the rivers Tenojoki and to the River Näätämöjoki. We have also prepared big posters for display at the roadside about *Gyrodactylus salaris* and disinfection of fishing equipment.

We have been drafting a bilateral agreement with the Russian authorities concerning prevention of fish diseases in water catchment areas common to Finland and Russia. *Gyrodactylus salaris* is also included. The Ministry of Agriculture and Forestry funds a research project on *Gyrodactylus salaris* (Perttu Koski, Pasi Anttila, Jaakko Lumme *et al.*): Virulence and epidemiological distribution of pathogenic strains of *Gyrodactylus salaris* in Finland.

IRELAND

Measures Implemented and Proposed to Minimise the Threat Posed by *Gyrodactylus salaris*

Prior to the implementation of EU Directive 91/67, the importation of live fish to Ireland was very strictly controlled. Subsequent to this, when it was obvious that Additional Guarantees were not to be granted in relation to List 3 diseases, a Safeguard Measure was sought and obtained from the EU Commission in relation to *G.salaris*. This measure was granted under Commission Decision 96/490/EEC. For the sake of clarity, this Decision has been repealed recently, and replaced by Commission Decision 2003/513/EEC. This measure ensures that live fish may only be imported from Great Britain, Northern Ireland, Isle of Man, Guernsey and certain parts of Finland, all of which are free of *G.salaris*. Ova may be imported from other geographical locations if they have been disinfected to ensure the destruction of the parasite, should it be present.

Within the past two months, Ireland has made a new application to the EU Commission for Additional Guarantees in relation to *G.salaris.* If the application is accepted, the temporary Safeguard Measure (2003/513/EC), will be repealed and a more permanent legal base will be available with which to control imports of live fish and gametes.

In addition to the legislative moves outlined above, a publicity campaign has also been launched, aimed at the angling community. This leaflet is widely available and is used as a tool with which to educate the angling public about the risks associated with the movement of live fish and fishing gear from infected to non-infected zones.

SWEDEN

Status report from Sweden concerning measures implemented to minimise the spread and threat of *G. salaris*

Veterinary management of *G. salaris* in Sweden

Region	Acts and regulations	Delivery	Management authority
West coast (Skagerrak and Kattegatt)	Annual control of *G. salaris* in fish farms by the National Veterinary Institute (NVI) using OIE standards (60 fish)	Reports to County Administrations, Swedish Board of Agriculture, Swedish National Board of Fisheries	County Administrations, Swedish National Board of Fisheries, Swedish Board of Agriculture
East coast	No restrictions concerning *G. salaris*		

Stocking practices with special emphasis on *G. salaris* in Sweden

Region	Acts and regulations	Management authority
West coast (Skagerrak and Kattegatt)	No permission for stocking salmonids in rivers emptying into the Skagerrak and Kattegatt with naturally reproducing salmon, in which *G. salaris* has not been found or the river being declared free from the parasite by the National Board of Fisheries	County Administrations
West coast (Skagerrak and Kattegatt)	Stocking of salmonids may be permitted above the second strict migration barrier.	County Administrations
West coast (Skagerrak and Kattegatt)	In the area above the second strict migration barrier, stocking only permitted if the fish are declared free from *G. salaris* (according to OIE standard) or coming from a fish farm in the same watershed	County Administrations
East coast	No restrictions concerning *G. salaris*	
All areas	No transfer of living fish from the sea to freshwater above the first strict migration barrier	County Administrations
All areas	Stocked fish from farms free from proliferative diseases and holding status of stocking farm	County Administrations
All areas	Permission holder follow special regulations when proliferative disease are registered	National Board of Fisheries, Swedish Board of Agriculture
All areas	Fish tanks disinfected	County Administrations
All areas	Alteration of water only at approved establishments when transporting living fish	County Administrations

Aquaculture practices concerning *G. salaris* and other fish diseases in Sweden

Region	Acts and regulations	Delivery	Management authority
West coast (Skagerrak and Kattegatt)	Stocking of salmonids into fish farms from the outlet to the second migration barrier. Stocked fish must be declared free from *G. salaris* (according to OIE standards)		County Administrations at every single event
All areas	No permission for new fish farm establishments in freshwaters holding salmon stocks		County Administrations
All areas	Status of farm for stocking of fish	3 years of compulsory health control	Swedish Board of Agriculture
All areas	Status of farm for stocking of fish	3 annual controls at different seasons	Swedish Board of Agriculture
All areas	Status of farm for stocking of fish	Recruitment of fish into farms shall minimise transfer of fish diseases (parental stock, eggs, disinfection, risk analysis)	Swedish Board of Agriculture

Border crossing of living fish in Sweden

No regulations concerning *G. salaris*	Swedish Board of Agriculture

ACTUAL SITUATION – STATUS OF *G. salaris* 2003

- New regulations concerning *G.s.* in year 2003, in order to reduce the risk of spreading the parasite on the Swedish West coast. The new legislation is strengthened since stocking restrictions now are higher in rivers free from the parasite (from previous first to second barrier) and there are no possibilities of bathing fish before stocking in rivers free from *G.s*.

- Two new infections in 2003 on the Swedish West Coast. Now more than half of the salmon rivers are considered to hold the parasite. At present, 13 of 23 salmon rivers are infected, mostly the rivers in the southern part of the coast.

UNITED KINGDOM

Measures to reduce the risk of introducing *Gyrodactylus salaris* into the UK

Ed Peeler, Centre for Environment, Fisheries and Aquaculture Science, Weymouth, UK

Introduction

Gyrodactylus salaris is a viviparous, monogenean freshwater parasite of salmon that naturally infects Baltic stocks of Atlantic salmon (*Salmo salar*) without causing clinical disease. However, in Atlantic stocks *G. salaris* is a serious pathogen of pre-smolts. It multiplies unchecked by an immune response and death normally results (Bakke *et al*., 1990b). The parasite is listed by the Office International des Epizooties (O.I.E.) in the Aquatic Animal Health code (O.I.E., 2003). It is a notifiable disease in the UK (Fish Disease Act, 1983), where it has never been recorded despite widespread surveillance. In this paper an assessment is made of the most likely routes of introduction into the UK and the measures in place to minimise the risk of introduction.

Geographic distribution of *G. salaris*

G. salaris has its natural origin in Atlantic salmon in western Sweden, northern Finland and northern Russia. It was first introduced into Norway in the early 1970's with the importation of Atlantic salmon smolts from Sweden (Johnsen and Jensen, 1991). The parasite has been introduced into 44 Norwegian rivers (currently 23 remain infected – Mo, T.A. *personal communication*). The parasite has also been found in Denmark (Buchmann and Bresciani, 1997; Nielsen and Buchmann, 2001) and it is thought to be in Germany (Cunningham *et al*., 2003). Reports of *G. salaris* in France (Johnston *et al*., 1996) have been disputed and it is generally agreed that the parasite found was a different species, *G. teuchis* (Lautraite *et al*., 1999). Similarly, it is possible that reports of *G. salaris* in Spain and Portugal (Johnston *et al*., 1996) may also have been due to misidentification. Surveys to substantiate freedom from *G. salaris* have been conducted only in the UK, Ireland, some river catchments in Finland, and France (Lautraite *et al*., 1999). Its spread throughout Europe has been attributed to the movement of infected rainbow trout (Bakke and Harris, 1998). There are no published data on the prevalence of *G. salaris* in Swedish fish farms; however, in Finland, where Baltic salmon are also farmed, *G. salaris* was found in 39% of all salmon farms (Haenninen *et al*., 1995). A survey of 11 Danish rainbow trout farms found seven infected with *G. salaris*; however, only 15 fish were sampled from each farm (Nielsen and Buchmann, 2001). The distribution of the parasite in Europe is not comprehensively known.

Biological factors

The importance of different routes of introduction will be influenced largely by biological and biophysical properties of *G. salaris*. The parasite has a short, direct life-cycle (no free-living dispersal stage), produces live young and is highly fecund (Harris *et al*., 1994; Jansen and Bakke, 1991). Although phylogenetically, *G. salaris* is a macroparasite, its life-cycle is similar to that of a micro-parasite's (e.g. viruses or bacteria). It reproduces and survives permanently only on Atlantic salmon and rainbow trout (Bakke *et al*., 1991), but can live for periods of 7-50 days on other salmonid and non-salmonid species without causing clinical disease (Bakke *et al*., 1992a; Bakke *et al*., 1990a; Bakke *et al*., 1992b; Bakke and Sharp, 1990; Jansen and Bakke, 1995; Soleng and Bakke, 2001) including eels (maximum duration of infection 8 days) (Bakke and Jansen, 1991). The parasite survives longest (up to 50 days) on grayling (*Thymallus thymallus*) (Soleng and Bakke, 2001) on which limited reproduction takes place. *G. salaris* rapidly detaches from a dead host and is highly efficient at finding a new host (Soleng *et al*., 1999a). It can survive for 6-7 days off the host in low water temperatures (Mo, 1997). The reproductive potential of *G. salaris* means that a single individual can start an epidemic. It cannot survive desiccation, freezing or elevated temperatures. Soleng and Bakke (1997) transferred hatchery Atlantic salmon smolts infected with *G. salaris* from freshwater to seawater varying in salinity from 5 to 33 parts per thousand (ppt) (33 ppt = full strength salinity) at different temperatures. At 5 ppt *G. salaris* continued to reproduce and increased in number. The rate of population growth was positively correlated with temperature. For salinities between 7.5 and 20 ppt survival time declined from 38 days to 16 hours, respectively (at 6ºC), and was negatively correlated with temperature. At 33% salinity at 6.0ºC the parasites ceased moving within 17 minutes and turned opaque (Soleng and Bakke, 1997). However, other work has shown that whilst the parasites are immobile within a few minutes, 30 minutes exposure to seawater (33ppt) will not kill all the parasites (Soleng and Bakke, 1997). The parasite is killed by aluminium sulphate at 202 $\mu g\ l^{-1}$ (Poleo *et al*., 2004; Soleng et al., 1999b), and most disinfectants (e.g. 0.5% Virkon ® S, Antec International, Sudbury, Suffolk, UK; Mo, T.A., *personal communication*).

Pathways of introduction and protective measures

The pathways of introduction fall into three main categories: importation of live fish and gametes, importation of eviscerated fish carcasses and mechanical transmission. All identified pathways are listed by the three main categories in Table 1 and the main protective measures in Table 2.

<u>Importation of live fish and gametes</u>

Under Council Directive 91/67 the movement of live fish can only take place between zones of the same health status for VHS and IHN or from a higher to a lower status zone. The UK is an approved zone for VHS and IHN (i.e. these diseases are absent). Therefore, importation of live salmonids into the UK can only take place from other zones approved as free from VHS and IHN. Furthermore, Council Decision 2003/513/EC (which replaces Council Decision 96/490) further restricts trade in live salmonids between regions that have recognised *G. salaris* free status. Member States of the EU can present a case for *G. salaris* freedom based on Article 13 of Commission Directive 91/67 for its territory or part of its territory. Areas within the EU that have recognised *G. salaris* free status are the UK, Eire and two river catchments in Finland. The UK apply the same criteria to trade in live salmonids from 3rd countries. Currently there are no importations of live salmonids into the UK with the exception of limited trade with Eire. Additionally, there is no evidence of illegal importation of live salmonids into the UK.

Salmonid eggs can be imported from farms outside of regions recognised as free of *G. salaris* provided they are disinfected (Commission Decision 2003/513/EC). *G. salaris* could be mechanically transmitted with eggs imported from an infected farm. It has been shown that viable *G. salaris* can stay attached to salmon eggs for some time, probably up to 6 days under damp, cool conditions. Atlantic salmon eggs are currently imported from Norway (hatcheries in Norway are free of *G. salaris* – Mo, T.A. *personal communication*) and rainbow trout eggs from Denmark (where some rainbow trout farms are known to be infected with *G. salaris*).

A risk of introduction from Denmark only exists if disinfection is not carried out. It is recommended by DEFRA that eggs are also disinfected before being taken into the hatchery in the UK, which will further reduce the risk of introduction. The short transit time (typically 24 hours) and cool, moist conditions of transport of rainbow trout eggs are likely to favour survival of the parasite.

Under EU legislation (Council Directive 91/67) live non-salmonid fish, including eels, can only be imported into Great Britain from zones with approved status for viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN). In recent years, live eels have been imported into the UK from France, Ireland, New Zealand, Spain and China. Currently, all eel imports for consumption originate from closed recirculation systems in the Netherlands (environmental contact is minimal and therefore risk of *G. salaris* infection is negligible) and legal imports of live non-salmonids originate from sites with no salmonid species. Wild caught elvers from mainland Europe are held in transit on one site in England under quarantine conditions. Hence the risk of infection with *G. salaris* associated with these imports is negligible. However, there is evidence that significant numbers of coarse fish, notably carp, are illegally imported from mainland Europe for recreational fisheries (Hudson, E.B., *personal communication*). There is a low probability that some of these fish originate from sites where salmonids are present.

It is almost certain that *G. salaris* would establish if introduced via the importation of live infected rainbow trout or Atlantic salmon. The importation of other species of fish, on which the parasite may survive for short periods, presents a considerably lower exposure risk because fewer parasites will be introduced and the probability that the parasite will find a suitable host (i.e. rainbow trout or Atlantic salmon) is considerably lower. There exists a risk that containers and residual water used to transport eggs and live fish may contain viable parasites and DEFRA recommend disinfection or burning for all equipment which has been in contact with the ova or live fish.

<u>Importation of eviscerated fish carcasses</u>

Annual imports of eviscerated salmon and trout carcasses by exporting country are summarised in Table 3. Considerable volumes of chilled or fresh salmon are imported from Norway and Sweden. However, harvested salmon originate exclusively from seawater, in which *G. salaris* survival will depend on salinity (Soleng and Bakke, 1997). In addition, the parasite dies rapidly if not covered with water and often leaves the host soon after death. It will not survive freezing or cooking. Significant volumes of fresh or chilled salmon have been imported from Norway in recent years (Table 3) without a *G. salaris* outbreak, which further suggests that this route presents an extremely low or negligible risk. On average, 49 metric tonnes of fresh or chilled rainbow trout were imported annually from Denmark into the UK between 1995 and 2000 (Table 3). In 2000, 80% of Danish rainbow trout production was in freshwater (Ariel *et al.*, 2002), thus it can be estimated that approximately 40 metric tonnes of imported rainbow trout per year were from freshwater farms, some of which were infected with *G. salaris*. A survey of five freshwater rainbow trout farms in Denmark found *G. salaris* in four farms (Buchmann and Bresciani, 1997) and, more recently, *G. salaris* was reported in seven of 11 Danish rainbow trout farms surveyed; however, only 15 fish were sampled from each farm (Nielsen and Buchmann, 2001). Research from Denmark found that the prevalence of *G. salaris* declined with the size of the fish and no *G. salaris* parasites were found on fish greater than 15 cm in length (Buchmann and Bresciani, 1997), indicating that the prevalence in market-size fish for export is probably low. Since *G. salaris* rapidly detaches from a dead host, many parasites are likely to be removed during harvesting and processing. The duration (typically 48 hours) and moist, cool conditions of transport from Denmark to the UK are likely to be reasonably conducive for survival.

G. salaris parasites on rainbow trout carcasses imported into the UK from Denmark would need to gain access to the aquatic environment and find a suitable host within 5-7 days in order for infection to become established. The parasite detaches rapidly from a dead host, thus the carcasses of fish infected at harvest may be free of *G. salaris* when sold. Effluent and waste from fish processing plants may contain *G. salaris* parasites. At most sites solid waste goes mainly for further processing and effluent enters the mains drainage untreated but viable parasites are extremely unlikely to enter the aquatic environment. However, some processing plants are sited on rainbow trout farms. The importation of fish carcasses directly to these farms creates a significant risk of contact between the introduced parasite and susceptible species in the aquatic environment. *G. salaris* present on uncooked scraps disposed of through the usual refuse disposal system will almost certainly die before entering the aquatic environment (via runoff, seepage or scavenging by piscivorous birds from a landfill site). There exists a theoretical possibility that viable parasites may enter a river or stream through picnickers' discard of uncooked scraps into a river or stream or used as bait. These routes account for only an extremely small volume of imported rainbow trout.

<u>Mechanical transmission</u>

There exists the possibility that *G. salaris* may be introduced by movement of animate or inanimate materials that carry fresh or brackish water, which have recently been in contact with infected fish, and have been kept in cool conditions. *G. salaris* can survive off the host for 5-7 days at ambient river temperatures (Mo, 1994). Items that may contain water and may move rapidly between freshwater areas include lorries moving live fish, canoes and angling tackle, especially keep nets.

A number of live fish hauliers use the same vehicles in mainland Europe and the UK. It is possible that one of these vehicles, travelling from an infected farm in Europe directly to a UK farm, could introduce *G. salaris* if appropriate cleaning and disinfection procedures were not followed. Pools of water within the vehicle may allow *G. salaris* to survive the journey back to the UK. The risk of introduction will be particularly high if live, dead or dying fish accidentally remained in the vehicle.

Gyrodactylids are not free-swimming and prefer to be in contact with a substrate and hence may preferentially attach to equipment. The risk presented by canoes and angling equipment (e.g. which have been in direct contact with infected fish) is low because the volume of water transported is low, and thus is unlikely to contain a parasite. It is likely that the parasite will become desiccated during transit. Canoes, boats, angling equipment, etc., have not been implicated in the transmission of the parasite between rivers in Norway (T.A. Mo, *personal communication*). This provides further evidence that these routes do not present a high risk for transmission over much longer distances (i.e. from mainland Europe to the UK). Nevertheless, angling equipment which has been used in *G. salaris* infected waters and re-used in the UK within a few days is a potential route for introduction. Anglers are advised to disinfect equipment before returning to the UK, where government fisheries departments have recently launched a campaign to raise awareness amongst the angling community of the risk of introduction.

Small leisure craft sail between the UK and Scandinavia. The boats contain freshwater tanks that will be replenished at remote anchorages when cruising in Scandinavia. It is possible that this water could be deposited in UK rivers or estuaries on their return, but the volume of water is low and hence the risk that parasites may be introduced is negligible. Ballast water taken on by a boat from an estuary of a *G. salaris* infected river presents a higher risk due to the high volume of water. Discharge of infected ballast water in an estuary in the UK, in contravention of the International Maritime Organisation's (IMO) guidelines, could introduce the parasite under certain circumstances. A few well-boat operators work in both Norway and Scotland and some boats are used in both countries. The movement of a well-boat which had transported *G. salaris* infected smolts in Norway before travelling to the UK presents a potential route of transmission if recommended cleaning and disinfection procedures are not carried out (Anon, 2000a).

The importation of aquatic plants and lumber from infected countries are potential routes of introduction; however, the risk posed by these routes can be considered as negligible because contact with potentially infected stocks will be almost non-existent.

Discussion

Live salmonid imports inevitably present the most serious threat of introduction since the parasite will survive transport and the fish will be introduced into a farmed aquatic environment where the parasite can quickly establish. The spread of fish diseases is generally through the movement of live fish. The importation of live salmonids, even from European countries or zones of equivalent *G. salaris* free status, would present a potentially serious route of introduction. Since *G. salaris* exists sub-clinically on rainbow trout, it could be introduced into a free zone and be undetected for a considerable time. This will depend on the surveillance and biosecurity systems in place and is a particular danger for zones with no significant Atlantic salmon populations. A high level of targeted active surveillance and biosecurity would be required to ensure that the risk of *G. salaris* introduction via these imports was reduced to an acceptable level.

Currently only a small number of sites on mainland Europe are legally supplying live non-salmonids to Great Britain for release into fisheries, none of which holds salmonids. Imports of non-salmonids from sites holding salmonids species could pose a significant threat of *G. salaris* introduction.

There are few well validated examples of the importation of eviscerated carcasses for human consumption resulting in the introduction of exotic fish pathogens. A number of risk analyses (LaPatra *et al.*, 2001; MacDiarmid, undated; Stone *et al.*, 2001) have shown that in general this route is of low risk because both the quantity of pathogen that may be introduced is low and the risk of entering the aquatic environment is extremely low or negligible. Undoubtedly, it is possible that fresh rainbow trout carcasses from infected farms in Denmark could introduce small numbers of parasites to the UK. However, the probability that viable parasites will enter the aquatic environment is negligible, with the possible exception of carcasses that are processed on fish farms. Currently in England and Wales, a few rainbow trout farms process carcasses and may, on occasion, buy in fish for processing from abroad. This pathway requires further investigation.

Mechanical transmission, e.g. via angling equipment, boats or lorries, has to be considered since the introduction of a single parasite could result in an outbreak. It is worth noting that lorries used to transport eels in Europe probably introduced the parasite *Anguillicola crassus* into Great Britain (Kennedy, 1990). It has been suggested that well-boats could have introduced infectious salmon anaemia (ISA) to Scotland from Norway (Anon, 2000b). Empty animal transports returning to Denmark after delivering pigs to Germany have been identified as a major route of introduction of classical swine fever into Denmark (Horst *et al.*, 1999). Boats and lorries used to transport live fish moving between mainland Europe and the UK probably present the most serious threat of mechanical transmission and merit further investigation.

The World Trade Organisation's (WTO) Agreement of Sanitary and Phytosanitary measures recommend that the acceptable measures are those that reduce the assessed risk to the acceptable level. The acceptable level of risk is based on the potential consequences of introduction, which in the case of *G. salaris* are severe. Further research is required to determine whether the current measures reduce the risk of introduction to an acceptable level. Work in the following areas is required: *G. salaris* contamination of imported salmonid carcasses, risk of exposure from on-farm processing of imported carcasses and the movement of fish transporters (lorries and well-boats).

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References

Anon 2000a, A code of practice to avoid and minimise the impact of infectious salmon anaemia - Joint government/Industry Working Group on ISA, Scottish Executive.

Anon 2000b, *Final report of the Joint Government/Industry Working Group on Infectious Salmon Anaemia (ISA) in Scotland*, Scottish Executive.

Ariel, E., Mortensen, H. F. & Olesen, N. J. 2002, *Report of the fifth annual meeting of the EU national reference laboratories for fish diseases*, DVI, Aarhus, Denmark.

Bakke, T. A. & Harris, P. D. 1998, Diseases and parasites in wild Atlantic salmon (*Salmo salar*) populations, *Canadian Journal of Fisheries & Aquatic Sciences*, vol. 55, no. Suppl 1, pp. 247-266.

Bakke, T. A., Harris, P. D. & Jansen, P. A. 1992, The susceptibility of Salvelinus fontinalis (Mitchill) to *Gyrodactylus salaris* Malmberg (Platyhelminthes; Monogenea) under experimental conditions, *Journal of Fish Biology*, vol. 41, no. 3, pp. 499-507.

Bakke, T. A. & Jansen, P. A. 1991, Experimental transmission of *Gyrodactylus salaris* Malmberg, 1957 (Platyhelminthes, Monogenea) from the Atlantic salmon (*Salmo salar*) to the European eel (*Anguilla anguilla*), *Canadian Journal of Zoology*, vol. 69, pp. 733-737.

Bakke, T. A., Jansen, P. A. & Brabrand, A. 1990, Susceptibility and resistance of brook lamprey, *Lampetra planeri* (Bloch), roach, *Rutilus rutilus* (L.) and perch, *Perca fluviatilis* L. to *Gyrodactylus salaris* Malmberg (Monogenea), *Fauna Norvegica, Series A*, vol. 11, pp. 23-26.

Bakke, T. A., Jansen, P. A. & Grande, M. 1992, The susceptibility of *Salvelinus namaycush* (Walbaum) to *Gyrodactylus salaris* Malmberg (Platyhelminthes; Monogenea) under experimental conditions, *Fauna Norvegica, Series A*, vol. 13, pp. 1-7.

Bakke, T. A., Jansen, P. A. & Hansen, L. P. 1990, Differences in the host resistance of Atlantic salmon, *Salmo salar* L., stocks to the monogenean *Gyrodactylus salaris* Malmberg, 1957, *Journal of Fish Biology*, vol. 37, no. 4, pp. 577-587.

Bakke, T. A., Jansen, P. A. & Kennedy, C. R. 1991, The host specificity of *Gyrodactylus salaris* Malmberg (Platyhelminthes, Monogenea): Susceptibility of *Oncorhynchus mykiss* (Walbaum) under experimental conditions, *Journal of Fish Biology*, vol. 39, no. 1, pp. 45-57.

Bakke, T. A. & Sharp, L. A. 1990, Susceptibility and resistance of minnows, *Phoxinus phoxinus* (L.) to *Gyrodactylus salaris* Malmberg, 1957 (Monogenea) under laboratory conditions, *Fauna Norvegica, Series A*, vol. 11, pp. 51-55.

Buchmann, K. & Bresciani, J. 1997, Parasitic infections in pond-reared rainbow trout *Oncorhynchus mykiss* in Denmark, *Diseases of Aquatic Organisms*, vol. 28, no. 2, pp. 125-138. Retrieved: Feb, from

Cunningham, C. O., Collins, C. M., Malmberg, G. & Mo, T. A. 2003, Analysis of ribosomal RNA intergenic spacer (IGS) sequences in species and populations of Gyrodactylus (Platyhelminthes: Monogenea) from salmonid fish in Northern Europe. *Diseases of Aquatic Organisms*, vol. 57, pp. 237-246.

Haenninen, M. L., Ridell, J. & Hirvelae-Koski, V. 1995, Phenotypic and molecular characteristics of *Aeromonas salmonicida* subsp. salmonicida isolated in southern and northern Finland, *J. Appl. Bacteriol.*, vol. 79, no. 1, pp. 12-21.

Harris, P. D., Jansen, P. A. & Bakke, T. A. 1994, The population age structure and reproductive biology of *Gyrodactylus salaris* Malmberg (Monogenea), *Parasitology*, vol. 108, no. 2, pp. 167-174.

Horst, H. S., Dijhuizen, A. A., Huirne, R. B. M. & Meuwissen, M. P. M. 1999, Monte Carlo simulation of virus introduction into the Netherlands, *Preventive Veteinary Medicine*, vol. 41, no. 2-3, pp. 209-229.

Jansen, P. A. & Bakke, T. A. 1991, Temperature-dependent reproduction and survival of *Gyrodactylus salaris* Malmberg, 1957 (Platyhelminthes: Monogenea) on Atlantic salmon (*Salmo salar* L.), *Parasitology*, vol. 102, no. 1, pp. 105-112.

Jansen, P. A. & Bakke, T. A. 1995, Susceptibility of brown trout to *Gyrodactylus salaris* (Monogenea) under experimental conditions, *Journal of Fish Biology*, vol. 46, no. 3, pp. 415-422.

Johnston, C., Mackenzie, K., Cunningham, C. O., Eiras, J. C. & Bruno, D. W. 1996, Occurrence of *G. salaris*, Malmberg 1957, in Portugal, *Bulletin of the European Association of Fish Pathologists*, vol. 16, no. 3, pp. 89-91.

Kennedy, C. R. 1990, Helminth communities in freshwater fish: Structured communities or stochastic assemblages?

LaPatra, S. E., Batts, W. N., Overturf, K., Jones, G. R., Shewmaker, W. D. & Winton, J. R. 2001, Negligible risk associated with the movement of processed rainbow trout, *Oncorhynchus mykiss* (Walbaum), from an infectious haematopoietic necrosis virus (IHNV) endemic area, *Journal of Fish Diseases*, vol. 24, no. 7, pp. 399-408.

Lautraite, A., Blanc, G., Thiery, R., Daniel, P. & Vigneulle, M. 1999, Gyrodactylids parasitizing salmonids in Brittany and Western Pyrenees water basins: Epidemiological features of infection and species composition, *Bull Fr Peche Piscic*, vol. 355, pp. 305-325.

MacDiarmid, S. C. undated, The risk of introducing exotic diseases of fish into New Zealand through the importation of ocean caught pacific salmon from Canada, Ministry of Agriculture and Fisheries, New Zealand.

Mo, T. A. 1994, Status of *Gyrodactylus salaris* problems and research in Norway, in J. W. Lewis, (ed.) *Parasitic diseases of fish*, vol. 1, Samara Publishing, Tresaith, Dyfed, Wales, pp. 43-48.

Mo, T. A. 1997, Taksonomiske og biologiske undersokelser, virksomheten i 1986 og forslag til virksomhet i 1987. University of Oslo, Oslo.

Nielsen, C. V. & Buchmann, K. 2001, Occurrence of Gyrodactylus parasites in Danish fish farms, *Bulletin of the European Association of Fish Pathologists*, vol. 21, no. 1, pp. 19-25.

O.I.E. 2003, International Aquatic Animal Health Code - fish, molluscs and crustaceans, 6th edn, Paris.

Poleo, A. B. S., Schjolden, J., Hansens, H., Bakke, T. A. & Mo, T. A. 2004, The effect of various metals on *Gyrodactylus salaris* (Platyhelminthes, Monogenea) infections in Atlantic salmon (*Salmo salar*), *Parasitology*, vol. 128, pp. 1-9.

Soleng, A. & Bakke, T. A. 1997, Salinity tolerance of *Gyrodactylus salaris* (Platyhelminthes, Monogenea): Laboratory studies, *Canadian Journal of Fisheries and Aquatic Sciences/Journal Canadien des Sciences Halieutiques et Aquatiques*, vol. 54, no. 8, pp. 1837-1845.

Soleng, A. & Bakke, T. A. 2001, The susceptibility of grayling (*Thymallus thymallus*) to experimental infections with the monogenean *Gyrodactylus salaris*, *International Journal for Parasitology*, vol. 31, no. 8, pp. 793-797.

Soleng, A., Jansen, P. A. & Bakke, T. A. 1999, Transmission of the monogenean *Gyrodactylus salaris*, *Folia Parasitologica*, vol. 46, no. 3, pp. 179-184.

Soleng, A., Poleo, A. B. S., Alstad, N. E. W. & Bakke, T. A. 1999, Aqueous aluminium eliminates *Gyrodactylus salaris* (Platyhelminthes, Monogenea) infections in Atlantic salmon, *Parasitology*, vol. 119, no. 1, pp. 19-26.

Stone, M. A. B., MacDiarmid, S. C. & Pharo, H. J. 2001, Import Health Risk Analysis: Salmonids for human consumption, in *Risk analysis in aquatic animal health*, ed. C. J. Rodgers, Office International des Epizooties, Paris, pp. 230-239.

Table 1. Pathways of *G. salaris* introduction

Category	**Pathway**
Live fish and gametes	Importation live salmonids[1]
	Importation of eels[2]
	Importation of coarse fish
	Importation of rainbow trout eggs
Fish carcasses	Fresh or chilled Atlantic salmon from Norway/Finland/ Sweden
	Fresh or chilled rainbow trout from freshwater production in Denmark
Mechanical transmission	Lorries moving live fish
	Ships' ballast water
	Freshwater tanks of leisure craft
	Angling equipment (esp. keep nets)
	Importation of lumber from
	Importation of aquatic plants

[1] currently no live salmonids are imported into the UK with the exception of Eire
[2] currently all eel imports originate from closed recirculation system

Table 2. Measures to prevent the introduction of *G. salaris* into the UK

Route	Measure	Legislation / Reference
importation of live salmonids	from G. salaris free approved zones	Commission Decision 96/490/EC as amended by 98/24/EC
importation of live non-salmonids	from VHS and IHN free zones or farms	Council Directive 91/67
importation of salmonids eggs	disinfection	Commission Decision 96/490/EC as amended by 98/24/EC
live fish/eggs containers & residual water	disinfection or disposal	guidelines in import certificate (DoF8c)
live fish transporters	cleaning and disinfection recommended before re-entry to the UK	disinfection guidelines in the ISA code of practice (Anon, 2000a)
angling equipment	disinfection recommended	G. salaris awareness leaflet
boat traffic	ballast water discharge outside UK coastal water	IMO discharge of ballast water recommendations (http://globallast.imo.org/index.asp?page=resolution.htm&menu=true)

VHS = viral haemorrhagic septicaemia, IHN = infectious haematopoietic necrosis, ISA = infectious salmon anaemia, IMO = International Maritime Organisation

Table 3. Average annual imports of whole eviscerated Atlantic salmon and rainbow trout carcasses for 1995- 2000 (metric tonnes)

	Fresh or chilled		Frozen	
	Salmon	Trout	Salmon	Trout
Belgium-Luxembourg	4	0	2	11
Canada	11	0	91	0
Chile	11	0	97	28
China	3	0	97	0
Denmark	150	49	77	185
Eire	822	175	36	45
Faroe Islands	3421	11	8	1
France	47	104	12	75
Japan	0	0	18	2
Germany	70	1	242	2
Iceland	277	3	20	4
Netherlands	13	29	131	27
New Zealand	0	0	3	0
Norway	6102	23	41	1
Portugal	0	0	0	16
S. Korea	0	0	3	0
Spain	10	3	1	204
Sweden	871	0	1	154
Thailand	0	0	3	4
U.S.A.	182	0	1057	<1
Total	11994	398	1940	760

Source : HM Customs and Excise

ICELAND

Disease Risk from *G. salaris* - Status Report for Iceland

Until late 2003 Iceland had a ban on the importation of live salmonids and only disinfected fertilized ova could be imported into the country subject to any exception granted by the Minister of Agriculture.

In November 2003 the Icelandic parliament passed some amendments to the Icelandic "Salmonid Fisheries Act", the "Laws on Importation of Animals" and the "Laws on Fish Diseases" to adapt Icelandic legislation to Council Directive 91/67/EEC, which Iceland had been temporarily exempted from since the creation of the European Economic Area.

Parasites of the species *Gyrodactylus salaris* have not been observed in Iceland and no systematic monitoring has been carried out in Icelandic rivers. Icelandic fish farms, however, are closely monitored by the Veterinary Officer for Fish Diseases, working under the office of the Chief Veterinarian.

It is of vital importance that international trade and health regulations consider the unique status of *Gyrodactylus salaris* free areas as this disease agent is unique in creating an epidemic in wild populations of Atlantic salmon with the threat of extinction of individual stocks.

NORWAY

Status report on measures against and managing of *Gyrodactylus salaris* in Norway

Jarle Steinkjer and Gunnbjørn Bremset, Directorate for Nature Management, Norway
Ivar Hellesnes, Norwegian Food Safety Authority, Norway
Espen Lydersen, Norwegian Institute for Water Research, Norway

1. Introduction

Infection by *G. salaris* is a category B disease and the responsibility for combating it comes under the Norwegian Food Safety Authority's remit. In a pollution context *G. salaris* is characterized as an alien and unwanted species in Norwegian fauna, so that this parasite problem requires the attention of the Ministry of Environmental Affairs and the Directorate for Nature Management as laid down in the Norwegian Salmon Act.

Rotenone is used for extermination in watercourses, and any release of rotenone requires a permit pursuant to the Norwegian Pollution Act, which is administered by the Norwegian Pollution Control Authority.

History and regulations

G. salaris has no natural occurrence in Norway but was introduced into the country on one or more occasions. The parasite was found for the first time in 1975. During those first years it was not acknowledged by the authorities that *G. salaris* was a pest that needed to be incorporated into the regulations for combating diseases. Only after the *Gyrodactylus Board* submitted their report in April 1982 was it clearly stated that the salmon stocks in the infected watercourses had been virtually exterminated and that "all possible measures must therefore be implemented to prevent this from spreading". On this occasion attention was also drawn to the fact that the matter had been raised with what was then the Veterinary Department of the Ministry for Agriculture. It was urged that the parasite should be included on the list of diseases the Fish Diseases Act would apply to, and that the necessary measures should be implemented to prevent further spreading.

The Veterinary Department announced in Circular M-79/83 of 6 June 1983 that the Fish Diseases Act would apply to *G. salaris* with immediate effect. The disease is now listed as a B disease on the disease list, which today comes under the Food Act. As of 1 January 2004 the Ministry of Fisheries is responsible for regulations relating to the health and welfare of aquatic animals, while all administration and all inspections authorized by this Act will be undertaken by the various offices of the Norwegian Food Safety Authority that were established on the same date.

A special regulation relating to the prevention, containment and extermination of *G. salaris* was established by the Fish Diseases Act and adopted on 28 February 1997. It authorizes the regional offices of the Norwegian Food Safety Authority to make diagnoses based on laboratory diagnoses from the Veterinary Institute. The Regional Director may also decide that aquatic organisms in all or parts of the watercourses where *G. salaris* has been found must be treated or killed, while also drawing attention to the fact that measures causing intervention in fish stocks or other fauna require permits pursuant to general legislation, the Salmon Act and the Pollution Act. The Ministry of Environmental Affairs administers the two latter Acts.

2. Administration plans

Cooperation and the division of work when combating the *G. salaris* have regularly been resolved through agreements between the agencies involved. The Directorate for Nature Management drew up the first Action Plan for measures against the parasite in 1986. The latest Action Plan was completed in 2000. In 1999 the Wild Salmon Committee designated *G. salaris* as the most comprehensive loss factor caused by human activity that has impacted the Norwegian salmon stock in recent years. The Committee proposed active measures by building salmon barriers and rotenone treatments. These recommendations were followed up in White Paper no.8 (1999-2000) "Regjeringens miljøvernpolitikk og rikets miljøtilstand" [The Government's Environmental Protection Policy and the State of the Environment in the Realm] where it was pointed out that activities to combat *G. salaris* would be given special priority in the coming years, and that the proposed Action Plan in general would be used as the basis for future activities to combat the parasite.

The division of responsibilities between the Ministries involved and their subordinate agencies was determined as follows:

Ministry of Environmental Affairs and its subordinate agencies are responsible for:

- studying and reporting on strategies for combating the disease in affected watercourses;
- a national resource centre for implementing measures against *G. salaris;*
- carrying out measures against *G. salaris;*
- studying and reporting on alternative measures;
- research.

The Ministry of Fisheries with its subordinate agency (Norwegian Food Safety Authority) is responsible for:

- monitoring programmes;
- measures to contain infection;
- epidemiological surveys;
- hygiene measures when treating infection;
- information on the status of infection and measures to prevent infection;
- research.

The Action Plan confirms the division of the involved watercourses into contamination regions based on the possibility of the parasite spreading via infected fish travelling in brackish water in the fjord systems. Of a total of 15 contaminated regions, in 2000 the parasite had been exterminated from seven of them. Of the remaining eight the Action Plan calls for the extermination of the parasite from seven regions using current knowledge. For the final region which comprises Drammenselva and Lierelva, the Action Plan states "Within the framework of this Action Plan, measures will not be introduced to exterminate the parasite. More experience with chemical treatment and the development of alternative methods for combating the disease are necessary before measures may be introduced in the future."

In December 2000 the Norwegian Parliament instructed the Government to draw up a multi-year plan of measures against *G. salaris*. The Measures Plan is the outcome of this assignment and is a direct follow-up with detailed specifications of the Action Plan from 2000, and emphasizes socio-economic costs more than the previous plan, estimated to be around NOK 200-250 million yearly. With a horizon of 10 years into the future, the plan aims for the removal of the parasite from all infected watercourses except the Drammen region within this period, claiming that this aim is realistic and viable. Up to the present Norway has incurred costs in the order of NOK 3 - 4 billion, and expenses under this plan will be approximately NOK 340-370 million for the ten-year period.

3. Research and development

The administration's choice of strategies for preventing and combating the disease have been based on research. Advice has been heard from the Advisory Group (proposals for choice of strategy and the order of treatment), the STOPP group (development of barrier solutions both generally and for specific watercourses) and the Method group (group with expertise on chemical treatment).

4. Prevention of infection

The most important preventive measure is to reduce the number of infection sources, i.e. infected fish farms and watercourses. Prevention of infection from contaminated fish farms is also in part effected by placing them under restrictions.

One important measure in watercourses is to prevent the migration of infected smolts by reducing the cultivation activity and by catching spawning fish. This leads to a major conflict of interests for the persons and communities that have fishing rights in the river, and in practice such measures have only been implemented when there have been specific plans for treatment.

As laid down by the Gyrodactylus Regulation, it is prohibited to take tackle used in an infected watercourse out of an infected zone without first having it disinfected. Comprehensive efforts have, therefore, been expended on establishing disinfection stations in various locations along the watercourses, in total 350 along all the watercourses. Moreover, regionally focused leaflets have been produced to inform and instruct users of the watercourses on the different procedures to be complied with. Information posters with a regional focus have been produced for a number of years and have been placed in strategic locations along watercourses. Employees in the various administration bodies also carry out substantial information activities through discussions, conversations, meetings and conferences.

Significant activities have also been implemented along non-infected watercourses to prevent infection. These include a system, voluntarily established by the owners of fishing rights, for the compulsory disinfection of fishing tackle before a fishing permit can be purchased.

5. Eradication measures

Fish farms

Any finding of *G. salaris* in aquaculture farms will immediately bring restrictions and ordinances into effect, which will be imposed by the regional offices of the Norwegian Food

Safety Authority. Up to this point in time a total of about 40 fish farms have been infected, but presently no fish farms are infected or under restriction.

Rivers

Two main extermination measures have been used in Norwegian rivers: physical barriers and the chemical treatment of rivers. During an early phase of the measures, rotenone treatment was the only extermination measure used. Physical barriers have nevertheless been used as an important element in the extermination measures in all the contaminated regions.

Barriers

Long-term barriers

The principle of long-term fish barriers is to prevent the salmon from entering spawning areas in upper parts of rivers. After five to seven years the areas upstream of the fish barrier will be free of salmon, thus also free of parasites, as these die rapidly without a host. The young salmon will either be dead due to the parasitic infection or have migrated as smolts. Thus the existence of the parasite will have been contained to the areas downstream of the fish barrier, simplifying the work to combat the parasite.

This type of barrier is only used in complex watercourses, particularly where big lakes are located in the section where salmon are found, rivers with a long anadromous distance or rivers that are difficult to treat, i.e. because of the cost of a barrier, the long period from the start to the end of the eradication, the influence on other anadromous fish species such as sea trout, and technical possibilities to build a barrier in the lower parts of the river.

An example of the successful use of a fish barrier is in the River Figga, in the central part of Norway. The River Figga was infected by *G. salaris* in 1980. There is a large lake in the section inhabited by salmon. The distance from the sea to the lake is 16 km (10 miles). The size of the lake is 20 km^2 (7.8 $miles^2$). There are also many tributaries. A main focus of eradicating the parasite from this part of the watercourse was to prevent the salmon from swimming up into the lake. Therefore, a fish barrier was built approximately 1 km (0.6 mile) from the estuary. The length of the barrier is 40 metres (131 feet). The river water is filtered through a 4-metre (13 feet) wide iron grating with 50 millimetre (2 inches) openings. After five years all Atlantic salmon and thus also all parasites were removed from the area upstream of the barrier. The rotenone treatment was contained to the areas below the barrier.

According to the Action Plan, three other rivers (River Driva, River Skibotnelva and River Signaldalelva) are included in the planning of long-term barriers. The River Driva is a rather large river. The anadromous stretch is about 90 km long and the mean discharge is 70 m^3/sec. Both the River Skibotnelva and the River Signaldalselva are considered as hydrologically complex rivers, and consequently challenging for effective chemical treatment.

Short-term barriers

Short-term barriers in tributaries are often used to section the river during chemical treatments, as sectioning of the river simplifies the treatment. Short-term barriers are built the year before, or the same year as, the main treatment. The barriers make it possible to perform the treatment of the tributaries at any time before the main treatment. In this manner it is possible to accomplish the treatment when the condition is most favourable.

Chemical treatment

In principle, there are two ways of eradicating the parasite by chemicals: 1) Species-specific biocides that kill only parasites, and 2) non-specific chemicals removing the hosts.

Non-specific chemicals

No species-specific chemicals have so far been developed that will eradicate only the parasite. Currently, the only available method of eradicating *G. salaris* is to remove its hosts from the watercourse for a short period of time. We know, of course, that the parasite can only live in those sections of a watercourse where fish species that are susceptible to the parasite are present. The parasite, moreover, gives birth to live offspring, meaning that there are no eggs or other resting stages where it can survive without the host fish. The chemical used to remove fish from infected rivers is rotenone.

Rotenone treatment has been carried out in a total of 28 infected rivers in Norway. In 21 of the treated rivers, the parasite has been removed. In seven rivers the parasite has been registered again after rotenone treatment. In three of these rivers, the rotenone treatment has failed; in the other four rivers the parasite has re-established from neighbouring rivers. Norwegian rivers with previous or current infection of *G. salaris* are shown in Appendix 1.

Bearing in mind that three rotenone treatments have failed, considerable efforts have been put into improving the treatment techniques and equipment. These improvements have increased the probability of successfully eradicating the parasite in the future.

One of the latest rotenone treatment projects in Norway was accomplished in 2002 (Appendix 2). The salmon can migrate 3 miles up River Byaelva to Lake Reinsvatnet, but not into the lake created by a hydroelectric power station. In River Ogna the salmon can migrate 21 km (13 miles) up to a high water fall. In addition, there are two smaller rivers in the same area (River Figga and River Lundselva). The project started in the autumn of 2001 with a limited rotenone treatment concentrated to the main rivers (River Byaelva and River Ogna). The purpose was to eliminate all spawners from the river, to reduce the number of fry during the main treatment. Six short-term barriers were constructed in the most complex tributaries. The next step was rotenone treatment above the short-term barriers. The main rotenone treatment, which was accomplished at the end of August 2002, was simplified because most of the complex tributaries were already treated.

The plan for eradication of *G. salaris* this year is a large rotenone treatment project in the northern part of Norway (Appendix 3). In this project a total of six infected rivers in the same fjord system will be treated with rotenone. Two rivers (River Ranaelva and River Røssåga) are quite large; the others are considerably smaller.

Species-specific chemicals

In recent years there has been a very one-sided and negative focus on the use of rotenone in rivers, making the development of alternative chemical measures that kill the parasite, but not the host, a high priority. The most promising results have been obtained using aluminium solutions.

Several years of research have shown that aluminium has a clear negative effect on ectoparasites such as *G. salaris*. The effect is dependent on concentration, water pH and temperature. Experiments in the laboratory, as well as in the field, show that the parasite is substantially more sensitive to aluminium than the salmon. In nearly all experiments that have been performed, aluminium eliminates *G. salaris* from the fish, but the salmon apparently does not seem to be affected by the treatment. Based on this, it is possible that aluminium can be used as the main agent in the future treatments of *G. salaris* infected rivers.

With only a single dosing point with aluminium sulphate (AlS) it was possible to eliminate the *G. salaris* infection on Atlantic salmon 4 – 5 km downstream from the dosing point in the River Batnfjordelva, Møre and Romsdal County. The total salmon habitat in the river is 11 km. At station 1, located 2.2 km downstream from the dosing source, all *G. salaris* were eliminated after 4 days of treatment. There are several important reasons why the researcher did not manage to eliminate the parasite further down in the main river. The water from 15-20 tributaries entering into the river contributes to a significant dilution of the "parasite killing" Al-forms. In addition these tributaries have high pH, causing a pH increase in the main river, which *per se* also reduces the amount of reactive Al-forms. The biological reactive forms are highly pH-dependent. The AlS added is a mixture of aluminium sulphate and sulphuric acid, which cause both increase in aluminium and a decrease in pH when added. In a future full-scale treatment of the river system, AlS will also be added into the tributaries.

6. Conservation measures

In all infected watercourses where individuals from the indigenous salmon stock are still to be found, these stocks have been preserved in the so-called Salmon Gene Bank. The gene bank was established in 1986, being the first fish gene bank of its kind anywhere in the world. Originally it was a semen bank, where salmon milt was frozen and conserved in liquid nitrogen. At the start of the 1990s specialized fish farms were established for the safekeeping of brood stock (the Living Gene Bank), and at present family groups from more than 30 salmon stocks have been preserved, of which 17 are from rivers infected by *Gyrodactylus salaris*.

The eradication measures against the parasite require suitable conservation measures for anadromous populations of trout and char. Without such measures, local fish stocks will be rapidly depleted, because these stocks spend almost their entire life-cycle in freshwater habitats. Without special protection measures, eradication measures using piscicides during the winter period would kill virtually all anadromous trout and char. Similarly, fish barriers close to the river mouth would prevent these species from reaching their spawning grounds upstream of the barrier. The most suitable protection measures for sea trout include temporary penning in fish cages at sea during chemical treatment, and controlled access through established fish barriers (after genetic identification of species). The same protection measures are also being considered for anadromous char, in addition to long-term safekeeping in the Living Gene Bank.

Recovery of depleted salmonid populations is highly dependent on adequate conservation measures and restocking procedures. In recently infected rivers with viable populations of anadromous salmonids, the recovery period after chemical treatment has been shown to be very short. In these rivers there is no urgent need for restocking, as large proportions of the stocks are at sea during the chemical treatment. In rivers with a long infection history, the recovery of salmon stocks needs to be augmented by large-scale stocking immediately after treatment. Successful restoration of previously infected salmon stocks has been performed in several salmon rivers in western Norway during the 1990s, resulting in viable salmon stocks that have given substantial river catches during recent years. In rivers with no stocking programme, however, the recovery of the salmon stocks is very slow, and even after 10-15 years the salmon yield is considerably less than prior to the introduction of *Gyrodactylus salaris*.

7. Summary

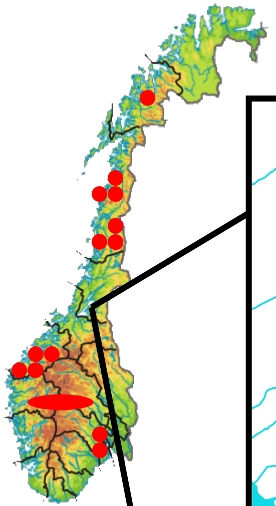
The Ministry of Fisheries is tasked with dealing with the outbreak of disease and the occurrence of the salmon parasite *Gyrodactylus salaris* through the regional and local agencies of the National Food Safety Authority, while the Ministry of Environmental Affairs is responsible for protecting salmon stocks, specific measures in rivers and matters that concern the use of chemicals in rivers through the Directorate for Nature Management and the Norwegian Pollution Control Authority. The Action Plan from 2000 and the Measures Plan from 2002 provide comprehensive plans for the prevention and extermination of the parasite in seven of the eight remaining contaminated regions. Locally run information and prevention activities are being undertaken to prevent further spreading of the parasite.

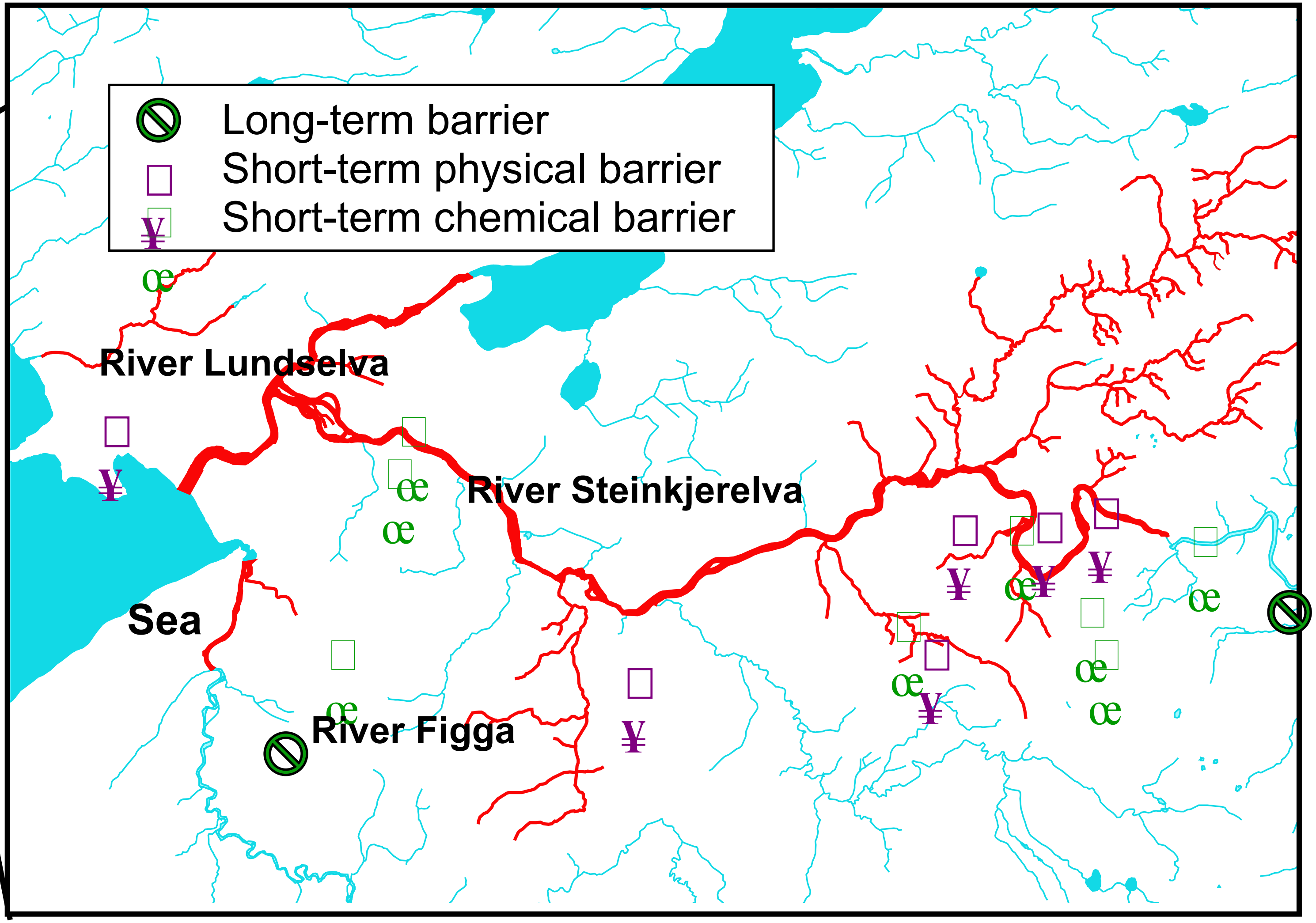
APPENDIX 1

Norwegian rivers with previous or current infection of *G. salaris*

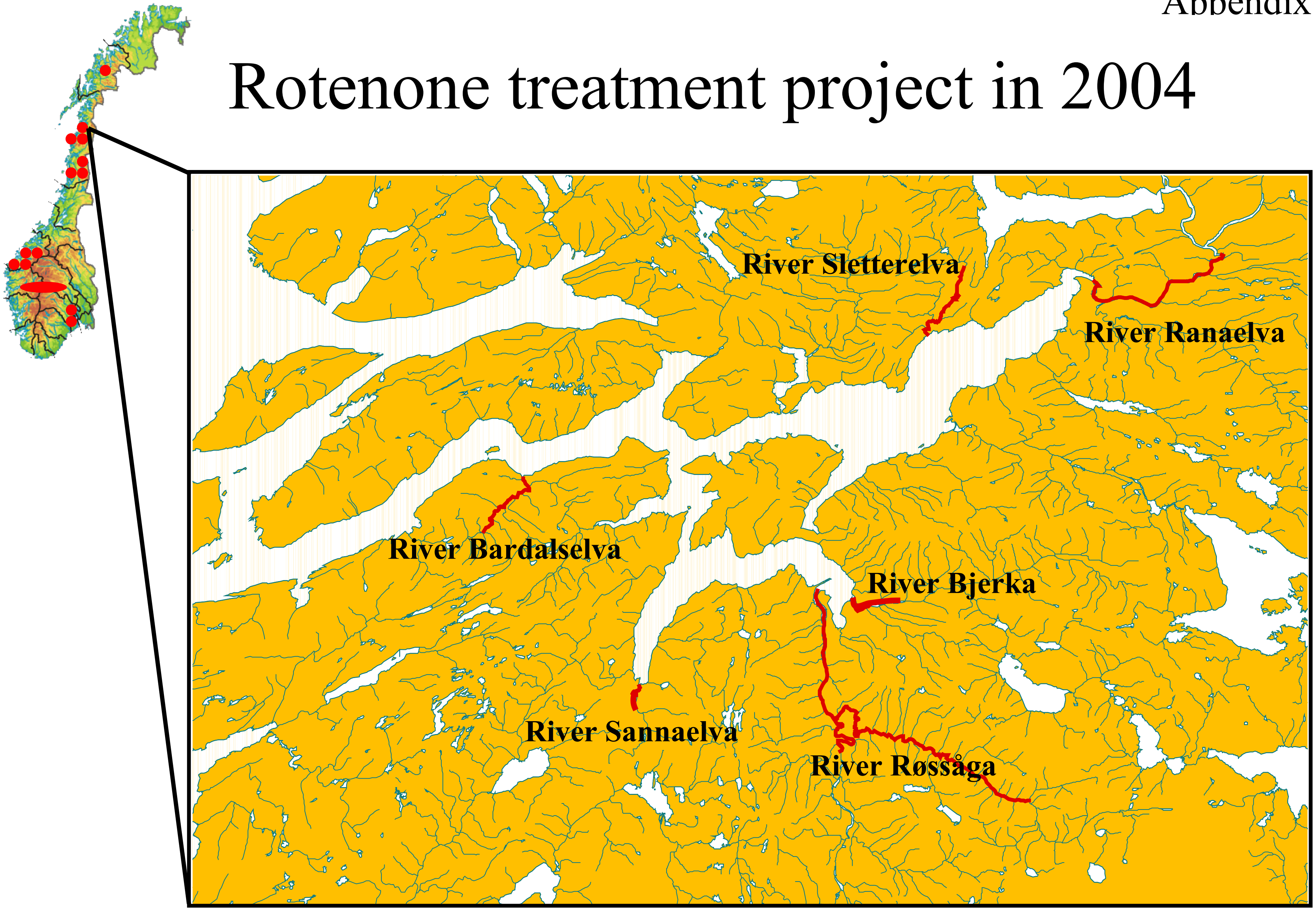
County	Rivers	Infection	Eradication	Infected today
Troms	Skibotnelva	1979		X
	Signaldalselva	2000		X
Nordland	Lakselva	1975	1990	
	Beiarelva	1981	1994	
	Ranaelva	1975		X
	Sletterelva	1993		X
	Røssåga	1980		X
	Bjerka	1980		X
	Sannaelva	1989		X
	Bardalselva	1989		X
	Leirelva	1996	1996	
	Drevja	1980		X
	Fusta	1980		X
	Vefsna	1978		X
	Hundåla	1992		X
	Halsanelva	2002	2003	
	Hestdalselva	2002	2003	
Nord-Trøndelag	Steinkjervassdraget	1980	2002	
	Figga	1980	2002	
	Lundselva	2001	2002	
	Vulluelva	1988	1988	
	Langsteinelva	1988	1988	
Møre og Romsdal	Bævra	1986	1989	
	Storelva	1989	1991	
	Batnfjordelva	1980		X
	Driva	1980		X
	Litledalselva	1981		X
	Usma	1980		X
	Rauma	1980		X
	Henselva	1980		X
	Skorga	1982		X
	Innfjordelva	1991		X
	Måna	1985	1993	
	Valldalselva	1980	1990	
	Tafjordelva	1981	1987	
	Norddalselva	1981	1990	
	Eidsdalselva	1981	1990	
	Korsbrekkeelva	1985	1986	
	Aureelva	1984	1988	
	Vikelva	1984	1988	
Sogn og Fjordane	Lærdalselva	1996		X
	Vikja	1981	1982	
Buskerud	Drammenselva	1987		X
	Lierelva	1987		X
Total number	**44**		**21**	**23**

Rotenone treatment project in 2002





Rotenone treatment project in 2004



RUSSIA

Measures Implemented by the Russian Federation to Minimize the Threat Posed by *G. salaris*

All measures taken by the Russian Federation to minimize the risk of spread of the parasite *G. salaris*, other parasites and diseases are based on the "Instruction on veterinary control of transfers of live fish, fertilized eggs, crustaceans and other aquatic organisms", which has been effective in the Russian Federation since 1971. When aquatic organisms are imported into the Russian Federation from abroad the importer shall fulfill the "Veterinary requirements to import of live fish, fertilized eggs, crustaceans, mollusks, forage invertebrates and other aquatic organisms into the Russian Federation", No. 13-8-01/1-17, approved by the Veterinary Department of the Agriculture Ministry of the Russian Federation on 23 December 1999. Besides, effective in the territory of the Russian Federation is the Instruction on measures to counteract *G. salaris,* approved by the Veterinary Department on 8 June 1998.

The Murmansk Regional Veterinary Service is currently developing "Temporary veterinary and sanitary regulations for fish farming in the Murmansk region", which will regulate veterinary aspects of fish farming. Regional regulations for preventing the transmission and spread of *G. salaris,* other parasites and diseases have only so far been developed and are effective in the Murmansk region only, which is, in the first place, linked to the development of salmon farming there.

These regulations include:

- measures for control of the epizootic situation in areas where aquaculture facilities are sited, and measures to prevent the spread of *G. salaris*, other parasites and diseases;
- measures for preventing escapes of fish during movement and handling of stocks at aquaculture units; development of contingency plans to be implemented in the event of accidents which have led to significant escapes;
- mechanisms for control of movement of fish at aquaculture units;
- possibility of moving an aquaculture unit to another site, if non-compliance with any of veterinary and sanitary or biotechnological standards has been identified during operations;
- measures to minimize the risk of diseases in cultured fish and their transmission, which include vaccination of fish, use of optimal stocking densities, careful handling, frequent inspection of fish, proper diet and feeding regimes, avoidance of unnecessary disturbance of fish, detailed health inspections, disinfection of transportation equipment, etc.

All aquaculture units have a list of prevailing infectious diseases and parasites, and the methods in practice for their control and prevention are detailed in an annual plan of veterinary/sanitary and preventive measures established for each disease-free unit. At facilities with diseases, which require introduction of restrictions, plans of therapeutic/preventive and curative measures are established.

Currently under consideration is the question of establishing *wild salmon protection zones* on major salmon rivers in the region, developing requirements for siting of aquaculture units relative to the mouth of salmon rivers.

Movement of live fish into the Murmansk region from abroad has been forbidden following a direction by the Chief State Veterinary Inspector based on the collective decision with the Murmansk Regional Administration.

It should also be noted that all projects on salmon farming are subject to licensing; this is done on the basis of comprehensive evaluation of the proposed project, which includes a mandatory assessment of risk of transmission of *G. salaris* and other diseases.

The Veterinary Service of the Murmansk region has developed a programme for veterinary and sanitary control of aquaculture facilities, which provides for regular (at least 4 times a year) veterinary and sanitary inspection of farms and hatcheries and ichthyopathological examination of reared fish.

To minimize the risk of spread of *G. salaris* in the recreational fishery the Polar Research Institute and Murmansk Veterinary Laboratory developed and issued an information leaflet, which included information on the parasite, possible ways of its transmission to rivers and specifies requirements to be fulfilled by anglers to avoid transmission of this monogenea with tackle.

In Karelia, as presently a major part of the salmon stock in the Keret river is comprised of hatchery-origin fish (more than 70%), to reduce the risk of infection with the parasite a number of precautions are taken such as juveniles of salmon are released at low temperatures under ice in the second half of April, when the parasite is not active. The juveniles are stocked as 2-year-olds in the downstream part of the river. Most of them do not stay in the river for a long time, as they are released as pre-smolts and leave the river for the ocean within a week. To minimize the risk of spread of *G. salaris* the recreational fishery for salmon on the Keret river is allowed only from the river banks.

ANNEX 5

North-East Atlantic Commission

NEA(04)13

'Road Map' for Taking Forward the Recommendations from the Workshop on Gyrodactylus salaris in the Commission Area

'Road Map' for Taking Forward the Recommendations from the Workshop on Gyrodactylus salaris in the Commission Area

Recommendations concerning opportunities to enhance cooperation on monitoring research and exchange of information				
Paragraph in Report	**Recommendation**	**Proposed Action**	**Responsibility**	**Timeframe**
7.2	Increase cooperation in both research and management among the NASCO Parties.	The North-East Atlantic Commission (NEAC) may wish to retain an item on *G. salaris* on future agendas to facilitate reports by its Parties and their relevant jurisdictions and by the Working Group (see 7.3.3) on measures to prevent the further spread of the parasite and to eradicate it in areas where it has been introduced and on other aspects of this road map.	NEAC	From 2004 (input from Working Group in 2005)
7.3.1	Introduce standardised targeted monitoring methods in watercourses, lakes and in aquaculture.	a) The Oslo Workshop anticipated that standardised monitoring methods would be based on forthcoming OIE recommendations. These recommendations should be implemented by NEAC Parties and their relevant jurisdictions (see 7.5.1). b) The extent of harmonisation of monitoring methods, as detailed in the OIE Manual of Diagnostic Tests and Vaccines for Aquatic Animals and the Aquatic Animal Health Code and in the EC Directive, might be explored by the Working Group (see 7.3.3).	a) NEAC Member Parties and their relevant jurisdictions b) Working Group	a) Following development of OIE recommendations b) From 2005
7.3.2	Map the present and natural distribution of *G. salaris* in the NEAC area and adjacent areas.	a) Existing monitoring programmes on salmonids in the wild and in culture environments undertaken by NEAC Member Parties and their relevant jurisdictions should be retained and expanded as necessary and as resources permit (see 7.4.6 and 7.5.1). Reports on these programmes should be provided to the Working Group (see 7.3.3). Mapping of *G. salaris* is also a recommendation in the Council's Williamsburg Resolution and reports should continue to be made to the Council in the annual reporting by the Parties. b) Opportunities for obtaining information from countries which do not have wild Atlantic salmon should be explored (see 7.4.6).	a) NEAC Member Parties and their relevant jurisdictions b) Working Group to consider possible approaches	a) From 2004 b) From 2005
7.3.3	Establish an international Working Group.	The NEAC should establish an international Working Group, the Draft Terms of Reference for which are contained in Annex 1.	NEAC	Agree ToRs in 2004. First meeting of the Working Group in 2005

Paragraph in Report	Recommendation	Proposed Action	Responsibility	Timeframe
7.3.4	NASCO should encourage the Parties to conduct research in relation to *G salaris.*	a) The NEAC should recommend that its Parties and their relevant jurisdictions undertake research, as resources permit, on: - the natural distribution and genetics of *G. salaris;* - the effects of salmon genetics on sensitivity to *G. salaris;* - general biology and mechanisms of spread of the parasite; - effect of environmental parameters and ecology on the distribution of *G. salaris.* b) NEAC Member Parties and their relevant jurisdictions should maintain and expand existing research programmes in accordance with these recommendations, as resources permit. c) The Working Group (see 7.3.3) should keep research requirements and monitoring needs under review and report to the Commission.	a) NEAC b) NEAC Member Parties and their relevant jurisdictions c) Working Group	a) From 2004 (research already ongoing) b) From 2004 c) From 2005
7.3.5	Publicity, information and cooperation with other authorities.	a) The Parties could develop publicity material (on the dangers of the parasite and measures to prevent its spread) and strategies for the effective dissemination of this material (particularly with regard to targeting high risk groups for the spread of the parasite) and report back to the Commission each year. Existing material should be reviewed and updated as appropriate in the light of current knowledge. b) The Secretariat could develop, for consideration by NEAC, a standard text for an information leaflet, as it has done in relation to catch and release, for use by the Parties. This information could be made available to the public and on the Organization's website. c) A number of recommendations in this road map call for cooperation with OIE and the EC Commission. The responsibilities for taking forward this cooperation are detailed in the relevant sections of this road map. d) There may be a need for improved coordination of research funded by the EU, national programmes and research undertaken at universities and other research facilities. This aspect might be considered by the Working Group.	a) NEAC Member Parties and their relevant jurisdictions b) Secretariat c) Various (as detailed elsewhere in road map) d) Working Group	a) From 2005 (some Parties have already developed such material) b) Report to NEAC in 2005 c) Various (as detailed elsewhere in road map) d) From 2005

Recommendations concerning the need for revisions to international guidelines and other measures to prevent the further spread of *G. salaris* *EU fish health legislation is currently under review. Directive 91/67 will be replaced in the next few years. A draft of the new Directive is currently with EU Member States for their consideration. The World Organisation for Animal Health (OIE) guidelines are reviewed annually. NASCO seeks to contribute recommendations for the control of G. salaris to the OIE, the European Community and the Russian Federation. The provisions of EC Directive 91/67 apply to Member States of the EU, members of the European Economic Area (EEA) and, under a bilateral agreement between the EU and the Faroe Islands, to the Faroe Islands. The recommendations below in relation to this Directive should be considered by the Russian Federation in considering the need for amendments to its disease legislation. Iceland, Norway, the Russian Federation and all EU Member States with Atlantic salmon interests are members of the OIE.*				
Paragraph in Report	**Recommendation**	**Proposed Action**	**Responsibility**	**Timeframe**
7.4.1	Article 1 of EC Directive 91/67 provides for measures for conservation of species and this should be retained in any replacement legislation.	a) NEAC Member Parties and their relevant jurisdictions to which EC Directive 91/67 applies should make representations to the Commission (DG SANCO) proposing that this provision be retained in any new legislation. b) The Secretariat might also be requested to make representations to the Commission (DG SANCO) on behalf of the NEAC.	a) NEAC Member Parties and their relevant jurisdictions b) NASCO Secretariat	a) From 2004 b) From 2004
7.4.2	*G. salaris* should be placed on list II in the new fish health directive since the parasite can cause severe ecological consequences and it is present in parts of the EU and other areas are free of it.	a) NEAC Member Parties and their relevant jurisdictions to which EC Directive 91/67 applies should make representations to the Commission (DG SANCO) proposing that this provision be included in any new legislation. b) The Secretariat might also be requested to make representations to the Commission (DG SANCO) on behalf of the NEAC.	a) NEAC Member Parties and their relevant jurisdictions b) NASCO Secretariat	a) From 2004 b) From 2004
7.4.3	Diagnosis of *G. salaris* by morphology should be confirmed by the use of molecular techniques.	NEAC Member Parties and their relevant jurisdictions should implement the molecular diagnostic techniques in the OIE Manual of Diagnostic Tests and Vaccines for Aquatic Animals, as resources permit (see 7.5.2).	NEAC Member Parties and their relevant jurisdictions	From 2004
7.4.4	The minimum approved zone size should be a river catchment; individual farms should not be given *G. salaris*-free status.	a) NEAC Member Parties and their relevant jurisdictions to which EC Directive 91/67 applies should make representations to the Commission (DG SANCO) proposing that this principle be included in any new legislation. Representations might also be made to OIE in relation to the Aquatic Animal Health Code. b) The Secretariat might also be requested to make representations on behalf of the NEAC.	a) NEAC Member Parties and their relevant jurisdictions b) NASCO Secretariat	a) From 2004 b) From 2004

Paragraph in Report	Recommendation	Proposed Action	Responsibility	Timeframe
7.4.5	Surveillance programmes should include all potential host species. On farms with both salmon and rainbow trout both populations should be tested. Since the expected prevalence is lower in rainbow trout higher sample sizes will be required for this species.	a) NEAC Member Parties should maintain and, where appropriate, enhance existing monitoring programmes in accordance with this recommendation. b) NEAC Member Parties and their relevant jurisdictions should make representations to the OIE proposing these principles are incorporated in the Manual of Diagnostic Tests and Vaccines for Aquatic Animals. c) The Secretariat might also be requested to make representations to OIE on behalf of the NEAC.	a) NEAC Member Parties and their relevant jurisdictions b) NEAC Member Parties and their relevant jurisdictions c) NASCO Secretariat	a) From 2004 b) From 2004 c) From 2004
7.4.6	The geographic distribution of *G. salaris* should be established with a view to minimising its spread to uninfected areas.	a) Existing monitoring programmes on salmonids in the wild and in culture environments undertaken by NEAC Member Parties and their relevant jurisdictions should be retained and expanded as necessary and as resources permit (see 7.4.6 and 7.5.1). Reports on these programmes should be provided to the Working Group (see 7.3.3). Mapping of *G. salaris* is also a recommendation in the Council's Williamsburg Resolution and reports should continue to be made to the Council in the annual reporting by the Parties (see 7.3.2). b) The Working Group (see 7.3.3) should be asked to consider options for obtaining information from EU Member States and other countries which do not have wild Atlantic salmon stocks (see 7.3.2).	a) NEAC Member Parties and their relevant jurisdictions b) Working Group	a) From 2004 (monitoring ongoing) b) From 2005
7.4.7	Criteria for diagnosis and establishing *G. salaris*-free zones should be based on international standards laid down by OIE.	NEAC Parties and their relevant jurisdictions should implement the diagnostic standards in the OIE Manual of Diagnostic Tests and Vaccines for Aquatic Animals.	NEAC Member Parties and their relevant jurisdictions	From 2004
7.4.8	Trade in live fish should only take place between zones of equal *G. salaris* status or from a higher to lower status zone.	a) NEAC Member Parties and their relevant jurisdictions to which EC Directive 91/67 applies should make representations to the Commission (DG SANCO) proposing that this principle be included in any new legislation. b) The Secretariat might also be requested to make representations on behalf of NEAC. c) NEAC Parties and their relevant jurisdictions should implement this principle (see 7.5.3). This principle is also included in the Council's Williamsburg Resolution and reports on any deviations from this principle should continue to be made to the Council in the annual reporting by the Parties.	a) NEAC Member Parties and their relevant jurisdictions b) NASCO Secretariat c) NEAC Parties and their relevant jurisdictions	a) From 2004 b) From 2004 c) From 2004

Paragraph in Report	Recommendation	Proposed Action	Responsibility	Timeframe
7.4.9	The guidelines on transportation of fish in the OIE Aquatic Animal Health Code should be implemented.	NEAC Member Parties and their relevant jurisdictions should implement these provisions through national and regional legislation (see 7.5.6).	NEAC Parties and their relevant jurisdictions	From 2004
7.4.10	Trade in gametes is preferable to trade in live fish.	a) NEAC Member Parties and their relevant jurisdictions to which EC Directive 91/67 applies should make representations to the Commission (DG SANCO) proposing that this principle be included in any new legislation. b) The Secretariat might also be requested to make representations on behalf of the NEAC. c) NEAC Member Parties and their relevant jurisdictions should implement this principle (see 7.5.10) and record all live fish movements (see 7.5.14).	a) NEAC Member Parties and their relevant jurisdictions b) NASCO Secretariat c) NEAC Member Parties and their relevant jurisdictions	a) From 2004 b) From 2004 c) From 2004
7.4.11	Countries with shared catchments should cooperate in the control and eradication of *G. salaris*.	NEAC Member Parties and their relevant jurisdictions with shared catchments should implement appropriate mechanisms for cooperation, including the establishment and strengthening of inter-country working groups (see 7.5.12).	NEAC Member Parties and their relevant jurisdictions	From 2004

Recommendations for strengthened national and regional legislation and measures to prevent the further spread of *G. salaris* *The new EU fish health directive will provide guidance on minimum measures for trade and disease control. The recommendations below are additional measures that NEAC Member Parties and their relevant jurisdictions should consider, from 2004, for the control of G. salaris.*	
Paragraph in Report	**Recommendation**
7.5.1	The geographic distribution of *G. salaris* should be established with a view to minimising its spread to uninfected areas (see 7.3.1, 7.3.2, 7.4.5, 7.4.6).
7.5.2	Within a country, criteria for diagnosis and establishing *G. salaris*-free zones should be based on international standards (see 7.4.3, 7.4.7).
7.5.3	Trade in live fish should only take place between zones of equal *G. salaris* status or from a higher to lower status zone (see 7.4.8).
7.5.4	Permission to stock fish into infected river catchments should be based on an assessment of the increased risk of transmission of the parasite to non-infected rivers (e.g. through migration and other routes).
7.5.5	In regions where the introduction of the parasite would lead to the extinction of Atlantic salmon population there should be no movement between river catchments of fish from infected farms.
7.5.6	Guidelines on the transportation of fish in the OIE Aquatic Animal Health Code (2003) should be implemented through national and regional legislation (see 7.4.9).
7.5.7	Countries should have contingency plans in place for treatment, containment or eradication. A legal base for use of rotenone and other treatment, containment and eradication measures should be put in place.
7.5.8	Where possible, routine breaks in production and disinfection on rainbow trout and salmon freshwater sites should be implemented as part of a control programme in infected areas.
7.5.9	There should be good containment to prevent escapees (see NASCO Guidelines on Containment of Farm Salmon, Annex 3 of Council document CNL(03)57).
7.5.10	Trade in gametes is preferable to trade in live fish (see 7.4.10).
7.5.11	Physical barriers to fish migration should be considered as a measure to minimise the risk of spread of *G. salaris* within a catchment and to uninfected catchments.
7.5.12	Countries with shared catchments should cooperate in the control and eradication of *G. salaris* and inter-country working groups for the control of *G. salaris* should be encouraged and strengthened (see 7.4.11).
7.5.13	Appropriate steps should be taken to minimise the spread of *G. salaris* through movement of anglers, boats, etc. by use of approved disinfection methods.
7.5.14	All movements of live fish should be recorded so that movements can be traced in the event of an outbreak of *G. salaris* (see 7.4.10).
7.5.15	The risk of *G. salaris* introduction through the processing of fish carcasses should be assessed and, where appropriate, mitigated through control of processing.
7.5.16	Countries should ensure that adequate resources are available for the implementation of measures to contain and eradicate *G. salaris*.

Annex 1 of NEA(04)13

Terms of Reference for a Working Group on Gyrodactylus salaris in the North-East Atlantic Commission Area

The North-East Atlantic Commission (NEAC), recognising the very serious damage that has been caused to the wild Atlantic salmon by the parasite *Gyrodactylus salaris* and the need for enhanced cooperation to prevent its further spread and eradication in areas in which it has been introduced, agrees to establish an international Working Group with the following Terms of Reference:

- to provide a forum for exchange of information among the Parties and their relevant jurisdictions on research on, and monitoring and control programmes for, the parasite;
- to develop recommendations for enhanced cooperation on measures to prevent the further spread of the parasite and for its eradication in areas where it has been introduced. Such measures would include, but would not be limited to, contingency plans and methods of eradication in the wild (e.g. barriers, chemical treatment) and at aquaculture facilities;
- to develop recommendations for workshops and seminars to facilitate improved exchange of information (including input from academic and other research institutes) and to develop recommendations for research requirements;
- to undertake cost benefit analyses in support of research, guarantees, policy decisions, publicity, etc.;
- to consider other fish health issues of relevance to wild Atlantic salmon.

The Working Group should meet initially on an annual basis under Norwegian Chairmanship. The Working Group will comprise representatives of the Member Parties of the North-East Atlantic Commission. Representatives of the USA and Canada may also participate in the meeting. A representative of the World Organization for Animal Health (OIE) should be invited to participate in an observer capacity in the work of the Group. The Secretariat will provide administrative support to the Working Group. The Working Group will report to the Commission at its Annual Meetings.

ANNEX 6

NEA(04)10

Decision regarding the salmon fishery in Faroese waters 2005

The North-East Atlantic Commission:

RECOGNIZING the right of the Faroe Islands to fish for salmon in their area of fisheries jurisdiction;

ACKNOWLEDGING the restraint demonstrated by the Faroe Islands by not having commercial salmon fisheries for a number of years and at the same time noting the continuing downward trend in many stocks, and the need for appropriate measures in homewater fisheries;

RECOGNIZING the need for scientific information on salmon from the Faroese area in the on-going development of scientifically sound and sustainably managed salmon fisheries;

WORKING expeditiously with ICES to improve the estimation of a combined conservation limit and thus enable catch advice for the Faroe Islands salmon fishery to be given on an effort or a quantitative basis;

AGREEING to continue to work together to establish an agreed mechanism to allocate any exploitable surplus between the Faroe Islands and homewater fisheries on a fair and equitable basis;

NOTING that the Faroe Islands will manage any salmon fishery on the basis of the advice from ICES regarding the stocks contributing to the Faroese salmon fishery in a precautionary manner and with a view to sustainability, taking into account relevant factors, such as socio-economic needs and other fisheries on mixed stocks;

ACKNOWLEDGING that Faroese management decisions will be made with due consideration to the advice of ICES concerning the biological situation and the status of the stocks contributing to the fishery, and that if such fishing will be decided upon, it will be limited in scope compared to the management measures agreed by NASCO in previous years, and that the fisheries shall be subject to close national surveillance and control;

FURTHER ACKNOWLEDGING that any fisheries will be organized in close cooperation between the fishermen and the authorities, taking due regard of the desires of the Parties, in conformity with ICES recommendations, to provide further scientific knowledge of the salmon resource;

NOTING that Denmark (in respect of the Faroe Islands and Greenland) will, in case of any decision to open the fishery, promptly inform NASCO Secretariat and all members of the Commission of that decision and the attached conditions. In that event, other members of the Commission could call for a Commission meeting in accordance with Article 10 (7) of the Convention. In such a case, it is agreed to derogate from the provisions of Rule 16 of the Rules of Procedure;

Decides not to set a quota for the Faroe Islands fishery for 2005.

ANNEX 7

CNL(04)13

Request for Scientific Advice from ICES

1. With respect to Atlantic salmon in the North Atlantic area:

   1.1 provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and worldwide production of farmed and ranched Atlantic salmon in 2004;
   1.2 report on significant developments which might assist NASCO with the management of salmon stocks;
   1.3 provide a compilation of tag releases by country in 2004;
   1.4 identify relevant data deficiencies, monitoring needs and research requirements[1].

2. With respect to Atlantic salmon in the North-East Atlantic Commission area:

   2.1 describe the key events of the 2004 fisheries and the status of the stocks; [2]
   2.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
   2.3 further develop the age-specific stock conservation limits where possible based upon individual river stocks;
   2.4 provide catch options or alternative management advice, if possible based on forecasts of PFA for northern and southern stocks, with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding; [3]
   2.5 provide an estimate of by-catch of salmon in pelagic fisheries.

3. With respect to Atlantic salmon in the North American Commission area:

   3.1 describe the key events of the 2004 fisheries and the status of the stocks; [2]
   3.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
   3.3 update age-specific stock conservation limits based on new information as available;
   3.4 provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding; [3]
   3.5 provide an analysis of any new biological and/or tag return data to identify the origin and biological characteristics of Atlantic salmon caught at St Pierre and Miquelon.

4. With respect to Atlantic salmon in the West Greenland Commission area:

   4.1 describe the events of the 2004 fisheries and the status of the stocks; [2, 4]
   4.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
   4.3 provide information on the origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes);
   4.4 provide catch options or alternative management advice with an assessment of risk relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding. [3]

Notes:

1. NASCO's International Atlantic Salmon Research Board's inventory of on-going research relating to salmon mortality in the sea will be provided to ICES to assist it in this task.

2. In the responses to questions 2.1, 3.1 and 4.1 ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality, of the salmon gear used, and on the by-catch of other species in salmon gear, and of salmon in any existing and new fisheries for other species is also requested.

3. In response to questions 2.4, 3.4 and 4.4 provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.

4. In response to question 4.1, ICES is requested to provide a brief summary of the status of North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions 2.1 and 3.1.

ANNEX 8

List of North-East Atlantic Commission Papers

Paper No.	Title
NEA(04)1	Provisional Agenda
NEA(04)2	Draft Agenda
NEA(04)3	Report of a Workshop on *Gyrodactylus salaris* in the Commission Area
NEA(04)4	Election of Officers
NEA(04)5	Draft 'Road Map' for Taking Forward the Recommendations from the Workshop on *Gyrodactylus salaris* in the Commission Area
NEA(04)6	Draft Report
NEA(04)7	Draft Letter to the President of NEAFC Regarding By-catch
NEA(04)8	Letter to the President of NEAFC Regarding By-catch
NEA(04)9	Draft Decision Regarding the Salmon Fishery in Faroese Waters 2005
NEA(04)10	Decision Regarding the Salmon Fishery in Faroese Waters 2005
NEA(04)11	Agenda
NEA(04)12	Report of the Twenty-First Annual Meeting of the North-East Atlantic Commission
NEA(04)13	'Road Map' for Taking Forward the Recommendations from the Workshop on *Gyrodactylus salaris* in the Commission Area

Note: This is a listing of all the Commission papers. Some but not all, of these papers are included in this report as annexes.

REPORT OF THE

TWENTY-FIRST ANNUAL MEETING

OF THE

WEST GREENLAND COMMISSION

7-11 JUNE 2004
REYKJAVIK, ICELAND

Chairman: Ms Patricia Kurkul (USA)

Vice-Chairman: Ms Julia Barrow (Canada)

Rapporteur: Dr Malcolm Beveridge (European Union)

Secretary: Dr Malcolm Windsor

WGC(04)8

CONTENTS

WGC(04)8

Report of the Twenty-First Annual Meeting of the West Greenland Commission of the North Atlantic Salmon Conservation Organization 7-11 June, 2004, Reykjavik, Iceland

1. Opening of the Meeting

1.1 The Chair, Ms Patricia Kurkul (USA), opened the meeting and welcomed delegates to Reykjavik.

1.2 There were no initial statements from the Parties. An opening statement was made on behalf of the NGOs by their Chairman. The NGOs noted the ICES advice to the Commission, that no fishery should take place at West Greenland. The NGOs urged continuing support and assistance from the Parties for the on-going conservation agreement negotiated between the North Atlantic Salmon Fund and the Atlantic Salmon Federation, on the one hand, and the KNAPK on the other.

1.3 A list of participants at the Twenty-First Annual Meeting of the Council and Commissions of NASCO is included on page 293 of this document.

2. Adoption of the Agenda

2.1 The Commission adopted its agenda, WGC(04)9 (Annex 1).

3. Nomination of a Rapporteur

3.1 The Commission appointed Dr Malcolm Beveridge (European Union) as its Rapporteur for the meeting.

4. Election of Officers

4.1 The Commission re-elected Ms Patricia Kurkul (USA) as Chair and Ms Julia Barrow (Canada) as Vice-Chair.

5. Review of the 2003 Fishery and ACFM Report from ICES on Salmon Stocks in the Commission Area

5.1 The representative of ICES, Dr Walter Crozier, presented the scientific advice from ICES relevant to the West Greenland Commission, prepared in response to a request from the Commission at its Twentieth Annual Meeting. The ACFM report from ICES, which contains the advice relevant to all Commissions, is included on page 219 of this document. Dr Crozier's powerpoint presentation to the Commission is contained in document CNL(04)40.

5.2 The representative of the United States complimented the ICES representative for the clear and comprehensive presentation of the ICES advice, noting, however, that the situation was grave.

5.3 The representative of Denmark (in respect of the Faroe Islands and Greenland) also complimented the ICES representative on his presentation. However, he pointed out that nominal catches in West Greenland had dropped from 1,426 tonnes in 1977 to less than 9 tonnes in 2003, a reduction of 99.4%. He asked whether the reduction in West Greenland catches had made any measurable difference to the North American or southern European stocks. The ICES representative stated that exploitation rates had dropped significantly everywhere throughout this period, but despite this, the abundance of North American and southern European stocks were at such a low level that ICES had concluded that no catch at Greenland is presently warranted. The representative of the European Union pointed out that while observed catches in West Greenland were less than 9 tonnes, unreported catches were estimated at 10 tonnes, bringing the total exploitation at West Greenland in 2003 to close to 20 tonnes. The ICES representative urged that NASCO accept the ICES advice of a zero catch for 2004, or a figure close to this.

5.4 The European Union raised the issue of the poor state of knowledge of the genetic composition of salmon stocks in southern European rivers that had been mentioned in the ICES presentation. The Commission was informed that EC funds had recently been made available to carry out an analysis of salmon stocks in rivers in France, Spain and Southwest England. This was welcomed by the ICES representative.

5.5 The Chair thanked the ICES representative for his excellent report, but reiterated the sentiment that it was sobering advice.

5.6 A paper on the 2003 fishery at West Greenland was tabled by Denmark (in respect of the Faroe Islands and Greenland), WGC(04)5 (Annex 2).

6. Regulatory Measures

6.1 There were no initial statements from the Parties.

6.2 Following discussions by Heads of Delegations, the Chair tabled a document for a 'Regulatory Measure for the Fishing for Salmon at West Greenland for 2004'. There were no comments from the Parties on the proposal. The regulatory measure was adopted, WGC(04)6 (Annex 3).

7. Sampling in the West Greenland Fishery

7.1 The United States presented a report on the North American/European Union sampling programme at West Greenland in 2003, WGC(04)10 (Annex 4). The representative of Canada complimented the United States on the presentation, which provided a thorough analysis and assessment of the fishery and the sampling programme carried out in 2003. The views were endorsed by the representative of the European Union.

7.2 The West Greenland Sampling Agreement for 2004 was tabled for discussion, WGC(04)7 (Annex 5). All Parties (the European Union, Denmark (in respect of the Faroe Islands and Greenland) and the United States) agreed to contribute to the resourcing of the sampling programme. Canada will not be able to send a sampler to West Greenland but will support all other measures, including the maintenance of the database and the analysis of scale samples. The representative of the European Union expressed his hope that Canada would be able to support sampling work in future years. Denmark (in respect of the Faroe Islands and Greenland) also complimented the United States on its presentation and looked forward to welcoming this year's samplers.

8. Announcement of the Tag Return Incentive Scheme Prize

8.1 For the first time since 2001, tags had been entered into the annual award scheme of the West Greenland Commission. The winning tag in the draw, made by the Auditor on 24 May, was of Canadian origin and had been applied to a smolt in the estuary of the Southwest Miramichi River, Canada, on 27 May 2002, as part of a cooperative smolt-tagging project. The fish was caught at Maniitsoq, West Greenland, by Ms Charlotte Lyberth, and sold on the open market during September 2003.

9. Recommendations to the Council on the Request to ICES for Scientific Advice

9.1 The Commission reviewed the relevant sections (paragraph 4) of document SSC(04)2 and agreed to recommend it to the Council as a component of the annual request to ICES for scientific advice. The request, as agreed by Council, is contained in document CNL(04)13 (Annex 6).

10. Other Business

10.1 There was no other business.

11. Date and Place of Next Meeting

11.1 The next meeting of the West Greenland Commission will be held during the Twenty-Second Annual Meeting of the Council from 6-10 June 2005.

12. Report of the Meeting

12.1 The Commission agreed a report of its meeting, WGC(04)8.

Note: The annexes mentioned above begin on page 191, following the French translation of the report of the meeting. A list of West Greenland Commission papers is included in Annex 7 on page 217 of this document.

WGC(04)8

Compte rendu de la Vingt-et-unième réunion annuelle de la Commission du Groenland Occidental de l'Organisation pour la Conservation du Saumon de l'Atlantique Nord 7-11 juin, 2004, Reykjavik, Islande

1. Séance d'ouverture

1.1 La Présidente, Ms Patricia Kurkul (Etats-Unis), a ouvert la réunion et a souhaité aux délégués la bienvenue à Reykjavik.

1.2 Les Parties n'ont prononcé aucune déclaration initiale. Une déclaration d'ouverture a été prononcée au nom des ONG par leur Président. Les ONG avaient pris acte des recommandations du CIEM présentées à la Commission, à savoir qu'aucune pêche ne devait avoir lieu au Groenland Occidental. Les ONG recommandaient vivement aux Parties de continuer à offrir leur soutien et assistance à l'accord de conservation qui avait été négocié entre, d'un côté, le *North Atlantic Salmon Fund* et la Fédération du saumon atlantique et, de l'autre, KNAPK. Cet accord était toujours en vigueur.

1.3 Une liste des participants à la Vingt-et-unième réunion annuelle du Conseil et des Commissions se trouve à la page 293 de ce document.

2. Adoption de l'ordre du jour

2.1 La Commission a adopté son ordre du jour, WGC(04)9 (annexe 1).

3. Nomination d'un Rapporteur

3.1 La Commission a nommé Dr Malcolm Beveridge (Union européenne) Rapporteur de la réunion.

4. Election des membres du Comité directeur

4.1 La Commission a réélu Présidente Ms Patricia Kurkul (Etats-Unis) et Vice-présidente, Ms Julia Barrow (Canada).

5. Examen de la pêcherie de 2003 et du rapport du CCGP du CIEM sur les stocks de saumons dans la zone de la Commission

5.1 Le représentant du CIEM, Dr Walter Crozier, a présenté les recommandations scientifiques du CIEM intéressant la Commission du Groenland Occidental, formulées à la suite d'une demande émanant de la Commission lors de sa Vingtième réunion annuelle. Le rapport du CCGP du CIEM contenant les recommandations scientifiques pour l'ensemble des Commissions figure à la page 219 de ce document. La présentation en Powerpoint du Dr Crozier est inclue au document CNL(04)40.

5.2 Le représentant des Etats-Unis a complimenté le représentant du CIEM pour la clarté et le détail de sa présentation des recommandations du CIEM, notant, néanmoins, que la situation était grave.

5.3 Le représentant du Danemark (pour les Iles Féroé et le Groenland) a également complimenté le représentant du CIEM pour sa présentation. Les captures nominales au Groenland Occidental, a-t-il toutefois signalé, étaient passé de 1 426 tonnes en 1977 à moins de 9 tonnes en 2003, ce qui représentait une réduction of 99,4%. Il voulait par conséquent savoir si la réduction des captures au Groenland Occidental avait eu un effet positif quantifiable sur les stocks nord-américains ou d'Europe du sud. Le représentant du CIEM a déclaré qu'au cours de cette période les taux d'exploitation avaient partout beaucoup baissé, mais que, malgré ceci, l'abondance des stocks nord-américains et d'Europe du sud demeurait à un tel bas niveau que le CIEM avait conclu qu'on ne pouvait actuellement permettre aucune capture au Groenland. Le représentant de l'Union européenne a fait remarquer que bien que les captures déclarées du Groenland Occidental fussent inférieures à 9 tonnes, on avait estimé les captures non déclarées à 10 tonnes, ce qui donnait, pour 2003, un chiffre total d'exploitation au Groenland Occidental proche des 20 tonnes. Le représentant du CIEM a recommandé vivement que l'OCSAN accepte les recommandations du CIEM conseillant une exploitation nulle ou quasiment nulle pour 2004.

5.4 L'Union européenne a soulevé la question du peu de connaissance concernant la composition génétique des stocks de saumons dans les rivières du sud de l'Europe dont la présentation du CIEM avait fait part. La Commission a été informée que la CE avait récemment mis à disposition des fonds pour effectuer une analyse des stocks de saumons dans les cours d'eau de France, d'Espagne et du sud-ouest de l'Angleterre. Le représentant du CIEM a salué cette initiative.

5.5 La Présidente a remercié le représentant du CIEM, mais a réitéré le sentiment que les recommandations donnaient à réfléchir.

5.6 Le Danemark (pour les Iles Féroé et le Groenland) a présenté un document sur la pêche de 2003 au Groenland Occidental, WGC(04)5 (annexe 2).

6. Mesures de réglementation

6.1 Les Parties n'ont prononcé aucune déclaration initiale.

6.2 A la suite des débats entre les Chefs de délégations, la Présidente a présenté le document intitulé « Mesure de réglementation de la pêche au saumon au Groenland Occidental pour 2004». Les Parties n'ont offert aucun commentaire sur cette proposition. La mesure de réglementation a donc été adoptée, WGC(04)06 (annexe 3).

7. Echantillonnage de la Pêche du Groenland Occidental

7.1 Le représentant des Etats-Unis a présenté un rapport sur le programme d'échantillonnage effectué par l'Amérique du Nord et l'Union européenne au Groenland Occidental en 2003, WGC(03)10 (annexe 4). Le représentant du Canada a complimenté le représentant des Etats-Unis pour la qualité de sa présentation. Celle-ci avait fourni une analyse et une évaluation approfondies de la pêcherie et du programme d'échantillonnage réalisé en 2003. Le représentant de l'Union européenne a avalisé l'opinion du Canada.

7.2 La question de l'accord d'échantillonnage au Groenland Occidental en 2004 a été soumise au débat, WGC(04)7 (annexe 5). Les Parties (l'Union européenne, le Danemark [pour les Iles Féroé et le Groenland] et les Etats-Unis) ont toutes convenu de contribuer un apport de ressources au programme d'échantillonnage. Le Canada ne sera pas en mesure d'envoyer un échantillonneur au Groenland Occidental, mais apportera son soutien à toutes les autres opérations, dont la maintenance de la base de données et l'analyse des échantillons d'écailles. Le représentant de l'Union européenne a indiqué qu'il espérait voir, à l'avenir, le Canada contribuer au travail d'échantillonnage. Le Danemark (pour les Iles Féroé et le Groenland) a également complimenté le représentant des Etats-Unis sur sa présentation et a indiqué qu'il se réjouissait d'avance à l'idée d'accueillir les échantillonneurs de cette année.

8. Annonce du Prix du Programme d'encouragement au renvoi des marques

8.1 On avait, pour la première fois depuis 2001, enregistré des marques au programme annuel d'encouragement au renvoi des marques de la Commission du Groenland Occidental. La marque gagnante du tirage au sort, effectué par le Vérificateur des comptes, le 24 mai, était d'origine canadienne. Elle avait été posée sur un smolt dans l'estuaire de la rivière Miramichi du sud-ouest, au Canada, le 27 mai 2002, au cours d'un projet coopératif de marquage de smolt. Le poisson avait été attrapé à Maniitsoq, au Groenland Occidental, par Ms Charlotte Lyberth, et vendu sur le marché en septembre 2003.

9. Recommandations au Conseil s'inscrivant dans le cadre de la demande au CIEM de recommandations scientifiques

9.1 Après avoir passé en revue les sections pertinentes (paragraphe 4) du document SSC(04)2, la Commission a convenu de les recommander au Conseil dans le cadre de la demande annuelle de recommandations scientifiques au CIEM. Le document CNL(04)13 contient la demande de recommandations scientifiques adressée au CIEM et approuvée par le Conseil (annexe 6).

10. Divers

10.1 Aucune autre question n'a été abordée.

11. Date et lieu de la prochaine réunion

11.1 La Commission a convenu de tenir sa prochaine Réunion annuelle lors de la Vingt-deuxième réunion annuelle du Conseil, qui se tiendra du 6 au 10 juin 2005.

12. Compte rendu de la réunion

12.1 La Commission a approuvé le compte rendu WGC(04)8 de la réunion.

Note : L'annexe 7 contient, à la page 217, une liste des documents de la Commission du Groenland Occidental.

ANNEX 1

WGC(04)9

Twenty-First Annual Meeting of the West Greenland Commission Radisson SAS Saga Hotel, Reykjavik, Iceland 7-11 June, 2004

Agenda

1. Opening of the Meeting
2. Adoption of the Agenda
3. Nomination of a Rapporteur
4. Election of Officers
5. Review of the 2003 Fishery and ACFM Report from ICES on Salmon Stocks in the Commission Area
6. Regulatory Measures
7. Sampling in the West Greenland Fishery
8. Announcement of the Tag Return Incentive Scheme Prize
9. Recommendations to the Council on the Request to ICES for Scientific Advice
10. Other Business
11. Date and Place of Next Meeting
12. Report of the Meeting

ANNEX 2

West Greenland Commission

WGC(04)5

The 2003 Fishery at West Greenland

(tabled by Denmark (in respect of the Faroe Islands and Greenland))

WGC(04)5

The 2003 Fishery at West Greenland

(tabled by Denmark (in respect of the Faroe Islands and Greenland))

At the Annual Meeting of NASCO in June 2003, the West Greenland Commission agreed to restrict the catch of Atlantic salmon at West Greenland to that amount used for internal subsistence consumption in Greenland. Furthermore, no commercial export of salmon was allowed.

In accordance with the Regulatory Measure adopted by the West Greenland Commission, the Greenland Home Rule Government decided to set the national quota for commercial landings of Atlantic salmon to fishing plants to zero tonnes, and prohibited any export of salmon from Greenland in 2003. Only a subsistence fishery was allowed, i.e. fisheries for private consumption, and fisheries with the aim of supplying local open air markets, hotels, hospitals and restaurants. The latter was only allowed for professional fishermen with licences.

In 2003, the fishery was opened on August 11 and closed on October 31. During this period a total catch of 8.7 tonnes of salmon was reported to the Greenland Fishery Licence Control (GFLK). Of this, 5.8 tonnes were reported by licensed fishermen as sold at open air markets, etc., and 2.9 tonnes were reported as used for private consumption.

The fishery is regulated in the Greenland Home Rule Executive Order No 21 of August 10 2002 on Salmon Fishery. The executive order distinguishes between 1) the commercial fishery for Atlantic salmon to be landed at fish plants, 2) the subsistence fishery by residents of Greenland, and 3) the rod fishery by tourists/non-residents.

All fishermen who wish to sell Atlantic salmon must hold a licence issued by GFLK. In 2003, 146 licences were issued, but only 20 of these were utilized for selling according to the reports to GFLK.

All catches of Atlantic salmon must be reported to GFLK. The catches were either sold at local open air markets, to local institutions, hotels, etc., or kept for private consumption.

The wildlife and fisheries officers of GFLK make random checks at local markets in towns and settlements along the west coast of Greenland, and in hotels, restaurants, shops, etc., in order to compare purchase of salmon with reported catches. In 2003, the wildlife and fisheries officers have put a lot of effort into handing out reporting forms to all fishermen whom they have observed fishing for salmon, and informing them that all catches must be reported to GFLK.

ANNEX 3

West Greenland Commission

WGC(04)6

Regulatory Measure for the Fishing of Salmon at West Greenland for 2004

WGC(04)6

Regulatory Measure for the Fishing of Salmon at West Greenland for 2004

RECALLING that the Parties to the West Greenland Commission have previously agreed regulatory measures for the West Greenland fishery based on the scientific advice from the International Council for the Exploration of the Sea (ICES);

The Parties:

(1) Acknowledge the good work undertaken by Greenland to improve the estimates of the annual catches of salmon taken for private sales and local consumption in Greenland and encourage Greenland to continue this work; and

(2) Commit to cooperate in the design and implementation of a sampling programme that will be closely coordinated with the fishery.

CONSIDERING the scientific advice from ICES which indicates that the stock complex at West Greenland is outside safe biological limits;

RECOGNIZING that cooperation for the conservation of wild Atlantic salmon is in their mutual interest, the Parties agree that in 2004, the catch at West Greenland will be restricted to that amount used for internal subsistence consumption in Greenland, which in the past has been estimated at 20 t. There will be no commercial export of salmon.

Denmark, on behalf of Greenland, will inform the other Parties on the outcome of the 2004 fishery.

ANNEX 4

West Greenland Commission

WGC(04)10

Summary Report of the 2003 NASCO West Greenland Sampling Agreement

WGC(04)10

Summary Report of the 2003 NASCO West Greenland Sampling Agreement

1. Summary

An international sampling programme was instituted in 2001 to sample Atlantic salmon landings at West Greenland. The sampling programme included sampling teams from Greenland, United Kingdom, Ireland, United States and Canada and coordination by the US. Teams were in place at the start of the fishery on 11 August 2003 and continued until 14 September 2003 with spot coverage until 21 October 2003. Samples were obtained from three landing sites: Qaqortoq (NAFO Division 1F), Nuuk (1D) and Maniitsoq (1C). In total, 2,198 Atlantic salmon were sampled for presence of external or internal tags and fin clips. For subsets of the specimens, length and gutted weight were measured, scales were taken for ageing, tissue samples were collected for DNA analysis, and disease and sea lice samples were collected. In some divisions, the sampling programme handled more fish (by number) than were reported as being landed and subsequently the landings data were adjusted to reflect this discrepancy in future analyses. The West Greenland Atlantic salmon harvest was effectively sampled both temporally and spatially, thereby providing critical input data for the North American and European assessment models.

2. Objectives

Under the NASCO West Greenland Sampling Agreement, 2003 (WGC(03)8), Parties to the NASCO West Greenland Commission agreed to provide staff to sample catches of Atlantic salmon in West Greenland during the 2003 fishing season. The objectives of the sampling programme were to:

- Continue the time series of data (1969-2002) on continent of origin and biological characteristics of salmon in the West Greenland Fishery;
- Provide data on mean weight, length and continent of origin for input into the North American and European run-reconstruction models;
- Collect information on fish diseases and recovery of micro-tags and external tags.

To this end, the sampling programme in 2003 was to collect:

- Meristic data including lengths and weights of landed fish;
- Information on tags, fin clips, and other marks;
- Scale samples to be used for age and growth analyses;
- Tissue samples to be used for genetic analyses;
- Tissue samples to be used for disease sampling for the detection of ISA, BKD and other disease and parasite organisms;
- Other biological data requested by the ICES scientists and NASCO co-operators.

Participating samplers from North America and Europe were deployed during the course of the salmon fishing season in an attempt to representatively sample fish harvested throughout. The EU agreed to provide a minimum of six person weeks, Canada three person weeks and the United States four person weeks in support of the programme. The United States also agreed to co-ordinate the sampling programme in 2003. The Home Rule Government of Greenland agreed to help facilitate the sampling programme by providing a sampling assistant when available, providing information related to the opening and closing of the fishery and facilitating the acquisition of the necessary waivers for landing salmon in a whole condition for disease sampling.

Samplers worked in three West Greenland communities: Nuuk, Maniitsoq and Qaqortoq (Figure 1). The samplers involved in the programme were as follows:

Country	**Sampler(s)**	**Institute**	**Period**	**Community (NAFO Division)**
UK	Iain McLaren	Fisheries Research Services	15 Aug - 1 Sept	Maniitsoq (1C)
UK	Mark Ives	Centre for Environment Fisheries and Aquaculture Science	29 Aug – 14 Sept	Maniitsoq (1C)
USA	Peter Ruksznis	Atlantic Salmon Commission	11 – 24 Aug	Nuuk (1D)
USA	James Hawkes	NOAA-Fisheries	25 Aug – 7 Sept	Nuuk (1D)
DEN (GRNLD)	Lotta Rasmussen	Greenland Institute of Natural Resources	11 Aug – 7 Sept	Nuuk (1D)
DEN (GRNLD)	Lars Heilmann	Greenland Institute of Natural Resources	20 - 21 Oct	Nuuk (1D)
CAN	Denis Fournier	Parks and Wildlife	11 – 30 Aug	Qaqortoq (1F)
IRE	Ger Rogan	Marine Institute	26 Aug – 12 Sept	Qaqortoq (1F)

3. Quotas, catches and fishing periods

The Organization of Fishermen and Hunters in Greenland (KNAPK) did not opt out of the 2002 Commercial Fishery Suspension Agreement between KNAPK and the North Atlantic Salmon Fund by the April 25, 2003 deadline. Therefore, the export fishery remained closed; however, this agreement doesn't affect the non-commercial fishery for personal and local consumption.

In the light of recommendations from ACFM in May 2003, NASCO, at its Annual Meeting in June 2003, agreed to restrict the fishery at West Greenland, *to that amount used for internal subsistence consumption in Greenland, which in the past has been estimated at 20 tons*. Consequently, the Greenlandic authorities set the commercial quota to nil, i.e. landings to fish plants, purchase of salmon to shops, and any export of salmon from Greenland were forbidden. Licensed fishermen were allowed to sell salmon at the open markets, to hotels, restaurants and institutions. The private fishery for personal consumption without a licence was also allowed. All catches of Atlantic salmon were to be reported to the Licence Office on a daily basis.

In agreement with KNAPK, the licensed fishery for salmon was allowed from August 11 to the end of October 31. As in the previous year, the salmon fishery was regulated according to the Greenland Home Rule Executive Order number 21 of August 10, 2002.

Landing reports were received from all NAFO Divisions and from 12 landing sites (communities). Some reports were received long after the closing date for the season, the last arriving after December 2003.

A catch of approximately 8.7 metric tonnes of salmon was reported at West Greenland in 2003. Of these, 6.0 tonnes were reported by licensed fishermen as being sold to open markets, hotels, restaurants or institutions, while 2.7 tonnes were reported as kept for private consumption. A breakdown of the landing information into landing sites and market categories is given in Table 1 and the main communities where salmon are normally landed is shown in Figure 1. As in preceding years, some unreported catch is likely to occur; there is presently no quantitative approach to estimate the magnitude of this catch, but it is thought to be at the same level as estimated for recent years (about 10 metric tonnes).

The limitation of the fishery to subsistence levels caused practical problems for the sampling teams; however, the sampling programme was successful in adequately sampling the West Greenland catch both temporally and spatially. In fact, the sampling teams in some Communities sampled more salmon than were reported as landings (Table 1). When that occurred, the Working Group adjusted the landings for that Community by replacing the reported landings weight with the sampled weight for use in assessment calculations. This adjustment amounted to an approximate 3 metric tonnes increase in total landings.

4. Samplers' observations on the fishery

During their stay in Greenland, the samplers made observations of the fishery and the way that catches were handled. These observations were based upon occurrences in a small number of locations during a limited part of the fishing season. They may not, therefore, be typical of the whole fishery.

The vessels operating in the salmon fishery were small (only vessels less than 10m are allowed to fish for salmon) with some having wheelhouses but many being open dinghies about 6 or 7m in length. Vessels were normally operated by two people fishing set nets and drift nets. Sometimes when fishing deep within a fjord, drift nets were anchored at one end to prevent them from drifting into shore. Fish were usually landed gutted with their head intact to avoid pollution in the coastal harbours. Calculated whole weight is derived from the measured gutted weight raised by a factor of 1.11.

Salmon are landed in the small fishing harbours by local inshore fishers who sell their catch in local markets (braettet in Danish), to restaurants and institutions such as hospitals, orphanages and old-age homes. Other species landed by local inshore fishers included cod, birds, halibut, catfish as well as some harbour porpoise and seal. The influence of caribou hunting is also important, especially in the north. Local residents and fishers pursuing fish for food or for sale locally will typically switch to caribou when the caribou season opens. Income from the local sale of caribou meat is typically higher than for fish.

In most communities, the local market was open seven days a week from 08:30 until 16:30. It appeared to serve as a social, as much as a commercial, function. All species could be landed at any time, including before the market opened. The most popular species on the market were porpoise, fresh and dried whale, and catfish. Reindeer and cod also sold reasonably well, but salmon only sold well on the day of capture. Salmon were landed gutted and were then thoroughly cleaned, occasionally including the removal of scales with hoses. Fish were on the market floor within half an hour of landing. Ascertaining precise details on the capture location of individual fish was problematic (due to the language barrier); it is believed that all of the catches were made within close proximity to the particular community.

The average catch was small, with many fishers landing between one and ten fish (often together with porpoise or seals) and the effort appeared to be very low, with most boats tied up at the market for the majority of the day. On many days no salmon were landed at the market at all. However, when the season opened in August, the effort directed at salmon was often greater, as people wished to stock their freezers for winter. By September, most people had their supply of salmon and the absence of a commercial fishery inhibits fishers from targeting salmon, as the local market appeared to be easily saturated. The reindeer and musk ox hunting seasons finish at the end of September and many hunters were reportedly away and would return to the fishery in October. The reindeer herds are very substantial and people can make more money in August by hunting rather than by fishing. The lack of effort also reflects the fact that fishers are aware that salmon are considerably less abundant than in the past. Fishing does seem to be in decline as many young people have moved to Denmark and the average age of fishers is consequently increasing.

5. Sampling programmes

Attempts were made by the samplers to examine all fish encountered for the presence of clips or tags. Whenever possible, all fish within a catch were fully sampled including examination for clips/tags, measuring (fork length), weighing (gutted weight) and taking scale and tissue samples. If the catch was sold prior to, or during, the sampling only a subset would be sampled. The Nuuk sampling team also collected 55 disease samples and all sampling teams were asked to collect sea lice samples as available. The sea lice samples were for a Canadian researcher with the Department of Fisheries and Oceans interested in determining the spatial structure in the genetic 'stock' composition of sea lice throughout the North Atlantic and North Pacific Oceans.

6. Sampling Practicalities

In 2003, the commercial fishery was subject to an agreement between KNAPK and NASF which closed the commercial portion of the Atlantic salmon fishery, but did not affect the internal consumption aspect of the fishery. This meant that sales to restaurants, institutions and individuals from local markets would still continue but sales to fish plants would not be permitted. Catches in food fisheries are typically low and broadly distributed posing many sampling problems. It is very difficult to sample this type of fishery adequately as the fishery can be spread out over 1000 km of coastline and extend several weeks or even months. The advent of the caribou-hunting season in August/September also affects the sampling programme as people generally switch to caribou hunting when the season opens, making salmon more difficult to find. Therefore, instead of having salmon readily available at a central and common point, typically the local fish plant, salmon had to be vigorously searched for in local markets, homes, on the wharf, in restaurants, and at public institutions and hospitals.

7. Summary of Results to Date

The 2003 West Greenland Sampling Agreement (WGC(03)8) was developed to sample Atlantic salmon landings at West Greenland in 2003. The sampling programme included sampling teams representing Greenland, United Kingdom, Ireland, United States and Canada.

Teams were in place at the start of the fishery and continued to the end of September, although landings continued until December. In total, 2,198 specimens, representing approximately 74% (by weight and number) of the landings, were sampled in 2003.

Maniitsoq

In total, 359 fish were handled in Maniitsoq. Detailed biological sampling occurred on 293 of these. Only one fish was observed with a clipped adipose; a coded wire tag (cwt) was recovered from it. No tags were detected or observed on any other sampled fish although one external tag was submitted to the Nature Institute by a consumer. Very few fish were seen in the market during August and the majority of the samples came from the first two weeks in September. The first Maniitsoq sampler spent a few days in Sissimuit in August and saw no salmon being landed during his time there.

Qaqortoq

In total, 1,089 fish were handled in Qaqortoq. Detailed biological sampling occurred on 795 of these. A total of 17 fish were observed with a clipped adipose fin and two Visual Implant Elastomer tags (VIE), two streamer tags and one Carlin tag were observed. Seven coded wire tags were also recovered. Sampling remained very steady during the course of the sampling programme with adequate numbers of fish available to the teams during their stay.

Nuuk

In total, 750 fish were handled and sampled in Nuuk. Only 15 fish were observed with a clipped adipose fin and one VIE was observed. One coded wire tag was also recovered. Sampling remained spotty during the course of the sampling programme with periods of 1-7 days occurring without access to any fish.

Overall

Of the 2,198 individuals inspected, 1,838 received detailed biological sampling. In total the sampling programme collected:

- 1,823 fork lengths
- 1,592 gutted weights
- 175 whole weights
- 1,824 scale samples
- 1,779 tissues samples
- 55 disease samples
- 64 confirmed sex identifications
- 12 otolith samples
- 103 sea lice samples

Tag/Clip Recoveries

A total of 33 adipose clips were detected. Of these, a total of 17 fish with either external or internal tags were detected as follows (Table 2):

- 9 coded wire tags
- 3 streamer tags
- 3 Visual Implant Elastomer tags
- 2 Carlin tags with non-recovered cwts (1 from East Greenland)

No cwt tags were recovered from the Carlin tagged fish. In one case, the fisherman wanted to be compensated for extraction of the cwt tag at a rate that the sampler deemed was too exorbitant. In the second case, the fisherman who captured the fish noticed the external Carlin tag but was unaware of the presence of the internal cwt tag nor did he have the equipment necessary to detect, and hence, retrieve the tag. However, in both cases the serial number from the Carlin tag was recorded, thereby allowing identification of the tagged individual.

External/internal tag recoveries from the 2003 West Greenland Atlantic salmon fishery originated from Canada (3), Ireland (7), UK Scotland (2), UK England and Wales (2) and USA (3). Coincidentally, each of these countries contributed to and participated in the 2003 Sampling Programme.

Continent of Origin

All 1,779 tissue samples were successfully genotyped at 4 microsatellite DNA loci (Ssa202, Ssa289, SSOSL438, and SSOSL311) for assignment to continent of origin. A database of 4,802 Atlantic salmon genotypes of known origin was used as a baseline to assign the 1,779 salmon to continent of origin.

In total, 1,212 (68.1%) of the salmon sampled from the 2003 fishery were of North American origin and 567 (31.9%) fish were determined to be of European origin (Table 3). From the samples taken at Maniitsoq (1C), 234 (79.9%) salmon were determined to be of North American origin and 59 (20.1%) were of European origin. From the samples taken at Nuuk (1D), 611 (81.9%) salmon were determined to be of North American origin and 135 (18.1%) were of European origin. In contrast, the Qaqortoq (1F) collection yielded an equivalent distribution of salmon of North American 367 (49.6%) and European 373 (50.4%) origins. The lack of correspondence in the portion of continental representation between these collections underscores the need to sample multiple NAFO regions to achieve the most accurate estimate of the contribution of fish from each continent to the mixed fishery (Table 3).

Length and Weight Characteristics of the Catch

Biological characteristics (length, weight, and age) were recorded for approximately 1,800 fish sampled in 2003. The smallest fish sampled was 510 mm fork length and weighed 3.18 kg gutted weight (river age of 5 and sea age of 1) while the largest salmon was 1,000 mm and weighed 10.74 kg (river age of 2 and sea age of 3 with 1 spawning mark). The overall mean size across all sea ages was 639 mm fork length and 3.03 kg gutted weight.

There was a general downward trend in mean whole weight (kg) of both European and North American 1SW salmon from 1969–1995 (Figure 2). This trend was reversed in 1996, when mean weights began to increase again, although there was a sharp drop in 2000. In 2003, the mean North American 1SW salmon was 630 mm and 2.94 kg and the mean European 1SW salmon was 644 mm and 3.08 kg. These values are above the 1991-2002 mean of 622 mm, 2.65 kg and 632 mm, 2.82 kg for North American and European origin 1SW salmon, respectively.

Age Structure of the Catch

The smolt and sea age distribution of the harvest were determined from scale samples obtained during the sampling programme. For the North American component only, the smolt ages were:

- 2.7% were 1
- 28.8% were 2
- 39.0% were 3
- 20.9% were 4
- 7.6% were 5
- 1.1% were 6

For European origin salmon only:

- 16.2% were 1
- 58.0% were 2
- 22.1% were 3
- 3.0% were 4
- 0.8% were 5
- there were no 6 year olds

The mean smolt age of the North American origin samples has varied throughout the last 10 years, but the 2003 mean (3.1) was barely above age 3.0, the overall mean (1968-2002). The percentage of smolt age-2 salmon of North American origin was close to the average (~34%) in 1998, at its lowest recorded level (15%) in 2001 but back up to 28.8% in 2003.

The mean smolt age of the European salmon in 2003 (2.1 years) was also barely above the overall average (1968-2002) of 2.0 years. The percent of smolt age-1 fish has been quite variable in recent years and the percentage in 2003 (16.2%) is among the lowest in the time series. A low percentage of this group may suggest a lower contribution from the most southerly European stocks. Percentages of smolt age-3 fish in 2003 (22.1%) have also been very variable but were close to the long-term mean (1968-2002) of 17.0%.

Overall, the 1SW age group dominated the collection at 97.5%, 2SW were 1.0% and repeat spawners were 1.5%. For North American origin salmon:

- 96.7% of the fish sampled were 1SW
- 1.0% were 2SW
- 2.3% were repeat spawners

For European origin salmon:

- 98.9% were 1SW
- 1.1% were 2SW
- 0% were repeat spawners

No significant changes in the percentages in the sea age of the North American component of the catch from 1998 to 2003 was detected while the percentage of 1SW salmon in the European component has remained very high since 1997.

Disease Sampling

The 55 disease samples were obtained by the sampling team stationed in Nuuk. These fish were purchased directly from the fisherman and delivered in the whole state. A 2-3 mm^2 section from the middle portion of the kidney was removed and placed in an eppendorf tube containing 1 ml of RNALater^R. The samples were then placed in a freezer for storage. All samples were transported back the USA by the samplers and delivered to Micro Technologies Inc. for processing.

All samples received by Micro Technologies were in good condition (frozen or still cold). All samples were tested for the presence of ISAv only. They were assayed by RTPCR only; no cell culture assay was done as cell culture tissues must be processed within 48 hrs of sampling and that was not feasible under these sampling conditions. All test results were negative.

8. Acknowledgements

The financial contribution made by NOAA Fisheries for funding the genetic analysis is greatly appreciated. In addition, the contribution by the Atlantic Salmon Federation to the Department of Fisheries and Oceans (DFO) Canada so that DFO staff could take part in the sampling programme is acknowledged. The cooperation and assistance of fishers and residents in Greenland who provided access to their fish for samples is wholeheartedly appreciated.

9. References

WGC(03)8. 2003. *West Greenland Fishery Sampling Agreement, 2003*. Report of the Twentieth Annual Meetings of the Commissions, p. 119-122.

Table 1. Reported landings (whole weight kilograms) of Atlantic salmon in Greenland by landing site and market category. The approximate whole weight of fish sampled/handled by the international sampling team is also provided.

NAFO Division	Landing Community	Private	Sold	Total	Sampled (% of reported landings)
1A	Upernavik	0	167	167	
1A	Ilulissat	62	0	62	
1A	Qasigiannguit	89	198	287	
1A	Aasiaat	78	26	103	
1A total		**229**	**390**	**619**	
1B	Sisimiut	0	17	17	
1B total		**0**	**17**	**17**	
1C	Maniitsoq	691	930	1621	1,054 (65%)
1C total		**691**	**930**	**1621**	
1D	Nuuk	429	219	648	2,201 (340%)
1D total		**429**	**219**	**648**	
1E	Ivituut	521	0	521	
1E	Arsuk	0	244	244	
1E	Paamiut	370	139	509	
1E total		**890**	**384**	**1274**	
1F	Nanortalik	107	280	386	
1F	Narsaq	28	1875	1903	
1F	Qaqortoq	313	1915	2227	3,196 (143%)
1F total		**447**	**4069**	**4516**	
Total		**2686**	**6009**	**8694**	**6,450 (74%)**

Table 2. Tag recaptures during the 2003 West Greenland Atlantic salmon fishery.

tag type	Envelope No.	Communtiy	NAFO Div.	Recapture Date	Tag color/code	Release Country	River/place released	Release Date	Origin (Hat/Wild)	Release Age	Fork Length (mm)	Gutted Wt (kg)
cwt	69	Nuuk	1D	13-Aug-03	04-47-39	Ireland	Delphi	23-Apr-02	Hat	1+	690	3.42
cwt	4141	Qaqortoq	1F	14-Aug-03	01-42-22 (102/117)	E&W	Dee	May-02	Wild	1+/2+	623	2.34
cwt	4287	Qaqortoq	1F	21-Aug-03	04-47-34	Ireland	Parteen	11-Apr-02	Hat	1+	562	1.78
cwt	4874	Qaqortoq	1F	26-Aug-03	01-47-80	Ireland	Burrishoole	30-Apr-02	Hat	1+	667	3.46
cwt	4896	Qaqortoq	1F	26-Aug-03	04-47-58	Ireland	Ballynahinch	18-Feb-02	Hat	1+	675	3.24
cwt	4366	Qaqortoq	1F	29-Aug-03	01-47-76	Ireland	Burrishoole	30-Apr-02	Hat	1+	664	3.40
cwt	4451	Qaqortoq	1F	3-Sep-03	01-47-82	Ireland	Burrishoole	30-Apr-02	Hat	1+	578	1.96
cwt	4478	Qaqortoq	1F	4-Sep-03	22-42-36	E&W	Severn (Teme)	14-Mar-02	Hat	1+	654	2.54
cwt	6017	Maniitsoq	1C	1-Sep-03	01-47-74	Ireland	Screebe	11-Apr-02	Hat	1+	661	
Carlin **AND** cwt	4579	Qaqortoq	1F	11-Sep-03	green (C51949)	Scotland	North Esk	Apr-June 2001	Wild	1+/4+	840	6.36
Carlin **AND** cwt		Qortortoq (East Grnld)		27-Oct-03	green (C58283)	Scotland	North Esk	April-May 2002	Wild	1+/4+	~800	~4.00
streamer	4156-4190?	Qaqortoq	1F	15-Aug-03	clear (A02249)	Canada	SW Miramichi (Dungarvon)	4-Jun-02	Wild	2+/4+		
streamer	4744	Qaqortoq	1F	22-Aug-03	green (NW20837)	Canada	NW Miramichi (Cassilis estuary)	2-Jun-02	Wild	2+/4+	658	2.56
streamer		Maniitsoq	1F	September-03	green (NW32274)	Canada	SW Miramichi (estuary)	May-June 2001	Wild	2+/4+		
VIE	104	Nuuk	1D	14-Aug-03	REO	USA	Penobscot (Howland-l) or Dennys (Robinson-e)	April-May 2002	Hat	1+	610	2.40
VIE	4209	Qaqortoq	1F	15-Aug-03	LEO	USA	Penobscot (Howland-e) or Dennys (Robinson-l)	April-May 2002	Hat	1+	665	3.40
VIE	4236	Qaqortoq	1F	18-Aug-03	LEO	USA	Penobscot (Howland-e) or Dennys (Robinson-l)	April-May 2002	Hat	1+	648	2.50

Table 3. Genetic based continent of origin determinations by NAFO division for Atlantic salmon sampled at West Greenland, 2003. Determinations are based on all 1,779 genetic samples obtained and are assumed to be 100% accurate.

Community (NAFO Division)	North American	European	Total
Maniitsoq (1C)	234 (79.9%)	59 (20.1%)	293
Nuuk (1D)	611 (81.9%)	135 (18.1%)	746
Qaqortoq (1F)	367 (49.6%)	373 (50.4%)	740
Total	1,212 (68.1%)	567 (31.9%)	1,779

Figure 1. Map of southwest Greenland showing communities to which salmon have regularly have been landed. NAFO Divisions are also shown.

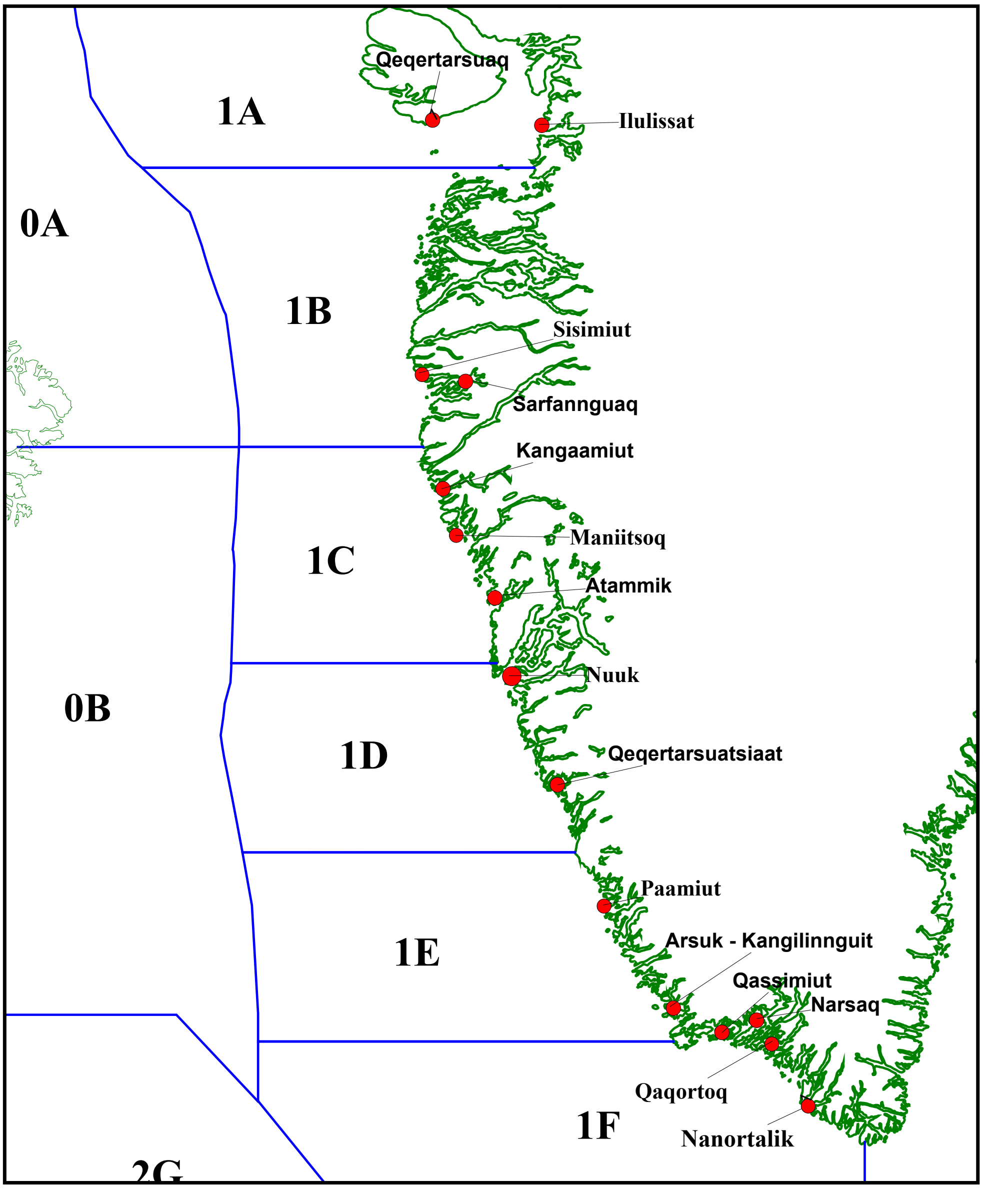
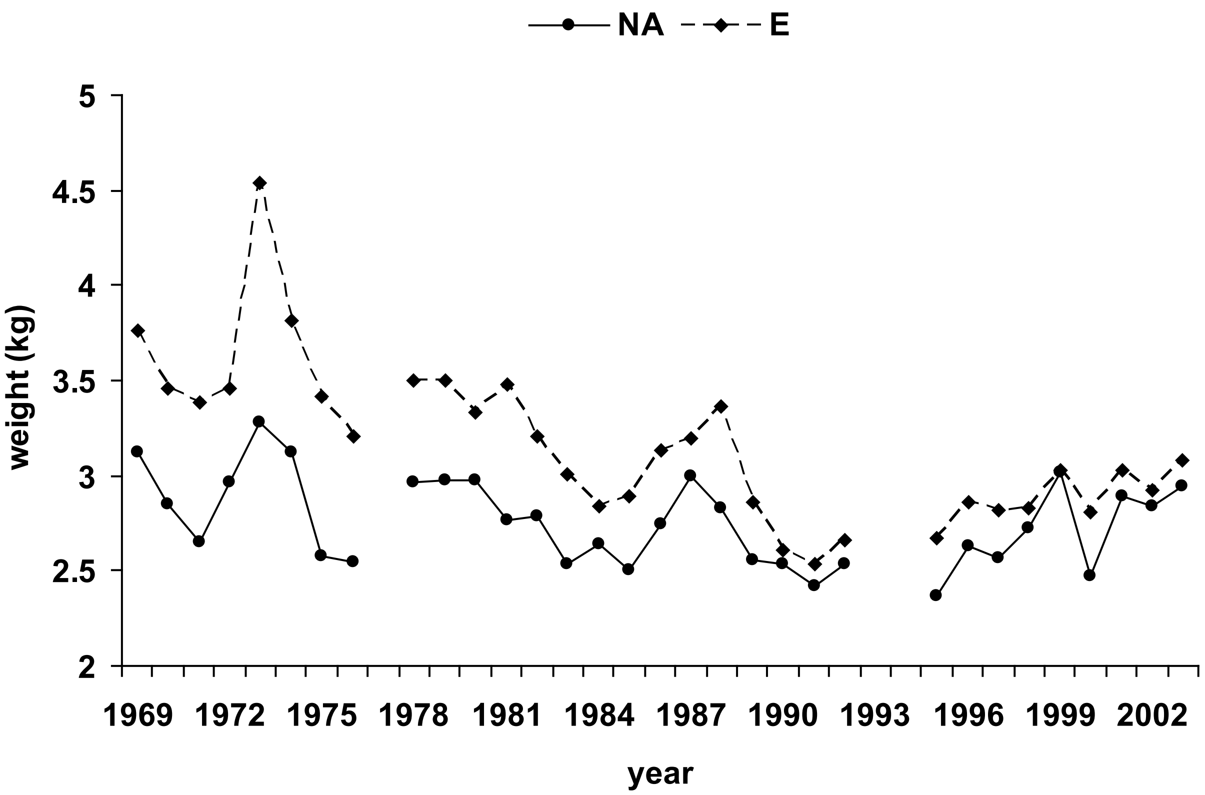


Figure 2. Mean whole weight (kg) of European and North American 1SW Atlantic salmon sampled in West Greenland from 1969–2003 (NA - North American, E - European).



<u>**ANNEX 5**</u>

West Greenland Commission

WGC(04)7

West Greenland Fishery Sampling Agreement, 2004

WGC(04)7

West Greenland Fishery Sampling Agreement, 2004

The West Greenland Commission recognizes the important contribution of sound biological data to science-based management decisions for fisheries prosecuted in the West Greenland Commission area. The Parties in the West Greenland Commission have worked cooperatively over the past three decades to collect biological data on Atlantic salmon harvested at West Greenland. These data provide critical inputs to the stock assessment completed by the ICES North Atlantic Salmon Working Group annually.

The objectives of the sampling programme in 2004 are to:

- Continue the time series of data (1969-2003) on continent of origin and biological characteristics of the salmon in the West Greenland Fishery

- Provide data on mean weight, length and continent of origin for input into the North American and European run-reconstruction models

- Collect information on the recovery of internal and external tags

- Collect information on fish diseases or other special samples as requested

To this end, the sampling programme in 2004 will collect:

- Meristic data including lengths and weights of landed fish
- Information on tags, fin clips, and other marks
- Scale samples to be used for age and growth analyses
- Tissue samples to be used for genetic analyses
- Tissue samples to be used for disease sampling for the detection of ISAv and other disease and parasite organisms as requested
- Other biological data requested by the ICES scientists and NASCO cooperators

<u>External Staffing Inputs</u>:

Parties external to Greenland with interests in the mixed stock fishery at West Greenland, including Canada, the European Union, and the United States, have historically provided personnel and analytical inputs into the cooperative sampling programmes. The NASCO Parties agree to provide the following inputs to the cooperative sampling programme at West Greenland during the 2004 fishing season:

- The European Union[1] agrees to provide a minimum of 6 person weeks[2] to sample Atlantic salmon at West Greenland during the 2004 fishing season
- The United States agrees to provide a minimum of 4 person weeks[2] to sample Atlantic salmon at West Greenland during the 2004 fishing season
- The United States agrees to co-ordinate the sampling programme for 2004

[1] The Republic of Ireland and the United Kingdom.
[2] For the purposes of this agreement, a person week of sampling is defined as a trained individual who works on site at West Greenland to collect samples of Atlantic salmon for a period of 7 days.

In addition, external NASCO Parties agree to provide the following technical analysis inputs to analyze samples and data collected at West Greenland:

- The United States of America agrees to provide microsatellite DNA analysis of tissue samples collected from Atlantic salmon harvested at West Greenland

- Canada agrees to provide ageing and other analyses of scale samples collected from Atlantic salmon harvested at West Greenland

- Canada agrees to maintain the historical West Greenland sampling database

- The United States of America agrees to provide disease analysis of tissue samples collected from Atlantic salmon harvested by West Greenland

- The European Union (UK, England & Wales) agrees to act as a clearing house for coded wire tags recovered from the fishery

Greenland Home Rule Government Coordination Efforts:

The Home Rule Government of Greenland agrees to provide 15 person weeks[3] annually to facilitate sampling of Atlantic salmon by samplers from other NASCO Parties. In addition, the Home Rule Government of Greenland agrees to identify a mechanism to provide sampling access to landed Atlantic salmon before grading/culling and before fish are subject to health regulations that would restrict or prohibit activities associated with sampling.

The Home Rule Government of Greenland agrees to inform persons designated by cooperating NASCO Parties of important developments in the management of the West Greenland fishery including planned openings and closures of the Atlantic salmon fishery at West Greenland.

The Home Rule Government of Greenland agrees to provide necessary waivers to the regulation that Atlantic salmon must be landed in a gutted condition to allow for the collection of biological samples (up to 120 salmon) required to complete disease sampling. To facilitate land-based collection of tissue samples required for disease sampling, the Home Rule Government of Greenland agrees to provide samplers with written permits that allow for landing of a total of 120 salmon.

The allocation of available scientific sampling personnel will be determined annually by ICES scientists to provide spatial and temporal coverage to characterize both the fishery and the Atlantic salmon populations along the West Greenland coast. Data and analyses of collected biological samples will be reported through the ICES North Atlantic Salmon Working Group in the year following data collection. Parties participating in the cooperative sampling programme will share access to resulting data and work cooperatively in the publication of information.

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[3] For the purposes of this agreement, a person week of sampling is defined as an individual who is capable of communicating with external samplers in English and fishers, and others in either Danish, Greenlandic, or preferably both, for a period of 7 days.

ANNEX 6

CNL(04)13

Request for Scientific Advice from ICES

1. With respect to Atlantic salmon in the North Atlantic area:

    1.1 provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and worldwide production of farmed and ranched Atlantic salmon in 2004;
    1.2 report on significant developments which might assist NASCO with the management of salmon stocks;
    1.3 provide a compilation of tag releases by country in 2004;
    1.4 identify relevant data deficiencies, monitoring needs and research requirements[1].

2. With respect to Atlantic salmon in the North-East Atlantic Commission area:

    2.1 describe the key events of the 2004 fisheries and the status of the stocks; [2]
    2.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
    2.3 further develop the age-specific stock conservation limits where possible based upon individual river stocks;
    2.4 provide catch options or alternative management advice, if possible based on forecasts of PFA for northern and southern stocks, with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding; [3]
    2.5 provide an estimate of by-catch of salmon in pelagic fisheries.

3. With respect to Atlantic salmon in the North American Commission area:

    3.1 describe the key events of the 2004 fisheries and the status of the stocks; [2]
    3.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
    3.3 update age-specific stock conservation limits based on new information as available;
    3.4 provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding; [3]
    3.5 provide an analysis of any new biological and/or tag return data to identify the origin and biological characteristics of Atlantic salmon caught at St Pierre and Miquelon.

4. With respect to Atlantic salmon in the West Greenland Commission area:

4.1 describe the events of the 2004 fisheries and the status of the stocks; [2, 4]
4.2 provide any new information on the extent to which the objectives of any significant management measures introduced in recent years have been achieved;
4.3 provide information on the origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes);
4.4 provide catch options or alternative management advice with an assessment of risk relative to the objective of exceeding stock conservation limits and advise on the implications of these options for stock rebuilding. [3]

Notes:

1. NASCO's International Atlantic Salmon Research Board's inventory of on-going research relating to salmon mortality in the sea will be provided to ICES to assist it in this task.

2. In the responses to questions 2.1, 3.1 and 4.1 ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries, the information provided should indicate the location of the catch in the following categories: in-river; estuarine; and coastal. Any new information on non-catch fishing mortality, of the salmon gear used, and on the by-catch of other species in salmon gear, and of salmon in any existing and new fisheries for other species is also requested.

3. In response to questions 2.4, 3.4 and 4.4 provide a detailed explanation and critical examination of any changes to the models used to provide catch advice.

4. In response to question 4.1, ICES is requested to provide a brief summary of the status of North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions 2.1 and 3.1.

ANNEX 7

List of West Greenland Commission Papers

Paper No.	Title
WGC(04)1	Provisional Agenda
WGC(04)2	Draft Agenda
WGC(04)3	Election of Officers
WGC(04)4	Draft Report
WGC(04)5	The 2003 Fishery at West Greenland (tabled by Denmark (in respect of the Faroe Islands and Greenland))
WGC(04)6	Regulatory Measure for the Fishing for Salmon at West Greenland for 2004
WGC(04)7	West Greenland Fishery Sampling Agreement, 2004
WGC(04)8	Report of the Twenty-First Annual Meeting of the West Greenland Commission
WGC(04)9	Agenda
WGC(04)10	Summary Report of the 2003 NASCO West Greenland Sampling Agreement

Note: This is a listing of all the Commission papers. Some, but not all, of these papers are included in this report as annexes.

Report of the
ICES Advisory Committee on Fishery Management
(Sections 3 to 6 only)

3. NORTH-EAST ATLANTIC COMMISSION

3.1 Status of stocks/exploitation

ICES has interpreted Atlantic salmon stocks to be within safe biological limits only if the lower bound of the confidence interval of the most recent spawner estimate is above the CL. Based on the most recent estimates of spawners. ICES classifies the stock complexes with respect to conservation requirements as follows:

Northern European 1SW stock complex was estimated to be outside safe biological limits (Figure 3.1.2a).

Northern European MSW stock complex was estimated to be within safe biological limits (Figure 3.1.2b).

Southern European 1SW and MSW stock complexes were estimated to be outside safe biological limits (Figure 3.1.4a,b).

Therefore, with the exception of Northern MSW stock complex, these stocks are considered outside safe biological limits.

The status of stocks is elaborated upon in Section 3.8.

3.2 Management objectives

NASCO (NASCO CNL31.210) has identified the primary management objective of that organisation as:

"To contribute through consultation and co-operation to the conservation, restoration, enhancement and rational management of salmon stocks taking into account the best scientific advice available".

NASCO further stated that "the Agreement on the Adoption of a Precautionary Approach states that an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks", and NASCOs Standing Committee on the Precautionary Approach interpreted this as being "to maintain both the productive capacity and diversity of salmon stocks".

NASCO's Action Plan for Application of the Precautionary Approach (NASCO CNL(99)48) provides interpretation of how this is to be achieved, as follows:

- "Management measures should be aimed at maintaining all stocks above their conservation limits…………by the use of management targets", and

- "Socio-economic factors could be taken into account in applying the Precautionary Approach to fisheries management issues";

"The precautionary approach is an integrated approach that requires, inter alia, that stock rebuilding programmes (including as appropriate, habitat improvements, stock enhancement, and fishery management actions) be developed for stocks that are below conservation limits".

3.3 Reference points

Section 1.4 describes the derivation of reference points for these stocks and stock complexes.

3.3.1 Progress with setting river-specific conservation limits

Specific progress in individual countries in 2003 is summarised below.

Conservation limits for all principal salmon rivers in UK (England & Wales) have been revised in 2003 to take account of the fact that levels of sea survival are currently much lower than those of 20 years ago. This will reduce the effect of high natural mortality at sea as a cause of failing CLs and will help managers focus on other issues over which they have more control (e.g. poor environmental quality in-river, over-exploitation by net and rod fisheries, etc.) when compliance failure occurs. The reduction in CLs means that lower levels of spawning escapement are accepted before the stock is considered to be outside safe biological limits.

ICES notes that this assumes the change in ocean survivorship is permanent. If survivorship recovers to previous levels the stocks would be below the true conservation limit required under these conditions. Managers then would need to give priority to rebuilding the stocks to the higher CL associated with more productive conditions rather than to increasing harvest.

River-specific conservation limits have been established for all rivers in Ireland using a stock recruitment analysis and transporting known stock and recruitment parameters from monitored European rivers to all Irish rivers (Section 2.3.2). The estimates of CL derived from this approach (195 950 1SW and 17 960 2SW) are similar to the estimates derived from the National Conservation Limit model (210 588 1SW, 23 301 2SW) in 2004. Furthermore, the approach adopted can be applied to provide conservation limits for each of the 17 salmon fishing districts in Ireland, as it accounts for the uncertainty associated with applying the National Conservation Limit model to district mixed stock catch and exploitation rate data.

3.3.2 National Conservation Limits

The national model has been run for all countries for which no river-specific conservation limits have been developed (i.e. all countries except France, Ireland, and UK (England & Wales)). For Iceland, Russia, Norway, UK (Northern Ireland), and UK (Scotland) the input data for the PFA analysis (1971–2003) have been provided separately for more than one region; the lagged spawner analysis has therefore been conducted for each region separately and the estimated conservation limits summed for the country. ICES has previously noted that outputs from the national model are only designed to provide a provisional guide to the status of stocks in the NEAC area.

For catch advice to NASCO, conservation limits are required for stock complexes. These have been derived either by summing of individual river CLs to national level, or taking overall national CLs, as provided by the national CL model. For the NEAC area, the conservation limits have been calculated by ICES as 309 831 1SW spawners and 152 155 MSW spawners for the Northern NEAC grouping, and 499 695 1SW spawners and 267 894 MSW spawners for the Southern NEAC grouping.

3.4 Advice on management

ICES has been asked to provide catch options or alternative management advice, if possible based on a forecast of PFA, with an assessment of risks relative to the objective of exceeding stock conservation limits in the NEAC area.

ICES emphasised that the national stock conservation limits discussed above are not appropriate for the management of homewater fisheries, particularly where these exploit separate river stocks. This is because they will not take account of differences in the status of different river stocks or sub-river populations and because of the relative imprecision of the national conservation limits. Nevertheless, ICES notes that the combined conservation limits for the main stock groups (national stocks) exploited by the distant water fisheries are the best guidance available for providing general management advice to the distant water fisheries.

Given the status of the stocks ICES provides the following advice on management:

- **Northern European 1SW stocks:** ICES recommends that the overall exploitation of the stock complex in mixed stock fisheries should decrease to the lowest possible level in order to increase the probability of exceeding the conservation limit of the stock complex. Moreover, due to the different status of individual stocks within the complex ICES considers that the only fisheries on maturing 1SW salmon should be on the river stocks which are shown to be above conservation limits.
- **Northern European MSW stocks:** ICES recommends that caution should still be exercised in the management of mixed stock fisheries which exploit this stock complex and exploitation should not be permitted to increase. Moreover, due to the different status of individual stocks within the complex ICES considers that the only fisheries on non-maturing 1SW salmon should be on the river stocks which are shown to be above conservation limits.
- **Southern European 1SW stocks:** ICES recommends that the overall exploitation of the stock complex in mixed stock fisheries should decrease to the lowest possible level to increase the probability of meeting the conservation limit of the stock complex. Moreover, due to the different status of individual stocks within the complex ICES considers that the only fisheries on maturing 1SW salmon should be on the river stocks which are shown to be above conservation limits.
- **Southern European MSW stocks:** The quantitative prediction of PFA for this stock complex indicates that PFA will remain close to the present low levels in 2004 (prediction 489 000) (Figure 3.4.1). There is evidence from the prediction that PFA will decrease in the near future and that the spawning escapement has not been significantly above the conservation limit for the last eight years (Figure 3.1.4b). ICES recommends that the overall exploitation of the stock complex in mixed stock fisheries should decrease to the lowest possible level to increase the probability of meeting the conservation limit of the stock complex. Moreover, due to the different status of individual river stocks within the complex ICES considers that the only fisheries on non-maturing 1SW salmon should be on the river stocks which are shown to be above conservation limits.

3.4.1 Relevant factors to be considered in management

For all fisheries, the Working Group considers that management of single-stock fisheries should be based upon assessments of the status of individual stocks. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be above biologically-based escapement requirements. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

Conservation limits normally refer to wild fish. However, there are significant numbers of escaped farmed salmon in Norwegian coastal waters. There are two consequences which need to be considered:

- Where they are identified, escaped farmed salmon are removed from the input data for the estimation of the PFA and spawners. However, the presence of unidentified escaped farmed salmon in the catch data will result in the exploitable surplus of wild salmon being overestimated.

- Escaped farm salmon do contribute to spawning to a small but variable degree. Therefore, whether this can be regarded as contributing to achieving conservation requirements is an issue which needs to be addressed by scientists and managers.

Based on recent work on resolving the most appropriate groupings for management advice for the distant water fisheries, ICES agreed that advice for the Faroese fishery (both 1SW and MSW) should be based upon all NEAC stocks. Advice for the West Greenland fishery should be based upon Southern European MSW salmon stocks only (comprising UK, Ireland, and France).

3.5 Catch forecast for 2004

In order to develop quantitative catch options for NEAC stock complexes, forecasts of PFA are required for each stock complex and for each sea age component. These are currently only available for the MSW component of the Southern European stock complex. The forecast of PFA for 2004 has been used in the catch advice for West Greenland for 2004 (Section 5). The development of this forecast is summarised below.

ICES had previously considered the development of a model to forecast the PFA of non-maturing (potential MSW) salmon from the Southern European stock group (comprising Ireland, France, and all parts of UK) (ICES 2002/ACFM:14 and ICES 2003/ACFM:19). Stocks in this group are the main European contributors to the West Greenland fishery. This year the model was fitted to data from 1977-2002 and used to predict PFA in the years 2003-2004 (Figure 3.4.1). These predictions were used, together with PFA forecasts from North America, to provide quantitative catch advice for the 2004 West Greenland fishery.

Predictions and 95% confidence limits (all values in thousands) of *PFA non-maturing* for Southern NEAC using *Spawners* (Eggs) and *Year.*

Year	Prediction	Lower limit	Upper limit
2003	525	321	859
2004	489	305	786

3.6 Medium- to long-term projections

The quantitative prediction for the Southern NEAC MSW stock component gives a projected PFA (at 1st January 2004) of 489 000 fish for catch advice in 2004. This is amongst the lowest in the 30-year time-series. No projections are available beyond that, or for other stock components or complexes in the NEAC area.

3.7 Comparison with previous assessment

National PFA model and national conservation limit model

Several countries made changes to the input data to these models.

Data input for Norway has been restricted to the period 1983 to the present. As a result, the time-series of PFA for both the NEAC area as a whole and for Northern Europe must be restricted to the same period.

Changes were made in the estimated contribution of UK (Scotland) origin fish to the UK (E&W) northeast coast net fisheries. These reflected the reduction in effort of the fishery and change in the relative contribution of coastal and drift net fisheries. Catches of these UK (Scotland) origin fish were also raised to estimated numbers of returning fish using unreported catch and exploitation rate estimates appropriate for the UK (E&W) fishery.

Changes were made to the Russian Kola Peninsula: White Sea Basin input data for 2001 onwards. Catches taken in the recently developed recreational rod fishery were subdivided into fish which had entered freshwater in the year of catch and those which had entered the previous year. Fish entering in the year of catch were used to estimate numbers of returning fish, and both categories were used in the estimate of spawning escapement. The sea age composition of the estimated numbers of fish returning to freshwater in Russia (Pechora river) in 2001 was also revised using a salmon:grilse ratio averaged over the previous 10 years.

Catch from the Foyle system has been removed from the input data for Ireland as these were included in the input catch for UK (NI). The exploitation rate for 1SW salmon is now based on estimates of exploitation rates on wild fish (+/- 15%), and unreported rates have been revised upwards for the period 1997 to 2000 to reflect new data available from the carcass tagging and logbook scheme in Ireland.

The river age composition of smolts has been revised for Iceland.

The river-specific conservation limits for UK (E&W) have been revised downwards. The river-specific conservation limit formerly used for Sweden has been replaced by the limit estimated from the PFA model.

PFA forecast model

The revised forecast of the Southern NEAC MSW PFA for 2003 provides a PFA mid-point of 525 000. This is very close to the value forecast last year at this time of 524 000.

3.8 NASCO has requested ICES to: describe the key events of the 2003 fisheries and the status of the stocks

3.8.1 Fishing in the Faroese area 2002/2003 commercial fishery

No fishery for salmon was carried out in 2002/2003 or, to date, in 2003/2004. Consequently, no sample data are available from the Faroese area for this season. No buyout arrangement has been in place since 1999.

Homewater fisheries in the NEAC area:

3.8.2 Significant events in NEAC homewater fisheries in 2003

A range of measures aimed at reducing exploitation were implemented or strengthened in 2003. These include: the use of a TAC to limit catches and a continuation of a carcass tagging scheme in Ireland to monitor catches in Ireland, a reduction of net licences issued and a move towards inshore nets which are known to exploit a higher proportion of local fish in UK (England & Wales). In Russia in 2003, a commercial in-river fishery was restarted in the Pechora River with the aim of deterring illegal fisheries.

3.8.3 Gear and effort

No significant changes in the type of gear used for salmon fishing were reported in the NEAC area: the number of licensed gear units has, in most cases, continued to fall; most fisheries for which data are available record reductions of over 40% in gear units operated over the last 10 years. There are no such consistent trends for the rod fishing effort in NEAC countries over this period.

3.8.4 Catches

In the NEAC area there has been a general reduction in catches since the 1980s (Table 2.1.1.1). This reflects a decline in fishing effort as a consequence of management measures as well as a reduction in the size of stocks. The provisional declared catch in the NEAC area in 2003 was 2315 tonnes**,** which was a reduction of 7% from 2002 (2479 t) and also below the previous 5-year mean. The catch in the Southern area declined from about 4500 t in 1972-75 to below 1500 t since 1986, and less than 1000 t in 1999 and 2003. The catch features two sharp declines, one in 1976 and the other in 1989-91. The catch in the Northern area also shows an overall decline over the time-series, but this is less steep than for the Southern area. The catch in the Northern area varied between 1850 and 2700 t from 1971 to 1986, and fell to a low of 962 t in 1997. However, since this time, the catch has increased and has fluctuated around 1500 t over the last four years. Thus, the catch in the Southern area, which comprised around two-thirds of the NEAC total in the early 1970s, is now lower than that in the Northern area.

3.8.5 Composition of catches

No general trends were evident in the percentage of 1SW fish in either the Northern or Southern NEAC areas. The contribution of farmed and ranched salmon to national catches in the NEAC area in 2003 was again generally low (<2% in most countries) and is similar to the values that have been reported in previous reports (e.g. ICES 2003/ACFM:19). However, in Norway farmed salmon continue to comprise approximately 30% of coastal and fjord catches (ICES 2001/ACFM:15).

3.8.6 National origin of catches

In 2003, a number of tags originating from fish released from other countries (58 from UK (N. Ireland), 27 from UK (England & Wales), and 17 from Spain) were recovered in Irish fisheries. A recent tagging study in Norway (1996-2001) confirmed previous observations that very few Norwegian salmon are intercepted in other countries.

3.8.7 Elaboration of status of national stocks in the NEAC area

In the evaluation of the status of stocks, PFA or recruitment values should be assessed against the spawner escapement reserve values while the spawner numbers should be compared with the conservation limits.

Northern European 1SW stocks: The PFA of 1SW salmon from the Northern European stock complex has been above the spawning escapement reserve throughout the time-series (Figure 3.1.1a). However, the spawning escapement shows an increasing trend in the number of 1SW spawners (Figure 3.1.2a) throughout the time-series.

Northern European MSW stocks: Numbers of non-maturing 1SW recruits (potential MSW returns) for Northern Europe (Figure 3.1.1b) are also estimated to have fallen throughout the period from the early 1980s to the late 1990s. The numbers of MSW spawners, however, show no trend. Spawners increased markedly from 1999 to 2001 but decreased again in 2002 and 2003. However, they remain above levels in the 1980's and 1990's. It therefore appears that the decline in recruitment has been balanced by the reductions in exploitation both in homewater fisheries and at Faroes. These trends in recruitment for the Northern European stocks are broadly consistent with the limited data available on the marine survival of monitored stocks in the Northern area (Section 3.8.8).

Southern European 1SW stocks: In the Southern European stock complex (Figure 3.1.3a), the numbers of maturing 1SW recruits are estimated to have fallen substantially since the 1970s. This pattern is consistent with the data obtained from a number of monitored stocks. Survival of wild smolts to return as 1SW fish fell to very low levels in the Southern European area for which data were available (Section 3.8.8).

Southern European MSW stocks: The PFA estimates suggest that the number of non-maturing 1SW recruits in Southern Europe has also followed a fairly steady and substantial decline over the past 30 years (Figure 3.1.3b). This is broadly consistent with the general pattern of decline in marine survival of 2SW returns in most monitored stocks in the area (Section 3.8.8). In more recent years, reductions in exploitation do not appear to have kept pace with the stock declines, and the spawning escapement suffered a substantial decline in the mid 1990s from which it has not recovered to date (Figure 3.1.4b).

This applies to the total stock complexes. ICES notes that CLs may not be appropriate for quantitative catch advice at national levels; however, they are regarded as useful indicators of overall stock status. Stock summaries are presented by country below as the point estimate of spawners in 2003 relative to the conservation limit. It is not possible to consistently put confidence intervals on these estimates, therefore the entries in the table below cannot be interpreted as an evaluation of the status of stocks relative to precautionary reference points.

For individual rivers the status with respect to conservation requirements may vary considerably from this picture.

Area	Country	1SW CL	2SW CL
Northern European Area	Finland	Below	At or above
	Iceland	Below	Below
	Norway	At or above	At or above
	Russia	At or above	At or above
	Sweden	At or above	At or above
Southern European Area	France	Below	Below
	Ireland	At or above	At or above
	UK (England and Wales)	Below	At or above
	UK (N. Ireland)	At or above	At or above
	UK (Scotland)	Below	Below

3.8.8 Survival indices

In both Northern and Southern NEAC areas wild and hatchery smolts show a constant decline in marine survival over the past 10-20 years (Figure 3.8.8.1). The steepest decline appears to be for the wild smolts in the Southern NEAC area. Survival indices of both wild and reared fish in the Northern NEAC area, however, have generally shown lesser declines than those in the Southern NEAC area. Results from these analyses are consistent with the information on estimated returns and spawners as derived from the PFA model. ICES notes that declines in marine survival have persisted despite decreases in marine catches. Clearly, there are factors other than fisheries influencing marine survival in recent years. Targeted research in the marine environment will be necessary to identify and evaluate the impacts of relevant factors contributing to these declines.

3.9 NASCO has requested ICES to: evaluate the extent to which the objectives of any significant management measures introduced in the last five years have been achieved

In order to achieve the NASCO management objectives, ICES has recommended reductions in catches in recent years. However, three of the four NEAC stock complexes remain outside safe biological limits (Section 3.1). The effect of specific management measures on stocks and fisheries has been evaluated in a number of NEAC countries. In summary:

NEAC Northern area

Russia – commercial catches have been declining steadily as a result of various management changes, including prohibition of some in-river fisheries and promoting catch and release for recreational fisheries. The mean commercial catch in the last five years (1999-2003) is 22% below that of the previous five years (1994-1998).

NEAC Southern area

Ireland – management changes in the commercial fishery in Ireland, introduced in 1997, to reduce effort was presented in ICES 2001/ACFM:15. More recently, there have been further management changes with the introduction of logbooks, carcass tagging, and TACs, resulting in a reduction in both the overall catch and the exploitation rates.
In UK (N. Ireland) – significant management changes came into effect in the Fisheries Conservancy Board area in 2002. The number of net licences was reduced and a voluntary code-of-practice to regulate angling was introduced in 2001. While the effects of these measures on stock status will require some years to fully evaluate, it is noted that the voluntary net buyout scheme probably contributed to the reduction in net catch in the FCB area from 23.4 t in 2001 to 9.4 t in 2002 and 6.3 t in 2003.

UK (England & Wales) – in 2003, national measures to protect spring salmon are estimated to have saved around 1200 salmon from capture by net fisheries and around 1000 by rod fisheries before June 1. In 2003 the drift net fishery was significantly reduced with the buyout of licences. The number of licenses issued has now been reduced by 89% since 1992 and a resultant decrease in catch was observed.

UK (Scotland) – A voluntary agreement was introduced in 2000 to delay fishing in order to protect early running MSW salmon. This was continued up until the present, resulting in about an 80% reduction in the catch of MSW salmon by nets in the months of February and March, compared with the previous five years.

3.10 NASCO has requested ICES to: provide estimates of bycatch of salmon in pelagic fisheries, and advise on their reliability

3.10.1 Fisheries and gears with potential to take salmon as a bycatch

Progress was made in clarifying the fisheries (including areas) and fishing gears where there was potential overlap with migrating post-smolt salmon in time and space. Table 3.10.1 summarises these fisheries. The ICES' areas and Divisions are shown in Figure 3.10.1. Potential fisheries are mackerel, herring (Norwegian spring-spawning and North Sea herring), blue whiting, capelin. The horse mackerel fishery was not thought to coincide significantly in time and space with salmon migrations. However, disaggregated data (i.e. by week, ICES rectangle and gear type, Table 3.10.1) have not been made available by all countries to ICES and this greatly limits the applicability of the catch data for assessment of post-smolt or adult bycatch.

The main gears with the potential to interact with migrating salmon were offshore pelagic trawls and purse seines. ICES noted that the gear used for surface and mid-water trawling was essentially the same and that they were deployed depending on where pelagic fish shoals were identified in the water. It was considered that the trawling on the surface was more likely to intercept post-smolt salmon than trawling lower in the water column. Purse seines probably did not have the same capacity to intercept smolts due to the smaller area fished by the individual nets compared to the towed gears.

3.10.2 Methods for estimating bycatch of salmon

ICES considered two sources of information on bycatches of salmon in fisheries identified as having fisheries with the potential to take salmon bycatch; research surveys and monitoring of commercial fleets.

A number of types of research surveys including targeted salmon research surveys, general and routine pelagic research surveys were all characterised as having complete screening, but small catches. They used a variety of gear types but none employed a fishing strategy of targeting dense concentrations of the target pelagic species (mackerel, herring etc.) Therefore, their catch composition cannot be extrapolated to the catches of commercial fleets operating in the same general area and time.

Data from independent observer programmes or from plant screening of bycatch from the relevant commercial fisheries are very infrequent. Coverage of these fisheries must be increased greatly if reliable estimates of salmon bycatch are to be obtained. Any resources available for obtaining these estimates are best directed at monitoring catches of commercial vessels and/or plant landings.

As the number of salmon in commercial catches relative to the target species is generally very low, there is a need to screen large volumes of catch in order to get statistically representative estimates of bycatch. This has cost implications in terms of the numbers of observers needed or the rate at which the pelagic catch can be processed.

A large-scale observer-based screening programme of the mackerel fishery in the Norwegian Sea was carried out in 2002 (ICES 2003/ACFM:19). However, the bycatch estimates from this study could not be developed as weekly disaggregated catches were not available. ICES endorsed observer-based screening programmes for pelagic fisheries and concluded that it should be possible to establish suitable protocols for such screening. For example, if the overlap in time and space between salmon and the mackerel fishery suggests that screening may only be required during a relatively restricted period of time in the fishery, thus a more intensive programme may be considered. The group noted that onboard screening is mostly viable onboard factory vessels, where fish pass along conveyor belts, in contrast to tank vessels where catch is pumped directly into holding tanks and screening is much more difficult compared to plant screening.

3.10.3 Estimates of bycatch of salmon in pelagic fisheries

Due to the reasons presented above, but particularly because of the non-availability of collected data, estimates of the total bycatch cannot be provided. However, catch rates from existing studies are provided in order to illustrate the range of potential outputs.

Information from research surveys

Information is available on research cruises carried out by Norway between 2001 and 2003. These cruises were dedicated to salmon and mackerel investigations both in the international area and in the Norwegian EEZ west (2001-2003) and north of the Vøring Plateau in the Norwegian Sea (2002 and 2003, 61 – 73.3°N; 1.5°W- 13°E). During the bycatch investigations, 198, 590 and 436 post-smolts were taken respectively between 2001 and 2003. Starting from the north and moving southwards during the 2003 cruise, the post-smolt catches were medium to large at the beginning of the cruise and became smaller when approaching the 66°N. As in 2002, the captures in single tows were smaller in the Norwegian EEZ than in the international zone. This might be expected, as the strongest branch of the North Atlantic Current passes west of the Vøring Plateau into the international area. However, post-smolts were also captured consistently within the Norwegian EEZ along with large numbers of mackerel. The mackerel sometimes filled the cod end of the experimental "Fish lift" trawl completely, resulting in post-smolts being badly damaged.

Calculation of the total number of post-smolts per tonne mackerel captured in the international zone gave an estimated 26 in 2002 and 25 in 2003. This area was not surveyed in 2001. In the Norwegian EEZ, in 2001, this estimate was 16 post-smolts/tonne compared with 57 post-smolts/tonne in 2002 and 6 post-smolts/tonne of mackerel in 2003. The overlap in time with the salmon and the fisheries in this area may, however, be shorter than first anticipated, but this would need to be verified with disaggregated data on the fisheries.

In July 2003, a Russian pelagic fish survey in the Norwegian Sea was carried out by the R/V "Smolensk" M-103 (cruise 50; the area surveyed was from 64°45N to 68°30N between 03°E and 06°). This survey is a part of an international research programme to study commercial species in the Norwegian and Barents Seas and is conducted on a yearly basis from May to July. Its target species are herring, blue whiting, and mackerel. One of the objectives of the survey was to map the distribution of post-smolts in the Norwegian Sea. The data collected in 2002-2003 in the Russian pelagic fish surveys are summarized in Table 3.10.2. Estimates provided for the research fishery in 2002 suggest a post-smolt/mackerel ratio of 5.93 per tonne and an adult salmon/mackerel ratio of 0.56 per tonne. No captures of salmon were reported in 2003.

As noted earlier, because they employ different fishing strategies ICES finds that reliable results cannot be obtained by applying the salmon catch from research surveys should be applied to commercial mackerel or herring fisheries.

Information directly from commercial fishery observer programme

In 2002 the Russian Federation started a comprehensive investigation of potential bycatch of Atlantic salmon and post-smolts in the Russian mackerel fishery in the Norwegian Sea. In 2003 the programme was continued. Scientific observers and fisheries inspectors worked onboard Russian fishing vessels in both years. Their tasks included, *inter alia*, screening of pelagic catch for potential bycatch of Atlantic salmon and its post-smolts. The catches were scanned immediately after retrieval of the trawl while discharging the fish into bins and also at a ship factory during grading. The screening protocol was the same as in previous years. One post-smolt and 15 adult salmon were recorded in July-August (Table 3.10.3). Two of the adults were caught when the targeted fish was blue whiting. Also one fish caught in late July was described as a sea trout.

Calculation of the ratio of total number of post-smolts per tonne of mackerel in the international zone gave an estimate of 0.002 post-smolts per tonne captured in the commercial fishery in 2002, and 0.0003 in 2003. The ratio of total number of adults per tonne of mackerel in the international zone was 0.002 in 2002 and 0.004 in 2003. As in 2002, the results suggest extremely low numbers of post-smolts and adult salmon caught in the mackerel fishery in July-August in the international waters of the Norwegian Sea.

Conclusions on estimating bycatch

Clearly there is a large discrepancy between the estimates derived from each of the methods. Given this wide range in catch rate estimates and limited observer coverage of pelagic fleets, it is not possible to provide sound estimates of bycatch for any pelagic fishery. This situation will prevail until there is sufficient monitoring of and information derived from commercial fisheries. ICES advises that observer-based programmes are the preferred methodology and should be expanded and further refined in order to examine the fishery in time and space where potential overlap is greatest. Access to weekly disaggregated catch data are an essential component of these programmes.

Examination of time-series of catches of herring, mackerel, blue whiting, and capelin against pre-fishery abundance (PFA) for Northern and Southern Europe stock complexes

ICES examined historical trends in pre-fishery abundance of NEAC stock complexes, compared to trends in catches of pelagic stocks in specific areas. The ICES areas are shown in Figure 3.11.1. The following pelagic fisheries were included :

Mackerel – Catch in Subarea I, II & Divs. Vb (ICES 2004/ACFM:08), Herring – Total catch of Norwegian spring-spawning herring (ICES 2003/ACFM:23) Blue whiting catch – Total catch in Northern areas (ICES 2003/ACFM:23)

Capelin catch – Total catch in Iceland-East Greenland-Jan Mayen area (ICES 2003/ACFM:23)

ICES noted that in the main, increase in catches of pelagic fish post-dated the apparent decline in salmon PFA. Again information of disaggregated catches in specific areas would greatly facilitate further analyses along these lines.

Table 3.10.1. Summary of countries and type of fishing gear in fisheries with potential overlap with salmon distribution. Italic text indicates peak salmon migration time (mid May-early August). (Areas refer to ICES fishing areas; Q is the quarter of the year.)

		Weeks 16-25					Weeks 20-26				Weeks 27-36			
Fishery	IVb 2Q	VIa 2Q	VIIb 2Q	VIIc 2Q	VIIj 2Q	VIIk 2Q	***IVa*** ***2Q***	Gear type	***Vb*** ***2Q***	Gear type	***IIa*** ***3Q***	Gear type	***IIb*** ***3 Q***	Gear type
Mackerel		England Scotland Ireland Germany	England Scotland Ireland	Ireland	England Scotland France Ireland Germany Netherlands		**England** **Scotland**	Midwater trawl Midwater trawl	**Russia**	Midwater trawl	**Norway** **Russia** **Faroes**	Purse seine Midwater trawl Midwater trawl		
Herring		Scotland					**Norway** **Scotland** **Germany** **Denmark**	Purse seine Midwater trawl Purse seine Purse seine Midwater trawl Purse seine Midwater trawl	**Germany**	Purse seine Midwater trawl	**Iceland** **Faroes** **Russia**	Purse seine Midwater trawl Purse seine Midwater trawl Midwater trawl	**Iceland** **Faroes** **Russia**	Purse seine Midwater trawl Purse seine Midwater trawl
Blue- whiting		Netherlands Norway Germany		Netherlands Germany					**Russia** **Iceland** **Faroes** **Norway**	Midwater trawl Midwater trawl Midwater trawl Midwater trawl	**Russia** **Norway** **Faroes** **Germany**	Midwater trawl Midwater trawl Purse seine Midwater trawl		
Capelin (Iceland, East Greenland, Jan Mayen)											**Iceland** **Norway** **Faroes**	Purse seine Purse seine Purse seine	**Iceland** **Norway**	Purse seine Purse seine
Horse- mackerel	Denmark Norway				England Ireland Netherlands									

Table 3.10.2 Summarized data from the pelagic fish surveys conducted in the Norwegian Sea in June-July 2002-2003 by Russian research vessels.

Year	No. of hauls taken	Total catch (t)	Mackerel catch (t)	No. of Salmon caught		No. of salmon caught per tonne of mackerel	
				Adults	Post-smolt	Adults	Post-smolt
2002	82	13.7	5.4	3	32	0.56	5.93
2003	31	15.6	13.3	0	0	0	0

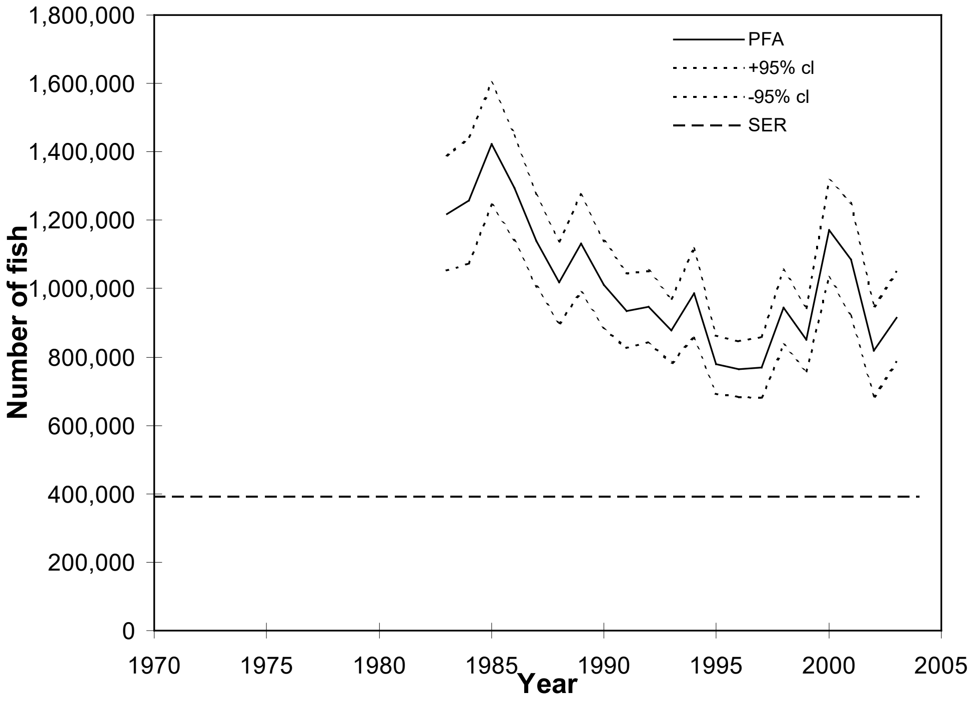
Table 3.10.3 Summarized data of the screening of catches from the Russian mackerel fishery in the Norwegian Sea in June-August 2002-2003.

Year	No of hauls screened	Total catch, t	catch, t	No of Salmon found		No. of salmon caught per tonne of mackerel	
				Adults	Post-smolt	Adults	Post-smolt
2002	1070	10,921	7,760	15	12	0.002	0.002
2003	416	7,200	3,800	15	1	0.004	0.0003

Figure 3.1.1 Estimated recruitment (PFA) and Spawning Escapement Reserve (SER) for maturing and non-maturing salmon in Northern Europe.

a) Maturing 1SW recruits (potential 1SW returns)

(Recruits in Year N become spawners in Year N)



b) Non-maturing 1SW recruits (potential MSW returns)

(Recruits in Year N become spawners in Year N+1)

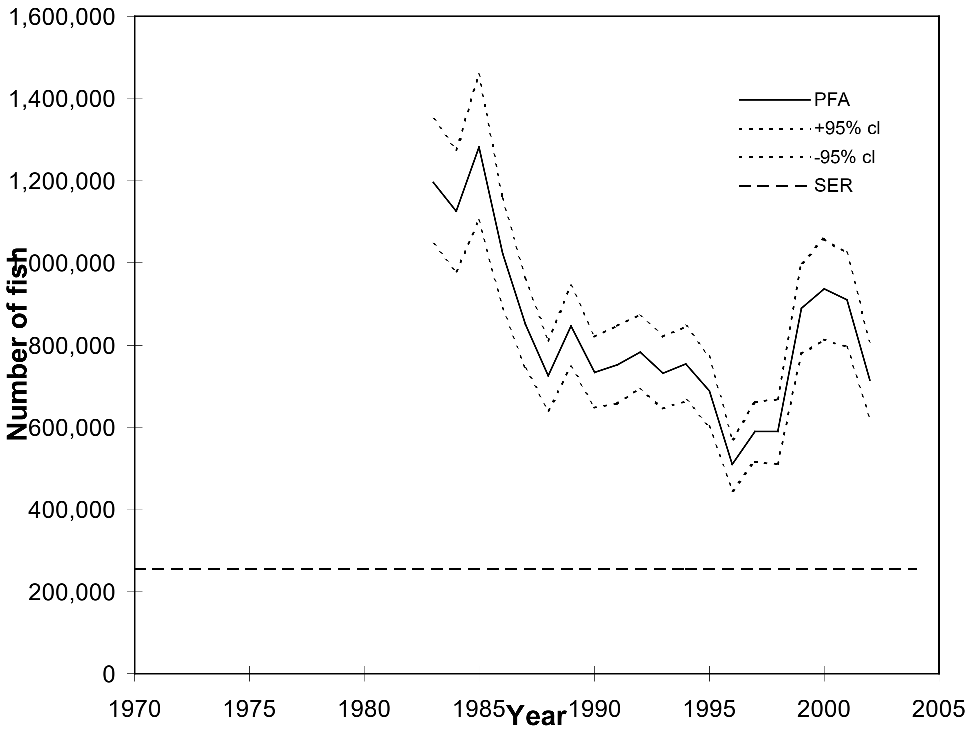
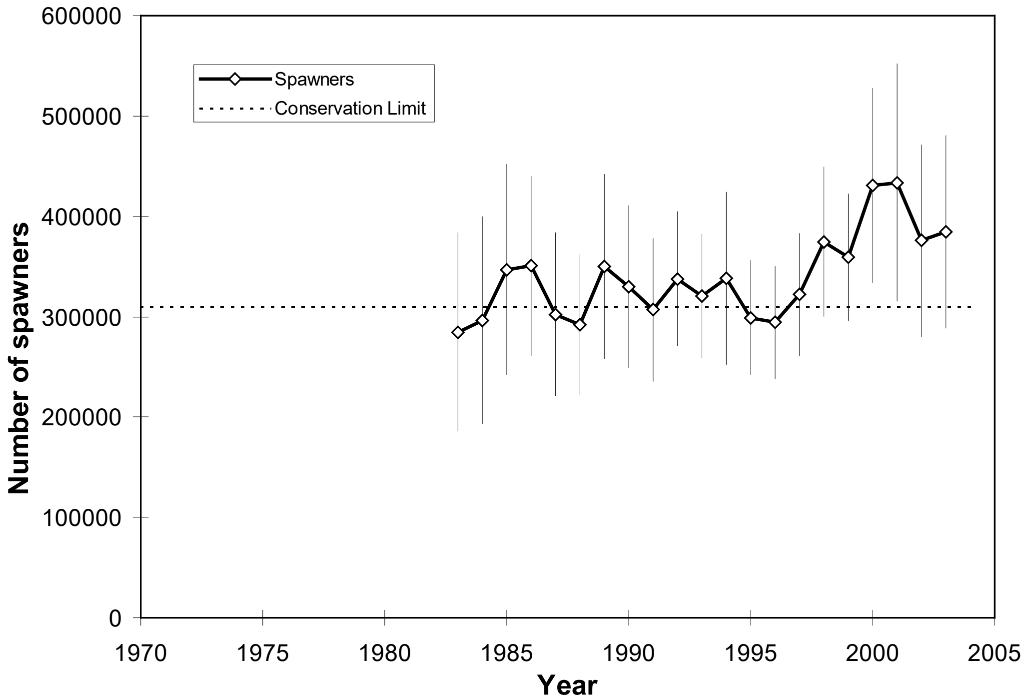


Figure 3.1.2 Estimated spawning escapement of maturing and non-maturing salmon in Northern Europe.

a) 1SW spawners (and 95% confidence limits)



b) MSW spawners (and 95% confidence limits)

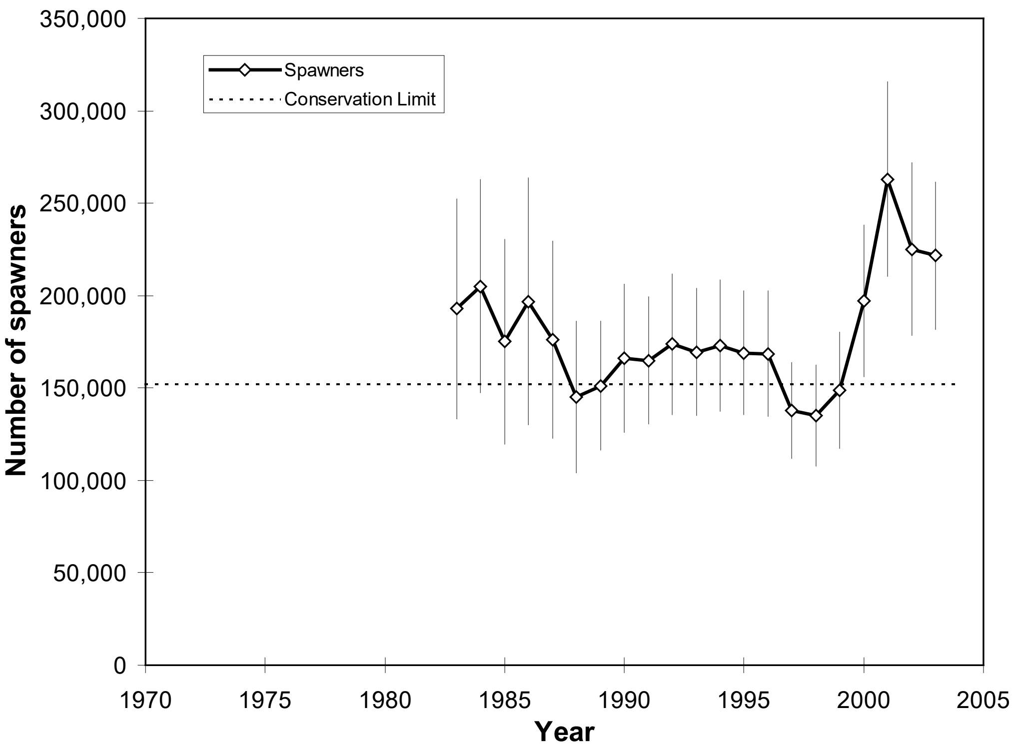
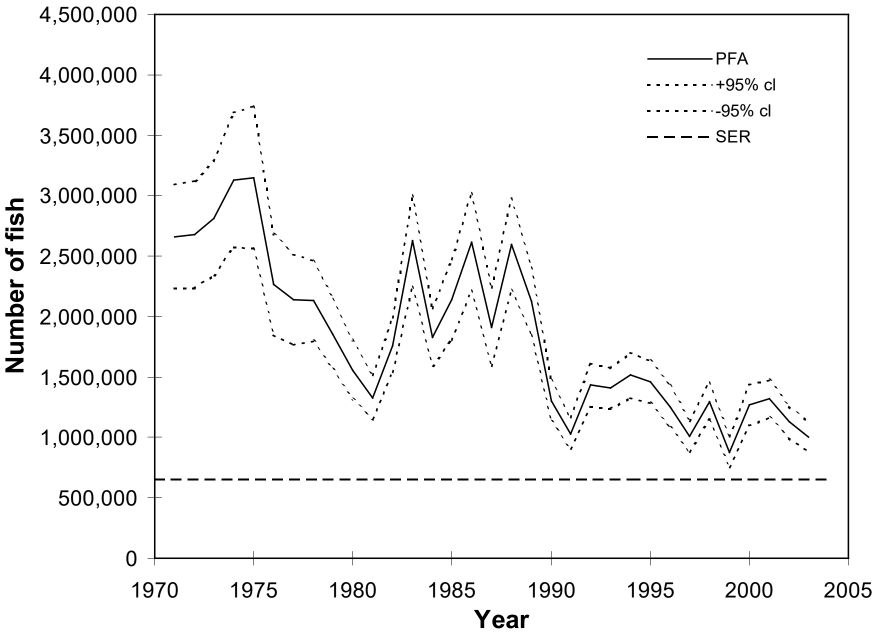


Figure 3.1.3 Estimated recruitment (PFA) and Spawning Escapement Reserve (SER) for maturing and non-maturing salmon in Southern Europe.

a) Maturing 1SW recruits (potential 1SW returns)

(Recruits in Year N become spawners in Year N)



b) Non-maturing 1SW recruits (potential MSW returns)

(Recruits in Year N become spawners in Year N+1)

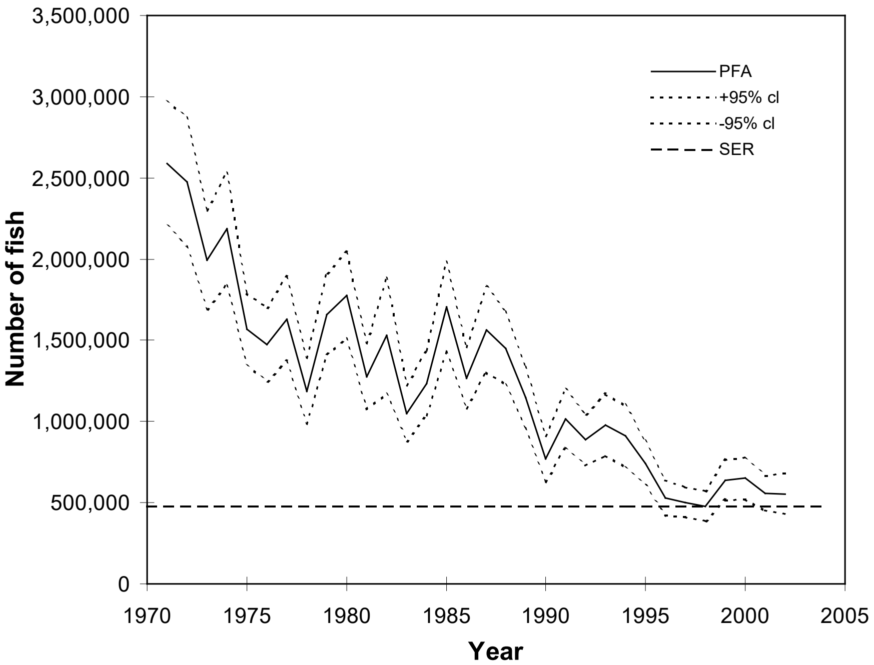
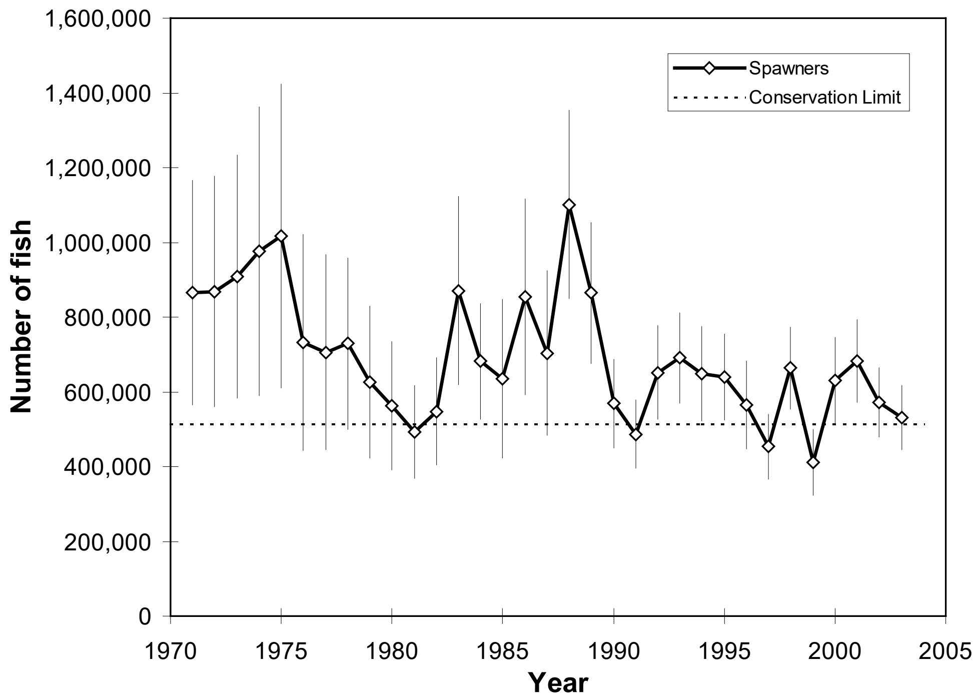


Figure 3.1.4 Estimated spawning escapement of maturing and non-maturing salmon in Southern Europe.

a) 1SW spawners (and 95% confidence limits)



b) MSW spawners (and 95% confidence limits)

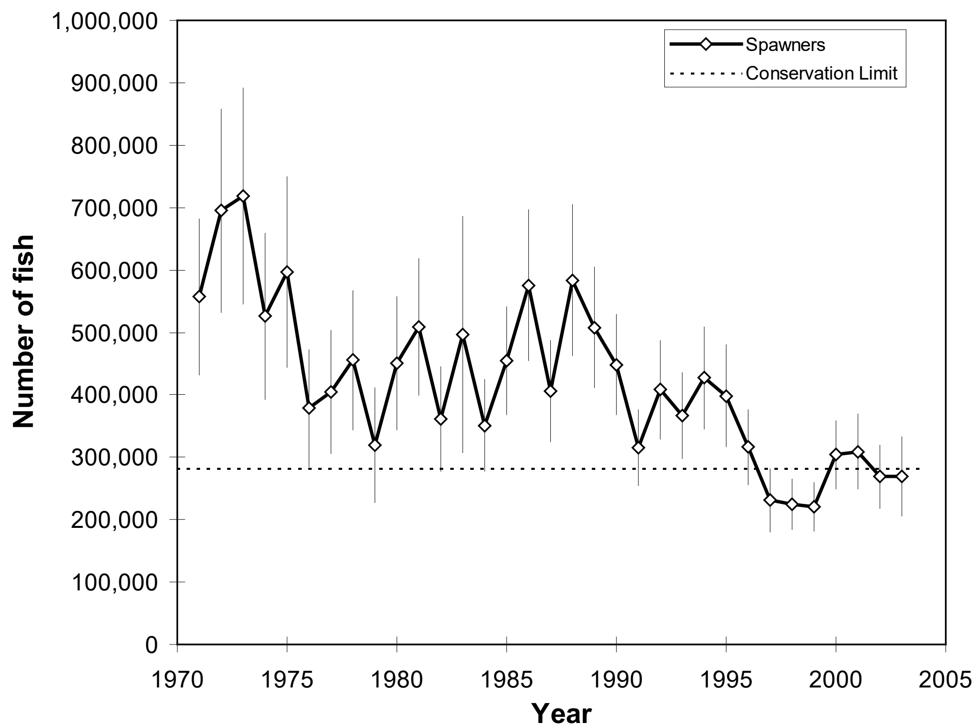


Figure 3.4.1 PFA trends and predictions (+/- 5% confidence intervals) for non-maturing 1SW Southern European stock

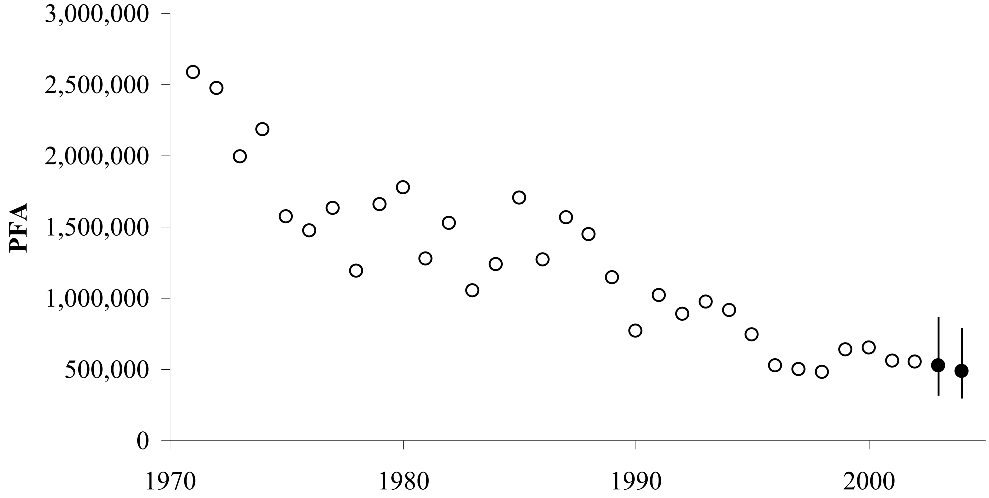


Figure 3.8.8.1. An overview of the estimated survival indices of wild and hatchery smolts to adult returns to homewaters (prior to coastal fisheries) in Northern and Southern NEAC area.
Index values represent averages of standardized (Z-score) survival estimates for monitored rivers and experimental facilities, and are relative to the average of the time series (0).
The number of rivers included are indicated in each panel legend.

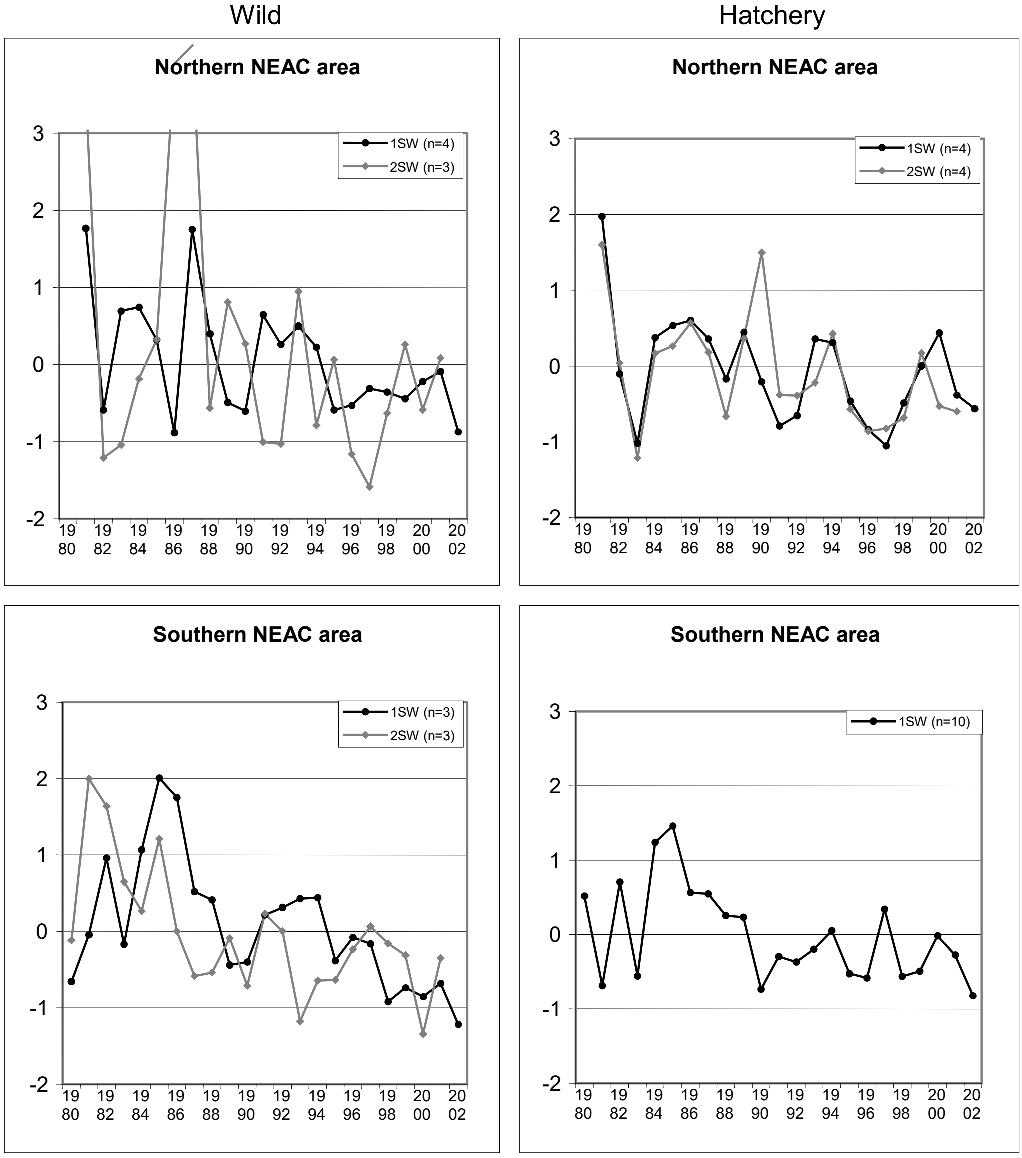
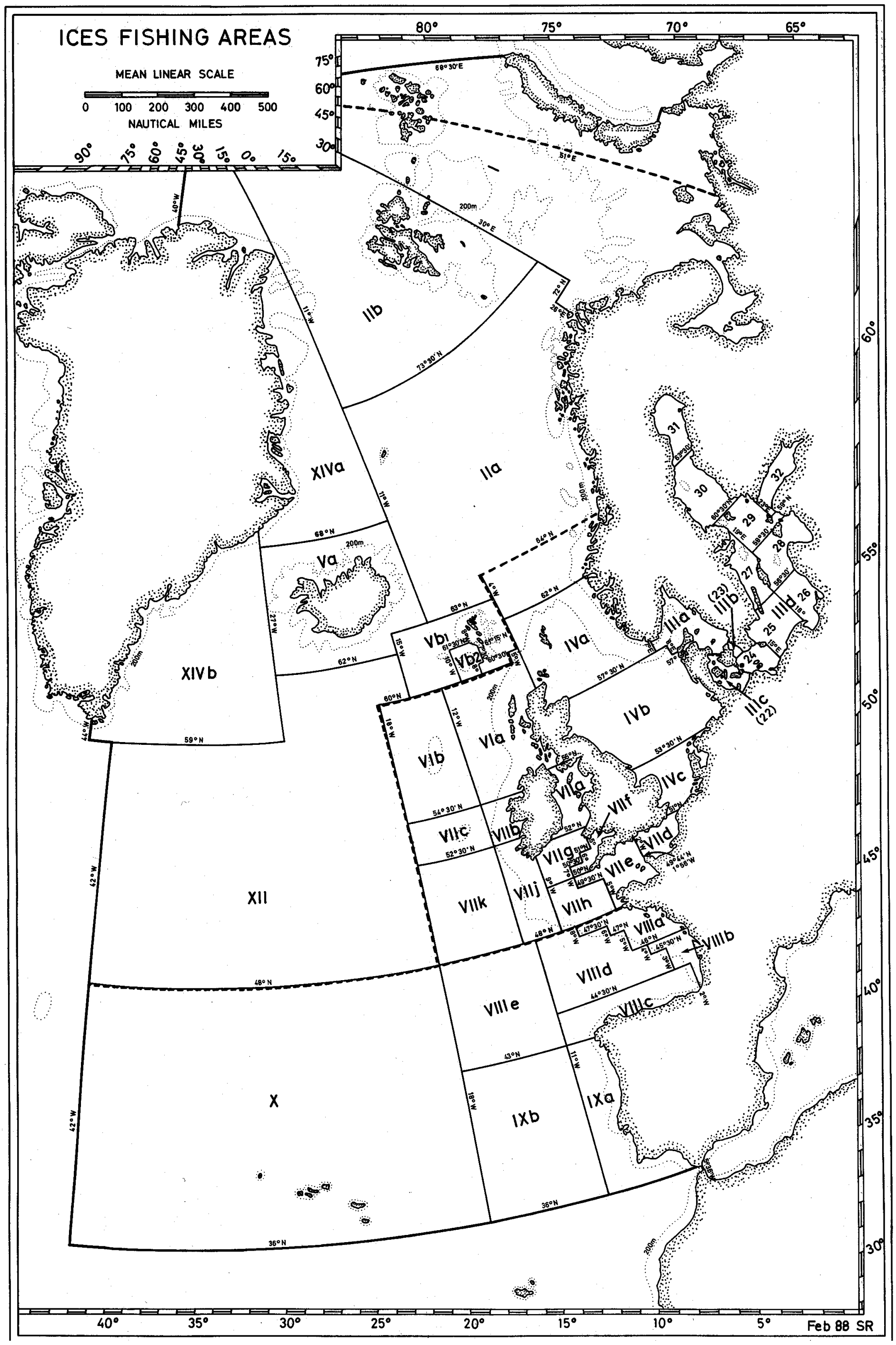


Figure 3.10.1 The ICES areas and Divisions.



4 NORTH AMERICAN COMMISSION

4.1 Status of stocks/exploitation

In 2003, the overall conservation limit (S_{lim}) for 2SW salmon was not met in any area. Therefore, based on the most recent estimates of spawners ICES classifies the stock complex with respect to conservation requirements as being outside safe biological limits.

4.2 Management objectives

NASCO (NASCO CNL31.210) has identified the primary management objective of that organisation as:

“To contribute through consultation and co-operation to the conservation, restoration, enhancement and rational management of salmon stocks taking into account the best scientific advice available”.

NASCO further stated that “the Agreement on the Adoption of a Precautionary Approach states that an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks”, and NASCOs Standing Committee on the Precautionary Approach interpreted this as being “to maintain both the productive capacity and diversity of salmon stocks”.

NASCO’s Action Plan for Application of the Precautionary Approach (NASCO CNL(99)48) provides interpretation of how this is to be achieved, as follows:

- “Management measures should be aimed at maintaining all stocks above their conservation limits…………by the use of management targets”, and

- “Socio-economic factors could be taken into account in applying the Precautionary Approach to fisheries management issues”;

“The precautionary approach is an integrated approach that requires, inter alia, that stock rebuilding programmes (including as appropriate, habitat improvements, stock enhancement, and fishery management actions) be developed for stocks that are below conservation limits”.

4.3 Reference points

Section 1.4 describes the derivation of reference points for these stocks and stock complexes.

In Atlantic Canada, CLs have been set on the basis of stock and recruitment studies which provided for MSY on a limited number of river stocks where data were available, and these derived egg deposition rates were used on the remainder of rivers where only habitat area and spawner demographics were available, as documented in O’Connell *et al*. (1997). The added production from lacustrine areas in Labrador and Newfoundland was also accommodated. In USA, conservation limits were set following a similar approach. Recently, the province of Quebec has changed the basis for estimating CLs for rivers in the province. A stock-recruitment analysis for six local rivers was used to define the CL, defined as the S_{MSY} level at 75% probability level. ICES provides advice within the risk framework adopted by NASCO (75% probability of exceeding the conservation limit) and notes that this will result in advice which is more risk averse for the stocks in Quebec rivers, than for other areas in the North Atlantic. For the purposes of management, egg deposition requirements are converted into 2SW fish equivalents. These are presented by fishery management zone in Table 4.3.1.

There are no changes recommended in the 2SW salmon conservation limits (S_{lim}) from those recommended previously. Conservation limits for 2SW salmon for Canada now total 123 349 and for the USA, 29 199 for a combined total of 152 548.

4.4 Advice on management

As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers where spawning requirements are being achieved, there are no biological reasons to restrict the harvest of returning salmon in excess of escapement targets. Advice regarding management of this stock complex in the fishery at West Greenland is provided in Section 5.

4.5 Relevant factors to be considered in management

For all fisheries, ICES considers that management of single-stock fisheries should be based upon assessments of the status of individual stocks. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be above biologically-based escapement requirements. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

Reduced exploitation on large salmon in the in-river and estuarine fisheries of the Miramichi has resulted in an expanded age structure in which repeat spawners have comprised as much as 50% of the large salmon returns. The contribution of all sea-age categories of females is however considered when assessing whether the eggs deposited in a river reach the total egg requirements for each assessed river.

4.6 Catch forecast for 2004

Catch options are only provided for the non-maturing 1SW and maturing 2SW components as the maturing 1SW component is not fished outside of home waters, and in the absence of significant marine interceptory fisheries, is managed in homewaters by the producing nations.

It is possible to provide catch advice for the North American Commission area for two years. The revised forecast for 2004 for 2SW maturing fish is based on a new forecast of the 2003 pre-fishery abundance and accounts for fish which were already removed from the cohort by fisheries in Greenland and Labrador in 2003 as 1SW non-maturing fish. The second is a new estimate for 2005 (see Section 4.7) based on the pre-fishery abundance forecast for 2004 from Section 5. A consequence of these annual revisions is that the catch options for 2SW equivalents in North America may change compared to the options developed the year before.

Based on the genera1ly decreased 1SW returns in 2003, some modest decrease is expected for large salmon in 2004. An additional concern is the low abundance levels of many salmon stocks in rivers in eastern Canada, particularly in the Bay of Fundy and Atlantic coast of Nova Scotia. USA salmon stocks exhibit these same downward trends. Most salmon rivers in the USA are hatchery-dependent and remain at low levels compared to conservation requirements. Despite major changes in fisheries management, returns have continued to decline in these areas and many populations are currently threatened with extirpation.

4.6.1 Catch advice for 2004 fisheries on 2SW maturing salmon

The revised forecast of the pre-fishery abundance for 2003 provides a PFA mid-point of 90 700.

In order to compare the PFA to conservation limits, the pre-fishery abundance of 90 700 can be expressed as 2SW equivalents by considering natural mortality of 3% per month for 11 months (equivalent to 28% lost to the population), resulting in 65 304 2SW salmon equivalents. There have already been harvests of this cohort as 1SW non-maturing salmon in 2003 for both the Labrador (358) and Greenland (1958) fisheries (Tables 4.9.1.1 and 4.9.1.2) for a total of 2316 2SW salmon equivalents already harvested, when the mortality factor is considered, leaving 62 988 2SW salmon returning to North America.

As the predicted number of 2SW salmon returning to North America (62 988) in 2004 is substantially lower than the 2SW conservation limit (S_{lim}) of 152 548, there are no harvest possibilities consistent with the level of risk aversion adopted by NASCO (at probability levels of 75%). Harvest possibilities refer to the composite North American fisheries. As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management is necessary. On individual rivers, where spawning requirements are being achieved, there are no biological reasons to restrict the harvest of returning salmon in excess of escapement targets.

4.7 Medium- to long-term projections

4.7.1 Catch advice for 2005 fisheries on 2SW maturing salmon

Most catches (88%) in North America now take place in rivers or in estuaries. The commercial fisheries are now closed and the remaining coastal food fisheries in Labrador are mainly located close to river mouths and likely harvest few salmon from other than local rivers. Fisheries are principally managed on a river-by-river basis and, in areas where retention of large salmon is allowed, they are closely controlled.

Catch options which could be derived from the pre-fishery abundance forecast for 2004 (100 400 at the midpoint) would apply principally to North American fisheries in 2005 and hence the level of fisheries in 2004 needs to be accounted for before providing them.

Accounting for mortality and the conservation limit and considering an allocation of 60% of the surplus to North America, there are no harvest possibilities consistent with the level of risk aversion adopted by NASCO (at probability levels of 75%) for 2SW salmon in 2005. This “zero” catch option refers to the composite North American fisheries. As the biological objective is to have all rivers reaching or exceeding their conservation limits, river-by-river management will be necessary. On individual rivers, where conservation limits are being achieved, there are no biological reasons to restrict the harvest.

4.8 Comparison with previous assessment and advice

The revised forecast of the pre-fishery abundance for 2003 provides a PFA mid-point of 90 700. This is about 18% lower than the value forecast last year at this time of 111 042. This is mainly due to slight changes in the input values and changes to the model used to forecast PFA for these stocks, as detailed in Section 5.

4.9 NASCO has requested ICES to: describe the key events of the 2003 fisheries and the status of the stocks

4.9.1 Catch of North American salmon, expressed as 2SW salmon equivalents

Catch histories of salmon, expressed as 2SW salmon equivalents, which could have been available to the Greenland fishery, 1972-2003, are provided in Tables 4.9.1.1 and 4.9.1.2. The Newfoundland-Labrador commercial fisheries were, historically, a mixed stock fishery and harvested both maturing and non-maturing 1SW salmon as well as 2SW maturing salmon. Mortalities within North America peaked at about 365 000 in 1976 and are now about 11 800 2SW salmon equivalents. In the most recent five years estimated (that is since the closure of the Labrador commercial fishery), those taken as non-maturing fish in Labrador comprise 3%, or less, of the total in North America.

Of the North American fisheries on the cohort destined to be 2SW salmon, 82% of the catch comes from terminal fisheries in the most recent year. This value has ranged from as low as 20% in 1973, 1976, and 1987 to values of 77-91% in 1996-2003 fisheries (Table 4.9.1.1). The percentage increased significantly since 1992 with the reduction and closures of the Newfoundland and Labrador commercial mixed stock fisheries.

The percentage of the total 2SW equivalents that have been harvested in North American waters has ranged from 47-100%, with the most recent year estimated at 88% (Table 4.9.1.2.)

4.9.2 Gear and effort

Canada

The 23 areas for which the Department of Fisheries and Oceans (DFO) manages the salmon fisheries are called Salmon Fishing Areas (SFAs); for Québec, the management is delegated to the Société de la Faune et des Parcs du Québec and the fishing areas are designated by Q1 through Q11 (Figure 4.9.2.1). Three user groups exploited salmon in Canada in 2003: aboriginal peoples, residents fishing for food in Labrador, and recreational fishers. There were no commercial fisheries in Canada in 2003.

Aboriginal peoples' food fisheries

In Québec, aboriginal peoples' food fisheries took place subject to agreements or through permits issued to the bands. In the Maritimes and Newfoundland (SFAs 1 to 23), food fishery harvest agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2003. The signed agreements often included allocations of small and large salmon and the area of fishing was usually in-river or estuaries, except in Labrador. In Labrador (SFAs 1 and 2), food fishery arrangements with the Labrador Inuit Association and the Innu resulted in fisheries in estuaries and coastal areas. Under agreements reached in 2003, several aboriginal communities in Nova Scotia agreed to retain only "adipose clipped" 1SW salmon from nine Atlantic coast rivers in SFAs 20 and 21, using methods that allowed live release of wild fish.

Residents food fisheries in Labrador

In the Lake Melville (SFA 1) and the coastal Southern Labrador (SFA 2) areas, DFO allowed a food fishery, using gillnets, for local residents. Residents who requested a license were permitted to retain a maximum of four salmon of any size. All licensees were to complete logbooks.

Recreational fisheries

Unless otherwise determined by management authorities, licenses are required for all persons fishing recreationally for Atlantic salmon, gear is generally restricted to fly fishing and there are restrictive daily/seasonal bag limits. Recreational fisheries management in 2003 varied by area. Except in Québec and Labrador (SFA 1 and some rivers of SFA 2), only small salmon could be retained in the recreational fisheries. Other measures included seasonal and daily bag limits, hook and release fisheries and total closures.

USA

There was no fishery for sea-run Atlantic salmon in the USA in 2003 as a result of angling closures in 1999. Therefore effort measured by license sales was 0.

France (Islands of Saint-Pierre and Miquelon)

There was no information available to ICES describing the Saint-Pierre and Miquelon fisheries in 2003.

4.9.3 Catches in 2003

Canada

The provisional harvest of salmon in 2003 by all users was 137 t, about 7% lower than the 2002 harvest (Table 2.1.1.1; Figure 4.9.3.1). The 2003 harvest was 44 426 small salmon and 11 172 large salmon, 17% fewer small salmon and 32% more large salmon, compared to 2002 (Table 4.9.3.1). The dramatic decline in harvested tonnage since 1988 is in large part the result of the reductions in commercial fisheries effort, the closure of the insular Newfoundland commercial fishery in 1992, the closure of the Labrador commercial fishery in 1998, and the closure of the Québec commercial fishery in 2000 (Figure 4.9.3.1). These reductions were introduced as a result of declining abundance of salmon.

The 2003 harvest of small and large salmon, by number, was divided among the three user groups in different proportions depending on the province and the fish-size group exploited (Table 4.9.3.1).

Aboriginal peoples' food fisheries

Harvests in 2003 of 43.8 t, about 10 800 fish (49% small by number) were down 5% from 2002 and 4% lower than the previous 5-year average harvest.

Residents fishing for food in Labrador

The estimated catch in 2003 was 6.8 t, about 3000 fish (79% small salmon by number).

Recreational fisheries

Harvest in recreational fisheries in 2003 totalled 40 692 small and large salmon, 5% below the previous 5-year average, 4% below the 2002 harvest level, and the lowest total harvest reported (Figure 4.9.3.2). The small salmon harvest of 35 994 fish was 19% below the previous 5-year mean. The large salmon harvest of 4698 fish was about 5% greater than the previous five-year mean. Small and large salmon harvests were down 18% and up 179% from 2002, respectively. In 2003, about 51 400 salmon (about 22 900 large and 28 500 small) were caught and released, representing about 56% of the total number caught, including retained fish (Table 4.9.3.2).

Unreported catches

Canada's unreported catch estimate for 2003 was about 118 t. Estimates were included for all five provinces and within each province for all salmon fishing areas (SFA), with the exception of Nova Scotia where estimates were available for two of five SFAs.

By stock groupings used for Canadian stocks throughout the report, the unreported catch estimates for 2003 were:

Stock Area	Unreported Catch (t)
Labrador	2
Newfoundland	42
Gulf	39
Scotia-Fundy	1
Québec	34
Total	118

USA

All fisheries (commercial and recreational) for sea-run Atlantic salmon within the USA remained closed, including rivers previously open to catch-and-release fishing. Thus, there was no harvest of sea-run Atlantic salmon in the USA in 2003.

Unreported catches in the USA were estimated to be 0 t. There was likely an illegal harvest of at least five 2SW salmon in 2003 from the federally endangered Gulf of Maine Distinct Population Segment (DPS). Management measures have been implemented to help prevent illegal take from occurring in the future.

France (Islands of Saint-Pierre and Miquelon)

There was no information available to the Working Group describing the Saint-Pierre and Miquelon fisheries in 2003.

4.9.4 Origin and composition of catches

In the past, salmon from both Canada and the USA were taken in the commercial fisheries of eastern Canada. These fisheries have been closed for some years. The aboriginal peoples and residents food fisheries that exist in Labrador may intercept some salmon from other areas of North America although there are no reports of tagged fish being captured there in 2003. The fisheries of Saint-Pierre and Miquelon catch salmon of both Canadian and US origin. Sampling was carried out on this fishery in 2003, but results were not available to ICES.

The returns in 2003 to the majority of the rivers in Newfoundland and to most rivers of the Gulf of St. Lawrence and Québec were comprised exclusively of wild salmon. Elsewhere, hatchery-origin salmon made up varying proportions of the total returns and were most abundant in the rivers of the Bay of Fundy, the Atlantic coast of Nova Scotia, and the USA. Aquaculture escapees were noted in the returns to four rivers of the Bay of Fundy and the coast of USA (Saint John, Magaguadavic, St. Croix, Dennys). Percentages of returns that were fish farm escapees in the returns to the St. Croix and Dennys rivers in 2003 were 38% and 18% respectively. In both the Union and Narraguagus rivers, no fish farm escapees were observed in 2003.

4.9.5 Elaboration on status of stocks

In 2003, smolt production decreased from the previous year in four of five monitored rivers in Newfoundland, in one of two rivers of Québec, and in two of three rivers in the Maritimes Provinces. Comparing the 2003 smolt production estimates to the previous five-year mean for the 9 rivers monitored during that time period, two of these rivers were unchanged (+ or – 10%) while production decreased in the seven other rivers.

Juvenile salmon abundance has been monitored annually since 1971 in the Miramichi (SFA 16) and Restigouche (SFA 15) rivers and for shorter and variable time periods in other rivers. In the rivers of the Southern Gulf, densities of young-of-the-year (fry) and parr (juveniles of one or more years old) have increased since 1985 in response to increased spawning escapements. Densities of parr remained at high values in the Gulf rivers in 2003. The mean density values were similar to the previous year and down slightly from the previous 5-year mean. Fry densities decreased from the previous year on all four monitored rivers. Rivers of SFAs 20 and 21 along the Atlantic coast of Nova Scotia are generally organic stained, of lower productivity, and when combined with acid precipitation, can result in acidic conditions lethal to salmon. In the low-acidified St. Mary's River, fry (age 0+) density was low (similar to 2002) and older parr (age-1+ and 2+) densities remain low. Trends in densities of age-1+ and older parr in the outer Bay of Fundy (SFA 23) have varied since 1980. Parr densities in the Nashwaak River and Saint John River above Mactaquac Dam have generally declined in accordance with reduced spawning escapements. In 2003, parr densities increased on the Saint John River and declined on the Nashwaak River from the previous year. For the salmon stock in 33 rivers of the inner Bay of Fundy (SFA 22 and a portion of SFA 23), juvenile densities remained critically low in 2003.

USA

Total estimated return to USA rivers was 1436, a 46% increase from the 2002 total (985). These are the sum of documented returns to traps and returns estimated using redd counts on selected Maine rivers. However, the documented return of Atlantic salmon as determined strictly from returns to traps and weirs to rivers in New England was 1396. Returns of 1SW salmon were 232, a 53% decrease from the 436 in 2002. Returns from MSW were 1157, a 120% increase from the 526 in 2002.

Total salmon returns to the rivers of New England continued the downward trend that began in the mid-1980s, and were lower than the previous 5-year and 10-year averages (Figure 4.9.5.1). These are minimal estimates, since many rivers in Maine do not contain fish counting facilities, and where counting facilities do exist they do not count 100% of the returns.

For five of the eight rivers that comprise the federally endangered Gulf of Maine Distinct Population Segment (DPS), redd counts were used in a linear regression model to estimate returns because traps or weirs were not present. The total estimated returns for the entire DPS was 72 fish (95% CI = 61-86) originating either from natural spawning or hatchery fry stocking, with no rivers having an estimate of zero. These estimates are up from the 2002 estimates of 33 fish (95% CI = 26-41) when two rivers had a zero estimate.

The majority of the returns were recorded in the rivers of Maine, with the Penobscot River accounting for nearly 77% of the total New England returns. Connecticut River returns accounted for 3.0% of the total returns. Overall, 16.5% of the adult returns were 1SW salmon and 83.2% were MSW salmon. Most returns (86%) originated from hatchery smolts and the balance (14%) originated from either natural spawning or hatchery fry stocking.

Wild salmon production has been estimated on the Narraguagus River for seven years. Smolt production in 2003 decreased both from 2002 and the previous five-year mean.

The mean parr density in 2003 from 37 sites on the Narraguagus River was low (less than 5 fish/100m^2) and similar to the values observed since 1990.

4.9.6 Estimates of total abundance by geographic area

Canada

Labrador

The basis for estimates of 2SW and 1SW salmon returns and spawners for Labrador (SFAs 1, 2 & 14B) prior to 1998 are catch data from angling and commercial fisheries. In 1998–2003, there was no commercial fishery in Labrador and although counting projects took place in 2003 on four Labrador rivers, out of about 100 salmon rivers that exist, it is not possible to extrapolate from these rivers to unsurveyed ones. For Labrador, returns were previously estimated from commercial catches and exploitation rates. As there was no commercial fishery since 1998, it was not possible to estimate the returns or spawners to Labrador for these years.

While total returns and spawners could not be determined for Labrador, there were four monitored rivers in Labrador in 2003 with known numbers of returning adults. Sand Hill River in SFA 2 has the longest time-series albeit broken into three time periods, 1970–1973, 1994–1996, and 2002–2003. Returns in 2003 were 3,157 small salmon and 621 large salmon. Small salmon returns were the 5th highest on record and returns of large salmon were the 2nd highest. Returns of small salmon in 2003 were similar to the mean of the returns in all other years; while returns of large salmon were approximately 50% higher then average returns of all other years. There are three other rivers in Labrador with counts although the time-series are relatively short. At Southwest Brook in SFA 2, a tributary of Paradise River, returns of small and large salmon have declined steadily over the last four years but remain higher than in 1998, the first year of operation. At Muddy Bay Brook in SFA 2, where information is available for only two years (2002, 2003), returns of small and large salmon increased considerably in 2003 over the previous year. At English River in SFA 1 where a counting fence has been operated since 1999, returns of small salmon have declined from a high of 367 in 2000 to a low of 133 in 2003. Large salmon have varied over the same time with no apparent trend.

Newfoundland

The mid-point of the estimated returns (185 300) of 1SW salmon to Newfoundland rivers in 2003 is 15% higher than in 2002 and 4% higher than the average 1SW returns (178 800) for the past five years (Figure 4.9.6.1). The mid-point (3900) of the estimated 2SW returns to Newfoundland rivers in 2003 was 11% higher than in 2002 and 94% lower than the recent 5-year average of 5600 (Figure 4.9.6.2).

Québec

The mid-point (27 500) of the estimated returns of 1SW salmon to Québec in 2003 is 19% lower than that observed in 2002 and is 5% lower than the previous five-year mean (Figure 4.9.6.1).The mid-point (34 200) of the estimated returns of 2SW salmon in Québec in 2003 is 52% higher than that observed for 2002 (Figure 4.9.6.2).

Gulf of St. Lawrence, SFAs 15–18

The mid-point (41 000) of the estimated returns in 2003 of 1SW salmon returning to the Gulf of St. Lawrence was a 39% decrease from 2002. The values noted in 1997 through 2003 are low relative to the values observed during 1985–1994 (Figure 4.9.6.1).

The mid-point (25 000) of the estimate of 2SW returns in 2003 is 93% higher than the estimate for 2002 (Figure 4.9.6.2), and similar to 2001. Returns of 2SW salmon have declined since 1995 with only slight improvement shown in 2001 and 2003, relative to the years prior to 1995.

Scotia-Fundy, SFAs 19-23

The mid-point (9500) of the estimate of the 1SW returns in 2003 to the Scotia-Fundy Region was a 25% decrease from the 2002 estimate, and the third lowest value in the time-series, 1971–2003. Returns have generally been low since 1990 (Figure 4.9.6.1). The mid-point (3800) of the 2SW returns in 2003 is 114% higher than the returns in 2002 but still the third lowest value in the time-series, 1971–2003 (Figure 4.9.6.2). A declining trend in returns has been observed from 1985 to 2003.

USA

Total salmon returns for USA rivers in 2003 were based on trap and weir catches (documented returns). Because many of the Maine rivers do not have fish counting facilities total abundance continues to be underestimated. The 1SW returns and spawners to USA rivers in 2003 were 237 fish (Figure 4.9.6.1). This was a decrease from the 2002 estimate and lower than both the previous 5-year (343) and 10-year (356) averages. The 2SW returns in 2002 to USA rivers were 1192 fish, an increase over the 5-year (856) average, but a decrease compared to the 10-year (1267) average (Figure 4.9.6.2). There were only 7 3SW and repeat spawners compared to 22 in 2002.

4.9.6.1 Run-reconstruction estimates of spawning escapement

When elaborating on the status of components of the stock complex from the six geographic areas of North America, ICES notes that CLs may not be appropriate for quantitative catch advice; however, they are regarded as useful indicators of overall stock status. Stock summaries are presented by geographic area below as the point estimate of spawners in 2003 relative to the conservation limit. It is not possible to consistently put confidence intervals on these estimates, therefore the entries in the table below cannot be interpreted as an evaluation of the status of stocks relative to precautionary reference points.

Labrador

As previously explained, it was not possible to estimate spawners in Labrador in 1998–2003 due to lack of information to determine returns and spawners for the entire stock area.

Newfoundland

The mid-point of the estimated numbers of 2SW spawners (3900) in 2003 was 14% above that estimated in 2002 (3400) and was 96% of the total 2SW conservation limit (S_{lim}) for all rivers. The 2SW spawner limit has been met or exceeded in nine years since 1984 (Figure 4.9.6.2). The 1SW spawners (164 600) in 2003 were 19% higher than the 138 300 1SW spawners in 2002. The 1SW spawners since 1992 were higher than the spawners in 1989–91 and similar to levels in the late 1970s and 1980s (Figure 4.9.6.1), although in 1995-1996 they were unusually high. There had been a general increase in both 2SW and 1SW spawners during the period 1992–96 and 1998–2001, and this is consistent with the closure of the commercial fisheries in Newfoundland. For 1997, decreases occurred most strongly in the 1SW spawners.

Québec

The mid-point of the estimated numbers of 2SW spawners (25 300) in 2003 was 67% higher than that observed for 2002 and was about 86% of the total 2SW conservation limit (S_{lim}) for all rivers (Figure 4.9.6.2). The spawning escapement in 2003 ranked approximately in the middle of the range in the time-series (1971–2003), with 1971 having been the lowest and the 2003 value was the highest since 1997. Estimates of the numbers of spawners approximated the spawner limit from 1971 to 1990; however, they have been below the limit since 1990. The mid-point of the estimated 1SW spawners in 2003 (19 300) was about 9% lower than in 2002 (Figure 4.9.6.1) and similar to the mean value of the previous ten years.

Gulf of St. Lawrence

The mid-point of the estimated numbers of 2SW spawners (24 700) in 2003 was about 93% higher than estimated in 2002 (12 800) and was about 81% of the total 2SW conservation limits (S_{lim}) for all rivers in this region (Figure 4.9.6.2). This is the eighth time in ten years that these rivers have not exceeded their 2SW spawner limits. The mid-point of the estimated spawning escapement of 1SW salmon (31 600) decreased by 39% from 2002 and was approximately the average of the last ten years. The abundance remains low relative to the peak (154 000) observed in 1992 (Figure 4.9.6.1). Spawning escapement has on average been higher in the mid-1980s than it was before and after this period.

Scotia-Fundy

The mid-point of the estimated numbers of 2SW spawners (3600) in 2003 is a 127% increase from 2002 (the lowest in the time-series, 1971-2003) and is about 15% of the total 2SW conservation limits (S_{lim}) for rivers in this region (Figure 4.9.6.2). Neither the spawner estimates nor the conservation limits include rivers of the inner Bay of Fundy (SFA 22 and part of SFA 23) as these rivers do not contribute to distant water fisheries and spawning escapements are extremely low. The 2SW spawning escapement in the rest of the area has been generally declining since 1985. The mid-point of the estimated 1SW spawners (9200) in 2003 is a 25% decrease from 2002 and is the seventh lowest in the time-series, 1971-2003. There has been a general downward trend in 1SW spawners since 1990 (Figure 4.9.6.1).

USA

All age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2003 (1436 salmon) represented 4.9% of the 2SW spawner requirements for all USA rivers combined. Spawning 2SW salmon, expressed as the percentage of conservation requirement was only 4.1% for all USA rivers combined (Figure 4.9.6.2). On an individual river basis, the Penobscot River met 13.2% of its spawner requirement while all the other US rivers met between 0.4-5.2% of their 2SW requirements.

4.9.7 Exploitation rates

Canada

There is no exploitation by commercial fisheries and the only remaining fisheries are for recreation and food.

In 2003, in the Newfoundland recreational fishery, exploitation rates ranged from 3% to 38% with a mean value of 12%. In the Québec recreational fishery, exploitation rates of small salmon ranged from 4% to 69% with a mean value of 24%, and exploitation rates for large salmon ranged from 1% to 29% with a mean value of 11%. Overall exploitation rates by the Québec recreational fishery, using mid-point estimates of total returns and recreational landings, were 18% for small salmon and 10% for large salmon.

USA

There was no exploitation of USA salmon in home waters, and no salmon of USA origin were reported in Canadian fisheries in 2003.

4.9.8 Pre-fisheries abundance

As the pre-fishery abundance estimates for potential 2SW salmon requires estimates of returns to rivers, the most recent year for which an estimate is available is 2002. This is because pre-fishery abundance estimates for 2003 require 2SW returns to rivers in North America in the year 2004, which are not yet available. The 2002 abundance estimates ranged between 77 291 and 159 558 salmon. The mid-point of this range (118 400) is 47% higher than the 2001 value (80 400) and is the 5th lowest in the 31-year time-series (Figure 4.9.8.1). The most recent six years are shown with hollow symbols as no Labrador values were estimated for these years and the raising factor described previously was used. Even though the 2002 value has increased considerably from the previous year, the general trend towards lower values in recent years is still evident and current year values are still much lower than the 917 300 in 1975. Despite the increase in the 2002 value, ICES expressed concern over the continued low numbers which remain considerably lower than the conservation limit.

The mid-point values of the PFA for the 1SW cohort are shown in Figure 4.9.8.1. The mid-point of the range of pre-fishery abundance estimates for 2003 (380 547) is 3% lower than in 2002 (393 100) but remains above the low 1994 value of 309 000, the lowest estimated in the time-series 1971–2003. The reduced values observed in 1978 and 1983–84 and 1994 were followed by large increases in pre-fishery abundance. Figure 4.9.8.2 shows these data combined to give 1SW recruits.

Although the declining trend appears common to both maturing and non-maturing (Figure 4.9.8.2) portions of the cohort, non-maturing 1SW salmon have declined further. ICES expressed concerns about these stock trends and noted that declines in PFA have persisted despite decreases in all catches. Clearly, there are factors other than fisheries influencing marine survival in recent years. At this point the specific causes are unknown; however, there have been major changes in the physical oceanographic conditions and some potential predators have increased in abundance. Targeted research will be necessary before the impacts of these or other factors can be evaluated. Spawning escapement of 2SW salmon to several stock complexes has been below S_{lim} (Labrador, Québec, Scotia-Fundy, USA) since at least the 1980s (Figure 4.9.8.3). In the last four years, lagged spawner abundance has been increasing in Labrador and Newfoundland, but decreasing in all other areas. Only the Newfoundland stock complex has received spawning escapements that have exceeded the area's requirements, all other complexes were below requirement, although most increased slightly in 2003.

The relative contributions of the stocks from these six geographic areas to the total spawning escapement of 2SW salmon has varied over time (Figure 4.9.8.4). The reduced potential contribution of Scotia-Fundy stocks and the initial increased proportion of the spawning stock from the Gulf of St. Lawrence and, more recently, from Labrador rivers to future recruitment is most noticeable.

Egg depositions by all sea-ages combined in 2003 exceeded or equaled the river-specific conservation limits in 34 of the 83 assessed rivers (41%) and were less than 50% of conservation limits in 24 other rivers (29%) (Figure 4.9.8.5). Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia where 8 of the 12 rivers assessed (67%) had egg depositions that were less than 50% of conservation limits. Proportionally fewer rivers in Gulf (0%) and Québec (16%) had egg depositions less than 50% of conservation limits. For 80% of the Gulf rivers and 52% of the Quebec rivers, egg depositions equaled or exceeded conservation limits (Figure 4.9.8.5). In Newfoundland, 33% of the rivers assessed met or exceeded the conservation limits and 14% had egg depositions that were less than 50% of limits. Most of the deficits occurred in the east and southwest rivers of Newfoundland (SFA 13).

All age classes of spawners (1SW, 2SW, 3SW, and repeat) in 2003 (1436 salmon) represented 4.9% of the 2SW spawner requirements for all USA rivers combined. Spawning 2SW salmon exclusively, expressed as the percentage of conservation requirement was 4.1% for all USA rivers combined. On an individual river basis, the Penobscot River met 13.2% of its spawner requirement while all the other US rivers met between 0.4-5.2% of their 2SW requirements (Figure 4.9.8.5).

In 2003, the overall conservation limit (S_{lim}) for 2SW salmon was not met in any area. The overall 2SW conservation limit for Canada could have been met or exceeded in only nine (1974-78, 1980-82 and 1986) of the past 31 years (considering the mid-points of the estimates) by reduction of terminal fisheries. In the remaining years, conservation limits could not have been met even if all terminal harvests had been eliminated. It is only within the last decade that Québec and the Gulf areas have failed to achieve their overall 2SW salmon conservation limits.

With the closure of most sea fisheries, counts of smolts and returning adult salmon can provide indices (% smolt survival) of natural survival at sea. In general the plots suggest:

- Survival of North American stocks to home waters has not increased as expected after closure of the commercial fisheries in 1984 and 1992,
- 1SW survival greatly exceeded that of 2SW fish (except for Maine, where survival of 2SW fish generally exceeds that of 1SW fish),
- Survival of wild stocks exceeded that of hatchery stocks by roughly a factor of 10, and
- Survival of fish from many rivers in North America is low compared to historic levels, especially in the south.

There have been no significant increasing trends ($p \leq 0.05$) in survival indices of any of the stock components since commercial closures in 1992.

4.10 NASCO has requested ICES to evaluate the extent to which the objectives of any significant management measures introduced in the last five years have been acheived

The management of Atlantic salmon in eastern North America has focused on the management of spawning escapement to meet or exceed conservation limits. Significant measures introduced in the last 18 years in order to meet this objective have included the closure of all commercial fisheries in eastern Canada as of 2000, the complete closure of numerous rivers to any fishing including native and recreational fisheries, and the imposition of catch-and-release only access in others. However, increased escapements were not realized in all areas (Figure 4.9.6.1 and Figure 4.9.6.2) and in some areas, increased escapements from fisheries did not always result in increased smolt production. Freshwater habitats generally have remained productive over the time period of the management actions, but an increase in marine mortality continues to impact yield in the more productive areas and persistence in some lower productive areas. These observations indicate that factors other than fishing are impacting survival of Atlantic salmon at sea.

4.11 NASCO has asked ICES to provide an analysis of any new biological and/or tag return data to identify the origin and biological characteristics of Atlantic salmon caught at St. Pierre and Miquelon

ICES is aware that the fishery was sampled in 2003 by the local government and that over 300 fish were examined. No further details on the sampling program are available.

ICES (ICES 2003/ACFM:19) has outlined the types of data which are essential to gaining a better understanding of the composition of the Saint-Pierre and Miquelon Atlantic salmon fishery and for determining the effect that this fishery has on the Atlantic salmon resources of North America.

4.12 NASCO has asked ICES to provide descriptions (gear type and fishing depth, location, and season) for all pelagic fisheries that may catch Atlantic salmon

ICES examined the potential for Atlantic salmon to be taken as bycatch in pelagic fisheries in the North Atlantic by reviewing existing data about the fisheries and gear that have reported salmon bycatch in the past, and by reviewing research survey data and observer data to identify gear known to have captured salmon.

Observer databases maintained by both the Northeast Fisheries Science Center (NEFSC) of the National Marine Fisheries Service (USA) and the Department of Fisheries and Oceans (DFO, Canada) were examined for records of Atlantic salmon catch. This database does not contain records of salmon catches, or even a code for Atlantic salmon.

Total landings of salmon reported in the DFO/ZIFF database are 6672 t, in comparison with the commercial landings of salmon reported by Canada to ICES of 6943 t during this time period. Therefore, most, if not all, of the salmon reported within this database are from past legal commercial salmon fisheries. Where the “main species captured” is known, 91.5% of the salmon catch occurred where salmon was reported as the main species captured, followed by cod (6.9%), herring (1.1%) and trout (0.2%). No landings from purse seines or trawls are reported in the DFO/ZIFF database.

4.12.1 Fisheries with bycatch potential

The following are the principal fisheries that are likely to account for most of the salmon bycatch in the NAC area. Smaller more localized fisheries also exist that have the potential to affect local populations.

Mackerel fishery (Gulf of St. Lawrence, Canada)

The mackerel fishery in the Gulf of St. Lawrence is executed by over 15 000 commercial licensees. They fish mainly inshore using gillnets, jiggers, purse seines, and traps. The timing of the fishery varies with location: most landings in 4X come from traps in May to July, from gillnets and jiggers in 4T from August to October, and from purse seines in 4R and 3K in August to October. Mackerel landings by Canadian fisheries are generally stable and have averaged about 20 000 t annually from 1990 to 2002. Close to 70% of the landings are made in a fall purse seine fishery in Newfoundland, mostly off the west coast (DFO 2003).

In 2000, there were 2 salmon marked in Miramichi River that were recaptured at sea in mackerel drift nets. Both were recaptured 20-30 km NNE of Cape North, Prince Edward Island. The first of these fish was recaptured on June 5 and had been tagged as a 1SW adult in the fall of 1999. The second was recaptured on June 23 and had been tagged as a smolt in the spring of 1999. A third recapture from the Miramichi River occurred off the coast of Newfoundland (fishery unknown) at Lance aux Meadows on September 12 and had been tagged as a 1SW adult in the fall of 1999.

Midwater trawl fisheries (USA)

This fishery, which targets mainly herring, in summer along the coast of Maine has the potential to catch salmon. Increased observer coverage in this fishery is anticipated in 2004 by the National Marine Fisheries Service due mainly to anecdotal reports of groundfish bycatch. These observers should be able to provide the most direct method to determine if bycatch of Atlantic salmon in the midwater trawl fishery for herring occurs and at what rate.

Capelin fishery (Newfoundland, Canada)

DFO evaluated the potential for bycatch in the Newfoundland capelin fishery in 1985 by examining the landings at five fish plants. No postsmolts were found in 90 859 kg of capelin examined. Additionally, all pelagic offshore fisheries for capelin in the Northwest Atlantic and, in particular in the Newfoundland and Labrador Region, were closed from 1992, including a Russian fishery for capelin for industrial use. The remaining fisheries are inshore and in recent years catches have been restricted to less than 25 000 tonnes, due mainly to a lack of markets.

Fisheries for bait (Newfoundland, Canada)

As of April 2001, there were 3,538 bait net licenses issued by DFO in Newfoundland, of which about 46% were fished (Reddin et al. 2002). These are distributed around the island of Newfoundland and along the coast of Southern Labrador. In order to receive a license to fish for bait, the individual must hold a license for a species requiring bait. Each licensee is permitted to fish two nets of maximum length of 40 fathoms and a maximum mesh size of 67 mm. In 2001, DFO carried out an assessment of bycatch in this fishery using telephone surveys, surveys by enforcement staff, examination of bycatch in herring index fisheries and experimental fishing. The overall conclusion was that some salmon are caught in this fishery, but the overall number captured and its effect is low (Reddin et al. 2002).

Herring fisheries (Gulf of St. Lawrence, Canada)

Herring stocks on the west coast of Newfoundland (Division 4R) are harvested by both large and small seines and by a large number of boats using gillnets (DFO 2002a). Herring landings in this area averaged 16 593 t per year, with about 75% of the catch being taken by large purse seiners. The average catch by gillnetters during this time period was 1512 t. The season is April to December. Herring in the Southern Gulf of St. Lawrence (4T) are harvested by an inshore gillnet fishery and an offshore purse seine fishery (vessels >65ft.). Both spring and fall spawning herring are harvested. From 1988 to 1997, landing of spring and fall spawning herring averaged 17 700 t and 51 000 t respectively (DFO 2002b).

The Working Group discussed potential salmon bycatch in the Northwest Atlantic area. At present, there is insufficient information to quantify bycatch although, based on information reviewed so far, there was no evidence of major bycatch of salmon in these fisheries.

Table 4.3.1. 2SW spawning requirements for North America by country, management zone, and overall. Management zones are shown in Figure 4.9.2.1.

Country	Stock Area	Management zone	2SW spawner requirement	
Canada	Labrador	SFA 1	7,992	
		SFA 2	25,369	
		SFA 14B	1,390	
	Subtotal			34,746
	Newfoundland	SFA 3	240	
		SFA 4	488	
		SFA 5	233	
		SFA 6 to 8	13	
		SFA 9 to 12	212	
		SFA 13	2,544	
		SFA 14A	292	
	Subtotal			4,022
	Gulf of St. Lawrence	SFA 15	5,656	
		SFA 16	21,050	
		SFA 17	537	
		SFA 18	3,187	
	Subtotal			30,430
	Québec	Q1	2,532	
		Q2	1,797	
		Q3	1,788	
		Q5	948	
		Q6	818	
		Q7	2,021	
		Q8	11,195	
		Q9	3,378	
		Q10	1,582	
		Q11	3,387	
	Subtotal			29,446
	Scotia-Fundy	SFA 19	3,138	
		SFA 20	2,691	
		SFA 21	5,817	
		SFA 22	0	
		SFA 23	13,059	
	Subtotal			24,705
Total				123,349
USA	Connecticut		9,727	
	Merrimack		2,599	
	Penobscot		6,838	
	Other Maine rivers		9,668	
	Paucatuck		367	
Total				29,199
North American Total				152,548

Table 4.9.1.1. Catches expressed as 2SW salmon equivalents in North American salmon fisheries, 1972-2004.
Only mid-points of the estimated values have been used.

	CANADA												
	MIXED STOCK				TERMINAL FISHERIES IN YEAR i						USA	Total
Year i	NF-LAB Comm 1SW (Year i-1) (b)	Year i % 1SW of total 2SW equivalents	Year i NF-LAB Comm 2SW (b)	Year i NF-Lab comm total	Labrador rivers (a)	Nfld rivers (a)	Quebec Region	Gulf Region	Scotia - Fundy Region	Canadian total		
1972	20,857	9	153,775	174,632	314	633	27,417	22,389	6,801	232,186	346	232,532
1973	17,971	6	219,175	237,146	719	895	32,751	17,914	6,680	296,105	327	296,433
1974	24,564	7	235,910	260,475	593	542	47,631	21,430	12,734	343,405	247	343,652
1975	24,181	7	237,598	261,779	241	528	41,097	15,677	12,375	331,696	389	332,085
1976	35,801	10	256,586	292,388	618	412	42,139	18,090	11,111	364,758	191	364,949
1977	27,519	8	241,217	268,736	954	946	42,301	33,433	15,562	361,932	1,355	363,287
1978	27,836	11	157,299	185,135	580	559	37,421	23,806	10,781	258,281	894	259,175
1979	14,086	10	92,058	106,144	469	144	25,234	6,300	4,506	142,798	433	143,231
1980	20,894	6	217,209	238,103	646	699	53,567	29,832	18,411	341,257	1,533	342,789
1981	34,486	11	201,336	235,822	384	485	44,375	16,329	13,988	311,383	1,267	312,650
1982	34,341	14	134,417	168,757	473	433	35,204	25,709	12,353	242,929	1,413	244,342
1983	25,701	12	111,562	137,263	313	445	34,472	27,097	13,515	213,105	386	213,491
1984	19,432	14	82,807	102,238	379	215	24,408	5,997	3,971	137,210	675	137,884
1985	14,650	11	78,760	93,410	219	15	27,483	2,708	4,930	128,765	645	129,410
1986	19,832	12	104,890	124,723	340	39	33,846	4,542	2,824	166,313	606	166,919
1987	25,163	13	132,208	157,371	457	20	33,807	3,757	1,370	196,781	300	197,082
1988	32,081	21	81,130	113,211	514	29	34,262	3,832	1,373	153,220	248	153,468
1989	22,197	16	81,355	103,551	337	9	28,901	3,426	265	136,488	397	136,886
1990	19,577	18	57,359	76,937	261	24	27,986	2,700	593	108,501	696	109,197
1991	12,048	14	40,433	52,481	66	16	29,277	1,777	1,331	84,949	231	85,180
1992	9,979	14	25,108	35,087	581	67	30,016	2,673	1,114	69,539	167	69,706
1993	3,229	8	13,273	16,502	273	63	23,153	1,211	1,110	42,312	166	42,478
1994	2,139	5	11,938	14,077	365	165	24,052	2,206	756	41,621	1	41,622
1995	1,242	3	8,677	9,918	420	155	23,331	2,007	330	36,162	0	36,162
1996	1,075	3	5,646	6,721	320	183	22,413	2,389	766	32,793	0	32,793
1997	969	4	5,390	6,360	175	157	18,574	1,849	581	27,695	0	27,695
1998	1,155	7	1,872	3,027	276	112	11,256	2,204	322	17,197	0	17,197
1999	179	1	894	1,073	311	72	9,032	1,446	450	12,383	0	12,383
2000	152	1	1,115	1,267	404	218	9,425	1,761	193	13,267	0	13,267
2001	286	2	1,380	1,666	336	102	10,104	1,624	255	14,086	0	14,086
2002	263	3	1,185	1,448	221	152	7,297	174	179	9,471	0	9,471
2003	312	3	1,806	2,118	221	57	8,870	348	189	11,803	0	11,803
2004	358			358						358		358

NF-Lab comm as 1SW = NC1(mid-pt) * 0.677057 (M of 0.03 per month for 13 months to July for Canadian terminal fisheries)
NF-Lab comm as 2SW = NC2 (mid-pt) * 0.970446 (M of 0.03 per month for 1 month to July of Canadian terminal fisheries)
Terminal fisheries = 2SW returns (mid-pt) - 2SW spawners (mid-pt)
a - starting in 1993, includes estimated mortality of 10% on hook and released fish
b - starting in 1998, there was no commercial fishery in Labrador; numbers reflect size of aboriginal fish harvest in 1998-2002 and resident food fishery harvest in 2000-2002

Table 4.9.1.2. Catches of North American salmon expressed as 2SW salmon equivalents, 1972-2004, in North America and Greenland.

Year	Canadian Total	USA Total	North America Total	% USA of Total North American	Greenland Total	NW Atlantic Total	Harvest in homewaters as % of total NW Atlantic
1972	232,186	346	232,532	0.15	206,814	439,346	53
1973	296,105	327	296,433	0.11	144,348	440,781	67
1974	343,405	247	343,652	0.07	173,615	517,267	66
1975	331,696	389	332,085	0.12	158,583	490,668	68
1976	364,758	191	364,949	0.05	200,464	565,413	65
1977	361,932	1,355	363,287	0.37	112,077	475,364	76
1978	258,281	894	259,175	0.34	136,386	395,561	66
1979	142,798	433	143,231	0.30	85,446	228,677	63
1980	341,257	1,533	342,789	0.45	143,829	486,618	70
1981	311,383	1,267	312,650	0.41	135,157	447,807	70
1982	242,929	1,413	244,342	0.58	163,718	408,060	60
1983	213,105	386	213,491	0.18	139,985	353,476	60
1984	137,210	675	137,884	0.49	23,897	161,781	85
1985	128,765	645	129,410	0.50	27,978	157,388	82
1986	166,313	606	166,919	0.36	100,098	267,017	63
1987	196,781	300	197,082	0.15	123,472	320,553	61
1988	153,220	248	153,468	0.16	124,868	278,336	55
1989	136,488	397	136,886	0.29	83,947	220,832	62
1990	108,501	696	109,197	0.64	43,634	152,831	71
1991	84,949	231	85,180	0.27	52,560	137,740	62
1992	69,539	167	69,706	0.24	79,571	149,277	47
1993	42,312	166	42,478	0.39	30,091	72,569	59
1994	41,621	1	41,622	0.00	0	41,622	100
1995	36,162	0	36,162	0.00	0	36,162	100
1996	32,793	0	32,793	0.00	15,343	48,135	68
1997	27,695	0	27,695	0.00	15,776	43,471	64
1998	17,197	0	17,197	0.00	12,088	29,285	59
1999	12,383	0	12,383	0.00	2,175	14,558	85
2000	13,267	0	13,267	0.00	3,863	17,131	77
2001	14,086	0	14,086	0.00	4,005	18,092	78
2002	9,471	0	9,471	0.00	6,989	16,461	58
2003	11,803	0	11,803	0.00	1,627	13,430	88
2004	358	-	358	-	1,958	-	-

Greenland harvest of 2SW equivalents = NG1 * 0.718924 (M of 0.03 per month for 11 months to July of Canadian terminal fisheries)

Table 4.9.3.1. Percentages by user group and province of small and large salmon harvested (by number) in the Atlantic salmon fisheries of eastern Canada during 2003.

	% of provincial harvest			% of eastern Canada	Number of fish
	Aboriginal peoples' food fisheries	Recreational fisheries	Resident food fisheries		
		Small salmon			
Newfoundland / Labrador	15.1	76.4	8.5	62.4	27,721
Québec	16.1	83.9	0.0	13.0	5,790
New Brunswick	8.9	91.1	0.0	23.2	10,327
P.E.I.	5.7	94.3	0.0	0.6	280
Nova Scotia	9.7	90.3	0.0	0.7	308
		Large salmon			
Newfoundland / Labrador	64.8	9.4	25.8	21.6	2,414
Québec	45.6	54.4	0.0	73.5	8,217
New Brunswick	100.0	0.0	0.0	4.8	541
P.E.I.	-	-	-	0.0	0
Nova Scotia	-	-	-	0.0	0
Eastern Canada		**% by user group**			
Small salmon	13.7	81.0	5.3		44,426
Large salmon	42.1	52.4	5.6		11,172

Table 4.9.3.2. Hook-and-release Atlantic salmon caught by recreational fishermen in Canada, 1984 – 2003.

Year	Newfoundland			Nova Scotia			New Brunswick					Prince Edward Island			Quebec			CANADA*		
	Small	Large	Total	Small	Large	Total	Small Kelt	Small Bright	Large Kelt	Large Bright	Total	Small	Large	Total	Small	Large	Total	**SMALL**	**LARGE**	**TOTAL**
1984				939	1,655	2,594	661	851	1,020	14,479	17,011							**2,451**	**17,154**	**19,605**
1985		315	315	1,323	6,346	7,669	1,098	3,963	3,809	17,815	26,685			67				**6,384**	**28,285**	**34,669**
1986		798	798	1,463	10,750	12,213	5,217	9,333	6,941	25,316	46,807							**16,013**	**43,805**	**59,818**
1987		410	410	1,311	6,339	7,650	7,269	10,597	5,723	20,295	43,884							**19,177**	**32,767**	**51,944**
1988		600	600	1,146	6,795	7,941	6,703	10,503	7,182	19,442	43,830	767	256	1,023				**19,119**	**34,275**	**53,394**
1989		183	183	1,562	6,960	8,522	9,566	8,518	7,756	22,127	47,967							**19,646**	**37,026**	**56,672**
1990		503	503	1,782	5,504	7,286	4,435	7,346	6,067	16,231	34,079			1,066				**13,563**	**28,305**	**41,868**
1991		336	336	908	5,482	6,390	3,161	3,501	3,169	10,650	20,481	1,103	187	1,290				**8,673**	**19,824**	**28,497**
1992	5,893	1,423	7,316	737	5,093	5,830	2,966	8,349	5,681	16,308	33,304			1,250				**17,945**	**28,505**	**46,450**
1993	18,196	1,731	19,927	1,076	3,998	5,074	4,422	7,276	4,624	12,526	28,848							**30,970**	**22,879**	**53,849**
1994	24,442	5,032	29,474	796	2,894	3,690	4,153	7,443	4,790	11,556	27,942	577	147	724				**37,411**	**24,419**	**61,830**
1995	26,273	5,166	31,439	979	2,861	3,840	770	4,260	880	5,220	11,130	209	139	348		922	922	**32,491**	**15,188**	**47,679**
1996	34,342	6,209	40,551	3,526	5,661	9,187						472	238	710		1,718	1,718	**38,340**	**13,826**	**52,166**
1997	25,316	4,720	30,036	717	3,358	4,075	3,457	4,870	3,786	8,874	20,987	210	118	328	182	1,643	1,825	**34,752**	**22,499**	**57,251**
1998	31,368	4,375	35,743	687	2,520	3,207	3,154	5,760	3,452	8,298	20,664	233	114	347	297	2,680	2,977	**41,499**	**21,439**	**62,938**
1999	24,567	4,153	28,720	591	2,161	2,752	3,155	5,631	3,456	8,281	20,523	192	157	349	298	2,693	2,991	**34,434**	**20,901**	**55,335**
2000	29,705	6,479	36,184	407	1,303	1,710	3,154	6,689	3,455	8,690	21,988	101	46	147	445	4,008	4,453	**40,501**	**23,981**	**64,482**
2001	22,348	5,184	27,532	527	1,199	1,726	3,094	6,166	3,829	11,252	24,341	202	103	305	809	4,674	5,483	**33,146**	**26,241**	**59,387**
2002	23,071	3,992	27,063	829	1,100	1,929	1,034	7,351	2,190	5,349	15,924	207	31	238	852	4,918	5,770	**33,344**	**17,580**	**50,924**
2003	21,599	4,637	26,236	618	2,092	2,710	1,618	3,253	1,089	7,981	13,941	177	125	302	1,238	7,015	8,253	**28,503**	**22,939**	**51,442**

* totals for all years prior to 1997 are incomplete and are considered minimal estimates
blank cells indicate no information available

Figure 4.9.2.1. Map of Salmon Fishing Areas (SFAs) and Quebec Management Zones (Qs) in Canada.

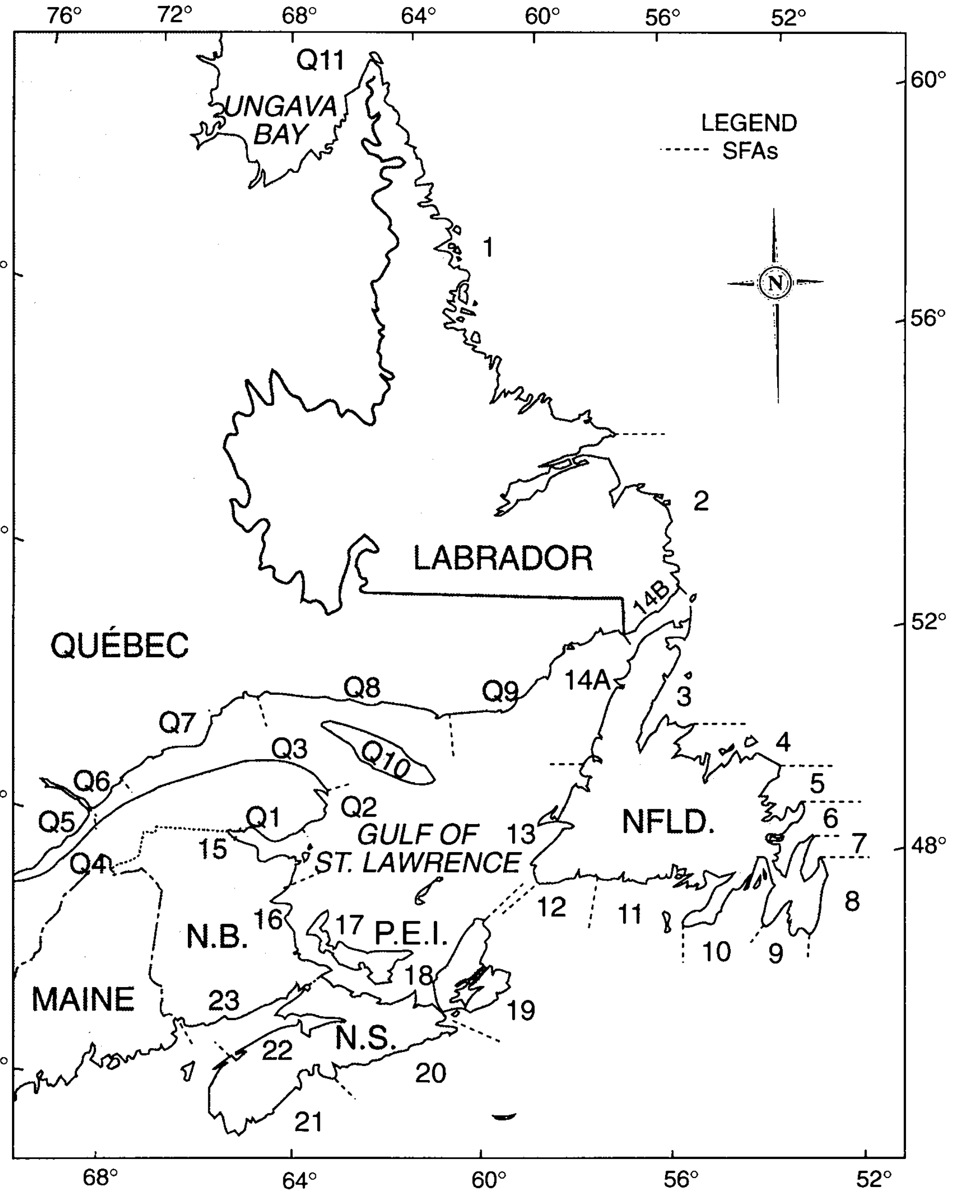


Figure 4.9.3.1. Harvest (t) of small salmon, large salmon, and combined in Canada, 1960-2003 by all users.

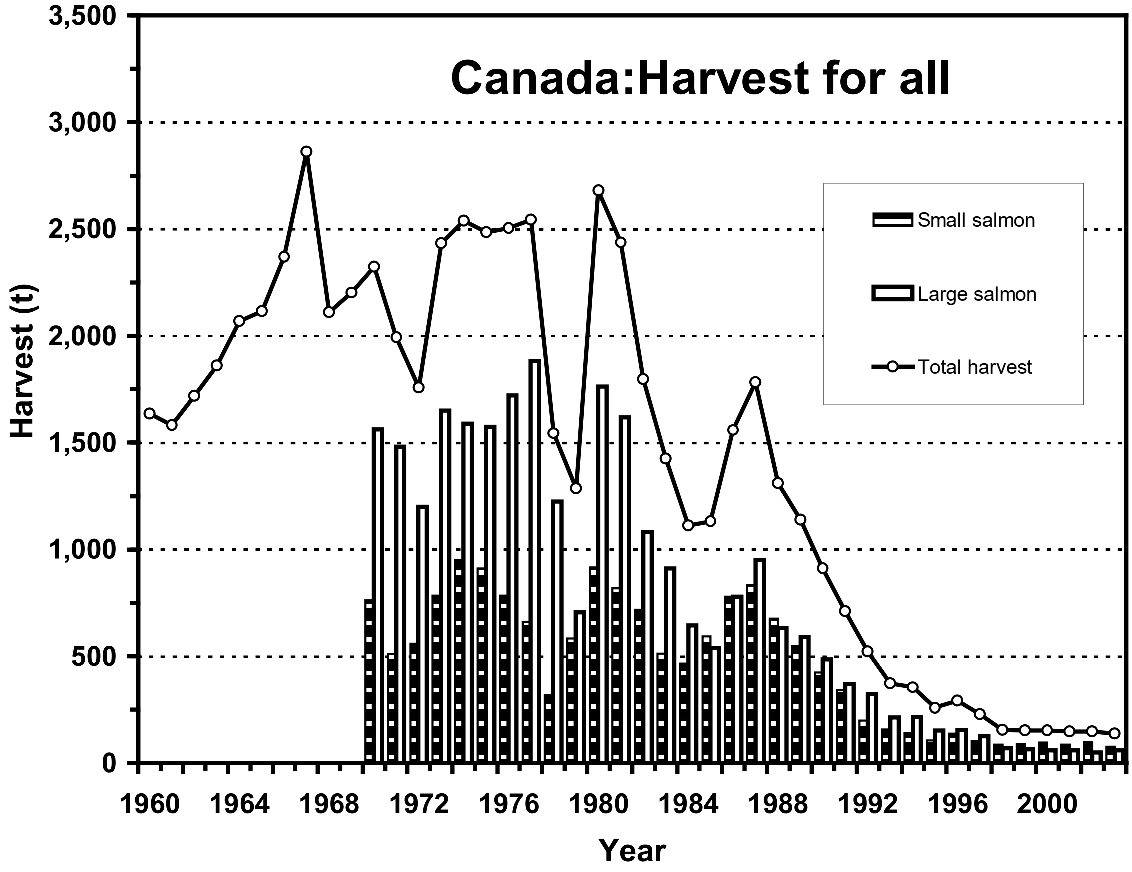


Figure 4.9.3.2. Harvest (number) of small and large salmon and both sizes combined in the recreational fisheries of Canada, 1974 to 2003.

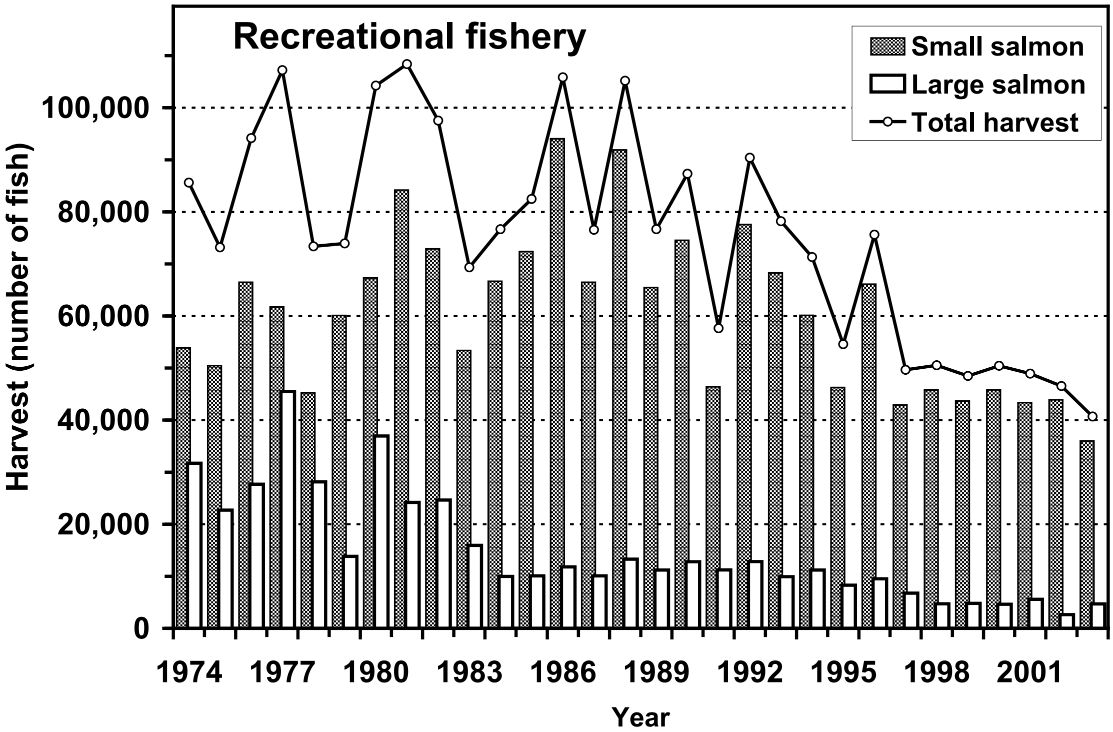


Figure 4.9.5.1. Documented returns of Atlantic salmon to USA rivers, 1967 to 2003. Natural refers to fry stocked or wild individuals.

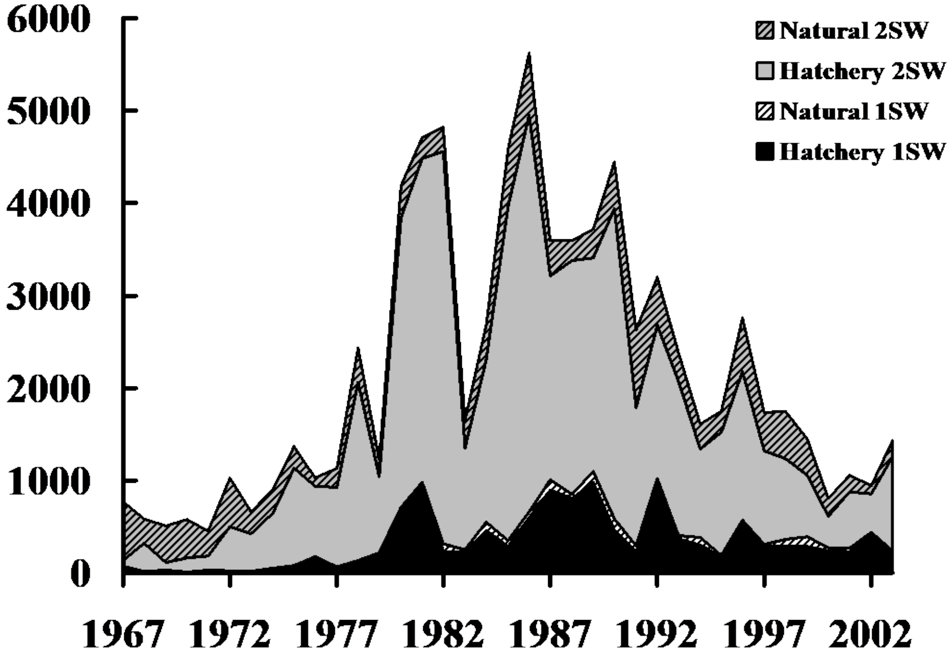


Figure 4.9.6.1 Comparison of estimated mid-points of 1SW returns to and 1SW spawners in rivers of six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23

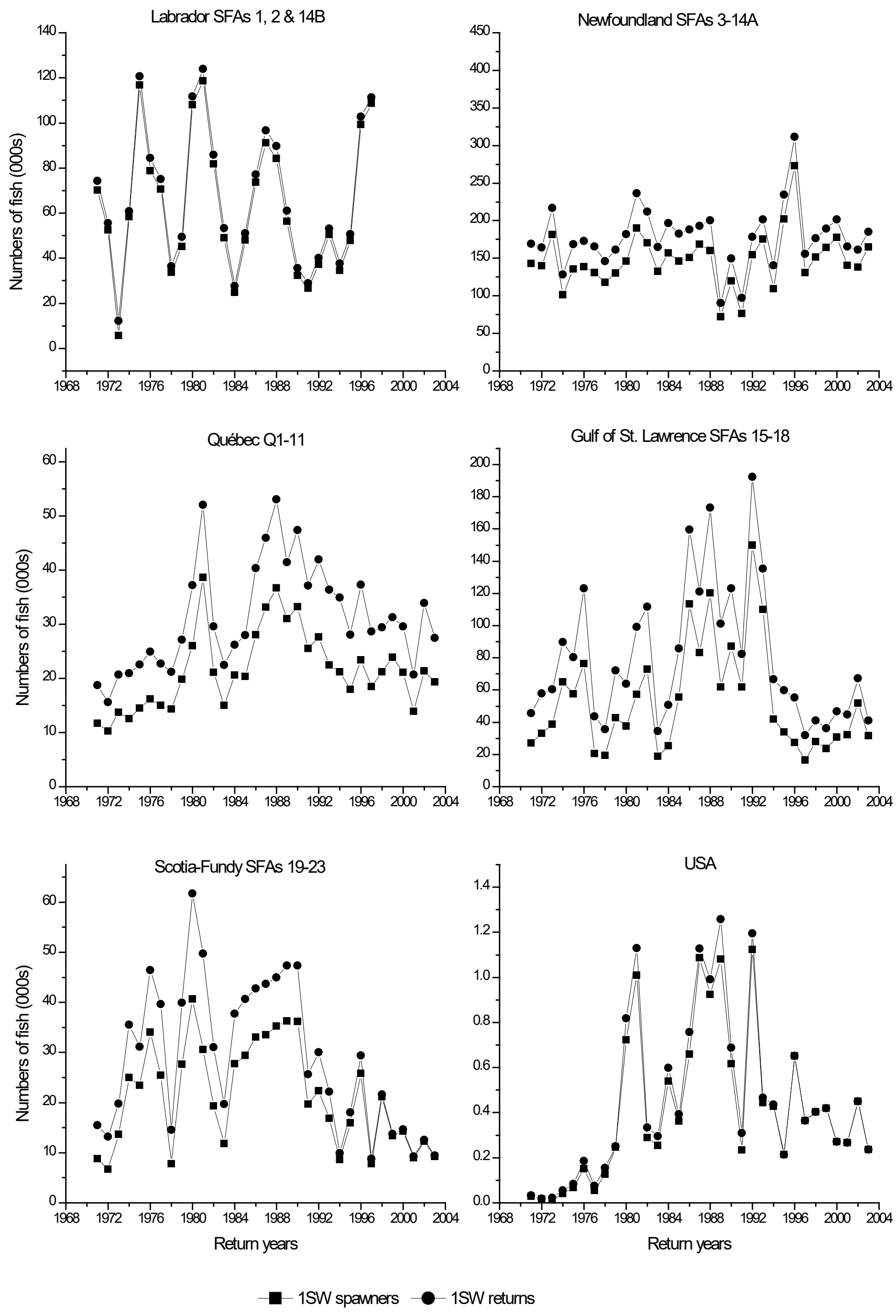


Figure 4.9.6.2 Comparison of estimated mid-points of 2SW returns, 2SW spawners, and 2SW conservation requirements for six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.

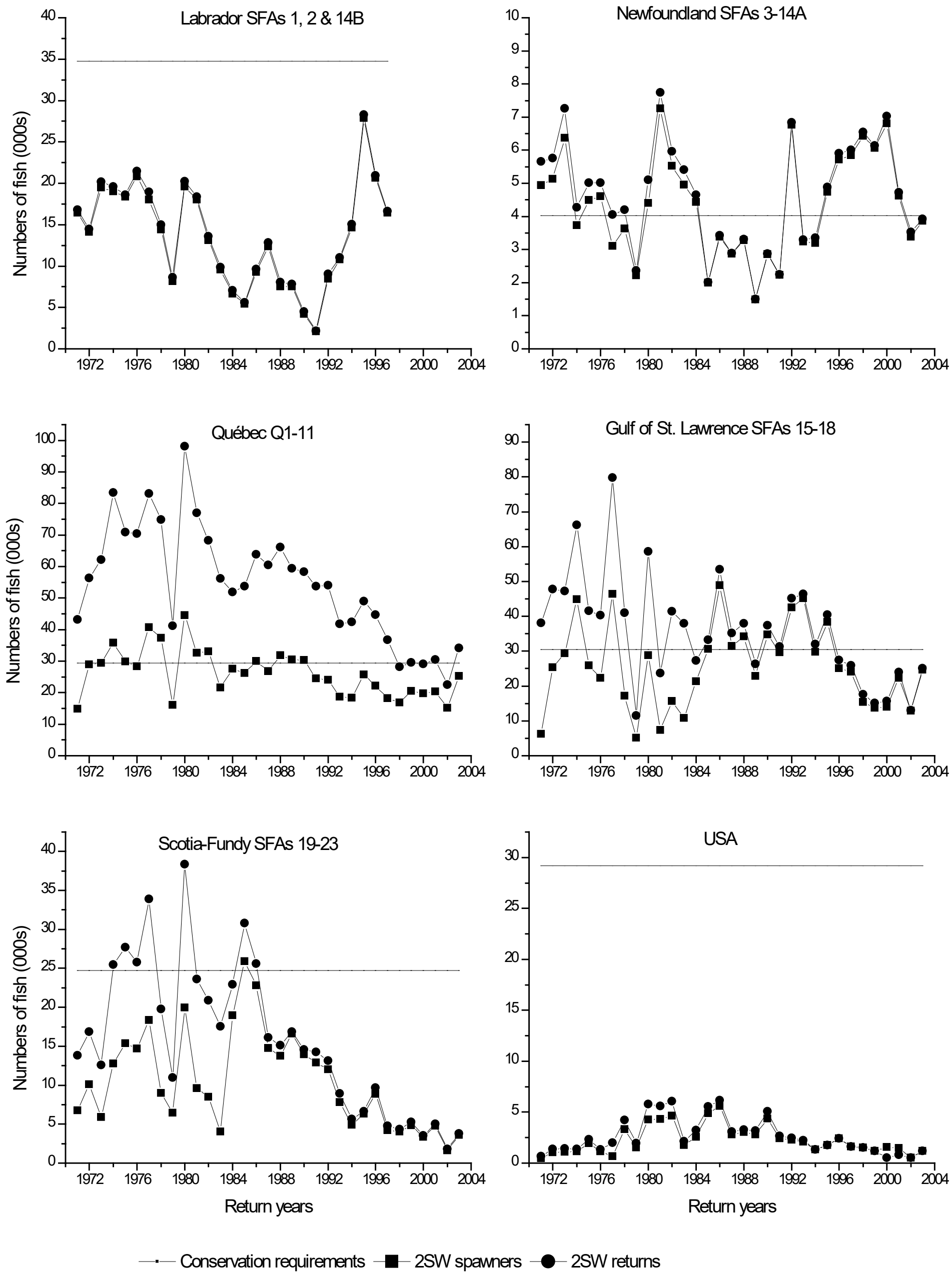


Figure 4.9.6.3 Top panel: comparison of estimated potential 2SW production prior to all fisheries, 2SW recruits available to North America, 1971-2002 and 2SW returns and spawners for 1971-97, as 1998-2003 data for Labrador are unavailable. The horizontal line indicates the 2SW conservation limits. Bottom panel: comparison of potential maturing 1SW recruits, 1971-2003 and returns and 1SW spawners for 1971-97 return years as Labrador data for 1998-2003 are unavailable.

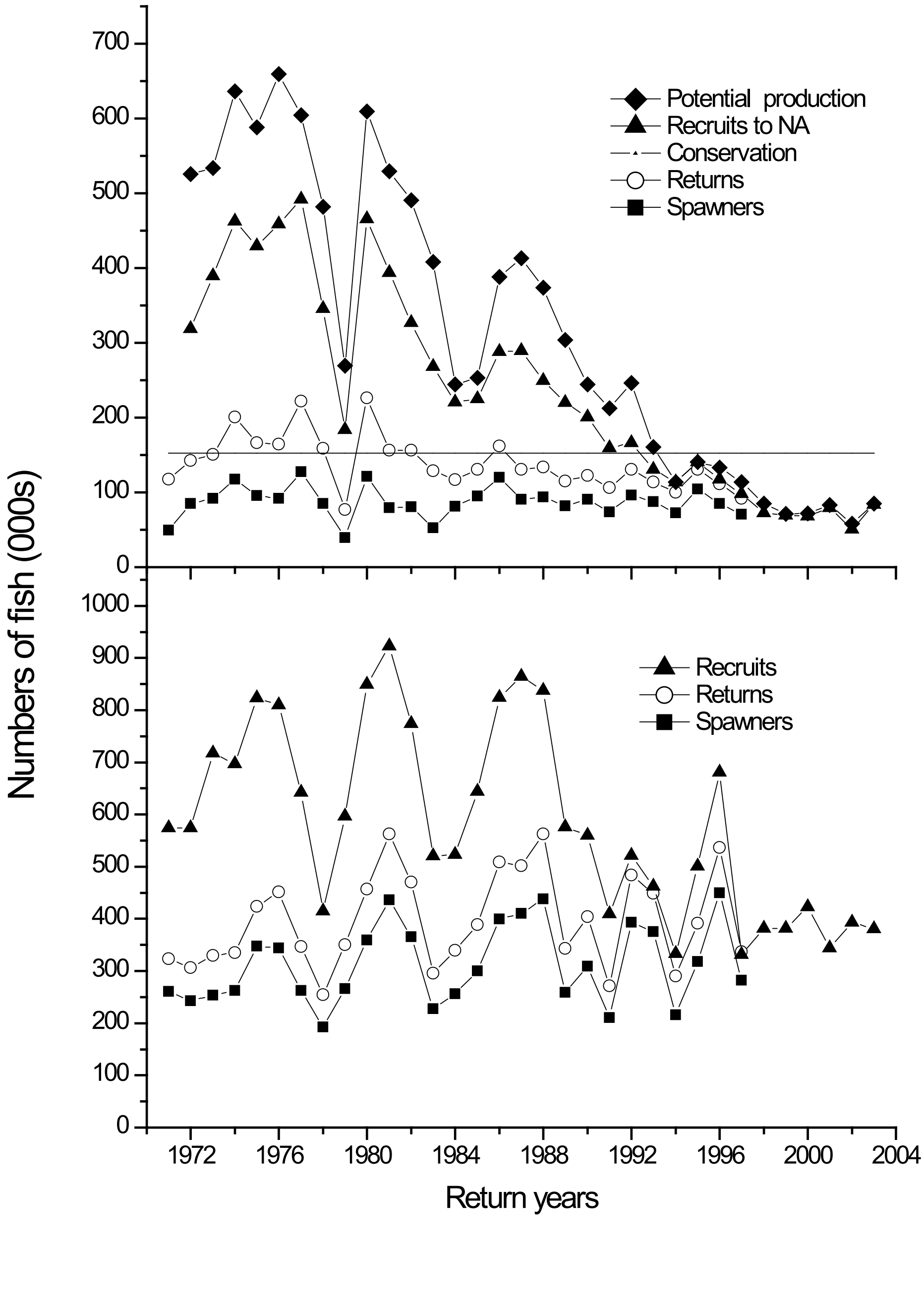


Figure 4.9.8.1. Pre-fishery abundance estimate of maturing and non-maturing salmon in North America. Open symbols are for the years that returns to Labrador were assumed as a proportion of returns to other areas in North America.

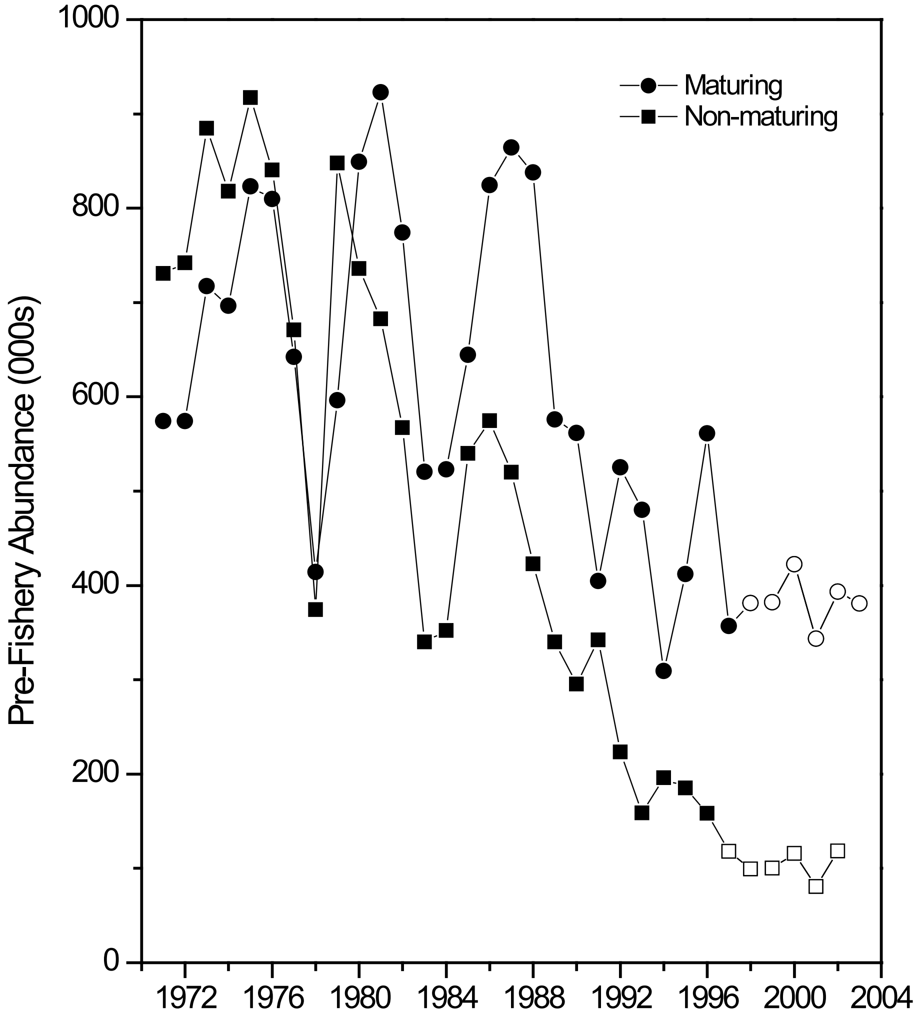


Figure 4.9.8.2 Total 1SW recruits (non-maturing and maturing) originating in North America.

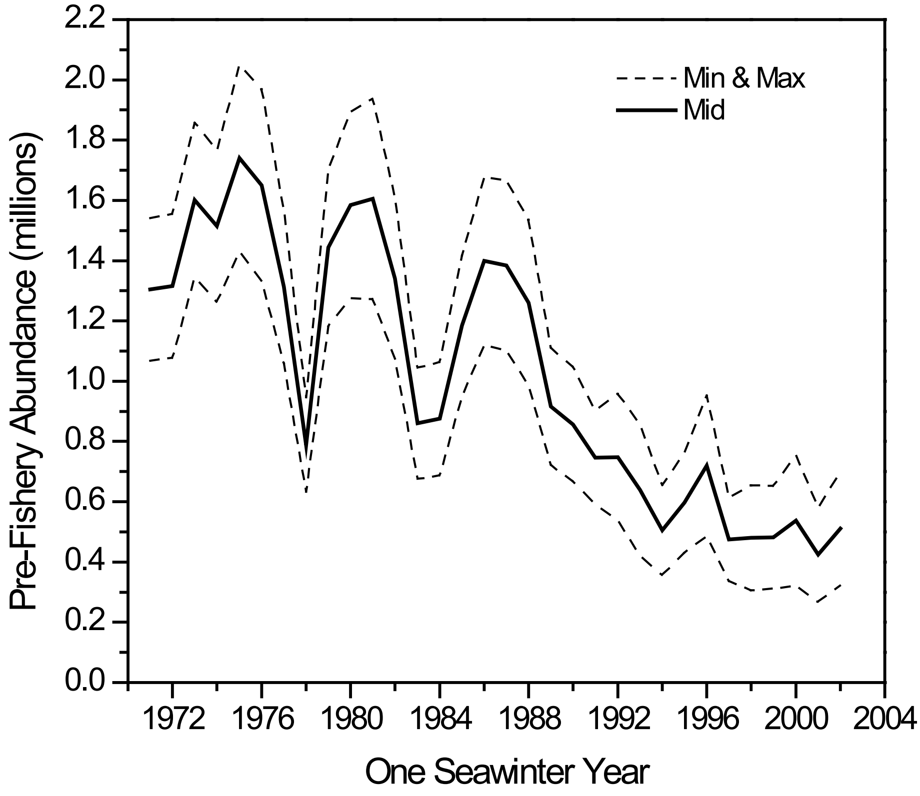


Figure 4.9.8.3. Mid-points of lagged spawners (solid circles) and estimated annual spawners (open circles) as contribution to potential recruitment in the year of prefishery abundance (PFA) for six geographic areas of North America. The horizontal line represents the spawning requirement (in terms of 2SW fish) in each geographic area. Labrador spawner numbers not available after 2002 or for 1977.

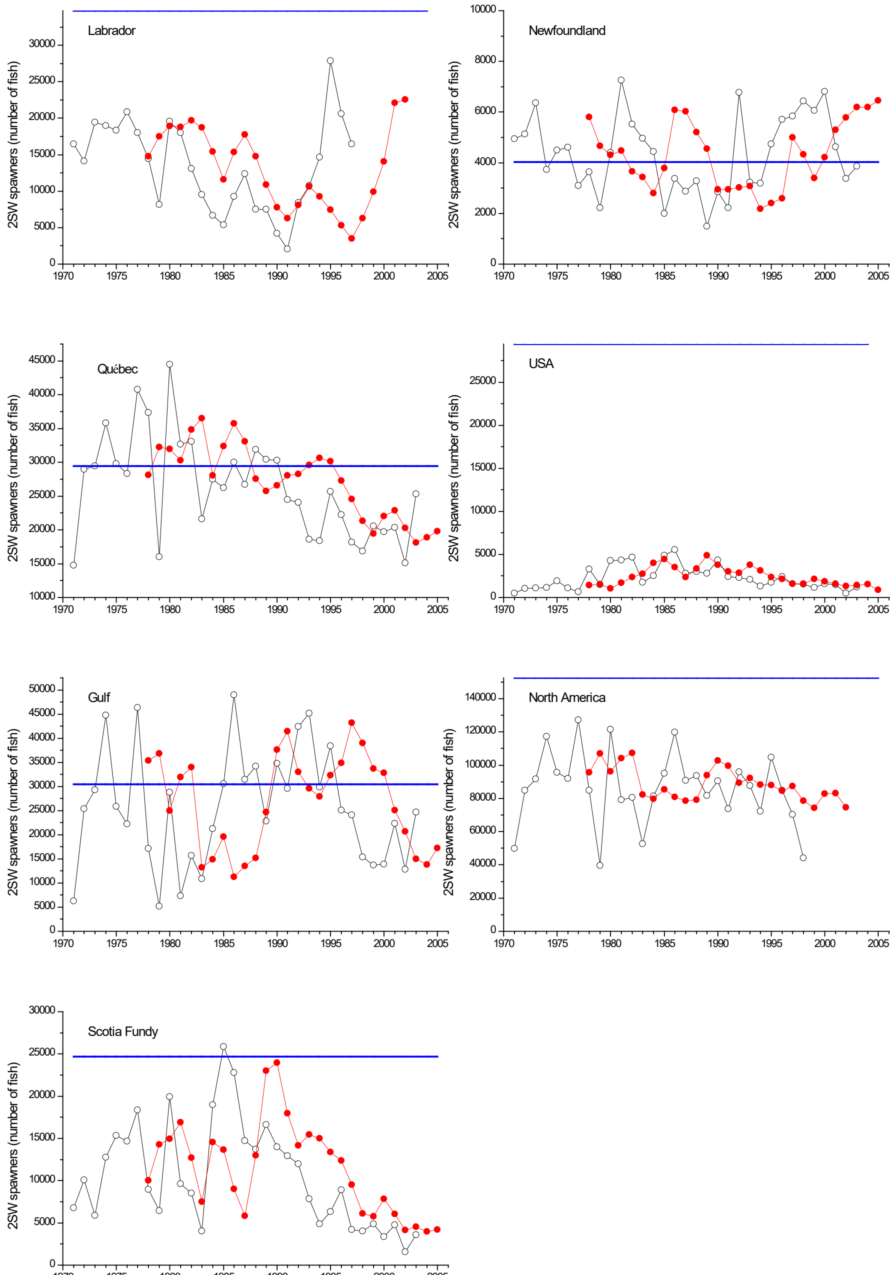


Figure 4.9.8.4. Proportion of spawners (mid-points) lagged to year of PFA (solid circles) and as returns to rivers (open circles) in six geographic areas of North America relative to the total lagged spawner or annual spawning escapement to North America. The horizontal line represents the theoretical spawner proportions for each area based on the 2SW spawner requirement for North America.

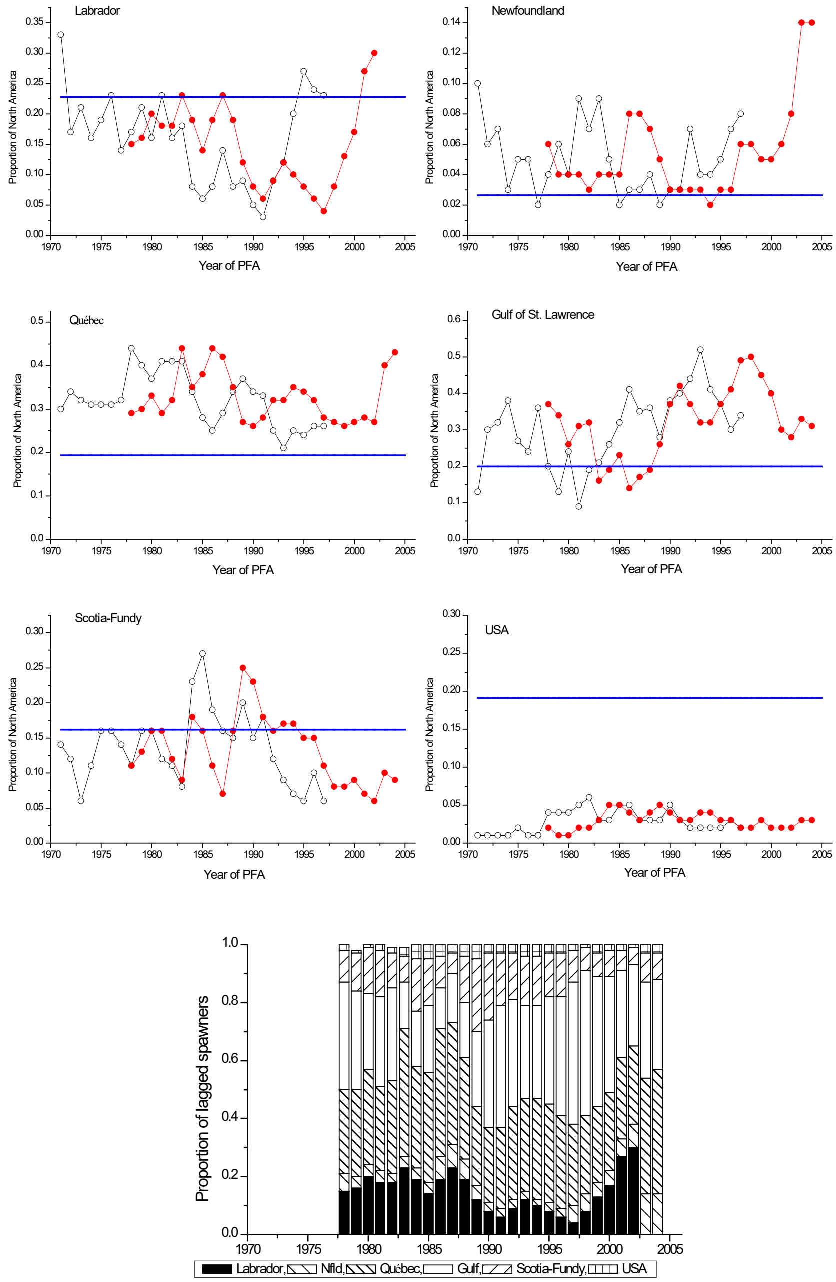
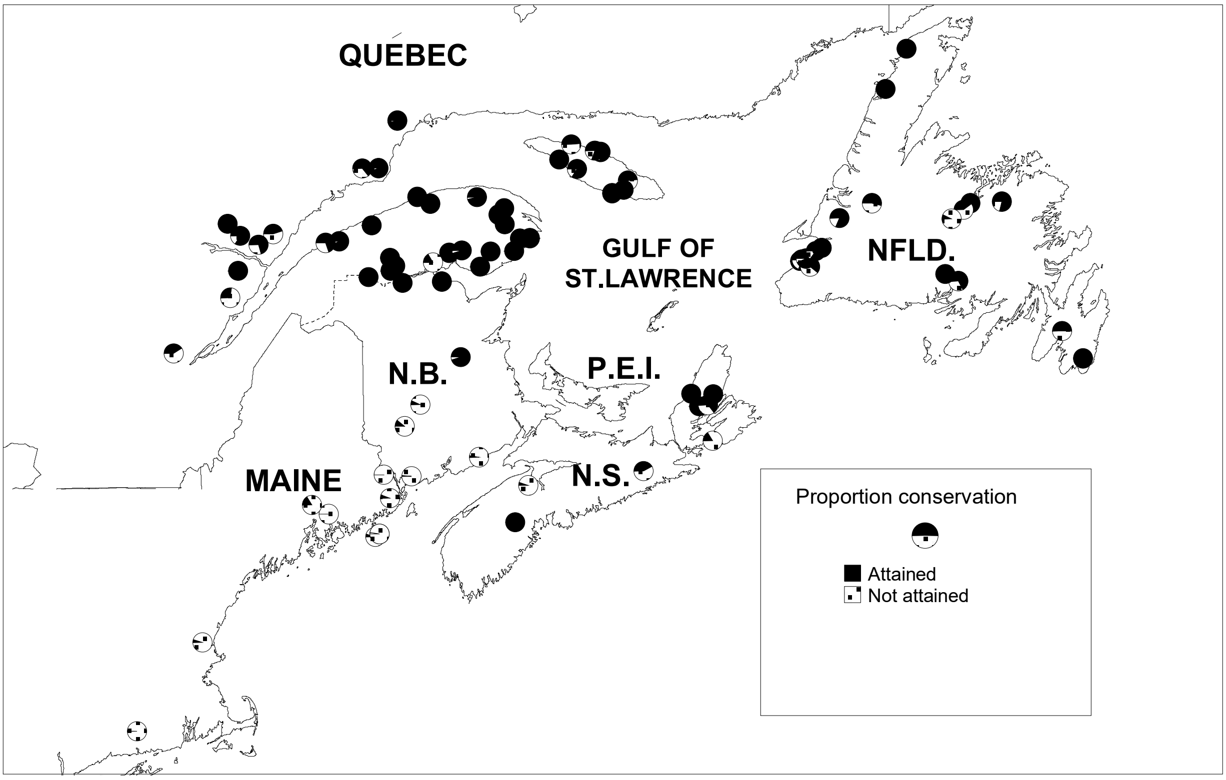


Figure 4.9.8.5. Egg depositions by all sea-ages combined relative to conservation limits in 83 rivers of North America in 2003. The black slice represents the proportion of the limit achieved. A solid black circle indicates the egg deposition limit was attained or exceeded.



5 ATLANTIC SALMON IN THE WEST GREENLAND COMMISSION

5.1 Status of stocks/exploitation

ICES considers the stock complex at West Greenland to be outside safe biological limits.

The salmon caught in the West Greenland fishery are mostly (>90%) non-maturing 1SW salmon, most of which are destined to return to homewaters in Europe or North America as MSW fish if they survive. There are also 2SW salmon and repeat spawners, including salmon that had originally spawned for the first time after 1-sea-winter. The most abundant European stocks in West Greenland are thought to originate from the UK and Ireland, although low numbers may originate from Northern European rivers. Most MSW stocks in North America are thought to contribute to the fishery at West Greenland.

ICES notes that the North American stock complex of non-maturing salmon has declined to record levels and is in tenuous condition. Despite the closure of Newfoundland commercial fisheries in 1992 and subsequently in Labrador in 1998 and Québec in 2000, sea survival of adults returning to rivers has not improved and in some areas has declined further. The abundance of maturing 1SW salmon has also declined in many areas of eastern North America. Smolt production in 2002 and 2003 in monitored rivers of eastern Canada was less than or similar to the average of the last five years. Unless sea survival improves, the abundance of non-maturing 1SW salmon in the Northwest Atlantic is not expected to improve above the levels of the last five years.

ICES also noted that the non-maturing 1SW salmon from Southern NEAC have been declining steadily since the 1970s (Figure 3.1.3), and the preliminary quantitative prediction of pre-fishery abundance for this stock complex will remain low for 2004 (489 000 fish) (Figure 3.4.1).

In European and North American areas, the overall status of stocks contributing to the West Greenland fishery is at the lowest level recorded, and as a result, the status of stocks within the West Greenland area is thought to be extremely low compared to historical levels. Status of stocks in the NEAC and NAC areas are presented in the relevant commission sections of this report.

ICES noted that tentative exploitation rates for non-maturing 1SW fish at West Greenland can be calculated by dividing the recorded harvest of 1SW salmon of North American origin at West Greenland by the PFA estimate for the corresponding year. This indicates that exploitation rates in the last five years have averaged around 5% compared to values prior to 1993 averaging 26%, and suggests that recent management measures in this fishery have reduced exploitation on this stock complex.

5.2 Management objectives

The spawning requirement used for North America is for the continent as a whole. However, based on past performance, there is no reason to expect the abundance of salmon in the North Atlantic to be proportional to the regional 2SW spawner requirements. Specifically, the 2SW returns to Scotia-Fundy and to USA have been below their corresponding conservation limits since 1985 (Figure 4.9.6.2). For the 1998 to 2002 PFA_{NA} years, the most recent years when estimates of lagged spawners are available for all regions of North America, the Quebec and Gulf regions have accounted for a disproportionate number of lagged spawners relative to their 2SW requirements (Figure 5.2.1). Assuming that the abundance of Atlantic salmon in 2004 will be proportional to the abundance of lagged spawners in the last five years when lagged spawner estimates across regions were available, it is possible to calculate the number of salmon required to return to North America to achieve region-specific conservation requirements. For example, to achieve the Newfoundland 2SW requirement of 4,022 2SW salmon, a total of 92 722 fish would be required to leave West Greenland at the PFA_{NA} stage (Table 5.2.1). In the regions with lower stock performance, a total PFA_{NA} abundance of about 439 000 fish would be required for the Scotia-Fundy region, and a PFA_{NA} abundance of about 1.8 million fish would be required for achieving the USA conservation requirements (See Section 4).

NASCO has therefore considered an Alternative Management Objective of meeting the conservation limits simultaneously in the four Northern regions of North America: Labrador, Newfoundland, Quebec, and Gulf. For the two Southern regions, Scotia-Fundy and USA, there is a zero chance of meeting conservation limits in the short or medium term; the objective must be to achieve the conservation limit as quickly as possible. In the absence of any other rebuilding plan this implies that there should be no fisheries on stocks which are below CL.

ICES has been asked to provide recovery trajectories under two possible scenarios (10% and 25% improvement per year) and also to consider appropriate baseline values. These improvements refer to current stock size and not to percent of conservation limits. ICES had previously used a moving average as the baseline value for these increases. However, if a moving average were used, and these stocks continued to decline, so would the baseline value. ICES therefore decided to establish 1992 to 1996 as the range of years to define the baseline for the Scotia-Fundy and USA regions against which to assess PFA_{NA} abundance and fishery options. These years correspond to about one generation time for 2SW salmon following the closure of the Newfoundland commercial fishery and reductions in the Labrador commercial fishery prior to the complete moratorium in 1998. This will provide NASCO with consistent criteria to assess performance of the fisheries management scenarios being considered. In Section 2, it was shown that stocks with low productivity, such as these, are particularly susceptible to overfishing in a mixed stock fishery, thus preventing or delaying rebuilding to conservation limits. To assess the potential to rebuild these stocks, ICES calculated the probability of returns to the weaker stocks in USA and Scotia-Fundy being equal or less than the previous five-year average.

5.3 Reference points

Section 1.4 describes the derivation of reference points for these stocks and stock complexes.

Sampling of the fishery at West Greenland since 1985 has shown that European and North American stocks harvested are primarily (greater than 90%) 1SW non-maturing salmon and are destined to mature as either 2 or 3SW salmon. Usually less than 3% of the harvest is composed of salmon that have previously spawned and a few percent are 2SW salmon that would mature as 3SW or older salmon. Therefore, conservation limits defined for North American stocks have been limited to the 2SW salmon. These numbers have been documented previously by ICES and are in Section 4.3. The 2SW spawner limits of salmon stocks from North America total 152 548 fish, with 123 349 and 29 199 required in Canadian and USA rivers, respectively.

Conservation limits for the NEAC area have been split into 1SW and MSW components on the basis of the average age composition of catches in the past ten years. The stocks have also been partitioned into Northern and Southern stock complexes, and tagging information and biological sampling indicates that the majority of the European salmon caught at West Greenland originate from the Southern stock complex. The current conservation limit estimate for Southern NEAC MSW stocks is approximately 268 000 fish. There is still considerable uncertainty in the conservation limits for European stocks and estimates may change from year to year as the input of new data affect the pseudo-stock-recruitment relationship.

5.4 Advice on management

ICES has provided management advice for the West Greenland fishery, based on the NAC stocks, and for the combined NAC and NEAC stock complexes.

Even in the absence of fisheries on the non-maturing 1SW salmon at West Greenland in 2004 and subsequently on the returning 2SW salmon to North America in 2005, there is a very small chance (5%) that the abundance of salmon will be sufficient to achieve the conservation requirements for 2SW salmon in the four Northern regions. The probability of realizing increases in returns to the Southern North American stocks is close to zero. None of the stated management objectives would allow a fishery to take place.

ICES concludes that using the level of risk aversion adopted by NASCO, (the 75% probability level), none of the stated management objectives in NAC or NEAC or the combined stock complexes would allow a fishery to take place.

5.5 Relevant factors to be considered in management

For all fisheries, ICES considers that management of single-stock fisheries should be based upon assessments of the status of individual stocks. Conservation would be best achieved if fisheries can be targeted at stocks that have been shown to be above biologically-based escapement requirements. Fisheries on mixed stocks, either in coastal waters or on the high seas, do not target only those stocks exceeding biologically-based escapement levels. Fisheries in estuaries and rivers are more likely to fulfil this requirement.

The abundance of non-maturing 1SW in the Northwest Atlantic is not expected to improve in the short or medium term. Sea survival of adults returning to rivers has not improved and in some areas of North America has declined further. The abundance of maturing 1SW salmon has also declined in many areas of eastern North America. Associations between 1SW returns in year ***I*** and 2SW returns in year ***i+1*** observed in several rivers in eastern Canada suggest that abundance of 2SW salmon in 2004 in eastern Canada will be less than that of 2003 (Section 4.9.5). Further, smolt production in 2002 and 2003 in monitored rivers in eastern Canada and USA was less than or similar to the average for the previous five years (Section 4.9.5).

ICES has described two temporal phases of salmon production in the Northwest Atlantic. A phase shift in recruitment per spawner in the northwest Atlantic became apparent during the last two decades. The lower recruitment rate, which may not be sufficient to achieve population replacement, is evident throughout eastern Canada and U.S., especially in the Southern regions. The reduced rate of recruitment may be the result of factors acting at many points across all aquatic habitats of Atlantic salmon. Given the present condition of salmon stocks, there is no evidence in the stock status from any of the regions in North America that there will be a turnaround in abundance in 2004.

ICES also concluded that the Southern European stock complex of non-maturing salmon has declined to record levels. The spawning escapement to Southern Europe has not greatly exceeded the conservation limit for the last eight years (Figure 3.1.4b).

5.6 Catch forecast for 2004

For 2004, the PFA (North America) forecast remains among the lowest of the time-series with a median value of 100 000 fish and a 75% probability that the abundance will be less than 136 000 fish (i.e. highly unlikely to meet the 2SW spawner reserve of 212,000 salmon to North America) (Figure 5.4.1). In the absence of any marine-induced fishing mortality, there is a very low probability (5% probability) that the returns of 2SW salmon to North America in 2005 will be sufficient to meet the conservation requirements of the four Northern regions (Labrador, Newfoundland, Quebec, and Gulf) (see table below). There is essentially no chance (<1%) that the returns in the Southern regions (Scotia-Fundy and USA) will be greater than the returns observed in the 1992 to 1996 base period. The table below shows the probability of meeting the 2SW conservation limits simultaneously in the four Northern areas of North America (Labrador, Newfoundland, Quebec, Gulf); of achieving increases in returns from the 1992 to 1996 base year average in the two Southern areas (Scotia-Fundy and USA) of NAC area, of meeting the MSW conservation limit of the Southern European stock complex relative to quota options for West Greenland. A sharing arrangement of 40:60 (F_{na}) of the salmon from North America and Southern European MSW stocks was assumed.

ICES followed the process developed last year for providing catch advice for West Greenland based on the combined PFA and CLs of the NAC and NEAC areas, in which the PFA for NAC and NEAC are applied in parallel to the Greenland fishery and then combined at the end of the process into a single catch advice table. In the absence of any fishery at West Greenland, there is a less than 75% probability that the MSW conservation limit for Southern Europe will be met.

West Greenland Harvest (t)	Simultaneous Conservation (Lab, NF, Queb, Gulf)	Improvement (SF, USA) of Returns in 2004		Conservation MSW Salmon Southern NEAC
		> 10%	> 25%	
0	0.05	0.01	0.01	0.73
5	0.05	0.01	0.01	0.73
10	0.05	0.01	0.01	0.73
15	0.04	0.01	0.01	0.72
20	0.04	0.01	0.01	0.72
25	0.04	0.01	0.01	0.71
30	0.04	0.01	0.01	0.71
35	0.04	0.01	0.01	0.71
40	0.03	0.01	0.00	0.70
45	0.03	0.01	0.00	0.70
50	0.03	0.01	0.00	0.69
100	0.02	0.01	0.00	0.66

In terms of assessing potential for stock re-building, ICES noted that even in the absence of a fishery at West Greenland there is a 73% probability of 2SW returns to Scotia-Fundy and USA being less than the previous 5-year average (1999 to 2003).

West Greenland Harvest Tons	Probability of 2SW Returns to NAC < 5yr av.
0	0.73
5	0.75
10	0.77
15	0.78
20	0.80
25	0.81
30	0.83
35	0.84
40	0.85
45	0.86
50	0.87
100	0.93

5.7 Medium- to long-term projections

North American stocks

Catch options which could be derived from the pre-fishery abundance forecast for 2004 (100 000) would apply principally to North American fisheries in 2005. Any harvest in fisheries in 2004 would need to be accounted for in 2004 before providing these catch options. Given the PFA forecast, expected mortality and the conservation limit, the only catch option which is consistent with the risk aversion adopted by NASCO for 2SW salmon in 2005 is zero catch. This zero catch option refers to the composite North American fisheries. As the biological objective is to have all rivers reaching or exceeding their conservation limits, river-by-river management will be necessary. On individual rivers, where conservation limits are being achieved, there are no biological reasons to restrict the harvest of returning salmon in excess of escapement targets.

NEAC stocks

The quantitative prediction for the Southern NEAC MSW stock component gives a projected PFA (at 1st January 2004) of 489 000 in 2004. No projections are available beyond that for this stock complex. The stock group is outside safe biological limits, and ICES considers that precautionary reductions in exploitation rates are required for as many stocks as possible in order to ensure with high probability that conservation requirements are met for each river stock. On individual rivers, where conservation limits are being achieved there are no biological reasons to restrict the harvest of returning salmon in excess of escapement targets.

5.8 Comparison with previous assessment and advice

The current modelling approach was applied to the PFA_{NA} series that now includes the 2002 PFA to update the 2003 forecast. The median value of the updated analysis has decreased to 90 000 fish from 110 000 based on the previous year's model and data. More importantly, the upper bound on the distribution is substantially lower, 196 000 in the updated analysis versus 305 000 in the previous year's analysis (Figure 5.8.1).

5.9 NASCO has requested ICES to describe the events of the 2003 fishery and status of the stocks

At its annual meeting in June 2003 NASCO agreed to restrict the fishery at West Greenland

"to that amount used for internal subsistence consumption in Greenland, which in the past has been estimated at 20 t".

Consequently, the Greenlandic authorities set the commercial quota to nil, i.e. landings to fish plants, purchase of salmon by shops for resale, and any export of salmon from Greenland were forbidden. Licensed fishermen were allowed to sell salmon at the open markets, to hotels, restaurants, and institutions. A private fishery for personal consumption without a license was allowed. All catches were to be reported to the License Office on a daily basis. In agreement with the Organisation for Fishermen and Hunters in Greenland the fishery for salmon was allowed from 11 August. The Greenland authorities set a closing date of 31 October.

5.9.1 Catch and effort in 2003

By the end of the season a total of 8.7 t of landed salmon were reported (Table 5.9.1.1). In total, 77 reports were received. The geographical distribution of the reported catches was similar to that in 2000 and 2001, with more than 50% of the landings reported from NAFO Div. 1F (Table 5.9.1.2; Figure 5.9.1.1). Provided that the information on the landing reports is representative of the temporal distribution of the catches, the fishery was not similar to previous years, with the majority of the catches taken in the first 7 weeks of the season.

The number of active participants in the salmon fishery has decreased sharply since 1987, when a catch of more than 900 tonnes was allowed and more than 500 licenses were active in the fishery. During 2000, 2001, and 2003, there were about 40 active fishermen, the lowest numbers recorded in the time-series.

Because the fishery includes provisions for personal consumption or subsistence fishing, unreported catch is likely. There is presently no quantitative approach for estimating the magnitude of unreported catch; however, it is thought to have been at the same level proposed in recent years (around 10 t).

5.9.2 Biological characteristics of the catches

An international sampling program instituted by NASCO in 2001 to sample landings at West Greenland has continued. The sampling program in 2003 included sampling teams from Canada, Greenland, Ireland, United Kingdom, and United States. Teams were in place at the start of the fishery and continued to mid-September. Further, one sample was obtained late in the season (20-21 October). In total, 2198 specimens, representing a high proportion of the landings, were sampled for presence of tags or fork length, weight, scales, and tissue samples for DNA analysis. The limitation of the fishery to subsistence fishery caused practical problems for the sampling teams; however, the sampling program was fairly successful in adequately sampling the Greenland catch temporally and spatially. In fact, the sampling teams at some sites sampled larger amounts of salmon than reported for sale in the official statistics. Where that occurred, ICES adjusted the total landings by replacing the purchased catch with the weight of fish sampled to use in assessment calculations.

Tissue and biological samples were collected from the mixed population at West Greenland caught for local consumption in 2003. Samples were obtained from three landing sites: Qaqortoq, Nuuk (NAFO Div. 1F), and Maniitsoq (NAFO Div. 1C) (Figure 5.9.1.1). The sampled salmon were measured, scales were removed for ageing, and gutted weight recorded. Data from this program were used to fulfil the requests for information from NASCO related to Atlantic salmon in the West Greenland Commission area.

Biological characteristics (length, weight, and age) were recorded from 1824 fish in catches from NAFO Div. 1C, 1D and 1F in 2003 (Tables 5.9.2.1 to 5.9.2.3). The smallest fish sampled was 51 cm fork length and weighed 1.46 kg gutted weight while the largest was 100 cm and weighed 10.74 kg. The average weight of fish in the 2003 catch was 3.04 kg, with North American 1SW fish averaging 63 cm and European 1SW fish averaging 64.4 cm in length (Table 5.9.2.1). There was a significant decline in weight (unadjusted for sampling date) of both European and North American 1SW from 1969 to 1992, followed by a significant increase in weights over time (1995-2003). The mean lengths and mean weights for 2003 were among the highest in the last decade.

The river ages of European salmon ranged from 1 to 5 (Table 5.9.2.2). Over half (58%) of the European fish in the catch were river-age 2 and 22% were river age 3. Although the proportion of the European origin river age 1 salmon in the catch has been variable in the last 15 years, it has been between 10% and 16% since 2001 (Table 5.9.2.2). A low proportion of this group suggests low representation of Southern European stocks in the catch. North American salmon up to river age 6 were caught at West Greenland in 2003 (Table 5.9.2.2), with over half distributed among river ages 2 (29%) and 3 (39%).

In 2003, 1SW salmon were 98.9% of the European catch (Table 5.9.2.3). No previous spawners of European origin were observed and 1.1% of the European samples collected from the West Greenland fishery were 2SW salmon. One SW salmon dominated (96.7%) the North American component, with repeat spawners 2.3% of the catch (Table 5.9.2.3).

Between 17 August and 4 September the sampling team stationed in Nuuk obtained 55 whole fish to remove tissue for disease testing. These samples were tested for the presence of ISAv by RTPCR assay only and all test results were negative. The sex of 59 individuals, the 55 collected in Nuuk and 4 in Maniitsoq, was determined by examining gonads; of these 6 (10%) were males and 53 (90%) females. ICES recommends that sex be determined on as many whole fish as practicable, and methods be considered for determining sex on gutted individuals.

5.9.3 Continent of origin of catches at West Greenland

A total of 1779 tissue samples were removed and preserved for DNA analysis. All genetically sampled salmon were genotyped at 4 microsatellite loci (Ssa202, Ssa289, SSOSL438, and SSOSL311). A database of 4802 Atlantic salmon genotypes of known origin was used as a baseline to assign the 1779 salmon to continent of origin. In total, 1212 (68.1%) of the salmon sampled from the 2003 fishery were of North American origin and 567 (31.9%) fish were determined to be of European origin (Table 5.9.3.1). For the first time, continent of origin was determined solely based on genetics. ICES noted that the variability in the composition of the catch among the divisions necessitates a broad geographic sampling program.

Applying the continental percentages to the adjusted total catch (12.3 t) resulted in estimates of 7.9 t of North American origin and 4.3 t of European origin fish (2600 and 1400 rounded to the nearest 100 fish, respectively) landed in West Greenland in 2003 (Table 5.9.3.2 and Figure 5.9.3.1). ICES also adjusted the 2002 landings. Raising the total catch from 9.0 t to 9.8 t to the weighted catch results in estimates of 6.8 t of North American origin and 3.0 t of European origin fish (2300 and 1000 fish rounded to the nearest 100 fish respectively). Quota reductions have resulted in an overall reduction in the numbers of both North American and European salmon landed at West Greenland.

5.9.4 NASCO has requested ICES to provide information on the origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country, or stock complexes)

Within a mixed stock fishery, the identification of the origin and composition of the catch is essential for responsible management. This is especially true for stocks that are protected under various nation-specific endangered species legislations. In addition, the NASCO Decision Structure requires that the stock composition of mixed stock fisheries be considered while developing management plans. The West Greenland Atlantic salmon fishery falls within this category.

In 2003, seven fish from Ireland, two from UK England and Wales, one from UK Scotland, three from Canada, and three from USA were identified during sampling the fishery through either external or internal tags.

A major genetic dichotomy exists between populations from either side of the North Atlantic Ocean with one microsatellite locus giving almost perfect separation of North American and European Atlantic salmon (Taggart *et al.* 1995; Koljonen *et al.* 2002). Such hypervariable nuclear DNA markers can in theory be used to distinguish any distinct population group from one another, provided that there is a demonstrated positive correlation between genetic and geographic distance and that a sufficient number of unlinked loci are studied. However, it remains to be seen how well these markers estimate finer scale composition within a mixed stock fishery where a large number of populations are contributing.

A revised probabilistic model that classified the West Greenland catch not only to continent of origin, but country and sub-country of origin as well was reviewed by ICES. Known misclassification accuracies at the sub-continent level within North America are incorporated and both point and variance estimates are generated for each assignment level. A suite of 11 loci allows for classification accuracy within the North America country of origin level. The 2002 West Greenland catch was partitioned into European and North American origin and then Canadian and USA origin. The USA estimate was then partitioned to river of origin, in particular, the federally protected Distinct Population Segment (a group of 8 federally protected rivers). The model demonstrates that identifying country or region of origin for the management of mixed stock fisheries is possible and practical. ICES endorsed the PGA model approach that accounts for the inaccuracy of assigning samples to country of origin and the estimation of both point estimates and variance around these estimates.

An example of the potential for management based on finer scale stock classification was described for the Foyle area of Northeast Ireland (Section 2.5.1), where genetics techniques are being used to identify stocks contributing to the coastal fishery. Knowledge of temporal and spatial variation in fishery composition may allow managers to achieve conservation in stocks and to identify where specific actions are required to protect or rebuild stocks.

ICES noted last year that reference baseline datasets for the European and Canadian stock complexes lacked adequate spatial and temporal coverage for finer scale assignments with acceptable accuracy. Some progress has been made to bolster reference datasets within the lab currently processing the samples from the West Greenland fishery; however, deficiencies remain, particularly for Southern NEAC stocks. An ad hoc approach will not assure significant progress toward assigning origin of Atlantic salmon caught at West Greenland at a finer resolution than continent of origin (river stocks, country or stock complexes). Therefore, ICES recommends an integrated approach that builds on work at the laboratories in NAC and NEAC areas currently studying Atlantic salmon genetics.

5.9.5 Elaboration on the status of the stocks in the West Greenland Commission area

The most abundant European stocks in West Greenland are thought to originate from the UK and Ireland, although low numbers may originate from Northern European rivers. Most MSW stocks in North America are thought to contribute to the fishery at West Greenland. The percentage of North American salmon in the West Greenland catch was less than 70% for all but one year until 1992, then increased from 60% to 90% from 1995 to 1999, and has averaged approximately 68% from 2000 to 2003 (Table 5.9.3.1).

North American stock complex

Estimates of pre-fishery abundance suggest a continuing decline of North American adult salmon over the last 10 years. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has oscillated around a generally declining trend since the 1970s, and the abundance recorded in 1993–2002 was the lowest in the time-series (Figure 4.9.8.2). During 1993 to 2000, the total population of 1SW and 2SW Atlantic salmon was about 600 000 fish, about half of the average abundance during 1972 to 1990. A 21% increase has however occurred between 2001 and 2002, the most recent year for which it is possible to estimate the total population. The decline from earlier higher levels of abundance has been more severe for the 2SW salmon component than for the small salmon (maturing as 1SW salmon) age group.

In most regions, the returns in 2003 of 2SW fish increased substantially from 2002; however, they are still close to the lower end of the 33-year time-series (1971-2003). In Newfoundland, the 2SW salmon are a minor age group component of the stocks in this area and even here, decreases of about 30% have occurred from peak levels of a few years ago. Returns of 1SW salmon generally decreased from 2002 in all areas except Newfoundland. In 2003, the overall conservation limit (S_{lim}) for 2SW salmon was not met in any area. Specifically:
Newfoundland:

- 2SW and 3SW salmon are a relatively small component of this stock complex
- 2SW returns ranked 19 for the last 33 years
- 2SW spawners in 2003 were approximately 96% of the 2SW stock conservation limits (S_{lim}).

Labrador:

- 2SW salmon are historically an important part of this stock complex
- 2SW returns peaked in 1995, and decreased again in 1996 and 1997
- no estimate is given after 1997 from this area when the commercial fishery, the basis for the return and spawner model for Labrador, ended.

Québec:

- 2SW and 3SW salmon are an important part of this stock complex
- 2SW returns ranked 19 in a 33-year time-series
- 2SW spawners in 2003 were at 86% of 2SW conservation limit (S_{lim}).

Gulf of St. Lawrence:

- 2SW salmon are an important part of this stock complex
- 2SW returns ranked 18 in a 33-year time-series
- 2SW spawners in 2003 were at 81% of 2SW conservation limit (S_{lim}).

Scotia-Fundy:

- 2SW salmon are historically an important part of this stock complex
- 2SW returns were the third lowest in a 33-year time-series
- 2SW spawners in 2003 were at 15% of 2SW conservation limit (S_{lim})
- inner Bay of Fundy stocks are listed as endangered by the Committee on the Status of Endangered Wildlife in Canada.

United States:

- 2SW salmon are historically an important part of this stock complex
- 2SW returns ranked 25 in a 33-year time-series
- 2SW returns in 2003 at 4% of 2SW conservation limit (S_{lim})
- stocks in 8 rivers are listed as endangered under the Endangered Species Act.

Southern European stock complex

The main contributor to the abundance of the European component of the West Greenland stock complex is non-maturing 1SW salmon from Southern Europe. The percentage of European fish in catches at West Greenland was around 30% in the early 1990's and the 2000's, but was below 20% from 1996 to 1999. The contributions of countries within NEAC to this PFA, based on tagging data are: France, 2.7%; Ireland, 14.7%; UK (England &Wales), 14.9%; UK (Northern Ireland), <0.01%; UK (Scotland), 64.5%; and Northern NEAC countries, 3.2%. Southern European MSW salmon stocks in the NEAC area consistently declined over the past 10-15 years, and the estimated overall spawning escapement has been below conservation limits (S_{lim}) in recent years. Information from individual countries is summarized below:

France:

- MSW returns are third lowest in the time-series
- MSW spawners are below CL in 2003.

Ireland:

- MSW returns are below the median value for the time-series
- MSW spawners are below the median value for the time-series
- MSW numbers are subject to considerable uncertainty as the sea age composition of the catch is not known accurately
- MSW spawners are above CL in 2003.

UK (England & Wales):

- MSW returns are below the median value for the time-series
- MSW spawners are close to the median value for the time-series

- MSW spawners are at or above CL in 2003.

UK (Northern Ireland):

- Historical trends are unclear as the sea age composition of the catch is unknown for most of the time-series.
- MSW spawners are at or above CL in 2003.

UK (Scotland):

- MSW fish are estimated to contribute between 40% & 70% of the spawning stock
- MSW returns are for the last nine years lowest in the time-series
- MSW spawners are below CL in 2003.

5.10 NASCO has requested ICES to provide a detailed explanation and critical examination of any changes to the models used to provide catch advice

Provision of catch advice for West Greenland involves the use of several models and procedures and several data sources. It is routine practice that data inputs are updated annually and provisional values confirmed. On some occasions whole or partial data series may be revised if new or improved information is made available. In addition, the formulation of models used in the provision of catch advice may be changed to reflect a better understanding of the relationships the model represent. This section reports on the latter two types of change. Other aspects of the development and risk assessment of catch options for 2004 and harvests were not changed from the methods report in 2003 and are not reported here.

The forecast model used to estimate pre-fishery abundance of 2SW salmon in 2004 was modified from the model used in 2003. The change to the model was made to better account for uncertainty in the data and in model selection. The overall approach of modeling the natural log transformed PFA_{NA} and LS_{NA} using linear regression did not change from 2003, and the Monte Carlo method used to derive the probability density for the PFA_{NA} forecast was also retained from 2003. The change to the model in 2004 was the addition of several alternative models, one of which was selected during each Monte Carlo simulation and used to contribute a value to build up the PFA_{NA} probability density. The specific changes to the model to incorporate this feature are:

- In 2003, a single model was used to estimate the mean PFA in each of two productivity phases. The break year between phases alternated between 1989 and 1990 in each Monte Carlo random draw when generating the probability density for the 2003 PFA_{NA}.
- In 2004, 42 models were fit to each dataset produced in each Monte Carlo simulation. These models included two models without phase shifts, plus five models with phase shifts and eight possible break years (1986 to 1993) for each model. In each simulation the model which captured the most information with the least complexity was selected (using the minimum on Akaike's Information Criterion) and this model contributed a value to build up the probability density for the 2004 PFA_{NA}.

5.10.1 Forecast models for pre-fishery abundance of 2SW salmon

The advice for any given year has been dependent on obtaining a reliable predictor of the abundance of non-maturing 1SW North American stocks prior to the start of the fishery in Greenland. A two-phase regression between North American pre-fishery abundance (PFA_{NA}) and lagged spawners (LS_{NA}) was used (Figure 5.10.1.1).

North American run-reconstruction model

ICES has used the North American run-reconstruction model to estimate pre-fishery abundance of 1SW non-maturing and maturing 2SW fish adjusted by natural mortality to the time prior to the West Greenland fishery (Section 4.9.8). Estimates of 2SW returns prior to 1998 in Labrador are derived from estimated 2SW catches in the fishery using a range of assumptions regarding exploitation rates and origin of the catch. With the closure of the Labrador fishery, 1998 to 2003 returns were estimated as a proportion of the total for other areas based on historical data (Section 4.9.8).

ICES examined 1SW and 2SW returns and spawner estimates for insular Newfoundland salmon stocks for the years 1971-2003. The catch statistics used to derive returns and spawner estimates were updated for 1994-2002 from those used in Anon. (2003) and new estimates were presented for 2003. The updated catch statistics are the result of information collected during telephone surveys of anglers who did not respond (non-respondents) to the prompts to return their angling logs with records of their angling activities. The sea age distribution required to convert large salmon to 2SW salmon was changed for SFAs 3-12 and for SFAs 13-14A, for the period of 1994 to 2003. These two revisions of the data resulted in PFA_{NA} changing from 1% to 8% in any year.

North American forecast model

A plot of the midpoint estimates PFA_{NA} versus the LS_{NA} index suggested two periods of productivity, a high productivity period during 1977 to 1988 and a low productivity period during 1990 to 2002, with intermediate productivity in 1978 and 1989 (Figure 5.10.1.1). The relative recruitment (PFA_{NA}) per spawner (LS_{NA}) has declined from an average of 7.6 during 1977-1989 to an average of 2.3 during the period 1990 to 2002.

In 2004, a more generalized nested model structure was considered which examined the form of the lagged spawner index and PFA relationship as well as the break years when a phase shift occurred (Table 5.10.1.1). The PFA_{NA} and LS_{NA} variables were natural log transformed before analysis. The linearized form of the model was:

$$Ln(PFA_{NA}) \quad = \quad \alpha + \beta * Ph + (\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$$

Akaike's Information Criterion (AIC_c) with the adjustment for small sample size (Burnham and Anderson, 1998) was used to determine the parsimonious model, i.e. the model that best explains the data while using the fewest parameters. The model and break year combination with the lowest AIC_c value was retained for forecasting. The effect of uncertainty in PFA_{NA} and LS_{NA} on the selection of the most parsimonious model and the detection of a phase shift was examined by Monte Carlo simulation. The minimum and maximum values of the PFA_{NA} and lagged spawner variables were calculated from the input data. PFA_{NA} was estimated by random draws from a uniform distribution within the minimum and maximum range of the catch and returns data (from Section 4.9). The uncertainty in LS_{NA} was characterized by random draws from a uniform distribution within the minimum and maximum range of the regional estimates prior to summation. A total of 10 000 data sets of annual values (1977–2002) of PFA_{NA} and LS_{NA} were generated.

The model and phase shift period combination resulting in the minimum AIC_c was saved for each of the simulated data sets. Over the 10,000 datasets, three models for predicting PFA were retained (Table 5.10.1.2). In 67% of the simulated data sets the AIC_c preferred a model including the lagged spawner model. In such years, the break years identified were 1988 and 1989. In the remaining data sets, models with two means describing phases in PFA were selected. The corresponding break years were 1991 and 1992 (Table 5.10.1.2).

Determining the probability of the forecast year of interest being in one of the phases

When sequential observations are auto-correlated, previous states may provide a reasonable forecast of the immediate future. For the phases described by the lagged spawner and PFA_{NA} model, it seems reasonable to expect that 2004 will be in the lower phase, as observed over the last ten years. However, to provide a PFA_{NA} for 2004, and a revised value for 2003, the probability of being in either phase was quantified. Specifically, for the 2004 forecast of PFA_{NA}, the probability (runs/10,000) of being in the high phase was negligible (0.5%) and the probability of being in the lower productivity phase was over 99.5% (Table 5.10.1.2). The predicted PFA_{NA} is then a modelled average distribution with random draws of a binomial distribution determining which phase applies to the lagged spawner variable in the year of interest. This distribution is as a weighted combination of the two possible predicted PFA distributions, with weights determined by the probability of being in each phase.

ICES critically evaluated the changes and updates presented above:

- Application of the updated model to estimate the 2003 PFA produced a lower estimate (median 90 000) than the estimate provided last year (median 110 000). More importantly, the upper bound on the distribution is substantially lower, 196 000 in the updated analysis versus 305 000 in this year's analysis (Figure 5.8.1).
- The lagged spawner variable used in the model declines in 2004 to its lowest value and is used to predict PFA using relative spawner abundances that are outside the range of previously observed values. The uncertainty of associations increases as the predictor variable gets farther from the mean, which is the case for the 2004 projection.
- A residual analysis of the model and break year performance indicated that all model formulations overpredicted the estimated PFA in the most recent five years (Figure 5.10.1.2). The phase shifted slope and intercept models had the least bias, but these models were picked less frequently.

5.11 NASCO has requested ICES, with respect to stock rebuilding, to consider and evaluate various alternative baseline measures for use in the risk analysis

This has been dealt with in Section 5.2.

5.12 NASCO has requested ICES to evaluate the extent to which the objectives of any significant management measures introduced in recent years have been achieved

The changes in the management regime since 1993 at West Greenland were:

- NASCO adopted a new management model (*Anon. 1993*) based upon ICES assessment of the PFA of non-maturing 1SW North American salmon and the spawner escapement requirements for these stocks. This resulted in a substantial reduction in the TAC agreed to by NASCO from 840 t in 1991 to 258 t in 1992, and further reductions in subsequent years.
- The fishery was suspended in 1993 and 1994 following the agreement of compensation payments by the North Atlantic Salmon Fund.
- In 1998, NASCO agreed on a subsistence fishery of 20 t.
- In 1999, a multi-year management was agreed restricting the annual catch to 20 t for internal consumption.
- In 2001, NASCO agreed to an ad hoc management arrangement with an adaptive quota calculation, based upon three harvest periods. The resulting total quota for all harvest periods was 114 t.
- In 2002 NASCO agreed to a revised ad hoc management arrangement. In addition, an agreement was negotiated between the North Atlantic Salmon Fund and its partners, and the Greenland Association of Hunters and Fishers (KNAPK), to suspend the commercial part of the salmon fishery. The agreement is for a total of five years, and is automatically renewed annually unless one of the parties gives notice in advance of the fishing season of their intention to withdraw.
- In 2003, NASCO agreed on a subsistence fishery of 20 t, which in the past has been estimated for internal consumption at Greenland. No landing to factories or shops, and no export from Greenland were permitted.

For 1994-2003, the mean number of salmon returning to home waters for each tonne not taken at Greenland was calculated as 172 and 83 salmon for North America and Europe, respectively (Table 5.12.1). This analysis examined the effects of the management measures taken at West Greenland in terms of numbers of fish only. Thus, it has been difficult to show direct benefits to homewater stocks from these measures.

Table 5.2.1. A – **Lagged spawners achieved, 2SW conservation limits and the PFA number of fish required to meet region-specific conservation limits if the returns to the regions are in proportion to the average lagged spawner distributions of 1998 to 2002.** B – **2SW returns to the regions of North America for two time periods, 1992–1996, 1999–2003.** C – **Management objectives for the NAC area used to develop the risk analysis of catch options for the 2004 fishery.**

A - Achieved lagged spawners

Year of PFA	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	North America	LS Index
1998	6285	4337	21312	39005	6080	1613	78632	72347
1999	9930	3404	19459	33680	5764	2152	74389	64459
2000	14098	4219	22055	32847	7845	1893	82958	68860
2001	22118	5307	22898	25088	6056	1575	83042	60924
2002	22527	5786	20286	20664	4133	1303	74697	52171
2003	.	6202	18121	14960	4525	1439	.	45246
2004	.	6202	18894	13829	3952	1518	.	44394
% of North America (1998-2002)								
	19.0	5.9	26.9	38.4	7.6	2.2		
% of Lagged Spawner Index (1998-2004)								
	.	8.7	35.0	44.1	9.4	2.8		
2SW Conservation Limit								
Number of fish	34,746	4,022	29,446	30,430	24,705	29,199	152,548	
% of NA	22.8	2.6	19.3	19.9	16.2	19.1		
Spawner Reserve corrected for 11 months of M at 0.03 per month							212,189	
PFA required to meet regional 2SW conservation limit based on average lagged spawner contributions 1998-2002								
	253,860	92,722	147,623	106,902	439,452	1,817,776		

B - 2SW Returns to Regions

	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	North America
1992-1996	18380	4689	42905	34450	7129	1868	117679
1999-2003	.	5067	29158	18559	3884	838	.

C - Management objectives for the NAC area

	Northern regions				Southern regions		
	Labrador	NF	Quebec	Gulf	Scotia-Fundy	US	
	2SW Conservation Limit				Average returns during base period 1992-1996		
Number of fish	34,746	4,022	29,446	30,430	7129	1868	
	2SW Conservation Limit				Increase relative to base period		
Total	98644				7,842	2,055	+10%
					8,911	2,336	+25%

Table 5.9.1.1. Nominal catches of salmon, West Greenland 1977–2003 (metric tonnes round fresh weight).

Year	Total	Quota
1977	1,420	1,191
1978	984	1,191
1979	1,395	1,191
1980	1,194	1,191
1981	1,264	1,265[2]
1982	1,077	1,253[2]
1983	310	1,191
1984	297	870
1985	864	852
1986	960	909
1987	966	935
1988	893	-[3]
1989	337	-[3]
1990	274	-[3]
1991	472	840
1992	237	258[4]
1993	0[1]	89[5]
1994	0[1]	137[5]
1995	83	77
1996	92	174[4]
1997	58	57
1998	11	20[6]
1999	19	20[6]
2000	21	20[6]
2001	43	114[7]
2002	9[10]	55[5,8,9,10]
2003	9[10]	20[6,8,10]

[1] The fishery was suspended.
[2] Quota corresponds to specific opening dates of the fishery.
[3] Quota for 1988-90 was 2,520 t with an opening date of 1 August and annual catches not to exceed the annual average (840 t) by more than 10%. Quota adjusted to 900 t in 1989 and 924 t in 1990 for later opening dates.
[4] Set by Greenland authorities.
[5] Quotas were bought out.
[6] Fishery restricted to catches used for internal consumption in Greenland.
[7] Calculated final quota in *ad hoc* management system.
[8] No factory landing allowed.
[9] Maximum allowable catch
[10] For the assessments the Working Group used higher catch figures for 2002 and 2003, based on information from the sampling programme.

Table 5.9.1.2. Distribution of nominal catches (metric tonnes) by Greenland vessels (1977-2003).

Year	NAFO Division							Tot West Greenland	East Greenland	Total Greenland
	1A	1B	1C	1D	1E	1F	NK			
1977	201	393	336	207	237	46	-	1,420	6	1,426
1978	81	349	245	186	113	10	-	984	8	992
1979	120	343	524	213	164	31	-	1,395	+	1,395
1980	52	275	404	231	158	74	-	1,194	+	1,194
1981	105	403	348	203	153	32	20	1,264	+	1,264
1982	111	330	239	136	167	76	18	1,077	+	1,077
1983	14	77	93	41	55	30	-	310	+	310
1984	33	116	64	4	43	32	5	297	+	297
1985	85	124	198	207	147	103	-	864	7	871
1986	46	73	128	203	233	277	-	960	19	979
1987	48	114	229	205	261	109	-	966	+	966
1988	24	100	213	191	198	167	-	893	4	897
1989	9	28	81	73	75	71	-	337	-	337
1990	4	20	132	54	16	48	-	274	-	274
1991	12	36	120	38	108	158	-	472	4	476
1992	-	4	23	5	75	130	-	237	5	242
1993[1]	-	-	-	-	-	-	-	-	-	-
1994[1]	-	-	-	-	-	-	-	-	-	-
1995	+	10	28	17	22	5	-	83	2	85
1996	+	+	50	8	23	10	-	92	+	92
1997	1	5	15	4	16	17	-	58	1	59
1998	1	2	2	4	1	2	-	11	-	11
1999	+	2	3	9	2	2	-	19	+	19
2000	+	+	1	7	+	13	-	21	-	21
2001	+	1	4	5	3	28	-	43	-	43
2002	+	+	2	4	1	2	-	9	-	9
2003	1	+	2	1	1	5	-	9	-	9

[1]) The fishery was suspended
+) Small catches <0.5 t
-) No catch

Table 5.9.2.1. Annual mean fork lengths (cm) and whole weights (kg) of Atlantic salmon caught at West Greenland, 1969-1992 and 1995-2003. NA = North America; E = Europe.

	Whole weight (kg)									Fork length (cm)			
	Sea age & origin									Sea age & origin			
	1SW		2SW		PS		All sea ages		TOTAL	1SW		2SW	
Year	NA	E	NA	E	NA	E	NA	EU		NA	E	NA	E
1969	3.12	3.76	5.48	5.80	-	5.13	3.25	3.86	3.58	65.0	68.7	77.0	80.3
1970	2.85	3.46	5.65	5.50	4.85	3.80	3.06	3.53	3.28	64.7	68.6	81.5	82.0
1971	2.65	3.38	4.30	-	-	-	2.68	3.38	3.14	62.8	67.7	72.0	-
1972	2.96	3.46	5.85	6.13	2.65	4.00	3.25	3.55	3.44	64.2	67.9	80.7	82.4
1973	3.28	4.54	9.47	10.00	-	-	3.83	4.66	4.18	64.5	70.4	88.0	96.0
1974	3.12	3.81	7.06	8.06	3.42	-	3.22	3.86	3.58	64.1	68.1	82.8	87.4
1975	2.58	3.42	6.12	6.23	2.60	4.80	2.65	3.48	3.12	61.7	67.5	80.6	82.2
1976	2.55	3.21	6.16	7.20	3.55	3.57	2.75	3.24	3.04	61.3	65.9	80.7	87.5
1977	-	-	-	-	-	-	-	-	-	-	-	-	-
1978	2.96	3.50	7.00	7.90	2.45	6.60	3.04	3.53	3.35	63.7	67.3	83.6	-
1979	2.98	3.50	7.06	7.60	3.92	6.33	3.12	3.56	3.34	63.4	66.7	81.6	85.3
1980	2.98	3.33	6.82	6.73	3.55	3.90	3.07	3.38	3.22	64.0	66.3	82.9	83.0
1981	2.77	3.48	6.93	7.42	4.12	3.65	2.89	3.58	3.17	62.3	66.7	82.8	84.5
1982	2.79	3.21	5.59	5.59	3.96	5.66	2.92	3.43	3.11	62.7	66.2	78.4	77.8
1983	2.54	3.01	5.79	5.86	3.37	3.55	3.02	3.14	3.10	61.5	65.4	81.1	81.5
1984	2.64	2.84	5.84	5.77	3.62	5.78	3.20	3.03	3.11	62.3	63.9	80.7	80.0
1985	2.50	2.89	5.42	5.45	5.20	4.97	2.72	3.01	2.87	61.2	64.3	78.9	78.6
1986	2.75	3.13	6.44	6.08	3.32	4.37	2.89	3.19	3.03	62.8	65.1	80.7	79.8
1987	3.00	3.20	6.36	5.96	4.69	4.70	3.10	3.26	3.16	64.2	65.6	81.2	79.6
1988	2.83	3.36	6.77	6.78	4.75	4.64	2.93	3.41	3.18	63.0	66.6	82.1	82.4
1989	2.56	2.86	5.87	5.77	4.23	5.83	2.77	2.99	2.87	62.3	64.5	80.8	81.0
1990	2.53	2.61	6.47	5.78	3.90	5.09	2.67	2.72	2.69	62.3	62.7	83.4	81.1
1991	2.42	2.54	5.82	6.23	5.15	5.09	2.57	2.79	2.65	61.6	62.7	80.6	82.2
1992	2.54	2.66	6.49	6.01	4.09	5.28	2.86	2.74	2.81	62.3	63.2	83.4	81.1
1993	-	-	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	2.37	2.67	6.09	5.88	3.71	4.98	2.45	2.75	2.56	61.0	63.2	81.3	81.0
1996	2.63	2.86	6.50	6.30	4.98	5.44	2.83	2.90	2.88	62.8	64.0	81.4	81.1
1997	2.57	2.82	7.95	6.11	4.82	6.90	2.63	2.84	2.71	62.3	63.6	85.7	84.0
1998	2.72	2.83	6.44	-	3.28	4.77	2.76	2.84	2.78	62.0	62.7	84.0	-
1999	3.02	3.03	7.59	-	4.20	-	3.09	3.03	3.08	63.8	63.5	86.6	-
2000	2.47	2.81	-	-	2.58	-	2.47	2.81	2.57	60.7	63.2	-	-
2001	2.89	3.03	6.76	5.96	4.41	4.06	2.95	3.09	3.00	63.1	63.7	81.7	79.1
2002	2.84	2.92	7.12	-	5.00	-	2.89	2.92	2.90	62.6	62.1	83.0	-
2003	2.94	3.08	8.82	5.58	4.04	-	3.02	3.10	3.04	63.0	64.4	86.1	78.3

Table 5.9.2.2. River age distribution (%) and mean river age for all North American origin salmon caught at West Greenland, 1968-1992 and 1995-2003.

	River age								Mean
Year	1	2	3	4	5	6	7	8	age
North American origin									
1968	0.3	19.6	40.4	21.3	16.2	2.2	0.0	0.0	3.4
1969	0.0	27.1	45.8	19.6	6.5	0.9	0.0	0.0	3.1
1970	0.0	58.1	25.6	11.6	2.3	2.3	0.0	0.0	2.6
1971	1.2	32.9	36.5	16.5	9.4	3.5	0.0	0.0	3.1
1972	0.8	31.9	51.4	10.6	3.9	1.2	0.4	0.0	2.9
1973	2.0	40.8	34.7	18.4	2.0	2.0	0.0	0.0	2.8
1974	0.9	36.0	36.6	12.0	11.7	2.6	0.3	0.0	3.1
1975	0.4	17.3	47.6	24.4	6.2	4.0	0.0	0.0	3.3
1976	0.7	42.6	30.6	14.6	10.9	0.4	0.4	0.0	3.0
1977	-	-	-	-	-	-	-	-	-
1978	2.7	31.9	43.0	13.6	6.0	2.0	0.9	0.0	3.0
1979	4.2	39.9	40.6	11.3	2.8	1.1	0.1	0.0	2.7
1980	5.9	36.3	32.9	16.3	7.9	0.7	0.1	0.0	2.9
1981	3.5	31.6	37.5	19.0	6.6	1.6	0.2	0.0	3.0
1982	1.4	37.7	38.3	15.9	5.8	0.7	0.0	0.2	2.9
1983	3.1	47.0	32.6	12.7	3.7	0.8	0.1	0.0	2.7
1984	4.8	51.7	28.9	9.0	4.6	0.9	0.2	0.0	2.6
1985	5.1	41.0	35.7	12.1	4.9	1.1	0.1	0.0	2.7
1986	2.0	39.9	33.4	20.0	4.0	0.7	0.0	0.0	2.9
1987	3.9	41.4	31.8	16.7	5.8	0.4	0.0	0.0	2.8
1988	5.2	31.3	30.8	20.9	10.7	1.0	0.1	0.0	3.0
1989	7.9	39.0	30.1	15.9	5.9	1.3	0.0	0.0	2.8
1990	8.8	45.3	30.7	12.1	2.4	0.5	0.1	0.0	2.6
1991	5.2	33.6	43.5	12.8	3.9	0.8	0.3	0.0	2.8
1992	6.7	36.7	34.1	19.1	3.2	0.3	0.0	0.0	2.8
1993	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-
1995	2.4	19.0	45.4	22.6	8.8	1.8	0.1	0.0	3.2
1996	1.7	18.7	46.0	23.8	8.8	0.8	0.1	0.0	3.2
1997	1.3	16.4	48.4	17.6	15.1	1.3	0.0	0.0	3.3
1998	4.0	35.1	37.0	16.5	6.1	1.1	0.1	0.0	2.9
1999	2.7	23.5	50.6	20.3	2.9	0.0	0.0	0.0	3.0
2000	3.2	26.6	38.6	23.4	7.6	0.6	0.0	0.0	3.1
2001	1.9	15.2	39.4	32.0	10.8	0.7	0.0	0.0	3.4
2002	0.6	26.7	44.8	16.9	10.1	0.9	0.0	0.0	3.1
2003	2.6	28.9	39.0	21.0	7.6	1.1	0.0	0.0	3.1
Mean	2.9	33.4	38.3	17.3	6.8	1.3	0.1	0.0	3.0

cont.

Table 5.9.2.2. cont. River age distribution (%) and mean river age for all European origin salmon caught at West Greenland, 1968-1992 and 1995-2003.

	River age								Mean
Year	1	2	3	4	5	6	7	8	age
European origin									
1968	21.6	60.3	15.2	2.7	0.3	0.0	0.0	0.0	2.0
1969	0.0	83.8	16.2	0.0	0.0	0.0	0.0	0.0	2.2
1970	0.0	90.4	9.6	0.0	0.0	0.0	0.0	0.0	2.1
1971	9.3	66.5	19.9	3.1	1.2	0.0	0.0	0.0	2.2
1972	11.0	71.2	16.7	1.0	0.1	0.0	0.0	0.0	2.1
1973	26.0	58.0	14.0	2.0	0.0	0.0	0.0	0.0	1.9
1974	22.9	68.2	8.5	0.4	0.0	0.0	0.0	0.0	1.9
1975	26.0	53.4	18.2	2.5	0.0	0.0	0.0	0.0	2.0
1976	23.5	67.2	8.4	0.6	0.3	0.0	0.0	0.0	1.9
1977	-	-	-	-	-	-	-	-	-
1978	26.2	65.4	8.2	0.2	0.0	0.0	0.0	0.0	1.8
1979	23.6	64.8	11.0	0.6	0.0	0.0	0.0	0.0	1.9
1980	25.8	56.9	14.7	2.5	0.2	0.0	0.0	0.0	1.9
1981	15.4	67.3	15.7	1.6	0.0	0.0	0.0	0.0	2.0
1982	15.6	56.1	23.5	4.2	0.7	0.0	0.0	0.0	2.2
1983	34.7	50.2	12.3	2.4	0.3	0.1	0.1	0.0	1.8
1984	22.7	56.9	15.2	4.2	0.9	0.2	0.0	0.0	2.0
1985	20.2	61.6	14.9	2.7	0.6	0.0	0.0	0.0	2.0
1986	19.5	62.5	15.1	2.7	0.2	0.0	0.0	0.0	2.0
1987	19.2	62.5	14.8	3.3	0.3	0.0	0.0	0.0	2.0
1988	18.4	61.6	17.3	2.3	0.5	0.0	0.0	0.0	2.1
1989	18.0	61.7	17.4	2.7	0.3	0.0	0.0	0.0	2.1
1990	15.9	56.3	23.0	4.4	0.2	0.2	0.0	0.0	2.2
1991	20.9	47.4	26.3	4.2	1.2	0.0	0.0	0.0	2.2
1992	11.8	38.2	42.8	6.5	0.6	0.0	0.0	0.0	2.5
1993	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-
1995	14.8	67.3	17.2	0.6	0.0	0.0	0.0	0.0	2.0
1996	15.8	71.1	12.2	0.9	0.0	0.0	0.0	0.0	2.0
1997	4.1	58.1	37.8	0.0	0.0	0.0	0.0	0.0	2.3
1998	28.6	60.0	7.6	2.9	0.0	1.0	0.0	0.0	1.9
1999	27.7	65.1	7.2	0.0	0.0	0.0	0.0	0.0	1.8
2000	36.5	46.7	13.1	2.9	0.7	0.0	0.0	0.0	1.8
2001	16.0	51.2	27.3	4.9	0.7	0.0	0.0	0.0	2.2
2002	10.1	65.2	18.4	6.3	0.0	0.0	0.0	0.0	2.2
2003	16.2	58.1	22.1	3.0	0.7	0.0	0.0	0.0	2.1
Mean	18.7	61.6	17.0	2.4	0.3	0.0	0.0	0.0	2.0

Table 5.9.2.3. Sea-age composition (%) of samples from commercial catches at West Greenland, 1985-2003.

Year	North American			European		
	1SW	2SW	Previous Spawners	1SW	2SW	Previous spawners
1985	92.5	7.2	0.3	95.0	4.7	0.4
1986	95.1	3.9	1.0	97.5	1.9	0.6
1987	96.3	2.3	1.4	98.0	1.7	0.3
1988	96.7	2.0	1.2	98.1	1.3	0.5
1989	92.3	5.2	2.4	95.5	3.8	0.6
1990	95.7	3.4	0.9	96.3	3.0	0.7
1991	95.6	4.1	0.4	93.4	6.5	0.2
1992	91.9	8.0	0.1	97.5	2.1	0.4
1993	-	-	-	-	-	-
1994	-	-	-	-	-	-
1995	96.8	1.5	1.7	97.3	2.2	0.5
1996	94.1	3.8	2.1	96.1	2.7	1.2
1997	98.2	0.6	1.2	99.3	0.4	0.4
1998[1]	96.8	0.5	2.7	99.4	0.0	0.6
1999[1]	96.8	1.2	2.0	100.0	0.0	0.0
2000[1]	97.4	0.0	2.6	100.0	0.0	0.0
2001	98.2	1.3	0.5	97.8	2.0	0.3
2002[1]	97.3	0.9	1.8	100.0	0.0	0.0
2003[1]	96.7	1.0	2.3	98.9	1.1	0.0

[1] Catches for local consumption only.

Table 5.9.3.1. Size of biological samples and percentage (by number) of North American and European salmon in research vessel catches at West Greenland (1969-82), from commercial samples (1978-92, 1995-97 and 2001), and from local consumption samples (1998-2000 and 2002-03).

		Sample size		Continent of origin (%)			
Source	Year	Length	Scales	NA	(95%CI)[1]	E	(95%CI)[1]
Research	1969	212	212	51	(57,44)	49	(56,43)
	1970	127	127	35	(43,26)	65	(75,57)
	1971	247	247	34	(40,28)	66	(72,50)
	1972	3,488	3,488	36	(37,34)	64	(66,63)
	1973	102	102	49	(59,39)	51	(61,41)
	1974	834	834	43	(46,39)	57	(61,54)
	1975	528	528	44	(48,40)	56	(60,52)
	1976	420	420	43	(48,38)	57	(62,52)
	1977	-	-	45	-	55	-
	1978[2]	606	606	38	(41,34)	62	(66,59)
	1978[3]	49	49	55	(69,41)	45	(59,31)
	1979	328	328	47	(52,41)	53	(59,48)
	1980	617	617	58	(62,54)	42	(46,38)
	1982	443	443	47	(52,43)	53	(58,48)
Commercial	1978	392	392	52	(57,47)	48	(53,43)
	1979	1,653	1,653	50	(52,48)	50	(52,48)
	1980	978	978	48	(51,45)	52	(55,49)
	1981	4,570	1,930	59	(61,58)	41	(42,39)
	1982	1,949	414	62	(64,60)	38	(40,36)
	1983	4,896	1,815	40	(41,38)	60	(62,59)
	1984	7,282	2,720	50	(53,47)	50	(53,47)
	1985	13,272	2,917	50	(53,46)	50	(54,47)
	1986	20,394	3,509	57	(66,48)	43	(52,34)
	1987	13,425	2,960	59	(63,54)	41	(46,37)
	1988	11,047	2,562	43	(49,38)	57	(62,51)
	1989	9,366	2,227	56	(60,52)	44	(48,40)
	1990	4,897	1,208	75	(79,70)	25	(30,21)
	1991	5,005	1,347	65	(69,61)	35	(39,31)
	1992	6,348	1,648	54	(57,50)	46	(50,43)
	1995	2,045	2,045	68	(72,65)	32	(35,28)
	1996	3,341	1,297	73	(76,71)	27	(29,24)
	1997	794	282	80	(84,75)	20	(25,16)
Local cons.	1998	540	406	79	(84,73)	21	(27,16)
	1999	532	532	90	(97,84)	10	(16,3)
	2000	491	491	70	[4]	30	[4]
Commercial	2001	2,896	1,718	69	(72,67)	31	(33,29)
Local cons.	2002	1,326	501	68	[4]	33	[4]
	2003	1,823	1,823	68	[5]	32	[5]

[1] CI – confidence interval calculated by method of Pella and Robertson (1979) for 1984 -86 and by binomial for the others, except 1997 when percentages extrapolated.

[2] During Fishery.

[3] Research samples after fishery closed.

[4] Determined by genetic analysis to be 100% correct

[5] Determined by genetic analysis only

Table 5.9.3.2. The weighted percentages and numbers of North American and European Atlantic salmon caught at West Greenland 1982-1992 and 1995-2003. Numbers are rounded to the nearest hundred fish.

	Percentages weighted by catch in numbers		Numbers of salmon caught	
Year	NA	E	NA	E
1982	57	43	192,200	143,800
1983	40	60	39,500	60,500
1984	54	46	48,800	41,200
1985	47	53	143,500	161,500
1986	59	41	188,300	131,900
1987	59	41	171,900	126,400
1988	43	57	125,500	168,800
1989	55	45	65,000	52,700
1990	74	26	62,400	21,700
1991	63	37	111,700	65,400
1992	55	45	46,900	38,500
1993	-	-	-	-
1994	-	-	-	-
1995	67	33	21,400	10,700
1996	70	30	22,400	9,700
1997	85	15	18,000	3,300
1998	79	21	3,100	900
1999	91	9	5,700	600
2000	65	35	5,100	2,700
2001	67	33	9,400	4,700
2002	69	31	2,300	1,000
2003	64	36	2,600	1,400

Table 5.10.1.1. Reference number, formula, and brief description of the nested models included in the approach to modelling lagged spawner index and PFA_{NA} encompassing a possible phase shift in relative recruitment per spawner.

Number	Function $Ln(PFA_{NA}) =$	Model description
0	$\mu + \xi$	A single mean PFA_{NA}; No phases or lagged spawner index variable
1	$\alpha + \gamma * Ln(LS_{NA}) + \xi$	A single regression of PFA_{NA} on lagged spawner index
2	$\beta * Ph + \xi$	Two means of PFA_{NA} for the two phases; no lagged spawner index variable
3,4,5	$\alpha + \beta * Ph + (\gamma + \delta * Ph) * Ln(LS_{NA}) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with possible variations in slopes and intercepts
6	$\alpha + \beta * Ph + Ln(LS) + \xi$	Two regressions of PFA_{NA} on lagged spawner index with intercept trough the origin
PFA_{NA} = PFA for North America (1977 to 2002) *LS_{NA} = Lagged spawner index excluding Labrador (1977 to 2002)* *Ph = Phase (indicator variable representing two time periods)* *μ = mean value* *$\alpha, \beta, \gamma, \delta$ = coefficients of the slope and intercept variables* *ξ = residual error, normal* *phase shift periods: ranging from 1977–1985 and 1986–2002 to 1977–1993 and 1994–2002*		

Table 5.10.1.2. Summary of model and break year selections for PFA prediction for 2004. Numbers are based on AIC_c selections from 10,000 simulations. Break year refers to last year in high phase.

	Models								
Break	Mean by phase		Intercept at origin – slope by phase		Intercept and slope by phase		By phase		By
Year	High	Low	High	Low	High	Low	High	Low	Year
1988				898	28	1123	28	2021	2049
1989				2304	20	930	20	3234	3254
1990				115		27		142	142
1991		2102		810		228		3140	3140
1992		1168		210		37		1415	1415
Total	0	3270	0	4337	48	2345			10000
By model		3270		4337		2393			
By phase							48	9952	

Table 5.12.1. Number of salmon returning to home waters provided no fishery took place at Greenland 1994-2003. The average number of potentially returning salmon per ton caught in Greenland is also given.

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Nominal catch at Greenland (tons) [1]:	137.0	82.7	92.1	58.2	11.1	19.0	20.5	42.5	9.8	12.3
Proportion of NA fish in catch (PropNA):	0.540	0.670	0.732	0.850	0.785	0.910	0.650	0.670	0.690	0.640
Proportion of EU fish in catch (PropEU):	0.460	0.330	0.268	0.150	0.215	0.090	0.350	0.330	0.310	0.360
Mean weight, NA fish, all sea ages (kg):	2.655	2.450	2.830	2.630	2.760	3.090	2.470	2.950	2.890	3.020
Mean weight, EU fish, all sea ages (kg):	2.745	2.750	2.900	2.840	2.840	3.030	2.810	3.090	2.920	3.100
Mean weight of all sea ages (NA+EU fish):	2.696	2.549	2.849	2.662	2.777	3.085	2.589	2.996	2.899	3.049
Proportion of 1SW NA-fish in catch:	0.919	0.968	0.941	0.982	0.968	0.968	0.974	0.982	0.973	0.967
Catch of 1SW NA fish:	25607	21892	22417	18471	3056	5416	5254	9479	2269	2523
Catch of 1SW EU fish:	21098	9606	8009	3019	813	546	2487	4457	1009	1383
Natural mortality during migration to NA:	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Natural mortality during migration to EU:	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Additional fish if no fishery at Greenland:										
2SW fish returning to NA (numbers):	**18410**	**15739**	**16116**	**13279**	**2197**	**3894**	**3778**	**6815**	**1632**	**1814**
Percent of conservation limit [2]:	**12.1**	**10.3**	**10.6**	**8.7**	**1.4**	**2.6**	**2.5**	**4.5**	**1.1**	**1.2**
2SW fish returning to EU (numbers):	**16597**	**7557**	**6300**	**2375**	**640**	**430**	**1956**	**3506**	**794**	**1088**
Percent of conservation limit [3]:	**6.2**	**2.8**	**2.4**	**0.9**	**0.2**	**0.2**	**0.7**	**1.3**	**0.3**	**0.4**

[1] Figure for 1994 correspond to calculated quotas. Figures for 2002 and 2003 were adjusted by the WG

[2] Conservation limit for NA: 152,548

[3] Conservation limit for Southern Europe: 267,894

Average number of salmon potentially returning to home waters per ton caught in Greenland:	
2SW fish returning to NA (numbers per ton, 10 year average):	**172**
2SW fish returning to EU (numbers per ton, 10 year average):	**85**

Figure 5.2.1. Average lagged spawners in the six regions of North America for the PFA years 1998 to 2002 and the 2SW spawner requirement in each region expressed as a proportion of the total for North America.

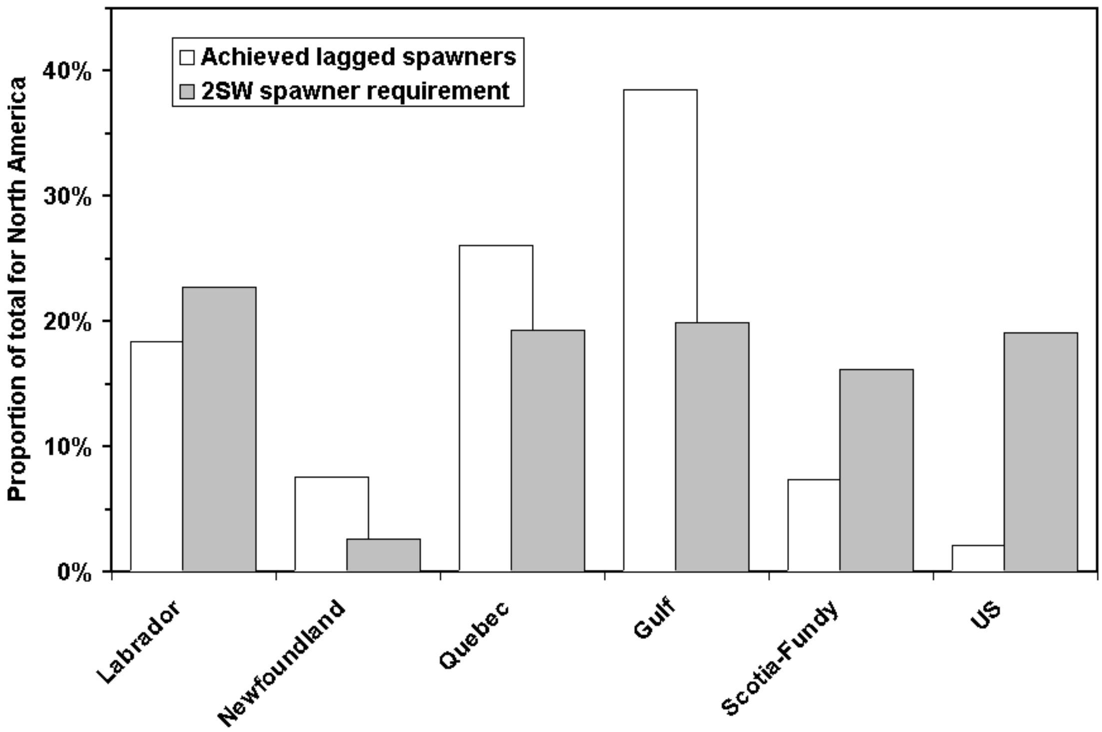
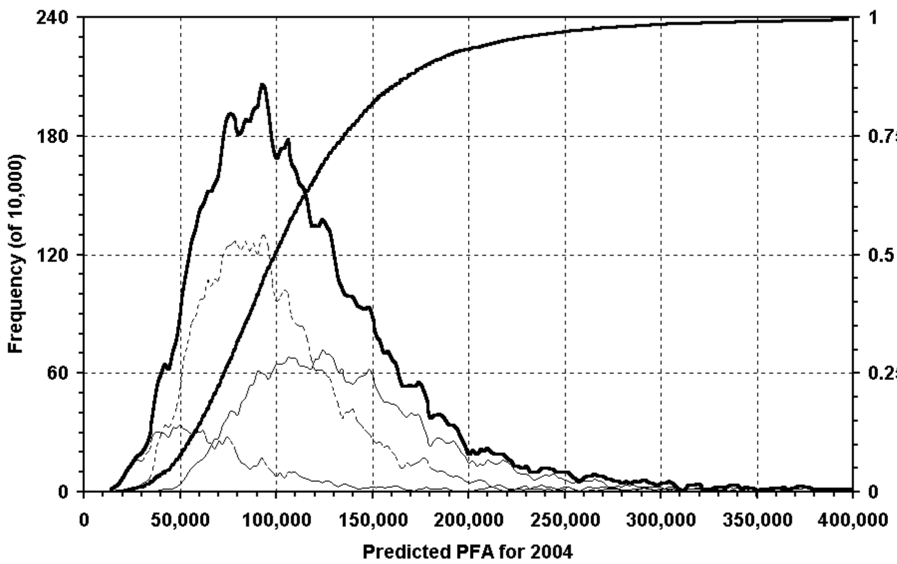


Figure 5.4.1. PFA_{NA} forecast estimate distribution for the year 2004 non-maturing 1SW salmon.



Percentile	Estimate
5	45,148
10	54,857
15	61,901
20	68,289
25	73,642
30	79,073
35	84,538
40	89,519
45	94,471
50	100,357
55	106,096
60	112,263
65	119,408
70	126,784
75	136,006

Figure 5.8.1. Revised PFA_{NA} estimated distribution for the 2003 PFA year using the updated data and nested model selection approach of 2004 (upper panel), and PFA forecast distribution using the previous year's formulation (lower panel).

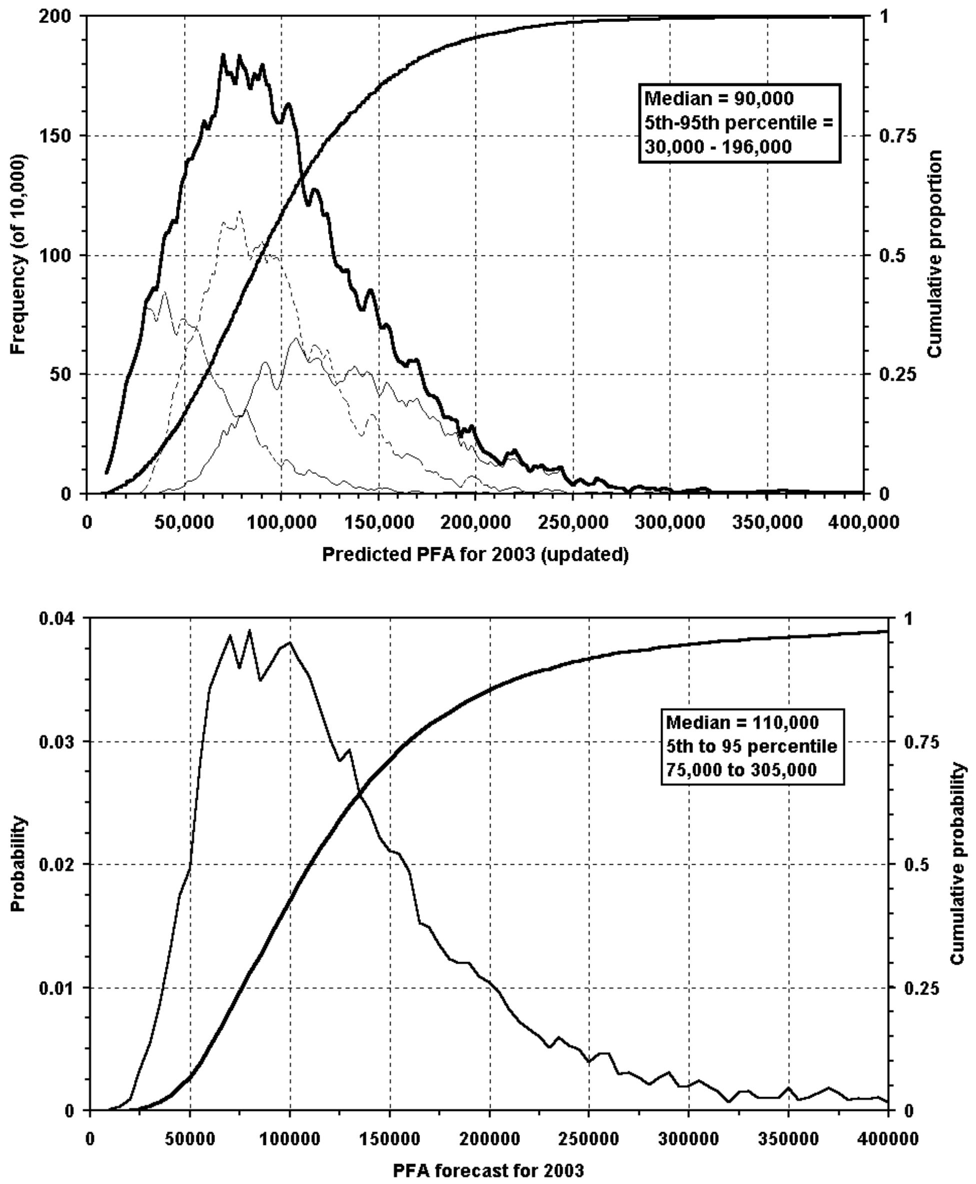


Figure 5.9.1.1. West Greenland NAFO divisions.

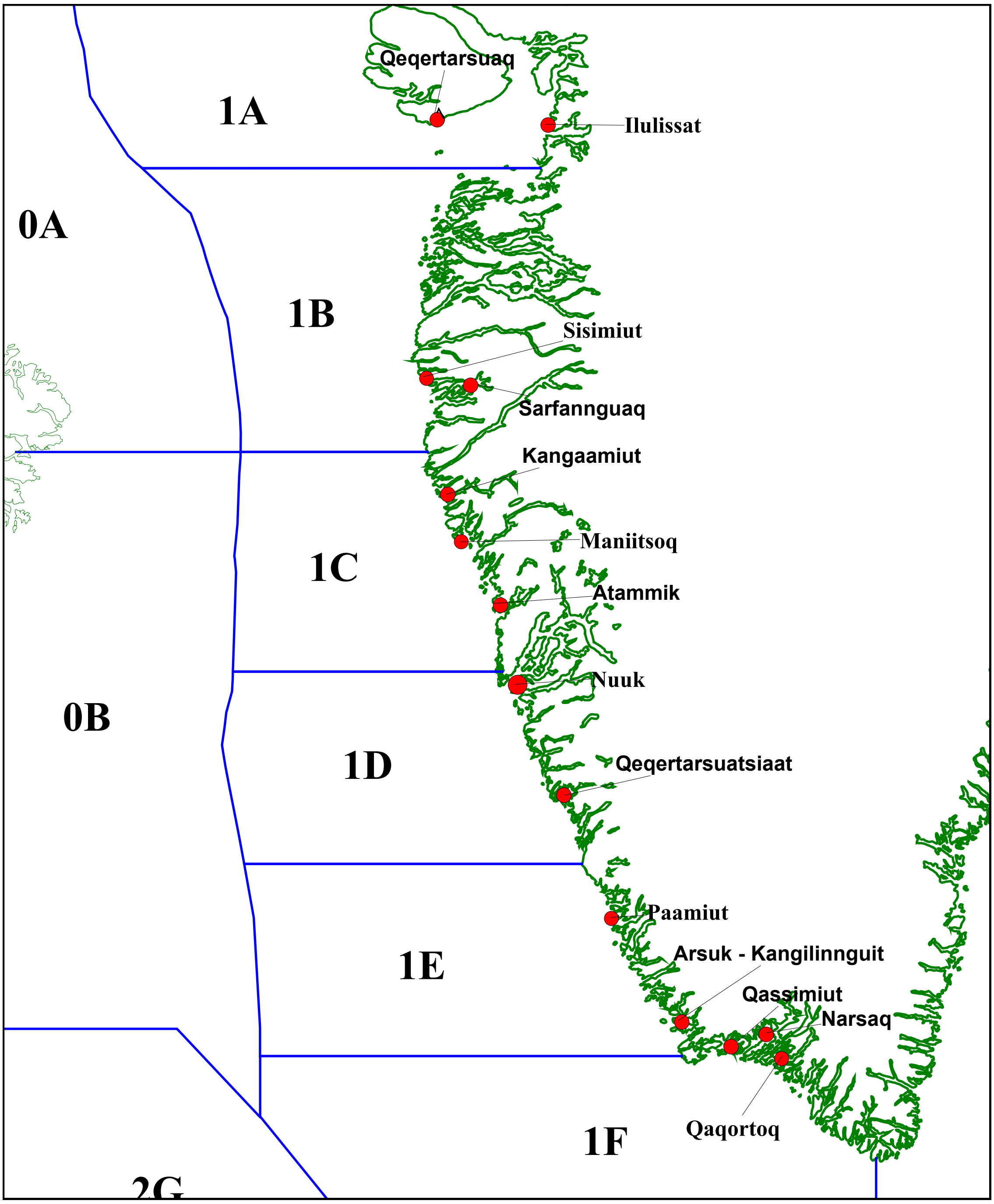


Figure 5.9.3.1. Number of North American and European salmon caught at West Greenland 1982-1992 and 1995-2003.

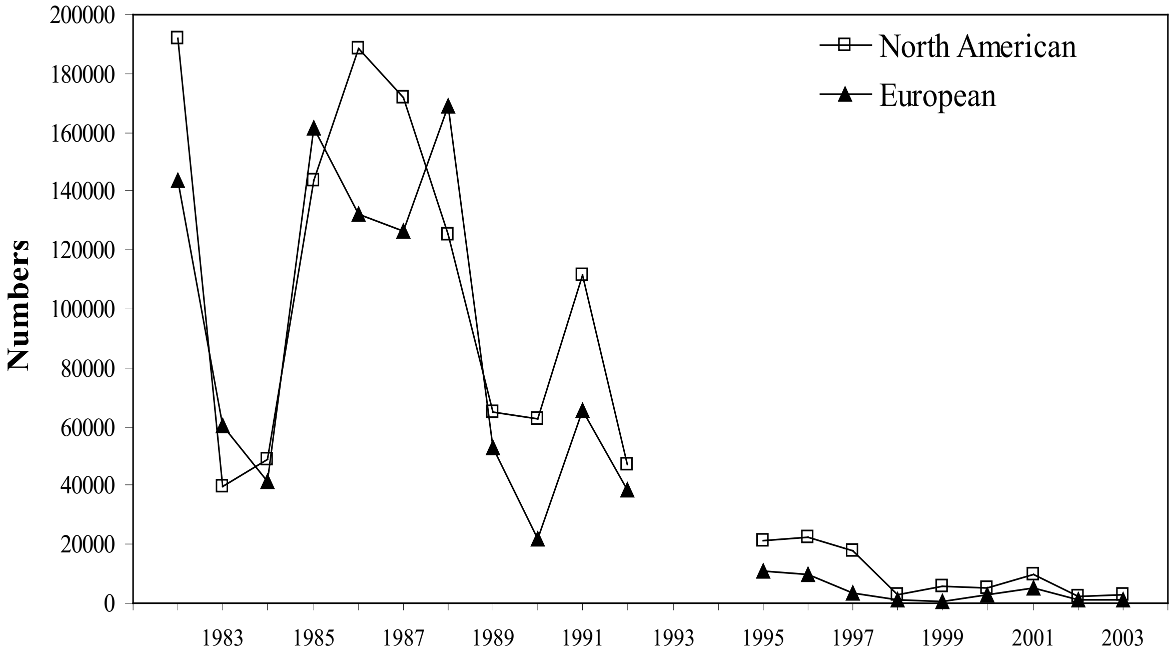


Figure 5.10.1.1. **PFA (mid-point) and lagged spawner (mid-point) association for the NAC area showing the sequence from 1977 to 2002 (upper panel) and the relative change of the Ln(PFA) (recruit) to Ln(LS) (lagged spawner index) over the time-series (lower panel).**

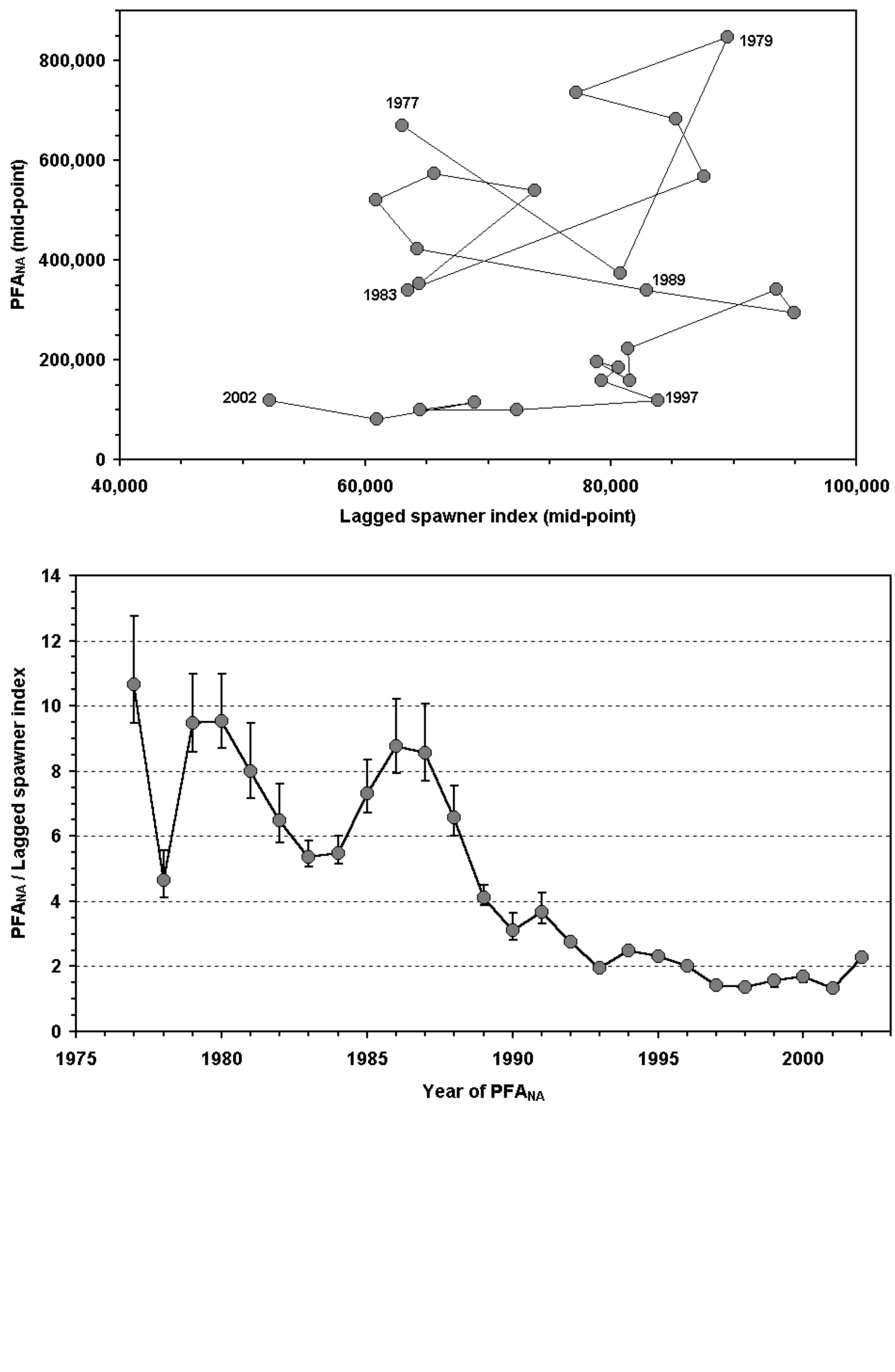
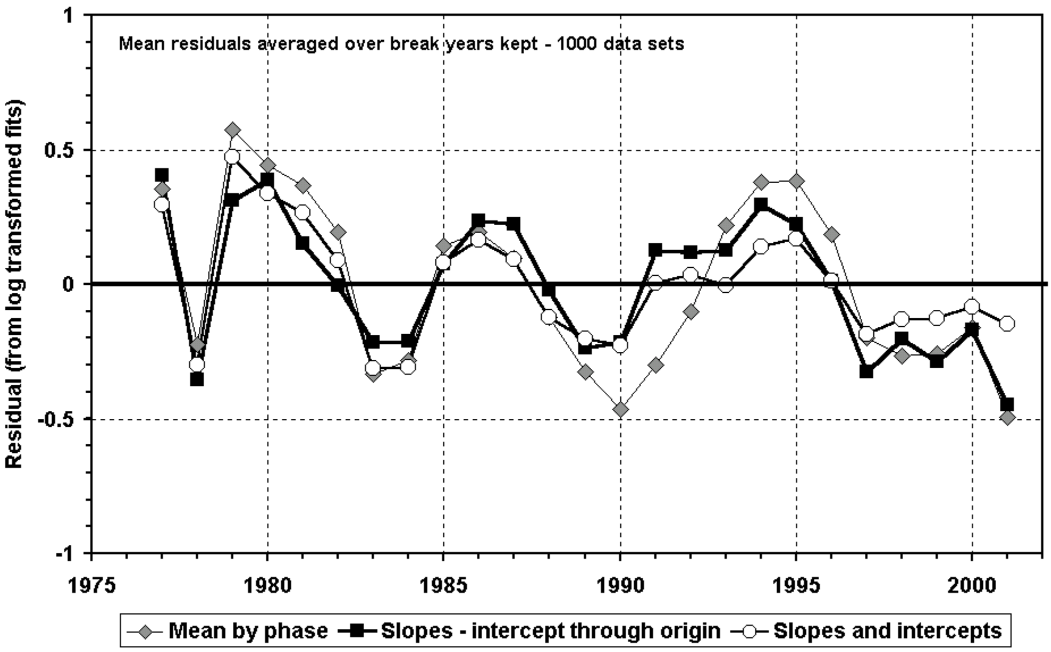


Figure 5.10.1.2. Mean residuals from the best model fits to 1,000 data sets for each of the model groups retained. Mean by phase refers to model predicting PFA based on average abundance in two phases. Slopes-intercept through origin refers to a model with lagged spawners proportional to PFA with the intercept set through the origin. Slopes and intercepts refer to models that allow the slope, intercept or both to vary with phase.



List of Participants

List of Participants

* Denotes Head of Delegation

CANADA

*Mr Guy Beaupré	Representative Department of Fisheries and Oceans, Ottawa, Ontario
Mr Pierre Tremblay	Representative Sainte-Foy, Quebec
Mr Jacque Robichaud	President of NASCO Ottawa, Ontario
Mrs Julia Barrow	Department of Fisheries and Oceans, Ottawa, Ontario
Mr Peter Cronin	New Brunswick Department of Natural Resources and Energy, Fredericton, New Brunswick
Mr Murray Hill	Department of Fisheries, Pictou, Nova Scotia
Mr Maurice Levesque	Department of Fisheries and Oceans, New Brunswick
Mr Brian Meaney	Department of Fisheries and Aquaculture, St John’s, Newfoundland
Mr David Meerburg	Department of Fisheries and Oceans, Ottawa, Ontario
Mr Rex Porter	Department of Fisheries and Oceans, St John’s, Newfoundland
Ms Sue Scott	Atlantic Salmon Federation, New Brunswick
Mr Berkley Slade	Department of Fisheries and Oceans, St John's, Newfoundland
Mr William Taylor	Atlantic Salmon Federation, St Andrews, New Brunswick
Mr Serge Tremblay	Societe de la Faune et des parcs du Quebec, Quebec
Mr Tim Young	Department of Fisheries and Oceans, Ottawa, Ontario

DENMARK (IN RESPECT OF THE FAROE ISLANDS AND GREENLAND)

*Mr Kaj P Mortensen	Representative Ministry of Foreign Affairs, Faroe Islands

Mr Emanuel Rosing	Representative Greenland Home Rule, Nuuk, Greenland
Ms Ulla Wang	Representative Ministry of Fisheries and Maritime Affairs, Faroe Islands
Dr Jan Arge Jacobsen	Faroese Fisheries Laboratory, Torshavn, Faroe Islands
Mr Per Kanneworff	Greenland Institute of Natural Resources, Nuuk, Greenland
Ms Ane Skak	Department of Fisheries and Hunting, Nuuk, Greenland

EUROPEAN UNION

*Mr Ole Tougaard	Representative European Commission, Brussels, Belgium
Mr Andrew Thomson	Representative European Commission, Brussels, Belgium
Mr Bo Bengtsson	National Board of Fisheries, Gothenburg, Sweden
Ms Carmen Beraldi	Secretaria General de Pesca, Madrid, Spain
Dr Malcolm Beveridge	Fisheries Research Services, Pitlochry, UK
Ms Hazel Campbell	Department of Culture, Arts and Leisure, Belfast, UK
Mr Richard Cowan	DEFRA, London, UK
Mr David Dunkley	SEERAD, Edinburgh, UK
Dr Jaakko Erkinaro	Finnish Game and Fisheries Research Institute, Oulu, Finland
Mr Lal Faherty	Western Regional Fisheries Board, Galway, Ireland
Dr Ulrich Fassbender	Federal Ministry of Consumer Protection, Food & Agriculture, Bonn, Germany
Dr Paddy Gargan	Central Fisheries Board, Dublin, Ireland
Mr Jose Luis Gonzalez Serrano	Secretaria General de Pesca Maritima, Madrid, Spain
Mr Michael Guilfoyle	Department of Communications, Marine and Natural Resources, Dublin, Ireland

Ms Eija Kirjavainen	Ministry of Agriculture and Forestry, Department of Fisheries and Game, Helsinki, Finland
Dr Guy Mawle	Environment Agency, Bristol, UK
Mr Pentti Munne	Ministry of Agriculture and Forestry, Department of Fisheries and Game, Helsinki, Finland
Mr John O'Connor	Central Fisheries Board, Dublin, Ireland
Mr George O'Doherty	Department of Communications, Marine and Natural Resources, Dublin, Ireland
Dr Niall Ó Maoileidigh	Marine Institute, Dublin, Ireland
Mr Ted Potter	Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, UK
Mr Frank Sheridan	Department of Communications, Marine and Natural Resources, Dublin, Ireland
Mr Tico Söderlindh	Ministry of Agriculture, Food and Consumer Affairs, Stockholm, Sweden
Mr Andrew Wallace	Association of Salmon Fishery Boards, Edinburgh, UK
Dr Ken Whelan	Marine Institute, Newport, Ireland

ICELAND

*Mr Guðmundur B Helgason	Representative Ministry of Agriculture, Reykjavik
Mr Arni Isaksson	Representative Directorate of Freshwater Fisheries, Reykjavik
Mr Gudmundur Eiriksson	Icelandic Ambassador to Canada, Ottawa
Mr Gudni Gudbergsson	Institute of Freshwater Fisheries, Reykjavik
Dr Sigurdur Gudjonsson	Institute of Freshwater Fisheries, Reykjavik
Mr Ingimar Johannsson	Ministry of Agriculture, Reykjavik

NORWAY

*Mr Steinar Hermansen	Representative The Royal Ministry of Environment, Oslo

Mr Arne Eggereide	Representative Directorate for Nature Management, Trondheim
Ms Eva Espeland	Representative The Royal Ministry of Environment, Oslo
Mr Raoul Bierach	Directorate for Nature Management, Trondheim
Ms Maren Esmark	WWF Norway, Oslo
Dr Lars Petter Hansen	Norwegian Institute for Nature Research, Oslo

RUSSIAN FEDERATION

*Dr Boris Prischepa	Representative Murmanrybvod, Murmansk
Dr Svetlana Krylova	Representative Murmanrybvod, Murmansk
Mr Alexej Grushko	State Committee for Fisheries, Moscow
Ms Elena Samoylova	PINRO, Murmansk
Dr Igor Studenov	SevPINRO, Archangel
Dr Alexander Zubchenko	PINRO, Murmansk

USA

*Ms Patricia Kurkul	Representative NOAA Fisheries, Gloucester, Massachusetts
Mr Stephen Gephard	Representative Department of Environmental Protection, Inland Fisheries Division, Old Lyme, Connecticut
Mr George Lapointe	Representative Maine Department of Marine Resources, Augusta, Maine
Mr Edward Baum	Atlantic Salmon Unlimited, Hermon, Maine
Ms Kimberly Blankenbeker	National Marine Fisheries Service, Silver Spring, Maryland
Mr Scott Burns	World Wildlife Fund (USA), Washington DC
Mr Stephen Chase	Atlantic Salmon Federation, St Andrews, New Brunswick

Ms Mary Colligan	National Marine Fisheries Service, Gloucester, Massachusetts
Ms Kim Davis	World Wildlife Fund (USA), Washington DC
Mr Patrick Keliher	Maine Atlantic Salmon Commission, Maine
Mr Pasquale Scida	National Marine Fisheries Service, Gloucester, Massachusetts
Mr Timothy Sheehan	NOAA Fisheries, Woods Hole, Massachusetts
Mr Stetson Tinkham	US Department of State, Washington DC
Mr John Ward	National Marine Fisheries Service, Silver Spring, Maryland

STATES NOT PARTIES TO THE CONVENTION

Mr Yann Becouarn	France (in respect of St Pierre and Miquelon)

INTER-GOVERNMENT ORGANIZATIONS

Dr Walter Crozier	Chairman, ICES Working Group on North Atlantic Salmon, Bushmills, Northern Ireland
Dr Walter Ranke	International Baltic Sea Fishery Commission, Warsaw, Poland
Ms Ulla Wang	North Atlantic Marine Mammal Commission, Tromsø, Norway

NON-GOVERNMENT ORGANIZATIONS

Major General Seymour Monro Dr Richard Shelton	Atlantic Salmon Trust, UK
Dr Frederic Mazeaud	AIDSA
Mr Gunnar Noren	Coalition Clean Baltic, Sweden
Mr Chris Poupard	European Anglers Alliance
Mr Noel Carr	Federation of Irish Salmon and Sea-Trout Anglers, Ireland
Mr Patrick Martin	Fondation Saumon, France
Mr John Gregory	Institute of Fisheries Management, UK

Mr Patrick Byrne	National Anglers Representative Association, Ireland
Mr Bjornulf Kristiansen	Norges Bondelag (Norwegian Farmers Union), Norway
Mr Aage Wold	Norskelakseelver (Norwegian Salmon Rivers), Norway
Mr Paul Knight	Salmon and Trout Association, UK
Mr Ian Calcott	Scottish Anglers National Association, UK

SECRETARIAT

Dr Malcolm Windsor	Secretary
Dr Peter Hutchinson	Assistant Secretary
Miss Margaret Nicolson	PA to the Secretary
Mrs Sophie Ross	PA

Support Staff

Mr Eirikur Beck	Directorate of Freshwater Fisheries, Reykjavik
Ms Gudlaug Jónasdóttir	Ministry of Agriculture, Reykjavik
Ms Sigridur Jónsdóttir	Ministry of Agriculture, Reykjavik
Mr Sumarlidi Oskarsson	Directorate of Freshwater Fisheries, Reykjavik