

SAG(10)7

Report of the Meeting of the Scientific Advisory Group of the International Atlantic Salmon Research Board Le Château Frontenac, Québec City, Canada Sunday, 30 May, 2010

1. Opening of the meeting

- 1.1 The Chairman, Dr Lars Petter Hansen (Norway), opened the meeting and welcomed participants to Québec City. He referred to the significant progress that had been made in implementing the SALSEA Programme since the Group's last meeting.
- 1.2 A list of participants is contained in Annex 1.

2. Adoption of the agenda

- 2.1 The SAG adopted its agenda, SAG(10)6 (Annex 2), after changing the wording of agenda item 5 to 'Review of Applications for Potential Support by the Board'.

3. Election of Officers

- 3.1 The SAG elected Mr Tim Sheehan as its Chairman for a period of two years commencing from the close of the Twenty-Seventh Annual Meeting.

4. Review of the updated inventory of research

- 4.1 An overview of the updated inventory of research relating to salmon mortality in the sea, SAG(09)2, was presented. For 2010, 44 ongoing projects had been included in the inventory with an annual expenditure of approximately £6.1 million. Ten new projects had been included since the last update.
- 4.2 Last year the SAG had received a report, SAG(09)10, from an Inventory Review Group which had been established to identify areas where there may be merit in encouraging improved coordination of research and to highlight gaps in the research programme where more work might significantly benefit the SALSEA Programme and which might be considered for funding by the Board. This Review Group had suggested that improvements might be made to the presentation of the inventory of marine research that would facilitate access to the information and future reviews, although no specific proposals for changes had been agreed. The Assistant Secretary introduced document SAG(10)3. Following consultations with the Chairman of the Sub-Group, Mr Ted Potter, two particular issues with the current presentation of the inventory had been identified. First, it was difficult to track projects over time because the ongoing projects listed in the inventory are renumbered each year and completed projects have no reference numbers. Secondly, only limited information was provided on completed projects, making it difficult to take account of this work in on-going research planning. A possible revised format for the inventory was

contained in document SAG(10)3 using the projects for Canada as an example. In this revised format, all ongoing and completed projects had been allocated the reference number first assigned to them when initially included in the inventory, and the same information was presented for completed and ongoing projects. The SAG also considered the merits of maintaining the inventory in spreadsheet or database software and options for updating the information including via the IASRB's website.

- 4.3 The SAG recommended that the inventory be presented in the format used in document SAG(10)3 and agreed that Table 4 should be made available in spreadsheet format so as to allow filtering of information. However, the full project descriptions in the Annexes to the inventory would be retained in Word format. The SAG agreed that the Secretariat should make the necessary changes and that members of the SAG should then be given an opportunity to review the information and to provide any necessary amendments to the Secretariat by 31 July. Thereafter, the inventory should be made available on the Board's website in the usual manner. The SAG would review the need for additional changes to the presentation of the inventory at its next meeting, including the desirability of including keywords to further assist access to the information and the desirability and costs of maintaining the inventory as a web-based database.

5. Review of Applications for Potential Support by the Board

- 5.1 At its last meeting, the SAG had recognised that the Board's guidance on applications for project funding, ICR(03)14, did not reflect the fact that some applications sought only an endorsement from the Board and that these did not need full project applications. The SAG had, therefore, recommended that the IASRB Chairman and the Assistant Secretary develop a revised guidance document for consideration by the SAG. This work had been completed inter-sessionally in correspondence with SAG members and had resulted in the development of 'Guidelines on Submitting Proposals for Research, Workshops, Symposia and Other Activities for Support by the IASRB', ICR(09)10. These guidelines had been made available on the Board's website.
- 5.2 Since last year, one new proposal entitled 'Research on Migration Timing of Salmon in the Loire/Allier, France', had been submitted to the Board by the Conservatoire National du Saumon Sauvage (CNSS), SAG(10)4 (Annex 3). The population reaching the spawning grounds 850-1,000km from the sea is almost exclusively MSW fish which because of changes in the river temperature will only reach the spawning grounds if they arrive in the estuary early in the year. However, information suggests that there has been a delay in arrival at the spawning grounds of about 1.5 days per year over the last 30 years, probably due to delayed arrival from the sea. There may also be problems for smolts migrating downstream because of increasing river temperatures. The proposal sought feedback on the value of research programmes on factors influencing the timing and migration of salmon (smolts and adults) and assistance in identifying laboratories or research organizations that are involved in research on migration timing that might wish to collaborate with CNSS in analyzing data obtained from the Allier. The SAG recognised the importance of research on salmon populations at the southern limit of their distribution range and noted with interest the proposal to use genetic techniques to investigate differences in the optimum temperatures for, and temperature sensitivities of, different sub-populations of salmon. The SAG suggested that CNSS may wish to contact scientists working on the Connecticut River in the USA and the Chairman of the ICES

Study Group on the Identification of Biological Characteristics for Use as Predictors of Salmon Abundance (SGBICEPS), Mr Ian Russell, CEFAS, England, with a view to identifying researchers working on this topic in other countries.

6. Progress with Implementing the SALSEA Programme

(a) Report on the SALSEA-Merge Project

6.1 Professor Ken Whelan described the four major marine components of the SALSEA Programme (SALSEA Merge, SALSEA North America, SALSEA West Greenland and SALSEA Irminger) and reported in detail on progress with the SALSEA Merge project in the North-East Atlantic. The overall objective of SALSEA-Merge is, by merging genetic and ecological investigations, to advance understanding of stock specific migration and distribution patterns and overall ecology of the marine life of Atlantic salmon and gain an insight into the factors responsible for recent significant increases in marine mortality. He indicated that there are 20 organizations in the SALSEA Merge consortium and that a number of coordination issues had arisen. He also referred to the significant contribution made to the project by its non-contracting partners. He then outlined the progress made in each of the work packages as follows:

Work Package 1: A molecular genetic tool to determine the region or river of origin of European Atlantic salmon captured at sea, using both historical and newly collected tissues, has been developed. A baseline has been established for 225 rivers (almost 500 sample sites) and approximately 23,000 individuals have been collected and screened. The final database will encompass approximately 500 rivers.

Work package 2: Tissue samples from 1,800 post-smolts from surveys undertaken prior to the SALSEA-Merge project have been identified for genetic stock identification. During marine surveys conducted in 2008 and 2009 by Irish, Faroese and Norwegian vessels, over 1,700 post-smolts and 37 adult salmon had been captured.

Work package 3: Preliminary analyses of samples from the marine surveys had resulted in 237 fish being assigned to country of origin and 118 to river of origin. Analyses of 2,700 archival samples and 1,800 samples from the marine surveys are underway using supercomputers.

Work package 4: Training of researchers from partner laboratories was completed in the use of digital scale reading techniques and new imaging and a digital scale library has been established. Scales dating back to the 1920s have been obtained and preliminary analyses of this material are showing some interesting changes in growth patterns. To date, 3,000 of 15,000 samples have been analysed. Stomach samples from 570 salmon and more than 900 other pelagic species (mainly mackerel) from the 2008 expeditions have been analysed and analysis of the 2009 samples is underway.

Work package 5: Development of a migration model is progressing and a hydrographic particle drift model has been completed and tested.

Work Package 6: A website has been established with web pages providing a description of the scientific work completed and planned under the relevant SALSEA work packages.

- 6.2 Professor Whelan indicated that a large amount of material had been collected for which no funds were available for their analysis (including material for isotope and lipid analyses, plankton samples and samples for diseases and parasites). The project Steering Group had agreed that this material would in the first instance be offered for analysis to members of the consortium and thereafter be advertised on the IASRB website on the condition that the material would only be made available to researchers with funds to conduct the analyses and that the work would be completed in an agreed timescale and published. The Steering Group had also agreed on an initial sequence for publishing the findings arising from the project. He also indicated that there would be a need to consider carefully what would happen to the genetic and biological databases of information developed during the project and there would be a need to consider fund raising to allow the data to be maintained, updated and used in the future.
- 6.3 He advised the SAG that blind tests will be carried out to confirm the accuracy of the genetic assignments. In response to a comment from the European Commission, he indicated that there had been some issues with reporting following a change in the project's coordinator but a comprehensive report on the project's progress had been made in February 2010.

(b) Report on SALSEA North America

- 6.4 Mr Dave Reddin reported on SALSEA North America. A research cruise had been completed in the Labrador Sea between 55^o N and 58^o N in September 2009. The objectives included to: sample the ecosystem components within the upper 20 m of the water column; to relate salmon geographic distribution to oceanographic characteristics; to provide information on the role of salmon within the pelagic ecosystem; and, to collect oceanographic data to define the habitat of the salmon post-smolts and other species. In spite of poor weather and other causes of lost ship time (fishing occurred on 8 out of 24 days), the survey objectives of sampling the ecosystem components within the upper 20 m of the water column were achieved. A total of 92 salmon were caught (8 in trawls and 84 in gill nets) and the fish were intensively sampled. The survey had confirmed that salmon could be caught in the surface trawl at night and had highlighted the high productivity and species diversity of the upper portion of the water column in the Labrador Sea. No salmon were caught in sets on the shelf area influenced by the cold Labrador Current. It was noted that the focus of previous surveys had been on demersal stocks and the current survey had generated considerable interest among scientists working on other species due to the high productivity and number of other species. Similarly, there had been great interest in the findings from SALSEA Merge from scientists working on other pelagic species and it was noted that in future it would be important to ensure that salmon scientists are involved in planning surveys for pelagic species.

(c) Report on SALSEA West Greenland

- 6.5 A report on the SALSEA West Greenland programme was presented by Mr Rory Saunders. SALSEA West Greenland is designed to enhance the long-term baseline

sampling and integrate with the coordinated marine surveys (SALSEA Merge and SALSEA North America) to provide data for investigating hypotheses on the causal mechanisms driving marine mortality. The baseline sampling in 2009 involved 7 samplers (2 from US; 1 from Ireland; 1 from Canada; 1 from England and Wales; 1 from Scotland; and 1 from Denmark) working in 3 of the 6 NAFO divisions. In total, 1,683 salmon were inspected representing 22% of the reported landings by weight. In addition tags had been recovered including three tags of Norwegian origin (2 of which were recaptured at East Greenland). In 2008, it had not been possible to implement the enhanced sampling programme but in 2009, 412 fresh whole salmon had been purchased directly from individual fishermen through funds provided by the US through NASCO. Fresh whole fish were needed, as the protocols for many of the samples require the collection of fresh internal tissues. The samplers had noted the very good condition of salmon in 2009. ICES had recommended that SALSEA West Greenland be conducted in 2010 and that efforts continue to integrate the results from this sampling program with results obtained from both SALSEA Merge and SALSEA North America.

(d) Analysis of historical tagging data

- 6.6 Since 2007, ICES has held three workshops on analysis of historical tagging data. The reports of all three workshops are available on the ICES and IASRB websites. The Board had supported these workshops by funding the participation of a GIS expert and a hydrographer and this had been extremely useful in facilitating the group's work.
- 6.7 The Chairman of these workshops, Dr Lars Hansen, presented an overview of the third and final workshop. The Terms of Reference included further developing the international database of marine tagging and tag recovery information for Atlantic salmon and using the database to investigate the distribution of salmon of different river (stock) origins and sea ages in time and space, and to assess changes in the distribution over time in relation to hydrographical factors.
- 6.8 In summary, the Workshop had made further progress in establishing an international database of tag recovery information and in using this to investigate the distribution of salmon of different origin and sea age in time and space at West Greenland and Faroes. The potential value of the information in the tagging database to support the development of migration models was also demonstrated. The Workshop recommended that all the tag data used by the Workshops should be compiled into a single database available to Workshop participants and held at the ICES Data Centre and that after a period of two years the data should be made freely available, where this is acceptable to the owners. Furthermore, the reports of the three Workshops will be combined into a single ICES Co-operative Research Report and the analyses initiated by the Workshops will be written up in peer-reviewed papers. The Workshop also recommended that further work should be carried out to improve and develop predictive models of annual migration and distribution.

(e) Report of the ICES Study Group on biological characteristics of salmon

- 6.9 Mr Ted Potter presented a summary of the work of the ICES SGBICEPS meetings which had been supported by the Board. The Study Group's Terms of Reference included identifying data sources and compiling time series of data on marine mortality of salmon, salmon abundance, biological characteristics of salmon and related environmental information, and considering hypotheses relating mortality (freshwater and marine) and/or abundance trends for Atlantic salmon stocks with changes in biological characteristics of all life stages and environmental changes. The Group had experienced some difficulties in obtaining data because many of the datasets are from long-term ongoing projects and the scientists concerned are understandably reluctant to release their data. The Study Group continued the work to compile a suite of standard biological measures over time series (>15 years) sufficient to account for natural variability and to facilitate trend analysis. Data on average annual values for various biological characteristics were available for North Atlantic stocks in nine countries and for three stocks in the Baltic Sea. A number of examples of ongoing work were described including analyses indicating substantial declines in condition factor of salmon in Scottish fisheries. The group had undertaken some meta analyses (e.g. that had shown reductions in river age in both northern and southern NEAC regions) and case studies had been developed. For example, on the River Bush it had been suggested that the increased marine mortality associated with earlier smolt migration might be the result of a mismatch in river and sea temperatures. A second case study came from Norway where in recent years evidence from three regions indicates that more salmon return as 2SW fish than expected from the relationship between the PFA of 1SW and 2SW salmon. The change in proportion at age could be explained by later maturation, and/or by an increase in survival in the second year at sea relative to the first year. The Group's report is being finalized but it was noted that its work had been constrained to some extent by the absence of oceanographic expertise or representation from North America at the second meeting. The Study Group will aim to highlight hypotheses that might be explored further and will recommend ways in which this work might best be developed.
- 6.10 The SAG recognised the value of long time series of data and the challenges in obtaining access to such data, particularly for ongoing projects. There is however, much to be gained from analysis of these datasets internationally. It was also noted that the work of SGBICEPS was in response to a request from NASCO and that through its Standing Scientific Committee the Council would need to consider if it wished to seek further advice from ICES on this topic. While there had been difficulties associated with lack of participation from North America and of oceanographers the Group had made considerable progress and the SAG believed that it would be valuable if this work could be continued. In this regard, the Study Group aims to highlight hypotheses that might be explored further and seek to recommend ways in which this work might best be developed. The Study Group also plans to develop a number of peer reviewed papers from the analyses. The data sets developed will be held by ICES. Reference was made to the EU INSPIRE Directive will have implications for accessibility to data obtained through publicly funded programmes in future. The representative of the EU agreed to obtain further information on this Directive and report back to the SAG. He also indicated that data arising from EU funded projects are the property of the Commission. This does not

mean that the data cannot be used, but authors intending to publish the results of these projects would need approval from the Commission and would need to recognise the role of the Commission in supporting the research.

(f) Progress on stable isotope analysis of West Greenland samples

- 6.11 The Board had previously agreed to support a study to examine any changes in trophic levels of Atlantic salmon through the marine phase of their life cycle. Mr Gerald Chaput presented a progress report. The aim was to comprehensively sample salmon at different stages of their life-cycle: smolts migrating out of rivers; post-smolts obtained in SALSEA North America; 1SW and 2SW salmon returning to rivers; and 1SW non-maturing salmon at West Greenland. In 2008, 30 smolts were sampled from each of fifteen index rivers in eastern Canada and tissue samples had been taken and stored for analysis. Approximately 100 post-smolts had been obtained from the marine surveys in 2008 and 2009 together with samples of prey items. In 2009, 1SW fish returning to 13 of the 15 rivers had been sampled (30 fish per river). Samples (412) of non-maturing 1SW salmon had been obtained through SALSEA West Greenland in 2009 and in 2010 2SW returning salmon will be sampled. The analysis of tissue samples has begun starting initially with one tissue type and there is interest in looking at comparisons with European samples.
- 6.12 The SAG recognised the importance of this study and it was noted that similar work is underway in Europe including ongoing work at St Andrews University. Furthermore, samples are also available for analysis from the SALSEA Merge project. The SAG believes that there may be benefits from closer cooperation and coordination of the work on stable isotope analysis in different laboratories; much of the work is being carried out in universities rather than government laboratories.

(g) Reports on sonic telemetry studies

- 6.13 A report on sonic telemetry studies in eastern Canada, which are a contribution to SALSEA North America (see www.asf.ca), was presented by Dr Fred Whoriskey. Since 2007, approximately 800 smolts have been released from rivers over a 600km range with sonic tags (together with approximately 50 kelts) and tracked as they migrated out of a number of rivers, through the estuaries and out to the Strait of Belle Isle. These studies have allowed quantitative estimates to be made of smolt and post-smolt mortality. The results show river specific patterns of mortality with no clear signal of a climate change impact. There are plans to establish further acoustic arrays in the Cabot Strait, in the Labrador Sea and off Greenland through the Ocean Tracking Network (OTN). It was noted that the OTN has a data management unit and that those joining the network can have free access to detections around the world. The research has estimated levels of mortality in three different parts of the early phase of migration for several salmon stocks and explored hypotheses concerning the speed of migration and the benefits of shoaling on mortality. The SAG recognised the importance of these tagging studies.

(h) Coordination of the SALSEA Programme

6.14 The Chairman of the Board, Professor Ken Whelan, referred to the significant databases that had been established through the SALSEA Merge programme and stressed the importance of considering how these can be maintained in the future and hopefully expanded to include North American information. Reference was made to a large amount of historical information from sampling at West Greenland that is held in a laboratory in the US but which would be very valuable to the SALSEA Merge project if an arrangement could be made to share the data. Furthermore, in Russia there has been a huge expansion in genetic baseline sampling and it would be interesting to include these data in the databases. He recognised that there were significant challenges in managing these datasets and agreeing on conditions of their use. It was noted that while ICES have considerable experience in managing such databases, and are very good at it, that might not be an appropriate home for data from ongoing experiments. However, if the datasets were to be maintained by the Board, there would be costs involved in employing a suitably qualified staff member. He suggested that there should be further discussions on these issues in the Board and consideration might be given to establishing a small working group to advise on the way forward and possible funding issues.

(i) 2011 Symposium

6.15 Mr Dave Reddin (Co-Convenor) presented a progress report on arrangements for the 2011 NASCO/ICES 'Salmon Summit'. The symposium Steering Committee has developed a preliminary announcement for the symposium, 'Salmon at Sea: Scientific Advances and their implications for management' which will be held in L'Aquarium, La Rochelle, France during 11-13 October 2011. This announcement has been widely circulated. The TOTAL Foundation is the major sponsor of the symposium. Numbers will be limited to 130 participants and registration is expected to open in Autumn 2010. The objectives of the symposium are to review recent advances in understanding the migration, distribution and survival of salmon at sea and the factors influencing them; to consider the management implications of recent advances in understanding the salmon's marine life; and to identify gaps in current understanding and future research priorities. The proceedings of the symposium will be published in the ICES Journal of Marine Science. The Steering Committee intends to meet later in the year to develop the programme for the symposium but there will be a strong focus on the management implications arising from recent research. Full details are given on the Board's website. The aim is to have a prestigious, well organized and well reported event that will raise awareness of the programmes of research on salmon at sea and its implications for management of the resource.

(j) Other activities

6.16 No other activities were brought to the attention of the SAG.

7. Other business

7.1 There was no other business.

8. Report of the meeting

8.1 The SAG agreed a report of its meeting.

9. Date and place of next meeting

9.1 The SAG decided to agree hold its next meeting in conjunction with the Twenty-Eighth Annual Meeting of NASCO.

9.2 In closing the meeting the Chairman thanked the participants for their contributions to the meeting. The SAG expressed its appreciation to the outgoing Chairman for his excellent work over the last four years.

List of Participants

Tony Andrews

Gerald Chaput

Barbara Franceschinis

Alan Gray

Lars Hansen, Chairman

Trevor Hastings

Peter Hutchinson

Patrick Martin

Niall O'Maoileidgh

Ted Potter

Sergey Prusov

Dave Reddin

Elena Samoylova

Rory Saunders

Andy Walker

Ken Whelan

Fred Whoriskey

SAG(10)6

Agenda

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 - (a) Report on the SALSEA-Merge project
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 - (c) Report on SALSEA West Greenland
 - (d) Analysis of historical tagging data
 - (e) Report of the ICES Study Group on biological characteristics of salmon
 - (f) Progress on stable isotope analysis of West Greenland samples
 - (g) Reports on sonic telemetry studies
 - (h) Coordination of the SALSEA Programme
 - (i) 2011 Symposium
 - (j) Other activities
7. Other business
8. Report of the meeting
9. Date and place of next meeting

SAG(10)4

Research on migration timing of salmon in the Loire/Allier, France

PATRICK MARTIN , JOCELYN RANCON
Conservatoire National du saumon sauvage (CNSS)
43300 Chanteuges - France

Genetic analyses have shown that the salmon population of the Loire Allier axis is probably the most ancient in Europe and is an important biological heritage worthy of conservation (Dr Eric Verspoor pers. comm). Unfortunately it has declined markedly in abundance since the early 20th century and, despite a range of conservation measures, the adult population currently comprises only approximately 500 individuals each year with spawning restricted to the upper basin.

The rarity of this population relates to the extensive nature of its freshwater migrations. Indeed, the spawning grounds are located between 850 km and 1,000 km from the estuary, making the migrations of the Allier salmon the longest in Europe. (Fig. 1)

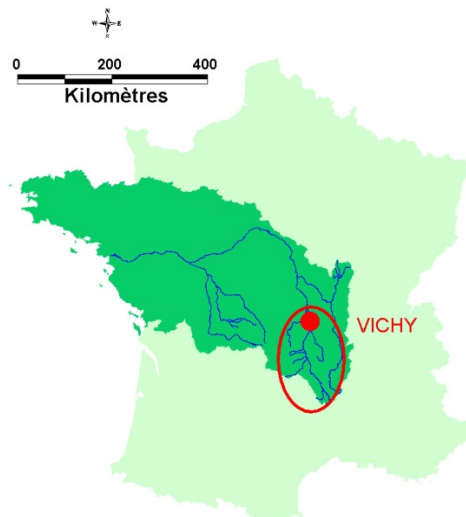


Figure 1

Salmon in the Loire/Allier have adapted to this extensive migration. While historical data (1890) shows that adult salmon entered the estuary all year round, except in August and September, the current window at the Vichy counting station (located 650 km from the estuary) is limited to about three months of the year from mid-March to mid-May.(Fig. 2)

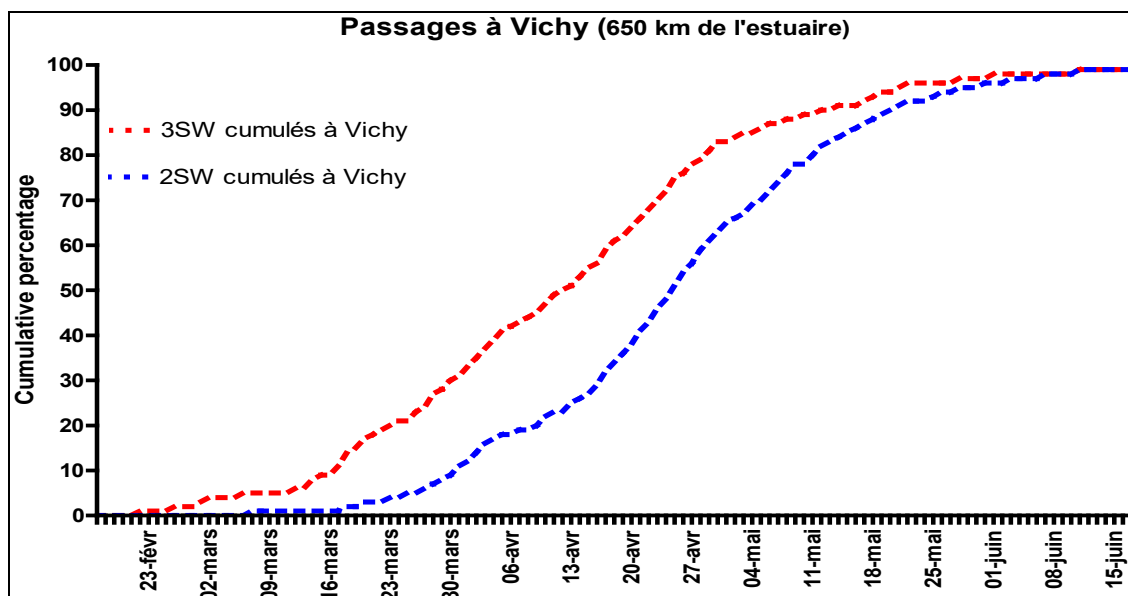


Figure 2

Outside this period, the water temperature is too high (above 26°C in the downstream part of the basin) (Fig. 3) to permit access to the spawning areas. The population reaching the upper basin is almost exclusively MSW (3SW and 2SW) salmon (>99%) which used to arrive in the estuary almost 14 months before their spawning.

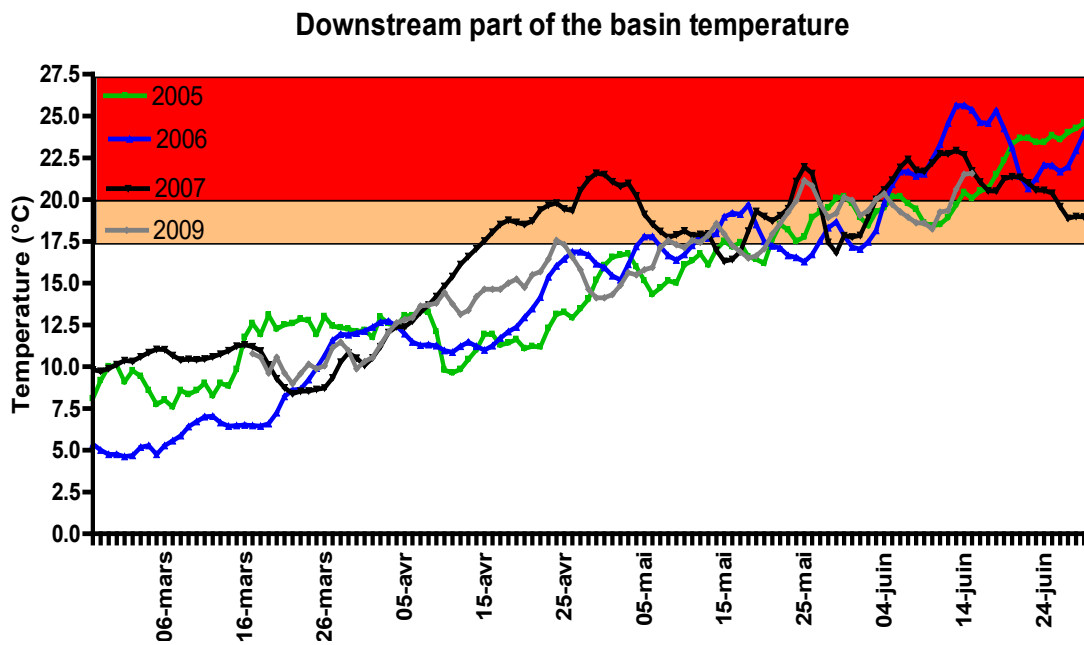


Figure 3

Analysis of data on the date of arrival of salmon at the spawning grounds indicates that the migration of fish has been delayed by about 1.5 days each year since the early 20th century. (Fig. 4)

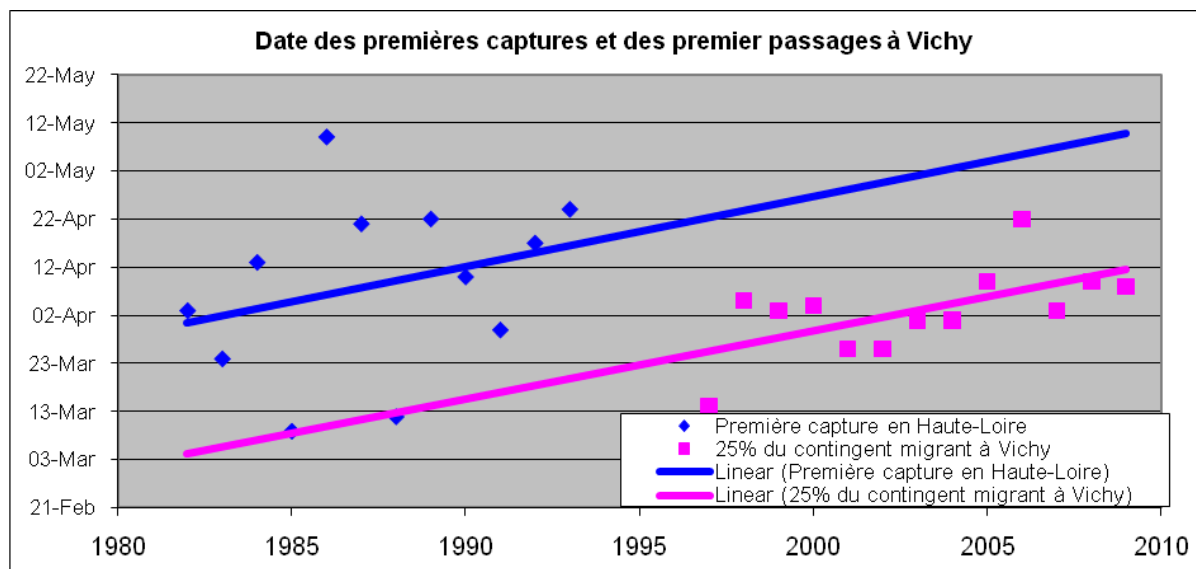


Figure 4

This delay could have adverse consequences for the population in the short-run because in parallel, the mean annual water temperature of the river has increased by 1.85°C in 24 years (Gosse *et al.* 2009)

The Allier River, located in the southern part of the distribution area of salmon, is subject to a marked continental climate. The problem of increasing water temperatures also impacts the downstream migration of smolts because the window of opportunity for migration to the estuary is very limited and decreasing. A late outmigration can cause mass mortality resulting from a loss of ability to adapt to sea water (physiological window) and arrival in the estuary at a time of unfavourable environmental conditions ("ecological window" e.g. unfavourable temperatures, oxygen levels and concentration of pollutants).

Individuals initiating their migration earliest in the year have a higher chance of reaching the ocean.

The CNSS has initiated a research program on the timing of the downstream migration of smolts to better characterize the populations of the Allier. Our data highlight the importance of water temperature for the initiation and modulation of downstream migratory behaviour. The sensitivity threshold temperature to initiate and regulate downstream migration is probably an adaptive response to environmental conditions and during migration; this temperature sensitivity will remain a key factor. So we determined for our smolts a thermal profile of activity with an optimum temperature (TO) and sensitivity (TS) (fig. 5) and we try to analyse

individual difference for possible subpopulations in our river. The development and use of this profile for each population, should allow restocking programme managers to select populations and habitat best-suited to the encountered conditions. We advocate taking into consideration the thermal stress associated with downstream migration in the development of predictive models of changing habitat with climate change.

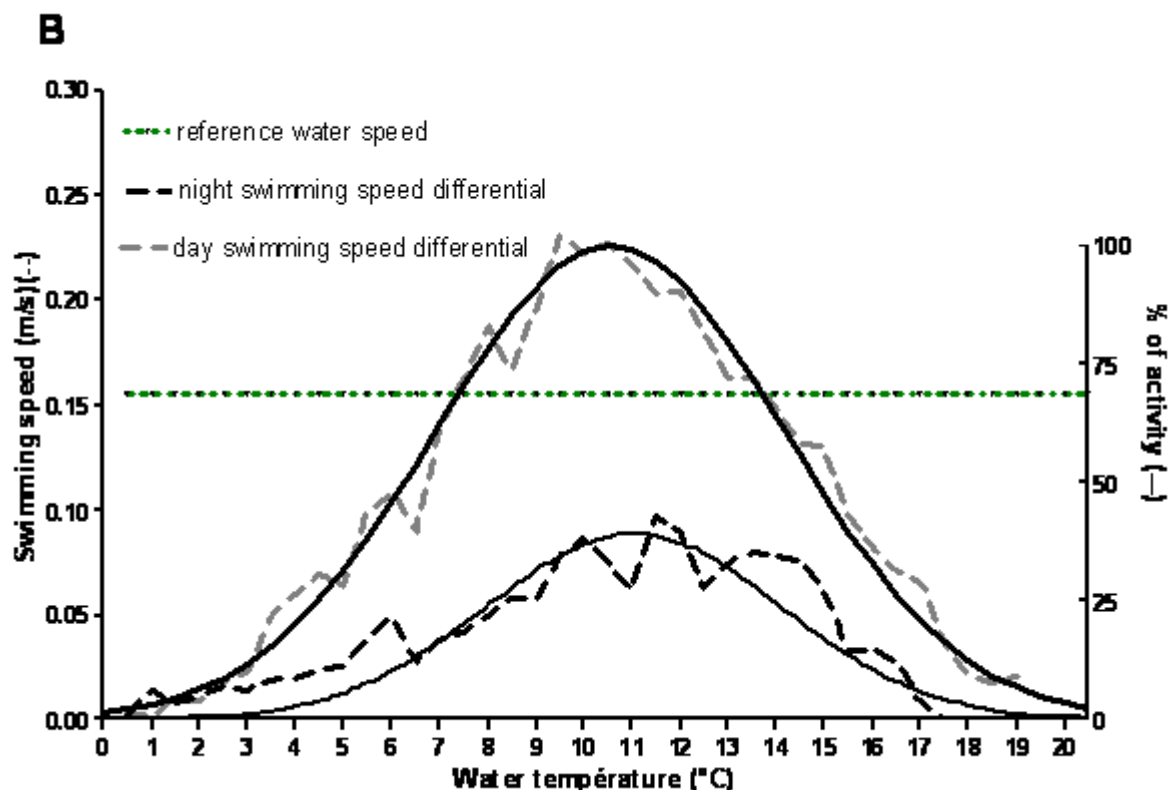


Figure 5

The migratory behaviour in the ocean, from the feeding grounds to the Atlantic coast, is a crucial factor in determining the time of arrival of adult salmon in the estuary and hence their ability to access the most favourable reproduction areas. The physiological, genetic and environmental factors that determine both the initiation and the rate of the return migration of adult salmon is beyond the research capability of the CNSS. Nonetheless, CNSS is keen to initiate a dialogue with other researchers working on the topic of migration timing of both smolts and adult salmon, particularly in large river systems.

Specifically, the CNSS would seek assistance from the Scientific Advisory Group of the IASRB in terms of:

- Feedback on the value of a research program on the theme of factors influencing the timing of migration of salmon (smolts and adults);

- identifying other laboratories or research organizations that are involved in the topic of migration timing of smolt and adult salmon that may wish to collaborate with CNSS in analysing data obtained from the Allier.