Council

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Report of the Theme-based Special Session

Management of single and mixed stock fisheries, with particular focus on fisheries on stocks below their conservation limit

Wednesday 4 June 2014

Saint-Malo, Brittany, France

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Contents

Executive Summary

NASCO's goal in relation to the management of salmon fisheries is to promote the diversity and abundance of salmon stocks and maintain all stocks above their conservation limits. Under its 1998 'Agreement on Adoption of a Precautionary Approach' it is stated that application of the Precautionary Approach to salmon fishery management requires that conservation limits (CLs) and management targets (MTs) be set for each river and that Stock Rebuilding Programmes are developed for stocks that are below their CLs. NASCO's 'Guidelines for the Management of Salmon Fisheries' state that:

- CLs should be established for all river stocks of salmon, or where CLs have not been established, alternative measures should be used that are effective and appropriate in defining adequate stock levels;
- fishing on stocks that are below their CLs should not be permitted, but if such fishing is allowed on the basis of overriding socio-economic factors it should be limited to a level that will still permit stock recovery within a stated timeframe;
- fisheries on mixed-stocks pose particular difficulties for management, since rational management of these fisheries requires knowledge of the stocks that contribute to the fishery and their status, and that management actions should aim to protect the weakest of the contributing stocks.

The objectives of the Theme-based Special Session were to allow for a more detailed exchange of information on the management of salmon fisheries including:

- Progress in establishing conservation limits, or alternative reference points, and the approaches being used to manage fisheries in their absence;
- How management measures are used to ensure the protection of the weakest contributing stocks in mixed-stock fisheries;
- How socio-economic considerations, including the interests of indigenous people, are weighed against conservation needs and, where fishing is permitted on stocks below their CLs, the approaches being used to ensure that exploitation is limited to a level that permits stock rebuilding within a stated timeframe.

The Steering Committee offers the following conclusions based on the information presented during the Theme-based Special Session:

- many Parties/jurisdictions have established river specific conservation limits. Those that have not have expressed a commitment to do so but it is not always clear either when this will be achieved or how rational management decisions are currently taken in the absence of conservation limits. The most significant of these given the number of rivers involved (~ 400) is Scotland;
- many Parties/jurisdictions continue to have mixed-stock fisheries but the scale is very different ranging from 330 tonnes in Norway to 2 tonnes in Sweden. It is not clear how these are managed to protect the weakest of the contributing stocks but newly available genetic tools should assist future management. Some Parties/jurisdictions have already closed mixed-stock fisheries and others have a policy of phasing these out although in some cases over an extended period of time;

- many Parties/jurisdictions allow fishing on stocks below their conservation limits and the rationale for doing so relates to different priorities among jurisdictions regarding socio-economic factors such as the economic needs of a community, the benefits of stakeholder engagement, the necessity for subsistence fishing and cultural issues. There appear to be very different approaches to the application of NASCO's guidelines in different jurisdictions but the reporting on what constitutes overriding socio-economic considerations was not always clear. This aspect deserves further consideration;
- where fishing is permitted on stocks below their conservation limits, it remains unclear whether stock rebuilding objectives can be achieved in a stated timeframe as required under the NASCO Guidelines. More information is required in the Implementation Plans as to the links between the management of fisheries exploiting stocks below conservation limits, other factors limiting stock recovery, and the NASCO requirement that a timeframe is specified for the recovery of the stock in question.

The Theme-based Special Session was a new venture for NASCO intended to draw on the considerable range of expertise available during NASCO meetings and to facilitate a more detailed exchange of information on a specific topic, in this case the management of salmon fisheries. Overall, the Steering Committee believes that the Theme-based Special Session was very valuable and recommends that future sessions on topics related to habitat protection and restoration, aquaculture and related activities and other aspects of management of fisheries would also be of benefit.

Introduction

At its Thirtieth Annual Meeting in 2013, the Council of NASCO considered proposals from the Parties for changes to the structure, frequency and location of its Annual Meetings. The Council decided not to change the frequency of its Annual Meetings, but agreed to change its structure on a trial basis for the 2014 meeting in order to improve the opportunities for information exchange on a particular topic through a Theme-based Special Session. The topic for the first such session was 'Management of single and mixed stock fisheries, with particular focus on fisheries on stocks below their conservation limit'. The Council had asked that the presentations during the Theme-based Special Session include information on how socio-economic issues are considered in management decisions and take the interests of indigenous peoples into account. A Steering Committee, comprising representatives of the Parties (Jóannes Hansen and Niall Ó Maoiléidigh (Chairman)), the NGOs (Paul Knight) and the Co-Chairman of NASCO's Socio-Economics Sub-Group (Guy Mawle), was appointed to develop the Programme and make the arrangements for the session in conjunction with the Secretary. The session was held on Wednesday 4 June 2014 during NASCO's Thirty-First Annual Meeting in Saint-Malo, Brittany, France.

Background

Over the last thirty years, there have been major reductions in fishing effort, increasing use of catch and release angling and other measures to reduce exploitation, yet the latest ICES advice continues to highlight the continuing low abundance of wild Atlantic salmon.

Under the Strategic Approach for NASCO's 'Next Steps', CNL(05)49, NASCO's goal in relation to the management of salmon fisheries is to promote the diversity and abundance of salmon stocks and maintain all stocks above their conservation limits. The key issues identified by NASCO include:

- further improving the 'fairness' and 'balance' in the management of distant-water fisheries;
- exchanging information and transferring expertise and knowledge between Parties and between NGOs and the authorities; and
- further developing the knowledge basis for fisheries regulations.

Under NASCO's 1998 'Agreement on Adoption of a Precautionary Approach' it is stated that application of the Precautionary Approach to salmon fishery management requires that conservation limits (CLs) and management targets (MTs) be set for each river and that Stock Rebuilding Programmes are developed for stocks that are below their CLs. In 2002, NASCO adopted a 'Decision Structure for the Management of Salmon Fisheries' to provide a basis for more consistent approaches to the management of exploitation and 'Guidelines for the Management of Salmon Fisheries'(referred to hereinafter as 'the Guidelines') were adopted in 2009 to assist jurisdictions in making further progress in implementing NASCO's agreements. The Guidelines state that CLs should be established for all river stocks of salmon, or where CLs have not been established, alternative measures should be used that are effective and appropriate in defining adequate stock levels.

In accordance with the Guidelines, fishing on stocks that are below their CLs should not be permitted, but if such fishing is allowed on the basis of overriding socio-economic factors it should be limited to a level that will still permit stock recovery within a stated timeframe. It

is noted that fisheries on mixed-stocks pose particular difficulties for management, since rational management of these fisheries requires knowledge of the stocks that contribute to the fishery and their status, and that management actions should aim to protect the weakest of the contributing stocks.

In 2013, the Council adopted an 'Action Plan for taking forward the recommendations of the External Performance Review and the review of the 'Next Steps' for NASCO', CNL(13)38, (referred to hereinafter as the 'Action Plan'). This 'Action Plan' identified management of fisheries as a priority area to strengthen the work of NASCO. Under the 'Action Plan', the Parties committed to critically review the 2013 - 2018 Implementation Plans (five-year plans detailing how Parties and jurisdictions will implement NASCO agreements), including the information provided on: the reference points used to assess the status of stocks; the decision-making process for fisheries management; the management approach for fisheries that are allowed on stocks that are below their reference points that still permits stock rebuilding; and the approach to managing mixed-stock salmon fisheries to ensure that all the contributing stocks are meeting their conservation objectives.

Objectives of the Theme-based Special Session

The objectives of the Theme-based Special Session were to allow for a more detailed exchange of information on the management of salmon fisheries including:

- Progress in establishing conservation limits, or alternative reference points, and the approaches being used to manage fisheries in their absence;
- How management measures are used to ensure the protection of the weakest contributing stocks in mixed-stock fisheries;
- How socio-economic considerations, including the interests of indigenous people, are weighed against conservation needs and, where fishing is permitted on stocks below their CLs, the approaches being used to ensure that exploitation is limited to a level that permits stock rebuilding within a stated timeframe.

In order to address these objectives, the Steering Committee had requested that Parties/jurisdictions ensure that specific information was provided on management of the fisheries to address the following questions:

- Have CLs, or alternative reference points, been established for each river, how have these been used on an ongoing basis to monitor stock status and what is the decision-making process for regulating exploitation?
- How is the composition of stocks contributing to mixed-stock fisheries assessed and how are the fisheries managed in order to protect the weakest of these stocks?
- With reference to a specific example from a single-stock or substantial mixed-stock fishery, where fishing continues to be permitted on stocks below their CLs or other reference points:
    - what were the specific socio-economic factors used to permit such fishing,
    - how were they quantified or otherwise documented,
    - what was the process for consulting those stakeholders who may have been affected by the decision prior to authorising such fishing, and

- what steps were taken to ensure that exploitation was limited to a level that will permit stock rebuilding within a stated timeframe?

In this report, the Steering Committee has provided a brief summary of each paper presented at the Theme-based Special Session, reported the discussions that followed each presentation and during the General Discussion and then drawn its conclusions based on the information presented. The papers, as submitted to the NASCO Secretariat, are annexed to this report.

Summary of contributed papers and discussion

Practical application of genetics in conserving the biological integrity (diversity) of populations of Atlantic salmon, CNL(14)66 (Annex 1)

The general principals relating to species, population complexes and populations which form the elements of biological diversity were outlined. The need to maintain biological diversity and the genetic integrity of populations was emphasised and the potential causes of loss of biodiversity from a salmon perspective were presented. These include factors such as overfishing, installation of dams leading to loss of connectivity, escapes of farmed salmon leading to loss of local adaptations and environmental changes beyond the biological tolerance of the species as a result of global warming.

Examples relating to Pacific salmon drawn from recent literature illustrate how bio-complexity (response to changing marine environment) can affect fisheries sustainability and species resilience and diversification (the 'Portfolio effect').

The genetic 'toolbox' (i.e. the methods for carrying out genetic stock identification) and application of these tools to investigate specific scientific questions were described. These include investigating population structure, establishing genetic marker baselines, identifying the components of a mixed-stock fishery and looking at long term monitoring programmes for evidence of population changes over time. Examples were drawn from studies on cod, whitefish and salmon.

Some examples of the practical applications of using quantitative genetics to support management of Atlantic salmon in the future were described including: identifying the contributions of individual river stocks to mixed-stock fisheries; population assignment from marine surveys; assessing impacts of salmon farm escapes; assessing the impacts of stocking; and the contribution to restoration ecology by selecting the most "successful" or suitable genetic families or groups to use in enhancement restocking programmes.

In summary:

- genetic markers provide an extraordinarily powerful tool for identifying and delineating management units in Atlantic salmon; the biology of this species lends itself well to these tools as adults return to their natal rivers;
- application of genetics has brought valuable new information on **where** specific populations (e.g. the Moy salmon) and population groups are in the environment and the **extent** of (quantifying and proportioning) different population specific impacts (fishing; climate; habitat; aquaculture);

- providing information on the genetic structure of populations allowing concepts such as the bio-complexity and the portfolio effect relating to abundance and resilience to be further investigated;
- identifying the most vulnerable populations so that appropriate protection can be considered.
- failure to meet river conservation limits is a fairly good indication that the population will be vulnerable if other pressures still apply i.e. overfishing, presence of escapees, effects of dams and climate changes.

Discussion:

Gérald Chaput (Canada) asked for clarification as to what the speaker believed constitutes a population. In response, Dr McGinnity indicated that a population is a group of interbreeding individuals and that, from a practical point of view, means individual rivers although some larger rivers may have distinct spawning populations within them. He stated that managing at a finer scale than individual rivers is a challenge for the future.

Overview of the 2013 – 2018 Implementation Plans in relation to the management of salmon fisheries, CNL(14)43 (Annex 2)

Based on information contained in the Implementation Plans, a review was presented of progress in establishing conservation limits, how management measures are used to protect the weakest of the contributing stocks in mixed-stock fisheries and how socio-economic needs are weighed against conservation needs when fishing is permitted on stocks below their conservation limit.

Progress in establishing conservation limits

Under NASCO's Guidelines for the Management of Salmon Fisheries, CNL(09)43, (hereinafter NASCO's Guidelines) it is stated that conservation limits (CLs) should be established to define adequate levels of abundance for all river stocks of salmon and where CLs have not been established, alternative measures should be used as reference points and should be shown to be effective and appropriate in defining adequate stock levels. Canada, Norway, the Russian Federation, the US and, within the EU, Ireland, Finland (Tana River) England and Wales and (Northern Ireland), have established CLs for individual rivers. Conservation limits for stock complexes had been developed for Faroe Islands and Greenland. Where conservation limits have not been established some alternatives approaches are being used by some jurisdictions.

Protection of the weakest of the contributing stocks in mixed-stock fisheries

NASCO has defined mixed-stock fisheries as those exploiting a significant number of salmon from two or more river stocks. The following Parties and jurisdictions reported mixed-stock fisheries (figures in parentheses are 2007 – 2011 five-year mean catches): Canada (58 tonnes), Greenland (29 tonnes), England and Wales (50 tonnes), Ireland (7 tonnes), Scotland (40 tonnes), Sweden (2 tonnes), Norway (331 tonnes), Russian Federation (35 tonnes).

NASCO's Guidelines state that rational management of a MSF requires knowledge of the stocks that contribute to the fishery and the status of each of those stocks and management actions should aim to protect the weakest of the contributing stocks. The magnitude of the mixed stock fisheries prosecuted by each Party/jurisdiction was presented based on the annual catch returns. It was noted that the status of all stocks contributing to mixed-stock fisheries is not assessed

annually except in Ireland. Similarly, the Implementation Plan Review Group had concluded that '…clear descriptions of how the fisheries are managed to ensure that all the contributing stocks are meeting their conservation objectives were often lacking.'

Weighing socio-economic and conservation needs when fishing is permitted on stocks below their conservation limits

NASCO's Guidelines state that fishing on stocks that are below their CLs should not be permitted. If a decision is made to allow fishing on a stock that is below its CL, on the basis of overriding socio-economic factors, fishing should clearly be limited to a level that will still permit stock recovery within a stated timeframe.' Fishing on stocks below their CLs is not permitted in the Faroe Islands, Asturias (Spain) and the US. In Ireland only catch and release fishing is permitted on stocks below conservation limits while in Northern Ireland fishing will not be permitted on stocks below conservation limits from 2014.

While the over-riding socio-economic factors that led to fishing being permitted were not always clear they appeared to fall into four categories: maintaining economic benefits; maintaining stakeholder engagement in resource protection and enhancement; subsistence needs for the well-being of local communities where options for other employment or food are limited; and cultural reasons such as priority being given to Aboriginal fisheries. NASCO's Guidelines state that in evaluating management options conservation of the salmon resource should take precedence and that transparent policies and processes should be in place to take account of socio-economic factors in making management decisions and for consulting stakeholders.

For many jurisdictions it may be inferred that the policy is for conservation to take precedence but generally little information was provided on how costs and benefits of different options were weighed in decision-making. Consultation is an important aspect of regulation and while many Implementation Plans referred to stakeholder consultations at both national and regional levels further clarification would assist in understanding how decisions are made when balancing socio-economic considerations against conservation.

In summary:

- conservation limits have been established for stocks in many jurisdictions and there are plans to address remaining gaps, although the timescale isn't always stated;
- many jurisdictions still permit fisheries, including mixed-stock fisheries, to operate on stocks below their conservation limits or alternative reference points;
- most fisheries are constrained, either by effort or by catch, and consultation with stakeholders is generally an important factor in the process of choosing a management option. Nonetheless, it is not clear how, or in some cases if, conservation is given precedence over socio-economic factors.

***Discussion**:*

Jóannes Hansen (Denmark (in respect of the Faroe Islands and Greenland)) commented that his delegation found it disappointing that some jurisdictions have not yet set conservation limits and that fishing is still taking place on stocks known to be below their conservation limits. He suggested that further progress was required on these issues in the coming years.

Management of single and mixed stock fisheries, with particular focus on stocks below their conservation limits - Ireland, CNL(14)67 (Annex 3)

A brief overview was provided of the history of salmon management in Ireland, how this led to the current management regime and the pressures now facing regime. The 'seminal moment' for the management of salmon in Ireland occurred in 2007 when the Government committed to aligning management with the scientific advice, to management on a catchment basis and to only facilitating exploitation of salmon stocks that had a surplus above the conservation limit. The 'traditional' three pronged approach to the management of salmon fisheries in Ireland, which encompassed scientific, socio-economic and management perspectives was significantly refocused. If there was no harvestable surplus as advised by the Standing Scientific Committee then there was no harvesting of salmon. Thus in 2007, only 43 rivers and 2 common estuaries were opened for exploitation and 7 rivers were opened on a catch and release angling basis. All remaining rivers (103) were closed for all forms of exploitation.

In 2007 a €25 million hardship scheme was introduced to support fishermen to exit the fishery. A payment equal to six times the average annual catch over the period 2001-2005 multiplied by the average price per salmon over the period (€23) was paid to each qualifying fisherman also received a payment equal to six times the license fee. Although the scheme was compulsory for drift net fishermen it was also opened to other commercial salmon fishermen who used other gear (e.g. snap and draft nets). Payment under the scheme was conditional on permanent cessation of salmon fishing by the recipient.

An additional €5 million fund was also made available for community support schemes. These schemes were designed to aid the development of those communities where the impact of the cessation of drift netting was hardest felt, and promote alternative economic opportunities for those affected.

On an annual basis Inland Fisheries Ireland provides management advice on 143 individual rivers to the Minister based on the considerations of the independent Standing Scientific Committee. The advice is provided within an extremely restricted timeframe. Every effort is made to obtain relevant data and monitor the performance of stocks (attainment of conservation limits) at the river level and consequently to assess the status of individual riverine stocks. Several sources of information are used by the Standing Scientific Committee in this process including commercial and rod catch data, trap and counter data, and monitoring of juvenile abundance. Following the procedure used by ICES for the provision of catch advice for West Greenland, the harvest option that provides a 0.75 probability level (or 75% chance) of meeting the conservation limit for a given stock is recommended. Where there is no harvest option which will provide a 75% chance of meeting the conservation limit then there is no surplus of fish to support a harvest (commercial or rod), although catch and release fishing is permitted in rivers that are achieving more than 65% of their conservation limit to provide another metric for scientific analysis. Where more than one river flows into an estuary, fishing in that estuary is only permitted if all contributing stocks are meeting their individual conservation limits.

This approach to salmon management in Ireland reflects international obligations, including those under the NASCO Convention but the measures imposed have been challenging not least because of the lack of alternative fishing opportunities in the affected coastal communities. These communities contend that they are continuing to suffer hardship by not

being able to fish on mixed stock fisheries when this practice still continues in other NASCO Parties and jurisdictions. The increasingly vigorous social and political pressure makes the task of maintaining the buy-in to the current management regime based on a conservation ethos very challenging.

Discussion:

Gérald Chaput (Canada) asked for clarification about the stocks contributing to the Castlemaine fishery and how temporally stable they are. Dr Byrne replied that several river stocks contribute to the fishery and genetic studies had indicated that some of these appear to be discrete while others showed temporal instability. Phil McGinnity (University College Cork) added that some river stocks such as the Emlagh and Behy are small and may have 20 spawners in one year, 50 in another and none in some years. The larger rivers like the Laune might have 30,000 spawners and if 10 fish from another river enter the Laune they would not have a major impact on the spawning population, whereas in a smaller river they could.

Peter Hutchinson (Secretary of NASCO) asked what role international obligations had played in influencing the decision to align management with the scientific advice from 2007. Dr Byrne responded that international obligations, including those under the EU Habitats Directive, were a significant factor as the drift-net fishery which was in operation in Ireland at that time could have been exploiting salmon from healthy stocks such as the River Moy together with salmon from endangered stocks including those from other jurisdictions.

Mary Colligan (President of NASCO) asked whether decisions that deviate from the scientific advice and permit catch and release fishing on stocks that are below their conservation limit are taken for socio-economic or management reasons. Dr Byrne replied that catch and release fishing is permitted where a stock is achieving more than 65% of its conservation limit, but it may also be permitted where a stock is below this level if juvenile abundance is satisfactory. Permitting catch and release fishing in these circumstances allows information on stock status to be collected to inform scientific assessments and support management.

Jóannes Hansen (Denmark (in respect of the Faroe Islands and Greenland)) stated that the management approach used in Ireland would be a good model for other jurisdictions to follow.

Noel Carr (Federation of Irish Salmon and Sea Trout Anglers) asked if it would be helpful if the advice from the Irish Government's Standing Scientific Committee was considered through the Fishery District Committee system in cases such as the River Feale. He noted that once stocks are above their conservation limit but are not yet maintained at this level, the opening of a commercial fishery could cause stocks to fall below their CL once again. He also asked if the impacts of aquaculture, particularly sea lice, are factored into the advice. Dr Byrne replied that the Feale is a river in the south of Ireland with a surplus of 2,000 – 3,000 fish over its conservation limit. There is a commercial fishery in the Cashen Estuary at the end of the River Feale and a rod fishery upstream. There is a lack of cooperation between the stakeholders, and the combination of socio-economic and recreational angling factors make deciding how the surplus should be allocated between the commercial and recreational fisheries a challenge. Additionally, there is a very tight time limit between the scientific assessments being conducted, the public consultation process being completed, the decisions being taken on harvest allocations for the fisheries and the laws enacted. With regard to sea lice impacts, Paddy Gargan (European Union) indicated that the assessments

are based on returns of salmon over the previous five-years which would reflect a range of impact factors including those associated with aquaculture.

Niall Ó Maoiléidigh (European Union) indicated that the case taken against Ireland under the EU Habitats Directive was only part of the reason why the decision was taken to align management with the scientific advice, and that recommendations had already been made to manage on an individual stock basis. He asked if any cases had been brought against mixed-stock fisheries in other jurisdictions under the EU Habitats Directive. Dr Byrne indicated that he was not aware of any other case having been brought.

Canada's management measures for wild Atlantic salmon stocks, CNL(14)46 (Annex 4)

There are more than 1,000 Atlantic salmon rivers in Eastern Canada, with conservation requirements having been defined for 470 of these based on the best available scientific information. Since 2000, there have been no commercial Atlantic salmon fisheries in Canada and current harvests in the recreational and Food, Social and Ceremonial (FSC) fisheries are based on scientific analysis and advice which draws on information from counting facilities, sampling of the fisheries, and catch and effort data. Stock status is assessed on the basis of the proportion of the conservation egg requirement achieved in a given year and the trend in abundance of various life stages.

ICES advice indicates that a small proportion of the salmon harvest at Labrador occurs on mixed-stocks, but new genetic data indicates that 89 - 97% (over a six year index) of the subsistence harvest of salmon are of Labrador origin and these stocks are healthier than in southern areas of Canada.

Recreational fisheries are closely monitored, enforced and reported. Management measures include: daily and seasonal harvest limits and daily maximum catch and release limits; prohibition of the sale of salmon caught in the recreational fishery; carcass tagging of harvested fish and retention of small salmon only in most of eastern Canada with retention of large salmon only permitted in Quebec and where conservation objectives are attained or fishing pressure is low. In 2014, new measures were introduced including reductions in the number of tags issued for retention of salmon in New Brunswick and Nova Scotia.

The provisions applying to the FSC fisheries are negotiated between the Government of Canada, the Provinces and Territories and individual aboriginal organisations. Harvest levels are controlled through the limited number of carcass tags issued and a limited and defined season. FSC fisheries occur in most areas of eastern Canada in both rivers and estuarine/coastal areas. In-river FSC harvests occur only in areas designated as open for recreational salmon fishing and are not permitted in rivers closed for conservation reasons. Harvests are reported and logbooks are mandatory in Labrador. Selling or bartering of salmon is prohibited. Communal licences specify other management measures that apply to control the FSC fisheries.

In Lake Melville and southern Labrador, there is a fishery by residents of Labrador targeting sea-run trout and arctic char. There is no directed harvest of salmon, but three salmon of any size may be retained as a by-catch each season and all fishing must cease when three salmon have been retained. Catches are reported through logbooks. Three carcass tags are issued per resident licence and selling or bartering of salmon is prohibited.

Discussion:

Tim Sheehan (US) asked if the reduced number of tags being issued, for example in New Brunswick and Nova Scotia, is related to attainment of conservation limits on individual rivers, or if the measures are being applied more broadly at the provincial level. Secondly, he noted that there is considerable uncertainty in the abundance estimates for Labrador and, as these are based on only three monitoring facilities, questioned if recreational catch statistics are being collected from a larger number of rivers.

Mr Nadeau replied that the measures are regional but there is one specific to the Miramichi River. In the provinces in question there is no retention of large salmon. Tony Blanchard (Canada) indicated that there are recreational fisheries in Labrador, including commercial outfitting lodges, and the data obtained from the lodges and individual anglers is used in scientific assessments.

Sue Scott (Atlantic Salmon Federation) noted that the presentations were meant to take into account the fact that NASCO considers a mixed-stock fishery to be any fishery exploiting salmon from two or more rivers and advises that such fisheries should aim to protect all contributing stocks. She did not consider that Canada's mixed-stock fishery was small; it is large based on NASCO's definition and the lack of monitoring of rivers in Labrador has already been highlighted. She asked if Canada had any plans to provide more assessments of the health of the salmon stocks in Labrador and to develop more precautionary management to reduce the interceptory nature of these fisheries.

Mr Nadeau stated that there is an intention to improve the assessment of the fisheries and the way they are managed, but there are challenges as there are many rivers and many different stakeholders. Traditional knowledge is also being used to support management.

Management approach to salmon fisheries in Norway, CNL(14)45 (Annex 5)

There are approximately 100,000 – 110,000 anglers fishing for anadromous salmonids in Norwegian rivers. The number of active salmon fishermen at sea has been reduced from 3,600 in 1993 to 900 in 2013. The proportion of fish released after capture in rod fisheries is increasing and in 2013 about 15 % of the total reported river catch was released. At the start of the 1980s, approximately 80% of the total catch was taken in the sea compared to 40% today.

The introduction of spawning targets and management targets from 2008 has succeeded in meeting the goal of increasing the number of salmon stocks that are at their maximum reproductive capacity. Spawning targets have been established for 439 rivers, and are now a key basis for fisheries management. The management target for each stock is to achieve the spawning target in at least three out of four years. Management based on spawning targets has also boosted stakeholder involvement in the form of local data acquisition resulting in improved river catch statistics. Attainment of the management target is assessed for 201 rivers, representing 98% of the total river catch. Advice on exploitation is given in five categories depending on the assessed probability of reaching the spawning target over the last four seasons in any given stock, and ranges from no harvestable surplus to the possibility for increased exploitation.

A system has been developed for aggregated assessment and advice for the mixed-stock fisheries in the fjords and along the coast. Sea fisheries are divided into 23 fjord and coastal regions, which form the basis for assessment and advice.

Bag nets and bend nets (Finnmark only) are the only gear types permitted in the sea. In addition to restrictions on fishing gear, the primary regulatory measures are length of fishing season and the number of fishing days per week. The sea fisheries regulations are based upon the estimated spawning target attainment of the stocks being exploited in the specific coastal or fjord region. In areas where target attainment is especially low, the fisheries in rivers and sea regions are closed or reduced significantly. Due to low target attainment, fishing is not permitted in 90 rivers, as well as in several coastal and fjord regions associated with these rivers. Approximately 50% of the catch by fixed gear along the coast is caught in Finnmark County. Between 1998 and 2010 the number of fixed gears in Finnmark was reduced from about 1,200 to about 600, and the number of fishermen was reduced from ~ 600 to less than 400. The reported catch has declined from ~ 300 tons in the 1980s to ~ 100 tons in 2013, due to lower Pre-Fishery Abundance (PFA), reduced effort and new regulations. Management target attainment has improved for a number of stocks in recent years. The exploitation rate is assessed to be low or very low for populations still not attaining the management target, with the exception of Tana salmon stocks, where exploitation is high. New modelling tools and datasets accumulated during the Kolarctic salmon project (2008-2012) provide important knowledge for a more precise regulation of both mixed-stock and riverine salmon fisheries. There has been a long-term negative trend in large MSW salmon in the Tana River and stock status is not satisfactory in tributaries where spawning target attainments are assessed. The situation is of most concern in upper parts of the Tana system. Accumulated fishing mortality on Tana salmon stocks is not sustainable and the total exploitation pressure can only be substantially reduced by reducing exploitation in all fisheries in the sequence. As a part of the negotiations for a new treaty on Tana fisheries, Norway and Finland have been working to develop new regulations aimed at a recovery plan and stricter regulation of the fisheries.

The Kolarctic salmon project has shown that the occurrence of Russian-origin salmon in Norwegian coastal fisheries was high in the municipality of Sør-Varanger, and relatively low along the remaining coast of Finnmark.

New regulations are being considered for Norwegian salmon fisheries including: revision of regulations for all salmon fisheries in Norway from 2016; phasing-out of bend nets in Finnmark County in 2018; and new regulations in Varangerfjord area from 2015.

Discussion:

Liss-Ellen Ramstad (Sami Parliament-Norway) asked how Norway will handle the current situation, where the Sami Parliament has not consented to the current regulations for the coastal fisheries in the Sami area. She stated that she believes this threatens the Sami peoples' livelihood and culture.

Mr Eggereide advised that fisheries had been permitted in Finnmark even though many rivers had not achieved their management target, mainly because of local culture and heritage reasons.

Torfinn Evensen (Norske Lakseelver) asked what is being done in terms of management of the mixed-stock fishery to protect the 100 or so rivers that are not achieving their management targets.

Mr Eggereide stated that the mixed-stock fisheries have been reduced in regions where rivers are not achieving their management targets and the exploitation on those stocks is very low.

Paul Knight (Salmon and Trout Association) asked if the impacts of aquaculture on attainment of conservation limits are taken into account.

Mr Eggereide replied that the impacts of aquaculture are taken into account and the number of escaped farmed salmon is excluded when assessing spawning targets.

The management approach to salmon fisheries in Scotland, CNL(14)50 (Annex 6)

In March 2014, a Wild Fisheries Review, independent of the Scottish Government, was announced in order to 'identify a modern, evidence-based management system for wild fisheries fit for purpose in the 21st century, and one that is capable of responding to the changing environment'. The Review Panel will report this autumn. The review will take current domestic and international obligations into account, including those of the EU and NASCO. The Scottish Government seeks to promote sustainable Scottish salmon and freshwater fisheries and recognises the desirability of evidence-based decision-making including science and socio-economic factors. Data from 2004 (to be updated in 2014) indicate that salmon and freshwater fisheries contribute more than £120 million to the Scottish economy and support more than 3,000 jobs, mainly in rural communities.

Scotland has not yet established meaningful conservation limits; there are only 3 sites on 2 of Scotland's 398 salmon rivers where stock-recruitment relationships exist to derive conservation limits. Work is underway to develop meaningful CLs and spawning escapement estimates in accordance with NASCO's Guidelines in order to assess stocks more accurately and to enable appropriate management decisions to be taken. Consideration is being given to the development and implementation of a counter network and an analysis of existing data sources (e.g. rod catch data, counters, fixed traps and juvenile surveys) and how these might be applied in support of management.

In the absence of conservation limits, District Salmon Fishery Boards (DSFBs) make decisions on the need for exploitation control using a decision flow chart based on rod catch data. DSFBs can develop voluntary measures and may also apply to the Scottish Ministers for statutory conservation measures. The Scottish Ministers have fisheries management backstop powers which can be exercised in the event of a local management failure or to tackle national issues, with additional powers available under the Aquaculture and Fisheries (Scotland) Act 2013. Overall, there is evidence that the number of salmon returning to rivers in Scotland has increased over recent years but there is variation in the trends among different stock components. A three year study is presently being conducted into perceived problems with spring salmon in the River South Esk and during this project there is a voluntary agreement to postpone the start of the netting season and implement catch and release in the rod fishery.

Discussion:

Andrew Graham-Stewart (Salmon and Trout Association (Scotland)) referred to the absence of conservation limits in Scotland and the lack of a timescale in which this will be addressed. He noted that the net catch increased by 50% in 2013 compared to 2012 and the catch in the largest mixed-stock fishery (Usan fisheries) increased by 100%. He asked how this could be justified given the international obligations in NASCO and the Precautionary Approach and he asked how the Scottish Government will ensure that this is not repeated. He also indicated that Usan fisheries is expanding its netting operations, having purchased three new netting stations over 16km of coastline in the last three years.

Mr MacLean agreed that Scotland was not meeting its obligations but is working to address that. He indicated that the current legislation is not appropriate for taking this forward and needs to be considered in this respect as well. While there were large increases in the net catch in 2013, catches in 2012 were probably low and netting effort in the coastal fisheries has decreased dramatically over the last five decades. He acknowledged that Usan fisheries had acquired new netting stations but, due to the pressure placed on them, they are not being fished.

Andrew Graham-Stewart (Salmon and Trout Association (Scotland)) stated that of the three new stations, two are being fished and the intention is to fish the third next year.

Mr MacLean replied that the Scottish Government would wait to see what Usan fisheries do next year.

Niall Ó Maoiléidigh (European Union) asked if there was a road map for making progress with defined timescales.

Mr MacLean responded that the Wild Fisheries Review Panel had been asked to complete its work in a six month period and is currently about half way through that period. Stakeholder consultation meetings are being held around Scotland and the Review Panel should report in October.

Paul Knight (Salmon and Trout Association) noted that there are rumours that individual license catch limits are to be introduced in England and noted that the Solway is a cross-border fishery. He asked if, in accordance with the Precautionary Approach, the Scottish Government might consider a catch limit for individual licenses or a quota for the total fishery.

Mr MacLean indicated that the Scottish Government is aware of the issue on the Solway and of the measures the EA has taken over a number of years to try to rectify it. Scotland was involved in discussions with the EA when the initial restrictions were introduced, although there are no current restrictions on the Scottish fishery. He stated that all options were being considered and nothing is being ruled out.

Paul Knight (Salmon and Trout Association) asked if the Scottish Government was beholden to the review or could they simply indicate that they don't agree with its recommendations.
Mr MacLean said that nothing is ruled out, but that the Scottish Government realises that it is not meeting its obligations internationally or even nationally sometimes. He stated that there is a real will within the Scottish Government to conduct the review, consider the

recommendations and see what kind of structure is suggested. He referred to previous reviews which, although good, had not been implemented and the Scottish Government is determined that will not happen with the current review.

Ivor Llewelyn (Atlantic Salmon Trust) recognised that there may be reluctance to commit to a timeframe but asked for clarification of what was meant by short-term for establishing interim conservation limits. He asked if this could mean five or ten years.

Mr MacLean indicted that the process began a long time ago so it could possibly take less than 5 years, but there are challenges in transporting data from one east coast river to rivers in the rest of the country with different habitat quality, for example. He advised that it may be possible to derive and use conservation limits for certain regions of the country in the short-term.

Management of single and mixed stock fisheries, with particular focus on fisheries on stocks below their conservation limit - England and Wales, CNL(14)51 (Annex 7)

There are 49 rivers in England and 31 in Wales that regularly support salmon and conservation limits have been established for the 64 principal salmon river stocks. Conservation limits will also be set for the others when stock recovery reaches reliable levels. The Management Objective is to exceed the conservation limit in four years out of five on average. Each stock is assessed and categorised annually according to whether it is meeting its Management Objective, using data from the past ten years to summarise stock performance. This helps to identify pressures on stocks and the need for management action to control exploitation (alongside maintenance and improvement of habitat). Stocks are classified as 'Not at Risk', 'Probably not at Risk', 'Probably at Risk' or 'At Risk'.

Following the annual assessments a formal decision structure is applied. This guides decision-making in terms of managing exploitation (balanced with maintaining/improving habitat in order to address the key pressures on a stock). All fisheries are managed on the basis of protecting the weakest contributing stock. When making management decisions, socio-economic factors are taken into account with an aim of minimising undue hardship to fishermen and maximising the social and economic benefits of commercial and recreational fishing if stocks are healthy enough. A number of different options are available to restrict fishing. Net Limitation Orders are a key tool and are used to limit the number of net licences available. Regulations also restrict fishing seasons, times, methods and areas and national, local or regional fishery byelaws are also used.

Fishing is permitted on some stocks below conservation limits, but only if the stock is achieving its Management Objective or exploitation will not prevent ongoing stock recovery, and there are good social or economic reasons to allow fishing to continue. The socio-economic factors considered include whether the proposed measure will have an unreasonable effect on someone's livelihood or property value; effects on different groups; the effect on the viability of the fishery; and the heritage value of the fisheries. Reducing exploitation is only one of the actions taken to manage a stock and the European Water Framework Directive and Habitats Directive are strong drivers for habitat improvements.
A case study of the North-East coast salmon and sea trout net fishery in England demonstrated the approach taken to managing a mixed-stock fishery where stocks are not consistently meeting conservation limits but where, taking socio-economic considerations into account, the continuation of some fishing has been allowed. The latest Net Limitation

Order for this fishery was introduced in 2012 and continues the phase-out of the drift nets and commences a phase-out of the T & J net fishery. Commitments were given that: the remaining drift net fishery will be closed at the end of 2022; an evaluation will be undertaken of the potential for maintaining some T & J and/or estuary nets; and the possibility of using quotas and/or effort to cap catches will be investigated. It is recognised that there may be a need for further management measures to avoid repeats of the high catches experienced in recent years, and that a potential catch limit or quota for the fishery should be investigated. This is underway and expected to report towards the end of 2014.

Discussion:

Ivor Llewelyn (Atlantic Salmon Trust) indicated that an important commitment has been made to close the drift net fishery by 2022 and asked if this was now in doubt. He noted that the presentation had indicated that a cap on the net catch might be introduced and this would be important because, although there was a new Net Limitation Order in 2012, the net catch in 2013 had doubled despite a fall in the rod catch both in North-East England and in Scotland. This implies that the net catch is not directly linked to stock levels, but more likely fishing conditions at sea and low water conditions in rivers. He suggested that in these conditions there could be a much greater impact on vulnerable stocks, so a cap on catches would be an important move that should be considered seriously at a political level.

Mr Owen responded that the Government does intend to close the drift net fishery by the end of 2022 at the latest, and the number of licences has already been reduced from the hundreds to only 13. He agreed that there are a number of possible reasons for the high net catch in 2013 and options are being explored for capping or limiting the catch and a report is expected from the Environment Agency by the end of this year.

Guy Mawle (Chairman of the Socio-Economics Sub-Group) noted that 70% of the catch in the drift nets and 30 -50% of the catch in T & J nets is from rivers in Scotland, and given the lack of conservation limits on Scottish rivers, asked how it is known whether the fishery is impacting SACs in Scotland as well as those in England.

Mr Owen replied that for those SACs in Scotland affected by the drift net fishery, all the standard assessments required under the Habitats Directive were carried out when the new Net Limitation Order was introduced in 2012, and these showed that the current fishery would not have a significant impact on those SACs. If conservation limits are developed for the various Scottish rivers those may be considered, but the protection necessary under the Habitats Directive would still be in place.

Guy Mawle (Chairman of the Socio-Economics Sub-Group) noted that the presentation referred to a lot of activity in England and Wales, and asked how successful it has been in achieving the management objectives and what the latest assessment indicated, given that the decision structure system has been in place for 10 years now.

Liz Black (European Union) responded that if the question had been asked last year then the answer would have been that there had been a progressive improvement, in that the number of rivers in the 'at risk' category had declined suggesting that the system was having a positive effect. This year, however, there was a sharp upturn in the number of rivers in the 'at risk' category although there may be statistical reasons for this. She advised that

consideration is currently being given to what additional action is necessary as a result of the increase.

Jóannes Hansen (Denmark (in respect of the Faroe Islands and Greenland)) stated that while the presentation had indicated that certain fishing methods have historical value and there was a will to preserve these, it is important to assess the effect the fishery has on the salmon stocks and the fact that the method has value should not preclude it from appropriate management measures.

Mr Owen replied that the fisheries using gear with heritage value have been reduced and limits have been introduced with the Habitats Directive in mind. So these fisheries are being carefully managed.

Ivor Llewelyn (Atlantic Salmon Trust) noted that for the 2012 review, a genetic analysis had been undertaken of the stock composition in the North-East coast fishery, but this had only been able to distinguish the stocks from northern England and Scotland. He noted that it was therefore not possible to assess the impact at the individual river level. He asked if there were plans to carry out further studies at a finer scale and to assess the stock contribution in the T & J net fishery.

Liz Black (European Union) replied that following the findings of the report due later this year consideration will be given to what further analyses may be needed and how this might be funded.

Niall Ó Maoiléidigh (European Union) asked if there was any evidence of stock recovery in a specified time frame in relation to management of the mixed-stock fisheries.

Ted Potter (European Union) noted that the phase-out for the fishery has been ongoing for about 20 years and in that time the River Tyne stock has progressed from being at a fairly depleted state to being the best river in England and Wales in terms of rod catch. Similarly, the rivers Wear and Coquet are achieving 200 - 300% of their conservation limits. Two rivers are currently below their conservation limits: the Tees which has other issues including a barrage to contend with, and the Esk, which is achieving around 96% of its conservation limit with an improving trend.

General Discussion (Morning Session):

Niall Ó Maoiléidigh (European Union) indicated that while some of the presentations advise that there has been stock recovery, it is not necessarily within a stipulated time-frame, and noted that this may be the case for England and Wales. He noted that it is not clear from the presentations whether the timeframe for recovery is detailed in management plans. He asked if there had been any recovery within a specified time period in Canada, or if recoveries there were not part of a specified time-frame.

Tony Blanchard (Canada) replied that it was a similar situation as in England and Wales.

Ciaran Byrne (European Union) referred to a conference held during the Irish EU Presidency on the financial situation in the EU, during which a German politician said 'we know what we have to do but what we have to figure out is how to be re-elected afterwards'. He noted that this could apply to the management of mixed-stock salmon fisheries.

Carl MacLean (Canada) indicated that, with regard to the Aboriginal fishery in Canada, the management measures introduced are ahead of those in some other jurisdictions. These measures include banning certain kinds of gear, mesh size limits, a mid-season closure of 10 days, limits on the number of large salmon that can be retained, nets set in straight lines rather than the T and J formations referred to, and a one day a week closed time when nets are removed from the water.

Dave Meerburg (Atlantic Salmon Federation) noted that the presentation from Canada had indicated that there is complete reporting of recreational catches, but that is not what the ICES ACOM report states. He believed that there is a gradation in reporting from Quebec where catches are well reported, to Newfoundland and Nova Scotia where catches are estimated in log books, to New Brunswick where there has not been reporting of recreational catches since 1996 yet there is an important fishery including that in the Miramichi. He stated that while there is an estimation procedure in place, he believed that there is certainly room for improvement in some areas.

Gérald Chaput (Canada) referred to the situation in Canada where salmon caught in both Aboriginal and recreational fisheries cannot be sold and he asked if the sale of rod caught salmon is prohibited in other jurisdictions. He was advised that while the sale of rod caught salmon is banned in EU – Ireland and EU – UK (England, Wales and Scotland), it is allowed in Norway.

Andrew Graham-Stewart (Salmon and Trout Association (Scotland)) asked what assessments the Scottish Government had undertaken, in accordance with the Habitats Directive, to determine the potential impact on SACs of opening up new netting stations.

Julian MacLean (European Union) replied that cycle 2 assessments had just been completed and they were somewhat better than cycle 1, but no specific assessments have been undertaken.

Liss-Ellen Ramstad (Sami Parliament-Norway) stated that a guiding star in all salmon management at a national level should be to seek indigenous peoples free, prior and informed consent and that this should involve, inter alia, early consultation, use of traditional knowledge and documentation of the outcome in a written protocol that is made publicly available. She stated that a clear, transparent process is not a guarantee of a good result but it is a safeguard that the views of indigenous peoples are heard.

Guy Mawle (Chairman of the Socio-Economics Sub-Group) indicated that there is a wider application to the process described in the last intervention and noted that the Guidelines also refer to the need to have pre-agreed management measures in place. This is a key element in the way Ireland is able to operate within such a tight timescale because there is an understanding of the measures that will apply at different stock levels.

The management approach to salmon fisheries in the Russian Federation, CNL(14)42 (Annex 8)

Anadromous Atlantic salmon occur in five regions of the north-western part of the Russian Federation: Murmansk region, Archangelsk region, Republic of Komy, Republic of Karelia and Nenets Autonomous Okrug. Conservation limits have been established for all salmon rivers in the Murmansk region and for a number of rivers in Archangelsk region. The status of individual river salmon stocks varies considerably, but overall they have not shown the same negative trend in abundance as observed in other parts of the Atlantic salmon's distribution range on both sides of the Atlantic. However, some stocks are suffering reduced numbers of spawners due to the impact of anthropogenic factors such as poaching, dams and pollution. The approach to management of Atlantic salmon fisheries in Russia is based on applying the Precautionary Approach, NASCO's various agreements and enforcing the adopted measures and existing fisheries regulations. Over the last two decades the effort in commercial fisheries has been noticeably reduced in order to conserve Atlantic salmon stocks and enhance recreational fisheries.

The Total Allowable Catch (TAC) is established annually for each region on a river-by-river basis on the basis of reference points (e.g. conservation limits, management targets) and the forecast abundance. The TAC does not limit catch-and-release fisheries. Regional TACs are allocated by the Federal Agency for Fisheries. Six types of fisheries are permitted: fisheries to support the traditional way of living of indigenous small nations of the North; scientific fisheries; enhancement fisheries; educational fisheries; recreational fisheries; and commercial fisheries. Recreational, commercial and Sami net fisheries are only allowed at specific fishing sites. Each salmon fishery is licensed and is conducted in accordance with the Fisheries Regulations in force.

Mixed-stock salmon fisheries take place in the Murmansk and Archangelsk regions in the White Sea. Over the last two decades the effort in commercial fisheries has been dramatically reduced and catches have fallen from more than 100t annually in the 1980s to around 30t annually since 2007. Today the commercial fishery is seen as a traditional way of fishing by local people from Pomor villages along the White Sea coast.

The Kolarctic salmon project has provided a comprehensive overview of spatial and temporal variation in stock compositions in coastal fisheries in the Barents and White Seas. The data from the project will provide managers with tools for regulating fisheries on a more informed basis.

Discussion:

Dave Meerburg (Atlantic Salmon Federation) noted that while conservation limits have been set for some rivers in Russia, it was not clear from the presentation if fisheries are permitted on stocks below their conservation limits. Sergey Prusov (Russian Federation) responded that the coastal fishery in the White Sea is mainly based on stocks that are above their conservation limits, including those in the two largest rivers in the region (Varzuga and Strelna). However, for in-river fisheries some are conducted in rivers where the conservation limit is not being achieved, for example there is a small, primarily catch and release, recreational fishery and a fishery for enhancement purposes on the Umba river.
Guy Mawle (Chairman of the Socio-Economics Sub-Group) asked what, if any, property rights there are associated with the fisheries in Russia and what consultations take place with

stakeholders regarding management measures. Sergey Prusov replied that the Atlantic salmon is a Federal resource. Users of fishing sites have contracts to conduct fisheries at these sites with the State, through the Federal Agency for Fisheries. They can organise either recreational or commercial fisheries. With regard to stakeholder consultations, these take place through regional anadromous fish commissions comprising representatives of the Regional Administration, Fisheries Directorates, scientists, NGOs and indigenous peoples.

Niall Ó Maoiléidigh (European Union) asked if decisions to allow fishing on stocks below their conservation limits are taken for socio-economic reasons and where such fishing is authorised, if the fishing is at a level that will permit stock recovery within a certain time period. Dr Prusov replied that on the Umba River fishing was permitted for socio-economic reasons. He advised that a major factor influencing the stock is illegal fishing and a small recreational fishery is permitted to allow tourism to be developed with a view to reducing illegal harvests. There is an enhancement programme on the river based on hatchery stocking.

Liss-Ellen Ramstad (Sami Parliament-Norway) asked for confirmation that the presentation had indicated that most salmon stocks in Russia are in good condition. Dr Prusov replied that most stocks in the Murmansk Region are in good condition with the exception of the Umba River, some rivers in the Kandalksha area and some rivers in the very west of the Kola Peninsula. However, in Karelia the stocks are in poor condition due to logging, dam construction and poaching and stocks in the larger rivers in the Archangelsk region, such as the Severnaya Dvina, Mezin and Onega, are not in particularly good condition. Ms Ramstad asked why, given this response, Russia had sought the closure of the Sami fisheries in Norway in 2012. Dr Prusov responded that this question might be answered by a representative from the Federal Agency for Fisheries after the presentation on the findings from the Kolarctic salmon project.

The management approach to North Atlantic salmon fisheries in Finland, CNL(14)47 (Annex 9)

The River Teno (Tana) is a very large border river (with a catchment area of 17,000km^2) with about 30 genetically distinct populations of Atlantic salmon exhibiting more than 100 different life-history combinations. There is little human impact on the river system. In-river fisheries in the main stem exploit salmon from different tributary populations. Management is based on bilateral agreements between the governments of Finland and Norway and a new regime is currently under development that will be based on target-based management.

Preliminary spawning-targets were set for some tributaries of the River Teno in 2007 and revised spawning targets were developed in 2014 for virtually all salmon populations in the river. Monitoring of target attainment has been assessed on six tributaries and, in the upper tributaries, the spawning stocks have been consistently well below their targets. Assignment of the tributary of origin of salmon caught in the main stem can be achieved by combining genetic sampling and catch information by age groups and life histories. For example, differences in the timing of upstream migration could be used in tailoring fishing restrictions to protect vulnerable tributary populations. Genetic data are available from the main stem fishery in the Teno and also for Teno salmon exploited in the Norwegian coastal fishery (data obtained through the Kolarctic salmon project). This information can provide a good basis for science-based, population-specific management measures in the future.

Salmon fishing is important in Sami culture and there are restrictions on access to fisheries for people from outside the Teno river valley. In addition to angling, traditional methods such as drift nets, gill nets and weirs are used. Tourist activities are mainly linked to salmon fishing. Many stakeholder groups are involved in the fishery and will need to be consulted as the new management regime and fishing rules are developed. Several events have already been held to disseminate information on key concepts such as spawning targets and a stock recovery plan. The new measures will be targeted so as to ensure biological sustainability while minimising adverse effects on local culture and the economy.

Discussion:

Liss-Ellen Ramstad (Sami Parliament-Norway) stated that the Sami Parliaments in Norway and Finland are highly concerned about the future of the endangered salmon population in the river Tana (the Teno in Finnish or Deatnu in Sami) and have emphasised the importance that Norway and Finland must agree on a new fishing treaty that would revive the endangered salmon population in this river. Modern science-based management will require a solid basis from research and monitoring, as well as local knowledge and she asked how Norway and the EU will strengthen funding to support scientific research. Mr Hakaste replied that, at present, funding for scientific research had been secured and that this would be important in future, and in that regard the fact the river is so important, not only for Finland and the EU, should be of benefit.

Steinar Hermansen (Norway) added that opportunities to secure funding to support knowledge-based management will be considered in developing a new agreement for the Tana river.

Guy Mawle (Chairman of the Socio-Economics Sub-Group) asked if it would be possible to define what is meant by the terms subsistence fisheries and traditional fisheries, given that the fisheries use drift nets and gill nets. Mr Hakaste replied that drift net fishing is an old method that requires particular skills and special places and timing to fish. He indictaed that it is not the same kind of drift nets and gill nets as used elsewhere. With regard to subsistence fishing, in renewing the Fisheries Act in Finland there have been considerable discussions on the meaning of this term and it is considered to be when any fish caught have value to the household and replace the need for other foods. It also relates to remote communities in northern Finland.

Dave Meerburg (Atlantic Salmon Federation) noted the complexity of the Teno system and asked if fishermen contribute to the cost of management and, if so, were licence fees high. Mr Hakaste replied that part of the income from licence fees is used to fund management, particularly fisheries enforcement measures. With regard to the angling licence fee it is high compared to some other rivers and consideration is being given to whether it should be higher. Gill net fishermen pay a lower licence fee, in part related to ownership of the fishing rights.

Oyvind Fjeldseth (Norwegian Association of Hunters and Anglers) noted that it is hard to overstate the importance of the Tana river which in the past accounted for 20% of the entire European river catch of salmon. He stated that too much time has been taken to develop a new agreement on the management of the river and time is running out. He asked how the process could be speeded up given the critical situation facing the salmon stock in the Tana and indicated that there will need to be sacrifices by all fishermen. Mr Hakaste replied that

the process is underway and the aim is to introduce a rebuilding programme and it is important to communicate what is being done to all stakeholders.

Niall Ó Maoiléidigh (European Union) asked if the subsistence fisheries are currently linked to stock status or fixed. Tapio Hakaste indicated that the basic rules are fixed, but where a tributary is entirely in Finland, local owners may make their own rules or close the fishery in particular areas.

The management approach to the West Greenland salmon fishery – fairness and balance in the management of distant-water fisheries, CNL(14)44 (Annex 10)

Greenland has a population of only around 57,000 inhabitants and fishing and hunting play an enormous role in Greenlandic culture and identity, with many small and isolated settlements dependent on fisheries. Approximately 2,800 small scale fishermen in Greenland provide for the livelihood of thousands of people and many small settlements, both directly and in-directly. It is always a feat to balance the inter-play between conservation and the livelihood of the coastal population; such is the difficulty that no Fisheries Minister has served a full term since the introduction of the Home Rule in 1979.

The Kapisillit river supports the only known spawning population of Atlantic salmon in Greenland. conservation limits have not yet been set for this stock but a protection plan is under development. Some rod and reel fishing occurs in this river, but catches are currently unknown.

The inshore salmon fishery in Greenland is a mixed-stock fishery exploiting stocks from North America and Europe. The fishermen that fish for salmon are mostly small scale fishermen that fish from a dinghy but there are also a few vessels over 6 meters. In accordance with NASCO agreements, the salmon fishery is limited to an internal-use fishery and is managed from a socio-economic perspective as well as from the need to feed the population in Greenland. The fishery is limited by the fishing season (1 August – 31 October), a minimum mesh size in gill nets of 70 mm and the number of nets. Unlicensed fishermen can use 1 salmon net and licensed fishermen can use up to 20 salmon nets. Furthermore, the licensed fishermen are allowed to use driftnets. All catches must be reported to the Greenland Fisheries License Control Authority (GFLK). Licensed fishermen can sell their catch to local markets, institutions or restaurants and, since 2012, they can also land a quota of 35 tonnes to factories. In 2013, four settlements (with populations ranging from 144 – 362 inhabitants) were authorised to allow landings of salmon at factories; Atammik, Kangaamiut, Qeqertarsuatsiaat and Arsuk. The factory landings quota was set to ensure that all citizens get the opportunity to consume Greenlandic salmon and at the same time ensure the fishermen landing opportunities. Although Greenland has no commercial salmon fishery and an export ban has existed since 1998, the Fishermen's Organisation (KNAPK) has pressed for lifting this ban. This is not possible due to Greenland's commitment to NASCO.

Greenland has limited its fishery continually for over 20 years in order to permit the rebuilding of stocks below their conservation limits. As Greenland is within its right to fish salmon as a subsistence fishery and also set an internal-use quota for landings within the framework of NASCO, it has not consulted NASCO stakeholders.

Discussion:

Ted Potter (European Union) asked what mechanism was in place for the cod fishery to record catches and implement the quota in small communities and whether all landings go through fish factories. Mr Rosing responded that the quota was for the offshore and inshore fishery in both East and West Greenland in the past, but separate catch advice is now provided for the inshore fishery. About 75% of the total landings occur in the months of May, June and July but the quota of 15,000 tonnes has not been utilised because of a lack of capacity in the factories in small communities due to a lack of investment in these facilities since the decline of the cod fishery in the 1980s and 1990s. In the last two years, ships have been used to receive and process cod but the quota is still not fully utilised, so the lack of processing capacity regulates the fishery.

Richard Nadeau (Canada) noted that reference had been made to the lack of capacity at the fish factories and asked if the level at which the quota is set is influenced by the lack of capacity, or whether landings would be permitted in other communities. Mr Rosing replied that the quota set would be influenced by both capacity and the market. In both 2012 and 2013 the quota for factory landings was set at 35 tonnes but in 2013 only 26 tonnes were landed through the factories, so adjustments in the level of the quota are being considered.

Recent investigations into the stock composition of the Norwegian and Russian coastal salmon fisheries (the Kolarctic salmon project), CNL(14)41 (Annex 11)

A mixed stock Atlantic salmon fishery operates off the coast of the three northernmost counties of Norway: Nordland, Troms and Finnmark. Average annual landings in the last 15-20 years have been close to 300 tonnes. Salmon stocks from Norwegian, Finnish and Russian rivers may migrate along the coastal areas in the period when the fisheries operate. Tagging studies have shown that Atlantic salmon from Russian rivers may be harvested along the northern Norwegian coast line. Following a pilot project in 2010 to identify the origin of salmon in catches from coastal areas, it was recognized that the spatial coverage of the baseline should be expanded, the number of genetic markers should be increased, and additional sampling should be conducted in a number of salmon rivers to improve the precision of the assignment of individuals. A further initiative to achieve this goal was taken by Norway, the Russian Federation and Finland through the 2011-2013 EU project entitled 'Trilateral cooperation on our common resource; the Atlantic salmon in the Barents region' (the Kolarctic salmon project – KO197).

This project has generated one of the most comprehensive and detailed genetic datasets for any fish species. Comprehensive sampling of adult Atlantic salmon along the northern Norwegian coast and in the White Sea was conducted in 2011 and 2012 through close collaboration between scientists and commercial fishermen. Genetic stock identification analyses confirmed that coastal fisheries in northern Norway exploit multiple stocks. Altogether, 145 rivers were found to contribute to fishery samples. Fisheries generally exploited salmon from wide geographic areas with catch localities on the open coast showing greater stock diversity than catch localities within fjords. Fishery samples from May and June were composed of salmon from wider geographical areas than samples from July and August. Salmon caught in the White Sea originated from 25 rivers with the vast majority of fish from 17 rivers in the Murmansk region. No adult salmon sampled in the White Sea were assigned to the rivers outside the area.

Approximately 40% of the catch in Finnmark County in 2011 and 2012 originated from salmon rivers in the Western Finnmark area. Of the remaining contributions, the River Tana stocks made up 17-18% of the catch, Russian stocks made up 16-18% of the catch and

salmon stocks from Eastern Finnmark made up 11-14% of the catch. Salmon stocks from Troms County made up 7% and with only small numbers of salmon originating from Nordland County. Between 38% and 50% of salmon caught in Troms County originated from rivers in that county. Stocks from Western Finnmark made up 27-39% of the catch. Salmon from the Tana, Eastern Finnmark and Russia rarely occurred in the catch in Troms County during the official fishing season. This fishery takes place in July when most of the eastern stocks have generally already passed through. Data from 2012 indicated that salmon caught in Nordland were mainly from the rivers of Troms County with salmon also originating from Western Finnmark, Russia and Nordland.

The highest salmon catches in 2011 and 2012 were taken in Sør-Varanger municipality, Finnmark where salmon of Russian origin accounted for 65% of the catch. Tana salmon accounted for a high proportion (80%) of the catch in the Tana municipality in Tanafjord. Salmon originating from each reporting group area were caught widely in the outermost coastal areas as well as in inner areas of the fjords. Salmon rivers of West Finnmark contributed to high proportions of the catches in almost all municipalities in western Finnmark. Salmon stocks from many rivers on the northern Kola Peninsula in Russia were important contributors to the fishery in eastern Finnmark and especially in the Sør-Varanger municipality. Salmon catches in the municipalities of Vadsø-Nesseby had large proportions of fish originating from Eastern Finnmark. Numerous salmon stocks from the River Tana contributed to the fisheries in the Tanafjord and the neighbouring Gamvik and Berlevåg municipalities. In the Terskiy Bereg area of the White Sea, 48% of the salmon sampled originated in the Varzuga River and 23% of samples were assigned to the Strelna River.

The results of genetic stock identification provide the first comprehensive overview of spatial and temporal variation in stock composition in coastal fisheries in Northern Norway and the White Sea. The data from the Kolarctic project will provide managers with tools for regulating fisheries on a more informed basis.

Discussion:

Liss-Ellen Ramstad (Sami Parliament-Norway) repeated an earlier question and asked for clarification as to why Russia had requested Norway to close the indigenous people's fishery in Norway in 2012 when stocks of salmon in Russian rivers are in a healthy condition. Gennady Zharkov (Russian Salmon Association) referred to the low abundance of salmon throughout the North Atlantic, the need to conserve stocks and the considerable efforts being made in Russia by both the State and private businesses to save the salmon. The salmon stocks are still in good condition because of these efforts. However, he did not believe it was appropriate for salmon originating in Russian rivers to be exploited in fisheries in another country. He noted that between 100 and 300 tonnes of salmon are caught in Finnmark, representing more than 50% of fish returning to the northern part of the Kola Peninsula, and bend nets (a form of gill net) are still being used when they are forbidden in the rest of Norway and in most of Europe. He noted that the fishing season in Finnmark is also longer than in the rest of Norway. He indicated that there was no intention to seek a complete ban on salmon fishing in Finnmark, but to make step by step progress to ensure conservation of the stocks and he looked forward to cooperating with the Sami Parliament on this important international conservation issue. The goal of the Russian Salmon Association is that the Atlantic salmon should be a resource to be used by recreational fishermen worldwide. Liss-Ellen Ramstad noted that in the presentation it had been stated that priority in Russia is given to indigenous peoples when quotas are allocated, but in the response to the question it seems

recreational fisheries are the priority. She indicated that information from the Kolarctic project had been obtained through the contribution made by Sami fishermen who collected samples for the project. She noted that the Sami fishery in the area pre-dates the establishment of the Norway-Russia border, and both Norway and Russia have an obligation to protect the Sami way of life. She asked how the Parties would act in future to protect the salmon as an important natural asset for the Sami people. Gennady Zharkov stated that he understood that the sea fishery for salmon in Finnmark involves between 100 and 300 people and it is primarily a hobby rather than a source of food and that salmon fishing was never a priority for indigenous peoples in Russia. He said that a new approach was needed concerning how this tradition could be accommodated today and that he did not represent the State, the fishermen or the fishery owners only the salmon and that he was right in stressing the need for progress with its conservation.

Recent investigations into the stock composition of the Labrador Atlantic salmon subsistence fisheries, CNL(14)48 (Annex 12)

During 2000 to 2013, the total annual harvest of Atlantic salmon in the Labrador subsistence (aboriginal food, social and ceremonial (FSC) and resident food) fisheries ranged from 6,500 to 15,600 salmon of all sizes, equivalent to 15.6 to 41.4 tonnes of fish. By number of fish, the harvest is predominantly small salmon, with most of the harvest of small salmon occurring in southern Labrador.

Differences in biological characteristics and more recently, genetic stock identification techniques, have been used to assign the origin of salmon sampled from the Labrador subsistence fisheries to a region of origin. Freshwater ages of Atlantic salmon sampled from the fishery indicated that there were very few age 1 and age 2 year old smolts with most (>75%) of the salmon sampled having a freshwater age of 4 years and older. These older smolts could potentially include salmon from northern Quebec, Newfoundland and Labrador populations.

Recent developments in genetic stock identification techniques are being used to address the questions of the origin of Atlantic salmon captured in marine fisheries. The application of these techniques to the catches of the subsistence fisheries of Labrador requires: establishment of an eastern North American baseline; definition of regional groups; sampling of the fishery; and assigning origin of salmon from the fishery samples. With regard to the genetic baseline, a total of 12,000 individual fish samples were obtained from 189 individual river systems from Ungava Bay to Maine. Microsatellite polymorphisms were scored at 15 loci. Reporting groups for assignment purposes represent regional clusters identified in previous landscape analyses of population structure. In total, 12 reporting groups were used for individual assignment and mixture analysis based on both new data and previously published data. A program to collect representative samples from the fishery (scales and finclips) was conducted in 2006-2011. Individual assignment methods and mixture analyses were utilized to assign the fishery samples to one of the 12 regional groups.
Genetic stock identification techniques indicate that the Labrador subsistence fisheries harvest salmon from several regions in eastern North America but the majority (> 96%) of salmon sampled were of Labrador central origin, distributed throughout the fishery areas and periods. The results are consistent with tagging studies suggesting 94% Newfoundland and Labrador salmon in the harvest during the 1970's and 1980's. Only the Labrador central group was identified in the Lake Melville fishery samples. Rare assignments to non-local Canadian stocks (South Labrador / lower north shore, Newfoundland, and Southern Gulf of

St. Lawrence / New Brunswick) in the fishery samples occur in the southern portion of the fishery area, near the Strait of Belle Isle. Total annual harvests in this area have ranged from 3,400-5,500 small salmon and 1,000-2,000 large salmon in the most recent 10 years. Rare assignments of USA origin salmon occurred in the northern area of the fishery. Estimation of total number of salmon from each regional group harvested in the fishery will require further work.

Recent investigations into the stock composition of coastal fisheries in Scotland, CNL(14)49 (Annex 13)

During the period 1952 - 2013 the percentage of the nominal catch taken by coastal fisheries in Scotland has remained at *ca*. 40%, catches in recent years being ca. 50 tonnes per annum. There has been a substantial reduction in the scale of these fisheries since 1952 and the present effort deployed is only 5% of the highest recorded value. In 2013, there were 34 active coastal fisheries. The largest fishery, accounting for 43% of the total reported catch from the coastal fishery, is adjacent to the river South Esk. The second largest fishery, accounting for 16% of the total coastal fishery reported catch, is located at Armadale. Investigations have begun to determine the stock composition of the catch in both of these fisheries.

Rod catches of spring salmon in the South Esk have continued to decline, despite a range of statutory and voluntary measures being introduced in both the coastal and freshwater fisheries, and are a cause for concern. A radio tagging and tracking project was conducted using salmon caught in the South Esk coastal net fishery in the spring of 2012 and 2013 in order to determine the spawning location of these fish and to assess the degree to which the coastal fishery is mixed stock in nature. Interpretation is complicated but it has been possible to derive an estimate of the contribution of the South Esk stock to the coastal fishery. This was estimated to be between 8 and 25% in 2012 and 11 and 29% in 2013. The wide distribution of detections relative to the tagging site is similar to that observed in earlier tagging experiments. In conclusion the South Esk near-shore coastal fishery is highly mixed stock in nature.

Genetic approaches to stock discrimination are now being explored and may allow assignment of fish caught in any fishery/location to area of origin. The approach requires that an extensive number of baseline samples are screened for either a set of microsatellite markers or a large number of SNP markers with cluster analysis then being used to select a set of markers that can provide differentiation among stocks at different geographic scales.

A recent study of the stock composition of the various fisheries operating off the coast of North East England, using the suite of 14 microsatellite markers used in the SALSEA-Merge project, allowed the assignment of fishery samples at a regional scale but not at the smaller river scale. The results indicated that higher genetic resolution was required before finer scale (i.e. river level) assignment could be achieved. Therefore, with respect to assessing stock composition in Scottish coastal fisheries, variation in SNPs has been examined. A baseline comprising 147 sites and a total of 3,787 fish has been established and a suite of 288 SNPs identified which best differentiate between regions. Within regions, sets of SNPs are being selected with the aim of achieving finer geographic assignment of fishery samples. Fishery samples have been obtained from both the South Esk and Armadale coastal fisheries and will be screened once the most appropriate suite of SNPs has been finalised.

General Discussion

Dan Morris (US) referred to the principles in the NASCO Convention and in the 2009 Guidelines for the Management of Salmon Fisheries. These include rational management, management based on the scientific advice, conservation and over-riding socio-economic factors. He indicated that it wasn't clear what constitutes over-riding socio-economic factors, although it was clear from the Irish presentation that the science takes precedence. He also noted that reference had been made to unreasonable economic hardship, subsistence fisheries and cultural value and asked what these terms mean to different jurisdictions. He asked if any other Party had developed guidance on what might constitute over-riding socio-economic factors.

Bud Bird (Canada) replied that in Canada one of the socio-economic factors is the aboriginal right which is protected by the Constitution and reaffirmed by the Courts. Aboriginals the have first claim on any harvest of salmon unless the stock status is such that the river is closed to fishing. This right is second to absolute conservation and that judgment is made by the Department of Fisheries and Oceans taking into account the scientific advice. One interesting aspect of the system in Ireland is that the scientific advice is independent and has to be taken into account by the government and stakeholders and he asked for clarification as to what is meant by independent.

Ciaran Byrne (European Union) responded that while the members of the Irish Government's Standing Scientific Committee (SSC) work for different agencies e.g. the Marine Institute and Inland Fisheries Ireland, when serving on the SSC they are not representing their agencies and there is no external influence by the State Agencies in the advisory process. The recommendations from the SSC input directly to the management process through which the decisions are taken, but the development of the science is independent of political and other influences. From November to March each year much effort goes into explaining the scientific findings to local communities affected by the decisions and they generally accept the findings because it has been developed through an independent process. Managers have adhered to the scientific advice, irrespective of whether it was good news or bad; the decision to open the Castlemaine fishery was taken because the scientific advice indicated that there was a harvestable surplus.

Niall Ó Maoiléidigh (European Union) noted that the process in Ireland also involved colleagues in Northern Ireland and from the Loughs Agency.

Paul Knight (Salmon and Trout Association) indicated that in Ireland there is obviously political support for the process, but not all Parties have the same attitude to the science and decision-makers may ignore the science if it does not align with their agendas. He indicated that in the UK there is a great dependency on using the EU Habitats and Water Framework Directive to press for change. Independent science is important but there must be a political commitment to follow the advice.

Ciaran Byrne (European Union) noted that in his presentation he had referred to the importance of the Habitats Directive in the decision to align management with the scientific advice but he highlighted the important pressure exerted through NASCO both in terms of the agreements it has developed internationally and by the other Parties and NGOs which certainly assisted in ensuring Ireland moved in the right direction.

Ted Potter (European Union) indicated that when the NASCO Guidelines were being developed it was evident that different jurisdictions around the North Atlantic had different attitudes to what they meant by management and how they viewed the balance between the importance of science for conservation and socio-economic factors. Some saw the scientific advice as absolute to the extent that if there is no harvestable surplus there is no fishery, whereas others saw management as balancing conservation needs with socio-economic issues. He cautioned against assuming that one approach is correct and the other is wrong. There may be justification for saying that there is science and there is management which is the point at which socio-economic factors come into play and that he had hoped the Socio-Economics Working Group might have been able to assist in this regard. He added that judgements have to be made and they are often affected by factors such as legal precedents and socio-economic valuations.

Niall Ó Maoiléidigh (European Union) noted that this was linked to the intervention by Dan Morris and acknowledged that there is a need to have a better way of assessing what constitutes over-riding socio-economic factors.

Guy Mawle (Chairman of the Socio-Economics Sub-Group) noted Mr Potter's comment and referred to the work of the Socio-Economics Working Group from 2003 and the development of the Guidelines for Incorporating Socio-Economic Factors in Management Decisions. These Guidelines relate not just to management of fisheries but also to habitat, aquaculture and stock-rebuilding programmes. He noted that these guidelines were not referred to in the Implementation Plans developed by the Parties/jurisdictions so it is not clear to what extent they are being used, but the common factor is that there should be transparent processes and policies available to stakeholders as to how decisions are taken in terms of what needs to be done on conservation, what the options are and what costs and benefits are involved. It may be that conservation measures are introduced over a longer time-scale for example. He indicated that the decision will always be a matter for the politicians, but it should be made with clarity to all concerned and having considered all the evidence. It is not clear from the review of the Implementation Plans that documentation of all the socio-economic factors is occurring in all jurisdictions.

Ted Potter (European Union) responded that he does not believe that the Guidelines are helpful. He stated that as decisions are taken for individual fisheries, different factors will be assessed. Each Net Limitation Order will have a different explanation but you would need two days to present those. He stated that a lot of information is available concerning specific decisions, but it is difficult to present this information in a forum such as this Theme-based Special Session.

Cathal Gallagher (European Union and EIFAAC) referred to the situation in Ireland and that questions are being asked in many areas by fishermen who wish to understand what assessments are being conducted elsewhere. It is not clear to them why, in other jurisdictions, fishermen can still take part in fisheries when they are not allowed to do so in Ireland and that brings pressure to reverse the decisions being taken in Ireland.

Ivor Llewellyn (Atlantic Salmon Trust) asked what impact closing a river has in Ireland since, from an NGO perspective, there would be reluctance to see complete closure as river owners are helpful in addressing other factors challenging rivers such as pollution, land-use change and abstraction and contribute funds to improve the riverine environment. Furthermore, he stated that there is a need for a political constituency arguing for the river

and if you close a river that advocacy for the fishery is lost. He indicated that it is important to have people positively engaged when considering socio-economic factors.

Ciaran Byrne (European Union) indicated that a lot of the rivers are small systems and, if there is uncertainty as to whether or not a river is meeting its conservation limit, it will be closed as a precautionary measure. While from a conservation point of view it is generally a good idea to have a value on the resource and an income derived from its use, it is difficult to implement on the ground because while some fishermen, both recreational and commercial, report fully and adhere to the regulations, others do not.

Jóannes Hansen (Denmark (in respect of the Faroe Islands and Greenland)) indicated that the Theme-based Special Session had been very useful to the Faroe Islands and Greenland because they had made huge sacrifices, in the case of the Faroe Islands there has been no salmon fishery for twenty-five years, and it is important that there is fairness and all Parties/jurisdictions take measures on an equal footing and that best practice in accordance with NASCO guidelines is adopted by all.

Liss-Ellen Ramstad (Sami Parliament-Norway) stated that Sami Parliament respectfully highlights the need to incorporate the indigenous dimension into the NASCO Guidelines.

Andrew Graham-Stewart (Salmon and Trout Association (Scotland)) stated that fisheries management in Scotland needs to improve dramatically because the four big netting operators taking most of the mixed-stock catch have, for the last few years, voluntarily not fished in the first six weeks of the legal season but have now signalled their intent to do so. He asked if Julian MacLean would like to comment on that proposed increase in netting effort, targeting the spring salmon that Mr MacLean identified as being particularly vulnerable.

Julian MacLean (European Union) indicated that the Scottish Government was keeping a close eye on this and nothing has happened this year but it will be important to see what happens next year. By then, the Review Panel, which will be looking at the management of netting, will have reported. He advised that this is of concern to the Scottish Government.

Niall Ó Maoiléidigh (European Union) asked if the Sami Parliament self-regulates the number of salmon fished at different stock levels.

Liss-Ellen Ramstad (Sami Parliament-Norway) replied that all regulations are now made at a national level in Norway but there has been local management in the Tana over the last three years. Through this local management the fishery in Norway was reduced by two thirds but similar reductions did not occur in Finland so negotiations are ongoing, and when the new regulations are in place the Sami should be involved in the local management of the fishery.

Carl MacLean (Canada) representing the Nanatsiavut Labrador Inuit indicated that all five communities in Northern Labrador are isolated with no roads in or out so access to them is by air or, in summer, some supplies come in by sea. He stated that salmon and other natural resources represent food security and the ability of the people to sustain themselves. In Nain, a small chicken costs 25 – 30 Canadian dollars so the resources of the land are very important. He noted that while much had been heard about 'western' science, traditional

knowledge should be given equal weight particularly in relation to decisions concerning food security issues.

Gérald Chaput (Canada) referred to the discussions about evidence-based management and that sometimes it is easy to forget what has happened in the past. In Canada, some commercial fisheries were closed in 1984. This decision, and others concerning both salmon and cod in 1992, was taken without waiting for every river to have a stock assessment done even though they resulted in sacrifices for the fishermen. He noted that today we are dealing with small fisheries and a declining stock, but it is probably not the remaining fisheries that are causing the stock declines, so the closure of fisheries may not be the most effective response.

Jóannes Hansen (Denmark (in respect of the Faroe Islands and Greenland)) indicated that the Faroe Islands and Greenland certainly respect the rights of indigenous peoples to utilise natural resources in a sustainable manner.

Paul Knight (Salmon and Trout Association) agreed with Gérald Chaput's comment about many of the impacts on salmon stocks being from factors other than the fisheries, particularly in fresh water, but reiterated the need for political commitment. He stated that while much is said about sustainable development and the need to protect the environment, it is often 'Yes, but' policies, where activities that impact on the environment are given precedence. He stated that until there is a genuine commitment to protect fish and the freshwater ecosystems on which they depend, we will not be successful in our goals.

Concluding remarks by the President of NASCO

This Theme-based Special Session has allowed an excellent exchange of information on progress in establishing conservation limits. While it is clear that many jurisdictions have established conservation limits over the past few years, NASCO's first agreement that proposed that jurisdictions should do so was adopted almost 20 years ago, and for some jurisdictions further progress is needed to implement those agreements. There is also a need for further progress in monitoring compliance with conservation limits in support of management, perhaps particularly in the case of mixed-stock fisheries. While conservation limits are used in management by some jurisdictions, it is not clear that this is the case in others. It is evident from the presentations that while some mixed-stock fisheries have already been phased-out and there are commitments to phase out others, they remain quite widespread and some remain substantial. In some cases not all of the contributing stocks have been identified, so it is hard to monitor those mixed-stock fisheries and assess their impact on the individual stocks, although new assignment tools are available to facilitate this in the future.

Where fisheries are permitted on stocks known to be below their conservation limits, whether the fishery is exploiting a single-stock or a mixed-stock, the rationale often seems to be socio-economics but it was generally vague as to what the specific criteria were that influenced the decision to permit the fishery. There seems to be some inconsistency in the definition of terms such as subsistence, commercial, traditional etc. Furthermore, it was not clear that the consequences of failing to follow the scientific advice had been identified and considered specifically in terms of stock rebuilding, for example its impact on the probability of stock rebuilding occurring or the timeframe for recovery. It was not always clear how these decisions weighed and balanced socio-economic factors and stock rebuilding targets.

The keynote presentation emphasised the importance of genetic diversity in resilience and abundance of populations; maintaining bio-diversity leads to better productivity and opportunities for increased fishing opportunities rather than decisions only concerning whether or not to fish. The NASCO Precautionary Approach agreements relating to the management of fisheries, including the Guidelines for the Management of Salmon Fisheries referenced in several presentations during this session, outline an approach to rational management and it is a question of how fast these can be comprehensively implemented by all jurisdictions so that hopefully we can all then benefit from improved abundance.

There was a lot to digest over the session, but it has been a great experiment for NASCO and a day very well spent with informative presentations and good discussions. Thanks are due to all contributors and to the Steering Committee for its excellent work in planning the programme and for the arrangements made.

Conclusions of the Steering Committee

Under the Strategic Approach for NASCO's 'Next Steps', CNL(05)49, NASCO's goal in relation to the management of salmon fisheries is to promote the diversity and abundance of salmon stocks and maintain all stocks above their conservation limits. The key issues identified include further improving the 'fairness' and 'balance' in the management of distant-water fisheries; exchanging information and transferring expertise and knowledge; and, further developing the knowledge basis for fisheries regulations.

To address the Council's objectives for the Theme-based Special Session, the Steering Committee had requested that all Parties/jurisdictions address specific questions in their presentations or, for those Parties/jurisdictions not making a presentation, be prepared to answer these questions in the discussion periods. These questions were as follows:

- Have conservation limits, or alternative reference points, been established for each river, how have these been used on an ongoing basis to monitor stock status and what is the decision-making process for regulating exploitation?
- How is the composition of stocks contributing to mixed-stock fisheries assessed and how are the fisheries managed in order to protect the weakest of these stocks?
- With reference to a specific example from a single-stock or substantial mixed-stock fishery, where fishing continues to be permitted on stocks below their conservation limits or other reference points:
    - what were the specific socio-economic factors used to permit such fishing,
    - how were they quantified or otherwise documented,
    - what was the process for consulting those stakeholders who may have been affected by the decision prior to authorising such fishing, and
    - what steps were taken to ensure that exploitation was limited to a level that will permit stock rebuilding within a stated timeframe?

The Theme-based Special Session was a new venture for NASCO intended to draw on the considerable range of expertise available during NASCO meetings and to facilitate a more detailed exchange of information on a specific topic, in this case the management of salmon fisheries. Overall, the Steering Committee believes that it was a considerable success; the presentations were of a high quality and informative with much valuable information presented and open and frank discussions. The information presented should allow a clearer

assessment of fairness and balance in managing fisheries in distant-water fisheries and those conducted in the States of origin. The Steering Committee recognises that there was limited time available for each presentation and that perhaps too much information was sought given time constraints. However, each Party/jurisdiction making a presentation was also given the opportunity to submit a paper to supplement the presentation so it is somewhat disappointing that not all Parties/jurisdictions have been able to provide clear responses to each of the questions posed to them. This is, perhaps, particularly the case in relation to the interplay between conservation objectives and socio-economic factors. Notwithstanding that shortcoming, the Steering Committee believes that the Theme-based Special Session was very valuable and believes that future sessions on topics related to habitat protection and restoration, aquaculture and related activities and other aspects of management of fisheries would also be of benefit.

The Steering Committee offers the following conclusions on each of the questions it posed, citing selected examples from both the presentations and submitted papers, usually to highlight best practice.

Have CLs, or alternative reference points, been established for each river, how have these been used on an on-going basis to monitor stock status and what is the decision-making process for regulating exploitation?

Have CLs, or alternative reference points, been established for each river?

There has been considerable and continuing progress with the development of conservation limits in line with the Agreement on Adoption of a Precautionary Approach, CNL(98)46, reiterated in NASCO's Guidelines for the Management of Salmon Fisheries (CNL(09)43). Nonetheless, even though it is sixteen years since NASCO and its Parties agreed to adopt and apply the Precautionary Approach, there remain gaps, notably in parts of the European Union (CNL(14)43). The most significant of these, given the number of rivers involved (~ 400),is Scotland, a major contributor to the southern European stock caught at Greenland. There is, however, acknowledgement from Scotland that it is not meeting its international obligations, and the Steering Committee notes that a review of wild fisheries management is due for completion in 2014. The remit for the review includes developing a modern, evidence-based management system for wild fisheries fit for purpose in the 21st century and capable of responding to the changing environment (CNL(14)50). The review is intended to take into account international obligations including those under NASCO agreements.

While the river is used as the basic unit, fisheries management should reflect the need to conserve the sub-populations within some river systems given NASCO's goal of promoting both abundance and diversity. On the river Teno or Tana in Finland and Norway, separate spawning targets have been set for virtually all of 30 genetically distinct populations (CNL(14)47). However, it is recognised that moving to management of sub-populations will be challenging since it will require the establishment of conservation limits and stock assessment for tributary stocks.

How have these been used on an on-going basis to monitor stock status?

Systems for monitoring compliance with management targets are not always clear. A variety of data sources are used including catch data from recreational and other fisheries, fish counters and traps, and in some cases snorkel surveys. Most jurisdictions make annual

assessment of spawning escapement or egg deposition, using a management target based on a given probability of exceeding the conservation limit (e.g. 75% in Ireland, CNL(14)61, and Norway, CNL(14)45; 80% in England and Wales, CNL(14)51; average in Labrador, Canada, CNL(14)46) over a number of years (e.g. four seasons in Norway; ten years in England and Wales; seven years in Labrador).

What is the decision-making process for regulating exploitation?

The process varies by jurisdiction and can involve using not only the current status, in relation to reference points based on the conservation limit, but often a forecast of abundance. Most jurisdictions do not change regulations controlling exploitation during the fishing season.

Some jurisdictions set the level of exploitation for individual stocks on an annual basis. Ireland is one such jurisdiction that adheres closely to the NASCO Guidelines (CNL(09)43) having the key principle that: 'Harvest of salmon should only be allowed in rivers where there is a surplus above the conservation limit identified and that no more than this surplus should be harvested.' Catch and release fisheries are allowed, if stocks are above a certain level, to help provide data on stock status. Elsewhere, decisions on exploitation levels may be reviewed less frequently and may allow harvest of stocks below conservation limits. In Norway, decisions are usually revised every four or five years, though it could be more frequent if a stock declined suddenly (CNL(40)45). In England and Wales, exploitation is reviewed annually according to a decision structure and based on the projected compliance with a management objective in five years' time (CNL(14)51). Fisheries, including limited harvest, may still be permitted though this should be negligible if there is a high probability that the management objective will not be achieved. In Russia, a regional TAC is set by the Federal Government, based on scientific advice and applied to harvest fisheries but excluding catch and release fisheries (CNL(14)42).

Where salmon are still exploited in jurisdictions outside their country of origin, the status of those stocks may not always be considered in regulating exploitation. NASCO regulations for the distant-water fisheries at Greenland and Faroe Islands consider salmon abundance relative to conservation limits, though these are for stock complexes rather than individual rivers.

How is the composition of stocks contributing to mixed-stock fisheries assessed and how are the fisheries managed in order to protect the weakest of these stocks?

How is the composition of stocks contributing to mixed-stock fisheries assessed?

Historically, contributions to mixed-stock fisheries were identified by tagging studies. However, these usually entailed risks of bias and imprecision because of high unit costs and other sampling constraints. Statistical analysis of genetic and other characteristics (e.g. smolt age, size) now enables the origins of large numbers of individual fish to be identified with high probability and greater accuracy. These techniques are being applied in a range of mixed-stock fisheries including those in Norway, Labrador (Canada), and Scotland. Currently, only in the Greenland fishery is the contribution to the fishery of different stock complexes assessed annually.

How are the fisheries managed in order to protect the weakest of these stocks?

Some jurisdictions have closed, or are phasing-out, mixed-stock fisheries because of the impracticality of managing them to protect weak stocks. Nonetheless, other jurisdictions still allow mixed-stock fisheries to operate without a clear basis for protecting the weakest of the contributing stocks. In the absence of CLs and knowledge of the contributing stocks there does not appear to be a sound basis for assessing whether this management objective is being achieved. However, the Steering Committee noted that some new regulatory regimes are being developed to better protect vulnerable stocks and allow stock rebuilding e.g. in the River Teno/Tana (CNL(14)45).

In Ireland, an estuarine mixed-stock fishery is only permitted where a harvestable surplus is available (i.e. there is at least a 75% probability that all of the rivers contributing to the fishery will exceed their conservation limit simultaneously). In other jurisdictions, increased constraints on mixed-stock fisheries have generally been used to reduce, though not necessarily stop, the exploitation of depleted and, in some cases declining, stocks.

In England, a coastal mixed-stock fishery is allowed to continue on the basis that exploitation will not prevent ongoing stock recovery (CNL(14)51).

With reference to a specific example from a single-stock or substantial mixed-stock fishery, where fishing continues to be permitted on stocks below their CLs or other reference points:

- **what were the specific socio-economic factors used to permit such fishing,**
- **how were they quantified or otherwise documented,**
- **what was the process for consulting those stakeholders who may have been affected by the decision prior to authorising such fishing, and**
- **what steps were taken to ensure that exploitation was limited to a level that will permit stock rebuilding within a stated timeframe?**

What were the specific socio-economic factors used to permit such fishing?

Over-riding socio-economic factors fall into one or more, not necessarily discrete, categories: i.e. economic, subsistence, stakeholder engagement and cultural (CNL(14)43). The significance of different factors varies with the circumstances and societal values within different jurisdictions.

The rights of indigenous peoples are protected in a number of jurisdictions (CNL(14)43). For example, the constitution of Canada protects, constrained where necessary, access for aboriginal peoples to salmon fisheries for food, social and ceremonial purposes (CNL(14)46).

Cultural factors are also significant in other jurisdictions without aboriginal peoples. In the United Kingdom, fisheries are deemed to have heritage value where fishing methods are unique to a very small number of locations (CNL(14)51).

In some jurisdictions, such as Norway and the United Kingdom, a high priority is given to protecting the property rights of local fishery owners.

In general, jurisdictions avoid undue negative impacts on the livelihood of fishermen and local economies. Retaining local, legal engagement with the resource can be important to ensure its protection. For example, on the Umba river in Russia, poaching has been reduced through the income to the local economy generated from a recreational fishery.
How were they quantified or otherwise documented?

Socio-economic terms such as subsistence, traditional, cultural, unreasonable economic impact, and stakeholder engagement are often unclear and even if defined, are rarely quantified. NASCO's Guidelines for Incorporating Social and Economic Factors in Decisions under the Precautionary Approach (CNL(04)57) were not cited by any jurisdiction. It is extremely important that where fisheries are permitted on stocks below their conservation limit the rationale behind the decision is clearly argued and made publically available.

The 10-year review of the management of the North East Coast salmon fishery in England is an example of where the socio-economic importance of the net and rod fisheries was analysed (CNL(14)51).

What was the process for consulting those stakeholders who may have been affected by the decision prior to authorising such fishing?

Most jurisdictions have processes for consulting stakeholders at local, national and in some cases international levels (e.g. in Norway, CNL(14)45).

The complexity of this process may make prompt, flexible management difficult. In some cases management measures, or at least the principles for management measures, are pre-agreed and that should facilitate a more rapid response to changes in stock status. Ireland has such an approach and its Standing Scientific Committee completes an annual assessment for individual rivers and makes recommendations to Government within two months of the start of the new fishing season. There is a one month statutory consultation period before the regulations are brought into place.

In Russia, where the Total Allowable Catch is determined on the basis of the scientific advice, fishing sites are allocated to users on the basis of competitive tenders (CNL(14)42).

What steps were taken to ensure that exploitation was limited to a level that will permit stock rebuilding within a stated timeframe?

The review of Implementation Plans in 2013 had noted that it was often unclear how the management measures were designed and implemented to promote stock rebuilding and if the costs and benefits of different options were weighed in decision-making (CNL(14)43). Several jurisdictions, such as the United States, the Faroe Islands, and Germany, do not permit harvest of salmon to facilitate stock recovery. For jurisdictions where fishing is allowed, it is not always clear how conservation is given precedence over socio-economic factors.

In England and Wales, the costs and benefits of different options are analysed to inform long-term decisions on fisheries management (CNL(14)51). The objective of the measures was to achieve a step change in the status of depleted stocks within five years.

The concept of allowing recovery within a given timeframe assumes that exploitation is a key limiting factor. Action to address other factors, such as degraded habitat, may need to be addressed before stock recovery can be achieved. If these factors are limiting then serious consideration should be given to closing fisheries exploiting stocks that are not meeting the conservation limits as a practical first step while the more long-term habitat factors are addressed.

Legislative constraints on exploitation must be supported by effective mechanisms for enforcement. Some jurisdictions such as Canada (CNL(14)46) and Ireland (CNL(14)61) require all harvested salmon to be carcass tagged. This makes the disposal of illegally caught fish more difficult whilst constraining the catch to agreed limits. The ICES advice indicates that in 2013 the estimated unreported catch for the North Atlantic area was 306 tonnes although not all jurisdictions provided an estimate.

In summary, the Steering Committee had reiterated its desire that the Theme-based Special Session would allow the Parties to provide more clarity on the questions above. Following the session and the information provided by the Parties some clarity has been provided on some issues. For example:

- many Parties/jurisdictions have established river specific conservation limits. Those that have not have expressed a commitment to do so but it is not always clear either when this will be achieved or how rational management decisions are currently taken in the absence of conservation limits. The most significant of these given the number of rivers involved (~ 400) is Scotland;
- many Parties/jurisdictions continue to have mixed-stock fisheries but the scale is very different ranging from 330 tonnes in Norway to 2 tonnes in Sweden. It is not clear how these are managed to protect the weakest of the contributing stocks but newly available genetic tools should assist future management. Some Parties/jurisdictions have already closed mixed-stock fisheries and others have a policy of phasing these out although in some cases over an extended period of time;
- many Parties/jurisdictions allow fishing on stocks below their conservation limits and the rationale for doing so relates to different priorities among jurisdictions regarding socio-economic factors such as the economic needs of a community, the benefits of stakeholder engagement, the necessity for subsistence fishing and cultural issues. There appear to be very different approaches to the application of NASCO's guidelines in different jurisdictions but the reporting on what constitutes overriding socio-economic considerations was not always clear. This aspect deserves further consideration;
- where fishing is permitted on stocks below their conservation limits, it remains unclear whether stock rebuilding objectives can be achieved in a stated timeframe as required under the NASCO Guidelines. More information is required in the Implementation Plans as to the links between the management of fisheries exploiting stocks below conservation limits, other factors limiting stock recovery, and the NASCO requirement that a timeframe is specified for the recovery of the stock in question.

Annexes: Contributed papers

Annex 1

CNL(14)66

Practical application of genetics in conserving the biological integrity (diversity) of populations of Atlantic salmon

Philip McGinnity, University College Cork

Below is provided a short outline of a talk prepared for the theme-base special session CNL(14)13 on the *'Management of single and mixed stock fisheries, with particular focus on fisheries on stocks below their conservation limit'* and presented at the NASCO Annual General Meeting in St. Malo, France in June 2014. The aim of the paper is to provide some examples of the application of genetic methods for managers and is not meant to be a comprehensive review of the subject. Most of the examples presented in the paper pertain to work (much as yet unpublished) undertaken under the auspices of the Beaufort Marine Research Award in Fish Population Genetics Group held jointly by University College Cork and Queens University Belfast, the Marine Institute (Ireland) and Agri-Food and Biosciences Institute (Northern Ireland) and funded by the Irish Government under the Sea Change programme. Many of the projects were supported by and carried out in collaboration with Inland Fisheries Ireland. Studies at an early stage include a collaboration led by Dr Martin Llewellyn, University of Bangor, Wales and Université de Laval, Quebec, Canada, on Atlantic salmon micro-biomes. Other examples of the application of genetic methods presented are referenced from reports based on the work of a variety of International research groups.

Background

The objective of Atlantic salmon management is the protection of the species integrity ensuring long-term sustainable natural productivity and resilience. Biological integrity has been described as consisting of two elements (Angermeier and Karr, 2004). The first element is biological diversity, which is usually perceived as a hierarchical scheme of increasing ecological and genetic complexity, commencing with allelic variants of genes, the combination of genes giving rise to a genome or individual, individuals as an isolated breeding entity comprising a population of interbreeding individuals, inter-related populations combining to form population complexes or meta-populations and ultimately the aggregate of populations to make a species. Within the context of biological diversity, the level of most interest from management is usually the population or population complex. The population can be readily associated with an individual river or a major tributary within a river system. The population, or at least the fish within an individual river system, is basis upon which the conservation limits are established for the regulation of fisheries and which designations important for fisheries conservation, such as evolutionary significant units (ESUs), are defined.

The second component of biological integrity is the evolutionary and ecological processes, both natural and anthropogenic, associated with contemporary and historical environments that shape and have shaped the observed diversity in separate populations. Increasingly, within the broader definition of biological integrity, managers have an appreciation of the genetic and evolutionary impacts of man's activities on salmon productivity, population resilience and adaptability to changing environments and to the occurrence of and necessity

to protect uniquely evolved and irreplaceable genetic solutions for life a range of environments. For example, changes in size at age and age at maturation in response to size and run time selective fisheries; genetic changes in recipient wild populations subsequent to escapes from farm populations or deliberate introductions of cultured fish through stocking; environmental changes close to and beyond the biological tolerance of populations as a consequence of global warming; losses of distinct genetic diversity due to habitat loss from impoundments for hydroelectric installations. These all have are assumed to have a negative impact on population abundance and persistence on affected populations in dynamic environments. Results of recent studies (Hilborn et al. 2003; Schindler et al. 2010) demonstrate the critical importance of maintaining population diversity for stabilizing ecosystem services and securing the economies and livelihoods that depend on them and for enabling adaptation to changing environments.

Genetic Toolbox

Population genetic techniques have provided a number of important additions to the fisheries management arsenal: resolution of genetic population structure; parentage assignment; mixed stock fisheries analysis; and pedigree reconstruction. These include the ability, classically, to determine population structure, to differentiate between individual populations and quantify inter population differences and to establish the status and genetic parameters pertaining to those populations such as levels of inbreeding, gene flow between individual populations, genetic drift, sex determination and consequently sex ratios, including, potentially, surrogate demographic attributes such as effective population size and number of breeders.

The capacity to assign individuals back to their parents, **parentage assignment**, has enabled salmon biologists to address a plethora of complex questions that were previously considered to be intractable. Within a common garden experimental framework in the wild, for example, .assessment of the relative fitness of the progeny of local wild and farm parents and their hybrids under natural conditions has been made (McGinnity et al. 2003); also the scale at which local adaptation occurs in salmon populations and its magnitude (McGinnity et al. 2004); and the role of variation in immune response genes as a basis for local adaptation (deEyto et al. 2011).

One of the most tangible benefits of genetic methods has been in the application of **genetic stock identification for mixed stock fisheries analysis**. With comprehensive baselines of potentially contributing populations, highly accurate assignments of individuals can be made to their river or region of origin. However, it very important to state here that while genetic markers can be considered to be analogous to physical markers, they are statistically derived assignments rather than absolute. As a consequence the quality of assignment will be a function of the quality of the baseline, which depends on coverage and molecular differentiation of the elements. The key advantage is that all samples in a mixed fishery provide biologically useful information, rather than just those from which a physical tag can be retrieved. In addition information is acquired from wild fish rather than for the most part data retrieved from fish that have be hatchery reared first in order to be large enough to successfully retain a tag.

Pedigree based analysis, facilitated by advances in statistical analysis and computing power, is a powerful method for separating genetic effects from environmental effects on the phenotype, as demonstrated by their common use in domestic animal breeding programmes. Pedigrees in the wild have rarely been constructed in any vertebrates because of the logistical and technical difficulties in identifying and following the performance of individual families.

The molecular pedigree reconstruction approach, as with any in the field of quantitative genetics, requires knowledge of the relatedness of individuals in a population. Such information, although challenging to come by in field populations, is increasingly available for studies of a range of taxa (Pemberton, 2008), fuelling a growing interest in the application of quantitative genetics to the multigenerational study of natural, rather than laboratory or domestic populations such as Atlantic salmon (Aykanat et al. 2014). In order to understand whether populations can adapt to human induced environmental change we need to understand the genetic basis of the phenotypic traits on which selection acts. To this end the skill sets associated with quantitative genetics are increasingly being employed in combination with those of population genetics. Questions being addressed by this approach include the impact of stocking and responses to climate variability, using fundamental quantitative genetics estimates of the heritability of important life history traits; selection; measuring evolutionary change e.g. human induced changes in critically important salmon population characteristics for ecological and fisheries management such as the age of reproduction and run time.

Some additional examples of the application of genetics for salmon management

The combined genetic and ecological study developed within the SALSEA-Merge project has demonstrated how this approach can provide new insights into the population specific biology of salmon in the sea. Knowledge has been acquired of distribution and migration patterns of post-smolts from individual populations in addition to measures of their growth rates and feeding preferences (Jensen et al. submitted). A recent study of the West Greenland fishery, exploiting the baselines developed in SALSEA (P. Prodöhl, QUB, *pers. comm.)* indicated that those European salmon caught there originated primarily from southern European rivers, predominantly from Scottish rivers with significant contributions from English and Irish rivers. Also, significantly, there was considerable agreement between estimates of non-maturing one-sea-winter salmon or potential multi-sea-salmon for southern European stocks and the ICES predictions of pre-fisheries abundance, thus adding considerable confidence in the veracity of both estimates. What was noteworthy was not those fish from regions that were present, but those fish from regions that were not. Surprisingly, there were few Icelandic fish observed and very few fish from the rivers of northern Europe. It must be assumed that they are migrating to some other part of the North Atlantic. The ability to locate salmon from different regions and stock complexes offers the prospect of linking geographically delineated oceanographic phenomena with the past performance of regional stocks and potential of making predictions about future performance (Friedland et al. 2014).

One of the most controversial salmon fisheries until recently was the Irish off-shore drift net fishery. A decision was taken by the Irish government in 2007 to close the fishery. Subsequently, one of the first and largest studies until recently undertaken in Europe (P. McGinnity, UCC, *pers. comm.*) showed that the fishery was indeed catching fish from multiple Irish river systems and vindicated the Government's decision to close the fishery. However, contrary to expectations its impact on non-Irish fish was found to be minimal. Coincidental to the mixed stock analysis some insights into the return migration behaviour of Irish salmon were acquired. The propensity for capturing mixed stocks declined from north to south suggesting the homeward migration for the majority of Irish stocks was from a similar direction. As might have been expected the closer the fishery is prosecuted to its home river the more likely the fish are to be from that river, for example, Moy fish constituted 20% of the salmon caught of the Northwest coast of Ireland. Within Killala Bay, the inshore coastal

district closet to the Moy river, Moy fish represented 60% of the catch. Significantly within the river itself at the transition from sea to river, Moy fish comprised 100% of the catch.

Modern fisheries management and stock assessment programmes require high accuracy census data to populate predictive models and to determine the success of management initiatives, relative to the achievement of conservation goals. It is difficult to count salmon in large river systems. In the Moy the potential of a different and innovative strategy whereby a counting facility is established in a small and manageable tributary, but critically one chosen because it has a genetically distinct salmon population compared to the rest of the system, was explored (P.McGinnity, UCC, *pers. comm.*). In collecting a representative mixed stock sample at the head of tide, for which the contributing stock components could be distinguished using genetic stock identification, it was possible to determine the total number of fish entering the river as the multiplication of the proportion that was accurately counted in the genetically distinct tributary relative to the genetically determined composition in the rest of the mixed sample.

On the basis of anecdotal evidence of distinct temporal patterns in run time among stocks using the estuary, an experimental fishery was operated in Castlemaine Harbour in Co. Kerry to enable samples to be collected for genetic stock identification to inform management in terms of operating a commercial fishery while safeguarding the spawning requirements of the salmon populations that were below conservation limit requirements (J. Coughlan, UCC, *pers. comm.).* Managers using a combination of genetic and biological data derived from this study found that there were indeed distinct and predominantly non-overlapping differences in run time among the various local populations indicating that the fishery could be prosecuted in a manner that only single stocks were targeted. The fishery was opened accordingly enabling a commercial salmon catch on sustainable populations that might otherwise have been foregone on the basis of designation as a mixed stock fishery.

While the extensive Irish genetic baseline for salmon has proven to be of great value for the analysis of mixed stock fisheries located around Ireland in terms of determining stock proportions in each fishery, the baseline has also been used to specifically identify the population of origin of fish that have undergone some level of processing (e.g. smoked salmon). In this respect, there is substantial interest in identification of farmed salmon, when processed, can be fraudulently sold (at considerable profit) as being of wild origin. Since 2005, all food businesses in Ireland are required to have traceability systems and must be able to authenticate the origin of all food products. In respect of salmon, these must be declared as being of wild or farmed origin. A test case taken in respect of smoked salmon by the Food safety Authority of Ireland (FSAI), falsely identified by the processors allegedly, using DNA profiling to confirm if salmon were of wild or farmed origin, showed that genetic data was admissible and acceptable as evidence in court (http://www.fsai.ie/uploadedFiles/News_Centre/Newsletters/Newsletters_Listing/Final_mar_apr_09.pdf). It was successfully argued in court that this was possible. The knowledge among food producers that the regulatory authorities can trace the origin of what was essentially a processed product should reduce the incidence of future mis-labeling.

In addition to tracing the origin of material in the food chain, genetic methods have come to the fore in identifying the origin of salmon that escape from aquaculture facilities into the wild. Trial studies in Norway by Glover et al. (2013a) show that this can be done very effectively. As stated by Glover et al. 2013 the point of identifying the origin of an escapee is that it also allows the identification of the cause of the escape, implementation measures to

prevent its recurrence in order to reduce the extent of escapes, and learn from what has happened. At the same time, the authorities can decide whether there are circumstances associated with an escape that need to be further investigated, in case a fish farmer should be made responsible for an escape and its potential environmental and economic consequences.

Glover and his colleagues (2013b) have also deployed genetic methods to quantify cumulative introgression of farmed salmon in native Atlantic salmon populations and the genetic changes that occur as a consequence. They show levels of introgression varying between 2 and 47% among 20 Norwegian rivers assessed. The estimations demonstrate that the level of introgression has been population-specific, and that the level of introgression is not solely predicted by the frequency of escapees observed in the population. However, some populations have been strongly admixed with farmed salmon, and these data provide policy makers with unique information to address this situation. Whatever about the propensity of farm salmon established from wild Norwegian populations freely introgressing with salmon in Norwegian rivers, some early data from a recent, as yet unpublished study, by the Beaufort group, indicates the intriguing possibility of Norwegian origin farm salmon establishing a discrete sustaining population within an Irish river. However, for the most part recent genetic surveys in Irish rivers suggest very little genetic carryover from the farms in affected areas.

There have been a series of incredibly powerful measures of the relative fitness of captive bred fish facilitated by pedigree reconstructions of long-term sampling programmes, particularly for a number of Pacific salmon species. A recent review of these studies by Christie et al. 2014 indicate that for the most part (i) early-generation hatchery fish averaged only half the reproductive success of their wild-origin counterparts when spawning in the wild, (ii) the reduction in reproductive success was more severe for males than for females, and (iii) all species showed reduced fitness due to hatchery rearing. These studies have been very useful for managers in the continuing debate on the appropriateness of and the risks to wild populations of stocking hatchery fish into wild. Studies employing this type of analysis, particularly where efforts have been made to collect biological material such as scales will be common practice and become an integral part of the Europe's long-term monitoring efforts for Atlantic salmon.

It can be difficult in some instances to decide in mitigation programmes or stock rehabilitation programmes between persisting with genetic material that has been maintained within a hatchery, resampling from depressed wild populations or sourcing fish from other non-native populations. The capacity to examine the structure of historical salmon populations by genetic profiling of archive scale collections can provide important starting point for the design of salmon restoration programmes and an assessment of the material available. For example in a recent restoration ecology project involving the Shannon River system in Ireland, genetic analysis of archive scale material prior to the installation of the rivers hydro-electric facility in the 1920's showed that it was possible to identify the elements of biodiversity and genetically distinct populations with different life history profiles that have been lost in the intervening period (P. McGinnity, UCC, *pers. comm.).* Current discussions in respect of the rivers rehabilitation, informed by the genetic data, centre on options for ecological as well as genetic matching to provide best chances of success.

Future developments

A full sequence of the salmon genome has been recently completed (http://www.icisb.org/salmonsequencing). Where up until recently a panel of 20 or so microsatellite type genetic markers were the norm, population geneticists now have ready access to panels of quarter of a million SNP markers. Probably one of the most exciting areas emerging in genetic and genomic methods is an increasing ability to assess patterns in the distribution of adaptive diversity and how it is adding to our understanding of the nature and extent of local adaptation (Hemmer-Hansen et al., 2014). It is now becoming increasingly feasible to link genes with life histories and to measure levels of expression and to gain new fundamental insights into the ecology and evolution of Atlantic salmon. Also most population genetic studies previously concentrated and depended on estimates of neutral genetic variation. Now there is a shift to the usage of molecular markers influenced by selection; so called adaptive or gene associated markers Neilsen et al. 2012). Markers under selection typically display elevated levels of differentiation, potentially enabling the discrimination of of salmon populations exhibiting low genetic differentiation, something which has been a feature of some of the large Irish and Scottish rivers.

Further new applications of genetics and genomics in fisheries management are constantly being developed and deployed, for example, the study of Atlantic salmon micro-biomes and the detection of environmental DNA (eDNA) are a good examples. Like the human gut micro-biome project, an understanding of the salmon micro-biome will provide insight into the role microbial species have in nutrient absorption and metabolism, and in immunity and disease response and consequently might provide an excellent window into our understanding of the health of salmon in marine and freshwater environments and their interaction with pathogens. Unlike in humans, where much of the micro-biome is transmitted to juveniles within families and social groups, salmon must selectively recruit all their commensal bacteria from the external environment (M. Llewellyn, Bangor University, *pers. comm.*; Llewellyn et al. 2014).

Environmental DNA (eDNA) is DNA that is released from an organism into the environment. Sources of eDNA include secreted feces, mucous, and gametes; shed skin and hair; and carcasses http://pubs.usgs.gov/fs/2012/3146/ . In aquatic environments, eDNA is diluted and distributed by currents within a given water body. Depending on the environment eDNA lasts about 7–21 days. Protocols using eDNA will allow for rapid, cost-effective, and standardized collection of data about species distribution and relative abundance, but probably most powerfully deployed for early detection of aquatic invasive species. Aquatic invasive species, where they occur with Atlantic salmon will most certainly represent a potent evolutionary force on the species.

Summary

Presented above are just a few examples of the application of genetic methods to the conservation of the biological integrity of the Atlantic salmon resource. Genetic markers provide an extraordinary powerful tool for identifying and delineating biologically significant management and conservation units in Atlantic salmon; the biology of species lends itself well to genetic population structuring with high, river specific, homing fidelity to discontinuously within river distributed spawning habitats Importantly genetic methods play an important role essential to identifying the most vulnerable populations; according them with appropriate protections. The application of genetic methods has brought valuable new information on the extent of anthropogenic impacts (fishing; climate; habitat; aquaculture) on population productivity and resilience. The incorporation of eco-evolutionary concepts such

as bio-complexity/port-folio effects are now central to the managers understanding of the factors that determine sustainable abundance and adaptability to dynamic environments.

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Annex 2

CNL(14)43

Overview of the 2013 – 2018 Implementation Plans in relation to the management of salmon fisheries

(Paper prepared for the Theme-based Special Session by the Steering Committee)

1. Introduction

1.1 The objectives of the Theme-based Special Session, as described in CNL(14)13, are to allow for a more detailed exchange of information on the management of salmon fisheries including:

- Progress in establishing conservation limits, or alternative reference points, and the approaches being used to manage fisheries in their absence;
- How management measures are used to ensure the protection of the weakest contributing stocks in mixed-stock fisheries;
- How socio-economic considerations, including the interests of indigenous people, are weighed against conservation needs and, where fishing is permitted on stocks below their conservation limits, the approaches being used to ensure that exploitation is limited to a level that permits stock rebuilding within a stated timeframe.

This paper aims to set the scene by presenting an overview of the relevant information in the 2013-2018 Implementation Plans produced by individual jurisdictions, drawing on the Implementation Plan Review Group's evaluations of these plans, CNL(13)12.

2. Background

2.1 NASCO and its Parties have agreed to adopt and apply a Precautionary Approach to the conservation, management and exploitation of salmon in order to protect the resource and preserve the environments in which it lives. Accordingly, their objective for the management of salmon fisheries is **to promote and protect the diversity and abundance of salmon stocks**, and in support of this, they have developed the following guidelines and agreements:

- The Agreement on Adoption of a Precautionary Approach, CNL(98)46;
- The Decision Structure to Aid the Council and Commissions of NASCO and the relevant authorities in Implementing the Precautionary Approach to Management of North Atlantic Salmon Fisheries, CNL31.332; and
- NASCO Guidelines for the Management of Salmon Fisheries, CNL(09)43, hereinafter referred to as 'the Guidelines'.

2.2 Additional information on these agreements and guidelines is contained in the Programme for the Theme-based Special Session, CNL(14)13. Excerpts relating to the three key subject areas from individual jurisdictions' Implementation Plans had been collated into a single document for use by the Steering Committee which is available from the Secretariat (document IP(13)23).

3. Establishment of Conservation Limits or alternative reference points

3.1 In the 1998 Agreement on Adoption of a Precautionary Approach, NASCO Parties agreed that stocks should be maintained above their conservation limits by the use of management targets established for each river.

> 'Conservation limits (CLs) should be established to define adequate levels of abundance for all river stocks of salmon' … 'Where CLs have not been established, alternative measures should be used as reference points and should be shown to be effective and appropriate in defining adequate stock levels.' The Guidelines, S.4a & d

3.2 The Implementation Plan Review Group noted progress: '*The Implementation Plans confirm the information provided by ICES that river-specific conservation limits have been established by some Parties/jurisdictions for all or most of their rivers. Progress is being made in most other Parties/jurisdictions towards development of these conservation limits and in the meantime juvenile abundance data and/or catch statistics are being used as temporary reference points by some jurisdictions.*'.

3.3 A summary is provided for individual jurisdictions in Table 1. The absence of conservation limits is most prevalent in the EU, though several jurisdictions there have established limits, associated management targets and annual assessment for all their rivers. As yet, EU Scotland (UK) has not considered it possible to establish meaningful conservation limits. Action to address stock depletion is triggered by low catch levels relative to those in the past 20 years following criteria in a flow chart. In the North American Commission, both Canada and the United States are working to improve their conservation limits.

4. How management measures are used to ensure the protection of the weakest contributing stocks in mixed-stock fisheries (MSF)

> 'NASCO has defined MSFs as fisheries exploiting a significant number of salmon from two or more river stocks;' …
> 'Fisheries on mixed-stocks, particularly in coastal waters or on the high seas, pose particular difficulties for management, as they cannot target only stocks that are at full reproductive capacity if there are stocks below CL within the mixed-stock being fished.'…
> 'Rational management of a MSF requires knowledge of the stocks that contribute to the fishery and the status of each of those stocks' ….
> 'Management actions should aim to protect the weakest of the contributing stocks'.
> The Guidelines, S.8

4.1 The Implementation Plan Review Group commented that: '*Where Parties/jurisdictions have such fisheries* (MSFs)*, the Implementation Plans generally provided information on catches but clear descriptions of how the fisheries are managed to ensure that all the contributing stocks are meeting their conservation objectives were often lacking.*

4.2 **Where are the MSFs?** As shown in Table 2, mixed-stock fisheries, as defined by NASCO, operate in many of the jurisdictions. The biggest catches identified in the Implementation Plans are reported from Norway, Canada, EU England and Scotland (UK), Greenland, and the Russian Federation. In general these are coastal fisheries. It is not clear that estuary fisheries exploiting a small number of stocks, such as described in Ireland, have always been included. Management can be more difficult where fisheries exploit stocks originating from other jurisdictions. The fisheries in Greenland and the Faroe Islands are not the only examples. The St. Pierre and Miquelon (France) coastal fishery which exploits North American stocks is noted by the United States but is not otherwise described in an Implementation Plan as France (in respect of St Pierre and Miquelon) is not a NASCO signatory. Management across jurisdictions may also be required for some estuary fisheries, such as the Solway on the English-Scottish border in EU United Kingdom, or even some in-river fisheries, notably in the R.Teno in Finland that flows as the R.Tana from Norway.

4.3 **Has the contribution of each stock in the MSFs been assessed?** For the Greenland and, when operating, the Faroes fisheries, contributions of stock complexes have been assessed rather than those of individual river stocks. This facilitates management as agreed by NASCO (S2.8 of the Guidelines). Elsewhere, it seems that assessment of the contributions of individual stocks to identified MSFs has rarely been annual or even regular. The information presented at this Special Session may indicate to what extent efforts are being taken to actively identify the stocks contributing to MSFs.

4.4 **Are the MSFs managed to protect the weaker stocks?** In most jurisdictions, weaker stocks have been given greater protection through reduced fishing effort or quotas, as indicated in Table 2. How, or indeed if, this enables conservation objectives to be achieved for individual stocks is unclear for most jurisdictions, especially given the limited assessment of contributions of individual stocks to the catch. It is intended that this Special Session will provide greater clarity and examples of best practice.

4.5 In some jurisdictions, such as EU Ireland and Northern Ireland (UK), protection has been, or is being, achieved by closing or phasing-out coastal fisheries with fisheries limited to estuaries and rivers where stocks are known to be meeting conservation objectives. This Special Session is intended to provide a clearer understanding of how jurisdictions are protecting, or intend to protect, weaker stocks.

5. Management of fishing on stocks below conservation limits

> 'Fishing on stocks that are below CLs should not be permitted. If a decision is made to allow fishing on a stock that is below its CL, on the basis of overriding socio-economic factors, fishing should clearly be limited to a level that will still permit stock recovery within a stated timeframe.' The Guidelines, S.2.7e

5.1 **Do many jurisdictions permit fishing on stocks below conservation limits?** Table 3 shows that with some exceptions such as Denmark in respect of the Faroe Islands, most jurisdictions do permit some fishing on stocks below conservation limits. Some use other reference points to determine whether there can be a harvest or, if so, its size. For example, Ireland allows angling by catch and release if stocks fall below the Conservation Limit but if they fall below 65% of the limit, the fishery is completely

closed. The harvest of multi-sea-winter fish is addressed separately in some rivers. Canada has similar constraints, regulations varying between regions.

5.2 The Implementation Plan Review Group commented: *'It is clear from the responses to this question that fisheries are permitted to operate on stocks that are below their reference point in several jurisdictions, but the number of fisheries involved and the management measures applying to these fisheries to promote stock rebuilding were not always clearly described.'*

5.3 **What are the over-riding socio-economic factors?** These are not always clear. The justifications appear to fall into four, not necessarily discrete, categories. The Steering Committee has categorised these based on statements in the Implementation Plans:

i) Maintaining economic benefits: Without continuity, fishermen and associated businesses will have to seek other opportunities, whether for employment or recreation. If stock depletion is short-term this may lead to unnecessary, potentially long-term, loss of economic benefits. In EU Scotland (UK), for example, consideration is given not only to livelihoods but also property rights. Such rights are also considered in Norway, where local owners have been given a greater role in stock management in the last decade.

ii) Maintaining stakeholder engagement in resource protection and enhancement: For example, EU Denmark flagged the role that angling associations have in protecting and enhancing local salmon stocks.

iii) Subsistence: In some locations, such as Greenland, maintaining a fishery is deemed vital to the well-being of local communities, options for alternative employment or food being limited.

iv) Cultural: Several jurisdictions deem it important that some fisheries are maintained for cultural reasons. Canada, the Russian Federation, and EU Finland give priority to aboriginal fisheries. Elsewhere, such as in EU England, Wales and Scotland (UK), where fishing methods are unique to a very small number of locations and deemed to have a heritage value, a residual fishery may be permitted with a low level of catch.

5.4 **Taking account of socio-economic factors:**

> 'In evaluating management options conservation of the salmon resource should take precedence; and transparent policies and processes should be in place to take account of socio-economic factors in making management decisions and for consulting stakeholders.' The Guidelines, S.2.9

5.5 For many jurisdictions, it may be inferred, where not specifically stated in the Implementation Plans, that policy is for conservation to take precedence. A summary is included in Table 3. For others, such as EU Scotland (UK), conservation is just one component of a national socio-economic objective. Even when policy appears to give conservation precedence, most Implementation Plans do not detail the process by which this is achieved. As noted by the Implementation Review Group '*generally little information was provided on how the costs and benefits of different options were*

weighed in decision-making.' No jurisdiction mentioned the NASCO 2002, 'Decision Structure for the Management of Salmon Fisheries'.

5.6 Consultation is an important facet of regulation. As noted by the Implementation Review Group: *'Many plans referred to stakeholder consultations, both at national and regional levels.'* Further clarification on such consultations would be helpful in understanding how decisions are made when balancing economic considerations against conservation.

5.7 **Are timeframes to permit stock recovery stated?** Multi-annual regulations operate in several jurisdictions, whether for single or mixed stock fisheries. However, it is not clear that timeframes for stock recovery are generally specified, or indeed appropriate where exploitation is not a key limiting factor. In EU United Kingdom timeframes for at least some stock recovery are defined in England & Wales and implied for Scotland. It is not clear however what evaluation processes are in place to monitor whether adequate recovery is taking place during the stated or implied timeframes and how these are reported to stakeholders and fisheries managers.

6. Conclusions

6.1 Conservation limits and management reference points have been established for stocks in most jurisdictions. Implementation Plans indicate the intention to establish biological reference points to address remaining gaps, though the timescale isn't always stated.

6.2 Many jurisdictions still permit fisheries, including mixed stock fisheries, to operate on stocks below their conservation limits or alternative reference points.

6.3 Most fisheries are constrained, either by effort or by catch, and consultation with stakeholders is generally an important factor in the process of choosing a management option. Nonetheless, it is not clear how, or in some cases if, conservation is given precedence over socio-economic factors.

6.4 The presentations and discussion in this Special Session offer the opportunity for jurisdictions to clarify how they are applying a Precautionary Approach to fisheries management, as agreed, and to share best practice.

JURISDICTION	Proportion of rivers/stocks with CLs established	Proportion of rivers/stocks with effective and appropriate alternative measures
Canada	All. CLs defined regionally to different criteria. 6% of rivers are assessed annually. Reassessment of CLs and reference points planned.	
Denmark in respect of Faroe Islands	Reference points established by ICES for stock complexes exploited in marine fishery. No rivers with self-sustaining wild stocks.	
Denmark in respect of Greenland	Reference points established by ICES for stock complexes in coastal fishery. No CL established for single Greenland river stock.	
EU Denmark	Conservation limits not set	In 4 rivers with wild salmon objective is 1,000 spawners. Each year stock is assessed in one river. None where wild salmon extinct.
EU England/ Wales (UK)	78 rivers regularly support salmon. All principal rivers (64) with CLs and assessed annually, though not split 1SW/MSW. Management target is to exceed CL 80% of the time.	
EU Finland	Yes for 1 of 2 rivers. CLs set for 5 tributaries of the R.Teno, working with Norway.	R. Näätämöjoki: catch statistics used as surrogate of abundance?
EU Germany	Only 'maintained' rivers at present. No CLs defined.	Conservation status determined with special assessment and evaluation keys. Management target is 'favourable conservation status'.
EU Ireland	100% (144 stocks). 16 rivers also have separate assessment for 2SW.	
EU N. Ireland (UK)	Yes, CLs in both Loughs Agency and DCAL areas. Management targets set in Loughs Agency area.	
EU Scotland (UK)	Not yet. Work currently underway to establish CLs.	Flow chart based on rod catches, related to other data from counters and juvenile surveys.
EU Spain	CLs planned in Cantabria. Not set yet in Asturias or Galicia.	Ref points unclear, abundance assessed by catch, counters, & observation to set TAC.
EU Sweden	None yet. CLs and management targets to be developed 2015-18	Status assessed by parr abundance relative to habitat potential combined with catch data.
Norway	439 rivers with self-reproducing stocks have spawning targets. Annual assessment of 227 river stocks.	
Russian Federation	100% in Murmansk region, the main rivers in Arkhangelsk and the Pechora. None in Komi or Karelia.	No information
United States	Conservation Spawning Escapement goal (as 2SW) is 29,199 adults. New targets proposed and being assessed by ICES.	

Table 1: The status of Conservation Limits or Alternative measures indicated in Implementation Plans

JURISDICTION	What size are the MSFs?	Has the contribution of each stock in the fishery been assessed and when?	Is the fishery managed with the aim of protecting the weaker stocks?
Canada	Mean catch over 5-year period - 58t (9606 grilse, 3616 large). 24t in 2013	Project to analyse stock composition in Labrador fishery due to report 2013	Not specifically though effort is constrained. Stock composition currently being assessed
Denmark in respect of Faroe Islands	No Fishing	Annual ICES assessment at stock complex level	Yes. Through ICES/NASCO
Denmark in respect of Greenland	Coastal fishery - mean catch over 5-year period - 29t. 47t in 2013	Annual ICES assessment at stock complex level	Yes. NASCO agreement allows stock rebuilding
EU Denmark	No significant fishery	N/A	No fishery
EU England/Wales (UK)	Policy to phase out those MSFs exploiting more than a few stocks. 2007 - 2011 mean catch approx. 13,000 fish (~50t) other than heritage fisheries.	Yes - recently in some MSF, but not annually	Yes, through effort, and sometimes catch restrictions, assured if and when phase out of MSFs is complete.
EU Finland	In-river (Teno) exploiting 30 tributary populations so outside NASCO definition,	No specific data	New agreement with Norway under development
EU Germany	None	N/A	No fishery
EU Ireland	3 fisheries (1X 2 stocks, 2 X 3 stocks). Average total catch = 7t	Yes - all exceeding CL	Yes
EU N. Ireland (UK)	None. Residual coastal fisheries have been closed.	N/A	Yes - led to cessation of fishery in 2012
EU Scotland (UK)	40 tonnes - mean 5-year coastal catch	No - some work underway	Not yet. Under review
EU Spain	None	N/A	No fishery
EU Sweden	MSFs on both wild and stocked fish. Average 2007 - 2011 catch of 2t	No	Plans to use only gear which allows release of wild salmon, compulsory from 2014
Norway	Mean catch in sea fisheries - 331 t. 345 t in 2013	No info	Country is divided into 23 regions to provide management advice to protect stocks.
Russian Federation	25 tonnes in Murmansk, 10 tonnes in Archangelsk regions.	Yes - 'in past' from tagging data	Not yet but quotas have been gradually reduced.
United States	None in jurisdiction	N/A	No fishery

Table 2: The mixed stock fisheries and their management as noted in Implementation Plans

JURISDICTION	Is fishing permitted within the jurisdiction on stocks below Conservation Limits?	What are the stated overriding socio-economic imperatives to justify continued fishing?	Does conservation take precedence?	Are transparent policies and processes in place for incorporating socio-economic factors and consulting stakeholders?
Canada	Yes. Measures vary depending on stock state. Fisheries may be closed if stock is severely depleted. Varies by province.	Resident subsistence fishery, Aboriginal fisheries and river stewardship scheme for angling.	Conservation needs to be met before a fishery operates then aboriginal fisheries have priority.	Yes, for policy and consultation,
Denmark in respect of Faroe Islands	No. Fishery closed in line with ICES advice on four stock complexes, i.e. N and S European 1SW and MSW	N/A	Yes	NASCO work is documented. Consultation by Government with local fisheries interests implied.
Denmark in respect of Greenland	Yes. By coastal fishery on N American and S European MSW stocks	Subsistence fishery. Internal use only. No commercial export.	Yes, up to a point. Fishery is limited by NASCO agreement to reduce risk to individual stocks	NASCO work is documented. Consultation by Government with local fisheries interests implied.
EU Denmark	Yes. Limited quotas set for sports fishery based on estimated spawning run	Stakeholder support over habitat, stocking and control of illegal fishing.	Yes	Process unclear. Local angling associations and land owners consulted annually on salmon management
EU England/Wales (UK)	Yes. But no harvest if stock projected to fail management target in 5 years.	Stakeholder engagement, stability and continuity in fisheries, heritage fisheries	Yes. There must be progress towards management objective.	Decision Structure and formal process for consultation on measures.
EU Finland	Yes. Fisheries though ref points on 5 Norwegian tributaries not attained.	Local economy and the Sámi culture	Not yet, on R.Teno	Not yet.
EU Germany	No. Negligible catch in some fisheries.	N/A	Yes	Not relevant as yet.
EU Ireland	No, if below 65% of CL. Yes, if >65% of CL but no harvest allowed and C&R only with method restrictions.	N/A	Yes	Consultation with stakeholders on allocation of harvest (usually based on historical catches).

EU N. Ireland (UK)	No, when new legislation introduced in 2014 for DCAL area: no commercial salmon fishing and angling C&R only until sustainable surplus above CL. No exploitation of stocks if targets not met in season in Loughs Agency area.	N/A	Yes.	Consultation with stakeholders
EU Scotland (UK)	Yes, though abundance flow chart used by local fishery boards and, if necessary, national government to constrain exploitation.	Various factors may influence measures applied and time frame for recovery: property values, livelihoods, heritage value of fisheries.	Not clear	Decision Structure for local management to implement with national overview. Consultation.
EU Spain	Yes, though not in Asturias. In both Cantabria and Galicia, fishing to a quota occurs on stocks that are likely to be below any reference point established.	To maintain the interest of the people in the species and protection of its habitat	Yes, except perhaps R. Mino.	Not clear. There is consultation with Fishing Advisory Council
EU Sweden	Yes. Restricted fishing allowed on 3 of 6 stocks identified below 50% of predicted potential production	No justification given	Not clear	Extensive consultation
Norway	Yes, but fisheries on stocks that do not reach their management target shall be limited, so as to permit stock recovery. In coastal areas fisheries harvest stocks below management targets.	Unclear but implication is to maintain a fishery and associated benefits	Yes, up to a point, by reducing fisheries on stocks below management targets 'as much as possible'	Strong local responsibility for management measures with local consultation based on national advice. Consultation with Sami Parliament.
Russian Federation	Yes. Fisheries may be permitted on stocks below reference point for socio-economic reasons	For allocation of TACs, fisheries are prioritised (6 levels). Indigenous small nations have priority.	Yes. Conservation and rational exploitation take priority over property rights. Regional TACs.	Policy stated, though no information on consultation.
United States	Not within US jurisdiction.	N/A	Yes	Not relevant as yet given depleted nature of the stocks

Table 3: The management of fisheries on stocks below their conservation limits as noted in Implementation Plans.

Annex 3

CNL(14)67

Management of single and mixed stock fisheries, with particular focus on fisheries on stocks below their conservation limits

Tabled by EU - Ireland

Introduction

This paper will provide an overview of the Irish position in relation to the management and exploitation of single and mixed stock fisheries. It will also provide a brief overview of the distant and more recent historical background to salmon management in Ireland, leading up to a detailed description of how we have arrived at the current management regime. Finally the paper will provide a review of the annual management process and an overview of the current pressures on the management regime being experienced in Ireland.

Historical Background

Salmon are an iconic species in Ireland, and their significance to Ireland is as much cultural as economic. Salmon have been recorded in the earliest of Irish manuscripts and form part of the Irish mythological tradition. The story of the *An bradán feasa* (the salmon of knowledge) is embedded in Irish folklore has been widely recounted to generations of Irish children.

In the more recent past salmon have greatly exercised the minds of regulators in Ireland. In 1836 there was a Royal Commission Enquiry into the State of Salmon in Ireland and in 1901 the Statistical and Social Inquiry Society of Ireland produced a report on the salmon fisheries of Ireland, to name just two important documents. In the 1940's Dr A. E.J. Went one of the founding fathers of fisheries management in Ireland produced seminal papers on the Salmon of the Owenduff (Ballycroy) River (1941) and the Salmon of the River Shannon (1943). However it was during the mid 1990s, and early 2000's that the management of salmon received even greater attention due to significant concerns about the state of the resource.

Recent History of Salmon Management in Ireland

In the 1990s Ireland was concerned about the decline of salmon numbers returning to the Irish coast. The then Minister with responsibility for wild fish established a Salmon Task Force to consider this matter and advise him on how this decline might be arrested and stocks improved. In 1996 the 'Salmon Task Force' reported to the Minister and made a number of recommendations. Having considered the recommendations the Minister introduced the following conservation measures in 1997.

i) The fishing area was reduced from 12 miles to 6 miles offshore.
ii) A cap was placed on the total number of commercial salmon fishing licenses issued.
iii) The Commercial fishing season for draft netting was postponed until May 12th and the drift netting season was postponed until June 1st.
iv) The fishing week was reduced to 4 days.
v) A ban was placed on night fishing.

In 2000 the National Salmon Commission was established by the Minister with the express function to "assist and advise the Minister in relation to the conservation, management, protection and development of the national salmon resource…". Supporting the National Salmon Commission was a Standing Scientific Committee (SSC), whose role was to advise, and assist the National Salmon Commission on all appropriate technical and scientific matters.

In 2001 a mandatory carcass tag and log book scheme was introduced for all wild salmon (and sea trout over 40cm), and the sale of rod caught fish was banned.

In 2002 Total Allowable Catches (TAC's) were introduced for commercial salmon fishermen and a bag limit of 20 fish per angler per season was introduced for recreational anglers. The TAC for wild salmon in 2002 was set at 219,000 salmon.

In 2003 the commercial TAC was further reduced to 182,000 salmon. The then Central Fisheries Board undertook an independent economic / socio economic evaluation of wild salmon in Ireland.

In 2004 the commercial TAC was again reduced to 162,000 salmon. The Standing Scientific Committee changed from using a catch based model for providing advice to using a wetted area model, based on available salmon habitat, for determining the conservation limits, and this report forms the basis of the conservation limits (CLs) currently being used for salmon management in Ireland.

In 2005 the Government confirmed its commitment to have National and District quotas fully aligned with scientific advice provided by the Standing Scientific Committee by 2007. The Standing Scientific Committee also introduced a risk analysis on the catch options for each river, the results of which determine their open/closed status. It was established that rivers, in order to open for exploitation, must provide at least a 75% chance of meeting aggregated District conservation limits based on average returns over the most recent 5 year period.

In 2006 the terms of reference for the Standing Scientific Committee were further amended so that scientific advice was provided on an individual catchment basis rather than a District basis. However as Ireland was still operating a mixed stock fishery at sea, the Standing Scientific Committee provided guidance figures on a District basis.

In 2006 the Government also appointed an Independent Salmon Group (ISG) to examine the implications of aligning with the scientific advice for commercial salmon fishermen. The ISG reported in October 2006 and identified measures to address any financial hardship arising for individuals involved in commercial salmon fishing from full compliance with the scientific advice.

Additionally the Irish Government reaffirmed its commitment to aligning with the scientific advice for the 2007 salmon season and end mixed stock salmon fishing at sea. This was a response to domestic concerns regarding the abundance of the salmon stock as against historical levels and also partially in response to an action against Ireland under the Habitats Directive.

In 2007 the Government introduced a hardship scheme to support fishermen to exit the fishery. This fund with an allocation of over €25 million and provided each qualifying fisherman, who wished to avail of the scheme, with a payment equal to six times their average annual catch over the period 2001-2005 multiplied by the average price per salmon over the period (€23). Each qualifying fisherman also received a payment equal to six times the license fee. Although the scheme was compulsory for drift net fishermen the scheme was also opened the other commercial salmon fishermen who use nets such as snap and draft nets. While not all fishermen took up the offer of the Hardship Scheme, for those who did, payment under the scheme was conditional on permanent cessation of salmon fishing by the recipient.

An additional €5 million fund was also made available for community support schemes. These schemes were designed to aid the development of those communities where the impact of the cessation of drift netting was hardest felt, and promote alternative economic opportunities for those affected. This hardship fund was a manifestation of the very serious consideration given by the Government to socio-economic factors when aligning activity and regulation with the scientific advice.

From this point forward the management of wild salmon was conducted on an individual river basis, a quantum leap from how the fishery was managed heretofore. The purpose of the new management regime was to ensure that the potential benefit of returning salmon was optimised, as well as ensuring that in each of the river salmon stocks would in time return to a healthy status. This means that the harvest of salmon, by any means, was restricted to those stocks of rivers that were judged by the scientific advice as meeting their conservation limits. Commercial fishing and recreational angling could only continue on rivers which had a scientifically identified exploitable surplus. From 2007 Ireland ceased exploitation of all stocks which did not meet their conservation limit.

The immediate impact of the cessation of the drift net fishery was that in the region of 68,000 fish that might otherwise have been taken in the at-sea drift-net fishery in 2007 were available for redistribution to their natal rivers. As a consequence of the redistribution of the foregone at-sea drift-net catch up to ten rivers, which would otherwise not have met their conservation limit in 2007, had a surplus over the conservation limit requirement.

From the recreational angling perspective the same harvest conditions were imposed. No harvest of salmon would be permitted unless the stocks of those rivers were judged by the scientific advice as having met there conservation limits. The angling bag limit was further reduced to a maximum of 10 fish per angler per year and restrictions were put in place to further protect spring fish at the beginning of the season and later running fisheries at the end of the season. In the case of spring fish anglers were restricted to a total of one salmon (any size) or sea trout (over 40cm) per day to a maximum of three fish for the period beginning January 1st to May 11th. Rivers which did not have a harvestable surplus but were judged to be reaching 65% or more of their conservation limit were opened on a mandatory catch and release angling basis to provide another metric for the scientific analysis. All other rivers were closed for all forms of exploitation. The Government also applied a conservation charge to the licence fee equal to the cost of the license. This was a mechanism to allocate and charge for the opportunity to harvest surplus fish in 2007, and finally they also committed to increasing the fishery rates in 2008.

The conservation component of the license fee was ring fenced and specifically targeted towards the rehabilitation of salmon rivers which were below their conservation limits. Since its inception in 2007 the salmon conservation fund has generated in excess of €4.25 million for the rehabilitation of salmon and sea trout populations.

2007 was the 'seminal moment' for the management of salmon in Ireland. It was from this point that the Government committed to aligning itself with the scientific advice, to the management of salmon on a catchment by catchment basis and to only facilitating exploitation of salmon stocks that had a surplus above the conservation limit. The 'traditional' three pronged approach to the management of salmon fisheries in Ireland, which encompassed, scientific, socio-economic and management perspectives was significantly refocused.

The primary driver became and remains the scientific advice. If there was no harvestable surplus as advised by the Standing Scientific Committee then there was no harvesting of salmon. Thus in 2007, only 43 rivers & 2 common estuaries were opened for exploitation and 7 rivers were opened on a catch and release angling basis all remaining rivers (103) were closed for all forms of exploitation.

Current Management Regime

Having committed to a fundamental shift in the salmon management regime in 2006, for the 2007 fishing season it is important to recognise the amount of resources which have been dedicated to salmon management in Ireland since that period. On an annual basis Inland Fisheries Ireland (IFI), established in 2010 by amalgamating the Central and all 7 Regional Fisheries Boards into a single authority, provides management advice on 143 individual rivers to the Minister for his consideration. This management advice is based on the considerations of the Standing Scientific Committee which is established in law as an independent body. Both Scientific advice and management advice is provided within an extremely restricted timeframe.

To achieve the statutory requirements provided for in legislation management measures must undergo a 28 day consultation period before they can be signed into law, and only then based on the result of the consultation process. To put further pressure on the system a number of recreational fisheries open on the 1st of January. In essence the entire process is focused on the last two weeks of October and the first two weeks of November. A graphical summary of the scientific advice process is provided in Figure 1.

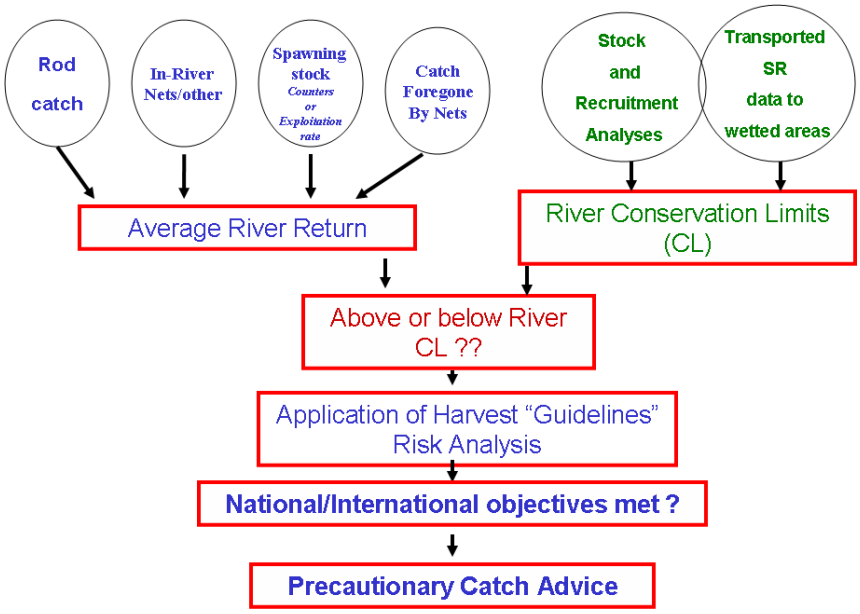

Figure 1. Graphical representation of the annual scientific assessment process (Ref: The Status of Irish Salmon Stocks in 2012 with Precautionary Advice for 2013, SSCS Report for IFI)

Every effort is made to obtain relevant data and monitor the performance of stocks (attainment of conservation limits) at the river level and consequently to assess the status of individual riverine stocks. Several sources of information are used in this process.

Commercial catch data:

Despite the closure of mixed stock fisheries below their conservation limits, the catch statistics derived from the estuarine commercial fisheries (draft nets & snap nets) which remain are an important source of quantitative information, particularly in determining the overall size of the returning stock and the attainment of river conservation limits. Following implementation of the wild salmon and sea trout tagging scheme which commenced in 2001 the catch data are derived from the logbook returns of commercial fishermen. Reporting rates are at 100% from this fishery.

Rod catch data:

The reported rod catch from the wild salmon and sea trout tagging scheme (Anon. 2003 to 2010) was adjusted to take into account the numbers of fish that have been caught by anglers who have not returned their logbook. The adjustment follows Small (1991). In some instances, directly reported rod catches from IFI Regional Fisheries Officers or rod catch data from managed fisheries (private owners who maintain reliable records), provided these have been vouched for by IFI officers, have also been used. Logbook returns have been consistently high in recent years and reached a return rate of 75% in 2012 and 74% in 2013.

Total traps and counters:

Data are available from 31 counters and salmon traps including the research and monitoring facility on the Burrishoole River in Mayo, which provides a direct measure of the total adult returns and smolt migrations annually. Similarly, data from an adult salmon trap on the Erriff

River (Ballinakill District) are available annually. Counter values for October to December are extrapolated from the mean of the previous five years where appropriate. A standardised approach has been developed to interpret the fish counter data and use it in the measurement of the attainment of the conservation limit.

National Coded Wire Tagging and Tag Recovery:

This programme provides an index of marine survival over a long time period and information on exploitation rates in marine and freshwater fisheries. Despite the closure of mixed stock fisheries in 2007, information from this programme continues to inform on marine survival rates and exploitation in some estuarine and rod fisheries and more importantly indicates whether fluctuations in the numbers of returning adults are as a result of management measures or changes in factors occurring outside of management control i.e. environmental/climate changes.

Other data:

An additional index, catchment wide electro-fishing, has been used since 2007, to provide information on juvenile salmon stock abundance in rivers nationally. An index of $\geq$ 17 salmon fry per 5 minute electrofishing is used by the SSC as the cut-off between rivers below this threshold where the stock is likely to be below conservation limits and those rivers above the threshold where it is more likely that the stock is meeting conservation limits. If the fry index is above the 17 fry threshold, catch and release fishing is permitted in the following year. Since 2007, up to ten rivers have been open annually for catch and release angling based on electro-fishing. The data generated by catch and release angling provides a direct estimate of salmon stock abundance on these rivers.

Status of individual rivers relative to Conservation Limits

In line with international advice on salmon stocks, the SSCS advise that the best way to meet national and international objectives of conserving salmon stocks in all salmon rivers is to allow fisheries only in rivers or the estuary of that river, where there is a greater probability of targeting only the stocks originating from these rivers (i.e. single stock fisheries). The SSC also advise that fisheries should take place only on stocks that are shown to be meeting their Conservation Limit with the catch restricted to the estimated surplus above conservation limit. This advice follows from International best practice as advised by NASCO and ICES. It is important to note that where more than one river flows into an estuary, fishing in that estuary is only permitted if all contributing stocks are meeting their individual conservation limits

The main objective of the SSC advice therefore, is to ensure that there are sufficient spawning salmon remaining after commercial and recreational fisheries to meet the required conservation limit for that river. In order to do this, the number of salmon which will be available before the fishery takes place must be "forecast" for each river annually, based on the average returns in recent years (usually the most recent 5 years provided sufficient information is available). The information required for this forecast is derived from commercial catch data, from extrapolation of rod catch information using exploitation rates or from estimates based on fish counter information.

Once estimates of average spawners, average catch, and river specific conservation limits have been derived, harvest options are provided with the associated probability of meeting conservation limits.

Following the procedure used by ICES for the provision of catch advice for West Greenland, the harvest option that provides a 0.75 probability level (or 75% chance) of meeting the Conservation Limit for a given stock is recommended. Where there is no harvest option which will provide a 75% chance of meeting the conservation limit then there is no surplus of fish to support a harvest (commercial or rod).

An objective of the catch advice from the SSC is to ensure that harvest fisheries only take place on river stocks meeting and exceeding conservation limits. Where a fishery comprises of more than one stock, the risk analysis is based on the simultaneous attainment of CL for all contributing stocks.

Mixed stock fisheries will always present greater risks than when stocks are exploited separately however, because of uncertainties or variability in the proportion of the catch originating from the weaker of the stocks. This is particularly true when there are large differences in the relative numbers of fish in each component stock as it may be difficult to estimate the impacts on the smaller stocks. Therefore, to avoid intercepting fish from other rivers, particularly those which are not meeting conservation limits, the advice of the SSC is to operate all commercial fisheries within the estuary of the river for which the catch advice is being given. Careful consideration must be made of local topography, fishing practices, number of contributing stocks and their status and the ability to discriminate the contributing stocks and manage the fishery effectively.

In a number of rivers the conservation limit will be achieved by the contributions of both 1 sea winter (1SW - grilse) and multi sea winter (MSW- spring fish). There is conservation of biodiversity and fisheries development value in identifying and protecting both life history types. It is important for fisheries management to be able to determine how much of the conservation limit is likely to be met by either MSW or 1SW fish and to regulate fisheries for both components separately.

In 2014 there was only a harvestable surplus for mixed stock fisheries, in Castlemaine Co. Kerry which is the common estuary of the Rivers Laune, Maine and Caragh and in the Killary Harbour, Co. Mayo which is the common estuary of the Erriff and Bundorragha Rivers. In each case all of the contributing stocks to the mixed stock fishery are judged to be achieving their conservation limit. However given the points referenced above and the greater risk of exploiting mixed stocks of fish, the combined total allowable catch of the rivers contributing to the fishery is reduced to reflect the higher risk associated with meeting the individual river conservation limits simultaneously.

The final advice presented to the Minister is a combination of both scientific and management advice, and while the science advice identifies whether there is a harvestable surplus or not the management advice takes other factors into consideration. For example in certain circumstances if there is a realistic prospect of anglers exploiting a small harvestable surplus on a particular river a brown carcass tag may be introduced, and there is an additional requirement to tag any fish caught with both a blue and brown carcass tag. The number of brown tags issued will only equal the exact size of the harvestable surplus. In other circumstances where there is a small surplus and it is not possible to manage it in a manner

which provides an appropriate level of confidence that the surplus will not be exceeded then management may recommend the closure of the river, or that it is managed on a catch and release angling basis. There is no harvestable exploitation on either single or mixed stocks below their conservation limit.

International Perspective

Ireland, in common with other States, has international obligations in relation to salmon management. Foremost amongst these obligations is the fact that Ireland, is part of the European Union - a contracting party to the North Atlantic Salmon Conservation Organisation (NASCO) convention. In the establishment of regulatory measures based on scientific and management advice, Irelands international obligations regarding catch advice and attainment of Conservation Limits, are comprehensively considered by both IFI and the Minister.

The primary management objective of NASCO is *'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'*.

In 1998, NASCO on behalf of member States adopted the "precautionary approach" to fisheries management (as outlined in FAO, 1995, 1996). The NASCO agreement on the adoption of the Precautionary Approach states, that *'an objective for the management of salmon fisheries is to provide the diversity and abundance of salmon stocks'* or in other words to maintain both the productive capacity and diversity of salmon stocks. NASCO provides interpretation of how this is to be achieved. Management measures should be aimed at maintaining all stocks above their conservation limits by the use of management targets. Since 2007 when the Irish Government committed to aligning fully with the scientific advice, all exploitation has been on stocks above their conservation limits and significant resources have been put in place to improve, rehabilitate and restore rivers which are not reaching their conservation limit.

The precautionary approach is an integrated approach that requires, *inter alia*, that stock rebuilding programmes (including as appropriate, fishery management actions, habitat improvements and stock enhancement) be developed for stocks that are below conservation limits. In 2008, NASCO indicated that the recent Irish salmon management procedures "fully comply with NASCOs agreements and guidelines."

In addition to implementing the precautionary approach to the management of fisheries Ireland also takes due cognisance of the scientific advice provided by the international Council for the Exploration of the Seas (ICES) and its obligations in respect of the Habitats Directive and other European Union Directives.

National Perspective

Notwithstanding all of the above factors and international obligations, the measures imposed by the Irish Government for 2007 and subsequent years, however necessary, have been challenging. They have had and continue to have a direct impact on rural coastal communities, particularly on the Western seaboard which are among the most peripheral and economically challenged regions of the EU. While the hardship scheme, designed to take social-economic impacts into consideration, alleviated the difficulties, these communities because of their peripherality have always been subject to significant economic and social pressure. The impact of the change in salmon management regime could also be viewed in

the context of other changes in inshore fisheries and the wider Irish economy.

In many peripheral coastal communities salmon fishing provided a significant portion of the 'basket of income' for families. When indiscriminate mixed stock salmon fisheries were ceased in 2007, diversification opportunities to replace income earned from salmon fishing were difficult as alternative fishing opportunities were essentially already fully subscribed. In cases where there was potential for alternative fishing opportunities these were already being reduced. Additionally the Irish economy has suffered a significant recession since 2008 which further reduced alternative employment opportunities.

It is in this regard that the executive and scientists from IFI along with officials from the Department of Communication Energy and Natural Resources(DCENR) have, in response to requests, been in regular contact with coastal communities and their representatives from around the Island. Invariably the issue of the possible re-opening of commercial salmon fisheries is advanced by community representatives.

The general position put forward is one of maintaining a fisheries tradition and heritage in these communities, and the fact that they have been 'off the water for' eight years and those who did not avail of the Hardship Scheme are now seeking a return.

In the last decade, due to more sophisticated communications and information flows, it is easier for peripheral coastal communities to look outward and take a more informed view of the international aspects of salmon exploitation. The recent focus on international salmon management issues within NASCO has not gone unnoticed by the communities and their representatives. They contend that their peripheral communities are continuing to suffer hardship by not being able to fish on mixed stock fisheries, when this practice is still going on in other jurisdictions who are also contracting parties to NASCO. There is a common view among communities that they are protecting the salmon so that they may be caught elsewhere.

In particular there is also a keen awareness of the situation in the Greenlandic and Faroese fisheries and the perception is that there is no sharing of the hardship across a common resource.

In this context, maintaining the current salmon management regime in Ireland has become increasingly challenging in the face of perceptions in communities that their efforts at sustaining the conservation imperative is futile unless those efforts are shared by all. This creates the perception that there is a failure on the part of other parties to act on the significant exploitation of mixed stock fisheries below their conservation limits. The increasingly passionate and vigorous social and political pressures brought to bear by the communities involved, makes the task of maintaining the buy-in to the current management regime based on a conservation ethos very challenging.

Conclusion

Ireland has a long and significant tradition of salmon fishing. Salmon is an iconic species on the Island and it has both cultural and economic significant. Regulatory measures for the management of salmon in Ireland have been in existence since the middle ages. More recently on foot of significant declines in the salmon stock additional conservation and regulatory measures, as well as changes in the scientific and management regimes have been implemented. This culminated in the cessation of indiscriminate mixed stock fisheries in

2007. Ireland exploits no salmon stocks which are below their conservations limits. Irish authorities are coming under increasing pressure from coastal communities who perceive that they are suffering continued hardship to reverse these measures. These communities are aware that there is still significant exploitation of mixed stock fisheries below their conservation limits by a number of contracting parties to NASCO.

Annex 4

CNL(14)46

Canada's Management Measures for Wild Atlantic Salmon stocks

Richard Nadeau – Head of Canadian Delegation to NASCO

Purpose

This document provides background on Canada's Regulations, Polices, and Legislative Obligations for fisheries on wild Atlantic salmon.

The key components include:

- The status of Canadian stocks throughout their extensive range,
- Designating sustainable harvest limits for river-systems with healthy stocks, while prohibiting and heavily enforcing harvest restrictions for river-systems with less than healthy abundance,
- Mixed-stock catches by Aboriginals off Labrador,
- Canada's Constitutional obligations to Aboriginal peoples, and
- Sustainable harvests where stock status permits.

International Cooperation - NASCO's Role

Rational management of shared wild Atlantic salmon can only be achieved in large part through international cooperation.

NASCO Parties have traditionally made management decisions which reflect the status of the stocks based on the best available science for the long-term benefit of the stocks, and for the Coastal people who depend on the stocks.

Canada continues to make management decisions on these shared anadromous stocks for the overall benefit of stocks, and the people who rely on these stocks as a food source.

Canadian Stocks

There are over 1000 Atlantic salmon rivers in Eastern Canada, with over 470 of these rivers having defined conservation requirements.

There are no commercial fisheries for Atlantic salmon in Canada, and there have not been since 2000. Prior to this, many Canadian fishermen depended on the commercial salmon fishery for part of their livelihood. These harvesters were negatively affected by the resource decline and subsequent closure of the fishery.

Canada carefully and scientifically manages the resource, by region and by river system.

Current harvest levels in the recreational and Food, Social, and Ceremonial (FSC) fisheries are based on scientific analysis and advice which considers information from counting

facilities where available, sampling from the fisheries, and catch and effort data from the recreational and FSC fisheries.
Canada's conservation requirements are established for individual rivers based on the best available science.

The stock status is assessed based on the proportion of the conservation egg requirement (from all groups of salmon) achieved in a given year and the trends in abundance of various life stages.

Specifically in Labrador and western Newfoundland, there are important large salmon components that contain a mixture of maiden fish that have spent two (2SW) or more years (MSW) at sea before spawning, and repeat spawners which are returning for a second or subsequent spawning. In other Newfoundland rivers, the large salmon component consists mainly of repeat spawning 1SW fish (grilse).

Harvests of single and Multi-Stocks

NASCO has a role to play in working to reduce the harvest of mixed-stocks by all of its Parties.

In Canada, analysis of data provided by to NASCO ICES indicates that a small portion of Labrador's harvests occur on mixed-stocks.

However, new sampling and genetic data indicates that 89% - 97% (over a 6-year index) of the Labrador subsistence harvests are of Labrador's stocks. The data also shows that these stocks are healthier than in Southern areas of Canada's range.

Canada recognizes that harvests of mixed-stocks in some cases may not contribute to the sustainability of the range of the wild Atlantic salmon resource. While it is a mixed stock fishery, the FSC fisheries off Labrador are mostly Canadian fish and the vast majority are of Labrador origin where the resource is sufficiently abundant to sustain these fisheries.

Canadian Management - Based on Science and Experience

In Canada, there are three forms of fisheries that harvest wild Atlantic salmon:

1. Recreational Fisheries
2. Aboriginal Fisheries
3. Bycatch in Labrador Resident Subsistence Fishery

1. Recreational Fisheries in Canada

All Canadian Recreational Fisheries are closely monitored, enforced, and reported.

Some of the management measures include:

- In most of eastern Canada, only small salmon (one-sea-winter or grilse) can be retained,

- Where large salmon are permitted for retention, it is only in the province of Quebec (40 rivers) and only allowed in rivers which are assessed for attainment of conservation objectives or which are relatively isolated and fishing pressure is low,
- Daily and seasonal harvest limits are established and there is a daily maximum catch and release limit,
- All harvested fish must be immediately affixed with a carcass tag, and
- Prohibition on selling or bartering salmon, caught recreationally.

Canada conducts region by region, and often river by river analysis, to make management decisions reflecting these diverse and changing conditions.

As an on-going review of Canadian management approaches, we are taking action to conserve all stocks.

In 2014, Canada instituted new measures which are expected to contribute to reductions in overall mortality of wild Atlantic salmon, and align stock exploitation with stock abundance;

- In New Brunswick, an overall reduction in tags for retention of grilse from 8 to 4,
- In New Brunswick, Salmon Fishing Area 15, the daily grilse retention quota is reduced from 2 to 1,
- In Nova Scotia, a reduction in tags for retention of grilse from 4 to 2, and
- Expanded catch and release measures on the Northwest Miramichi River system.

2. Aboriginal Fisheries

Aboriginal groups traditionally harvested salmon for food throughout Atlantic Canada and Quebec. The remote nature of some of the communities means that sources of fresh and affordable meat/protein are limited. Salmon, through food, social and ceremonial (FSC) fisheries, play a vital role in providing food for, and sustaining aboriginal groups.

Aboriginal access for FSC purposes is recognized in Canada's Constitution Act.

The Government of Canada, and the Province and Territories, maintain relationships with individual aboriginal organisations through which they negotiate the provisions of various FSC fisheries.

The provision of the FSC fisheries are included as conditions in the communal licence issued to the groups. The harvest levels are controlled through the issuance of a limited number of carcass tags and a limited and defined season, coupled with enforcement.

FSC fisheries for Atlantic salmon take place in most areas of eastern Canada in both in river and in coastal / estuarine areas.

The in river harvests occur only in areas designated as open (by Government of Canada / Province of Quebec) for recreational salmon fishing.

FSC fisheries are not permitted in rivers closed for conservation reasons.

Harvests are reported to authorities (Government of Canada / Province of Quebec)
For harvests off Labrador, logbooks are mandatory.

There is a prohibition on selling or bartering salmon.

In addition to the season and the requirement to affix carcass tags to all harvested fish, the communal licences include numerous other management measures that control the fishery including:

- reporting catches to authorities (Government of Canada/Province of Quebec) and the requirement to complete and submit logbooks for the fisheries in Labrador,
- fishing gear type and number restrictions, and
- fishing location.

3. Bycatch in the Residents of Labrador Food Fishery

The Resident Food Fishery occurs in Lake Melville (off Goose Bay) and southern Labrador coastal communities from Cartwright to Cape St. Charles. This fishery is for residents of Labrador and targets sea-run trout and arctic charr. There is no directed harvest of salmon for this fishery. If salmon is caught, it is a result of bycatch. Salmon are a by-catch. There is a maximum season retention of three salmon of any size. All fishing (for trout and charr) must end when the three salmon are retained.

For reporting, logbooks are used.

The government of Canada issues carcass tags (3 per resident licence).

There is a prohibition on selling or bartering salmon.

Annex 5

CNL(14)45

The management approach to salmon fisheries in Norway

Norwegian Environmental Agency May 2014

1. Background

Estimates based on studies indicate that there are approximately 100 000 - 110 000 anglers fishing for anadromous salmonids in Norwegian rivers. The number of active fishermen at sea has been reduced from 3600 in 1993 to 900 in 2013. According to the Norwegian official catch records (Statistics Norway), approximately 50 % of the catch by fixed gear along the coast is caught in Finnmark County.

The proportion of released fish is growing and in 2013 the number of reported released salmon was about 15 % of the total reported river catch. In the beginning of 1980s the proportion of the salmon catch in weight between sea and river was approximately 80-20, respectively (Figure 1). Today the sea salmon catch accounts for approximately 40 %, while the river catch accounts for 60 %.

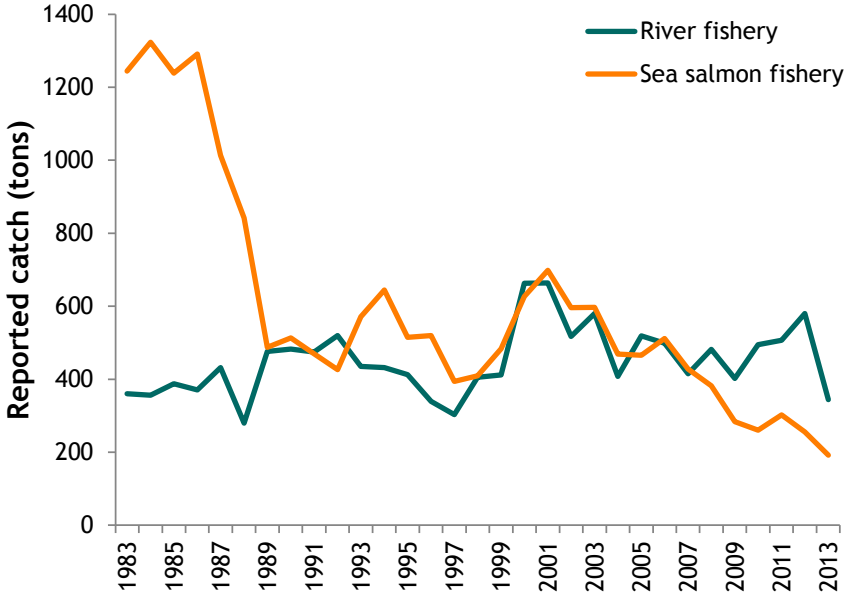

Figure 1. Total reported salmon catches in rivers (green colored line) and sea fisheries (orange colored line) in 1983 – 2013. Note that the river catches from 2009 include killed and released salmon.

The rights to both sea and river salmon fisheries are related to land ownership. In North-Troms and Finnmark the authorities in addition have to pay special attention to indigenous people's historical rights concerning the use of local nature resources.

The Norwegian Environment Agency is responsible for managing salmon fisheries in Norway. Management of the mixed stock fisheries along the coast is the most challenging part, and will have the main focus in this presentation.

2. Conservation limits for salmon stocks

Implementation of spawning targets and management targets in salmon management from 2008 has proven to be a success in meeting the goal of increasing the number of the stocks that are at their maximum reproductive capacity. Spawning targets are calculated for 439 rivers, and are now a key basis for fisheries management.

Previously the Norwegian Environmental Agency defined the management targets for each stock as reaching the spawning target in at least three out of four years. The Norwegian Scientific Advisory Committee for Atlantic Salmon Management (Scientific Committee) has operationalized this target by defining a threshold at 75% average probability of attaining the spawning target over a four year period (Forseth et al., 2013).

The number of stocks that reached their spawning target increased substantially after the introduction of spawning targets and subsequent new regulations addressing these targets, even if the number of returning salmon remained at historical low levels. The improvement could largely be attributed to reduced exploitation rates, due to new and stricter regulations in coastal as well as river fisheries (Forseth et al., 2013).

Management according to spawning target also had other positive effects. It has boosted stakeholder involvement in the form of local data acquisition in an increasing number of rivers. This involvement has also lead to improved river catch statistics (Forseth et al., 2013).

3. Assessment and advice

The Scientific Committee assesses management target attainment for 201 rivers which represent 98 % of the total river catch in weight. Advice on exploitation is given in five categories depending on the assessed probability of reaching the spawning target over the last four seasons in any given stock; the advice ranges from no harvestable surplus to possibility for increased exploitation, given that marine survival remains at current levels. The catch advice addresses all fishing on the stocks, in the river, fjord or along the coast.

A system has been developed for aggregated assessment and advice for the mixed-stock fisheries in the fjords and along the coast. Sea salmon fisheries are divided into 23 fjord and coastal regions, which form the basis for assessment and advice. The extension of the regions is mainly based on mark-recapture studies which were conducted along the coast of Norway in the period 1935-1982.

4. Management of mixed-stock fisheries

Bag nets and bend nets are the only allowed gears in the sea (bend nets only in Finnmark). In addition to restrictions on fishing gear, the primary regulatory measures are length of fishing season and the number of fishing days per week.

The sea fisheries regulations are based upon the estimated spawning target attainment of the stocks being exploited in the actual coastal or fjord region. Implemented regulations reflect the gap of meeting the management target, so that the regulatory measures get stricter the greater the gap. In areas where target attainment is especially low, the fisheries in rivers and sea regions are closed or reduced significantly. Due to low target attainment, fishing is not

permitted in 90 rivers, as well as in several coastal and fjord regions associated with these rivers.

5. The decision-making process for regulating salmon fisheries

The Norwegian Environment Agency provides national guidelines based on scientific advice and political instructions from the Ministry for Climate and Environment. The process of fisheries regulations is resource intensive for all involved parties. Main revisions are normally conducted every 4th or 5th year. In the event of unforeseen changes in stock status, for instance a sudden significant drop in pre-fishery abundance, annually adjustments in fishery regulations are considered, as well as in-season restrictions.

Regulatory processes involve many organizations and agencies locally, regionally and nationally, including Sami interests. Local management bodies in salmon rivers have been given considerably responsibility, especially local river-by-river organizations of fishing right holders. In order to facilitate participation and influence from all stakeholders a national salmon management advisory board and a number of local and regional councils have been established.

County Governors initiate the local and regional processes, and based on guidelines given by Norwegian Environment Agency, scientific advice, and input from stakeholders, they propose new fisheries regulations for each county. The national salmon advisory board meets and assesses guidelines and proposed regulations, while at the same time the Norwegian Environment Agency performs a national hearing on its proposals.

If regulatory measures are proposed in Finnmark, formal consultations are held with the Sami Parliament before regulations are adopted by the Norwegian Environment Agency. As part of the consultations concerning the current fisheries regulations, which came in force in 2012, a working group with participation from most of the stakeholders in the area was established and proposed coastal and river regulations.

Russia and EU are consulted at pre-agreed stages throughout the processes regarding fisheries which intercept stocks originating in their rivers.

6. Mixed-stock Fisheries in Finnmark

6.1 Background

As stated earlier approximately 50 % of the total catch with bag nets and bend nets in coastal areas of Norway is caught in Finnmark County. Bag nets and bend nets are the allowed gears. Furthermore, the relations to other countries (Russia and Finland), and to indigenous Sami people implies that these fisheries have to be especially carefully considered.

From 1998 to 2010 the number of fixed gear in Finnmark was reduced from about 1200 to about 600, and the number of fishermen was reduced from slightly above 600 to less than 400 (Figure 2). From the beginning of 1980s the reported catch was reduced from about 300 tons to about 100 tons in 2013, due to lower PFA, reduced effort and new regulations (Figure 2).

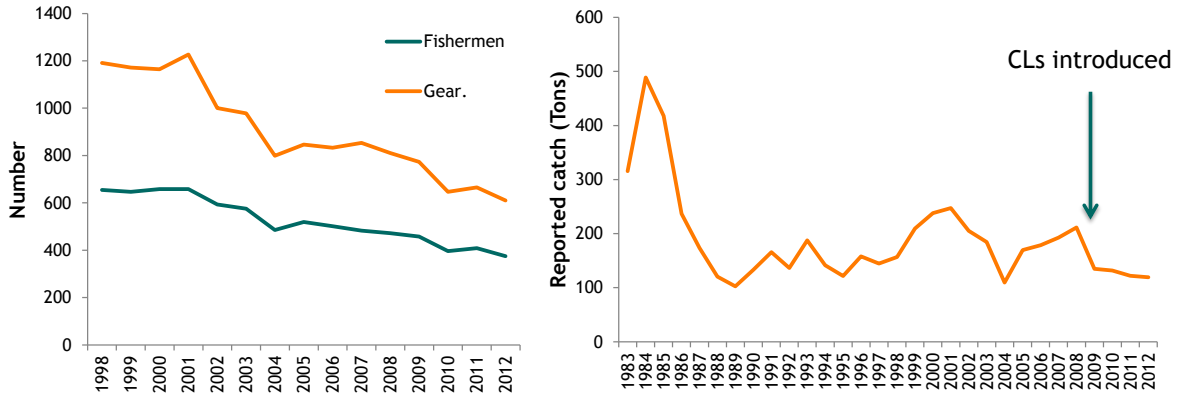

Figure 2. The number of active fishermen and the number of fixed gear in sea salmon fisheries in Finnmark from 1998 – 2012 (left figure), and reported catch in sea salmon fisheries in Finnmark from 1983 – 2012 (right figure).

The coast of Finnmark is currently divided into 5 salmon management regions.

6.2 Estimated management target attainment in 2012 - Finnmark County

Management target attainment has improved for a number of stocks in later years. This has occurred in spite of poor survival at sea, and historically low number of returning salmon (Figure 3). The improvement could largely be attributed to reduced exploitation rates due to new restrictions in both the coastal and river fisheries (Forseth et al., 2013).

The exploitation rate is assessed to be low or very low for populations still not attaining the management targets, with the exception of Tana salmon stocks, where exploitation is found to be high. Preliminary results from the Kolarctic salmon project indicate that estimated exploitation rates of the Tana pre-fishery abundance at sea were relatively low (13 % in 2011 and 9 % in 2012).

New modelling tools and datasets accumulated during the Kolarctic salmon project (2008-2012) provide important knowledge for a more precise regulation of both mixed-stock and riverine salmon fisheries. The Kolarctic Salmon project is a trilateral cooperation (Norway, Finland and Russia) aiming at merging modern science with traditional salmon fishing knowledge to create a future sustainable, long-term and knowledge-based salmon management of the common Atlantic salmon stocks in the Barents region.

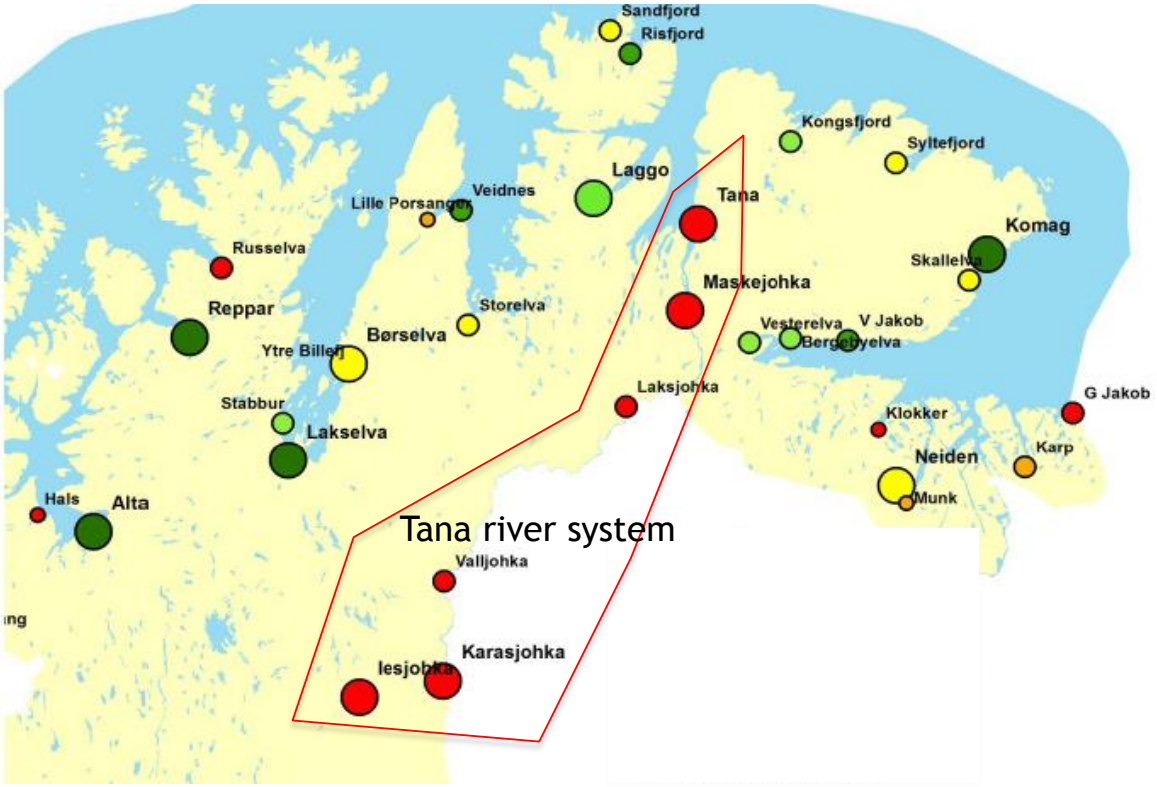

Figure 3. The map indicates management target attainment in Finnmark. Color indicates: Green: spawning stock above management target, light green: management target attained, yellow: at risk of not attaining management target, orange: management target probably not attained, red: far from attaining management target. Size of the circle indicates size of the spawning target (kg female salmon): Small – egg deposition corresponding to less than 200 kg, medium – egg deposition corresponding between 200-2000 kg, large – egg deposition corresponding more than 2000 kg. Source: The Norwegian Scientific Advisory Committee for Atlantic Salmon Management

6.3 The situation in Tana

The subarctic River Tana (Deatnu in Sami and Teno in Finnish) is a border river between Norway and Finland, about 70 % of the catchment area is in Norway. The Tana salmon stock complex actually consists of 20-30 unique stocks (Vähä et al., 2007). Consequently, all fisheries in the Tana main stem (including the lower Norwegian part and the border stretch between Norway and Finland) are mixed-stock fisheries.

There has been a long-term negative trend in large MSW salmon, and stock status is not found satisfactory in tributaries where spawning target attainments are accessed (Anon., 2012). Average spawning target attainment for the entire stock complex for 2009 to 2012 was estimated to 54 %, and spawning target attainment in five Norwegian tributaries is estimated to vary between 15 % and 50 %. The situation is most alarming in upper parts of the Tana system.

Accumulated (coastal + fjord + main river + tributary fisheries) fishing mortality on Tana salmon stocks results in a situation which is not sustainable. The total exploitation pressure can only be substantially reduced by reducing the efficiency of all fisheries in the sequence.
As a part of negotiating a new treaty on Tana fisheries, Norway and Finland have been working with new regulations aiming at a recovery plan and stricter regulations of the fisheries. Furthermore, the regulations shall be designed to ensure that fish resources are

fairly distributed between the countries, and aimed at a fair and balanced burden-sharing between the user groups.

6.4 Exploitation of salmon originating in Russian rivers

Results from the Kolarctic salmon project gives an overview over when and where salmon from Russian rivers migrate through Norwegian waters and are subject to harvest. The occurrence of salmon originating from Russian rivers was high in the municipality of Sør-Varanger, and relatively low along the remaining coast of Finnmark.

6.5 Plans for new regulations of salmon fisheries

- Main revision of regulations will be considered for all salmon fisheries in Norway from 2016
- Phasing out bend nets in Finnmark county in 2018
- Possible new regulations in Varangerfjord area from 2015 on are for the time being under consideration

6.6 Social, economic and cultural factors

Bag net fishing along the coast of Finnmark is a 150 year old tradition and is important for subsistence and culture for the coastal populations, especially in small Sami communities which have a lifestyle of multiple incomes from small scale pastoral agriculture and fisheries. And historically the salmon resource of the Tana River system was one of the main reasons for settlements in the river valley. Salmon and salmon fisheries are vital for Sami culture. This is expressed by name of places, legends, and traditional religion (Pedersen et al., 2010).

Bend net and bag net fisheries on the coast still play a role for subsistence and provide some economic impact. However these fisheries are of considerably less economic importance today than before 1980 (Pedersen et al., 2010). The in-river fishery in Tana has significant economic implications, mostly due to tourist fishing on the Finnish side of the border

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Annex 6

CNL(14)50

Management approach to salmon fisheries in Scotland

Objective of session

Under the 'Action Plan' it is stated that the focus of the first Theme-based Special Session should be on mixed-stock fisheries, with the opportunity for an exchange of information on fisheries exploiting stocks that are below their CLs and on the interplay between socio-economic considerations, including the interests of indigenous people, and conservation needs.

The objectives of the Theme-based Special Session are to allow for a more detailed exchange of information on the management of salmon fisheries including:

- Progress in establishing conservation limits, or alternative reference points, and the approaches being used to manage fisheries in their absence;
- How management measures are used to ensure the protection of the weakest contributing stocks in mixed-stock fisheries;
- How socio-economic considerations, including the interests of indigenous people, are weighed against conservation needs and, where fishing is permitted on stocks below their CLs, the approaches being used to ensure that exploitation is limited to a level that permits stock rebuilding within a stated timeframe.

Scene-setting

NASCO 2014, and the opportunity to make a presentation on the management approach to salmon fisheries in Scotland, is indeed timely.

Since March of this year and indeed during the passage of the Aquaculture and Fisheries (Scotland) Act 2013 much of the focus in Scotland has been about looking towards the future, culminating with the recently announced (March 2014) wild fisheries review - http://www.scotland.gov.uk/Topics/marine/Salmon-Trout-Coarse/fishreview

That review, which critically is independent of the Scottish Government, has been tasked to:

'***Identify a modern, evidence-based management system for wild fisheries fit for purpose in the 21st century, and one that is capable of responding to the changing environment.'***

What does that mean?

At the heart of an effective management system is its governance structure (the central coordinating mechanism). This needs to be able to provide strategic leadership, direction and monitor progress in a manner that links clearly to the outcomes sought. To work towards that goal, the Chair of the review has asked for views and thoughts on the kind of governance structure that our stakeholders believe might best achieve this, including how best to ensure a direct line of sight back to Scottish Ministers and the national public interest.

Key to that thinking will also be the Scottish Government's commitment to manage, conserve and develop its wild fisheries to maximise the sustainable benefit of Scotland's wild fish resources to the country as a whole and particularly to rural areas.

Reconciling current thinking with determining what structure we need to move forward has proven to be very challenging, both for our stakeholders and the various component parts within Scottish Government. There are many entrenched views and there is significant history, distrust and disappointment.

While the review is still very much in its infancy, the nature and speed of public and political expectations being what they are, means it will be required to grow up very quickly indeed. Patience is not necessarily considered a virtue by some in the sector.

Our stakeholders are watching intently as the various review events, involving the many stakeholders, take place nationwide and discuss both the bigger picture, the relationship between accountability and responsibility both at a local and national perspective, and the challenges of the current fiscal environment which are particular to all sectors.

The fact that the review panel has duration of around six months with the clock ticking rapidly outlines the importance given to the task in hand by the Scottish Government.

International Obligations including NASCO

On the review table will be some analysis on both domestic and international obligations, ranging from European Union and global biodiversity targets and the ambitious and challenging water framework directive designed to prevent deterioration in ecological quality and where necessary to improve the quality of our rivers, lochs, estuaries, coastal waters and groundwater.

Moreover, the Panel will be very conscious of and alive to the obligations placed on member states by NASCO, and the principle of international cooperation to ensure that Atlantic salmon is protected during its marine phase. As part of that discussion, the guidelines for Management of Salmon Fisheries which NASCO consider member states should have in place or work towards in order to protect abundance and diversity of salmon stocks, will be of clear interest.

Scotland is clearly signed up to NASCO.

With that background in mind, and in recognition of the potential for change in the legislative basis for the management of wild fisheries, I have approached this presentation in the spirit for which it planned – namely, a discussion on the current management approach to salmon fisheries in Scotland but with an eye on important socio economic considerations.

The starting point for any discussion for Scotland must be on the Scottish Government's focus on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth.

Underneath that fundamental principle is the protection and promotion of sustainable Scottish salmon and freshwater fisheries. And within that the desirability of evidence –based decision making, of which science is clearly a key component part - but certainly not in isolation from

other priorities –, and the wider social, economic and political strands of policy making. In essence, it is not a straight forward equation and sometimes produces a multitude of applicable layers and answers.

Economics

Let's look at the economic picture.

Salmon and freshwater fisheries contribute over £120m to the Scottish economy and support around 3,000 jobs, mainly in fragile rural communities whilst providing a basis for sustainable rural tourism. Those statistics are somewhat dated – from 2004 although we will update these through research being commissioned this year – but they provide an indication of value even if one to simply look to maintain the status quo.

Scotland's freshwater fish populations and communities are of international natural heritage value and of global renown.

Key drivers within the policy making arena include environmental issues (the protection of natural resources, protecting and improving the habitat and bio-security), resources (sustainable fisheries and the monitoring of fish stocks), contingency (how would we handle a disease outbreak), and the wider social (inclusion) agenda (community involvement, tourism and the needs of the user).

Progress towards Conservation Limits

In agreeing to make this presentation, I acknowledge that Scotland has yet to establish meaningful conservation limits - there are only 3 sites on 2 of Scotland's 398 identified salmon rivers where catch data is available to establish stock-recruitment relationships from which CL'S can be derived - but that equally we are making great strides to reach that goal.

As outlined in our Implementation Plan, Scotland is **actively** working towards the development of meaningful conservation limits and spawning escapement estimates so that salmon stocks can be more accurately assessed according to the NASCO guidelines, in order that appropriate management decisions can be taken.

What does that look like in practice? Well, a number of developments have taken place and a number of initiatives are in train with a view to moving us forward enough that we are confident in making that next step.

In practice these amount to:

A current tender programme to identify the right body to undertake a technical, logistical and economic consideration for the development and implementation of a Scottish Salmon Counter network. This work is a critical phase of our work towards establishing meaningful conservation levels.

Forward planning in recognition of the significant financial and resource investment required to accompany this work.

Consideration of how we might be able to accelerate our thinking in parallel with the work around counters and the considerations of the review. This will include some analysis of existing data sources and how these might be applied. For example we know stock assessment is informed by a number of sources of scientifically useful information including rod catches, counters, fixed traps and juvenile surveys. These data sources clearly have different strengths and weaknesses and I am sure the science colleagues in the room would be able to say more than I about their individual strengths and weaknesses.

Equally I am sure we would agree that fisheries management decisions should be taken according to the best available science and evidence.

Action in the absence of conservation limits

Our Implementation Plan accurately reflects that District Salmon Fishery Boards (as the statutory managers) make determinations on the need for exploitation reduction based on a Decision Flow Chart Based on Rod Catch as an Abundance Indicator as well as and in addition to other locally available data (e.g. juvenile densities).

Should a need for measures be evidenced DSFBs they are encouraged to agree voluntary measures with all relevant parties. Examples include catch and release and potential compensation for cessation of netting.

District Salmon Fishery Boards may also make applications for statutory conservation measures to Scottish Ministers.

While District Salmon Fishery Boards are the recognised statutory managers of salmon fisheries, Scottish Ministers now have a set of fisheries management backstop powers which they can exercise in the event of local management failure or to tackle national issues.

In addition to the ability to make conservation measures at their own hand, Ministers (having sought advice from scientific advisors) can alter the weekly close time and carry out investigations into particular fisheries.

The Aquaculture and Fisheries (Scotland) Act 2013 which I mentioned earlier and which we talk about in greater detail within the Implementation Plan provides additional powers for Ministers to carry out sampling, make annual close time orders and require information from salmon fishery proprietors.

Indeed we are about to go to our Minister's detailing the extent to which the District Salmon Fishery Boards are meeting their obligations – both as a minimum and in some cases beyond – and the action we may need to take to ensure full compliance within the first year of the legislation come into force.

River Esk Project

Ministers are currently carrying out a 3 year investigation into perceived problems with the spring salmon in the River South Esk; this investigation has included genetic sampling of the net fishery and radio tagging of fish to identify spawning locations.

The project was commenced following an application for conservation measures by the local Board and aims to gather additional information on the nature of the problem in order to inform suitable management action. For the duration of the project, voluntary agreement to postpone the start of the netting season and implement catch and release in the rod fishery has been agreed between the Board and the proprietors.

My colleague, Julian Maclean, we say a lot more about this project this afternoon.

Salmon Stock Assessment paper

It is also worth noting that Marine Scotland Science recently produced and published a report presenting a simple summary and interpretation of the various data collected by Scottish Government regarding adult salmon abundance to provide an overview of the current status of Scottish stocks.

Available information suggests that the overall number of Atlantic salmon returning to Scottish rivers has increased over recent years. However, there is variation in trends of abundance among components of the stock associated with particular regions and run times. In particular, spring-running salmon remain at low levels and we recognise are worthy of particular management consideration.

Our intention will be to update this report when our catch statistics are published in April next year. This will provide our ministers, NASCO and the public with an up to date interpretation of the status of Scottish salmon stocks.

I think that is probably enough from me. I would welcome any comments from colleagues about our work going forward.

Annex 7

CNL(14)51

Management of single and mixed stock fisheries, with particular focus on fisheries on stocks below their conservation limit – England and Wales

Paper for presentation at the NASCO 2014 Theme-based Special Session

By:
Marc Owen (Policy Adviser, Migratory and Freshwater Fisheries, Department for Environment, Food and Rural Affairs)
Ted Potter (Senior Fisheries Adviser, Centre for Environment, Fisheries and Aquaculture Science)
Liz Black (Senior Adviser, Environment and Business (Fisheries), Environment Agency)
Peter Gough (Senior Technical Specialist (Fisheries), Natural Resources Wales)

Summary

Conservation Limits have been established for the principal salmon river stocks in England and Wales. Each stock also has a Management Objective - to exceed its Conservation Limit in four years out of five on average. Each stock is assessed and categorised annually according to whether it is meeting its Management Objective. This helps identify pressures on stocks and the need for management action to control exploitation (alongside maintenance and improvement of habitat).

Following the annual assessments a formal decision structure is applied. This guides decision-making in terms of managing exploitation (balanced with maintaining/improving habitat in order to address the key pressures on a stock). All fisheries are managed on the basis of protecting the weakest contributing stock.

When making management decisions, socioeconomic factors are taken into account with an aim of minimising undue hardship to fisherman and maximising the social and economic benefits of commercial and recreational fishing if stocks are healthy enough.

Fishing is permitted on some stocks below Conservation Limits, but only if the stock is achieving its Management Objective or exploitation will not prevent ongoing stock recovery, and there are good social or economic reasons to allow fishing to continue.

A case study of the North East coast salmon and sea trout net fishery in England demonstrates the approach we have taken to managing a mixed stock fishery where stocks are not consistently meeting Conservation Limits but where, taking socioeconomic considerations into account, the continuation of some fishing has been allowed.

Stock assessment and classification

49 river systems in England and 31 in Wales regularly support salmon. Conservation Limits (CLs)[1] and Management Targets (MTs)[2] have been set for 64 of these. It is expected that CLs and MTs will be set for other rivers (those recovering from historic degradation) when stock recoveries reach reliable levels.

Each principal salmon river stock is assessed annually to establish whether it is meeting its Management Objective (which is to exceed its CL in four years out of five on average), using data from the past ten years to summarise the stock's performance. Based on this assessment stocks are classified (annually) into one of four categories: 'Not at risk'; 'Probably not at risk'; 'Probably at risk'; or 'At risk'[3].

This system allows for fluctuations and variability in stock levels to be taken into account when making management decisions, and provides an early warning that a river has fallen or may fall below its CL. For more information on how we classify salmon river stocks see the annual Cefas/Environment Agency stock assessment report (http://www.cefas.defra.gov.uk/publications/salmon/salmonreport2012.pdf; report for 2013 imminent).

The decision-making process for managing exploitation

A formal Decision Structure (DS) is applied to each stock following annual assessment/ classification to indicate what management measures are required. Any fishery exploiting more than one stock is managed to protect the weakest contributing stock (i.e. options indicated for the weakest stock are applied to the whole fishery).

The DS allows us to take account of the social and economic benefits of fishing. This allows for the potential to increase those benefits where a stock is considered healthy enough. This is generally only where all stocks exploited in a fishery are 'not at risk'; options to increase benefits are considered for stocks classified as '*probably* not at risk', but only if commensurate with achieving 'not at risk' status within a given timeframe. The DS also allows for consideration of how social and economic benefits can be maintained, *if possible*, where a stock is considered 'at risk' or 'probably at risk' and further restrictions on exploitation are considered necessary.

The timeframe for recovery is considered when making management decisions for any fishery: when the DS is applied, management measures are selected to aim for the stock to move up an assessment category (e.g. from 'probably not at risk' to 'not at risk', or from 'at risk' to 'probably not at risk').

[1] Conservation Limits (CLs) have been developed that indicate the minimum spawning stock levels below which stocks should not be allowed to fall. Details of the process for setting CLs and assessing compliance with these biological reference points are given in Annex 7 of the latest salmon stock assessment for England and Wales (available at http://www.cefas.defra.gov.uk/publications/salmon/salmonreport2012.pdf).

[2] Management Targets (MTs) have been set for each of the 64 principal salmon rivers, representing a spawning stock level for managers to aim at in order to meet the management objective that a river's stock should be meeting or exceeding its CL in at least four years out of five (i.e. >80% of the time).

[3] Note that 'Probably at risk' and 'At risk' are not the same as 'endangered', 'threatened' or similar terms – they mean that there is a less than 50% chance that the Management Objective will be achieved

Reducing exploitation is only one of the actions taken to manage a stock. Our salmon managers, angling clubs, conservation organisations etc. also work to conserve and improve habitats, contributing to the stocks increasing productivity over the longer term[4]. The European Water Framework Directive and Habitats Directive are strong drivers for this.

Options for restricting exploitation, taking socioeconomic factors into account

A number of different options are available to restrict fishing. 'Net Limitation Orders' are a key 'tool' – they are used to limit the number of net licences available and can be used to prevent new entrants into a fishery either until the fishery reaches a certain reduced size or until it is phased out entirely. The advantage of this is that we can reduce exploitation without causing immediate hardship to already licenced netsmen by bringing in an immediate ban on fishing.

Regulations also restrict fishing seasons, times, methods and areas.

National, local or regional fishery byelaws are also used. These place various requirements on fisheries, according to need, for example to:

- Restrict season times to protect stocks or particular components of stocks;
- Restrict methods that can be used at particular times of year to protect particular stock components (e.g. early running multi-sea-winter salmon);
- Ban netting or angling where fish may be more vulnerable, e.g. near obstructions;
- Require all rod-caught fish or fish above a certain size to be returned, or limit number of fish that can be kept;
- Implement 'carcass-tagging' for commercial fisheries to prevent poaching/illegal fishing and trading;
- Ban sale of rod-caught fish, removing incentive for anglers to catch fish to sell;
- Close fisheries entirely where there is a justified conservation concern.

Emergency byelaws can be used if urgent action is required due to unforeseen circumstances. Catch limits are being increasingly used to manage commercial fisheries. Voluntary measures are also in place in many areas e.g. agreements to restrict methods/baits used or to release all rod-caught fish (70% of rod-caught fish are now released, largely through voluntary agreement).

Is fishing allowed on stocks below their Conservation Limits?

Achieving the Management Objective is not contingent on a stock meeting or exceeding its CL every year. Management decisions are based on the performance of stocks over the previous ten years and predicted future performance – to aim to achieve or move towards the Management Objective within a defined timeframe. Fishing may therefore be allowed where a stock is not consistently exceeding its CL.

This allows for an even-handed, long-term approach to managing salmon fisheries, taking long-term trends in stock performance into account. It also allows for social and economic

[4] Whilst improving productivity can take a number of years, because the required action is complex or because a stock may need to go through a number of generations for the improvement to take effect, reducing exploitation has a more or less immediate effect on the number of spawning fish. Thus it is not a choice of reducing exploitation *or* improving habitat but the appropriate combination of both. When a stock falls below its Conservation Limit reducing exploitation is nearly always required in the short term.

factors to be accounted for when making management decisions, including aiming to maintain stability and continuity in fisheries as far as possible.

How are socioeconomic factors taken into consideration?

This is set out in our NASCO Implementation Plan. The primary objective is the conservation or restoration of stocks, but when considering new management measures we take socioeconomic factors be taken into account, depending on who will be affected and how, and the intended rate of stock recovery. We consider:

- Whether proposed measures will have an unreasonable effect on someone's livelihood (e.g. net fishing) or the value of their property (e.g. fishing rights) - we might plan recovery of a stock over longer period to reduce these impacts.
- Effects on different groups – we seek equal impact on commercial and recreational fisherman.
- The effect on the viability of fisheries – e.g. mandatory 'catch and release' has less effect on anglers than on commercial netsmen.
- Heritage value: where fishing methods are unique to a very small number of locations, we consider retaining a residual fishery and/or permitting a low level of catch.

Case study: management of salmon netting in the North East of England

Overview

The North East Coast fishery is the largest remaining coastal salmon and sea trout net fishery in England and Wales. Fishing is from small boats using driftnets operated up to six miles offshore and 'T' and 'J' nets anchored close to the shoreline.

There has been a long tradition of coastal fishing in this area. Communities depend at least partly on salmon fishing: not just fisherman but also those employed in processing fish, boatbuilding, making nets, etc.

It is a mixed stock fishery, taking fish from five principal salmon rivers in northeast England (Coquet, Tyne, Wear, Tees, Yorkshire Esk) and rivers in Scotland as far north as the Aberdeenshire Dee.

Regulation of the fishery is by a range of controls on fishing effort, including gear specifications and season, time and area restrictions. A key regulatory instrument used is the 'Net Limitation Order' (NLO). This restricts the number of licences issued and therefore the number of nets operating. The first NLOs for this fishery were introduced in 1964 to counter the increasing number of entrants into the fishery attracted by the introduction of highly efficient monofilament nets.

NLOs typically last ten years. When we review an NLO before it expires there is an opportunity to review the whole management approach for the fishery. We consider the 'conservation case' setting out what further restriction is required, and develop a number of management options, informally consulting stakeholders as we do this. A preferred option is decided upon and advertised and stakeholders can submit formal objections or statements of support (this is both a legal requirement in England and Wales and in line with NASCO's guidance that processes should be in place for consulting stakeholders).
The latest NLO for the North East coast fishery was introduced in 2012:

- continues to progressively implement the phase-out of the drift nets;
- allows netsmen who hold a licence to continue to fish;
- prevents new netsmen from entering the fishery;
- fishery shrinks each time a netsmen leaves;
- commences a phase-out of the T & J net fishery (previously limited to a certain number of licences per year).

Commitments were given that:

- the remaining drift net fishery will be closed at the end of 2022;
- evaluation will be undertaken of the potential for maintaining some T & J and/or estuary nets;
- possibility of using quota and/or effort to cap catches to be investigated.

What is the rationale for managing this fishery in this way?

What steps were taken to ensure that exploitation was limited to a level that will permit stock rebuilding within a stated timeframe?

What were the specific socioeconomic factors used to permit such fishing?

In 1992, it was determined that the drift net fishery should be phased out because it made the management of individual recovering stocks more difficult. However, these stocks were not in immediate danger so the phase out was implemented in a way that avoided undue hardship on licensees dependent on fishing for their livelihood.

When the Net Limitation Orders were reviewed in 2012, of the English river stocks contributing to the fishery the River Tees (classified as "at risk") and the Yorkshire Esk ("probably at risk") were considered the weakest. The Decision Structure indicated that management should urgently reduce exploitation of the 'at risk' Tees stock to zero. However this has to be balanced with a number of other considerations:

- Industrialisation and pollution of the rivers of Northeast England: this virtually wiped out their salmon populations, but with massive improvements in water quality from the 1970s to the 1990s salmon have returned to all the major river systems; all English stocks exploited by the fishery were assessed in 2012 as meeting management objectives or showing improving trends; work is ongoing to improve habitats, address obstructions, reduce pollution etc. We can't concentrate solely on restricting fishing as a means of ensuring stock recovery.
- Impact on Scottish stocks, particularly on designated features of 'Special Areas of Conservation' under the European Habitats Directive – having considered this we concluded the proposed controls would mean that the fishery would not significantly impact upon the integrity of those protected areas.
- The social and economic importance of the net fishery to the local area. A study was commissioned to assess this.
- Social and economic importance of the rod fisheries that exploit the same stocks. These also provide a range of opportunities for rural communities.

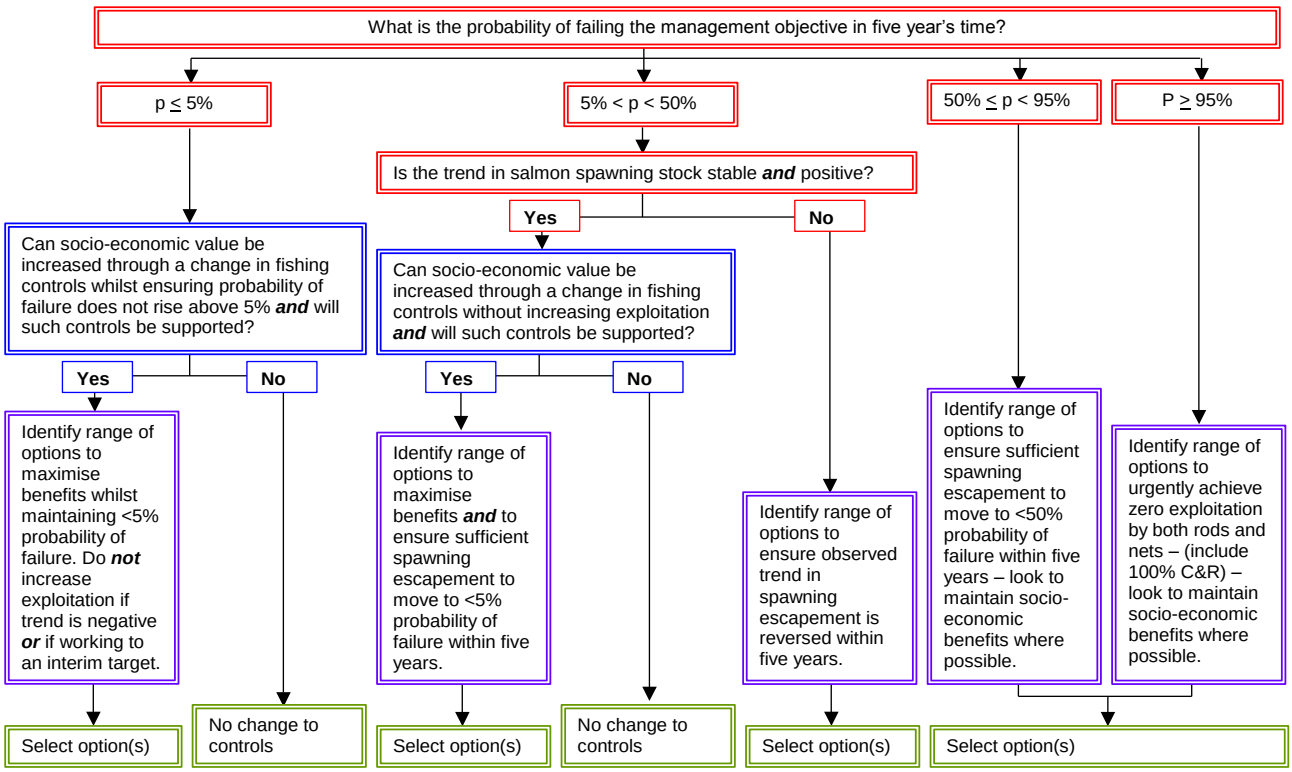
Therefore the overall rationale for managing the fishery remained the same as in 1992: affording adequate protection to the contributing stocks was paramount, but the socioeconomic importance of both rod and net fisheries was also taken into account as far as possible.

Thus the aim is to continue to phase out the drift net fishery and begin reducing the beach nets, but to minimise the socioeconomic impact of reducing exploitation on netsmen and their communities. The progressive phase-out does not immediately render them without an income and provides time to diversify or find other occupations (or for the many older fishermen, to fish until retirement). It is also expected to achieve a progressive decline in the level of exploitation in the fishery.

It was recognised that there may be a need for further management measures to avoid repeats of the high catches experienced in recent years, and that a potential catch limit or quota for the fishery should be investigated. This is underway and expected to report towards the end of 2014.

However, given the social and importance of salmon fishing in the area it was also agreed that it would be worthwhile to investigate the potential for some form and some level of fishing to continue that is in line with national policy and international commitments etc. (e.g. NASCO guidance, and the European Habitats Directive). The midway review of the Net Limitation Order in 2017 will provide an opportunity to think about this in more detail.

Decision structure for salmon fishery management in England and Wales



Annex 8

CNL(14)42

The management approach to salmon fisheries in the Russian Federation

Introduction

Anadromous Atlantic salmon is present in five regions of the north-western part of the Russian Federation: Murmansk region, Archangelsk region, Republic of Komy, Republic of Karelia and Nenets Autonomous Okrug (Berg, 1948). The great number of rivers indicates a large genetic diversity within Atlantic salmon populations in Russia, resulting in a huge production potential. The status of individual river salmon stocks varies considerably, but overall they have not shown the same negative trend in abundance as observed in other parts of salmon distribution range on both sides of the Atlantic (ICES, 2013). However, there is a number of stocks suffering reduced numbers of spawners due to the impact of anthropogenic factors such as poaching in coastal areas and in rivers, dams, pollution, etc. (PINRO, 2013).

Over the last two decades the effort in commercial fisheries has been noticeably reduced which aimed at conserving Atlantic salmon stocks and enhancing recreational fisheries. In recent years the total declared catch including all fisheries varied around 70-80 tonnes. The coastal catches in the White Sea fluctuated around 50 tonnes in 1990s and were around 30 tonnes since 2007. Nowadays commercial coastal salmon fishery in Russia is viewed more as a social measure – a traditional way of fishing by local people from Pomor villages along the White Sea cost whereas the recreational salmon fishery in the Murmansk region today is seen as one of the most prestigious in the North Atlantic.

Objectives

The Federal Law "On Fisheries and Conservation of Aquatic Biological Resources" (No. 166-FZ, 2004) prioritises the conservation of aquatic biological resources and their rational exploitation to their utilization as an object of the right of property or other rights.

The approach to management of Atlantic salmon fisheries in Russia is based on applying the Precautionary Approach, NASCO's agreements and enforcing the adopted measures and existing fisheries regulations. The objectives are as follows:

- to preserve biodiversity and enhance the numbers of Atlantic salmon;
- to minimize the risk from management actions taken;
- to rationally utilize natural biological resource to ensure continuity of its reproduction;
- to preserve Atlantic salmon habitat;
- to resolve socio-economic issues by improving economic returns to local communities through salmon fishing.

Total Allowable Catch

The Total Allowable Catch (TAC) for anadromous fishes is established annualy for each region on a river-by-river basis and based on advice from a fisheries research institution. TAC is estimated on the basis of reference points (e.g. conservation limits, management targets) and abundance forecast. Conservation limits have been established for all salmon rivers in the Murmansk region and for a number of rivers in Archangelsk region. Regional TACs are allocated to the subjects (regions) of the Russian Federation by the Federal Agency for Fisheries. TAC establishes a catch limit for catch-and-take fisheries, but it does not limit catch-and-release fisheries.

Quotas

Regional TAC is distributed as quotas among fisheries and allocated to users by the Federal Agency for Fisheries (federal regulatory, control and enforcement authority), its Territorial Directorates (regional control and enforcement authority) and by Regional Commissions on Regulation of Harvesting the Anadromous Fish (regional regulatory authority). There are six types of fisheries that are legally allowed. They are listed below in the order of priority in terms of quota allocation:

- fishery to support traditional way of living of indigenous small nations of the North;
- scientific fishery;
- fishery for enhancement purposes;
- educational fishery;
- recreational fishery;
- commercial fishery.

Annual quotas for scientific fishery, educational fishery and fishery for enhancement purposes are established on the basis of applications from scientific research institutions, universities and regional directorates for enhancement of fish stocks (Murmanrybvod, Sevrybvod, Karelrybvod and Komirybvod). The quotas are allocated to users by the Federal Agency for Fisheries based on approved scientific, educational and enhancement programs.

Quotas for recreational and commercial fisheries, quotas for fishery to support traditional way of living of indigenous nations of the North are allocated to users by Regional Commissions on Regulation of Harvesting the Anadromous Fish on the basis of recommendations from the fisheries research institute (PINRO). The information about quantities applied for by indigenous small nations of the North is provided by a Territorial Directorate of the Federal Agency for Fisheries and is taken into account when quotas are decided. Murmansk region is the only subject of the Russian Federation where indigenous nation (Sami) fishery for Atlantic salmon takes place. Commissions have the authority to regulate methods of fishing, fishing seasons and fishing areas. A Commission is chaired by the Governor/Head of the region. It consists of representatives of deferent authorities such as the Federal Security Service and Ministry of Defense, regional administrations such as Departments for Fisheries and Ecology, fishery research institute (PINRO) and from non-governmental organizations. Commission’s decisions must be approved by the Head of the Territorial Directorate of the Federal Agency for Fisheries. Commissions are established in all five regions with Atlantic salmon stocks.

Fishing sites

Recreational, commercial and Sami net fisheries are allowed at fishing sites only. The fishing site boundaries are decided by a regional Commission on assigning the fishing sites on the basis of applications from users and recommendations from a scientific research institute (PINRO). A regional inventory of fishing sites is to be approved by the Government of the region. The inventory specifies the boundaries and the intended use of fishing sites (e.g. recreational fishery, commercial fishery, Sami fishery and aquaculture). Fishing sites are allotted to users on the basis of competitive tenders. The Territorial Directorate of the Federal Agency for Fisheries is the authority to organize tenders and a signatory of contracts for fisheries of marine species in coastal waters and anadromous fish fisheries at sea and in-river, whereas the Government of the region is the authority to organize tenders and a signatory of contracts for fishing sites for fisheries of freshwater species. A contract for the use of a fishing site can cover a period of up to 20 years.

Licences and permits

Each salmon fishery is licensed by a Territorial Directorate of the Federal Agency for Fisheries. There are three Territorial Directorates responsible for Atlantic salmon fisheries control and enforcement:

- Barents-Belomorskiy (Murmansk) is responsible for Murmansk region;
- Dvino-Pechorskiy (Archangelsk) is responsible for Archangelsk region, Komi and NAO;
- Severo-Zapadniy (St.-Petersburg) is responsible for Karelia.

The Territorial Directorates issue licences for users of the fishing sites in accordance with the quota allocation made by the Regional Commissions on Regulation of Harvesting the Anadromous Fish. The licence gives legal rights to the user of the fishing site to organise salmon fisheries. The licences are issued for no more than 1 calendar year. The user of the fishing site is obliged to report catches to the Territorial Directorates of the Federal Agency for Fisheries twice a month. Once the allocated quota is fished the fishery must be closed. A user of the recreational fishing site is authorized to issue permits (tickets) to Russian and foreign anglers. Atlantic salmon recreational fishing is allowed on a permit basis only. Therefore, it is not possible to fish for Atlantic salmon outside the fishing site. However, Atlantic salmon catch-and-release fishing is technically possible outside the fishing site as there is no requirement to have a permit for fishing other species outside fishing sites in salmon rivers.

Fisheries Regulations

All fisheries are conducted in accordance with the Fisheries Regulations in force. They set rules for fisheries in respect of areas, periods, gear and other restrictions. The current Fisheries Regulations were adopted by the Order of the Federal Agency for Fisheries in 2009 (No. 13, 2009). New Fisheries Regulations were developed recently and due to be adopted by the Ministry of Agriculture in 2014. Existing Fisheries Regulations prohibit by-catching Atlantic salmon and contain no rules for coastal salmon fisheries in the Barents Sea, which could be interpreted as a ban for such fishery, however, there is no explicit reference to this in the Regulations. New Fisheries Regulations in addition to current rules contain stronger measures to explicitly prohibit coastal salmon fishery in the Barents Sea and to restrict it in

some areas of the White Sea: in the Kandalaksha Bay and in the area along the Kola Peninsula coast between Cape Svyatoy Nos and Sosnovka village. Fisheries for all fish species with nets are prohibited in the estuaries of salmon rivers at a distance less than 0.5 km from the outlet into the river and 0.5 km seaward from the river mouth all year round. Only trap nets with mesh size 40 mm are allowed for coastal salmon fisheries in the White Sea in the Murmansk region whereas gill nets can be used in Archangelsk region.

Mixed stock fisheries

Mixed stock fisheries take place in the Murmansk and in Archangelsk regions in the White Sea. Over the last two decades the effort in commercial fisheries has been dramatically reduced. Commercial coastal catches of Atlantic salmon in the White Sea in the period from 1983 to 2013 are shown in Figure 1.

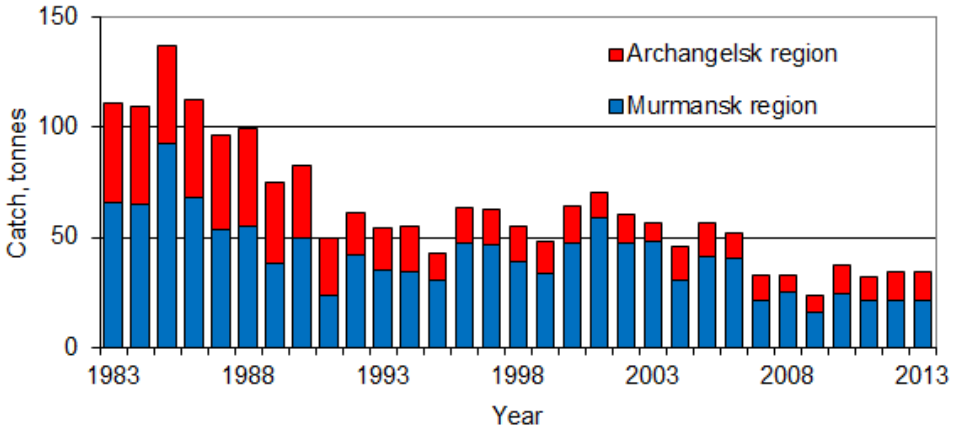


Figure 1. Commercial coastal catches of Atlantic salmon in the White Sea in 1983-2013 by region, tonnes.

In the beginning of the time series the total catches were above 100 tonnes and almost half of the catches consisted of salmon taken in Archangelsk region. Since the beginning of 1990s the catches taken in Murmansk region were accounted for over 2/3 of the total catch which fluctuated around 50 tonnes in 1990s and was around 30 tonnes since 2007. Pre-Fishery Abundances (PFA's) for exploited salmon stocks were above the Conservation Limits (CL) and there were considerable surplus left for in-river fisheries (PINRO, 2013).

Nowadays commercial salmon fishery in Russia is viewed more as a social measure – a traditional way of fishing by local people from Pomor villages along the White Sea coast. The White Sea salmon fishery at sea fishing stations remains a main source of income for local communities, especially in odd years, when pink salmon come for spawning. The lifestyle of Pomors on the White Sea coast has been over centuries influenced by salmon fishing at sea fishing stations. There would have been no life in many Pomor villages and settlements, moreover, they would have never emerged in this area without a generous gift from Nature, such as salmon, to the people of the Kola North.

In 2010 the baseline for a number of Russian rivers was established through a pilot project to identify the origin of salmon in catches from coastal areas. The results from that project demonstrated that the GSI method could give reliable estimates of the proportion of salmon in the catches as well as estimates of how salmon from different regions and rivers were exploited in the coastal fisheries (Svenning et al. 2011). A further initiative to achieve this

goal was taken by Norway, the Russian Federation and Finland. An EU project "Trilateral cooperation on our common resource; the Atlantic salmon in the Barents region" (Kolarctic salmon project - KO197) was implemented in 2011-2013. The project was supported by both EU-funding (Kolarctic ENPI CBC Programme) and national funding from Norway, the Russian Federation and Finland. The Kolarctic salmon project has generated one of the most comprehensive and detailed genetic datasets for any fish species. Results of the project provide first and comprehensive overview of spatial and temporal variation in stock compositions in coastal fisheries in the Barents and White Seas. The data from the project will provide managers with tools for regulating fisheries on a more informed basis.

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Annex 9

CNL(14)47

The management approach to North Atlantic salmon fisheries in Finland

Ministry of Agriculture and Forestry, Finland May 2014

Example from the River Teno

Introduction

The River Teno runs to the Barents Sea in Norwegian territory, and forms the borderline between the northernmost Finland and Norway. The catchment area is c. 17 000 m^2, and there is c. 1200 km salmon distribution area in different tributaries and in the main stem. The Atlantic salmon population complex in the River Teno system is very diverse, with c. 30 genetically distinct salmon populations and a very wide variability in life histories (smolt ages 2-8 years, sea ages 1-5 years, previous spawners; more than 100 life history combinations in total).

River Teno system is one of the few remaining large river systems that still support abundant Atlantic salmon stocks with little or no human impact to the system, except for fishing. Large part of the fishery in the river is mixed stock fishery, as salmon from the tributaries are fished mainly in the main stem.

Management of the salmon stocks is based on bilateral agreements between the governments of Finland and Norway. All aquaculture activities and transfers of live fish and eggs from other catchments are strictly forbidden in the catchment area of the River Teno.

At the moment, new regime for the Atlantic salmon stock management is under preparation, aiming to systematic and target-based management, based on spawning targets according to NASCO guidelines. At the same time, new detailed information has been produced to enable the target-based approach.

Requirements for assessment of the status of the salmon stocks

Setting population-specific reference points (conservation limits, spawning targets)
Construction of river- and population-specific spawning targets requires information on salmon distribution, habitat quality, and stock-recruitment relationships. After setting preliminary targets for some of the River Teno tributaries following the Norwegian methodology in 2007, revised spawning targets have been established in 2014, and have now been set for virtually all salmon populations of the Teno system.

Monitoring the target attainment
The monitoring can be carried out by counting the ascending fish, or by assessment of the spawning populations e.g. by diving counts. In many cases, catch statistics and exploration rates have also been used in assessment. At the moment, spawning target attainment has been assessed in six tributaries situated in the upper, middle and lower parts of the Teno watershed. Spawning target attainment varies from year to year, but especially tributaries in

upper parts of River Teno watershed spawning stock have constantly been far below the target levels.

Assignment of the mixed stock catches to the populations of origin

Salmon fishing of the River Teno takes place largely in the main stem of the system. As the tributary stocks migrate through the main stem, fishing in the river is mostly mixed stock fishery Assigning the river of origin of individual salmon in mixed-stock catches in various fisheries can be done by combining genetic samples and detailed catch information by age groups and life histories. This information is needed for assessing the factors of fishing mortality in the mixed-stock fishery in the main stem.

Socioeconomic and cultural aspects

River Teno is a large watershed between two countries. There are many different ways to use the salmon resource. Salmon fishing is an important part of the indigenous Sámi culture and there are restrictions in the access to fisheries for people from outside the river valley. Besides angling, traditional fishing methods like drift nets, gill nets and weirs are used actively. Tourism is a very important livelihood in the remote Utsjoki municipality, and tourist activities are mainly linked to salmon fishing season. Besides multiple fisher groups involved, there are also complex issues concerning fishing rights. In both countries there are exceptions in the overall fishing rights system that are applied in River Teno. This means that there are many stakeholder groups that are involved in the fishery and who need to be informed as the new regime for fishing rules is being planned. It is also important to consider that stakeholders receive enough information on the fisheries management, where many concepts, e.g. the biological ones may not be familiar in local context.

There have been many events to distribute information about key concepts like spawning targets and stock recovery plan, to ensure the acceptance of these basic concepts and strengthen confidence to planned regime. It has been important to repeat the message and coordinate information between management and research.

Altogether socioeconomic and cultural aspects make a challenge to fisheries management. Measures should be targeted in a way that will ensure biological sustainability but also minimize harmful effects to local culture and economy. In the case of the River Teno, the new genetic information seems to give some promising possibilities for more precise targeting of measures.

Genetics of the river Teno salmon

River Teno salmon stock consists of 20-30 different populations with clear genetic differences between the sub-populations in various parts of the watershed (Vähä et al. 2007). This genetic information makes it possible to distinguish different populations from the main stem catch .

Besides the genetic diversity observed, there is a steady pattern in spawning migration timing in the Teno main-stem for the different populations and life history groups. The different migration times can be used in targeting and tailoring the fishing restrictions to vulnerable stocks (figure 1).

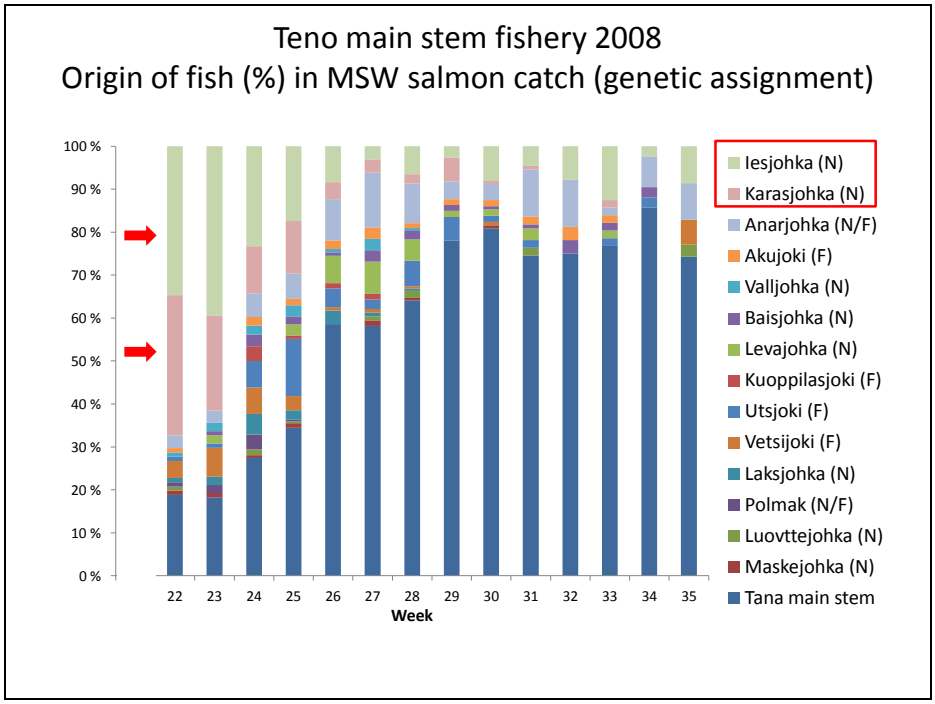

Figure 1. Weekly stock composition of salmon caught in the Teno main stem mixed-stock fishery in 2008 for MSW fish

Combining catch samples, catch statistics and genetic information gives more detailed possibilities to quantify the catch composition at different times and places within the fishing season (figure 2).

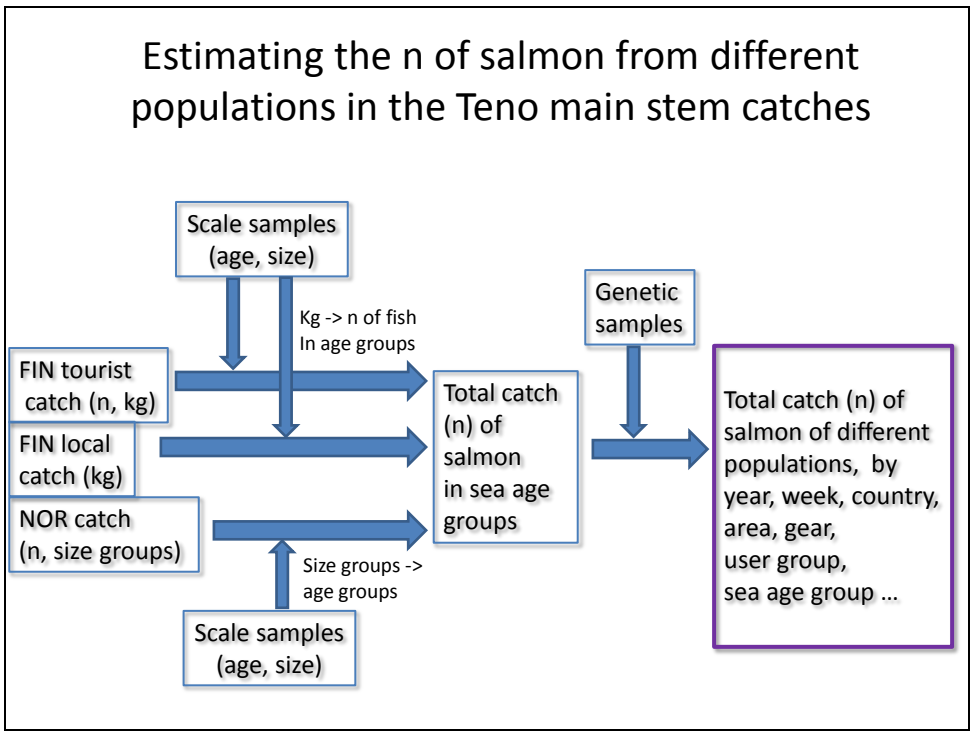

Figure 2. Different sources of information and the process used for constructing the population-specific estimate of catch in the Teno main stem.

Good scientific basis for the new management system

Combining catch statistics, scale samples and genetic information gives possibility to study the salmon fisheries of the River Teno in detail and to examine catches from different gear types, user groups or areas, for example. It enables identification of critical elements for vulnerable populations in mixed stock fishery of the River Teno main stem. More detailed information is valuable also for the stakeholders, in providing a more comprehensive picture on the complexity of the salmon management.

At the moment, genetic data from the main stem fishery are available for 2006-2008 and 2011-2012. There are also recent corresponding, complementary data on the River Teno salmon in mixed-stock fishery on the Norwegian coast (KOLARCTIC project). This information in concert gives a good basis for science-based, population-specific and tailored management measures.

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Annex 10

CNL(14)44

The management approach to the West Greenland salmon fishery – fairness and balance in the management of distant-water fisheries.

The Government of Greenland's contribution to the Theme-based Special Session – NASCO AM 2014

Session title: Managing the Inter-Play between Conservation and Socio-economic Considerations.

1. Introduction

Despite its size (2,166,086 km^2), approximately from Bergen in Norway to Malaga in Spain - Greenland only have a population of 56,968 (31 Mar 2014) with a population density of 0.026/km^2 due to the Ice Cap that only make approximately 10% of the landmass habitable. Fisheries are the most important industry in Greenland not only economically but also emotionally. Fishery and hunting play an enormous role in the Greenlandic culture and identity. Many small and isolated settlements are dependent on fisheries. The approximately 2,800 small scale fishermen in Greenland provide for the livelihood of thousands of people and many small settlements – both directly and in-directly. Thus, every time the Ministry of Fisheries, Hunting and Agriculture makes a decision concerning the management of the fisheries, it takes the inter-play between conservation and socio-economic as well as emotive considerations into account. Greenland is still very much a fishing and hunting nation – and any limitations or changes in management is always monitored closely by the media, the Fishermen's organization (KNAPK) and the politicians. There is an enormous pressure to ensure the means of subsistence and survival of the small scale fishermen and the small settlements.

It is always a feat to balance the inter-play between conservation and the livelihood of the coastal population – the difficulty in achieving this balance, is evidenced in that no Fisheries Minister served a whole term in Greenland since the introduction of the Home Rule in 1979.

Greenland only has one salmon river with its own unique stock. Thus, the stocks exploited in Greenland mainly originate in other countries. Therefore, an essential part of the Greenlandic regulatory and management measures for the salmon fishery are agreed to internationally within NASCO. Since 1998 Greenland through NASCO committed to ban commercial fishery and export of salmon. Greenland is allowed to carry out an internal use fishery, the so-called subsistence fishery.

The salmon fishery in Greenland is an inshore fishery. Greenland has no salmon fishery beyond 12 nautical miles. The fishermen that fish for salmon are mostly small scale fishermen that fish from a dinghy but there are also a few vessels over 6 meters. The salmon fishery in Greenland is a relatively small fishery limited by a fishing season, 1 August - 31. October. Therefore, the salmon fishery is often a supplement for the fishermen or hunters ensuring a stable income throughout the year or to supplement the household outside of the hunting season. The fishermen that fish for salmon also fish for other species. Unlicensed

fishery for private consumption has always been allowed5. Everybody living in Greenland is allowed to catch salmon for their own consumption.

This is an essential part of management measures in all Greenlandic fisheries, that everybody can fish for their own consumption. In the larger towns and cities people mostly fish for their own consumption because fresh fish is available and it is a good addition to the diet as well as fishing being an enjoyable pastime. However, in smaller settlements along the coast it is a vital part of peoples survival – not being able to afford buying expensive food the supplement that the fish you can catch gives is essential. Furthermore, in North- and East Greenland the supply ship is not able to sail through the ice between October and May, thus the shops begins to become empty by February/March – then fishing and hunting is important to the survival.

2. River Fishery

Greenland only has one known spawning population Atlantic salmon, *Salmo salar*, located in the Kapisillit river in the inner part of the Nuuk fjord, in West Greenland. Potentially, other rivers could hold a salmon population, but in general the rivers in Greenland are short, steep and cold. Although, the contribution of the small Kapisillit population to the salmon fishery around Greenland is persistent, it must be regarded as insignificant[6].

Some rod and reel fishery exists in the Kapisillit river, but the extent, size and catches is currently unknown. Electrofishing in the river in 2012, however revealed several yearclasses of smolts and the stock is persistent (unpublished). No CLs or other reference points have been established for the Kapisillit river.[7]

However, the Ministry of Environment and Nature is currently working on a strategy for the protection of biodiversity in Greenland. The Kapisillit salmon will in connection with this strategy stand out as especially conservation demanding and thus, it will be one of the highest priorities in the future conservation work. The main goal is to increase the protection of the river itself and endemic salmon stock from anthropogenic effects. The river is still almost undisturbed. The only known permanent disturbance to the river is that it, functions as water supply to the local settlement housing around 50 all year citizens. The disturbance involves a wooden structure and a 2.5 km long pipe from one of the lakes to the Kapisillit settlement . As part of the process, the local inhabitants have been heard about their opinion concerning the future of the river, the stock and the surrounding area. The protection plan includes the river, the river mouth, all areas supplying water to the river, the inner part of the fjord from the settlement to the river and surrounding areas. The process for an increased protection plan was started a few years ago and the expectation is a full protection of the area and a new set of rules for the use of the stock and area by 2015.

[5] Nygaard, Rasmus; *The Salmon Fishery in Greenland 2012 – Working paper 2013/XX*. International Council for The Exploration of the Sea – North Atlantic Salmon Working Group.
[6] Nygaard, Rasmus; *The Salmon Fishery in Greenland 2012 – Working paper 2013/XX*. International Council for The Exploration of the Sea – North Atlantic Salmon Working Group.
[7] [7] Nygaard, Rasmus; *The Salmon Fishery in Greenland 2012 – Working paper 2013/XX*. International Council for The Exploration of the Sea – North Atlantic Salmon Working Group.

3. Inshore Salmon Fishery

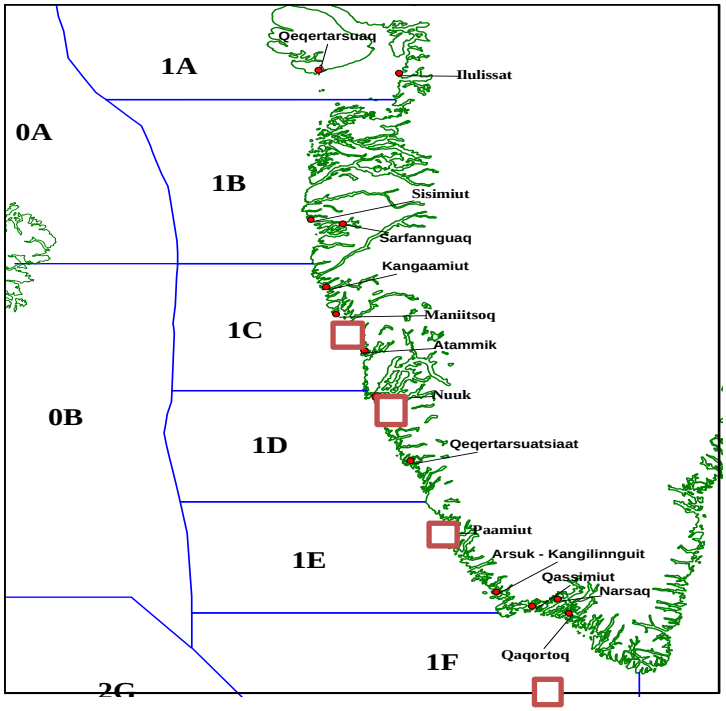
The inshore salmon fishery in Greenland is a mixed-stock fishery with contributions from the North American salmon and European salmon. The North Atlantic Salmon Working Group in ICES assess the stocks that contribute to the Greenland salmon fishery on the basis of the data from scientific samplers from NASCO and the Greenland Institute of Natural Resources. Through NASCO Greenland participates in a scientific cooperation concerning the salmon in the West Greenland fishery. A group of scientist work in Greenland during the fishing season with sampling of salmon. Collecting DNA, length and weight samples. Furthermore, the Greenland Institute of Natural Resources participates in the North Atlantic Salmon Working Group in ICES. The scientists at the Institute collect data on the salmon fishery to ICES from the factory landing reports and the catch reports provided directly by the fishermen to Greenland Fisheries License Control (GFLK).

In accordance with the agreements in NASCO Greenland has no commercial fishery on salmon and an export ban has existed since 1998. In addition to the regulatory measures from NASCO, the Greenlandic fishermen is limited by; the fishing season from 1 August – 31 October, a minimum mesh size in gillnets of 70 mm and number of nets. The unlicensed fishermen can use 1 salmon net and licensed fishermen can use up to 20 salmon nets. Furthermore, the licensed fishermen are allowed to use driftnets. All catches must be reported to GFLK, this entails that both licensed and unlicensed fishermen must report their catches.

The salmon fishery in Greenland is limited to an internal-use fishery - subsistence fishery, thus the fishery is managed from a socio-economic perspective as well as from the need to feed the population in Greenland. Salmon can be fished by non-professionals, who is allowed to fish for their own consumption and by professional fishermen, who have to require a license. The licensed fishermen can sell their catch to local markets, institutions or restaurants and since 2012 they can also land a quota of 35 tons to factories. This quota has been set by the Government of Greenland in order to ensure that all citizens get the opportunity to consume Greenlandic salmon and at the same time ensure the fishermen landing opportunities. The opportunity to land salmon entails employment for both small scale fishermen and employees at the factories. This opportunity can be the difference between closing the factories for longer periods at the time and ensuring the means of subsistence for fishermen and factory workers.

When the Government of Greenland decided to set a factory quota is was based on socio-economic considerations – the salmon fishery in Greenland is a small and regulatory very limited fishery but the Government of Greenland has some possibilities within the regulatory framework to ensure the means of subsistence for its population. The Fishermen's organization KNAPK has for some time put pressure on the Government to lift the ban on commercial fishery and export of salmon. This is not possible due to Greenland's commitment to NASCO – however, from a socio-economic perspective some settlements in especially Mid- and South Greenland needed help to ensure their livelihood and thus, a factory quota was set in order to provide work all year around in the settlements – all within the regulatory framework of NASCO. In 2013, four settlement received salmon for factories; Atammik, Kangaamiut, Qeqertarsuatsiaat and Arsuk. For these small settlement with respectively, 213, 362, 218 and 144 inhabitants it has been an important decision.

Figure 1. Location of the NAFO divisions along the West coast of Greenland - Identifying the four settlements that landed salmon in 2013 with a red square.



The salmon fishery has been regulated and limited during the last decades through NASCO and is today on a very low level. As shown in the table of reported landings in tons for the fishery at West Greenland 1990-2013 below, Greenland has limited its fishery continually in the last more than 20 years in order to permit the rebuilding of stocks below their CLs. As Greenland is within its right to fish salmon as a subsistence fishery and also set an internal-use quota for landings within the framework of NASCO, it has not consulted stakeholders.

Table 1. Reported landings (t) by NAFO Division for the fishery at West Greenland, 1990-2013.

Year	1A	1B	1C	1D	1E	1F	Unk.	West Greenland	East Greenland	Total
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										
1994										
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
2004	3	1	4	2	3	2	-	15	-	15
2005	1	3	2	1	3	5	-	15	-	15
2006	6	2	3	4	2	4	-	22	-	22
2007	2	5	6	4	5	2	-	25	-	25
2008	4.9	2.2	10	1.6	2.5	5	0	26.2	0	26
2009	0.2	6.2	7.1	3	4.3	4.8	0	25.6	0.8	26
2010	17.3	4.6	2.4	2.7	6.8	4.3	0	38.1	1.7	40
2011	1.8	3.7	5.3	8	4	4.6	0	27.4	0.1	28
2012	5.4	0.8	15	4.6	4	3	0	32.6	0.5	33
2013	3.1	2.4	17.9	13.4	6.4	3.8	0	47.0	0	47

+ Small catches <5 t.
- No catch.

Some of the stocks that Greenland fish on is below their CLs and therefore, Greenland has taken several steps in order to ensure that exploitation was limited. Measures have been taken during the last 20 years to limited the fishery through both NASCO regulation and national regulation. Greenland has lived up to its obligations in NASCO and reduced its fishery from 274 tons in 1990 to 46,9 tons in 2013, banned export and commercial fishery. Committing to a subsistence fishery, fishing only to sustain its population and the survival of the settlement.

The Government of Greenland always aim to manage the fisheries sustainably and the Ministry of Fisheries, Hunting and Agriculture works closely with the Greenland Institute of Natural Resources. However, the socio-economic considerations also play an huge part in the management of fisheries in Greenland. The foremost consideration is to secure the means of subsistence for the fishery communities – because Greenland does not have any alternative employment or industry that can replace the fishery. Therefore, if there is no fishery it would not only limited peoples means of survival – but it would also entail that all the people in the fishery and the connected industries would have to be supported by the society, receiving social help.

The inter-play between socio-economic considerations and conservation in the management is also often a balance between the present and the future. Greenland has high hopes for the oil and minerals industry, however evaluations deem the raw material adventure to be 25-50 years into the future – thus, fisheries is going to continue to be the main livelihood in Greenland in many years to come. Which makes the management an even harder feat for the Government of Greenland as it needs to find a balance between the Fishermen's organization, its international partners in NASCO and the need of its population both now and in the future. This is a difficult exercise. The fishermen want to return to commercial salmon fishery in Greenland because they see more salmon throughout the whole year – but the scientific advice show us that the stocks has not improved despite our best efforts and continually reducing the fishery in West Greenland, thus caution is needed in order to allow the stocks to rebuild and secure a salmon fishery in the future.

The title of Greenland's presentation was '*The management approach to the West Greenland salmon fishery – fairness and balance in the management of distant-water fisheries'*. Whether the management of the salmon fishery in Greenland is fair is difficult to judge as one can never please everybody – some wants to lift the export and commercial fishing ban and others want to limit the fishery further - considering this, the Government of Greenland tries within its capacity to balance the management between the need for conservation and the socio-economic impact on the Greenlandic society. This has been the management approach in the West Greenland salmon fishery in the last more than 20 years.

Annex 11

CNL(14)41

Recent Investigations into the stock composition of the Norwegian and Russian coastal salmon fisheries (the Kolarctic salmon project)

(Tabled by the Russian Federation)

Introduction

Atlantic salmon (*Salmo salar* L.) exhibit a complex life history, in which the more commonly recognized form is anadromous, i.e. fish that spend their first years as juveniles in rivers and then migrate out in the ocean to grow and mature as an adult fish before migrating to their natal rivers for spawning (Mills 1989). Seawater migration is the key element in the life history of the Atlantic salmon. Mixed-stock fisheries on the migration routes pose a particular challenge for management, as they cannot distinguish between stocks that are at full reproductive capacity and those who are not.

A mixed stock Atlantic salmon fishery operates off the coast of northern Norway, in the three northernmost counties: Nordland, Troms and Finnmark. Average annual landings in the last 15-20 years have been close to 300 tonnes (Statistics Norway). Different salmon stocks from Norwegian, Finish and Russian rivers may migrate along the coastal areas at the time when the fishery operates. Tagging exercises in the past have showed that Atlantic salmon from Russian rivers migrate through the Barents and Norwegian Seas (Danilchenko, 1938; Bakshtansky, 1970) and may be harvested along the North-Norwegian coastal line.

Due to strong homing, salmon inhabiting different rivers are reproductively isolated from each other and, therefore, the populations inhabiting different rivers have accumulated significant inter-population genetic variation which can be used to identify the river of origin of samples from coastal mixed-stock fishery. In 2010 the baseline for a number of Norwegian and Russian rivers were established through a pilot project to identify the origin of salmon in catches from coastal areas. The results from that project demonstrated that the GSI method could give reliable estimates of the proportion of salmon in the catches as well as estimates of how salmon from different regions and rivers were exploited in the coastal fisheries (Svenning et al. 2011). However, it was also recognized that the spatial coverage of the baseline should be expanded, the number of genetic markers should be increased, and additional sampling should be conducted in a number of salmon rivers to improve the precision of the assignment of individuals.

A further initiative to achieve this goal was taken by Norway, the Russian Federation and Finland. In 2011-2013 an EU project "Trilateral cooperation on our common resource; the Atlantic salmon in the Barents region" (the Kolarctic salmon project – KO197) was implemented. The project was supported by both EU-funding (Kolarctic ENPI CBC Programme) and national funding from Norway, the Russian Federation and Finland. The Kolarctic salmon project has generated one of the most comprehensive and detailed genetic datasets for any fish species. Results of genetic stock identification provide first and comprehensive overview to spatial and temporal variation in stock compositions in coastal fisheries of Northern Norway and in the White Sea. The data from the project will provide managers with tools for regulating fisheries on a more informed basis.

Genetic structure analyses

Genetic stock identification (GSI) has been used in salmon research and management over the last three decades allowing assessment of origin of the stocks being harvested. With the advent of powerful genetic markers, reduced costs of analysing large numbers of samples accompanied with the development of tailored statistical methods, genetic stock identification is one of the most successful biological tools available for assessing stock compositions in mixed stock fisheries. During the last decade it has become an indispensable and powerful tool to understand fishery dynamics, especially of salmonid fishes (Beacham et al. 2008, Hess et al. 2011).

The Kolarctic salmon project has generated one of the most comprehensive and detailed genetic datasets for any fish species. More than 13 000 individuals from over 200 samples collected from over 180 rivers in the Kolarctic area have been analysed for 31 DNA markers displaying well over 600 alleles (Vähä et al. 2014). Major genetic divisions were found at different geographical scales; the main genetic barrier appearing between the eastern populations of Russia, including the White Sea populations, and populations from northern Kola and northern Norway. Genetic barriers/shifts were also observed at finer geographic scales. Genetic differences between populations, overall and within a region, were greatest for the eastern populations of Russia. Genetic structuring within major river systems was observed in the Pechora, Ponoi and Teno rivers. In these river systems multiple populations exist and they should be managed as separate units. The genetic baseline developed for this project allows for precise identification of salmon caught at sea to individual rivers/reporting groups, providing opportunities for more adaptive and informed management of coastal salmon fisheries.

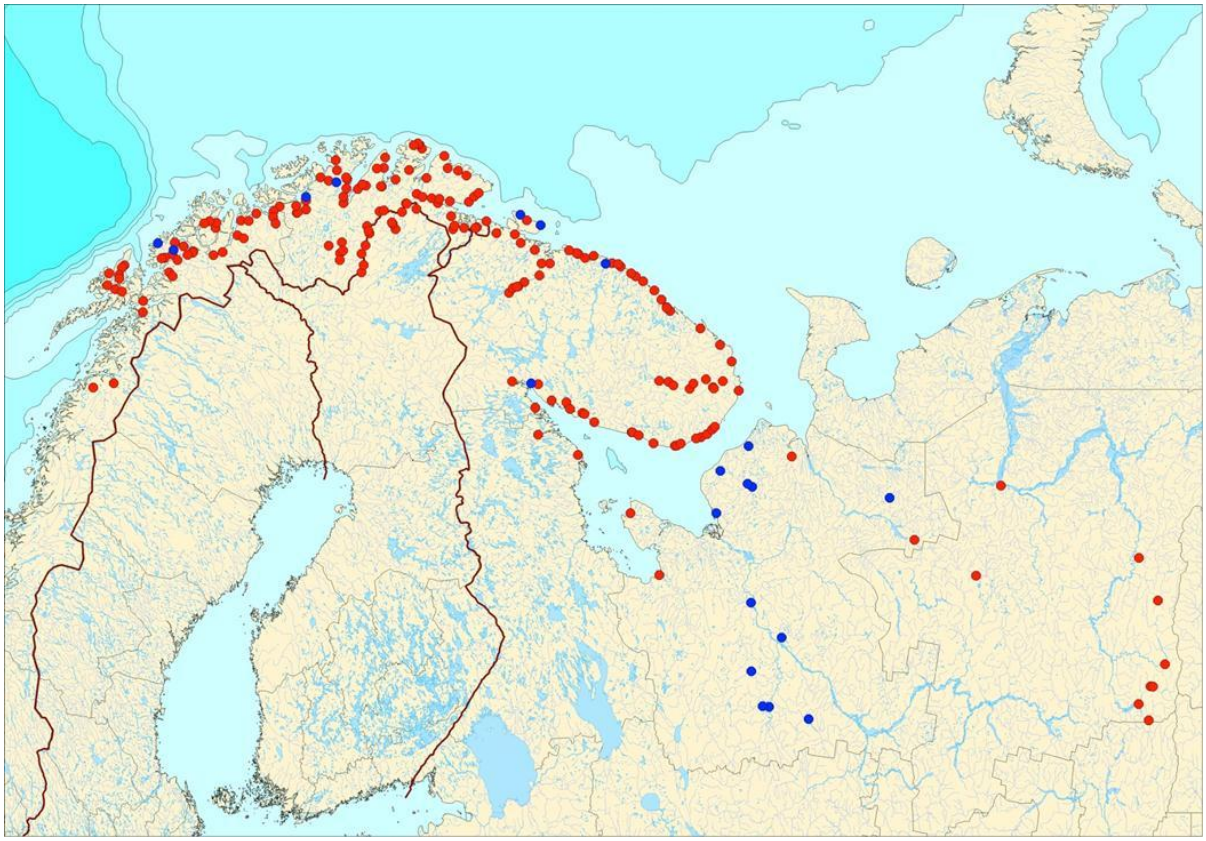


Figure 1 – A map showing rivers sampled for genetic dataset in the Kolarctic salmon project.
Genetic stock identification

The comprehensive sampling of adult Atlantic salmon along the North-Norwegian coast and in the White Sea was conducted in 2011 and 2012 through a very close collaboration between scientists and commercial fishermen. In total 17383 wild salmon were collected in the Norwegian coastal waters in May-September and 2058 salmon were sampled in the White Sea in June-December. To determine the river of origin of captured salmon, each fish was compared with genetic profiles of river stocks of nine reporting groups.

Power tests of genetic stock identification using test samples from the baseline data revealed large differences among rivers and regions in the expected level of stock identification. On average, 69% of samples assigned to a river were correct, but more than 70 stocks were distinguished and identified with high (>80%) assignment success to their river of origin. Highest correct assignment was observed for rivers in the Eastern Barents, in the White Sea and in the Teno River system salmon stocks (90%), while the lowest was observed for the Troms and Nordland stocks (54%).

Nine reporting groups, roughly following genetic boundaries, were delineated for identifying the geographical region of origin of salmon from coastal catches. Individuals from Russian rivers and Teno River system were correctly assigned to their respective reporting groups with 94-99% accuracy, while slightly lower assignment success was obtained for the samples from rivers in eastern and western Finnmark: 86%. Northern Troms and southern Troms reporting groups were combined, 80% of Troms salmon were correctly identified while salmon from rivers in Nordland had correct assignment of 72%.

Genetic stock identification analyses confirmed that coastal fisheries in northern Norway exploit multiple stocks. Altogether, 145 rivers were found to contribute to fishery samples. Fisheries generally exploited salmon from wide geographical areas with catch localities on the open coast showing greater stock diversity than catch localities within fjords. Fishery samples from May and June were composed of salmon from wider geographical areas, whereas samples from July and August were composed of more local populations. No adult salmon sampled in the White Sea were assigned to the rivers outside the area. Salmon caught in the White Sea originated from 25 rivers and a vast majority of fish was from 17 rivers of Murmansk region.

Genetic baseline developed in the Kolarctic salmon project allows for further studies of the marine distribution and exploitation of salmon from the Kolarctic area, such as mapping of migration of post-smolts and adults in the open sea, as well as identification of important genetic biodiversity units for conservation. Assignment accuracy and precision can be further increased by supplementing the baseline population data with more samples. With accumulating baseline data, genetic stock assignments assessed in the project can be refined, but the current data already provides valuable information on the stock compositions, harvest rates and migration patterns of salmon of the Barents Sea Region (Vähä et al., 2014).

Migration model

A stock-specific migratory model was developed for four large stocks, i.e. Målselv salmon in Troms county, Alta and Tana salmon in Finnmark county and Kola salmon in the Kola Peninsula, Russia (Svenning et al. 2014). All these stocks reached the North-Norwegian coast mainly in June-July, while MSW-salmon in general arrived earlier than 1SW-salmon.

The Målselv stock was mostly exploited around islands and coastlines in western Troms and close to the Malangen fjord system. Both MSW and 1SW Målselv salmon seem to reach the coast from the west, whereas MSW salmon reach the coast one month earlier. Thus, due to the coastal migration pattern of Målselv salmon, most sea fishery exploitation take place in inner part of Troms county, i.e. based on the strong regulations in salmon sea fishery in Troms, a relatively small fraction of the stock is exploited through the official sea fishery season.

The Alta stock seems to have a fairly similar migrating pattern as the Målselv stock, i.e. reaching the coast more or less from the west, and the dominant part of the stock is exploited within the Alta fjord. Still, due to their westward migration pattern, a relatively large fraction of the stock is also exploited by the salmon sea fishery in outer/northern Troms, and also in areas in western Finnmark, i.e. along the coast line west of Alta fjord. Based on the migration model, some of the 1SW salmon enters Alta fjord from the north, being slightly different compared to the MSW Alta stock. Although MSW Alta salmon reach the coast several weeks earlier than 1SW, MSW salmon was quite heavily exploited not only in late May and early June, but also in July and even in August. The Alta stock suffers a very high exploitation rate from the salmon sea fishery, especially within the Alta fjord in July and early August.

Tana salmon, as opposed to Målselv and Alta salmon, was recorded in the coastal catches from all fishing regions in the study area. Although the highest number of salmon (CPUE) was captured in the Tana fjord, the relatively high CPUE-values, both in southern Troms, as well as in western and eastern Finnmark strongly suggest that Tana salmon reach the coastal areas both from southwest, west, north and east.

Salmon originating from Russian rivers comprised more than 20% of the recorded catches. Still, the incidence of Russian salmon in the catches varied strongly within season and among fishing regions, being less than 9% in the coastal catches from Nordland, Troms, western Finnmark, mid Finnmark and the Tanafjord, while nearly 50% of all salmon captured in eastern Finnmark, mostly in Varangerfjord, had Russian origin. Further, the catch of Russian salmon decreased by time within season, and in eastern Finnmark the incidence of Russian salmon decreased from 70% in May to 20% in August. Thus, catches of Russian salmon were much higher before the start of official fishing season in eastern Finnmark, but, still a fairly large amount of the recorded catch in this area consisted of salmon stocks originated from Russian rivers.

Kola salmon, both 1SW and MSW, was most frequently recorded in catches in Eastern Finnmark, i.e. especially in Varangerfjord, whereas some Kola salmon were caught in western Finnmark in very early season. This may indicate that most Kola salmon reached the coast in Eastern Finnmark, whereas some fishes migrated from the west, but fairly far from the North-Norwegian coastal areas. The CPUE-values of MSW Kola salmon in Varangerfjord was highest in June/July, while Kola salmon was more or less absent in catches from early August and onwards.

Origin of catches during the official fishing time

Salmon catches during the official fishing time consisted of fish from a large geographical area especially in Troms and Finnmark counties. In Finnmark the official fishing time was covering period from June 1 to August 4 with many spatial and temporal differences between municipalities and therefore the origin of salmon in the catches was covering more precisely

salmon stocks occurring in Kolarctic area than catches caught with much more limited fishing time in Troms County or in Nordland County where the official fishing took place during six-eight days in three -four weeks' time in July.

In 2011 and 2012 in Finnmark County about 40% of catches had origin of salmon rivers of the Western Finnmark area. The River Tana stocks made 17-18%, Russian stocks made 16-18% and salmon stocks from East Finnmark made 11-14% of the official salmon catches. Salmon stocks from Troms County made 7% and stocks from Nordland County have minimal numbers in catches taken in Finnmark.

38-50% of salmon caught in Troms County originated from Troms rivers. Stocks from West Finnmark had high proportions in Troms County with 27-39%. Salmon stocks from Tana, East Finnmark and Russia did not occur often in the catches in Troms County during the official fishing time because the fishery took place during 4 weeks in July when most of the eastern stocks have passed that area.

Material from Nordland in 2011 was too small to make conclusion on the origin of salmon in the catches during the official fishing time in 3 weeks in July. Data from 2012 indicated that salmon caught in Nordland were mainly from the rivers of Troms County and also from West Finnmark, from Russian rivers and from Nordland rivers.

According to official catch statistics the highest wild salmon catches in 2011 and 2012 were taken in Sør-Varanger municipality, Finnmark. Proportions of wild salmon originating from different reporting groups had remarkable differences in catches between municipalities. Salmon of Russian origin made 65% of the catches taken in Sør-Varanger municipality. Tana salmon made high proportion in the municipality Tana in Tanafjord: 80%. Salmon originating from each reporting group area were caught widely in the outermost coastal areas as well as in inner areas of the fjords. Salmon rivers of West Finnmark were supporting high proportions of wild salmon catches in almost all municipalities in western Finnmark. Salmon stocks from numerous rivers in northern Kola Peninsula in Russia were important resources supporting salmon fishery in eastern Finnmark and especially in Sør-Varanger municipality. Salmon catches taken in the municipalities Vadsø-Nesseby had large proportion of fish from the East Finnmark reporting group. Numerous salmon stocks of the River Tana were supporting largely fisheries in Tanafjord and also in neighboring Gamvik and Berlevåg municipalities.

In Terskiy Bereg of the White Sea 48% of sampled salmon had origin of the Varzuga River and 23% of samples were assigned to the Strelna River. The occurrence of Varzuga salmon was highest in the coastal catches taken in the western part of the fishing area: 89%. Fishing over there began in the autumn time when the Fall run fish started approaching the river. The proportion of Varzuga salmon decreased eastward and it was the lowest in the autumn catches (27%) taken in the eastern areas. A variety of salmon populations (15 stocks) was higher in catches taken in June-July than in the autumn time when salmon from only 6 stocks were found in catches (Prusov et al. 2014).

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Annex 12

CNL(14)48

Recent investigations into the stock composition of the Labrador Atlantic Salmon subsistence fisheries

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Lead investigator: Dr. Ian Bradbury, Fisheries and Oceans Canada

Atlantic salmon, *Salmo salar*, in eastern Canada were historically fished in rivers, estuaries and in the marine coastal waters in commercial, recreational and aboriginal fisheries. As a result of declining stock abundance, the commercial fisheries were progressively closed beginning as early as the 1940s, with important closures in 1984, 1992, 1998 and finally closed overall in eastern Canada in 2000. In addition to the closure of the commercial fisheries, restrictive management measures were introduced in the recreational fisheries that included mandatory catch and release of large salmon (>= 63 cm fork length) in most areas of eastern Canada along with season and daily retention limits on small salmon (< 63 cm fork length). Aboriginal peoples of eastern Canada have access to Atlantic salmon for food, social, and ceremonial (FSC) purposes. The Supreme Court of Canada, in the case of Regina vs Sparrow affirmed the constitutional right of aboriginal peoples to priority access to natural resources after conservation requirements are met.

In the western Atlantic, salmon migrate to the Labrador Sea or the waters west of Greenland to feed and may move into coastal regions of Labrador and Newfoundland during the summer months where fisheries targeting mixtures of populations have traditionally occurred. Marine fisheries that harvest Atlantic salmon originating from rivers of eastern Canada and the US occur at Greenland, in estuarine and coastal waters of Labrador and at Saint-Pierre et Miquelon off the southeast coast of Newfoundland

Labrador subsistence fisheries

The Labrador FSC fishery is practiced by several groups located in different parts of the region. These fisheries occurring in estuaries and marine coastal waters of Labrador are essentially artisanal fisheries using fixed gillnets, set in bays and around coastal islands from small boats. Three aboriginal peoples groups (Labrador Inuit Association, the Innu First Nation, and the NunatuKavut Community Council) fish for salmon based on negotiated fisheries agreements. A bycatch of three Atlantic salmon is provided to registered Labrador residents under a food fishery licence targeting sea-run speckled trout and Arctic charr. These fisheries are managed by season, location, gear, and quota allocations to the respective groups. In all cases, the sale or bartering of Atlantic salmon is prohibited.

Total annual harvests of Atlantic salmon in the Labrador subsistence (aboriginal FSC and resident food) fisheries ranged from 6,500 to 15,600 salmon of all sizes, equivalent to 15.6 to 41.4 metric tons of fish, during 2000 to 2013 (Fig. 1). By number of fish, the harvest is predominantly small salmon, ranging from 4,800 to 11,100 fish compared to large salmon numbers ranging from 1,400 to 6,500 fish annually. Most of the harvests of small salmon occur in southern Labrador whereas large salmon harvest numbers are relatively similar among the three salmon fishing areas of Labrador (Fig. 1).

Progress in assigning origin of salmon in the Labrador subsistence fisheries

Differences in biological characteristics and more recently, genetic stock identification techniques, have been used to assign the origin of salmon sampled from the Labrador subsistence fisheries to a region of origin.

There is a positive relationship between latitude of the river and the freshwater age of smolts with proportionally older smolts produced in the more northern areas (Fig. 2). Freshwater ages of Atlantic salmon sampled from the fishery indicated that there were very few age 1 and age 2 year old smolts with most (>75%) of the salmon sampled having a freshwater age of 4 years and older (ICES 2013). These older smolts could potentially include salmon from northern Quebec, Newfoundland and Labrador populations.

Recent developments in genetic stock identification techniques are being used to address the questions of the origin of Atlantic salmon captured in marine fisheries. The application of these techniques to the catches of the subsistence fisheries of Labrador required the following steps:

- Establishment of an eastern North American baseline,
- Definition of regional groups,
- Obtaining samples from the fishery,
- Assigning origin of salmon from the fishery samples

The establishment of the eastern North American baseline was supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) grant to Dr. L. Bernatchez from Université Laval (Quebec, Canada) with collaborations from scientists at Fisheries and Oceans Canada (P. O'Reilly and I. Bradbury), from the Government of Quebec (M. Dionne), and the USA (T. King). A total of 12,000 individual fish samples were obtained from 189 individual river systems from Ungava Bay (Quebec) (58.8ºN) to Maine (USA) (44.8ºN). Analyses were standardized for three different laboratories.

Microsatellite polymorphisms were scored at 15 loci: Ssa85, Ssa202, Ssa197, SSOSL417, SsaD85, SsaD58, SsaD71, SsaD144, SsaD486, MST-3, SSsp2201, SSsp2210, SSsp2215, SSsp2216 and SSspG7. Genotyping of fishery samples follows the methods outlined in Bradbury et al. (2014). The database also includes data from an EST-based medium-density SNP array which provides data on over 5000 SNPs for 20-25 individuals for each of 46 sampling locations (Bourret *et al.* 2013). The SNP dataset is divided into neutral and potentially adaptive markers based on a genome scan analysis.

Reporting groups for assignment purposes represent regional clusters identified in previous landscape analyses of population structure (; Dionne et al. 2008; Bradbury et al. 2014) In total, 12 reporting groups were used for individual assignment and mixture analysis (Fig. 2), based on both new data and previously published data from Quebec, Labrador, and New Brunswick from Dionne et al. (2008) and Newfoundland and Labrador from Bradbury et al. (2014).

A program to collect representative samples from the fishery in 2006-2011 was conducted by NunatuKavut Community Council Aboriginal guardians, and Conservation Officers of the Nunatsiavut Government. Samples collected for genetic analyses were comprised of both scales (2006-2010) and fin clips in 95% ethanol (2011). In total 1,772 samples of individual catches collected in the fishery over the six year period were available. The spatial distribution of samples from the fishery varied from year to year. In 2006 and 2007, fishery

samples were limited in northern regions whereas sampling in the south was limited in 2007. Coverage was more evenly distributed across the region in 2009, 2010, and 2011. Temporally, the majority of the samples were collected from the end of June till the middle of August.

Individual assignment methods and mixture analyses were utilized to assign the fishery samples to one of the 12 regional groups. Accuracy and efficiency of the approaches for mixture analysis and individual assignment were evaluated using a variety of simulations and known origin samples. Accuracy is defined as the proportion of the mixture or individuals which are correctly assigned, and efficiency as the proportion of individuals which assign with greater than 0.70 probability.

Mixture analysis of all fishery samples revealed significant differences among regions in terms of contributions to the fishery. The proportion of the fishery mixture allocated to central Labrador represented the majority of the mixture estimated at 96.0% ± 0.7%. When the entire Labrador region is taken as a whole (southern including some lower north shore of Quebec, central Labrador, and northern Labrador / Ungava), the total contribution to the fishery overall is 97%. Both mixture and assignment analyses indicated similar relative contributions in the fishery samples with Labrador sources dominating. Taken together, the contribution of all possible non-Labrador sources to the fishery is estimated as <3%.

Individual assignment was used to explore geographic distribution of possible non-local interceptions in the fishery. Assignments to central Labrador dominated the catch and were widespread across the region. The only regional group assigned to the Lake Melville area (SFA 1B) was central Labrador. In contrast, assignments to southern Labrador / Québec (n=7), Newfoundland (n=4), Southern Gulf (n=3), all showed clusters of assignments in the southern region near the limit of the fishery, and often no assignments elsewhere. Only four individuals were assigned to the USA reporting group over all years sampled and they all occurred from northern Labrador catches.

Considerations and future initiatives

Genetic stock identification techniques indicate that the Labrador subsistence fisheries harvest salmon from several regions in eastern North America but the majority (> 96%) of salmon sampled were of Labrador central origin, distributed throughout the fishery areas (SFAs 1A, 1B, 2) and periods (Fig. 4). The results are consistent with tagging studies suggesting 94% Newfoundland and Labrador salmon in the harvest during the 1970's and 1980's (Pippy 1982). Only the Labrador central group was identified in the Lake Melville fishery samples (SFA 1B).

Rare assignments to non-local Canadian stocks (South Labrador / lower north shore, Newfoundland, and Southern Gulf of St. Lawrence / New Brunswick) in the fishery samples occur in the southern portion (SFA 2) of the fishery area, near the Strait of Belle Isle. Total annual harvests in this area have ranged from 3,400-5,500 small salmon and 1,000-2,000 large salmon in the recent 10 years. Rare assignments of USA origin salmon occurred in the northern area of the fishery (SFA 1A).

Estimation of total number of salmon from each regional group harvested in the fishery requires further work. Points to consider for this include sampling intensity and distribution, harvest reports, and size group (sea age) of salmon in the fisheries and the fishery samples to ensure representativeness of the sampling program.

There is an interest to attempt to differentiate the origin to finer spatial scale regional groups than those reported here. However, it should be clear that it will not be possible to assign a fish to an individual river even for the 189 river systems in the baseline. Further work is

ongoing to refine the regional groups and involves lowering the criterion for probability of correct assignment (may produce more groups), or by using pre-established groups and validating probability of assignment.

Alternatively, new techniques are being considered. Single Nucleotide Polymorphisms (SNPs) markers widely distributed across the Atlantic salmon genome were examined for 26 populations (Bourret et al. 2013). To date, the neutral genetic structure supported by SNP markers is similar to the structure interpreted from microsatellite markers with a regional organization identical to the one reported in Dionne et al. (2008).

Sampling of the fisheries continued in 2012 and 2013, and is anticipated to continue for 2014. Funding has been secured to process these samples and to continue exploration of new technologies (SNPs) to further refine regional groups. Information such as this is essential in enhancing management approaches to reduce the impact of the subsistent fisheries on non-local salmon stocks migrating through these areas.

Acknowledgements

All fishery samples were collected with the assistance of the NunatuKavut Community Council, the Nunatsiavut Government, and Fisheries and Oceans staff. Funding for baseline sample collection in Newfoundland and fishery sample analysis was provided by the Atlantic Salmon Federation and by the Genomics Research and Development Initiative of Fisheries and Oceans Canada. Funding was also provided by a strategic project grant from the Natural Sciences and Engineering Research Council of Canada (NSERC) led by L. Bernatchez, as well as the Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs et des Ressources Aquatiques Québec.

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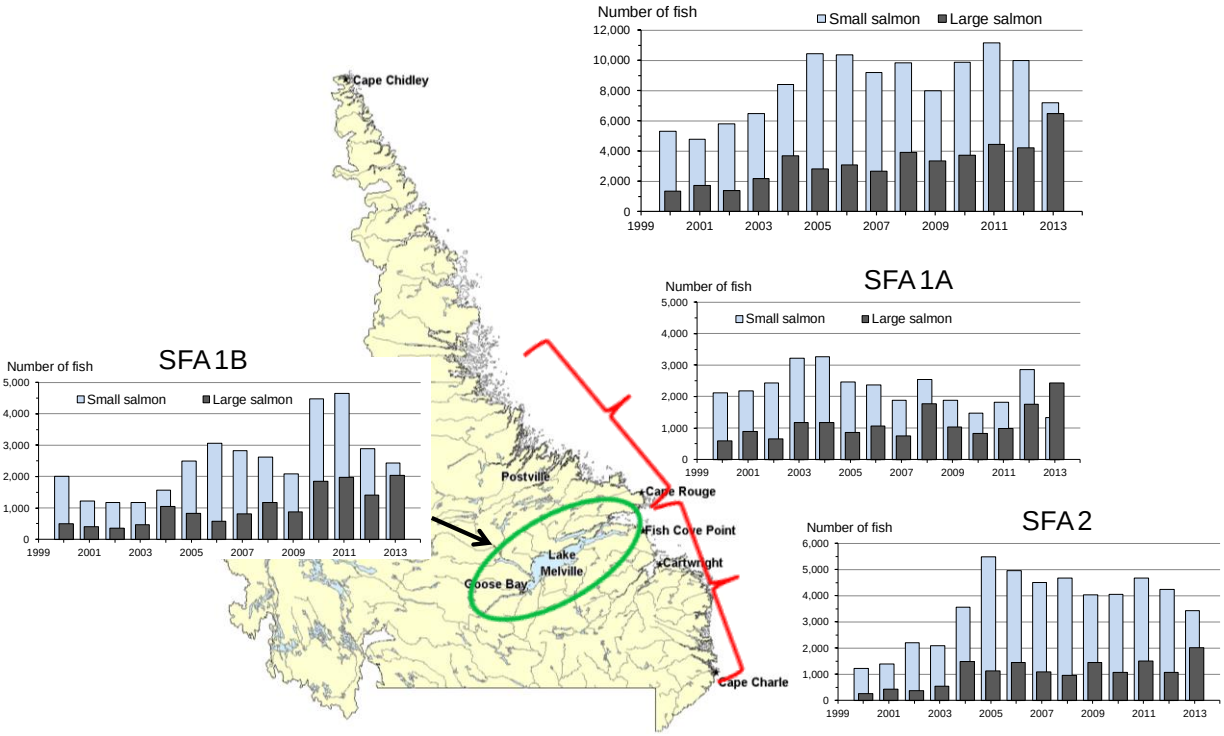

Figure 1. Reported harvest numbers of small salmon and large salmon by Salmon Fishing Area (SFA) and overall in the subsistence fisheries of Labrador, 2000 to 2013.

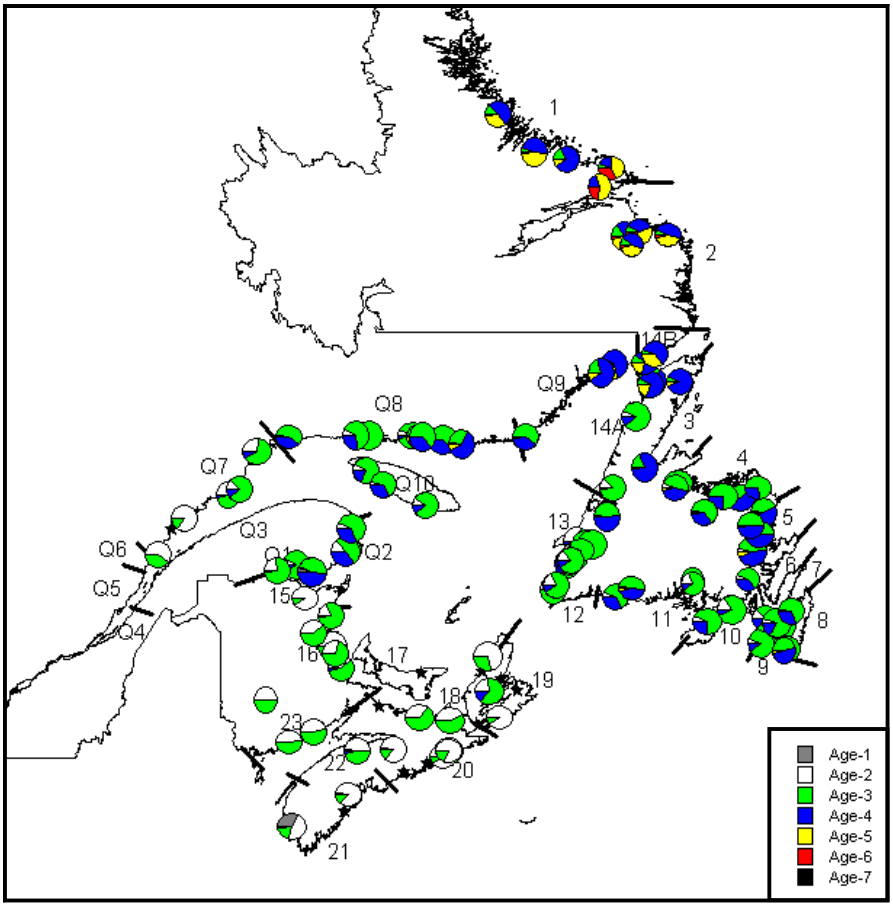

Figure 2. Proportions by freshwater age of Atlantic salmon from rivers of eastern Canada.

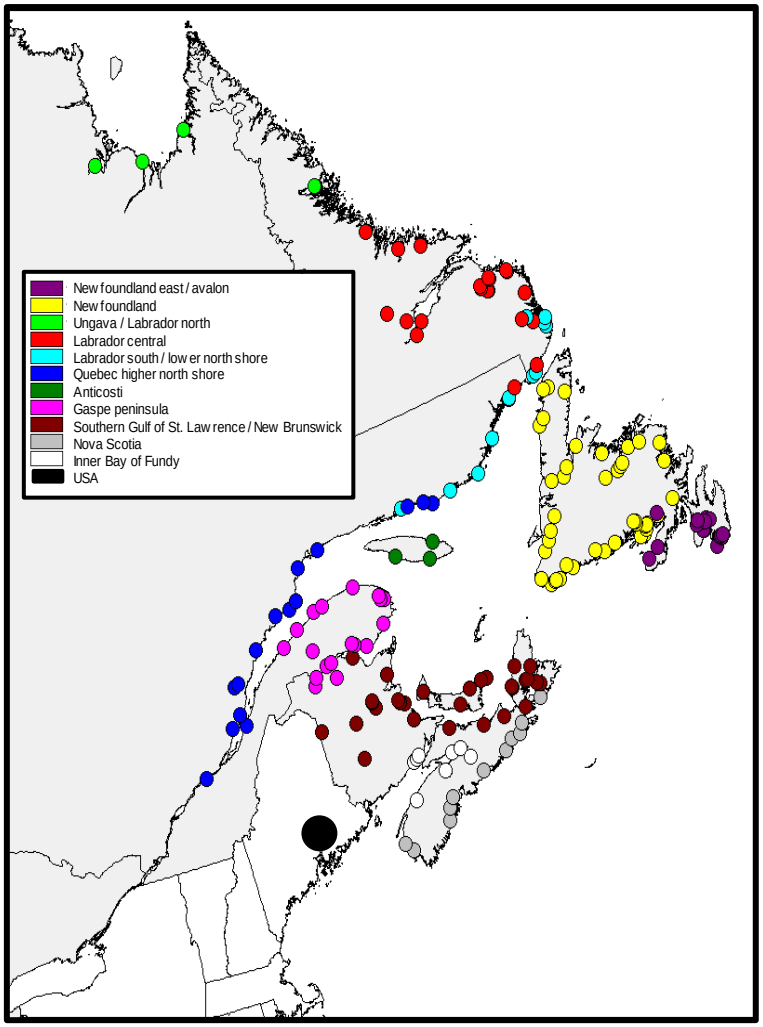

Figure 3. Regional groups based on 15 microsatellite markers for salmon populations of eastern North America.

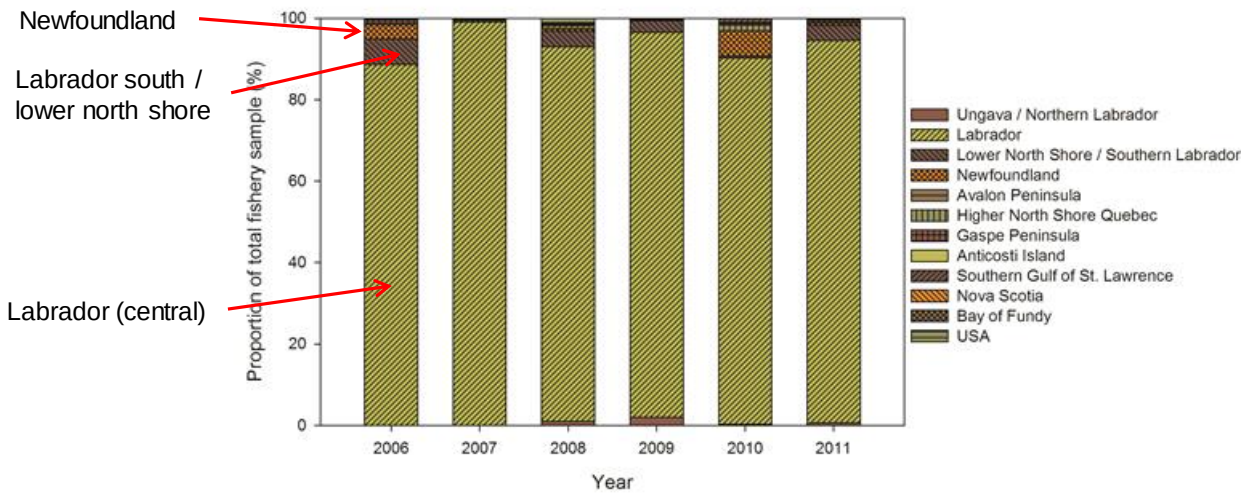

Figure 4. Temporal variation in fishery composition of samples from the Labrador Atlantic salmon subsistence harvest over the period 2006-2011, estimated by Bayesian mixture analysis.

Annex 13

CNL(14)49

Recent investigations into the stock composition of coastal fisheries in Scotland

Introduction

In Scotland, it is acknowledged that coastal fisheries are highly likely to be mixed stock in nature. Further, it is recognised that in accordance with the NASCO Guidelines for the Management of Salmon Fisheries
(http://www.nasco.int/pdf/far_fisheries/Fisheries%20Guidelines%20Brochure.pdf)
"Rational management of a MSF (mixed stock fishery) requires knowledge of the stocks that contribute to the fishery and the status of each of those stocks". This paper provides brief background information on the nature of Scottish coastal MSF fisheries and describes the recent investigations that have been undertaken to assess stock composition in these fisheries.

Background

Over the period 1952 to 2013, there has been a marked decline in the Scottish nominal catch from a peak of ca. 1500 tonnes to the current level of ca. 120 tonnes per annum. Throughout this period the percentage of the nominal catch taken by coastal fisheries has remained at ca. 40%, catches in recent years being ca. 50 tonnes per annum. There has been a substantial reduction in the scale of these fisheries since 1952 and the present effort deployed is only 5% of the highest recorded value. There are a number of types of coastal nets but all are operated close to the shore and are indeed prohibited beyond 1500 m from the shore.

In 2013, there were 34 active coastal fisheries reporting either catch or effort to the Scottish Government. However, the overall coastal catch was not apportioned equally among fisheries with a small number accounting for the majority of the catch. The largest four fisheries accounted for 79% of the total reported coastal fishery catch,. The remaining 30 fisheries accounted for just 21% of the total reported coastal fishery catch. The largest fishery, accounting for 43% of the total coastal fishery reported catch, is based on the east coast adjacent to the river South Esk. The second largest fishery, accounting for 16% of the total coastal fishery reported catch, is located on the north coast at Armadale. Investigations have begun to determine the stock composition of the catch in both of these fisheries.

Recent investigations into the stock composition of coastal fisheries

South Esk radio tracking investigation

In Scotland, the number of spring salmon (early running MSW fish) in the rod catch have generally declined since the early 1950s, although in recent years, numbers have stabilised, albeit at historically low levels. However, on the river South Esk rod catches have not stabilised but have continued to decline, despite a range of statutory and voluntary measures being introduced in both the coastal and freshwater fisheries, leading to concerns about the status of this particular sub-stock in this river. A radio tagging and tracking project was conducted using salmon caught in the South Esk coastal net fishery in the spring of 2012 and 2013 with the aims of determining (a) the spawning location of these fish (as a prerequisite of for targeted freshwater investigations) and (b) to assess the degree to which the coastal

fishery is mixed stock in nature. A number of radio receivers were deployed in the river South Esk to track the migration of salmon in the river and, in addition, individual receivers were sited on a number of other east coast rivers. The number of salmon tagged and the number subsequently detected in different locations are given in Table 1.

Table 1. The number of salmon tagged and the number and location of subsequent detections in 2012 and 2013.

Year	Number tagged	Number and location of subsequent detections						
		Spey	Don	Dee	North Esk	South Esk	Tay	Tweed
2012	153	See footnote (a)	2	7	16	18	5	See footnote (a)
2013	38	2	0	0	5	5	2	0

Footnote (a): Not monitored in 2012.

Interpretation is complicated as not all the tagged salmon were subsequently detected and tracking was only undertaken on a small number of east coast rivers. However, it is possible to derive an estimate of the contribution of the South Esk stock to the coastal fishery. This was estimated to be between 8 and 25% in 2012 and between 11 and 29% in 2013. The wide distribution of detections relative to the tagging site is similar to that observed in earlier coastal experiments, carried out at various locations around the Scottish coast, using external tags and relying on recapture reports from the fisheries active at the time (Malcolm *et al*, 2010). In conclusion the South Esk near shore coastal fishery is highly mixed stock in nature.

Genetic approaches

Genetic approaches to stock discrimination are now being explored and may allow assignment of fish caught in any fishery/location to area of origin. The potential advantages of such approaches, if they work, are that they do not rely on extensive tracking programmes, recaptures from active fisheries, which in themselves compound interpretation, and large numbers of fishery samples might be assessed relatively cheaply. Such techniques rely on identifying informative genetic variation from freshwater baseline sample sites at a level that is informative for the particular management question being addressed.

Two types of genetic marker may be used, namely microsatellites or Single Nucleotide Polymorphisms (SNPs). Microsatellites comprise short regions of DNA where sequences of genetic bases are repeated a variable number of times and hence the regions differ in length depending how many repeat units are present. SNPs are the most common type of genetic variation (every few hundred bases) where variation occurs at a single genetic base.

The approach requires that an extensive number of baseline samples are screened for either a set of microsatellite markers or a large number of SNP markers with cluster analysis then being used to select a set of markers that can provide differentiation among stocks at different geographic scales.

Application of the concept at a gross scale of definition is evidenced by a recent contract work undertaken by Scottish Government geneticists in collaboration with Environment

Agency staff in England to determine the stock composition of the various coastal fisheries operating off the North East of England (Gilbey *et.al.*, 2012). In this case, a suite of 14 microsatellite markers, as used in the EU SALSEA-Merge project (Anon, 2011), allowed the assignment of fishery samples at a regional scale but not at the smaller river scale. The derived assignments were to those previously found using external tags (Potter and Swain, 1982).

The results from the study above strongly indicated that higher genetic resolution was required before finer scale (i.e. river level) assignments of fishery samples could be achieved. Therefore, with respect to assessing stock composition in Scottish coastal fisheries, variation in SNPs have been examined. We have collected a SNP baseline comprising 147 sites and a total of 3,787 fish. The material has been screened using the 'V2-salmon SNP microarray' to provide ca. 5,000 SNPs per fish. Cluster analysis has been performed to identify hierarchical assignment units of regions with similar genetic signatures and a suite of 288 SNPs identified which best differentiate between these regions. Within regions, we are currently selecting sets of SNPs with the aim of achieving finer geographic assignment of fishery samples, for example to rivers where possible. Fishery samples have been secured for both the South Esk and Armadale coastal fisheries and will be screened once the most appropriate suite of SNPs has been finalised.

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