

ANNUAL MEETING OF NASCO (Bad Neuenahr-Arweiler, Germany, 7-10 June 2016)

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This report is a personal account of the 31st annual meeting of NASCO Council and Regional Commissions, this year held in Germany. I represented SANA there as one of over 30 international NGOs able to take part in observer capacity. Aberdeen and District Angling Association were once again generous in helping to fund the costs. The British Isles were well-represented among the NGOs by Salmon and Trout Conservation Scotland and S&TC UK, Atlantic Salmon Trust, the Association of Salmon Fishery Boards and Salmon Watch Ireland. Previously, we had little status at these meetings, although allowed to take part during informal discussions. Now, however, the written and verbal communications of the NGOs, made together as a group, are recognised as a valuable part of the proceedings. We were led jointly and admirably in Germany by Paul Knight (S&TCUK) and Sue Scott (Atlantic Salmon Federation Canada).

Established under the Convention of Salmon in the North Atlantic Ocean (1983), NASCO has a key international advisory role in conserving wild salmon stocks. Its current international participants are Canada, USA, Denmark (in respect of Greenland and the Faroe Islands), the Russian Federation, Norway and the European Union. Iceland had to withdraw its membership because of finances, but wishes to return in due course. Finland and Sweden are covered under the EU. NASCO's Headquarters are at Rutland Square in Edinburgh and their Secretary is Dr Peter Hutchinson. Further background and other details of the crucial work of NASCO are provided in their website (<http://www.nasco.int/>).

In view of the travelling costs involved in recent years SANA has participated only by correspondence. The primary reason for attending this time was to attend a full-day Special Session entitled '*Addressing impacts of salmon farming on wild Atlantic salmon: challenges to, and developments supporting, achievement of NASCO's international goals.*' However, many other challenges for salmon conservation and management were discussed at the meeting. The main reports and supporting papers can be consulted via <http://www.nasco.int/meetings.html>. The coded list of documents may seem intimidating at first sight, but can soon be 'cherry-picked' and parts printed and saved as required. Having selected the 2016 Annual Meeting from NASCO Home Page, go via 'Documents' to 'Archive of Council and Commission Papers.'

For a summary of the meeting, view the following NASCO Press Release after the meeting entitled ‘*Salmon in a Changing World*’ (CNL(16)67). ‘*Salmon face many challenges, not least those associated with a changing climate. A major new initiative, the International Year of the Salmon, was announced this week with the aim of improving scientific understanding of the factors driving salmon abundance and improve awareness of the challenges facing the species and the measures taken to mitigate these. NASCO President Steinar Hermansen (Norway) said ‘We look forward to close collaboration with our colleagues working with salmon in the North Pacific Ocean, the Baltic Sea and the Arctic as we seek to join forces in a concerted effort to conserve and restore these highly valuable species. Working with the salmon farming industry in order to ensure wild salmon are protected from genetic and sea lice impacts from salmon farming was a primary focus during a session organised jointly with NASCO’s NGOs. The information presented at the session will contribute to identification of best practice on measures to protect the wild Atlantic salmon. In the North-East Atlantic, the parasite Gyrodactylus salaris poses a serious risk to wild salmon stocks and measures related to preventing its spread and its eradication from infected rivers will be reviewed by NASCO in order to strengthen protection to the wild salmon. NASCO’s Annual Meeting again took place against a background of continuing low, and in some areas, critically low abundance of salmon throughout the North Atlantic and the need for urgent action to understand the causal factors. Progress with an ambitious new research programme to track salmon from their rivers of birth out into the ocean was reported and the expansion of this programme will improve understanding of where salmon mortality is occurring and what is causing it. NASCO has agreed a new classification system for stock status to support the development of a ‘State of the Salmon’ report. NASCO reviewed the implementation of its regulatory measure for the West Greenland fishery and commended Greenland for the steps it has taken to improve management control in its fishery. Other Members of the Commission have agreed to review the management of their fisheries. The North American Commission continued to review events in the St Pierre and Miquelon salmon fishery.’*

To examine the meeting in greater detail, key areas of interest are the annual progress reports from the contributing Parties and countries which are summarised in the Report of the Meeting of the Implementation Plan/Annual Progress Report Review Group (CNL(16)13). Particularly relevant for Scottish anglers are the ‘*Annual Progress Report on Actions Taken Under the Implementation Plan for the Calendar Year 2015, EU – UK (Scotland) (updated 31 May 2016)*,’ (CNL(16)26). The Scottish Government has completed a review of the management of salmon and freshwater fisheries and taken action to limit killing of salmon beyond estuary limits for the next three years (from 2016) because of the mixed-stock nature of the fishery and limited data on the composition of the catch. Conservation limits have been developed for Scottish rivers, and there are new measures to limit killing of salmon in inland waters as well as the introduction of a carcass tagging program for net-caught salmon.

For information on the aquaculture debate, consult:- *‘Supporting sustainable aquaculture growth alongside a thriving recreational fisheries sector: Reducing the impacts from sea lice and escapes on wild fish in Scotland in parallel with NASCO’s international goals (Tabled by EU – UK (Scotland)’ (CNL(16)47)*; also, a *‘Summary of the discussions during the Special Session on the evaluation of Implementation Plans and Annual Progress Reports’ (CNL(16)59)* and the *‘Report of the Theme-based Special Session: Addressing impacts of salmon farming on wild Atlantic salmon: challenges to, and developments supporting, achievement of NASCO’s international goals’ (CNL(16)60)*. Potentially crucially important in the context of salmon farming impacts, but also much more widely than that, please do check out the substantial *‘Report of the ICES Advisory Committee’ (CNL (16)9)*. This provides scientifically based and highly authoritative advice to NASCO (*ICES is the International Council for the Exploration of the Sea (www.ices.dk), the oldest intergovernmental organisation in the world concerned with marine and fisheries science*). NASCO had asked ICES about possible effects of salmonid aquaculture on wild Atlantic salmon populations, focusing on the effects of sea lice, genetic interactions, and the impact on wild salmon production. In summarising its conclusions, and supported by a very detailed review of the scientific literature, ICES advised *‘that there is substantial and growing evidence that salmon aquaculture activities can affect wild Atlantic salmon, through the impacts of sea lice and fish farm escapees. Both factors can reduce the productivity of wild salmon populations and there is marked temporal and spatial variability in the magnitude of the reported effects.’* The advice to NASCO from ICES includes *‘...survival of Atlantic salmon during their marine phase has fallen in recent decades.....is evident over a broad geographical area and is associated with large-scale oceanographic changes. For monitored stocks around the North Atlantic, current estimates of marine survival are at historically low levels, with typically fewer than 5% of outmigrating smolts returning to their home rivers for the majority of wild stocks and even lower levels for hatchery-origin fish.’* Then under *‘Knowledge gaps,’* they add *‘In order to put mortality from lice into context, there is a need to better understand the causes underlying the current approximate 95% natural mortality of wild salmon and their interactions.’* As required by NASCO, the summary statement from ICES refers specifically to salmon, and not to sea-running trout, or to charr populations that inhabit more northerly regions of the Atlantic seaboard, although the potentially greater vulnerability of populations of these more coastal salmonid fishes to negative impacts of intensive coastal salmon farming is well-recognised in the ICES report. In order to understand some of the complexities of sea lice dispersal from salmon farms and resulting infection probabilities for wild salmonids consult the report on modelling and monitoring studies in Norway (CNL(16)48).

The one-day Special Session provided an excellent opportunity for the countries most heavily involved to outline respectively their regulatory measures taken to find a balance between the massive development of salmon farming and its *‘environmental footprint.’* Since the 1980s, salmon farming has become prodigiously successful worldwide and governments support the growth of the aquaculture industry for obvious economic reasons. In the North Atlantic, salmon farming production now exceeds the nominal catch of wild salmon by more than 1900 times (estimated in 2014).

Scotland, according to the report to NASCO (**CNL(16) 47**) from Marine Scotland (MS), the Directorate of the Scottish Government responsible for marine and fisheries issues, now provides 94% of total salmon farming production in the European Union and farmed salmon is our main food export. In support, we have a National Marine Plan (NMP) with economic, social and marine ecosystem policy objectives, special protected areas and a *'continuing presumption against finfish aquaculture development on the North and East coasts of Scotland in order to help safeguard migratory fish species.'* The MS report endorses NASCO's goals of minimising any potential impacts of aquaculture on wild salmon (while mentioning also trout), adding *'It is the aim of the Scottish Government and the Scottish aquaculture industry to reduce interactions of aquaculture with wild fish by lessening incidences of escapes and managing sea lice to the lowest achievable level.'* The Scottish salmon farming industry has adopted a Technical Standard for fish farm equipment and ensures a well-trained workforce to meet site-specific operational procedures. However, this positive statement, which was accompanied by a graph highlighting a declining trend in numbers of escaped farmed salmon, was undermined by news of a loss of 160,000 reared salmon in the Western Isles reported towards the end of the NASCO meeting.

Marine Scotland describe how fish farm planning developments are assessed by the relevant Local Authorities, who seek advice from statutory consultees. Fish farms are licensed and controlled by the Scottish Environmental Protection Agency (SEPA) and require them to comply with stringent Environmental Impact Assessment legislation. Fish Health Inspectors enforce fish health legislation and inspect fish farms for containment measures, disease control and sea lice management. The Fish Health Inspectorate (FHI) publishes quarterly summaries of all cases conducted, case inspections and outcomes per region, enhanced inspections conducted under the Aquaculture and Fisheries (Scotland) Act 2007, and individual case information. Annual summaries of case inspections and outcomes per region, and reports of operations and activities also are published. A Code of Good Practice for Scottish Finfish Aquaculture (CoGP), provides an industry standard, including a National Treatment Strategy for sea lice and Integrated Sea Lice Management. And for transparency, the Scottish Salmon Producers Organisation also publishes quarterly reports on fish health management, giving information for 30 regions across Scotland, from farm management areas, on stocking and fallowing, strategic sea lice treatments and average lice counts.

Yet in spite of these welcomed measures there remains a deep-seated problem with aquaculture-enhanced populations of parasitic sea lice, both for the industry itself and for the wild salmon post-smolts which migrate through the same waters; even more so for the sea trout post-smolts, finnock and older stages which are liable to be near the rafts of salmon cages at some stage and especially those anchored in semi-enclosed bays and near rivers. In any case, the infective stages of sea lice can drift on tidal and other sea currents for more than 50 kilometres, so the problem of breeding lice accumulating within intensive salmon farming cage units is exportable between sea lochs and *'farm management areas.'*

Moreover, there is clear international recognition that lice on farmed fish are increasingly resistant to chemical control treatments previously used to good effect

and there appear to be no new highly efficacious alternative '*medicines*' on the horizon. The vexing problem of sea lice resistance is not mentioned in the MS report, but it highlights the increasing use of '*cleaner fish*' (Ballan wrasse and also now lumpsucker/lumpfish) to pick off the lice from the salmon, as an environmentally friendly alternative. Wild wrasse have been trapped and deployed as a complementary means of lice control by the Scottish industry for many years. However, in 2014, Scotgov match-funded (£22 million) the development of hatchery technology for growing cleaner fish on a commercial scale (250,000 wrasse and 800,000 lumpsucker produced in 2015). Marine Scotland states that the use of cleaner fish has significantly reduced sea lice levels, in some cases resulting in zero or close to zero chemical treatments, and that the Scottish industry shares information on their use, plus other innovative control methods e.g. freshwater treatments, thermolicers, brush systems and the possible use of closed containment in the early production stages (of salmon). [For further background information consult '*Drug resistance in sea lice and integrated lice management strategies*' (CNL(16)42)].

The MS report (CNL(16) 47) also outlines a continuing commitment to research to address the issue of sea lice management in Scotland, including sea lice dispersal modelling. Together with industry, they will review the boundaries of Farm Management Areas '*to ensure they are optimal for sea lice management..... In the shorter term it is expected that expansion of the aquaculture industry will occur in higher energy, more exposed sites....and will aim to achieve its 2020 sustainable production targets under improved management in a shared space.....In the longer term, Scottish Government will engage with the aquaculture sector to enable expansion of the aquaculture industry further offshore into the open sea using innovative engineering and design.....*' And '*Expansion into offshore waters should reduce interactions with migratory fish, and help to mitigate against some of the current fish health issues, including sea lice management.*' Note that this projection for further expansion into more exposed, offshore sites does not mention the closure of those inshore ones that are close to sensitive wild salmon and sea trout breeding populations.

In the meantime, however, all Scottish salmon farms are required to produce a site-specific escalation plan, to be triggered at levels above 3.0 average female lice. This '*will allow monitoring during any escalation in sea lice numbers and intervention where it is demonstrated that satisfactory measures to control sea lice are not in place. Exceeding a level of 8.0 average female lice will result in enforcement action, including the potential to require reduction in biomass.....Scottish Government have worked cooperatively with the aquaculture industry to agree this new policy and industry in turn are also revising their own integrated sea lice management strategy. This will lead to future updates to the industry Code of Good Practice.*'

SANA members will wish to compare this Scottish Government cooperative approach in dealing with lice and other environmentally stressing influences from aquaculture with actions taken by other salmon farming countries:-

Norway's salmon farming industry, with by far the largest share of farmed salmon production in the Atlantic, also has strong government support, although with a clearer

acceptance that the environmental footprint of aquaculture should decide production areas. Consult **CNL(16)41** – *‘Measures introduced to meet NASCO goals of reducing impacts from sea lice and escapees on wild salmon (Tabled by Norway).’* As a result of the Government’s conclusion that environmental impact must determine future growth in the salmon farming industry, the Institute for Marine Research (IMR) has divided the coast into production areas and is using models and analyses on how particles (organic matter or pathogens) spread along the coast. Furthermore, the Parliament decided that sea lice impact on wild populations is the key indicator when determining whether a production area is suited for growth or not. *‘Norwegian fish farmers are required to take coordinated de-licensing measures every spring at low treatment thresholds (0.1 motile/adult female lice), to protect the Atlantic salmon smolt migrating to sea. Monitoring show(s) that the campaigns have been successful. However, there are still reports of high levels of sea lice on sea trout (*Salmo trutta*) in certain areas.’* The Norwegian report further states *‘We now shift the main monitoring over to a model based system using data on sea lice (copepodites) emission from all sea based facilities in a production area, and relate this to the risk for unacceptable impact on wild salmonids. Norwegian research institutions will test the model this season. Surveillance on wild salmon will be used to verify the results. The model will continuously be adjusted as new knowledge is acquired.’* Although their indicator system primarily involves monitoring of sea lice levels on the farms and wild salmonid fish, high mortality levels on farms will trigger a freeze or reduction in rearing biomass. With regard to genetic impacts of escapes, the aquaculture industry is now legally responsible for financing mitigating measures in rivers with a high prevalence of escaped fish, and also covers expenses for recapturing escapees in the sea, if the source of the fish is unknown. This arrangement encourages the industry to develop good methods of traceability so that *‘only the owner of the fish (the polluter) should pay.’* Financial incentives are now provided for marking/tagging to identify fish from specific farms. The prevalence of escaped fish in Norway in the years 2006 to 2015 has been gradually declining. However, there is still a problem as *‘128 Norwegian rivers were assessed to have a moderate prevalence of escaped fish (< 10 %) while 17 were assessed to have a high prevalence.....The use of sterile fish in fish farming can reduce genetic and ecological impact from escaped farmed fish. Research on sterile farmed salmon’* is evaluating animal welfare considerations as well as performance in relation to various environmental factors. Consequently, research licenses are currently using triploid fish. In addition, several commercial salmon-farmers have started up using triploid fish as in “green” salmon farm licenses.’ Furthermore, there is a movement towards the use of much larger smolts (c.400g) to reduce their marine rearing time to harvest. There is also a keen interest in closed containment and onshore developments. With regard to the latter, the Norwegian Parliament is *‘not limiting the number of licenses to onshore salmon farming. Furthermore, such licenses, will be granted without paying the normal licence-fee.’* All of these measures are very progressive from a wild fish conservation perspective, and it was refreshing to see Norway’s clearly stated and joined-up approach.

Canada (CNL(16)38) also has a strong commitment to the aquaculture industry, while trying to protect wild populations and fisheries, although noting that the wild populations are declining. Salmon farms needed good siting but this was not always

achieved initially. Aquaculture Activities Regulations were coming in but there were still confidentiality issues. Unlike the seas around Scotland, very cold sea temperatures in winter and spring in eastern Canada provided a big natural break in sea lice levels. Also escapes were claimed to be minimal. Industry was left to decide their technology and was not ready for the extra costs of land-based closed containment. On the other hand, good progress was being made with identifying stock from individual farms and in the use of triploidy. Also, 'super-smolts' (200-250g) were seen as a way forward. It is interesting and requires a cautionary note here that *'Canada continues to invest in contained, land-based laboratory research involving transgenic fish, to generate scientific knowledge that informs risk assessment, risk management, and regulatory approaches aimed at protecting the aquatic environment, including wild Atlantic salmon (see <http://www.dfo-mpo.gc.ca/science/coe-cde/cabrrcrrba/index-eng.asp>).....Canada continues to inspect all facilities that rear transgenic Atlantic salmon in Canada, and enforces compliance under the Canadian Environmental Protection Act, 1999, and Significant New Activity Notice No. 16528.'*

Ireland (CNL(16)36) has a much smaller salmon farming industry than Scotland, peaking at 23,000 t. and then declining, with 23 active sites in 2015. Stringent action is taken by the Irish authorities to enforce Treatment Trigger Levels for sea lice, including accelerated harvests and early fallowing of sites. During the spring period sea lice protocols set lice thresholds (0.3-0.5 ovigerous lice per fish March–May and 2.0 ovigerous lice per fish outside this period). When the threshold is breached a notice to treat is issued to the salmon farm to bring lice levels under control. On-farm sea lice checks together with alternative approaches to complement husbandry and medicine treatments and rigorous regulatory oversight are reported to have led to improved sea lice levels throughout the industry. In 2015, for farmed salmon in their first year at sea, 97% of inspections were below the Treatment Trigger Level* compared to 94% in 2014 and 100% in 2013. The corresponding figures for one-sea-winter salmon were 78%, 71% and 82%. Mortality due to Amoebic Gill Disease was reported to have decreased significantly in the last 12 months due to weekly monitoring and early intervention. A new National Strategic Plan for Sustainable Aquaculture Development was published for consultation in 2015. It reviews the current status of farmed salmon production in Ireland and the potential for sectoral growth.

The **Faro Islands** (see **CNL(16)34**), although lacking rivers with wild salmon stocks, has applied strict government regulations for salmon farming, especially to control the development of immunity to lice treatment, applying a threshold of 1.5 adult female lice per fish and automatic penalties for exceedance, including immediate slaughter. Their speaker said that the 'big stick' approach to salmon farming was needed to maintain a premium market price. During 2015, monitoring and enforcement by the Faroese Veterinary Authority continued and the Faroes Annual Progress Report (APR) indicates that had there been an issue with regard to sea lice and containment, these matters would have been dealt with by the regulatory procedures.

What then of **closed containment** as the way forward to have complete control of the rearing environment and minimal environmental impact? Canada and Norway

appeared to be the frontrunners here, but land-based systems for full industrial-scale production are still widely considered capital expensive, hi-tech and over-dependent on favourable market prices. A presentation on recent developments, costs and benefits of closed containment by Ivar Warrer-Hansen from Inter Aqua Advance A/S, Egaa, Denmark told us that quality salmon can be reared in such systems, although some technical difficulties remained to be solved, including sex pheromone accumulation and filtration problems, neither of which should be insurmountable. Operational costs could compare with cage rearing, but capital costs remain relatively high and hence also capitalisation and depreciation. At present, market price fluctuations for the product fish may determine business success or failure, but new concepts for Recirculating Aquaculture Systems (RAS) were emerging that will have a positive effect on land-based salmon production (**CNL(16)52**). In my view, it is unwise to assume that closed containment will replace Scottish marine fish farms in the near future, although it would have many advantages. In the meantime, more active mitigation of environmental impacts of salmon farming must take precedence.

The NGOs tabled a document (**CNL(16)54**) '*Salmon farming: the continuing damage and required solutions*' (*but the text could not be downloaded on 30.6.16), which sets out firm recommendations for actions in regulating salmon farming in Norway, Scotland, Canada and Ireland, to help '*redress the balance towards protection of wild stocks..... in line with the aims and objectives of NASCO.*' The Scottish NGOs asked for:-

- Provision of a statutory duty to protect wild salmonids and the introduction of an 'upper-tier' sea lice threshold above which an immediate cull or harvest of farmed fish is required by law.
- Closure and/or relocation of persistently failing farms and greater weight given to wild fish interests in planning applications for new/larger farms.
- Immediate publication of individual farm sea lice data and compulsory independent monitoring of sea lice counts.
- Tougher regulation and inspection of fish farms.
- Replacing the voluntary code of practice on sea lice with a statutory code.
- Ending smolt production (*i.e. reared for aquaculture*) in river systems that contain wild salmon.
- Developing other more sustainable technology.

*I take the liberty of adding '*Making mandatory that all salmon (within technical limits) are made sterile by triploidy or other means.*' N.B. In licensing stocking for angling, the Scottish Government now insists that for conservation reasons by 2020 all rainbow trout and all brown trout (in special circumstances - other than progeny of wild brown reared for stocking in the same catchment) must be from triploid ova, in line with England and Wales. It appears unjustifiable that this conservation measure should not apply equally to farmed salmon, since escapes will continue to happen with present rearing technology, maintaining a high risk of genetic introgression with wild populations. This ought to be standard practise throughout all salmon farming.

SUMMARY COMMENTS

Scotland was complimented by NASCO for their precautionary approach to coastal mixed-stock exploitation and introduction of carcass tagging and our anglers were at the top of the international table for adopting catch and release. However, the Scottish Government approach to the regulation of sea lice levels on salmon farms appeared very weak in comparison with our competitors. In particular, there was a lack of urgency in concern for the conservation of wild migratory fish stocks in the major aquaculture areas of our West Coast, especially bearing in mind the huge numbers of salmon grown in sea cage farms situated close to river catchments. Many of these catchments, most notably the River Ewe and Loch Maree, supported world-famous angling fisheries for salmon and sea trout until the 1980s. At present, this western area of the country is far from meeting the aim to support '*sustainable aquaculture growth alongside a thriving recreational fisheries sector.*' Sadly, in the absence of a widespread and substantial improvement in marine survival, with all its complexities, this rosy aspiration for recreational fisheries may only be realisable by regular stocking with farmed fish on a put-and-take basis. This may help to sustain and grow the aquaculture industry, but only by disregarding for the foreseeable future the sustainability of many of our naturally-selected and iconic wild populations.