

	<p>Council</p> <p><i>Overview of the monitoring and management of pink salmon outside of Norway and the Russian Federation</i></p>	<p>CNL(24)48</p> <p>Agenda item: 7a)</p>
---	---	---

Overview of the monitoring and management of pink salmon outside of Norway and the Russian Federation

Tom Staveley, Department of Aquatic Resources (SLU Aqua), Swedish University of Agricultural Sciences, Sweden.

Introduction

Since the human introduction of pink salmon in north-west Russia in the 1950s, in order to increase fishery resources, the majority of catches and reports have been recorded in Russia and Norway (particularly in Troms and Finnmark in Norway) (ICES 2022). In 2017, many other countries in the North Atlantic began reporting presence of pink salmon in their rivers, coastal and marine waters (Northern Hemisphere Pink Salmon Expert Group 2023). The odd-year spawning population is the main population found throughout the North Atlantic region, and reports on pink salmon have continued to be highest in odd years, i.e. 2019, 2021 and 2023, as opposed to fewer even-year reports. Outside of Norway and the Russian Federation, pink salmon reports have been relatively low in comparison and variable over the last eight years, i.e. four pink salmon spawning cycles for the odd-year population. Nonetheless, as this alien species has been reported in unprecedented numbers throughout countries in the northern North Atlantic region from Europe, across to Greenland and Canada, many countries have thus began monitoring for up to date distributions and initiating management responses to potential impacts and risks.

For this paper, in order to collect the most thorough and up to date information, scientists with expert knowledge about salmon from North Atlantic countries (N=15), outside of Norway and the Russian Federation, were contacted (over email) and asked to answer five questions relating to monitoring and management of pink salmon in their respective country. The following questions were posed:

1. Has any monitoring of pink salmon been conducted between 2017-2023 (can include non-target monitoring e.g. cameras)?
2. Have any management actions been taken for pink salmon e.g. barriers, removals?
3. Are there any management decisions for pink salmon e.g. rules, regulations?
4. Are there any strategies to prevent further introductions?
5. Has there been any awareness/ educational work?

Fourteen countries responded, namely USA, Canada, Greenland, Iceland, Faroe Islands, Ireland, UK, Denmark, Sweden, Finland, Germany, Netherlands, France and Portugal (Table 1). At the time of writing, no responses were received from Spain, however, as no pink salmon has been reported in these areas, monitoring and management could be expected to be minor, or non-existent.

A summary of the answers from the above questions, split by country, is shown in Table 1. Out of the 14 responding countries, all but one had some sort of monitoring (e.g., traps, catch reports, eDNA, snorkelling). Roughly 50% of the countries had taken some type of management action or management decision (not necessarily the same country had taken both a management action and decision). Only two countries had implemented prevention strategies against further introductions, while all but one had taken actions to create and increase awareness of pink

salmon in their respective countries. Where relevant, certain answers received via email are given as examples, and explained in more detail in the following sections.

Monitoring of pink salmon

Monitoring of pink salmon employs various techniques and differs largely between countries; some have targeted monitoring through environmental DNA (eDNA) and counter fences, while many make use of established monitoring equipment and methods already in place for other target species (Table 1). For example, in the UK (Scotland) and Ireland, eDNA monitoring was conducted across 31 and 13 river systems, respectively, during 2023 to detect the geographic spread of pink salmon not only across the country but also in different stretches of the river systems. Also in Sweden, eDNA monitoring was introduced for pink salmon spawners in 2023 (part of the project [Pink salmon in Sweden](#)), which sampled 27 rivers, mainly on the west coast region where pink salmon have been reported previously (Staveley and Ahlbeck Bergendahl 2022). Monitoring was also conducted in some rivers draining into the Baltic Sea, which was particularly important, as this species has not been reported in that region for several decades (Staveley and Ahlbeck Bergendahl, 2022). In addition, eDNA (as well as electrofishing) has been used in order to try to detect pink salmon juveniles in some Swedish rivers where spawning adults had previously been detected (part of the project [Pink salmon in Sweden](#)). At an international level, there is an ongoing NASCO EU project, PINKTrack, which involves some EU countries and Norway. The aims of this project are to better understand pink salmon distribution using eDNA, identify temporal and geographic patterns of spread and provide an ‘early warning system’, and inform appropriate management responses.

At the beginning of detecting and monitoring for alien invasive species, catch reports from both commercial and recreational fishers are vital to gain knowledge regarding the distribution of non-native species, and are encouraged throughout many of the countries here (Table 1). This can prove to be of great help to understand the spread of pink salmon outside of Norway and the Russian Federation. Many countries encourage reporting and have information and websites to register pink salmon reports. In the UK (Scotland and England), for example, there is a specific [online application system](#) where anglers can register their pink salmon catches and observations.

The most common monitoring occasion is to monitor spawning pink salmon adults, but there have been some efforts using nets in Iceland (Skóra *et al.* 2024) and in the UK (Scotland) (Skóra *et al.* 2023) to catch the downstream migration of pink salmon smolts before heading out to sea. These studies showed evidence of successful spawning which could lead to potential self-sustaining populations in these regions. Snorkelling surveys to try to detect pink salmon redds have been conducted in Ireland (though none found) (Table 1).

In the northern parts of Finland, sonar and snorkelling methods have been used in order to gain a better understanding of pink salmon numbers in freshwaters (Table 1). Whilst in European countries in the southern part of the pink salmon distribution (i.e. Netherlands, France, Germany), that have very low numbers, reports are solely from angling catch reports and existing fish counters (Table 1).

Table 1. Summary of answers regarding the monitoring and management of pink salmon questions per country.

Country	Q1. Monitoring	Q2. Management actions	Q3. Management decisions	Q4. Prevention strategies	Q5. Awareness/ education
USA	Indirect monitoring traps	No	No	No	Among scientists only
Canada	Targeted & non-targeted counting fences, cameras, eDNA	Planned targeted removal, anglers asked to retain and report catch	Regulation to allow retention by anglers with no bag limit	Yes- regulations, action plans & official committees	Awareness campaign- posters, leaflets, radio, social media
Greenland	Catch reports, snorkelling, eDNA	Some removal - harpoon	Reported as bycatch	No	Social media
Iceland	Catch reports, camera fish counters, smolt traps, eDNA	Some targeted removal with nets	Temporary exemptions allowing seine netting in rivers	No	Website – biology & ID, social media, reports
Faroe Islands	Citizen science project, catch reports	No	No	No	Citizen science project – interviews, articles
Ireland	Catch reports, camera fish counters, eDNA, snorkelling	Anglers asked to retain and report catch	No	No	Awareness campaign- press, social media, ID guide, website. Anglers to report and provide specimens
UK	Catches/observations -> reporting app, eDNA, smolt traps, cameras	Single trap, public encouraged to kill if caught, redd excavation	Illegal to fish and retain, bycatch possible	No	Awareness materials, websites – biology & ID, previous observations, reporting
Denmark	No	No	No	No	Website – biology & ID, previous observations
Sweden	Catch reports, camera fish counters, eDNA, electrofishing	No	If caught, kill and do not return to the water	No	Website- biology & ID, reporting, social media, magazines, posters, stickers, webinars, exhibitions
Finland	Sonar, video, snorkelling, eDNA, catch reports & observations	Local restricted fishery	Specific fishing rules	No – all stocking of fish/eggs forbidden	Meetings, talks - biology & ID, potential threats, mitigation
Germany	Catch reports, camera fish counters	No	No	No	Scientist briefing, magazines, brochure, website
Netherlands	Catch reports, camera fish counters	No	No	No	Online article
France	Catch reports, camera fish counters	No	Recommend no release after catch	No	Public awareness
Portugal	Catch reports	No	No	No	No

Management of pink salmon

Since pink salmon numbers are generally low across these countries, little effort has focused on removal in general (Table 1). Nevertheless, some targeted removals with nets have occurred in Iceland, and snorkelling with harpoons have been used in Greenland (Table 1). In contrast, in Finland, where thousands of pink salmon have been reported, locals with fishing rights were able to apply for a permit to fish pink salmon using gill, drift and seine nets in 2023. Canada and Iceland reported that some changes and exemptions from fishing regulations were put in place in order to allow for pink salmon fishing during migration times (Table 1).

Only Canada and Finland mentioned any kind of prevention strategies for further introductions of pink salmon in their home waters, although other countries may also have such regulations regarding restrictions on the introduction of non-native species (Table 1).

Conducting risk and impact assessments helps evaluate the potential impacts of pink salmon on native ecosystems and species. The UK was the first country to produce, firstly, a rapid risk assessment in 2017 (Copp 2017), followed by a full risk assessment in 2018 (Cowx 2019). In addition, in response to the unprecedented pink salmon migration in 2017, Sweden (Pettersson *et al.* 2018) and Ireland (Millane *et al.* 2019) published risk and impact assessment reports. However, as more knowledge is gathered on the distribution of pink salmon, potential impacts and appropriate mitigation measures, the need for more, evidence-based, up to date management plans and actions, as well as resources to conduct such activities, is expected and needed.

Pink salmon populations often transcend national borders, necessitating international cooperation for effective management. Countries can collaborate through international organisations (e.g., NASCO) to share information, coordinate monitoring efforts (e.g., project PINKTrack), and develop harmonized management strategies.

Awareness & Education

Most countries, especially where pink salmon have been regularly reported since 2017, have conducted awareness and educational campaigns focusing on pink salmon (Table 1). Much of has been done through social media to reach the general public and specific target groups, such as recreational anglers. Websites, set up through government agencies, universities and institutions have also been widely created which are great tools in spreading information, particularly on identification of pink salmon, species biology, and how and where to report any sightings / catches. Some examples can be found here from [Ireland](#), [Denmark](#), [UK \(Wales\)](#) and [Germany](#). Other media channels, such as TV, radio, newspapers and magazines articles have also aided in the spread of pink salmon awareness in some countries. Information has also been distributed to relevant stakeholders and the public through webinars, meetings, talks and exhibition events (Table 1).

Acknowledgements

Much thanks and appreciation for the responses to the questions goes to: Tim Sheehan (USA), Julien April (Canada), Rasmus Nygaard (Greenland), Hlynur Bárðarson (Iceland), Kirstin Eliassen and Jan Arge Jacobsen (Faroe Islands) Michael Millane (Ireland), Colin Bean (UK), Niels Jepsen (Denmark), Jaakko Erkinaro (Finland), Marko Freese (Germany), Laurent Beaulaton (France), Jacco van Rijssel (Netherlands), Pedro R. Almeida, Carlos M. Alexandre and Sara Silva (Portugal). Thanks to Josefin Sundin and Ida Ahlbeck Bergendahl for constructive feedback on the paper.

References

- Copp, G. H. 2017. Rapid Risk Assessment of: *Oncorhynchus gorbuscha* (Walbaum) (pink or humpback salmon). GB Non-native Species Rapid Risk Assessment (NRRA). Centre for Environment, Fisheries & Aquaculture Science (Cefas). https://www.cefas.co.uk/media/w0notcdi/rrav4_ Oncorhynchus_gorbuscha_pinksalmon_releas_e_v2_07-03-18-passed-dj.pdf
- Cowx, I. G. 2019. *Oncorhynchus gorbuscha* - pink salmon. GB non-native species risk analysis. Non-native species secretariat NNSS. https://www.nonnativespecies.org/assets/Uploads/Oncorhynchus_gorbuscha_pink_salmon_R_A-1.pdf
- ICES. 2022. Distribution and abundance of pink salmon across the North Atlantic. In Report of the ICES advisory committee, 2022. ICES Advice 2022, sal.oth.pink. <https://doi.org/10.17895/ices.advice.21020050>
- Millane, M., Roche, W. and Garga, P. 2019. Assessment of potential ecological impacts of pink salmon and their capacity for establishment in Ireland. Inland Fisheries Ireland Research and Development report. <https://www.fisheriesireland.ie/sites/default/files/2021-08/assessment-of-potential-ecological-impacts-of-pink-salmon-and-their-capacity-for-establishment-in-ireland.pdf>
- Northern Hemisphere Pink Salmon Expert Group. 2023. A review of pink salmon in the Pacific, Arctic, and Atlantic oceans. North Pacific Anadromous Fish Commission Technical Report, 21. Available at. <https://npafc.org/technical-report/>
- Petersson, E., Degerman, E. and Axén, C. 2018. Översikt, riskbedömning och förslag på åtgärder för puckellax (*Oncorhynchus gorbuscha*). Aqua reports 2018:17. Institutionen för akvatiska resurser, Sveriges lantbruksuniversitet, Drottningholm Lysekil Öregrund. 51 s. In Swedish. https://pub.epsilon.slu.se/15622/7/petersson_e_et_al_180919.pdf
- Skóra, M. E., Guðbergsson, G., Copp, G. H. and Jones, J. I. 2024. Evidence of successful recruitment of non-native pink salmon *Oncorhynchus gorbuscha* in Iceland. Journal of Fish Biology, 104, 329–334. <https://doi.org/10.1111/jfb.15556>
- Skóra, M. E., Jones, J. I., Youngson, A. F., Robertson, S., Wells, A., Lauridsen, R. B. and Copp, G. H. 2023. Evidence of potential establishment of pink salmon *Oncorhynchus gorbuscha* in Scotland. Journal of Fish Biology, 102, 721–726. <https://doi.org/10.1111/jfb.15304>
- Staveley, T. A. B. and Ahlbeck Bergendahl, I. 2022. Pink salmon distribution in Sweden: The calm before the storm? Ecology and Evolution, 12, e9194. <https://doi.org/10.1002/ece3.9194>