

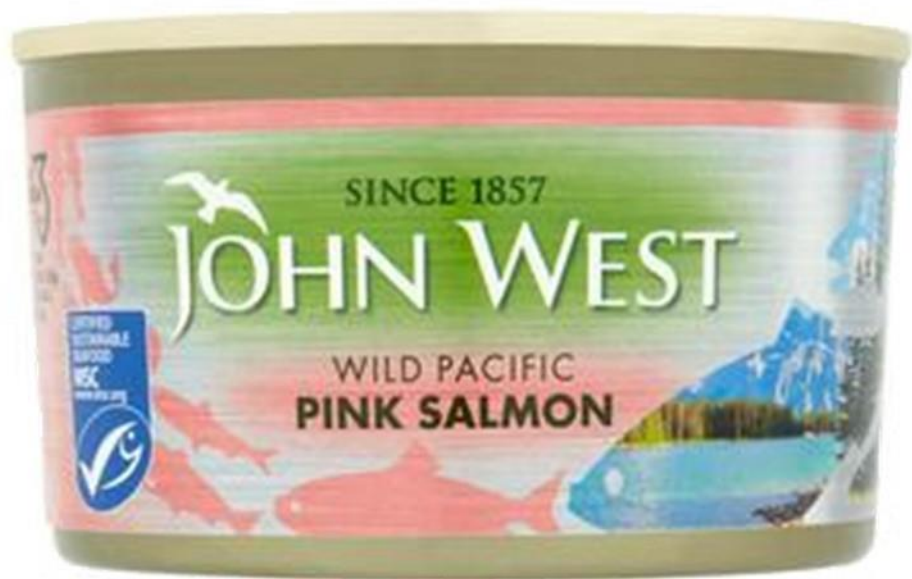
Pink salmon: an emerging threat in Scottish freshwater ecosystems

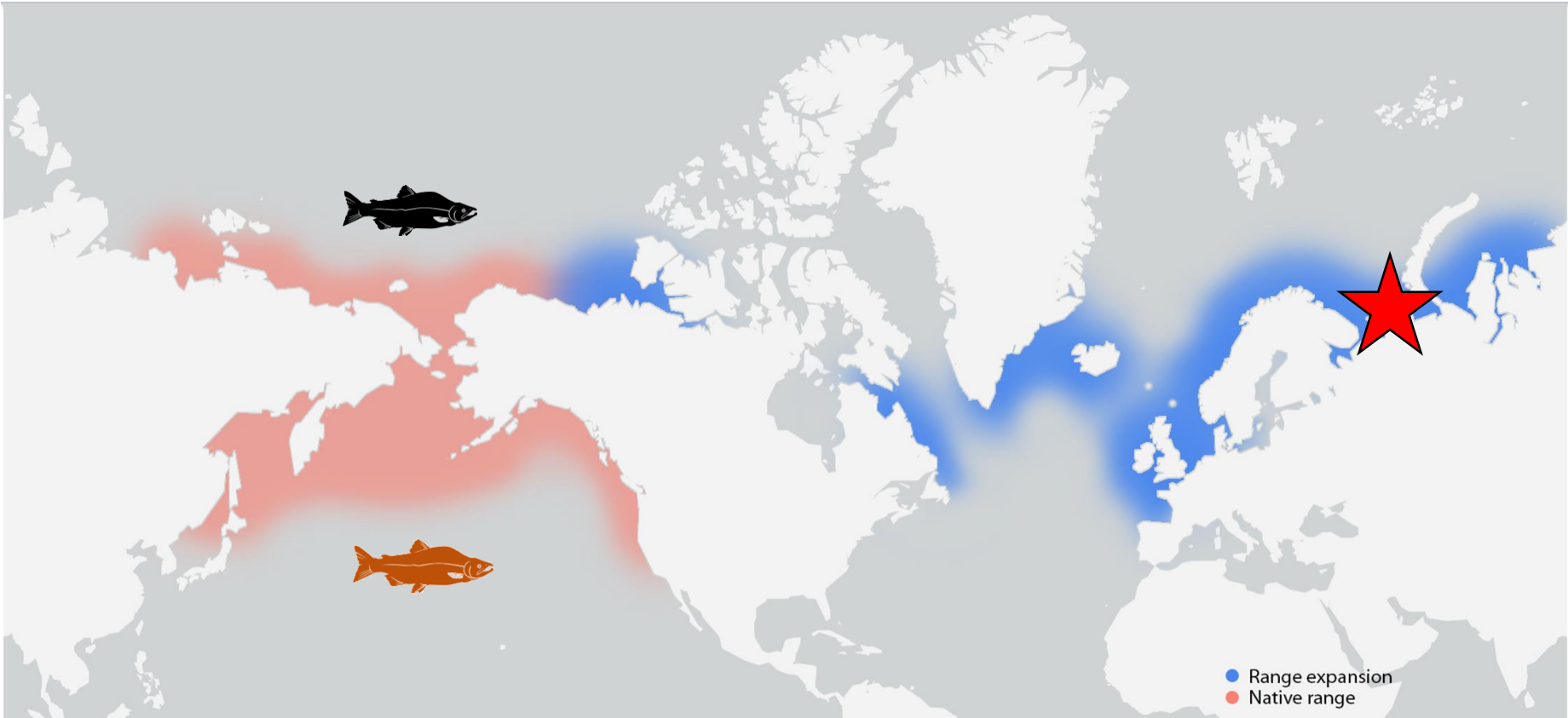


Professor Colin Bean

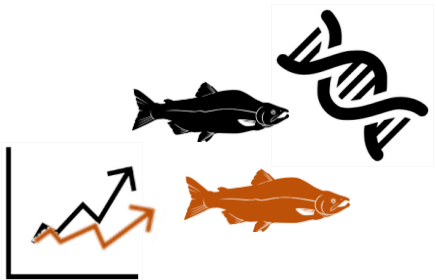
SISI Invasives Conference
Aviemore – 06 September 2023







Most Abundant Pacific salmonid



Odds & Evens



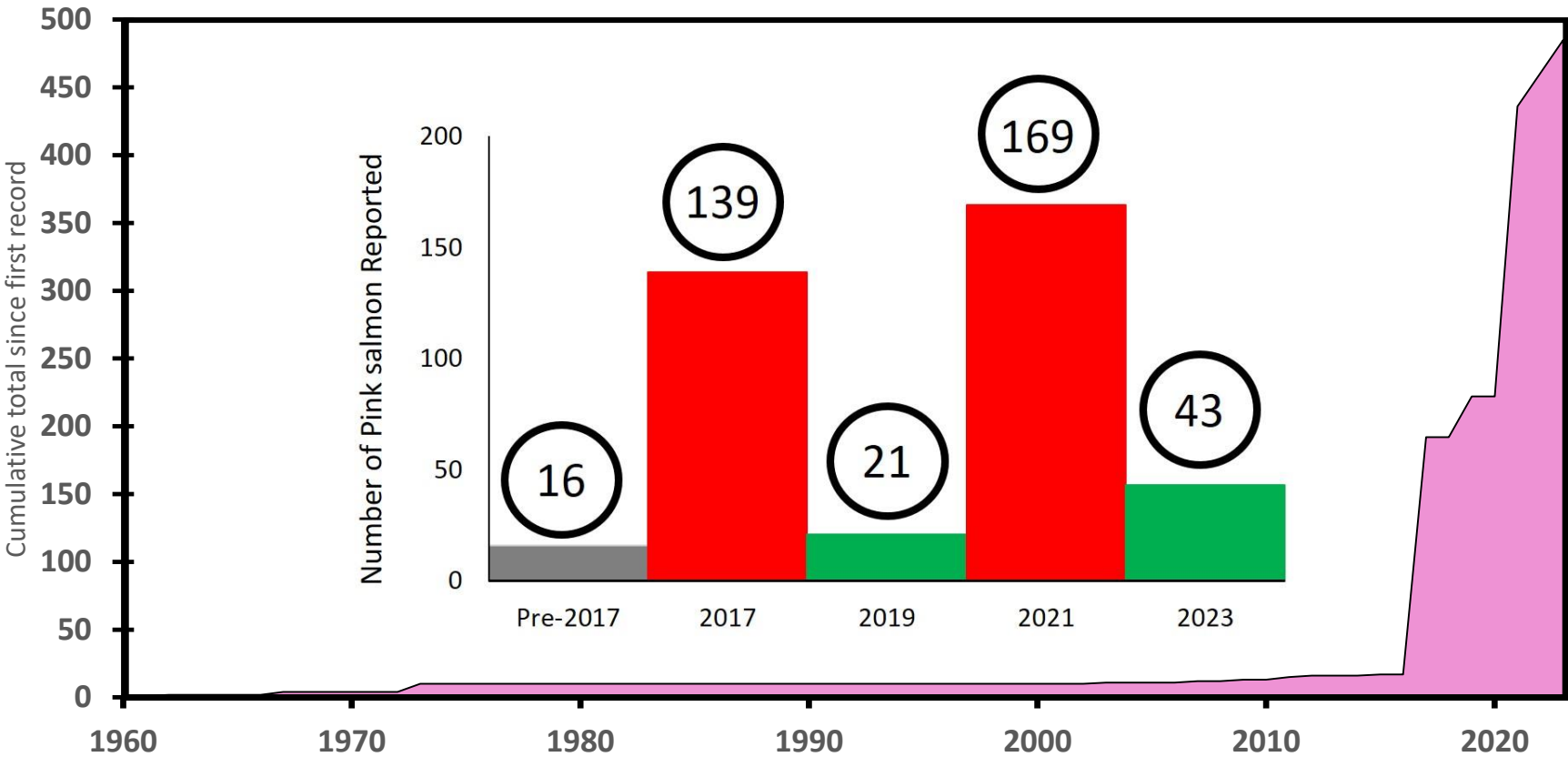
Ecologically plastic



5.6 – 14.6°C



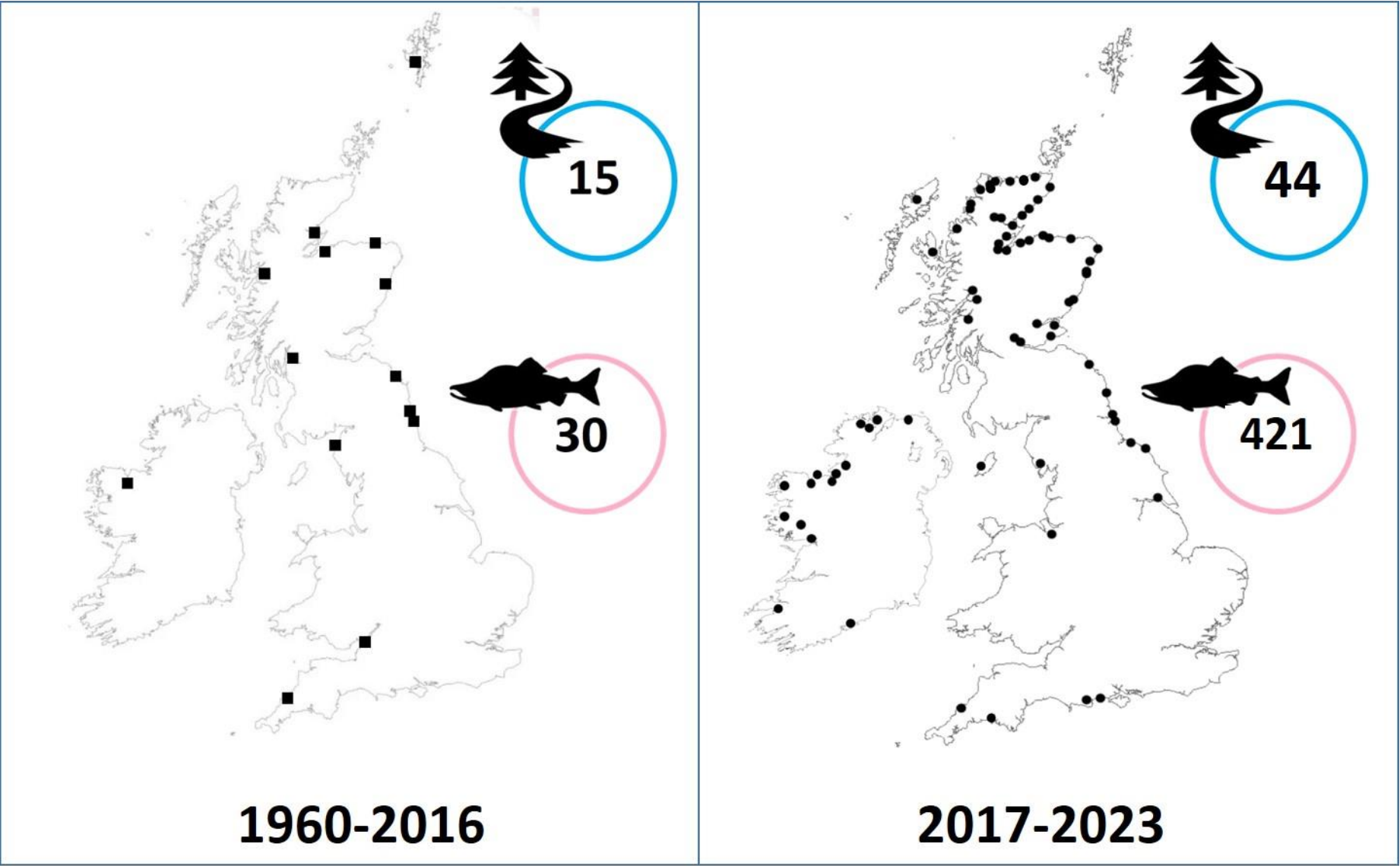
Homing and site fidelity

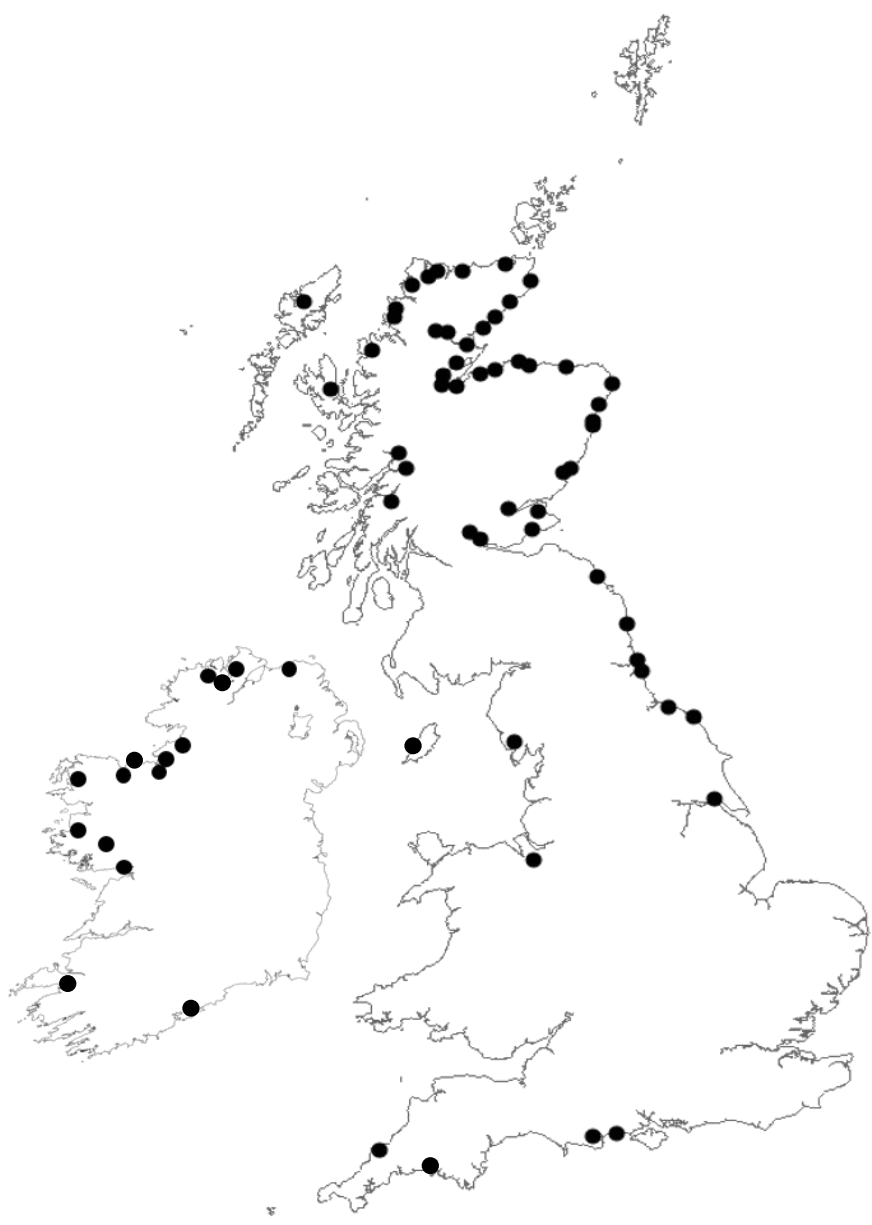


First fish
recorded in
Scotland &
England

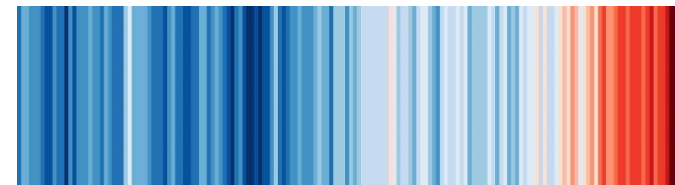
First fish
recorded in
Ireland

First fish
recorded in
Wales





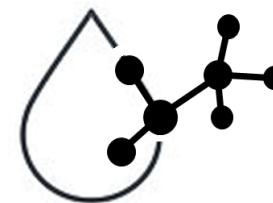
Climate-mediated range expansion



Following or use of olfactory cues

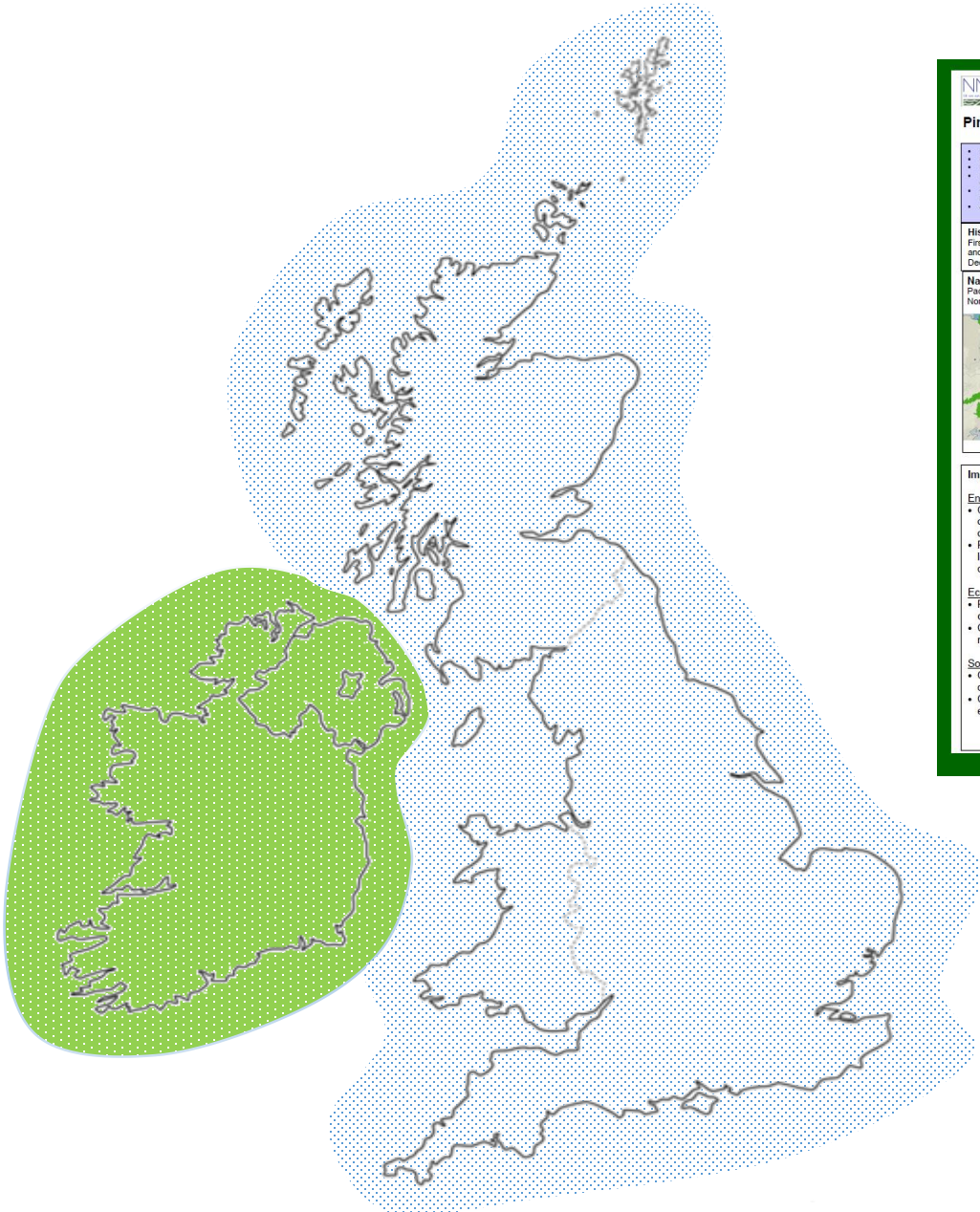


River discharge or catchment chemistry



Chance





RISK ASSESSMENT SUMMARY SHEET
Updated March 2019

Pink salmon (*Oncorhynchus gorbuscha*)

- Native to the northern Pacific ocean and coastal rivers of North America and Asia.
- Migrated to the UK from hatchery stocks imported into Russia.
- Reported frequently in GB and successfully spawned in Scotland.
- Not yet thought to have established in GB, though potential for future establishment, particularly in Scotland.
- Carcasses may affect spawning native salmonids or disturb nests of sea lampreys; possible vector of sea lice.
- Appears only in odd-numbered years due to spawning patterns.

History in GB

First recorded in 1960 in Scotland. In 2017, pink salmon were in at least 20 rivers in Scotland and Northern England and spawning activity was reported on at least two rivers with 'hundreds of redds' (spawning nests) being cut in the Dee.

Native distribution

Pacific Ocean, Arctic Sea coast, and coastal rivers of North America and Asia

Distribution in GB

Extensive sightings in Scotland; multiple sightings in England

Source: State of the Salmon © 2005

Impacts

Environmental (moderate)

- Carcasses may affect native salmonids spawning, sea lamprey nests, or nutrient-sensitive pearl mussels.
- Possible vector of lice though sea lice in coastal aquaculture is likely to dissipate any dose response.

Economic (moderate)

- Possible decline in native salmonid commercial fisheries.
- Costs of monitoring and awareness-raising actions.

Social (moderate)

- Could impact rural areas with high dependence on fishing.
- Carcasses could create a negative experience for anglers.

Introduction pathway

Migrants from Russian hatcheries in 1950s-70s established in most of the the Nordic countries, Latvia and Poland.

Spread pathways

Natural (rapid) - High capacity for natural dispersion.

Human-aided (slow) - No legal pathways for introduction. Introductions would be illegal acts or stocking of contaminated supplies of Atlantic salmon or brown trout.

Summary

	Risk	Confidence
Entry	VERY LIKELY	HIGH
Establishment	VERY LIKELY	HIGH
Spread	RAPIDLY	HIGH
Impacts	MODERATE	LOW
Conclusion	MODERATE	MEDIUM

www.noninvasivespecies.org

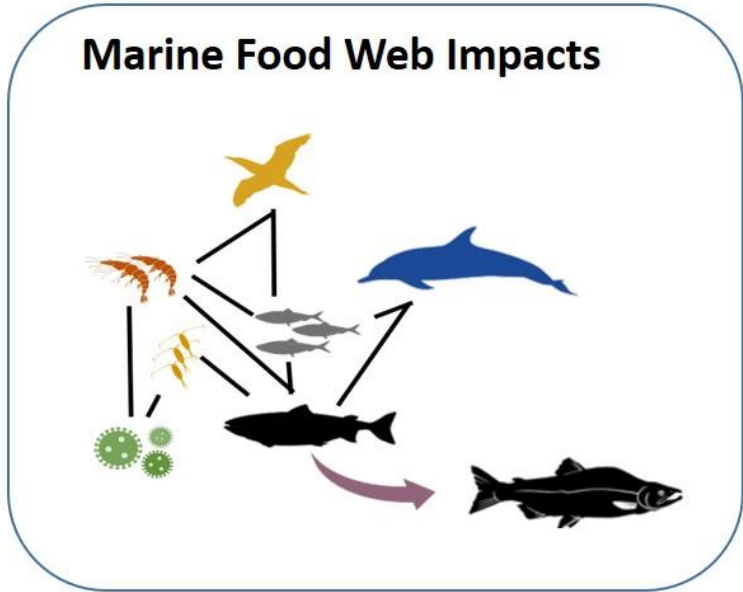
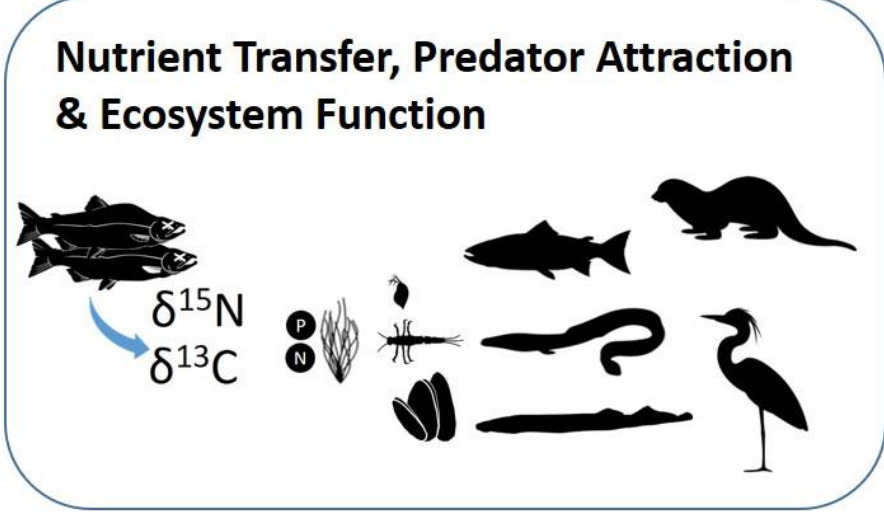
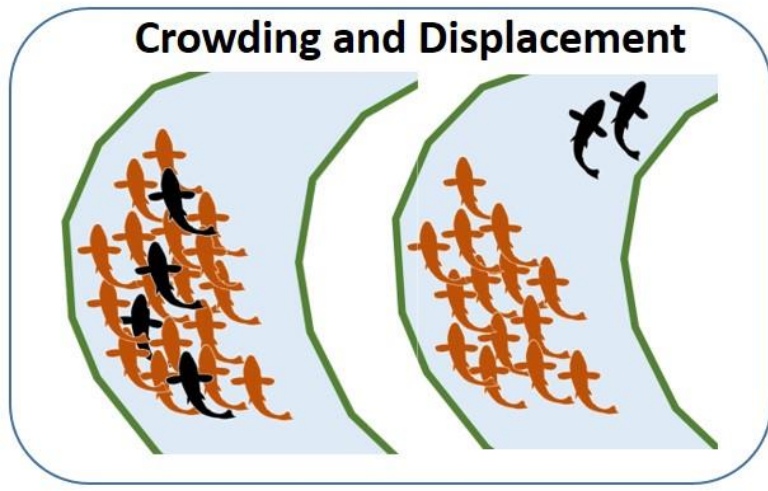
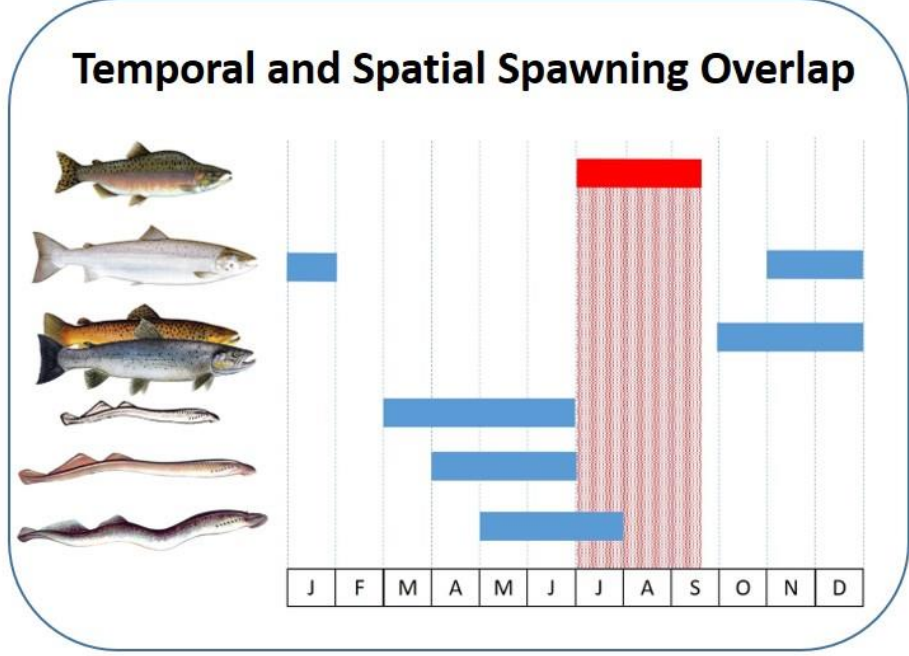
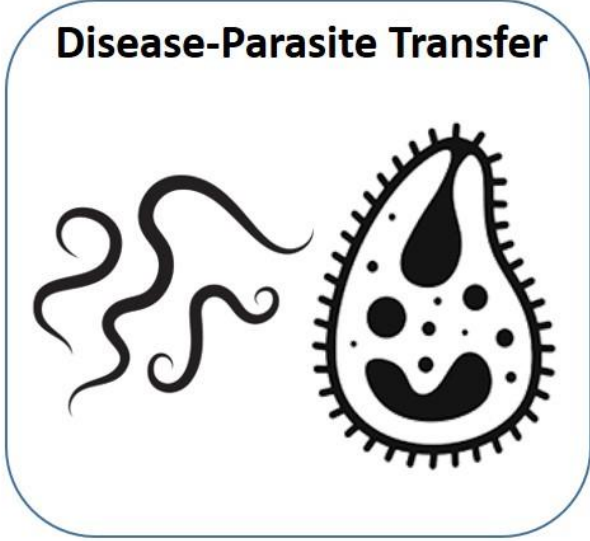
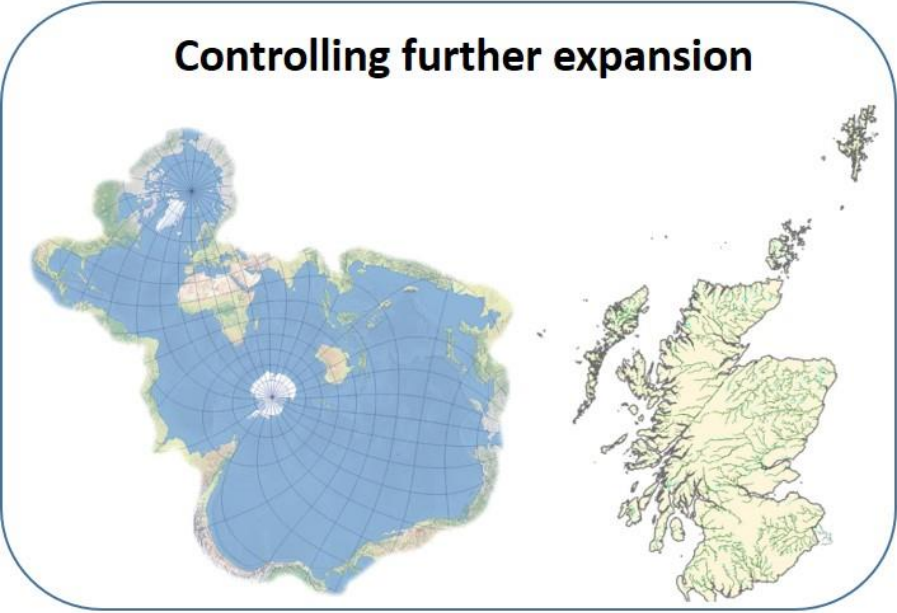


Prevention

Control

Eradication

RA Stage	Risk	Confidence
Entry	VERY LIKELY	HIGH
Establishment	VERY LIKELY	HIGH
Spread	RAPIDLY	HIGH
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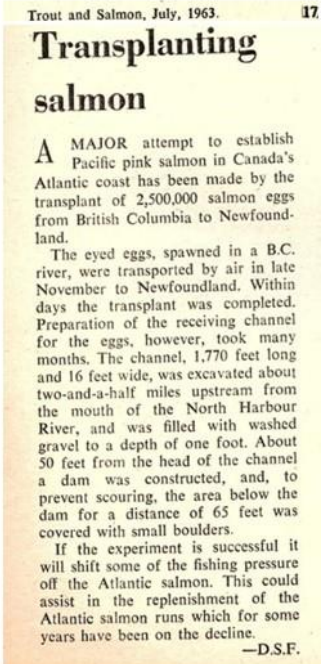




- Loss of native biodiversity
- Loss of reputation

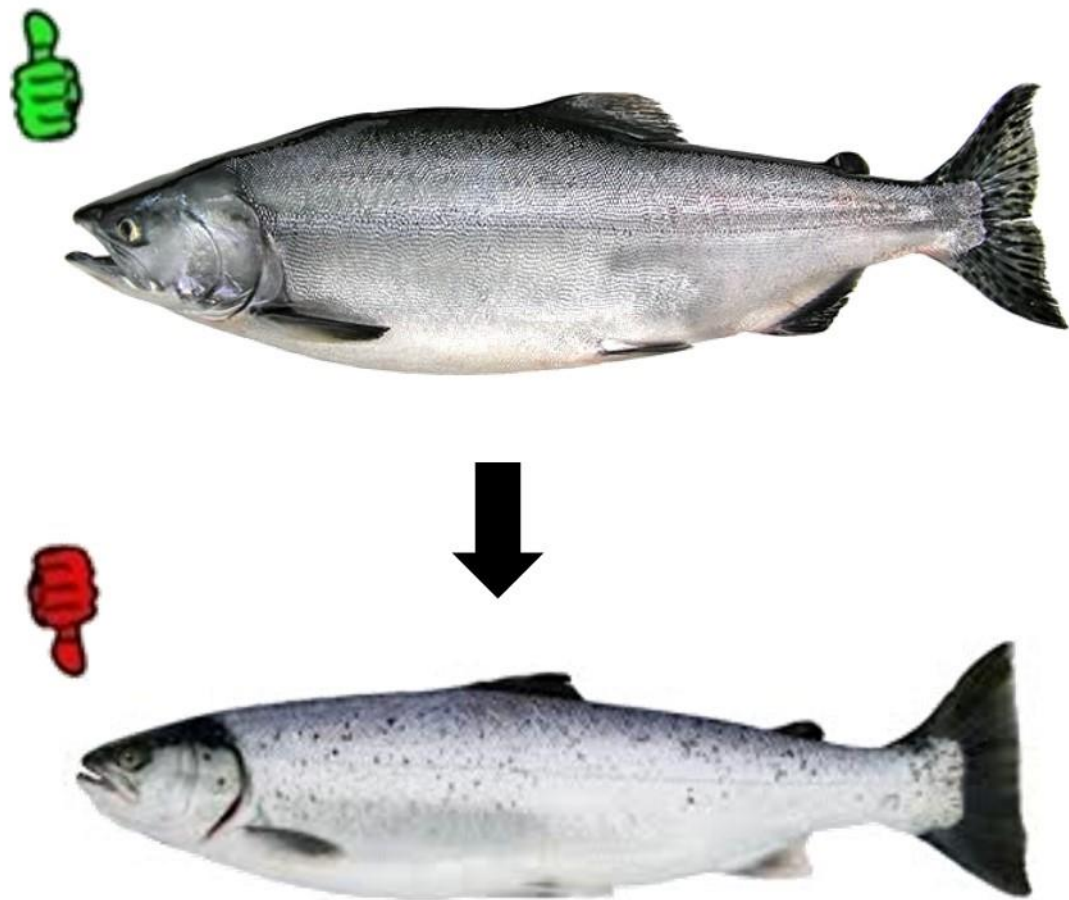


- Loss of the angling experience.
- Loss of fishery reputation.
- Loss of revenue.
- Loss of jobs in rural areas

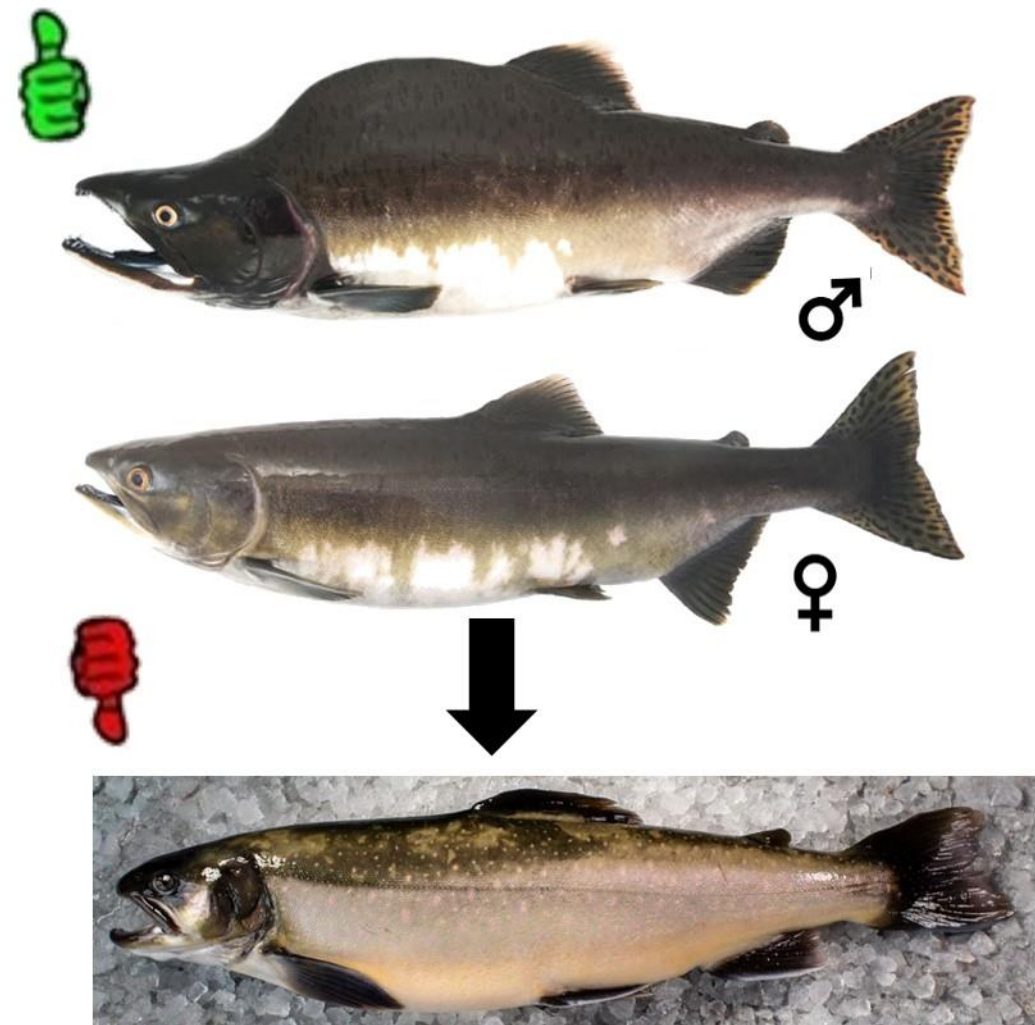


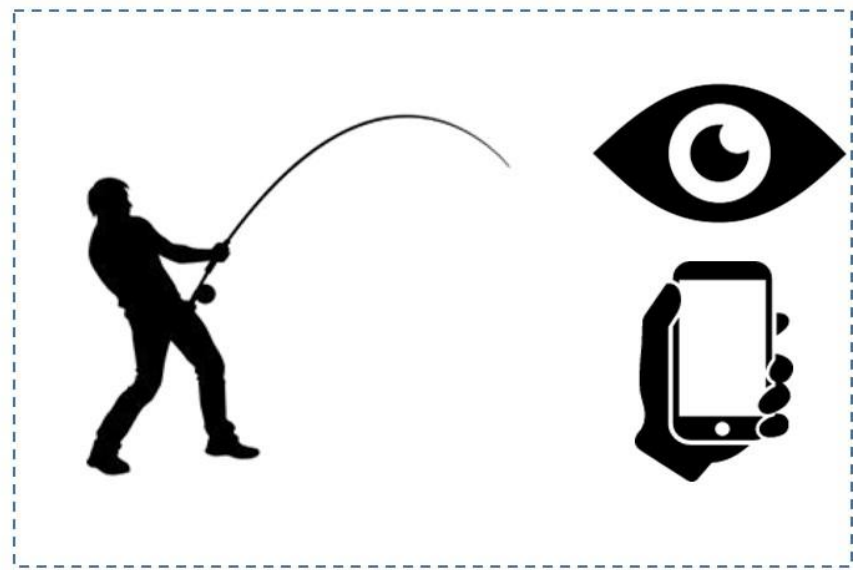
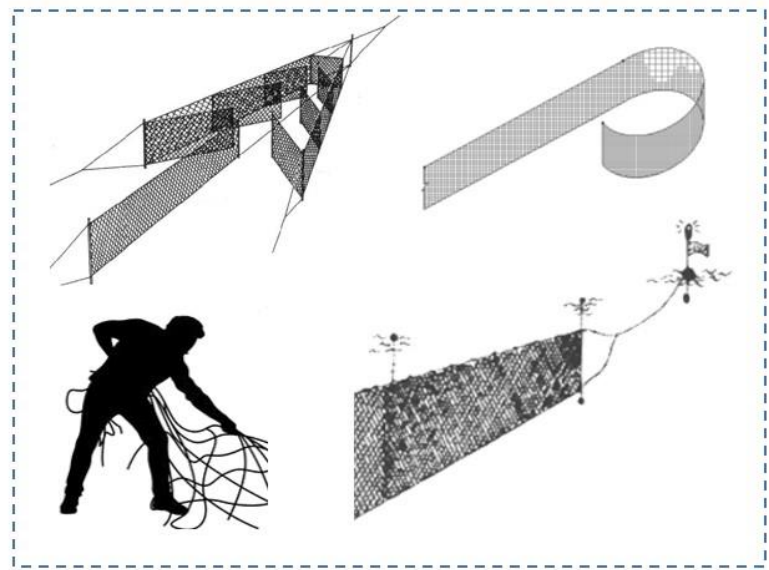
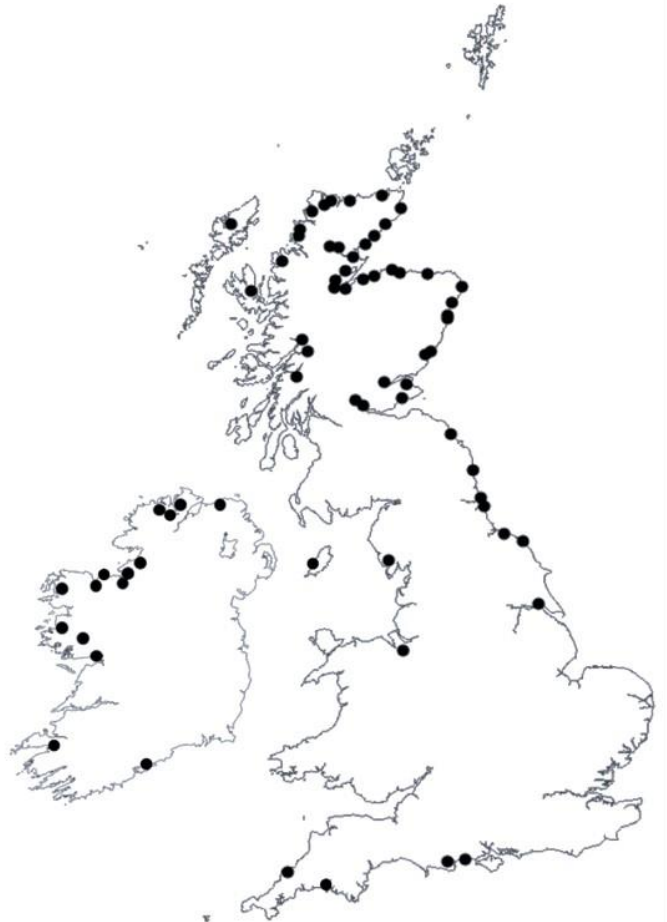
- An alternative fishery if Atlantic salmon are lost.
- Less concerned about the angling experience.

At sea and first river entry



In freshwater during spawning





- Coastal netsmen pick fish up as early as 01 June.
- Earliest capture by anglers is 26 June.
- Spawning can occur mid July and May continue beyond 30 August into September.
- River catches are typically, but not exclusively, limited to the lower reaches.
- Significant under-recording from anglers and netsmen.

marine.scotland
TOPIC SHEET NUMBER 109

Reporting pink salmon in Scottish waters

Pacific Pink Salmon:
Advice note – May 2021

Introduction
The purpose of this advice note is to ensure:

- That all stakeholders, including fishery managers and anglers, are alert to the possibility of the return of pink salmon in Scottish waters during 2021
- To clarify the legal situation regarding capture and retention of these fish in Scotland
- To ensure anglers, fishery managers and others know what to do should pink salmon be observed or captured in Scotland

Background
In 2011, unprecedented numbers of Pink salmon were captured across the UK. Captures were also reported in Norway, Ireland, Iceland, Denmark and Germany. 2011 saw further captures, but much less than that reported in 2011. Pink salmon (*Oncorhynchus gorbuscha*) are not native to Scotland and are likely to have 'leaked' from some of the rivers in northern Norway or Russia. These fish were originally introduced to some Russian rivers in the 1860s, have since spread westwards and have now colonised some northern Norwegian rivers. These fish spawn at a different time from Atlantic salmon, have a two-year lifecycle and generally spawn in summer (and often in major river channels in the lower reaches of rivers, and sometimes in urban rivers).

Due to their two-year lifecycle, juvenile fish will be derived from distinct 'half' or 'year' years, with the Russian/Norwegian fish being odd year stocks. It is therefore possible that they will occur again in Scottish rivers in 2021. The reasons behind the unusually large numbers in 2011 remain unclear. We know that the population from the Russian fish female stocks is to be larger and more numerous in odd years rather than even years. It would appear that the 2011 salmon originated from a particularly strong year class with good marine survival and this may repeat the unusually high numbers across several countries in 2021.

Information gleaned from the 2017 and 2019 events
Previous advice had suggested that the environmental conditions in Scotland are not favourable for colonisation. During 2017, important information was gathered about the interactions of these fish in Scottish rivers. Pink salmon were observed creating nests and spawning, and the opportunity was taken to closely monitor the activities of these fish and consider what management action might be effective to reduce potential impacts on native fish. Tag experiments concluded that the eggs remained from nest sites and observed under laboratory conditions were viable – these eggs hatched into alevins. As such, we need to remain alert to the possibility that a viable population could become established if conditions are suitable.

The 2021 situation
Fisheries Management Scotland, Scottish Government, Scottish Natural Heritage (SNH) and the Scottish Environment Protection Agency (SEPA) are co-ordinating a number of actions and sharing advice to ensure that any return of pink salmon in Scotland can be managed appropriately. This will include engaging advice to stakeholders, publicising awareness raising and liaison with UK and international fishery managers to exchange information on any new situation. For 2021, there have been no recorded incidences of Pink salmon in the UK, however these fish did not previously begin to appear in catches until January in the UK.

The law
Under the Wildlife and Countryside Act 1981, Pink salmon of the species *Oncorhynchus gorbuscha* are an invasive non-native species. The 1981 Act makes it an offence to fish for and retain Pink salmon (i.e. have

What does the law say?

1. <https://www.fisheries.gov.scot/>
2. <https://www.sepa.gov.uk/>
3. <https://www.environment.gov.uk/>

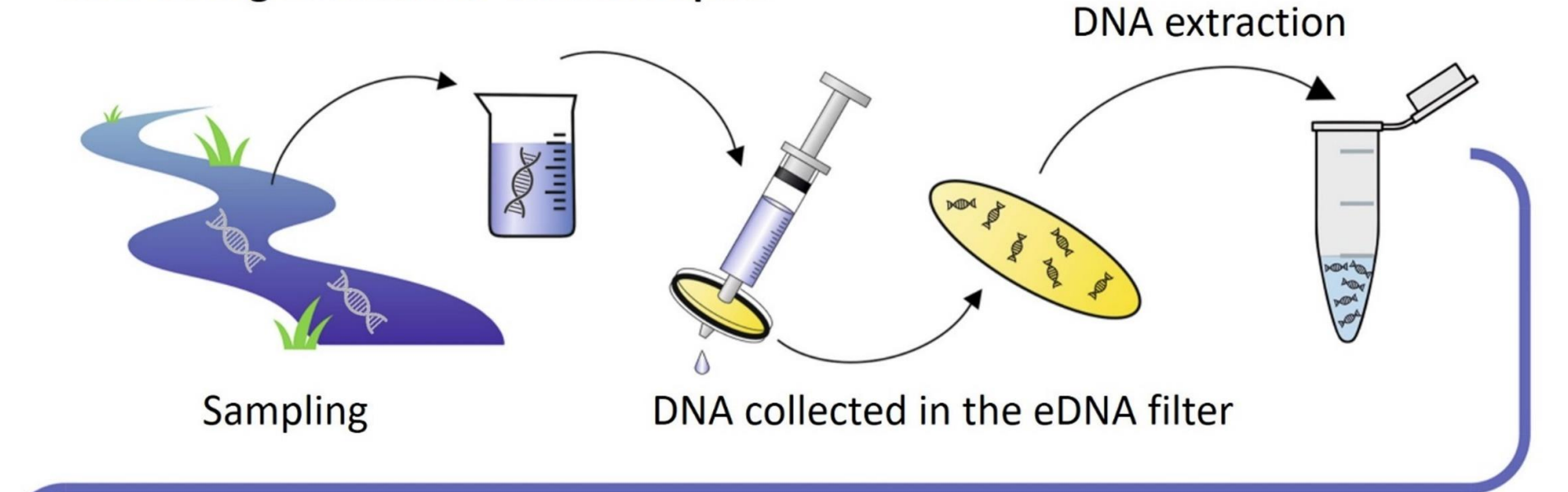
Photo: © Neil Grant for Salmon Fishery Board

Pink salmon have a two-year lifecycle and fewer fish were reported in 2019 – just 20 across Scotland as a whole. However, it is not possible to predict numbers which may come to Scotland in 2021.

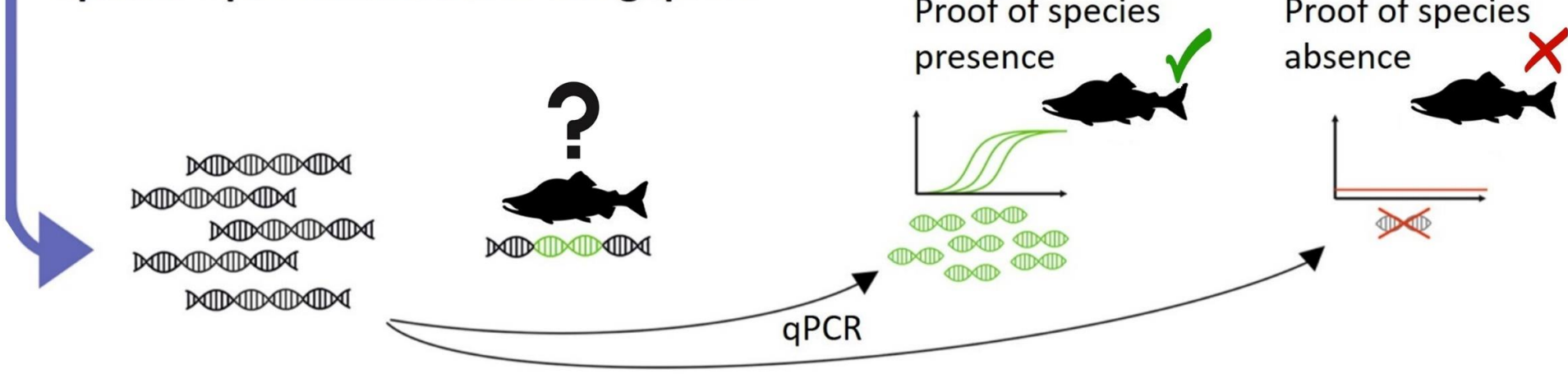
The Scottish Government works with FMS, Natural Scotland and the Scottish Environment Protection Agency (SEPA) to co-ordinate advice and actions to help ensure that any recurrence of pink salmon in Scotland can be identified, reported and managed appropriately.

FMS have produced a detailed Advice Note 'Advice Note' to identify pink salmon and an app which can be used to report incidences. The findings will be available on [Scotland's environment site](https://www.scotlandscotland.gov.uk/).

Recovering eDNA from water samples



Species-specific detection using qPCR



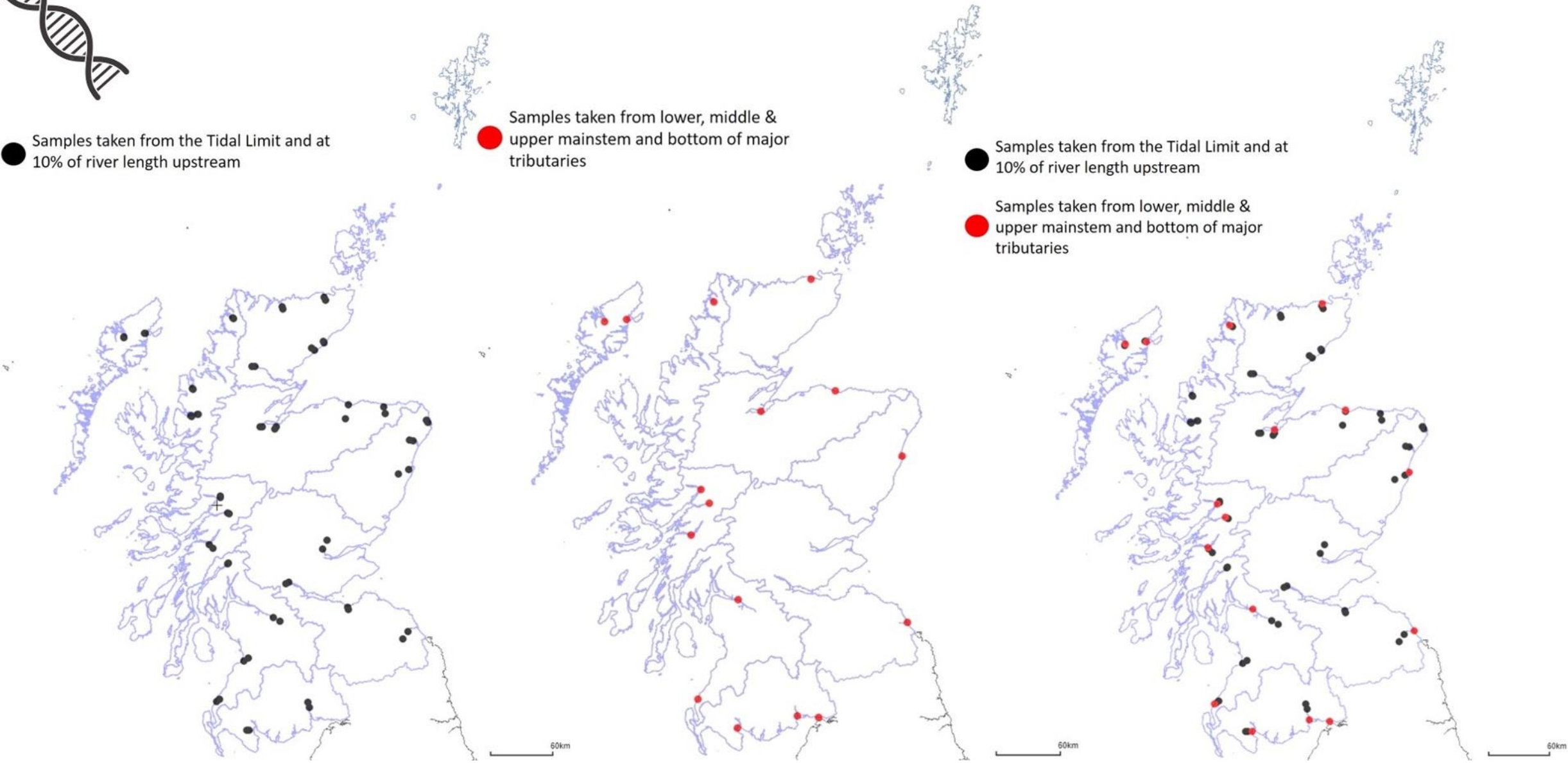


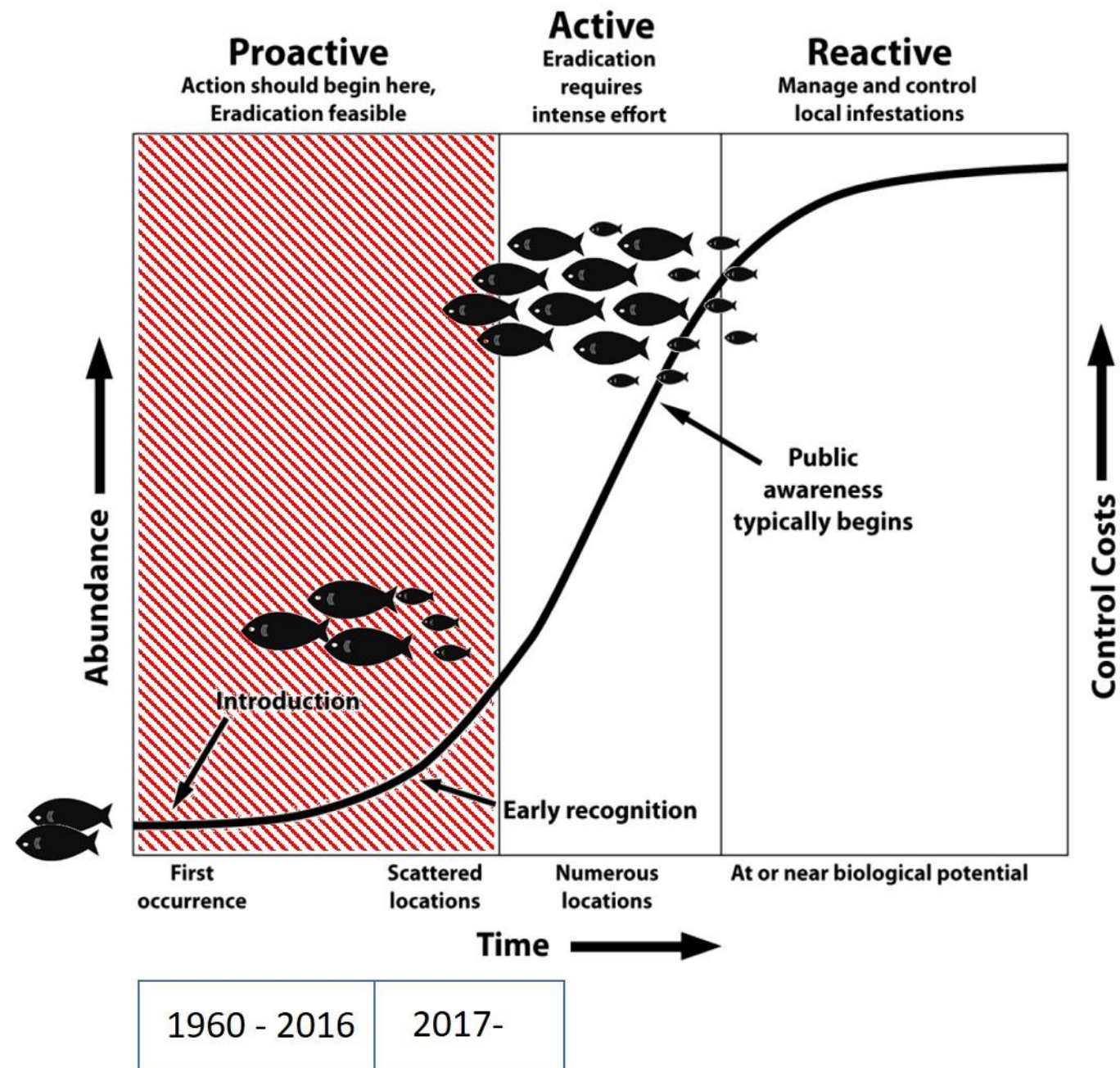
● Samples taken from the Tidal Limit and at 10% of river length upstream

● Samples taken from lower, middle & upper mainstem and bottom of major tributaries

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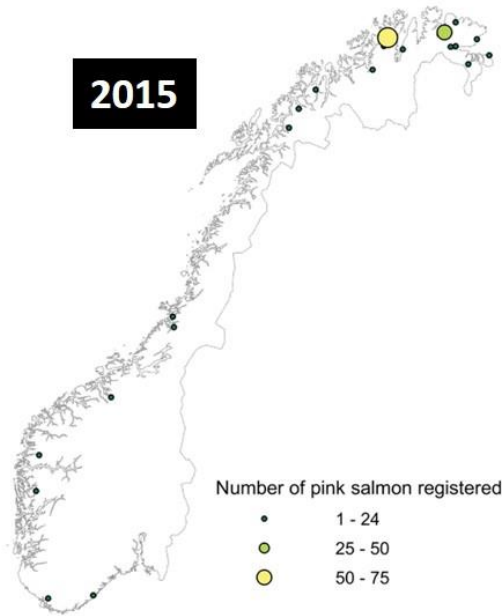




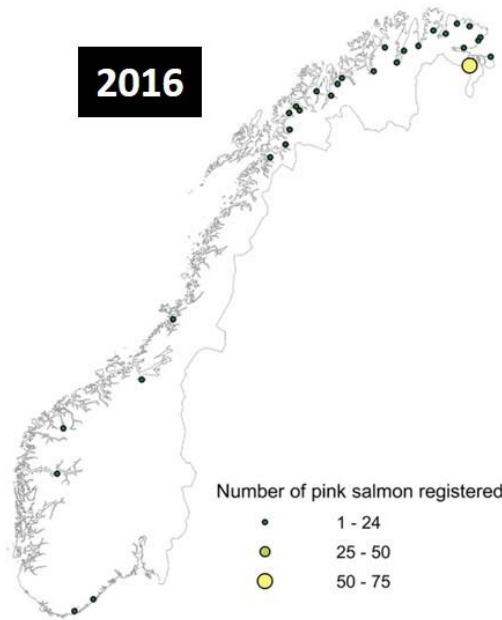
Up to 2012



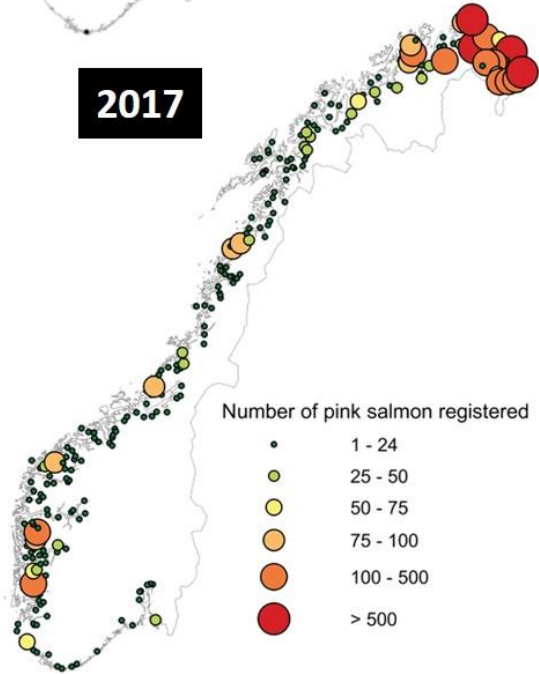
2015



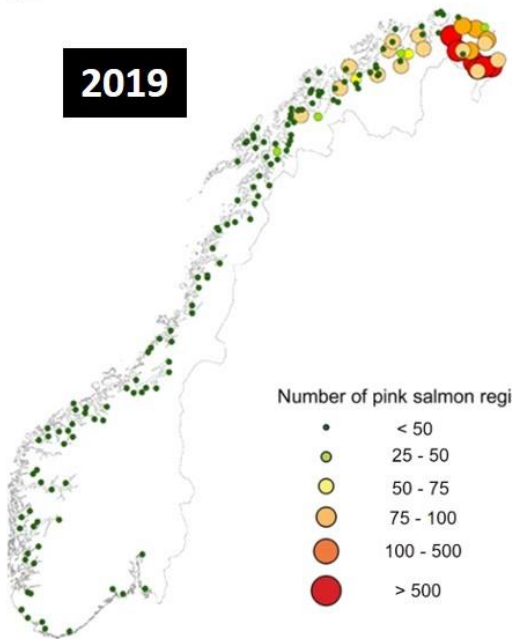
2016



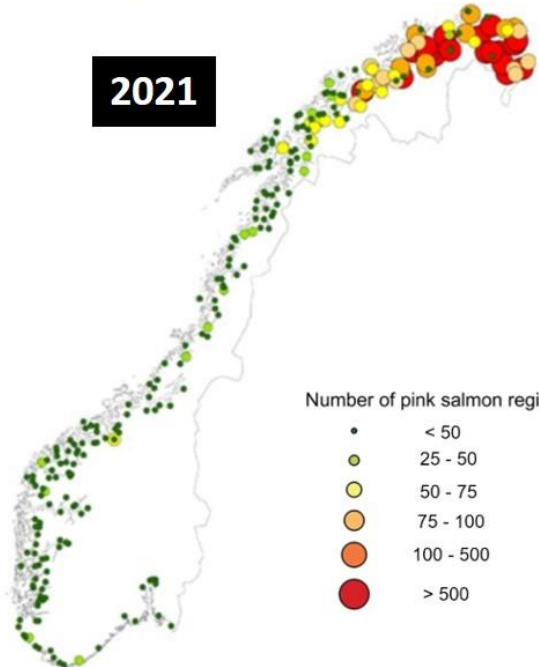
2017

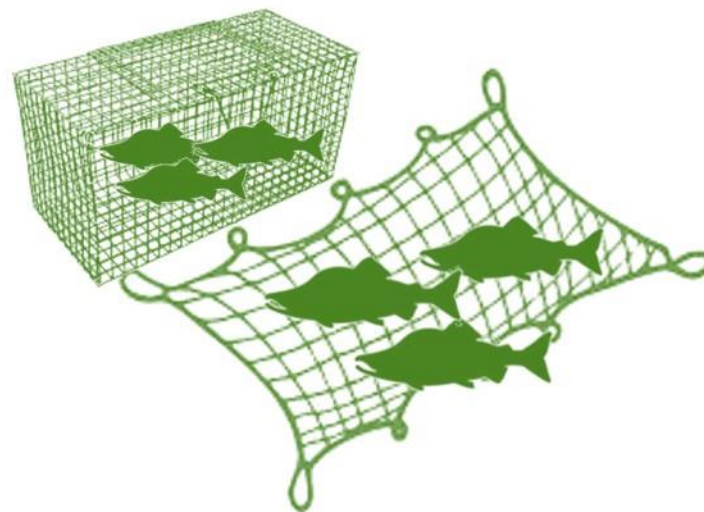
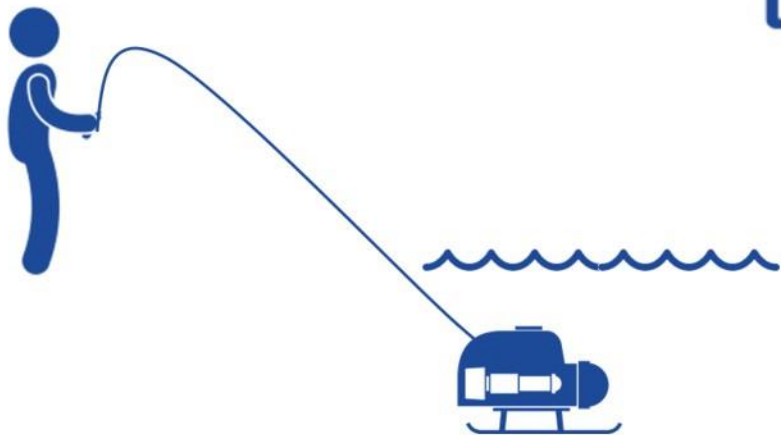


2019



2021













CNL(22)47

*Statement of the Council Regarding Pink Salmon, *Oncorhynchus gorbuscha*, in the NASCO Convention Area*

RECOGNISING that the pink salmon, *Oncorhynchus gorbuscha*, in the NASCO Convention Area is an introduced species native to the Pacific Ocean;

AWARE that ICES advised in 2018 (CNL(18)08rev) that introductions to the White Sea basin in northern Russia in the mid-1980s led to the rapid establishment of self-sustaining, odd-year populations in the White Sea rivers in the Murmansk and Archangelsk regions of Russia and that, despite cessation of these introductions, catches of pink salmon, at previously unrecorded levels, were reported in 2017 in various countries around the North Atlantic over a wide geographical area including all three NASCO Commission areas;

RECOGNISING that ICES advised in 2013 (ICES CM 2013/ACOM:09) that pink salmon can pose threats to wild Atlantic salmon, *Salmo salar*, and ecosystems in a number of ways and potential threats were either not evidenced and unlikely or occurred for short periods of time, an explosive increase in numbers and spread over a wider geographical area may have the potential to increase the risk of adverse impacts on wild Atlantic salmon in some rivers;

NOTING that, in an increasing number of rivers in the Convention area, self-sustaining populations of pink salmon have become established and there was explosive population growth and geographic spread from 2019 to 2021 to the extent that pink salmon have become the most numerous fish species in some rivers, increasing the risk of adverse impacts in the Convention area;

ACKNOWLEDGING that the Steering Committee of the International Year of the Salmon Symposium held in Tromsø in 2019 recommended that NASCO should facilitate co-operation between Parties when there is a need for international collaboration to prevent or reduce the threat to wild Atlantic salmon stocks from invasive species;

RECOGNISING the provisions of the Resolution by the Parties to the Convention for the Conservation of Salmon in the North Atlantic Ocean To Minimise Impacts from Aquaculture, Introductions and Transfers, and Transgenics on the Wild Salmon Stocks, CNL(06)48, the 'Williamsburg Resolution';

- **Co-operate** to minimise adverse effects of pink salmon on wild Atlantic salmon. Such co-operation could include **data sharing and exchange of information on monitoring and surveillance programmes, scientific understanding of impacts** and **best practice on methods to prevent the spread and establishment** of populations of pink salmon without damage to wild Atlantic salmon stocks;
- **Initiate corrective measures, without delay, when significant adverse effects on wild Atlantic salmon stocks are identified**, and that these should be designed to achieve their purpose promptly;
- **Encourage research and data collection in relation to pink salmon** in the Convention area;
- **Develop and distribute educational materials to increase awareness** of the risks that pink salmon pose to wild Atlantic salmon and the need for the measures to control their spread; and
- The Council of NASCO agrees to **establish a Standing NASCO Working Group** on the threat of pink salmon

COLLABORATION



NOAA FISHERIES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ALASKA FISHERIES SCIENCE CENTER

 Fisheries and Oceans
Canada

 ALASKA
DEPARTMENT OF FISH AND GAME

 **UAF**
COLLEGE OF FISHERIES
AND OCEAN SCIENCES
University of Alaska Fairbanks

 **NPAFC**

*Environnement,
Lutte contre
les changements
climatiques,
Faune et Parcs*

 Québec

 Washington Department of
FISH & WILDLIFE

 Atlantic Salmon Federation
Fédération du Saumon Atlantique

 **Luke**
NATURAL RESOURCES
INSTITUTE FINLAND

 HAVFORSKNINGS
INSTITUTTET

 **NINA**
Norwegian Institute for Nature Research

 Fisheries
Management
Scotland

 Department of
Agriculture, Environment
and Rural Affairs

 **NatureScot**
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

 Iascach Iníre Éireann
Inland Fisheries Ireland

 **Cefas**

A review of pink salmon in the Pacific, Arctic, and Atlantic oceans.

North Pacific Anadromous Fish Commission Tech. Rep. 21.

Available at www.npafc.org/technical-report/



Scan here to access the Workshop Report



Scottish Government
Riaghaltas na h-Alba
gov.scot

marine scotland
science



Scottish Environment
Protection Agency

Buidheann Dion
Àrainneachd na h-Alba



NatureScot

Scotland's Nature Agency
Buidheann Nàdair na h-Alba



Fisheries
Management
Scotland

