Topic Sheet

January 2025

Scottish Government
Riaghaltas na h-Alba

Trends in the number of female Atlantic salmon returning to the Girnock and Baddoch traps:

Understanding global and local drivers of change.

Figure 1: Baddoch adult fish trap in foreground and emigrant trap in midground.

Introduction

The numbers of adult female salmon returning to the Girnock and Baddoch index monitoring sites in 2024 were the lowest and fourth lowest on record respectively, with only a single female returning to the Girnock, and seven females returning to the Baddoch. In this topic sheet, we explore how these observations relate to wider trends in salmon numbers, and what these monitoring sites can tell us about the processes affecting salmon at global and local spatial scales.

The Girnock and Baddoch (Figure 1) are two intensively monitored sub-catchments of the Aberdeenshire Dee that have been studied since 1966 and 1988 respectively. Pairs of fish traps collect information on the numbers, sizes and ages of fish migrating to and from the sea; providing a detailed understanding of changing populations and the factors affecting them. Interpretation of these data is supported by studies of physical habitat, river flows, water quality and river temperature. The Girnock traps were established on an existing sawmill weir that impeded access to the upper catchment.

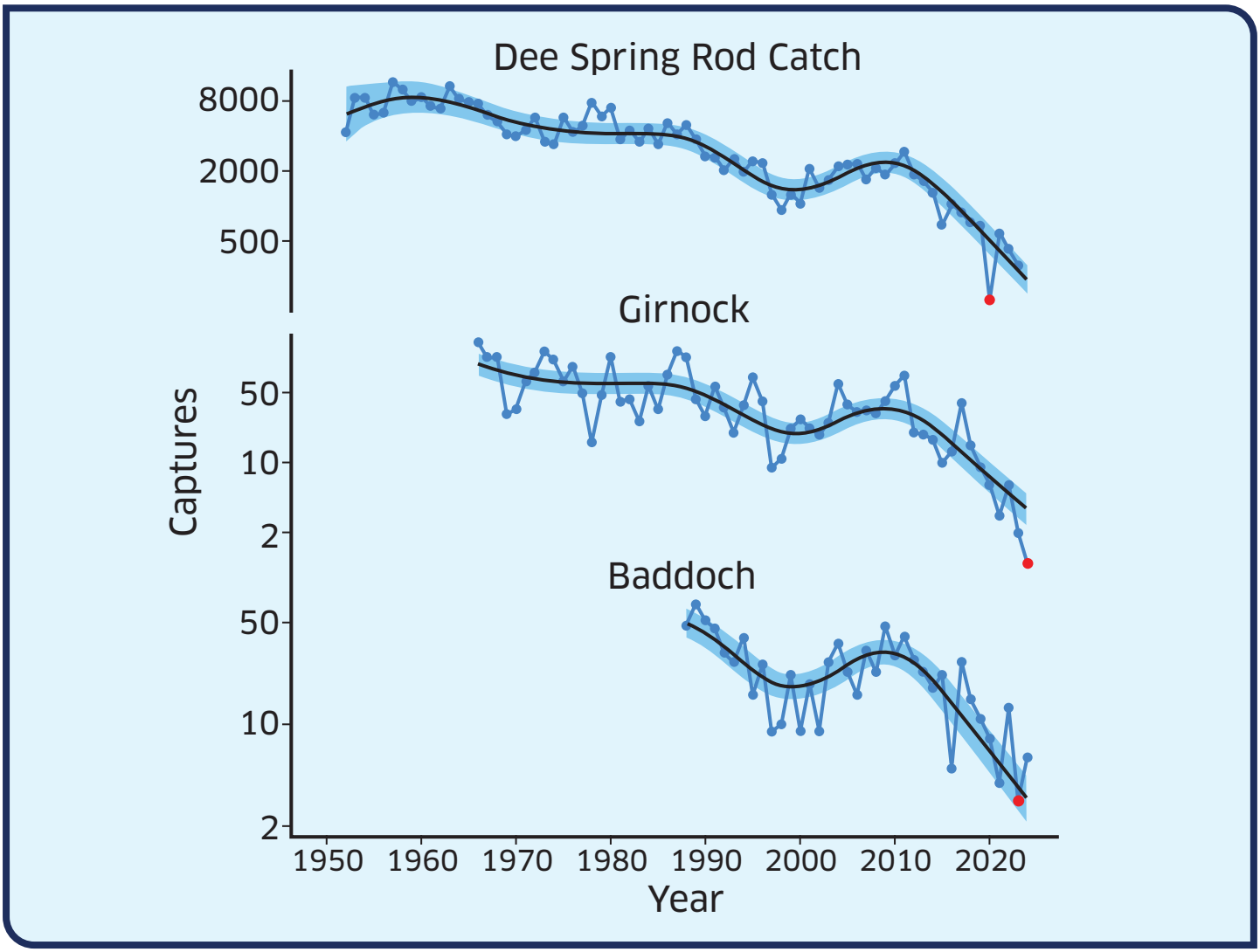

Figure 2 Trends in the Aberdeenshire River Dee spring rod catch, and Girnock and Baddoch female numbers over time. The lowest value in each time series is marked in red. Trends are shown as black lines with 95% confidence intervals as shaded blue bands. Note that the lowest point in Dee spring rod catch (2020) was affected by COVID restrictions

Both sites are dominated by spring salmon populations that return to rivers between January and May having spent multiple years at sea. Salmon catches have been monitored across Scotland since 1952. During this time, the River Dee spring rod catch has declined by around 96% (Figure 2). Changes in the River Dee spring rod catch, and the number of females returning to the traps, can be explained by a common trend over time indicating a consistent pattern of decline across all three datasets (Figure 2). This suggests that the processes observed at the traps are representative of those affecting spring salmon more broadly on the Dee.

Atlantic salmon depend on good feeding at sea to survive and grow. Recent studies suggest that the amount and quality of food has declined with climate change. Data from the traps show that the percentage of emigrants that go to sea and return as adult females (return rate) has declined by ca. 70% since the 1960's reflecting reductions in survival between leaving tributary streams as emigrants and returning as adults. As the number and sizes of returning adults have declined, so too has the number of eggs being deposited, to the point where this is now insufficient to fill the available freshwater habitat with juveniles. This

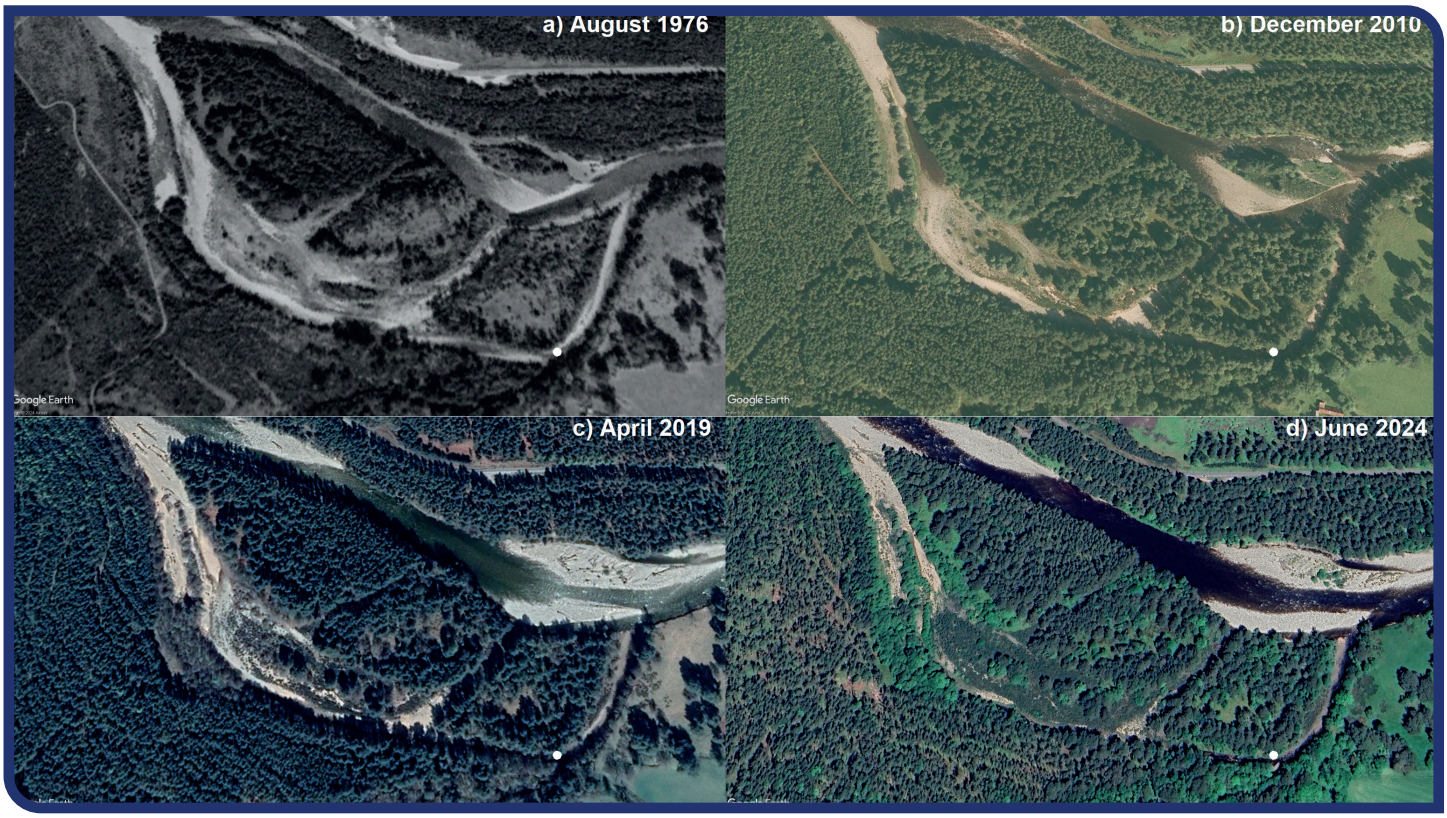

Figure 3. River Dee channel at confluence with the Girnock burn through time. The 1901 Girnock confluence with the mainstem River Dee marked by white point. Image courtesy of Google Earth (2010, 2019, 2024) and USGS (KH-9 Hexagon imagery, 1976).

reduces the number of emigrants produced and further reduces adult returns. Local environmental variability can also affect the number of adult returns in particular locations and years. For example, low flows at spawning time can limit access to tributaries and affect spawning distributions. While access to the Baddoch appears unaffected by flow conditions, previous analyses indicate access to the Girnock depends on higher flows. Recent channel change is likely to have exacerbated access issues, particularly following Storm Frank (December 2015) when a 1 in 200 year flood straightened the mainstem Dee channel at the Girnock confluence, depositing material at the head of the secondary channel that previously connected the Girnock and mainstem Dee during higher flows (Figure 3).

River flows during Autumn 2024 were less than half of the long-term average for the Dee, with only a single two-day high flow event during the main spawning migration period. In contrast, high flows extended over approximately two weeks during same period in 2023. Taken together, channel change and low flows may have further reduced adult returns to the Girnock in 2024.

Summary

The number of female salmon returning to the traps are the lowest and fourth lowest on record, but consistent with wider trends in the abundance of Dee spring salmon as indicated by the rod catch data. Long-term trends are being driven primarily by reductions in marine survival. However, in recent decades this has been exacerbated by reductions in production of emigrants due to low egg deposition which fails to make use of available freshwater habitat. Additional year-to-year variability is being affected by local environmental change including changing channel characteristics and autumn flows.

Further Reading

Soulsby, C., Malcolm, I.A. and Tetzlaff, D. (2024). Six decades of ecohydrological research connecting landscapes and riverscapes in the Girnock Burn, Scotland: Atlantic salmon population and habitat dynamics in a changing world. Hydrological Processes, 38:3. **https://doi.org/10.1002/hyp.15105**.

Glover, R., & Malcolm, I. (2015). Girnock and Baddoch: Adult return rates. **https://doi.org/10.7489/1607-1**

Glover, R., & Malcolm, I. (2015). Girnock and Baddoch: Adult returns to the traps. **https://doi.org/10.7489/1588-1**

Glover, R., & Malcolm, I. (2015). Girnock and Baddoch: Emigrant numbers by year of emigration. **https://doi.org/10.7489/1017-1**

© CROWN COPYRIGHT 2025