



## Post-doctoral researcher in ecology

### Questioning stable isotopes to investigate change in Atlantic salmon *Salmo salar* growth at sea (17 months)

*The French National Research Institute for Agriculture, Food, and the Environment (INRAE) is a public research establishment. It is a community of 12,000 people with more than 200 research units and 42 experimental units located throughout France. The institute is among the world leaders in agricultural and food sciences, in plant and animal sciences, and is 11th in the world in ecology and environment. INRAE's main goal is to be a key player in the transitions necessary to address major global challenges. In the face of the increase in population, climate change, scarcity of resources and decline in biodiversity, the institute develops solutions for multiperformance agriculture, high quality food and sustainable management of resources and ecosystems.*

#### WORKING ENVIRONMENT AND ACTIVITIES

The successful applicant will be welcomed in the research unit ESE Ecology and Ecosystem Health (Rennes, France: <https://www6.rennes.inrae.fr/eese/>) for a 17-month post-doctoral fellowship in quantitative ecology of migratory fish populations.

She/he will work in close collaboration with a stimulating group of quantitative ecologists (researchers, post-doctoral fellow and PhD student) with a great experience in salmon ecology and population dynamics. Main contacts will be Marie Nevoux, Etienne Rivot and Jean-Marc Roussel. The team and local collaborators offers a challenging and creative working environment. It uses a broad range of approaches to investigate the impact of environmental changes on populations and ecosystems, aiming to connect statistical modelling, population dynamics and trophic ecology. The postdoctoral researcher will also have opportunities to report her/his work to the research community of the EU-funded SAMARCH project (<https://samarch.org/>). She/he will also have the opportunity to interact with other researcher in France or internationally.

By building on the synergy between 10 French and English partners from both the academic and management communities, the SAMARCH project aims to improve our understanding of salmon ecology at sea in order to improve the quality of scientific expertise and the effectiveness of management measures. Understanding the response of populations to global changes is critical to

support ecosystem-based management of exploited species. Over the last 50 years, Atlantic salmon populations have undergone significant decline in their abundance, together with changes in their life history traits (e.g., change in size and age at reproduction). Causes of this decline are multifactorial and involve multiple stressors acting on different stages of the life cycle, in different environments (in freshwater, at sea) and at different spatial scales. Available knowledge supports the hypothesis that these changes partly result from profound modifications in the environment of fish during their marine migration. However, the marine phase of the life cycle remains difficult to observe and knowledge about the mechanisms involved in the response of individuals and populations to these changes remains fragmented.

#### ■ Specific objectives of the post-doctoral project

The post-doctoral project will benefit from an existing database consisting in detailed phenotypic data available for more than 6500 adult salmon collected in 5 rivers (Scorff, Sélune, Bresle, Frome and Tamar) between 1987 and 2018. There might be some opportunity to complement the database with additional data from other rivers outside the Channel area.

Previous analysis highlighted a rapid decline in salmon growth at sea from 2005 in 5 rivers of France and England by using fish scales collected on returning salmon as tracers of individual life at sea. We demonstrated that growth and/or body size is a key driver of marine survival and sex-specific maturation age (Tréhin et al. 2021, <https://doi.org/10.1139/cjfas-2020-0236>). This means that any change in growth at sea may affect the size of returning individuals as much as their numbers, age and sex structure with expected consequences on population dynamics.

The post-doctoral fellow will investigate potential cause and consequence of changes in salmon growth at sea by analyzing long-term empirical data from these 5 populations. The approach will rely on the detailed analysis of marine growth to better understand, and predict, the response of salmon populations to ongoing changes in the North Atlantic Ocean. As fish scales grow at the same time as fish body, scales collected from returning individuals are valuable tracers of salmon growth trajectory at sea, when individuals are not observable. As scales grow, they also incorporate chemical elements that are specific to the location and diet of the fish at the time of the feed.

The post-doctoral researcher will produce a detailed analysis of individual growth patterns to better characterize the variability in environmental conditions at sea throughout the successive stages of the salmon migration and maturation. Using data extracted from archived scale materials, the post-doctoral researcher will investigate how growth patterns correlates with C and N isotopic ratios to identify potential environmental drivers of spatio-temporal variability in growth at sea. In particular, she/he will test for change in salmon feeding zone ( $\delta^{15}\text{C}$ ) and trophic levels ( $\delta^{15}\text{N}$ ). This work will provide valuable clues on the size, the condition and the migration timing of salmon returning to their natal rivers after their marine sojourn. This approach may help infer about large-scale ecological changes influencing salmon populations across its entire distribution range.

The post-doctoral researcher will be in charge of drafting manuscripts for publication in international scientific journals. She/he will communicate her/his results with partners of the SAMARCH project on a regular basis.

## INRAE'S LIFE QUALITY

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By joining our teams, you benefit from (depending on the type of contract):

- until 30 days of annual leave + 15 days "Reduction of Working Time" (for a full time);
- [parenting support](#): CESU childcare, leisure services;
- skills development systems: [training](#), [career advise](#);
- [social support](#): advice and listening, social assistance and loans;
- [holiday and leisure services](#): holiday vouchers, accommodation at preferential rates;
- [sports and cultural activities](#);
- collective catering.

## TRAINING AND SKILLS REQUIRED

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- Recommended training: doctoral degree in quantitative ecology and/or fisheries sciences or a related field.
- Required knowledge: experience with handling and analyzing large empirical datasets with quantitative approaches.
- Appreciated experience: an experience in life history theory, oceanography and stable isotope ecology would be an advantage.
- Skills sought: The ability to work as part of a team and to publish articles in well ranked international scientific journals is considered as a prerequisite.

### ↘ Reception modalities

- Unit: Ecology and Ecosystem Health (ESE)
- Postal code + city: 35000 Rennes, France
- Type of contract: Short term contract (CDD)
- Duration of the contract: 17 months
- Starting date: 1<sup>st</sup> November 2021
- Remuneration: indicative gross monthly salary between 2516€ and 2736€, depending on experience

### ↘ How to apply

Send a motivation letter and a CV to :

- Marie Nevoux: [marie.nevoux@inrae.fr](mailto:marie.nevoux@inrae.fr)
- Etienne Rivot: [Etienne.Rivot@Agrocampus-Ouest.Fr](mailto:Etienne.Rivot@Agrocampus-Ouest.Fr)
- Jean-Marc Roussel: [jean-marc.roussel@inrae.fr](mailto:jean-marc.roussel@inrae.fr)

✘ Deadline for applications: 31<sup>st</sup> September 2021