

	<p>Council</p> <p><i>Overview of adaptive management actions undertaken by France to mitigate the negative impacts of climate change</i></p>	<p>CNL(23)55</p> <p>Agenda item: 7a)</p>
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Overview of adaptive management actions undertaken by France to mitigate the negative impacts of climate change

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Background

Like Ireland and Spain, France will present elements of the management measures put in place to mitigate the effects of climate change on *Salmo salar*'s habitats, which are not, at this stage, targeted at the species but which *de facto* contribute to its maintenance in French rivers.

This presentation will be held at the NASCO 2023 Thematic Special Session (TBSS), entitled "Informing a strategic approach to addressing climate change impacts on wild Atlantic salmon".

Introduction

This session follows the one more focused on Research issues, which highlights the fact that climate change is already having observable effects on salmon populations. Although it is considered as a major concern, it is extremely difficult to anticipate the response of a population to a given change, and to identify management levers that would have a positive impact on population dynamics and resilience (Piou & Prévost 2013).

To understand the impact of climate change on salmon populations, it is first and foremost necessary to have observation data on the populations evolution. In this, there is a critical need to maintain and even expand observatories over the long term, which requires maintaining sufficient levels of logistical, technical, and scientific investment to do data bases that will inform effective mitigation strategies; these data should encompass all life stages, across a wide range of scales and ecosystems (Diack et al. 2022). The previous session states that life history models can aim to predict the future of populations in response to different scenarios of environment change or management practices (Bull et al. 2022).

In metropolitan France, water resource management is managed by watersheds policy, delimited by surface water divides. The 5 river basins where salmon are present are Adour-Garonne, Artois-Picardie, Loire-Bretagne, Rhin-Meuse, and Seine-Normandie. Each of these watershed has set up planning documents: the master plan for water development and management (SDAGE) and the strategic facade document (DSF) in response to European directives such as the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD), and a management document: the migratory fish management plan (plagépomi).

At the national level, the second national action plan for adaptation to climate change¹ (PNACC 2) and the national plan for migratory species² (PNMA) are framework documents on which management is also based.

Finally, the Interreg program Diadromous fish and Ecosystem Services³ (DIADES) calls for international cooperation to better understand the effects of climate change.

¹ https://www.ecologie.gouv.fr/sites/default/files/2018.12.20_PNACC2.pdf

² https://professionnels.ofb.fr/sites/default/files/pdf/PNMA_Projet-Approuve_11_02_2022_Vanglais.pdf

³ <https://diades.eu/>

It is through the construction of these documents that the effects of climate change are perceived and measures proposed and implemented in France. The objective of this contribution is to present these different tools and measures.

Where is France on taking into account the adaptation of aquatic environments to climate change?

Measure: Implementation of the national plan for adaptation to climate change (PNACC) 2 and implementation of the watershed plans for adaptation to climate change.

By 2070-2100, climate experts estimate that water resources will be scarcer, with 10% to 50% less low-water flow for the major french rivers and up to 30% less for groundwater. France is located at the southern limit of the salmon's distribution area. In this respect, the impacts of environmental changes induced by climate change are likely to be more important than in other watersheds of the distribution area.

Thus, one of PNACC 2 objectives is to allow the healthy functioning of aquatic ecosystems, which is at the origin of a multitude of ecosystem services, thus constituting one of the keys to better mitigation and adaptation. It is therefore necessary to strengthen the resilience of these ecosystems in the face of climate change, with a view to maximizing synergies between ecosystem preservation and human use, by anticipating future transformations. The proposed measures favor nature-based solutions wherever relevant and must be supported by legislation and tools deployed such as the monitoring of river thermals by the National River Thermal Network (NRT).

To this end, at the level of watersheds mentioned above, each SDAGE proposes a climate change adaptation component. Within the framework of their eleventh intervention program (2019-2024), the water agencies support actions taken into account the impacts of climate change on the preservation of water resources and the restoration and preservation of aquatic and wetland environments. In France, most of the recommended adaptation actions in the water component are eligible for support from the water agencies: nearly €500 million per year are mobilized for operations contributing to climate change adaptation.

Many actions of restoration of watercourses with restoration of ecological continuity have been financed and realized. For example, the Orne River's restoration in Normandy⁴, where almost the entire length of the river was under reservoirs influence, causing the disappearance of riffles and an increase in the warming and evaporation of the water, has allowed salmon to return to the riffles in the restored sectors. Or the Gave de Pau's restoration of the ecological continuity project⁵, in Nouvelle-Aquitaine, which is included in the national program "Nature 2050", supported by CDC Biodiversity, which aims to restore biodiversity and strengthen the adaptation of territories to climate change by 2050.

How is climate change addressed in the various tools dedicated to migratory fish?

Measure: Take into account the need for adaptation in the measures identified

The PNMA was developed in line with the National Strategy for Biodiversity (SNB2030), which promotes the need to integrate "biodiversity" issues into French policy to combat climate change.

This national plan proposes concrete actions such as, for example, *improving knowledge on migratory species, particularly in marine environments and transitional waters, or guaranteeing a high level of protection and restoring the functionality of environments and*

⁴ https://www.eau-seine-normandie.fr/actualites/DTMBN/effacement_seuil_Hom_orne

⁵ <https://www.institution-adour.fr/continuite-ecologique-forward/op%C3%A9ration-gave-de-pau.html>

ecological continuity in territories with high stakes and particularly resistant to climate change. It is indeed impossible to ignore the global warming effects which will lead, for example, the modification of migration corridors and functional areas or the accelerated habitats degradation (migration, reproduction, growth). Because of the reduction of the impacts of some key structures for the future of migratory fish, these actions will allow access to many habitats, the improvement of the functionality and the resistance of the territories for migratory fish in a context of climate change. This has already been demonstrated in the context of the removal of Sélune dams⁶, in Normandy, by a decrease in average summer temperatures after the removal of dams : the presence of the reservoirs caused the warming of the water up to +2°C downstream in summer.

To date, some of the plan's actions have been integrated into France's application to the European LIFE program via the LIFE BIODIV'France project, whose general objective is to fully implement the SNB2030 in order to halt the decline in biodiversity and improve the conservation status of habitats and species (particularly of community interest) in metropolitan and overseas France. This project will use the results of ongoing LIFE projects such as LIFE Artisan, a program that participates in the implementation of PNACC 2, in particular by accompanying and amplifying nature-based adaptation solutions projects throughout the national territory, such as the Ellé River re-meandering⁷, in Brittany, for example. Thus, the LIFE BIODIV'France project has used the results of various LIFE ARTISAN projects highlighting that biodiversity issues must be linked to other environmental and climatic issues in order to be heard by local authorities, businesses and citizens.

At the watershed level, the plagépomis complete the water resource management tools by setting measures related to climate change more focused on migratory fish, including salmon. In addition, more local actions are set up in consultation between actors in order to mitigate the more and more frequent low water levels; thus, managers of water reservoirs are requested to set up objective flows for low water support and thus maintain the good functioning of aquatic ecosystems downstream.

What monitoring of the effects of climate change on salmon?

Measure: scientific studies underway to guide management

Within the Observatory for Environmental Research on Diadromous Fish (ORE DiaPFC) and the Pole for the Management of Migratory species in their Environment (MIAME), French researchers are studying the evolution of migratory fish populations under the effect of environmental changes affecting the rivers they frequent. The ORE is based on four coastal rivers of the Atlantic coast, the Bresle and the Oir in Normandy, the Scorff in Brittany and the Nivelle in Nouvelle-Aquitaine. These four rivers, equipped with monitoring stations for migratory fish, have been subject to recurrent biological and physicochemical monitoring since the early 1980s. These rivers are associated with experimental facilities in Rennes and Saint-Pée-sur-Nivelle. The whole is completed by individual-centered demo-genetic simulators for experimentation on virtual populations. The work carried out on these workshop sites is integrated into regional, national and international research projects that emphasize the fundamental nature of maintaining long-term observation systems and the need to pool data at the international level (Diack, 2022) to allow for the generalization of results and the integration of ecological mechanisms and issues into a multi-scale approach.

⁶ <https://programme-selune.com/>

⁷ <https://rmcom.bzh/le-remeandrage-sur-le-bassin-versant-de-lelle>

Conclusion

In France, management measures aimed at mitigating the effects of climate change on aquatic habitats, and therefore on salmon habitats, are the result of consultations at the watershed or national level and benefit from funds from water agencies and other funds including European funds. At the same time, applied research programs are being developed to set up predictive life cycle models. Feedback on the measures to be put in place, such as the preservation of territories with high stakes and that are particularly resistant to climate change, will be necessary to ensure that what needs to be done is properly impregnated throughout the French territory. Consultation is a key word in the challenge of mitigating climate change and it is necessary to better understand this phenomenon in all management documents for migratory fish and therefore for salmon.

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