

## LIFE4FISH CLOSING CONFERENCE



Let's share the results of our studies about ecological continuity on the Meuse river and discover other worldwilde experts' experience in fish migration during this one-day conference.

Brussels • September 06 • 2023

# LIFE4FISH

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## EDITO



In June 2017, Luminus and its partners (UNamur, ULiège, Profish technologies, EDF R&D) received a grant from the European Commission to test and validate different means of protection for two species of migratory fish in the Meuse, the silver eel and the salmon smolt. The Life4Fish program was born. It aims to combine the protection of the two species with the sustainable exploitation of hydroelectric power plants.

The Life4Fish project represents our common determination to play an active role in renewable energy production as to fight against climate change and at the same time protect our biodiversity.

During those 7 years, we have been cooperating all together - industrials, academics, experts, engineers - and we have witnessed encouraging results: deep understanding of fish migration, development of migration models that allow to shutdown turbines when silver eel migration is planned, implementation of several solutions to propose alternative passage routes to fish (bypass, electrical barriers).

Let's hope that our initiatives will serve as a platform to drive change, inspire action, and foster collaborations for a more sustainable and resilient future.

I want to express my gratitude to our partners, as well as to each and every one of you who has been part of this extraordinary journey. Your passion, expertise, and relentless pursuit of a better future have made this project a resounding success. Let us remember that our collective efforts can and will shape a more sustainable world for generations to come.

**Grégoire Dallemagne,  
CEO Luminus**

## ON THE RIGHT TRACK

Prior the Life4Fish program, Luminus started an ambitious field study in order to establish referential of salmon smolts and silver eel survival along the 6 successive hydropower plants. From these results, we developed the Life4Fish project with the ambition to improve migratory fish survival at the global scale more than focusing on each site. That integrative approach was only feasible by the building of a multi-disciplinary and international team around the project.

Deep understanding of salmon and eel migration in our project contributed to the development of fish migration models that are now implemented in our control centre to warn our production teams that our turbines have to enter in a "migration mode".

With the precise behavioural datasets from the biologists, hydraulic engineers developed and validated different solutions to propose alternative passage routes to fish. A bypass has been open for salmon smolts at one site, which reveal to attract more than 50% of smolts and pass them safely downstream. An even higher efficiency has been obtained when opening a dam gate of 50 cm when salmon migration in the Meuse is warned by the model.

This solution, applied in particular in Monsin and Lixhe, improved significantly the migration success of salmon smolts. Turbine shutdowns of 24h are committed when silver eel migration is warned by the model. The good precision of the model allows to optimize the loss of production and the reduction of eel turbine passage. At two sites, turbines shutdown are associated with an electrical barrier which increase the protection level.

In addition, two new turbines were installed on the Monsin site, excluding Life financing. Operators can switch them to a fish friendly mode during critical periods and thus reduce the impact on migrating fish.

Those measures are driving us on the right track towards our initial goals. While our objectives for both species are met in terms of engaged means and results, it is still necessary to go further in the protection actions to continue the efforts started by the project. Our results revealed that other impacts, associated with the physical status of the River Meuse, are the next challenges and that the Life4Fish developed expertise is now ready to deal with them in the Meuse basin as in other river catchment of Europe.

### The Project team

# PROGRAMME OF THE DAY

## Part 1

### Innovative and inspiring solutions for the protection of migratory fish

09.15	<b>Welcome</b>	<b>Pierre Theunissen,</b> Senior Project Manager, Luminus
09.30	<b>Introduction</b> - Background International Commission for the Meuse and Masterplan for migratory fish	<b>Johan Coeck,</b> President of the Working Group Fish of the International Meuse Commission
09.45	<b>Recent discoveries</b> about the eel's life cycle and the causes of its decline	<b>Eric Feunteun,</b> Professor of Marine Ecology at the French National Museum of Natural History
10.15	<b>LIFEEL</b> - Urgent measures in the Eastern Mediterranean for the long-term conservation of the European Eel	<b>Cesare Puzzi,</b> Founding partner and managing director of the environmental design and applied research company GRAIA
11.00	<b>Field Investigation</b> of American Eel Response to a Light Guidance Array	<b>Maarten Bruijs</b> Principal Consultant and Owner of Pecten Aquatic, the Netherlands.
11.30	<b>Hydropower and fish migration</b> in the Meuse: background, policy, research and recent developments	<b>Jochem Hop,</b> Dutch water authority Rijkswaterstaat, member of the International Meuse Commission <b>Tim Vriese,</b> fish migration specialist at ATKB in Waardenburg (NL)
12.00	<b>Silver eel migration</b> in the Dutch regulated Meuse	<b>Erwin Winter,</b> Researcher (PhD) at Wageningen Marine Research & Aquaculture and Fisheries Group, Wageningen University & Research
12.30	<b>Lunch &amp; networking</b>	

# PROGRAMME OF THE DAY

## Part 2

### Life4Fish : global results

13.45	<b>Introduction</b>	<b>Grégoire Dallemagne</b> , CEO Luminus
13.50	Life4Fish summary presentation <ul style="list-style-type: none"><li>• tested solutions</li><li>• behavioural results</li><li>• measured efficiency compared to initial goals of fish survival</li></ul>	<b>Pierre Theunissen</b> , Senior Project Manager - Luminus Damien Sonny, Fish Biologist PhD, Profish Olivier Machiels, Project Engineer Arcadis
14.50	Q&A	
15.00	Round table and outlook <ul style="list-style-type: none"><li>• Downstream migration modelling and management optimisation</li><li>• Liège-Albert canal knot : status and perspectives</li><li>• Fish monitoring is the basis to develop solutions</li><li>• New development of Eco sustainable turbines</li></ul>	<b>Eric de Oliveira</b> , Researcher and Engineer EDF R&D <b>Sébastien Erpicum</b> , Assistant Lecturer, ULiège <b>Damien Sonny</b> , Fish Biologist PhD, Profish <b>Pierre Theunissen</b> , Senior Project Manager, Luminus
16.30	Closure	<b>Pierre Theunissen</b> , Senior Project Manager – Luminus <b>Johan Coeck</b> , President of the Working Group Fish of the International Meuse Commission
	Cocktail	

## SPEAKERS' PROFILES AND ABSTRACTS



**PIERRE THEUNISSEN**  
Senior Project  
Manager, Luminus

After studying Industrial Engineering in Liège and working for several years at Cockerill Sambre and Prayon Ruppel, Pierre Theunissen joined Luminus in December 2000. With over 20 years' experience at Luminus, he is now Senior Project Manager.

During his career, Pierre has been involved in the implementation of the strategic reserve to ensure the security of our country's electricity supply, the study and implementation of possible solutions for the future of the Seraing CCGT power station and the implementation of green hydrogen production projects to decarbonise the transport sector. For several years now, Pierre has been involved in the Life4Fish project as Project Manager.



**JOHAN COECK**  
President of the  
Working Group  
Fish of the Inter-  
national Meuse  
Commission and  
Senior Researcher  
@INBO – Research  
Institute for Nature  
and Forest, Brussels,  
Belgium

Research focus: ecological water management and rehabilitation of rivers for fish, fish habitat modelling, fish migration research, restoration and reintroduction of endangered fish species.

In 2011 the International Meuse Commission (IMC) adopted a masterplan for migratory fish. The masterplan aims to improve the situation of migratory fish species in the River Meuse catchment, with a focus on Atlantic salmon and eel. With this plan, the countries and regions in the Meuse catchment agreed on a program of measures to restore the river continuity for upstream migration, to improve the river continuity for downstream migration, to develop suitable spawning grounds and other habitats for migratory species, to reintroduction migratory species, to regulate the fisheries, to install international coordination of measures in different countries/regions.

The working group Fish of the IMC provides international coordination between the different countries and regions, evaluates the measures and actions taken by the different countries and regions and advises the plenary meeting of the IMC.



## ERIC FEUNTEUN

Professor of Marine Ecology at the French National Museum of Natural History

Professor E. Feunteun has been working on the biology and the Ecology of migratory fish, and diadromy for more than 35 years. He has mainly focused on the ecology of marine phases of Anguillid eels. His research aims at understanding variability of life history traits among and within eel species with an evolutionary perspective, and also with issues for management of these declining species. In this view he has sampled eels over Europe and indo-pacific areas, both in inland waters but also in the South West Indian Ocean. He also focuses on the resilience of marine fish communities and populations to environmental variability in the frame global change drivers, and to human activities. This research provides the roots of his expertise in the field of conservation Ecology.

He has published over 130 papers in peer review journals and he is considered a renowned expert in marine ecology and biology of migratory fish. He works on citizen science as a tool for the management of biodiversity

### **European eel, extraordinary and threatened: management impossible?**

The European eel is one of 16 species of anguillid known worldwide, whose ancestors are thought to have appeared over 60 million

years ago, i.e. just before the disappearance of the dinosaurs. This longevity is based on a successful biological cycle: catadromy. Eels reproduce at sea, often far from the coast. The eggs give rise to leptocephalus larvae that are directed by ocean currents towards coastal environments. The young eels colonise continental aquatic environments, where they settle and grow for an average of 5 to 20 years. They then return to the sea to reproduce. Their life cycle has been the subject of scientific questions and controversy since Aristotle over 2,400 years ago. Recent research has led to a better understanding of the life cycle, marine migrations and orientation mechanisms, but there is still no certainty about the area and behaviour of reproduction, as no eggs or adults have ever been sampled in the natural environment.

Over the millennia of its existence, the European eel has lived through major ecological crises and changes in climatic and oceanic regimes, and has witnessed the birth and development of humankind. Once so abundant that it was considered a nuisance, the European eel has declined to such an extent over the last 40 years that it is now considered an endangered species.



## **CESARE PUZZI**

**Founding partner and managing director  
of the environmental design and applied  
research company GRAIA**

Cesare Puzzi, founding partner and managing director of the environmental design and applied research company GRAIA Srl, has over 30 years of professional experience in freshwater ecosystems management and research. He's an expert in biomonitoring and impact assessment of freshwater environment and he works extensively with fish community analysis and fish resource management. The working activity of Mr. Puzzi covers in particular the study of aquatic environment, aiming at finding out new ways for water resource management and applied purposes. He gained experience in

species protection and conservation practices carrying out projects aimed at preserving endangered autochthonous fish species.

Cesare Puzzi has carried out many projects about management and restoration of natural habitats, in particular aquatic environments. Carrying out these projects, he has improved his skills and experience in projecting restoration plans, focused on conservation of species and habitat. He also contributed to bioengineering projects in order to restore damaged and artificialized habitats and in particular the realization of dozens of fish passes.

### **LIFEEL - Urgent measures in the Eastern Mediterranean for the long-term conservation of the European Eel**

LIFEEL is the acronym for the project «Urgent measures in the Eastern Mediterranean for the long-term conservation of the European Eel», a four-year project (1/10/2020 - 31/12/2024) co-funded under the Life Natura program, with a total budget of € 5,428,447. For Italy, the project area corresponds to the entire basin of the Po river, including a suitable area for eel equal to over 20,000 km<sup>2</sup>, while in Greece the activities are carried out in the area of Eastern Macedonia and in the Thracian National Park.

To face the present threats, the project puts in place the following concrete conservation actions:

- Impact of fisheries and aquaculture: a protocol developed to identify the best breeders and facilitate their release into nature to support the wild stock. In addition, a breeding program in captivity is carried out, with the aim of producing young to be released into the wild.
- Fragmentation of the habitat: the ecological river connection will be assured also thanks to the construction of specific passages for the eels, reopening areas suitable for the species.
- Mortality due to turbines: a demonstration system will be created to prevent migrating eels from entering the turbine, and widespread among the management staff of the hydro-plants.
- Lack of information on the species: the project provides for the activation of a series of activities aimed at all the different categories of stakeholders such as: students, fishermen, representatives of the managing bodies.



**MAARTEN BRUIJS**  
Principal Consultant and Owner of Pecten Aquatic,  
the Netherlands.

Maarten is an environmental consultant with over 23 years of experience, performing projects internationally for a variety of large-scale industrial surface water users and legislative/permitting authorities. Initially working at KEMA / DNV GL (2000 – 2016) and Sweco (2016 – 2018), Maarten formed Pecten Aquatic, in 2018, assisting industries in their mitigation of environmental impacts on daily operations and in complying with permit requirements while maintaining a safe, reliable and commercially robust operation. Pecten Aquatic also assists legislative/permitting authorities by providing objective insights for framing effective and realistic regulatory requirements.

Expertise topics comprise among others management of fish I&E/debris, fish passage, intake design review, turbine mortality, fish deterrence, monitoring and mitigation of biofouling, biofouling control, cooling water discharge impacts. Maarten provides support to EPRI in several of its programs, among others the Anguillid Eel and Sturgeon Interest Groups.

Maarten holds a M.Sc. in Biological Sciences (Aquatic Ecology) from the Radboud University of Nijmegen in the Netherlands (aquatic ecology: eco-physiology and eco-toxicology of fish and invertebrates).



**JOCHEM HOP**  
Dutch water authority Rijkswaterstaat, member  
of the International Meuse Commission

For the past fifteen years, Jochem Hop has worked at the consultancy firm ATKB. He worked on a wide variety of research concerning fish stocks and fish migration in the Netherlands and Flanders.

Since the beginning of this year Jochem is employed at the Dutch water authority Rijkswaterstaat, where he is advising on the theme of fish. He is also member of the International Meuse Commission on behalf of Rijkswaterstaat.



**TIM VRIESE**

Fish migration specialist at ATKB in Waardenburg (NL)

Tim Vriese is a fish migration specialist working at ATKB in Waardenburg (NL). He has a career of 34 years in fish migration research. From 1996 onwards Tim is working together with Rijkswaterstaat (RWS) on fish telemetry with the NEDAP Trail system and has studied migration of salmonids (adults and smolts) and silver eel on the rivers Rhine and Meuse for many years. Currently he is involved in a five year research programme on the 'Kier' in the Haringvliet: sluices are opened at high water, letting seawater in and improving fish migration.

Tim also advises RWS ZN, for the last ten years, on mitigation measures and permitting procedures for hydropower stations on the Meuse.

**Hydropower and fish migration in the Meuse: background, policy, research and recent developments**

Already in 2001 it was decided by the involved Ministries (LNV, RWS and Economic Affairs) that the cumulative mortality of fish, especially salmon and eel, cause by hydropower stations (HPS) should not exceed 10% in the river Meuse. HPS owners, however, were reluctant to take measures to reduce fish mortality, as in their view it was not possible to achieve this.

In the licensing process the HPS initiative is evaluated against the goals of the Dutch Water Act as to, whether or not, there is a negative influence on the ecological quality of the water body and especially on the fish stock in it. In the past this evaluation was done by RWS based on the fish mortality standard for the Meuse (10%). From 2014 onwards the licensing process is based on the official guideline for hydropower licensing (in Dutch: "Beleidsregel watervergunningverlening waterkrachtcentrales").

As permits for HPSs had to be renewed, HPS owners initiated several years of research into possibilities



**ERWIN WINTER**

**Researcher (PhD) at Wageningen Marine Research & Aquaculture and Fisheries Group, Wageningen University & Research**

Dr H.V. Winter (Erwin) is a fish ecologist working at Wageningen Marine Research and Wageningen University since 1996. He is specialised in studying fish behaviour, anthropogenic impacts and consequences.

**Silver eel migration in the Dutch regulated Meuse**

Silver eel migration in the Dutch section of the Meuse is hampered by a series of weirs, sluices and hydropower stations. During 2004-2023 several telemetry experiments have been carried out using the network of NEDAP-trail detection stations and implanting silver eel with transponders with two years battery life. Success rates, route selection and migratory behaviour at barriers will be presented for subsequent study years. Finally an outlook to ongoing Dutch studies on silver eel using acoustic telemetry in the Meuse and delta will be given.

## LIFE4FISH PROJECT SPEAKERS



**DAMIEN SONNY**

**Fish Biologist PhD, Profish**

Following a doctoral thesis on fish migration at the University of Liège, Damien Sonny set up the spin-off Profish Technology in 2007. This company carries out fish migration monitoring in a variety of contexts, with its expertise focused primarily on the crossing of hydroelectric power stations and fish protection measures. The company currently employs 8 people in Belgium, France and Germany. Damien is also a member of several international expert committees, and regularly contributes to conferences and scientific articles.



**OLIVIER MACHIELS**  
**Ingénieur de projets Arcadis**

Olivier Machiels graduated from the University of Liège as a civil construction engineer in 2008, followed by a doctorate in engineering sciences.

A water expert with Arcadis Belgium for 10 years, Olivier specialises in surface water management: Spillways, stormwater basins, stormwater management in urban areas, flood and drought risk management, renaturalisation of watercourses, wetlands, etc. Within the Life4Fish project, Olivier provides the link between the contributions of the various partners in order to define, evaluate and verify the technical objectives of the project (survival of eels and salmon, maintenance of green productivity, implementation of the most appropriate solutions).



**ERIC DE OLIVEIRA**  
**Chercheur et Ingénieur EDF R&D**

Eric De Oliveira joined EDF R&D in 2005 as a biology research engineer. As an EDF expert since 2014, his areas of expertise cover the design of innovative solutions for fish protection, the development of new environmental monitoring systems

and methods and, more generally, the study of the impact of EDF's activities on animal species. The design and implementation of field experiments also represent a significant part of its activity.



**SÉBASTIEN ERPICUM**  
**Assistant lecturer at the University of Liège**

Sébastien Erpicum is an assistant lecturer at the University of Liège, where he is in charge of the Hydraulics and Construction Laboratory - HECE. For more than 20 years, he has been developing teaching and research activities related to hydraulic

engineering and hydraulic structures, based on coupled numerical and experimental modelling approaches. For his work, he received the prestigious Hydraulic structures medal from ASCE in 2020 and the 21st Arthur Ippen Award from IAHR in 2021.





# LIFE4FISH



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[www.life4fish.be](http://www.life4fish.be)

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