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Regional Conference on river habitat restoration for inland fisheries in the Danube river basin and adjacent Black Sea areas

Conference Proceedings
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Cover photograph: Cormorants in the Danube Delta
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Preparation of this document

This document has been prepared by the International Organisation for the Development of Fisheries and Aquaculture in Europe (EUROFISH) for the Food and Agriculture Organisation of the United Nations (FAO) and the FAO Regional Office for Europe and Central Asia. It stems from the regional conference “River habitat restoration for inland fisheries in the Danube River basin and adjacent Black Sea areas” held in Bucharest, Romania from 13 to 15 November 2018. The conference was organised by FAO in partnership with EUROFISH and the Danube Sturgeon Task Force (DSTF), and in collaboration with the Romanian Government, in particular the Ministry of Waters and Forests and the Ministry of Agriculture and Rural Development. Recommendations were summarized with assistance from Cristina Sandu, Danube Sturgeon Task Force, Mr Cathal Gallagher and Mr Reinhold Hanel of the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC).

This publication gathers the scientific and policy information and outcomes of the regional conference for wider distribution. The long abstracts were written by the invited speakers. These proceedings are intended as a useful collection of information focusing on river habitat restoration and inland fisheries of the European continent, with specific examples from the Danube river basin. It makes a significant contribution to existing knowledge of these issues.

Abstract

Inland waterway management is complex and faces unique challenges as inland waterways have a variety of users. The mixture and overlap of local, regional, national and at times international regulations exacerbate the problem of managing inland waterways. The Danube is an international river flowing through many European countries and its health has direct impact on environmental conditions in the Black Sea, especially for migratory species that require the sea and river habitats for parts of their life cycle. Pressures such as capture fisheries, fish farming, electricity generation, crop irrigation and dredging for transportation routes to name a few are among the reasons for the degeneration of this important waterway. These are issues that face many rivers on the European continent.

In this context, the regional conference 'River habitat restoration for inland fisheries in the Danube River basin and adjacent Black Sea areas' was held from 13 to 15 November 2018 in Bucharest, Romania. This event was organised by the Regional office for Europe and Central Asia of the Food and Agriculture Organisation of the United Nations (REU) in partnership with the International Organisation for the Development of Fisheries and Aquaculture in Europe (EUROFISH) and the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) and hosted by the Ministry of Agriculture and Rural Development and the Ministry of Waters and Forests of Romania.

This event offered a unique opportunity for stakeholders to share their experience and help raise awareness of the issues affecting the sustainability of the Danube river and Black Sea regions. Over 100 attendees from local community level fisherman and farmers to academics, and national and EU level representatives interacted with to 27 invited speakers. Each speaker focused on one of four session subjects 'Valuing Inland Fisheries Resources', 'Conservation and Management', 'Regulatory Framework' and 'Shared Country Experiences'. A round table discussion concluded the conference, with all participants invited to express their thoughts and discuss the issues affecting sustainability and inland fisheries in the Danube river basin and the Black Sea. The key findings from this concluding discussion have been complied into a list of conference recommendations included in this publication.

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Acknowledgements

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Special gratitude is also extended to the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) Members and all national representatives, without whom it would not have been possible.

This work has also benefitted from the contribution and inputs of the Danube Sturgeon Task Force (DSTF), the International Association for Danube research (IAD), The Government of Romania, and from all speakers and participants.

Abbreviations and acronyms

AS	Alien Species
ADDBR Reserve	Administration of the Danube Delta Biosphere
AMBER Rivers	Adaptive Management of Barriers in European
AZA	Allocated Zones for Aquaculture
CCRF	Conduct for Responsible Fisheries
CITES	Conservation on International Trade in Endangered Species of Wild Fauna and Flora
CSO	Civil Society Organisations
DAIS	Danube Region Invasive Alien Species Network
DRB	Danube River Basin
DRE	Dam Removal Europe
DSTF	Danube Sturgeon Task Force
DWA Waste	German Association for Water, Wastewater and
EAF	Ecosystem Approach to Fisheries
EIFAAC	European Inland Fisheries and Aquaculture Advisory Commission
EMFF	European Maritime and Fisheries Fund
EU	European Union
EUROFISH	International Organisation for the Development of Fisheries and Aquaculture in Europe
EUSDR	EU Strategy for the Danube Region
FAO	Food and Agriculture Organization of the United Nations
FLAG	Fisheries Local Action Group
GHG	Green House Gases
HAKI	Research Institute for Fisheries and Aquaculture, Hungary
IAD	International Association for Danube research
IAFS	Invasive Alien Freshwater Fish Species
ICPDR	International Commission for the Protection of the Danube River
ICZM	Integrated Coastal Zone Management

IFI	Inland Fisheries Ireland
IUCN	International Union for Conservation of Nature
KIT	Karlsruhe Institute of Technology
LDR	Lower Danube River
MSP	Marine Spatial Planning
MEASURES	Managing and Restoring Aquatic Ecological Corridors for Migratory Fish Species in the Danube River Basin
NGO	Non-Governmental Organisation
NIMRD	National Institute for Marine Research and Development, Romania
PIT	Passive Integrated Transponder
PSAT	Pop-up Satellite Archival Tags
RBD	River Basin Districts
RBMP	River Basin Management Plans
S-ADC	Shellfish Aquaculture Demonstrative Centre
SDG	Sustainable Development Goal
WFD	Water Framework Directive
WGBS	Working Group Black Sea
WSV	Federal Waterways and Shipping Administration, Germany

Executive summary

Reaching from the Black Forest all the way to the Black Sea, the Danube River is the second longest river on the European continent. Only the Russian Volga is longer than the Danube. This river is a flagship for European inland waterways and was thus chosen as the focus of this Conference. There are many rivers and their tributaries in the countries of Europe, Caucasus and Central Asia that provide aquatic biodiversity and valuable freshwater resources. Unfortunately, most of these rivers face environmental challenges both man-made and from external drivers. This is of concern from a conservation perspective, but also as inland fisheries are an important resource for food security, riparian livelihoods and rural development.

The United Nations Sustainable Development Summit approved the 2030 Agenda for Sustainable Development on 25 September 2015. The "2030 Agenda" is a follow up to the Millennium Development Goals and includes 17 Sustainable Development Goals (SDGs) with targets and indicators of achievement under each SDG. Governments have committed to achieving these targets. FAO as a specialized agency of the United Nations is responsible for monitoring relevant indicators under SDG 2 (zero hunger), SDG 5 (gender equality), SDG 6 (clean water and sanitation), SDG 12 (responsible consumption and production), SDG 14 (life below water) and SDG 15 (life on land). FAO also provides technical assistance to Governments to achieve all related targets of the SDGs.

Why is the 2030 Agenda important in the context of this Conference on inland fisheries? SDGs 1 and 2 aim to eliminate poverty and attain zero hunger. Fish is food! Global fish consumption per capita in 2016 reached 20.3 kg per year. This figure was 9.0 kg in 1961, representing an average annual growth of 1.5 percent. Evidence shows that this trend is continuing. For landlocked countries in Europe and Central Asia, this fish consumption statistic is shockingly low, below 5 kg per capita. With extensive river and lake resources available on the European continent, the potential for inland fisheries to contribute to healthy diets and regional food security is high. World population of 7.3 billion is expected to reach 9.7 billion by 2050 (World Bank). These additional people will require food. Since 1961, the global apparent food fish consumption has grown twice as fast as population growth, demonstrating that the fisheries sector is crucial in meeting FAO's goal of "A world without hunger and malnutrition". With the triple burden of malnutrition, fish is a nutritious and low-fat protein source that provides essential micronutrients that is especially important for European and Central Asian populations. Increasing household consumption of fish for better health will require increased supplies in the region.

Total fish production reached an all-time high of 171 million tonnes in 2016 (FAO, 2018b), of which 88% was utilized for direct human consumption. This establishes a new all-time record in the volume of fish for human consumption of 151 million tonnes, 16% growth since 2011. This can be

attributed to relatively stable capture fisheries production, reduced loss and waste, and significant aquaculture growth. Global capture fisheries production was 90.9 million tonnes in 2016, the marine catch was 79.3 million tonnes and global inland catch was 11.6 million tonnes. It is well known that inland fisheries statistics are unreported or under-reported, so the actual harvest from inland fisheries should be much higher. A question to be addressed by this Conference is: how accurate are statistics on inland fisheries production for Europe, Caucasus and Central Asia? Do we have good statistics on inland fisheries production and economic valuation of the sector? If not, how can policymakers make informed decisions about allocation of freshwater resources between competing uses.

FAO's commitment to leaving no one behind is a call to focus action and cooperation on achieving the core ambitions of the 2030 Agenda for the benefit of all, including inland fishers, their families and their communities. SDG 8 is on decent work and economic growth. Inland fisheries are an important source of direct employment and income to an estimated 16.8–20.7 million people globally. Nearly 60 million people are employed along the inland fisheries value chain. As most inland fisheries are small scale, they typically create more employment than industrial scale fisheries, and the World Bank has shown that half of global workers in fisheries and aquaculture value chains are women.

Recreational fishing adds to the global economy and is valued at 65 to 79 billion U.S. dollars. Sport fishing has grown, especially in Europe, and this activity not only provides health benefits to the fishermen, it also contributes to the tourism sector of local communities in the form of jobs for hospitality services, transportation, and fishing equipment. The value of recreational fishing to production and consumption is under-estimated, especially when the catch is not released but consumed by the household of the fisher. Angler Associations provide social and recreational benefits to their members, but they also generate positive externalities to their communities by advocating on behalf of inland fisheries and the river and lake habitats that support these fisheries.

Inland fisheries are environmentally friendly when compared to other forms of food production, especially terrestrial meat. Green House Gas (GHG) emissions from global inland fisheries are estimated at 43 million tonnes, mostly from gear construction and fuel use. If inland fisheries did not exist and this sector's contribution to food supply was replaced by:

- aquaculture, GHG emissions would increase by 22.3 million tonnes.
- beef production, GHG emissions would increase by nearly 1 billion tonnes (0.82).
- rice, GHG emissions would increase by 9.3 billion tonnes.

It is apparent that inland fisheries are more carbon friendly than other food production systems and this highlights the importance of managing our river and lake habitats for healthy fisheries.

The FAO Code of Conduct for Responsible Fisheries (CCRF), although over two decades old, is still the premier document for guiding sustainable management and use of fisheries resources. The CCRF is comprehensive and challenging for many countries, who report on implementation of the Code to the FAO Committee on Fisheries in biennial questionnaires. Many countries report that they are not able to implement all the recommendations in the CCRF. In particular, data collection on inland and recreational fisheries production and inland stock assessments have been especially elusive, even in Europe. The lack of accurate comprehensive data on inland fisheries prevents adoption of sound management plans for freshwater resources, especially for the highly migratory species like sturgeon, salmon and eel, and shared stocks in lakes that cross international boundaries. Without adequate data collection, it is not possible for policymakers to place appropriate value on the sector to manage the fisheries resources. Undervaluation of the sector is one of the factors that allows for competing uses to take precedence at national level, such as construction of hydroelectric dams, flood control, irrigation for crops, dredging for transport routes, and gravel removal from fish spawning grounds. Full valuation of inland fisheries and international collaboration on river management are priorities to safeguard these fragile eco-systems and the communities that depend on them.

An important aspect of the UN Agenda 2030 is the need for all stakeholders to take part in achieving these national targets, namely under SDG 17 on Partnerships. A good example is the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), which is an FAO regional fisheries body. EIFAAC promotes shared research between Members' institutions and provides overarching policy advice for improved management of inland freshwater resources of Europe. Priority issues identified by EIFAAC Member countries are: 1) Management-related issues and principles for inland fisheries and aquaculture; 2) Protection and restoration of the fresh water aquatic environment and species; 3) Social and economic aspects of inland fisheries and aquaculture; and 4) Adaptation of inland fisheries and aquaculture to climate change. EIFAAC holds Sessions every two years with its 34 Members, including the European Commission. EIFAAC hosts International Symposiums prior to the sessions on a timely topic relevant for European fisheries, i.e. recreational fishing (2015), climate change (2017), and Food safety and conservation in inland fisheries and aquaculture (2019).

In conclusion, the aim of this Conference is to highlight the above shortcomings and areas that need more research, and to provide realistic policy recommendations that are evidence-based to guide us on the way forward. Through this FAO publication we will further disseminate the key findings and recommendations of the speakers and participants on habitat restoration for inland fisheries.[1]

[1] Executive summary is derived from the keynote speech given by Ms Victoria Chomo, Senior Fisheries and Aquaculture Officer, FAO Regional Office for Europe and Central Asia, Budapest, Hungary.

Participants from the conference

Introduction

OPENING OF THE CONFERENCE

The conference was officially opened by Ms Adriana Petcu, State Secretary of the Ministry of Waters and Forests, Romania. She acknowledged the delegates as well as all those who were involved in organising the conference. She outlined the importance of such an event to create awareness of the need to restore the Danube's habitat, which is essential for implementing the European Union's Water Framework Directive (WFD). She recognised that a past focus on social and economic development had negatively impacted the river and its diversity of species.

She emphasised efforts by Romania to protect and improve river habitat and biodiversity in the Danube catchment area, focusing on several pieces of legalisation to this effect. She also highlighted Romania's cooperation with neighbouring countries and external partners to restore longitudinal river connectivity. In addition, she emphasised Romania's commitment to the WFD.

ADDITIONAL OPENING REMARKS

Mr Nicolae Dimulescu, President of the National Agency for Fisheries and Aquaculture, Romania in his opening statement reiterated the focus that Romania has on improving the Danube river catchment habitat, especially in relation to the sturgeon. He also stressed the importance of multilateral efforts when facing such complex issues and the need to ensure the survival of not only the sturgeon, but all users of the water, from fish to people now and for future generations.

Mr Alexandru Potor, State Secretary, Ministry of Agriculture and Rural Development, Romania focused on the challenges of reconciling the protection and conservation of fisheries with the socio-economic importance of the fishing industry. He highlighted the collaboration between Romanian ministries to take a balanced and long-time approach to this issue and concluded by reiterating the ministry's commitment to the European Union's sustainability targets.

Ms Victoria Chomo, Secretary of EIFAAC and Senior Fisheries and Aquaculture Officer, FAO Regional Office for Europe and Central Asia, Budapest, Hungary presented a speech on behalf of Mr Audun Lem, Deputy Director, FAO Fisheries and Aquaculture Department who was unable to attend. His speech pointed out that the conference did not only focus on Sustainable Development Goal (SDG) 14 (Life under Water) but supports many other SDGs in much the same way that management and restoration of a river basin supports and involves a number of

stakeholders. He also stressed the importance of an event that focused on inland fisheries and river restoration, which do not receive the attention or support they deserve by Governments and intergovernmental bodies.

Ms Aina Afanasjeva, Director, EUROFISH, in her opening remarks, thanked all those involved and went on to detail the socioeconomic and cultural importance of the Danube river basin and the Black Sea. She too stressed the importance of joint efforts between countries and stakeholders to improve the fisheries sector, aquaculture, and river habitat restoration in the Danube basin.

Ms Victoria Chomo delivered the Keynote Address 'Role of inland fisheries for food security, livelihoods and rural rejuvenation'. Setting the tone for the conference, Ms Chomo identified the environmental challenges currently faced by not only the Danube river but European rivers in general. She stressed the importance of sustainable river use and its connection to inland fisheries. She emphasised the importance of inland fisheries and its role in achieving the Sustainable Development Goals (SGD). Not only does inland fisheries contribute to targets under SDG 14 but contributes to many other targets under SDG 1, 2, 3, 5, 6, 8, 12, 13, and 15. She highlighted many scenarios where inland fisheries benefit both human health and environmental services.

Recognising the shortcomings faced by inland fisheries and how these prevent the adoption of sound management plans for freshwater resources, she challenged the conference participants to highlight these shortcomings and provide realistic policy recommendations that are evidence-based.

To conclude, she provided an example of Sustainable Development Goal 17 (Partnerships). The European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), which is a FAO regional fisheries body provides guidance and scientific-based advice for improved management of inland fisheries resources of Europe.

Conference Programme

During the three-day conference, a total of 27 presentations divided into four sessions were made over the two days, with the third day reserved for a field trip to the Nucet Research and Development Station. The sessions were 1. 'Valuing Inland Fisheries Resources', 2. 'Conservation and Management', 3. 'Regulatory Framework' and 4. 'Shared Country Experiences'. After each session, the presenters and audience engaged in an open dialogue guided by a professional moderator. In a final Round Table the audience, speakers, and other experts discussed the key findings of the conference and identified a list of recommendations to be delivered to policy-makers. The recommendations are documented in session 5 of these proceedings.

SESSION 1: VALUING INLAND FISHERIES RESOURCES

Presentation title: Sturgeon 2020 – how can a conservation program bring benefit to local communities?
Presented by: Cristina Sandu, Coordinator, Danube Sturgeon Task Force (DSTF), Romania

Summary of presentation

The adoption of the EU Strategy for the Danube Region (EUSDR) represented a corner stone for sturgeon conservation in the Danube Basin. In January 2012, representatives of governmental and non-governmental organizations from the Danube Region have established the Danube Sturgeon Task Force (DSTF) in the frame of EUSDR Priority Area 6 (Biodiversity), to support the achievement of the EUSDR target "to ensure the revival of Danube sturgeons and other indigenous fish species by 2020". As a follow-up, the Program Sturgeon 2020 (Sandu, Reinartz and Bloesch, 2013) was elaborated based on the Sturgeon Action Plan (Bloesch *et al*., 2005). Several projects were launched to foster its implementation, in 2016 the program becoming one of the success stories of the EUSDR. This program combines environmental aspects with social and economic measures aiming not only to bring benefit to sturgeons, but also to the local communities affected by the conservation measures.

The habitat quality plays an essential role for the aquatic communities. Rivers provide home to billions of aquatic organisms, from bacteria to fish and waterfowls, generating numerous benefits and supporting the life of human society. However, life in the aquatic environment can be easily affected by e.g. water pollution, presence of the invasive alien species, overexploitation of natural resources, climate change, hydromorphological alterations, etc. In particular, lateral and longitudinal connectivity disruption, preventing access to essential habitats, have impacted dramatically the fish populations. One of the most affected groups were the long-distance migratory sturgeons, whose conservation status declined drastically in the last decades to critically endangered.

The conservation measures required a fishery ban in the Lower Danube countries, affecting the fishermen communities who used to base their livelihood on sturgeons. To compensate their loss the program Sturgeon 2020 aims to support the development of alternative livelihood for local communities such as: aquaculture for fish and other aquatic species, small scale production of bio-products, eco-tourism, etc. Experiences in other countries have shown that aquaculture, recreational fishery and eco-tourism can bring more income than commercial fishery, allowing also time for recovery of the wild fish stocks and maintaining the genetic diversity.

To support the revival of the fish stocks, one key measure is the restoration of their access to lost habitats, essential to fulfil their life-cycle. At the same time, restoration of river habitats and functionality contribute to the

restoration of some of the services provided by the river systems, yielding also higher benefits for the human society compared to the costs, as proven by numerous examples (COM 155, 2013):

- In Germany, the restoration of river Elbe floodplain (dikes shifting, decreasing impact from agriculture, construction of fish ladders) resulted in benefits 2.5–4 times higher;
- In Denmark, the restoration of Skjern River floodplain nearly doubled the benefits by reducing water processing costs and increasing fishing, hunting and recreational opportunities;
- The restoration of river Gardon (France) from pollution, hydromorphological alterations, generated a cost-benefit ratio of 1.9;
- The habitat restoration works of Fishing Wales in UK resulted in increased number of salmon and trout in the rivers, generating jobs, tourism and increasing incomes for local communities.

Worldwide, there is an increasing interest for fish products, as emphasized by FAO, with fish production increasing constantly from approximately 70 million tonnes in 1976 to over 170 million tonnes in 2016 (FAO, 2018b). With most of the marine stocks depleted by overexploitation, the inland fishery and aquaculture could provide a viable alternative for fish production - for instance, in low income countries, inland fishery provides livelihood to over 60 million people (FAO, 2014). However, for a sustainable development of the inland fishery, several principles should be respected (Cooke, *et al,* 2016): (1) invest more in proper valuation and assessment of benefits provided by natural aquatic systems, (2) build capacity and incentives for effective governance, (3) integrate inland fishery in water resources management.

The further regional development in the Danube area should therefore consider several aspects:

- Create the frame to integrate inland fishery needs in the management of water resources;
- Assess the benefits provided by river systems (valuation of ecosystem services) and quantify the value of inland fishery for the Danube Region;
- Reduce the pressure of inland fishery to allow the recovery of wild stocks;
- Facilitate recreational fishery to increase the income for local communities;
- Enhance aquaculture development (fish, mussels, etc.);
- Enhance animal welfare in aquaculture to ensure high quality products.

These measures, combined with the other socio-economic measures foreseen by the program Sturgeon 2020, could provide twofold benefits, by supporting the local communities to develop alternative activities to commercial fishery and engage more in the conservation activities, allowing the wild populations more time to recover.

Presentation title: **Restoration of river connectivity in Romania**
Presented by: **Gheorghe Constantin, Ministry of Waters and Forests, Romania**

Summary of presentation

The presentation focused on the activities undertaken within the last 10 years in Romania to restore river continuity and to ensure the fish migration corridors. This aspect is a very important issue not only in Romania but at the Danube River level and therefore is reflected in the last Danube River Management Plan developed in accordance with the Water Framework Directive. In this plan the barriers which interrupt river continuity as well as those passable or not passable by fish at the level of 2015 were highlighted. Also, the plans include a program of measures for reaching the “good water status”, which are related to the fish migration and fish spawning. In this respect there are measures for floodplain or/and wetlands restoration, fish passages and limitation of hydromorphological deterioration within the transport projects. In the National River Basin Management Plan three types of measures were included: for longitudinal connectivity, for lateral connectivity and for restoring hydrological regime. In total, 18 measures have been identified with a cost of 2 million EUR and another 600 000 EUR were provided for further studies. Based on the studies, up until now, three national level restoration works have been proposed in the Someș River Basin. In relation to the Danube River Basin the greatest concern for fish migration, particularly for sturgeons, is represented by Iron Gates I and II dams. To explore the feasibility to overcome these barriers, a project “*Possible solutions for fish migration at Iron Gates I and II*” was created during 2013–2014 with the support of Dutch Partners for Water. Within this project pre-feasibility solutions were identified but there is now a need for feasibility studies and funding from the EU. Partners involved in this project are ICPDR, Romania and Serbia government agencies.

Lastely, the MEASURES project was introduced. This project has three specific objectives:(1) Identification & mapping of migratory fish habitats, (2) Development of a harmonized & improved strategy (including prioritization) for the re-connection of migratory fish habitats to secure and re-establish vital ecological corridors in the DRB, which will be implemented into policy and management plans and (3) Provision of a strategy to conserve Danube sturgeon species, including an appropriate design of broodstock facilities. This project involves partners from eight Danubian countries, started in June 2018 and will last for three years. The water management authorities will continue to work for the rehabilitation of the water bodies and will cooperate with the fishery authorities to have a rich living water.

Presentation title: Non-native crayfish species in the region and their effects on the environment

Presented by: Antonín Kouba, Research Faculty, University of South Bohemia, Czech Republic

Summary of presentation

Freshwater crayfish are the largest and among the longest-lived freshwater invertebrates that have prominent roles in the ecosystem. They are considered keystone species and ecosystem engineers. Their value to humans is unquestionable in many aspects. Distribution of over 670 crayfish species known is worldwide, with the exception of continental Africa and Antarctica. Crayfish biodiversity hot spots are represented by North America and Australia. The number of species native to Europe is low, being represented by only five clearly distinct species. All these are native to at least some parts of the Ponto-Caspian basin. Typical species distributed in Eastern Europe are the narrow-clawed crayfish *Pontastacus leptodactylus sensu lato* and thick-clawed crayfish *P. pachypus*. The number and abundance of native crayfish stocks have been declining for more than 150 years, among other as a result of introduction of an oomycete *Aphanomyces astaci*. This pathogen is undoubtedly one of the most devastating diseases in European freshwaters, often known as a crayfish plague. Due to declines of native crayfish populations, several non-native crayfish originating from North America (spiny-cheek crayfish *Faxonius limosus*, signal crayfish *Pacifastacus leniusculus*, and red swamp crayfish *Procambarus clarkii*) were introduced into Europe as alternative species with the aim of their utilisation in fishery and aquaculture. These are already well settled and widespread in many European countries. Unfortunately, in the course of time, it became obvious that North American crayfish species are non-symptomatic vectors of this disease, to which all crayfish not originating from North America are highly susceptible.

The pet trade of crayfish has developed into an alternative pathway for further introductions. Now, eight non-native crayfish species have been established in Europe presumably originating from the pet trade. Considering that fewer non-native crayfish species have become established in Eastern Europe, this region was presumed relatively safe for native crayfish. Nevertheless, recent confirmation of two distant marbled crayfish *Procambarus virginalis* populations in Ukraine is particularly alarming. Pet trade survey in several countries of the region (e.g. Hungary, Ukraine, Russia, and Kazakhstan) revealed a range of traded non-native crayfish species. At least some traded species pose features enabling them to establish in the region, as supported by new distribution data. Besides negative effects on native crayfish, detrimental impacts on entire ecosystems are expectable. The red swamp crayfish and marbled crayfish are probably the most problematic in this view. Considering that eradication of already established crayfish is costly and feasible only under a very narrow range of specific conditions, the main attention should be focused on the prevention of intentional as well as accidental introduction. Thus, education of public in general, should be a priority.

Presentation title: The invasive *Rapana venosa* and alternative fishing methods and species in the Black Sea
Presented by: Luchian Florin, Dobrogea North Maritime Fisheries Federation, Romania

Summary of presentation

Dobrogea North Maritime Fisheries Federation is a relatively new federation, but its members have a long history in fishing and processing of products from fish to molluscs. We catch approximately 3 000 tonnes from the Black Sea annually, predominantly *Rapana Venosa*. This accounts for about 30% of the total annual catch for Romania. We also process approximately 2 500 tonnes of fish and other fish products annually.
Our main objectives are:

- Promoting sustainable fishing activities by our members in full compliance with the conservation policy, as laid down in particular in Regulation (EU) No. 1380/2013 and environmental law, respecting social policy;
- Supporting projects and applications for European funds to fishermen, including the improvement of infrastructure needed to develop fishing industry such as fishing ports, landing sites, fishing shelters, premium hubs sale and upgrades on current infrastructure;
- Representing the interests of the Federation towards domestic or international bodies and other associations for that our members work with.

Brief history of *Rapana Venosa* in the Black Sea

In the marine area of ADDBR (Administration of the Danube Delta Biosphere Reserve), where the saltwater is predominant, we find large populations of molluscs including: *anadara inaequivalvis, mya arenaria, chamelea gallina, mytilus galloprovincialis* and *donax trunculus*. It is here that *Rapana Venosa* is also found. Latest tests have shown that *Rapana Venosa* has populated to such an extent, that in 2017 in the waters between depths of 20 m (ARBDD limit) and 30 m, within southern part of the ARBDD approximately 9 000 tonnes of *Rapana Venosa* were harvested. Therefore, we it is possible to calculate the approximate density of *Rapana Venosa* between 20 m to 0 m, which is actually the preferred habitat of *Rapana Venosa.*

Situation of *Rapana Venosa* in the ARBDD Marine Area

This species is having a major negative impact on the environment, as follows:

- It has drastically reduced some species of molluscs, namely: *Cerastoderma edule*, and Stridia (*Ostrea Edulis*). Interestingly, it has preferences similar to that of humans. It selects the species of molluscs in order of economic value, leaving behind small non-commercially valuable species like *anadara inaequivalvis* and *mya arenaria* (species that are found in large quantities);

- It has positively influenced the turbidity of the water but negatively the purity by decreasing the populations of the mollusc (*Mytilus Galloprovincialis*) that played an important role in filtering the water.

Proposal for measures to reduce its population

Considering that the volume of the *Rapana Venosa* biomass is so great, the only way to maximize the effectiveness in reducing it, in our opinion, would be to:

- Introduce trawl fishing for a limited period and within a specific area and depth (e.g. between 20 m and 10 m), with biomass verification before and after trawling;
- Promote alternative fishing techniques (hand dragged tools, dear boats, etc.) outside of this period. Including incentives for Rapana fishing in the ARBDD area.

Presentation title: Restoration of Ireland's valuable inland fisheries resource

Presented by: Cathal Gallagher, Research and Development for Inland Fisheries, Ireland / EIFAAC

Summary of presentation

Ireland's inland fisheries resource supports a unique combination of fish, fauna and habitats influenced strongly by its geographical location and glacial history. This resource provides social, well-being and economic benefit to a wide group of stakeholders including the angling sector. It is estimated that angling in Ireland generates EUR 836 million annually for the Irish economy while supporting over 11 000 jobs, many of which are in the rural areas.

Recent decades have seen a dramatic intensification of agricultural practice, increased industrialization and urbanization, all of which have impacted negatively on Ireland's lakes and rivers. These impacts are further inflated by climate change and the introduction of invasive species. Inland Fisheries Ireland (IFI) is tasked with the conservation and protection of the inland fisheries resource which includes the assessment and mitigation of these impacts.

The assessment of hydro morphological pressures in water bodies is a key element of Ireland's Water Framework Directive (WFD) second cycle plan. To support this plan and empowered by its core functions IFI is actively involved in assessment, restoration and monitoring of catchments impacted by arterial drainage and by barriers. This presentation explores the methodologies and techniques used in the delivery of these riverine restoration programmes with a strong focus on the restoration of fish communities.

Presentation title: **An overview of the European trade focusing on the Danube species**
Presented by: **Ekaterina Tribilustova, EUROFISH, Denmark**

Summary of presentation

The Danube river is known for being the most multinational river basin in the world, passing through 10 countries along its course: Germany, Austria, Slovakia, Hungary, Croatia, Serbia, Bulgaria, Romania, Moldova, and Ukraine. The Danube river is also known to have the highest fish species richness in Europe, 102 species ever reported.

The presentation highlighted European trade of fish and seafood product, including species related to the Danube river basin. Trout, carp and eel are the species most internationally traded, while other species including Northern pike, pike, burbot, tench and asp are locally traded and do not appear in the international or regional trade markets.

Seven European countries, which are located along the Danube river basin, including Germany, Austria, Slovakia, Hungary, Croatia, Bulgaria and Romania exported 7 200 tonnes of trout and 6 800 tonnes of carp in 2016. Although, exports of trout declined 23% between 2013 and 2017, resulting in a larger volume of trout available on the domestic markets, the export of carp nearly tripled. During the same period, those countries imported nearly 7 900 tonnes of carp products and over 49 400 tonnes of trout, increasing its import of both species by 45% and 8% respectively. Tarde of eel products followed negative trends in both imports and exports due to their status of being “overfished” or otherwise a depleted fish species. In 2017, the mentioned group of countries exported 642 tonnes of eel, while imports of ell exceeded 850 tonnes.

Key points identified from session 1

- Some presenters emphasized the need for more focus on protection and restoration of biodiversity, especially with regard to endangered migratory species such as sturgeons and eels, rather than focusing primarily on exploitation of river ecosystems;
- Policies should help riparian communities to adapt to new and potential pressures such as invasive species and climate change;
- The need to identify alternative activities, such as new fisheries and/or new methods in response to the changing environment;
- Develop new trade opportunities through the diversification of products and to reduce dependence on over-utilised species such as sturgeons and eels.

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Inland waters are of significant environmental importance

SESSION 2: CONSERVATION AND MANAGEMENT

Presentation title: Ecosystem approach to inland fisheries
Presented by: John Jorgensen, Food and Agriculture Organization of the United Nations (FAO), Italy

Summary of presentation

The application of the Ecosystem Approach to Fisheries (EAF) in an inland fishery context, is a way to promote broader consideration of the linkages between components in an ecosystem and fisheries. It is a process that facilitates trade-offs between different stakeholder's priorities, balancing human and ecological needs. It provides increased support for better governance and promotes stakeholder participation – better communication and trust.

The fish resources, upon which inland fisheries rely, are not only vulnerable to fishing pressure, but equally depend on good water quality, adequate water quantity at the right time, healthy habitats and ecosystem integrity. Therefore, although inland fisheries do not consume water resources nor affect their quality to any significant extent, inland fisheries are in direct competition with a range of other actors that either extract water for a variety of uses, affect environmental flows, degrade habitats or contaminate the water. It is thus not possible to address the sustainability of inland fisheries in isolation from the rest of the ecosystem.

“Fisheries management” is generally considered “An integrated process that aims to control fishing activities to improve the benefits that society receives from harvesting fish”. However, this is a one-sided focus on the fishery activity and does not view the fishery as it is embedded within the broader ecosystem, which inevitably means that classical management approach for inland fisheries runs into problems, when confronted with threats and issues beyond the control of fishers and managers. The reality is that sustainable management of inland fisheries is actually largely outside of the hands of the fisheries sector. The sector is often poorly positioned to influence decision-making within water-management, land management, and broader developments related to landscape developments.

In order to strive for sustainable inland fisheries, the sector must therefore seek ways to become accommodated within such decision-making processes which govern other sectors. This requires clear articulation of the needs of inland fisheries for water and broader ecosystem health, as well as the underlying economic, environmental and ecological justification for this.

The EAF is an emerging paradigm that goes beyond the fish-centric view that has typically dominated thinking until now.

This holistic approach at several scales, enables the recognition of larger-scale, longer-term issues and their solutions across sectors. It reduces conflicts, especially between different fishery sub-sectors and between fisheries and other sectors. Good planning and momentum fosters can trigger support from governments, donors and NGOs, and help access financial resources for fisheries.

EAF shifts the focus towards understanding the importance of the interaction and connection between human activities and needs for food, income and livelihoods (incl. fisheries) and the requirements for sustaining the integrity of the aquatic ecosystem. This typically requires trade-offs, which inevitably means that some aspect of a production system is sacrificed, to accommodate another.

We must recognize that there is a wide range of societal objectives to be met by fisheries resources and aquatic ecosystems. The goal is therefore to improve human well-being and equity between the various stakeholders, whilst ensuring that the system that sustains these services is not irretrievably compromised. This requires engagement with a broader range of stakeholders to be involved in prioritization and management decision making.

We need to start by asking: What do we want to achieve and for whom and why?

Stakeholders can conveniently be divided into four groups according to their degree of dependence on the aquatic ecosystem and level of influence:

i) Highly dependent with little influence (inland fishers are found in this group). These people must be involved in EAF-inland discussions.
ii) Low dependence with little influence (people without a direct stake in water allocations). These people may not need to be directly involved but should be kept informed.

iii) Highly dependent with significant influence (e.g. Irrigation managers, commercial fishers and farmers, NGOs, recreational fishers). These people are essential to keep involved in the planning process.

iv) Low dependence with significant influence (e.g. leaders, politicians and conservationists). These people may have less interest in participating and may need to be convinced to support the management plan.

Inland fisheries are rarely considered as an important stakeholder in decision making regarding inland water management. Where inland fisheries are tangibly contributing to livelihoods and ecosystem services, it is the responsibility of the national fisheries authority to lobby for the sector's inclusion on its behalf. This requires a comprehensive analysis of the sector, its vulnerability, pressures/drivers and how it relates and interacts with other sectors. It may also require prioritization according to the benefits it provides to society.

EAF operates across different scales, at the lowest level, it may be a planning framework to aggregate fisheries management plans of communities within a broader watershed or water management framework. This sort of plan can be nested within broader-scale plans such as landscape management or river basin planning.

From a classical fisheries management perspective, the most logical would be to use a basin approach i.e. divide a major basin into manageable units of different sizes (e.g. fisher group, community, stream, sub basin, basin). But this may not necessarily coincide with the way planning is done in the sub-national context (e.g. village, district, provincial government). A nested EAF plan allows local details to be accommodated, as well as compliance with overarching national objectives and regulation. EAF does not stop with local and national planning. It can also be an effective tool for planning in transboundary context with supranational entities such as a River Basin Organization or a Lake Management Body.

Each step in the hierarchy play has its own focus and functions. At the governmental level, the focus is on setting the overall policy and regulatory framework for management and economic development. This could include a policy to roll out EAF planning at subsidiary levels. When working out a strategy for inland fisheries development, other related sectors, that impact inland fisheries through their activities, should be invited to participate. Equally, the competent agency for fisheries should actively seek involvement in developing strategies for other sectors.

The national framework would guide lower administrative levels on how to meet national policy targets. At the lowest administrative levels EAF planning can be more sector oriented (e.g. resolving intra-sectoral conflicts, regulating access, gear bans, closed seasons etc.), working with groups of fishers using a participatory co-management approach. However, even at this level there will be some requirement to interact with other sectors e.g. water management committees on sluice management, or crop producers to reduce pesticide use and run off. Typically, the fisheries agency facilitates EAF planning and negotiations, but other CSO or NGO actors can also facilitate the process.

An EAF process results in the development of a management plan through consultations with the primary stakeholders. These are context specific and no two plans will be identical, although often have quite similar objectives and actions.

The EAF plan starts out with some general objectives with roots in the framework of national strategies or international agreements to which the country adheres.

In the second step key issues, concerns and problems will be determined and prioritized and the risks assessed.

The third step will define the operational objectives and indicators and identify available management options to achieve them.

In the fourth and final step, the plan will become operational and be implemented.

Reality checks are needed in the process, to limit unrealistic expectations about what can actually be achieved with the actual resources and commitments of the stakeholders.

The plan should be implemented in small steps using precautionary principles. It is essential that management plans are adaptive and incorporate periodic revisions and adjustments. Progress should be reviewed periodically at least on an annual basis and adjustments made to the plan as required. Management measures must be compatible across sectors and jurisdictions, which requires constant exchange of information.

Challenges in implementing an EAF approach include differences between stakeholder expectations what can be achieved with the resources available.

There will always be a need to reconcile diverging objectives, and it is not always possible to identify win-win solutions. People relying on the extracting natural resources are commonly very poor and often have little flexibility in terms of their livelihoods, they will therefore not be willing or able to abandon any of their practices unless it brings immediate returns.

Stakeholders are frequently poorly organised, and some stakeholder groups may not participate sufficiently in the planning process. It is important to be conscious that in many settings there are visible as well as invisible hierarchies, based on culture, traditions, wealth and political influence. This will tend towards biased or inequitable decisions and outcomes.

Stakeholders may have limited education and low capacity to engage in the planning process, and staff from fisheries agencies may not have been trained in working with people.

There may be very little data and information available on the particular fishery/ecosystem in concern. However, while the management plan should build on the best available knowledge, this knowledge may well be provided by the stakeholders themselves.

Despite these challenges, the establishment of an EAF approach for planning and mobilising action for the management of inland fisheries can and does bring rewards. The act of engagement and stakeholder participation is an empowering action itself. Even limited progress can drive by-in and the benefits that flow from this cooperation include increased trust between fisheries and fishery managers, more appropriate regulations on fishing, greater compliance, data sharing and more effective communications.

Presentation title: **Adaptation to climate change in the Danube Region**
Presented by: **Roswitha Stolz, Ludwig Maximilien University, Germany**

Summary of presentation

Climate change is a cross-cutting issue, causing impacts to different sectors on a transboundary scale. The quality of water and its availability are very much at the heart of the expected changes and therefore requiring coordinated action in an integrative way.

Adapting to these changes, in addition with reducing greenhouse gas emissions, is of importance, because water is a key resource and essential for human living, culture, economy and ecosystems. Due to the transboundary character of water and its relevance for various issues and water-related sectors such as its role for biodiversity and the ecosystem, energy, transport, agriculture, floods and droughts, integrated river basin management is key for an approach to climate change adaptation. Nevertheless, adaptation strategies for the large river basins in Europe hardly existed until 2012. For the Danube as Europe's second largest river basin, in December 2012 the International Commission for the Protection of the Danube River (ICPDR) adopted the Strategy on Adaptation to Climate Change, being the first large river basin with a climate change adaptation strategy. This strategy is actually updated to take into account the developments within the basin and to consider the new scientific findings regarding climate change modelling and impacts.

In order to provide a basis for the development of an appropriate climate change adaptation strategy, a study funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, was carried out in 2017 by the authors in close cooperation with the ICPDR and experts and stakeholders from the Danube countries. In order to reach a common, basin-wide understanding of the scale and magnitude of climate change pressures and impacts on water resources, 73 research and development projects and studies dealing with climate change in the DRB or parts of the basin were compiled. The findings form the scientific knowledge base for the update of the ICPDR strategy on adaptation to climate change.

Climate Change Scenarios

In the future, temperature and precipitation are expected to change significantly in the Danube River Basin (DRB) and the developments of both are highly certain. But due to the large geographic coverage and the heterogeneity of landscapes and environment, the scale varies significantly. Future climate change is simulated under the representative concentration pathways RCP4.5 and RCP8.5. For the DRB the following temperature changes are calculated

from data of the EURO-CORDEX initiative relative to the period 1981–2010 (Status: September 2018).

- Increase of annual mean temperature between 1.1°C and 1.5°C until 2050 under RCP4.5
- Increase of annual mean temperature between 2.0°C and 2.6°C until 2100 under RCP4.5
- Increase of annual mean temperature between 1.3°C and 1.7°C until 2050 under RCP8.5
- Increase of annual mean temperature between 4.0°C and 5.0°C until 2100 under RCP8.5

In contrast to the increase in annual mean temperature, which can be quantified relatively precise, the annual mean precipitation shows little variation until 2050 under RCP4.5 and RCP8.5. Nevertheless, particular trends have been identified:

- Wet regions tend to become wetter and dry regions drier
- Strong precipitation gradient: northwest (high) – southeast (low)
- Highly certain significant changes in seasonality – wetter winters, drier summers

Water related impacts of climate change

Due to the expected changes in climatic conditions, water availability is likely to decrease in the southern and eastern parts of the DRB, whereas in the northern and western part it will remain unchanged or even increase. Changes in water availability can highly differ locally and regionally. Runoff is projected to significantly decrease until the end of the 21st century, whereas only little change is projected in the next decades. According to precipitation, changes in runoff seasonality are expected. Although the assessment of future extreme events like floods and droughts includes some uncertainty, it is consensus that extreme hydrological events will occur more often and more intense. It is frequently discussed in scientific publications that one of the most relevant climate change impacts in the DRB are the impacts on ecosystems and biodiversity. The expected basin-wide impacts on ecosystems and biodiversity can be grouped in direct and indirect impacts. Most striking is the increase in water temperature which leads to a decline in water quality. Other direct impacts are:

- an increase in extreme hydrological events;
- an increased number of invasive species;
- a decrease of summer discharge;
- a decreased number of native species.

Indirect impacts which may be similar engraving as the direct impacts are:

- the organic and chemical pollution from agricultural areas and settlements especially during flood events;
- the increased water extraction for irrigation;
- the changes in sediment transport;
- the river alterations to meet the navigation requirements.

From knowledge to action: a basin wide approach to adapt to climate change

To respond to the challenges created by climate change and the water related impacts, it is of great importance to consider the consequences which today's actions may cause during the next 50–100 years. This needs adaptation

strategies which are more ambitious than up to now. Nevertheless, there is consensus between the Danube countries and the European Union that adaptation to climate change is a central environmental policy issue. Most of the riparian countries have already developed National Adaptation Strategies which are also addressing water related issues, but the main focus is on measures which are not directly related to climate change and which are necessary anyway, like the improvement of measurement systems, the generation of data or better communication. Transboundary issues or planned synergies between neighbouring countries are not considered. But aquifer boundaries do not coincide with national borders and basin-wide concerted actions would create benefit for all partners. The ICPDR Strategy on Adaptation to Climate Change which will be updated by the end of this year is set to close this gap. Guiding principles provide support for the integration of adaptation to climate change into river basin management. Adaptation should start with a priority on win-win, no-regret and low-regret measures that are flexible enough for various conditions. The adaptive approaches require enough flexibility, so they can also be modified and adapted to local conditions. This way of working has the benefit of increasing resilience and decreasing vulnerability for the whole Danube ecosystem. The adaptation measures can be classified into five different categories, targeting different objectives. Preparation and technological measures are aiming on monitoring and infrastructural issues; eco-system based measures should enhance the capacity of eco-systems to adapt, whereas behavioural and managerial measures aim to raise awareness and to encourage knowledge exchange. Policy approaches are most important for basin-wide transboundary solutions. It is of primary importance for all measures that environmental implications and the conservation of biodiversity have to be taken into consideration.

Some eco-system based measures, which are indispensable for adaption to climate change, are:

- Sustainable management of land use practices for improving resilience, and for enhancing the capacity to adapt to climate change impacts;
- Implementation of green infrastructure to connect bio-geographic regions and habitats;
- Protection, restoration and expansion of water conservation and retention areas;
- Rehabilitation of polluted water bodies.

Presentation title: A century of sturgeon fisheries, Danube sturgeon where to?

Presented by: Tudor Ionescu, Research and Development Centre for Sturgeon, Aquatic Habitats and Biodiversity, Romania

Summary of presentation

The order of Acipenseriformes is represented by 27 species occurring throughout the whole Northern Hemisphere (Bemis and Kynard, 1997). The special importance of the Danube in this context is given by the fact that it represented the habitat for six of these species of sturgeon (Bacalbasa, 1997), and being among the last natural water habitats, where these species can be found and reproduce in the wild. Two Danubian species, the sterlet (*Acipenser ruthenus*) and the ship sturgeon (*A.nudiventris*) are fresh water species respectively forms, they live and reproduce in the Danube. Four species, the beluga sturgeon (*Huso huso*), the Russian sturgeon (*Acipenser gueldenstaedtii*), the starry sturgeon (*A. stellatus*) and the European sturgeon (*A. sturio*) are anadromous species, which reproduce in the Danube and live in the Black Sea. All these species are critically endangered or extinct in the Black Sea Basin.

These "living fossils" declared as “Danube Sturgeons – the flagship species of the Danube River Basin” (ICPDR, 2016) represent a unique component for the biodiversity of the aquatic ecosystem in this area, and their importance, both from a scientific and a socio-economic perspective, is indisputable at international level.

From ancient times, from Mesolithic, the inhabitants of the villages of the Lower Danube were fishermen, as it was revealed by archaeological research conducted in the area Schela Cladovei (Iron Gates). The experts concluded that the main occupation of the prehistoric inhabitants of that village was fishing and especially sturgeon which represented the main source of protein in those times. This was proven by the large number of bones collected from those archaeological sites. (Bartosiewicz, Bonsall and Sisu, 2008).

A common method of fishing in the 13th to 18th centuries consisted of blocking the Danube with wooden poles; only in the middle an opening was left so that the sturgeons could enter in a cage from where they were easily captured, as there was no escape. Evil Celebi, Ottoman traveller and historian, wrote in 1658 "in the vicinity of the Silistra Fortress (km 375), every day 70 big beluga, with lengths up to 8-9 Arsini (5.6-6.3 m) were caught, producing up to 10 Cântare of caviar-575 kg” (Decei, 1976).

The first law for fisheries was introduced by Gr. Antipa in October 7, 1896, and for the first time in the history of Romania, a period of "sparing" the sturgeons began as the minimum catch sizes were imposed (Daia, 1926). In addition to the prohibition and the minimum lengths admitted by this law, it was forbidden to fish with wooden poles. Since the beginning of the 20th century, the decline in sturgeon stocks has been observed.

The beginning of the 20th century marked for the sturgeons and the fisheries in general, the establishment of the first rules for the protection and conservation of sturgeons through concrete measures of management and with standards that organised fishing and the commerce of fish and fish related products. This

century was one that brought political and social transformations that influenced both directly and indirectly, through laws and legal provisions, the form of organisation of the Romanian fisheries. But one thing remained unchanged, the decreasing trend of the wild population of sturgeon.

The last century of sturgeon fishing (1904–2005), offers the first data about the exact quantities of sturgeon that were captured commercially in Romania, in the Danube and the Black Sea, due to the organisation of the Romanian fisheries. A simple analysis shows that after a century of commercial captures of Russian sturgeon species, in the area Sf. Gheorghe, numbers decreased 99.7%, from 10 570 specimens (145 000 kg) during the period 1903–1904 to just 28 fish (550 kg) during 2003–2004. In the case of the beluga the quantity of the commercial fishing in the Black Sea decreased 97%, from 4 254 specimens (230 000 kg) in 1903–1904 to just 111 fish (3 400 kg) in 2003–2004. (Antipa, 1909; MPADR, 2006). Comparing the quantities of sturgeon fished during the period 1920–1924 with the quantities caught in 1998–2005 in Romania, it can be noticed that in the first period the average quantity per year was 439 tonnes and decreased to 90 tonnes per year during the last period. The same situation can be observed regarding the annual production of caviar, that decreased from 17 tonnes/year to 3.4 tonnes exported/average/year (Daia, 1926; CITES, 2017). Worldwide, the captures of sturgeon from fishing had the same drastic decreasing trend in the last century as in Romania. In 1978 the fished quantity reached approximate 32 tonnes, in 2016 the fished quantity and reported of sturgeon worldwide decreased to 2.2 tonnes. (FAO, 2018a).

In the case of Danube sturgeon, the natural productivity decreased as it is affected by many factors: dams, breeding site alteration, pollution, chemical changes of Danube water, alien species, with the biggest impact being large scale mortality caused by fishing. Overfishing, that was practiced in the last centuries without a sustainable vision, diminished the stocks of spawners and juvenile (subadults). This was possible due to the lack of legal measures and by the errors in the legal provisions. From 1886 to 1974, the Romanian legislation stipulated minimum measurements (dimensions) for the captures which were too small (for example the minimum dimension (total length) of capture for beluga was 122 cm, the equivalent of a specimen which had 5–6 years). This created the permission to capture legal and commercial subadults specimens. During the years 1955, 1956, 1961, 1962, 1967 and 1968 the total of 20 610 of beluga specimens captured commercially in the Black Sea, Sf. Gheorghe area, 81% were subadult, and the total medium lengths decreased from 220 cm in 1955 to 193 cm in 1968.

The phenomenon of poaching and bycatch was encountered in Romania, especially after the fall of communism (1989) when the transition to capitalism allowed illegal fishing and trade with sturgeons and sturgeon products until 1997 when Romania joined CITES. From this year the phenomenon of poaching has been reduced; however, it persisted after 2005, when the Romanian law banned the sturgeon fishery. It’s evident that the bycatch is more frequent than poaching.

It is necessary to discover/analyse the causes that directly and indirectly affected aquatic habitats and wild sturgeon populations, as well as to research /understand the sturgeon life-cycle including specific behaviour at all

development stages, to identify the conditions indispensable for developing optimal solutions for the recovery of sturgeon populations in the Black Sea Basin, on short, in the future, to treat causes rather than effects. We must urgently and quickly establish “a live gene bank”, a special facility dedicated to ensuring the future of these species by preserving genetic biodiversity because the Danube has almost lost half of the sturgeon species.

By correlating the historical data with research from the past years which has monitored the survival and spreading in the Black Sea of the sturgeons populated experimentally in the Danube (200 000 young sturgeons) and with monitoring of the sturgeon natural reproduction from the Danube river it can be concluded that at this point it is mandatory to apply concrete measures, direct and fast for these species of fish in order to ensure their preservation.

Presentation title: Habitats of sturgeons in the Lower Danube River and the North Western Black Sea: status of knowledge and perspectives for restoration
Presented by: Radu Suciu, DSTF and IAD, Romania

Summary of presentation

Since ancient times the Danube was known for its most valuable fish, the sturgeon. Out of the six-initial species of sturgeons, historically known to live in the Danube River, today only four species still survive and reproduce in its lower reach, downstream of the Iron Gate dams. Three of these species, the beluga sturgeon (*Huso huso*), the Russian sturgeon (*Acipenser gueldenstaedtii*), and the stellate sturgeon (*A. stellatus*) are anadromous, long-migratory fish, living from the second year of their life to adult hood in the North Western Black Sea but migrating for spawning in the Danube River. Only one of the still existing species, the sterlet (*A. ruthenus*) spends its whole life cycle in freshwater but migrates for spawning, feeding and over-wintering to characteristic habitats located in the Danube or in its large tributaries. Due to their meat and roe (caviar) sturgeons were always the most important and valuable fishery resource of the Danube River.

As in all species of plants and animals, the survival of sturgeons in the wild, to this day and in the future, depends on the existence of undisturbed, functional habitats, to which these species adapted over millennia. It is increasingly believed that sturgeons have developed survival strategies of their early life stages, fertilized eggs, free embryos, feeding larvae, fry and fingerlings, adapted to the particular conditions of their homing rivers (Kynard, Bronzi and Rosenhal 2012).

All sturgeon species have in common the benthic feeding and their preference for spawning on hard substrate, where their fertilized eggs are protected, hidden in crevices. Additionally, functional spawning habitats for sturgeons require a moderate water flow (0.4-0.8 m/sec) and a certain, minimum water depth. Danube sturgeons are deep water fish spending all their life near the bottom of the river or sea. Even in the Black Sea, juveniles, and adult sturgeons alike, spend their life on the bottom in continental shelf areas, or offshore at water depth exceeding 5 m, the average visibility limit in this low salinity sea (Suciu et

al. 2015). To find their native spawning sites, meeting these conditions, sturgeons migrate very long distances in the Danube River and its many large tributaries (Prut, Siret, Olt, Jiu, Tisza, Sava, Drava and Mura, Vah, Morava, Inn), sometimes over 2 000 km (Antipa 1909; Holcik 1989; Hensel and Holcik 1997; Friedrich 2013).

Until recently, because of their benthic dwelling and complicated life cycle, involving spring and fall migrations, astonishing longevity (50–100 year) and late sexual maturation (4–14 year), as well as multi-annual species-specific intervals between consecutive maturation and spawning migrations, the location and functioning of essential habitats of sturgeons in the Danube River and in the Black Sea were poorly known and understood (Antipa, 1909; Holcik, 1989).

Only recent technological developments have enabled tracking of their movements over long distances in the river and the sea using acoustic and satellite telemetry, coupled with depth and temperature sensors, and data-logging capacities, advanced hydraulic measurement equipment (electromagnetic and Doppler velocity meters), 3D and side scanning sonar technology to map the morphology and the nature of substrate of the riverbed, special tools for collecting and capturing early life stages of sturgeons (fertilized eggs, moving free embryos, feeding larvae and fingerlings), backed by molecular genetics and ecology, have enabled the first steps, making the difference, in more detailed understanding of the peculiarities of functioning of essential habitats for sturgeons in the Lower Danube River (LDR).

Still, we only know the location of two spawning grounds for beluga and sterlet sturgeons, at LDR km 100.5 and km 111, where fertilized eggs and feeding larvae were captured during several years using D shaped drift nets (Paraschiv, Suciu and Suciu, 2006; Suciu *et al.* 2013). Deep holes in the riverbed of the Danube formed by the Coriolis as well as by eddies formed were the river current is deviated by hard rocky banks, are used by sturgeons as habitats for over-wintering or as waiting sites before spawning. Such sites were located and described by 3D bathymetry at Danube km 100.3, km 110.8, on the Borcea branch at km 49 and Bala branch at km 7.5. Wintering of adult beluga sturgeons in the Karkinyt'ska Bay, south of Odessa, on grounds located at 40–60 m water depth has been demonstrated using satellite telemetry (Suciu *et al*. 2015). Nursery sites of young of the year sturgeons in the LDR are located in active sedimentation sites near existing or emerging islands (e.g. upstream of the Hinog Island, D km 110). The importance of the coastal shelf around the mouths of the Danube branches as feeding habitats for juveniles of all three anadromous sturgeons and adult stellate and Russian sturgeons was recently reconfirmed by experimental fishing (Holostenco *et al*. 2013; Ionescu *et al.* 2017).

Presentation title: **Eels habitat and combatting IUU fishing**
Presented by: **Reinhold Hanel, Institute of Fisheries Ecology, Germany / EIFAAC**

Summary of presentation

Within the last 50 years the European eel has turned from one of the largest freshwater fishery resources in many areas of Europe and northern Africa to an endangered species. While the reasons for this tremendous decline of the panmictic eel population are still not fully understood, three anthropogenic causes of mortality are thought to have a significant impact at least in specific habitats. Together with the unpredictable risks caused by water and sediment pollution, intensive fisheries on all continental life stages as well as habitat fragmentation and destruction play a major role.

Despite the lack of a quantified assessment of the impact of fisheries on the whole stock, it is noteworthy that any mortalities caused by fisheries further reduce the spawner escapement from continental waters. Since European eels, being semelparous, spawn only once in their lifetime in Sargasso Sea, measures like increased minimum landing sizes are largely inadequate. In addition, in many areas fishing is only sustained through extensive stocking activities. Restocking of wild caught glass eel is still continued under the premise of a potential net benefit on the overall population, but effectively may even further increase the pressure on the panmictic stock.

The introduction of barriers represents one of the major factors affecting riverine fish populations, in particular of migratory species. Such barriers include culverts, weirs, bridge aprons, dams, hydropower stations, pumping stations, tidal flaps and sluices. With regard to eels, different types of obstacles and barriers can adversely affect their continental life stages during migration. Typical negative effects of barriers include the loss of upstream habitats due to restrictions in river continuity for glass eels and juvenile eels, delays in migration and, of course, direct mortality at pumping stations, water intakes and, especially for downstream migrating silver eels, hydropower turbines.

In light of these developments, several measures were taken to facilitate an internationally coordinated management and aid the recovery of the eel stock: In 2007, the European Union passed council regulation 1100/2007 “establishing measures for the recovery of the stock”. Accordingly, member states were obliged to identify natural habitats of the European eel and develop eel management plans in order to achieve an escapement target of 40% of silver eels as compared to pristine conditions (i.e. silver eel escapement that would have existed if no anthropogenic impacts had ever influenced the stock). In 2009, the European eel was listed under CITES Appendix II, requiring export permits for eels. In 2011 EU member states published a zero-export quota for the species. However, IUU fishing is still regarded a major threat for the European eel. While current total landings are likely to be significantly underreported and effort data are incomplete, several countries still do not report at all to the relevant international authorities. In addition, recent reports of glass eel trafficking estimate more than 350 million live eels (> 100 t) being illegally shipped to Asia every single year.

As a consequence, there is an urgent need to evaluate the effectiveness of measures for the protection and recovery of the European eel for conformity with the Precautionary Approach. All regulatory measures adopted for its stock recovery should directly target at a significant and verifiable reduction of eel mortalities. These include river continuity restoration and habitat quality improvement as well as significant reductions in commercial and recreational fisheries related mortalities.

Presentation title: Invasive alien freshwater fish species in the Danube – implications for management.
Presented by: Marina Piria, University of Zagreb, Faculty of Agriculture, Croatia / EIFAAC

Summary of presentation

Invasive alien freshwater fish species (IAFS) introductions represent one of the main threats to native freshwater ichthyofauna. IAFS introductions have been considered as a major factor for biotic homogenization at large spatial scale, by reducing native freshwater fish species diversity. For more than 100 years the Danube River basin has been under huge pressure by IAFS introductions, which began in the 19th century, and it is continuing today. The main route for introductions into the Danube River basin is through the Southern Invasive Corridor that links the Black Sea basin with the North Sea basin via the Danube-Main-Rhine waterway including the Main-Danube Canal. Forty-one alien fish species were identified in the Southern Invasive Corridor, of that 20 were observed in the main course of the Danube River. There are numerous challenges in the management of IAFS. Literature suggests that there is only one possible effective management solution and that is when the fish is newly introduced and spatially constrained. Management efforts can be made towards the control of their distribution and dispersal in the environment, thus reducing their impacts on native species and ecosystems. Standardization of methods for data collection and usage, and best practices can improve the efficiency and speed of efforts against IAFS. The International Commission for the Protection of the Danube River (ICPDR), the EU Strategy for the Danube Region (EUSDR) and the Danube Region Invasive Alien Species Network (DIAS) acknowledges that further data collection and analysis, and cooperation are vital for effective Danube River basin management. Proposed actions of the EUSDR and DIAS for alien species (AS) introduced into Danube River basin include: (1) assessing the impact on the ecosystem; (2) identification of environmentally friendly ways to control AS development (3) controlling and limiting the spread, dispersal and impact of AS; (4) prioritisation of river basins based on the impacts of AS; (5) promoting research to identify ecologically sound ways to keep AS populations under control or eliminate them; (6) development of regional network within the Danube River Basin dealing with AS; (7) establishment of monitoring, early detection and warning systems, (8) development of cost-efficient and realistic approaches for management and restoration of habitats and (9) raising public awareness about the threat of alien species. However, international cooperation and common legislation is of paramount importance to the effective management of IAFS, which in the Danube Region is currently lacking.

Presentation title: River habitats restoration experiences at European level

Presented by: Christian Wolter, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Germany

Summary of presentation

With the implementation of the European Water Framework Directive (2000/60/EEC on 22 December 2000, WFD), a shift in restoration paradigms has occurred setting ecological status of surface waters besides a good chemical quality as a mandatory environmental target. All member states became obliged to take rehabilitation measures to achieve either a good ecological status (GES) for waters classified as “natural”, or good ecological potential (GEP) for waters classified as “artificial” or “heavily modified” in all surface water bodies by 2015. With this legacy the Member States adapted to an increasing awareness that, despite measurable, significant success in improvements of water quality and aquatic communities, the trend of declining freshwater biodiversity did not reverse.

In their first River Basin Management Plans (RBMP) 26 Member States have designated altogether 104 311 river water bodies in 157 River Basin Districts (RBD) with a total length of 1.17 million km. About 56% of these water bodies (>51 000) and 64% of their total length (630 000 river km) have been reported to hold less than good ecological status or potential. Both, hydromorphological pressures and altered habitats have been reported as the most common impact for 48.2% and 42.7% of all river water bodies, respectively. Thus, the current restoration focus has shifted from purely physico-chemical water quality to rivers’ hydromorphology and habitats.

However, six years later, the second RBMPs show limited change in status, as most water bodies did not improve between both cycles. Hydromorphological pressures remained the most significant pressure affecting 40% of all surface water bodies. This raises questions on the efficiency of rehabilitation measures implemented and whether the most pressing bottlenecks had been addressed.

A meta-analysis of 91 restoration projects revealed highly variable outcomes with one third of the projects showing no or even negative results. The biggest improvements were achieved for semiaquatic taxa, which do not belong to the biological quality elements of the WFD. Also, measurable effects were more efficient in terms of species’ abundance and biomass rather than species richness and diversity. The meta-analysis further revealed that the most significant effects were assessed shortly after measures were implemented, while the ecological performance decreased with time. This finding points to the restoration of forms, i.e. habitat features and characters, rather than processes, i.e. the hydromorphological processes maintaining essential habitat structures.

A comprehensive analysis of the effects of various drivers and pressures, altogether 130 hydromorphological processes and variables, identified flowing water as the most important. Flow dynamics further drive processes like sediment gathering, transport and sorting, which creates patterns of substrate structures. This seemingly trivial result is commonly ignored in river restoration, which is usually far from rehabilitating hydromorphological processes. Therefore, the linkage between river hydromorphology and biotic response has been conceptualized in a rather pragmatic way.

The main hydromorphological features and structures are primarily determined by the natural flow regime of the river and the nature of the sediments available for erosion, transport and deposition. In turn, the interaction between flowing water and the size and quantity of available sediment leads to diverse substrate calibres emerging from flow-induced sorting, which are typical and specific for river systems and thus, indicator for hydromorphological integrity. Accordingly, specific indicator taxa for hydromorphological alterations should respond to these specific substrates, i.e. to coarse gravel, which substantially limits the available number of species and life history traits. Correspondingly, successful rehabilitation should address those species and the processes leading to their required habitat structures.

So far less demonstrated is the total amount of rehabilitation measures needed to achieve an ecological effect at the water body or even river scale. Some thoughts are presented on functional connectivity depending on quality and spatial arrangement of habitats within a river reach. However, to make an impact and to achieve significant improvements of our rivers and even to halt the ongoing deterioration of biodiversity, much more effort is needed including a certain revolution in restoration planning at large spatial scales and beyond institutions and political or administrative borders. There is no chance to achieve any improvement if all existing uses perpetuate. Specific uses have to be abandoned in favour of free-flowing rivers for the potential of ecologic improvements, e.g. small-scale hydropower, or fairway maintenance for inland navigation in waterways of negligible freight volumes.

Presentation title: Importance of telemetry in the detection of fish habitats

Presented by: Carolyn Rosten, Norwegian Institute for Nature Research (NINA), Norway

Summary of presentation

Most aquatic life forms move. They respond to their environment (e.g. temperature or flow) and to their internal status (e.g. physiological or energetic state). They move to feed, to seek shelter, to find mates and spawning or nursery areas. In doing so they influence the environment around them, transporting nutrient, biomass and dynamic energy through the ecosystem. In this way they influence the structure and function of populations and ecosystems.

A significant problem hampering the study of aquatic species, is that of determining their geographical locations at fine scales over long durations. Developments in recent decades have led to the use of telemetry, the wireless measurement of behavioural or physiological information by use of electronic tags for monitoring, in studies of animal ecology. Several different methods exist, each with its own advantages and disadvantages and it is this suite of tools that is used to address ecological questions through the remote monitoring of individual movements and physiology. I will briefly present the telemetry toolbox, highlighting case studies of their application.

Passive integrated transponder (PIT) tags offer a low-cost alternative, providing the opportunity of tagging large numbers of individuals (e.g. Rosten, Gozlan and Lucas, 2013). These tags do not contain a battery but are charged up to send out their unique identifier code when in the proximity of an energy source. While this means that the tag can theoretically last the lifetime of the animal carrying it, detections are limited to being within up to one meter of the receiver. Active telemetry techniques, whereby the tag contains a battery and actively sends a signal, extend the detection range to at least hundreds of meters. Though the battery size defines both the active life and size of the tag.

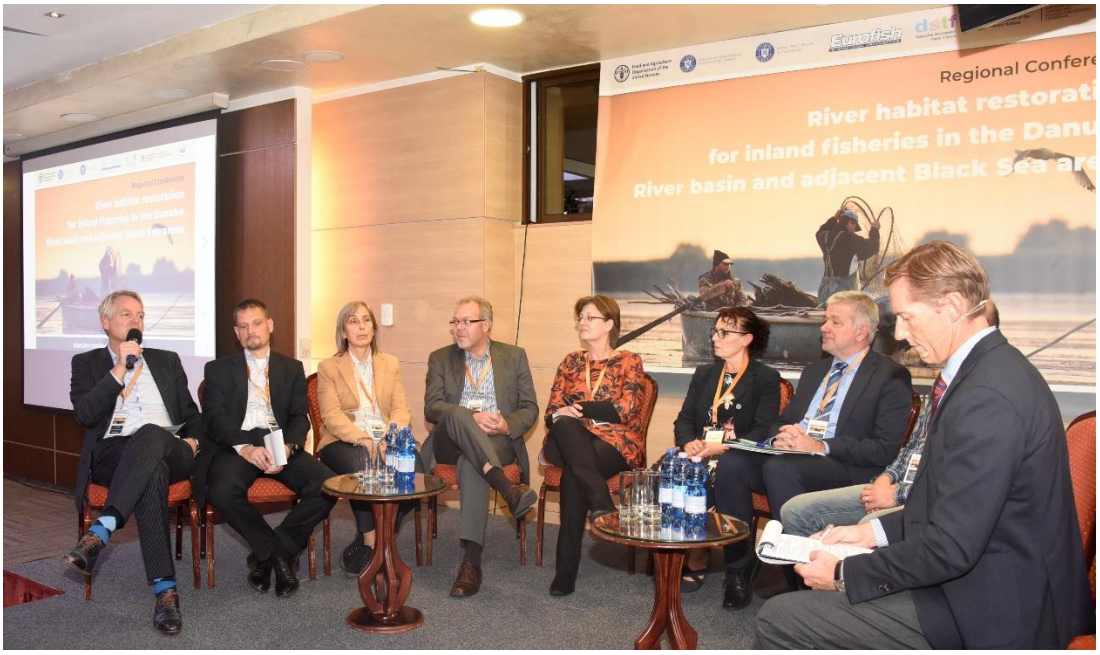
Radio and acoustic tags offer autonomous, continuous monitoring, sending signals that can be detected at a range of several hundred meters (dependent on environmental conditions). Radio telemetry is favoured in relatively noisy aquatic environments, for example at hydropower dams where acoustic telemetry signals would be distorted or masked. However, radio telemetry does not function in the marine environment and is thus limited to tracking freshwater dwelling organisms (e.g. Rosten, Gozlan and Lucas, 2016). Acoustic tags are detected by means of submerged acoustic receivers which may be deployed as singular points (Jensen *et al.,* 2016), as arrays (Urke *et al*., 2013) or as networks, enabling 3-dimensional logging of tag location (Hawley *et al*., 2016). Until recently, acoustic telemetry has been limited to providing spatial and temporal information about the location of the tagged individual. New developments in sensor technology now enable the combination of environmental measurements such as (e.g. temperature, conductivity) and physiology measurements (e.g. heart rate (Gräns *et al.,* 2008)) with location. By combining movement sensors (e.g. accelerometers) into tags (Føre *et al.,* 2018), it is now also possible to identify specific behaviours (e.g. prey capture or spawning) in tagged individuals.

Satellite telemetry offers the potential for tracking animals with no geographical limits (Pop-up Satellite Archival Tags (PSAT) measure temperature and light data in order to calculate the position of the tag, since the tag location can only be detected, and data sent, when the tag is on the water surface. PSATs detach from the fish at a predetermined time and float to the surface to transmit telemetry data to overpassing satellites. These tags are large due to high battery requirements and are thus limited to use on large species. PSATs are limited in the amount of data that can be transferred by transmission costs and the short time that the receiving satellite is above the horizon. In some locations interference on frequencies selected for tags can limit the success of data transfer to satellites (see Musyl *et al.,* 2011). However, despite these limitations, PSATs offer great potential for monitoring the movements of large, long distance migratory species such as sturgeons (e.g. Beardsall *et al.,* 2016).

Telemetry technology and techniques are constantly evolving to meet the future needs of animal ecology research. As focus turns increasingly to the bigger picture and an ecosystem-based approach to science and management, so the need for larger, more comprehensive data sets grows. Cooperation between and within countries, managers and scientists is required to extract the best insight from both new and existing telemetry datasets (Meeuwig *et al.,* 2015). Collaborative networks of acoustic receiver arrays over large geographical scales are already in place in North America (Cooke *et al.,* 2011) and Australia (Steckenreuter *et al.,* 2016) and have been proposed in Europe (Abecasis *et al*., 2018). Increasing cooperation data-sharing is necessary, although conventions for data-sharing and protocols for crediting those who contributed data are still under development (Lennox *et al.,* 2017). Aquatic telemetry was developed as a tool for informing science, management and policy, but technology development and data collection are now outpacing the incorporation of science into management and policy. Improved knowledge transfer and involvement of stakeholders, regulators and policymakers is necessary to ensure that scientific advances are used to make effective contributions to conservation and resource management (Lennox *et al.,* 2017).

Key points identified from session 2

- Create autonomous approaches to management of inland waterways as these are shared resources and cross international boundaries, requiring holistic approaches and improved international collaboration;
- Balance the social, economic, and environmental pillars of sustainability to insure resource availability for future consumption, employment and recreation;
- Promote and finance research aimed at river habitat restoration, including dam removal and/or construction of fish passes;
- Strengthen legislation and international cooperation regarding alien species to prevent displacement of native species;
- Foster closer relationships and information exchange between scientists and policy makers to ensure science-based policy-making processes;
- Strengthen cooperation between regional and international organisations responsible for fisheries and environment.



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Each conference session was followed by a round of questions and answers

SESSION 3: REGULATORY FRAMEWORK

Presentation title: **Hydro-morphological alterations versus sustainable management of fish stocks**
Presented by: **Predrag Simonović, University of Belgrade, Serbia**

Summary of presentation

River hydromorphology in terms of hydrology, morphology and connectivity of rivers and streams determines fish habitats and the structure of native fish communities. Alterations to the river channel, banks and floodplain disturb the original structure of fish communities and make ecosystems more susceptible to introduction of non-native species. The major alterations are those coming from hydropower production, navigation, flood defense, urbanization and channelization, land use, storage for water supply and water abstraction. Modifications of river morphology decrease their capacity to cope with flooding events, pollution and are unable to sustain fish populations and communities because of changes in local habitats, affecting the whole ecosystem's integrity. Case studies revealed that stream order influence fish diversity, both taxonomic and ecological, and that alteration of hydromorphology by reservoir construction affects more streams that are not accessible to migratory fish species, while the potamodromous fish species diversity increases. The impact of Iron Gate I dam on both the fish species diversity and biomass, and therefore the fishery was recorded far upstream. It was determined that an increase in diversity and the availability of fish habitats, as well as a rise in primary production occurred due

to increased siltation. That nominal benefit, however, was offset by a change in the fish community structure, from predominantly rheophilic to potamodromous fish species and from native to non-native one. This led to changes within the fishing industry, the fishing gears used, targeted fishing species, fishing effort applied, market availability and consumers' habits. The decrease of floodplain zones strongly affected the fishery, as revealed in case study from the River Sava, where the productivity remained satisfactory in the river sections where the floodplain availability was retained. No dams of any type constructed for hydropower production favors fishery, since they alter upstream habitats and make them inconvenient by water level fluctuations, with the accompanied introduction of non-native fish species into the reservoirs and socio-economic alteration of the fishery. Hydropower plants also destroy downstream habitats by hydropeaking and disturbing sediment transportation resulting in the loss of connectivity, population integrity and lessening of the spawning and nursery grounds for fish species. Dams constructed for water supply at the locations can favor brown trout and grayling fishery by supplying the cold tailwaters and reduced water level oscillations downstream. Fish passes commonly do not truly resolve the fish connectivity problem at both high dams and hydropower plants, due to either hydromorphological, ecological, or life-history demands that original fish species have, especially downstream migrations. The lack of connectivity and/or ability to pass to the historic upstream spawning grounds for shad and sturgeon species at the Iron Gate I and II dams of the River Danube has placed them amongst the most threatened fish species of the Black Sea region.

Presentation title: Connecting fish, rivers and people. Opening swim-ways around the world from local to global
Presented by: Pao Fernandez Garrido, World Fish Migration Foundation, Austria

Summary of presentation

Free-flowing rivers are the arteries of Europe’s richest ecosystems. The larger part of the European biodiversity is connected to rivers, wetlands and deltas. Currently, however, there are hardly any free-flowing rivers left in Europe as we have been fragmenting rivers for centuries, in part, due to dam construction.

At this moment, there is scarce information about the number of barriers (type and size) blocking European rivers. We only have the European inventory of big dams (those higher than 10 m), but studies show that this could be less than 3% of the existing barriers (Belletti *et al.,* 2018). In the AMBER Project (Adaptive Management of Barriers in European Rivers) the estimations done by inventory validations in the field show that there could be one barrier per kilometre of river. Actually, the countries with the most complete barrier inventories show this situation: France 95 000 barriers (out of which 70 000 are weirs and dams), Switzerland 80 000 barriers, England and Wales 22 000, Spain 22 000 (AMBER, unpublished).

Dams impact every aspect of healthy rivers. They impede the migration patterns of fish and other aquatic fauna and this can cause a decline and even local extinction of many species. Dams can be responsible for a significant loss of natural riverine habitat and many times create ideal conditions for alien and/or

invasive species to thrive. They alter the natural flow of rivers by reducing the downstream flow and decreasing the river's natural flood frequency. This reduces the channel connection with the floodplain, which decreases the soil fertility and aquifer recharge. Dams can block nutrients and sediments upstream of the dam, in greater or lesser degree depending on the dimensions of the dam and on the type of sediments on the valley. Invariably, this causes downstream incision problems in the river channel and bank erosion that diminishes delta formation due to the lack of sediment deposition, and sometimes causes coastal erosion due to sand decrement.

Upstream the dam, the riverine dynamics is modified to a lentic (standing-water) system, deteriorating the water quality and causing greenhouse gas emissions through the decomposition of stored vegetation and carbon inflows from the basin.

Dam Removal Europe (DRE) is a European wide dedicated cooperation of organizations with the ambition to bring back life to our rivers by removing old, obsolete dams – to open our European rivers again and have rivers full of fish. Dam Removal Europe was started by six organizations, World Fish Migration Foundation, World Wildlife Fund, Karlstad University, European Rivers Network, the Rivers Trust and Rewilding Europe. Currently it is a strong growing network of authorities, NGO's, companies and knowledge institutes from many different European countries working on dam removal.

The objective of Dam Removal Europe is to highlight and emphasize removal of old, obsolete dams as the most eco-efficient and cost-effective measure. It is proven that after the removal of dams, the river-ecosystem quickly recuperates. It is an interesting measure for water authorities to meet the Water Framework Directive goals. Furthermore, DRE facilitates the development and exchange of knowledge on dam removal between partners in different countries. It does so by inspiring and connecting people so together we can re-create and protect our great European rivers.

To our surprise, Europe is actually leading when it comes to the demolition of dams. It was once believed that the USA held this leading position with more than 1 300 documented dams removed (American Rivers, 2018). However, Europe has managed to demolish over 4 000 barriers. According to collected records, France has removed more than 2 300 barriers, naturally or artificially, Finland has torn down more than 450 and Spain over 250 dams (DRE, 2018).

There are several reasons why dams are being demolished in Europe and the USA, and it is not only because of environmental reasons.

In the USA, for example, the primary reason is mostly economical. This is because US law dictates that if you own a dam then you are obliged to maintain it. This invariably means that the dam is subject to periodical inspections, which will cost the owner money. If, after those inspections, the state engineer considers that repair must be carried out, then this will cost a lot more than if one were to remove the dam.

Another reason is public safety. All dams have a shelf life, which is why it is important to inspect dams that no longer serve a purpose to avoid potential accidents which may arise due to dam failures. Additionally, small dams (weirs) can also pose major safety hazards. They are known in USA as “drowning machines” because they generate a very strong suction force (hydraulic notch) below the dam, sucking any object down to the base of the dam. This phenomenon is responsible for taking lives every year.

Although less known, there are also legal cases for removing dams in Europe. Under the terms of the European Union Water Framework Directive, Member States agree to achieve “good ecological status” in all water bodies by the year 2015 (in some cases this has been extended to 2027). Under the Habitats Directive, the European Commission has required Member States to restore and maintain the natural habitats of the European Union Natura 2000 network by 2015. The restoration of the freshwater environments of Europe is therefore underpinned by important EU legislative requirements, and the restoration of the continuum of rivers is a fundamental part of that.

Additionally, some European countries have specific national laws which support dam removal. For example, Spanish legislation dictates that once a dam has finished its objective, the dam owner must leave the river in the same conditions they found it in prior to the construction of the dam. However, very few people have actually paid any attention to this law, leaving thousands of dams abandoned in rivers and without any consequences to the offender.

Many times, initiatives to remove dams come from outside the region, like central governments or national angling- and nature organisations. Local citizens and communities are involved in later stages, which can cause negative reactions. As with any project that will impact local communities, it is imperative to communicate, plan and carry out proper consultation meetings with local residents from the start. This way, dam removal initiatives will be implemented with a vision that better suits nature and people.

In addition to this, there is the Renewable Energy Directive, which requires EU countries to fulfil at least 20% of their total energy needs with renewable energy by 2020, and amongst these renewable energy sources is hydropower. This makes dam removal projects tremendously difficult to those who are willing to start removing outdated and obsolete dams and makes dam removal an uncomfortable subject to mention to politicians. This situation is like a snake biting its own tail and it will not progress until we come to an understanding of the need for both restoration of efficient dams and removal of obsolete and abandoned dams. Therefore, we need to provide more awareness and funding to remove more obsolete dams.

This is why Dam Removal Europe (DRE) started in 2016 (www.damremoval.eu). DRE wants to improve citizens’ awareness about removing dams, facilitate communication within Europe and between USA and Europe, create a reference community of experts and starters who generate and share knowledge about dam removal and put dam removal on the agenda of policy makers. Together we can locate and remove obsolete dams.

Presentation title: **European Maritime and Fisheries Fund (EMFF) support to inland fisheries**
Presented by: **Cristian Badiu, DG Mare, European Commission, Belgium**

Summary of presentation

In a policy context where inland fisheries are under the national responsibility of the EU Member States, the European Union (EU) is strongly committed to supporting the efforts for the protection of the Danube ecosystem and the development of inland fishing communities. As a result, the Union financial instruments and programmes were given an appropriate role in this case. Among them the European Maritime and Fisheries Funds (EMFF) which gives the EU Member States the possibility of funding inland fishing via a wide-range of measures. The opportunities range from investments from fishing vessel diversification to support for inland fishing ports and shelters, start-up for young fishermen etc. In fact, inland fishing is funded under the same conditions as marine fishing. In addition, the EMFF fosters partnerships via the Community Local Led-Development programs, another funding measure aiming to the development of fishing communities and is registering excellent results since its introduction in 2007. The EMFF funding opportunities are expected to continue post-2020 and in certain cases they might even be extended in line with the needs of the sector and the reality on the ground.

Presentation title: **FLAGs: community led development in EU inland waters**
Presented by: **Gilles Van de Walle, European Commission, FARNET Support Unit, Belgium**

Summary of presentation

Fisheries Local Action Groups (FLAGs) are public private partnerships set up at local level in fisheries and aquaculture areas with the support of the European Maritime and Fisheries Fund (EMFF). FLAGs are responsible for the development and implementation of local development strategies which place local stakeholders at the center of the decision making process. Indeed, local stakeholders are the ones that subsequently decide on the projects they want to see developed in their territories within the framework of these local strategies.

For the 2014–2020 period, there are 368 FLAGs operational across 20 Member States of the European Union. Fifteen percent of these FLAGs (around 55 of them) are located in inland areas spread across 10 Member States. The presence of important fish farming activities in a territory will very often be the main rationale for the establishment of a FLAG in an inland area. This is very much the case in traditional carp farming areas of Poland or Germany for example.

The presence of commercial inland fishing activity will more rarely be the defining factor justifying the development of a FLAG. This is, however, the case for several of the inland Finnish FLAGs, even though fish farming will also be present in these areas. The same holds true for Estonia and Sweden, which boast the largest lake fisheries in the EU (lakes Peipsi and Vorstjav for the

former, lakes Vannern and Vattern for the latter).
In Sweden, the Vindeälven FLAG is one of the few FLAGs in Europe which has taken a river basin approach, covering the whole Vindel river system. The Vindeälven FLAG objectives revolve around the possibilities to:

- Improve management and availability of resources,
- Improve cohabitation between recreational and commercial fishing,
- Increase job opportunities from both sectors.

In Romania, nine of its 19 inland FLAGs are located along the Danube river covering nearly the whole length of this river from the Bulgarian border to its Black sea delta with important commercial fishing activities. The other 10 Romanian inland FLAGs are mostly linked to fish farming operations as are the three Slovenian inland FLAGs.

The presence of active commercial inland fishing activities is more difficult to assess in other Member States harbouring inland FLAGs – namely Germany, Poland, Latvia, Lithuania and Bulgaria. Indeed, a certain level of confusion exists at local level between commercial fishing, put and take angling fisheries and/or extensive fish farming operations.

Member State	Number of FLAG
Finland	8
Estonia	2
Sweden	9
Romania	10
(Poland)	n.a.
TOTAL	**29+**

Number of FLAGs harbouring significant commercial inland fishing activities per Member State

In terms of types of projects supported by FLAGs, we can broadly-speaking identify five categories across the EU:

- Adding value to local fisheries and aquaculture products,
- Diversification of the local economy (both within and outside the fisheries value chain),
- Protection and management of the local environment,
- Development of cultural and social heritage,
- Support to local governance.

Looking more specifically at the types of projects stemming from FLAGs with strong inland commercial activities, they cover a fairly broad range of topics with the same dominance for those projects related to improving the marketing of the local catch than can be noticed for coastal/maritime fishing activities. This similarity in terms of types of projects can partly be explained by the fact that small scale fishermen are the natural partners of FLAGs, independently of the types of waters (coastal or inland) they ply their trade in.

A prominent project aimed at adding value to inland local fish is the Fish Handling Centre developed by the Kainuu-Koillismaa FLAG in Northern Finland. This is a

remarkable project in different ways: first because of its scale (close to EUR 2 million), which is quite large as far as inland fishing operations go. Second because of its cooperative nature, that in turn helps explain the scale of the project. This project represents a collective effort between inland commercial fishermen, fish farmers, a fish processor and even included a retailer – basically integrating the whole supply chain vertically. What is also remarkable here is the role played by the FLAG which acted as a catalyst, by helping to bring the different partners together and by providing the funding necessary to prepare the project. In a second stage, the FLAG also helped leverage the larger sums required for the investment. In this case from the Axis 2 (processing) of the European Fisheries Fund (EFF) as these types of large projects go beyond the financing possibilities of a single FLAG. FLAGs have, on average, a budget of around EUR 2 million for the seven-year duration of the implementation period and therefore usually focus on smaller projects.

In terms of diversification of the local economy, the Danube Delta FLAG supported Ecaterina, a fisherman´s wife, to diversify her family's economic activities through offering tourist accommodation in her home and serving her husband's freshly-caught fish in the village of Mila 23 on the Danube Delta. For Ecaterina, it all began as hospitality for family and close friends. Their return every year encouraged others to come too and she was unable to meet the high demand. She therefore asked the FLAG for help in expanding her activity and building new facilities offering seven bedrooms, an open terrace and a dining room with capacity for 20 people.

The Lake Peipsi FLAG has been instrumental in generating better visibility for the fisheries sector around the lake area and directing consumers towards fish products as an option for their regular diet. The FLAG managed to introduce fisheries-specific themes and activities to traditional local festivals in the Lake Peipsi region, thereby promoting the fishing heritage and products of the area through cooperation with different NGOs, local authorities and entrepreneurs. For this purpose, it also teamed up with four LEADER groups present in the area. These are similar community-led initiatives in rural areas financed by the EAFRD which have very often been supportive of aquaculture of commercial fishing operations in areas where no FLAG was present.

Many Swedish FLAGs have been active in supporting better management of resources at the local level. On Lake Vättern, for example, the FLAG has provided support to the Lake Vättern Society for Water Conservation, a co-management group that brings together representatives of commercial and subsistence fishermen, anglers, water owners, researchers, NGOs, as well as the relevant local, regional and national authorities. The group has already developed a number of recommendations and legislative proposals which have been taken into account by the national authorities including the setting up of three protected areas in Lake Vättern and the introduction of escape openings in crayfish traps. The Kustlinjen FLAG, for its part, has helped set up a river basin management on the Nyköping River in South East Sweden to secure a balance between socio-economic and environmental interests and improving local resources governance.

In the EU, inland commercial fishing operations are characterized by their fragmented nature, with small scale commercial inland fishing operators often dispersed over large territories and lacking a critical mass to ensure adequate organization and representation. Beyond individual support to projects highlighted above, FLAGs also therefore represent a vital link for many of these dispersed inland fishing operators, helping to reduce their territorial and technical isolation.

Key points identified from session 3

- Promote a bottom up approach in resource management to increase community and stakeholder engagement in decision making processes related to river and lake resources vital for livelihoods of riparian communities;

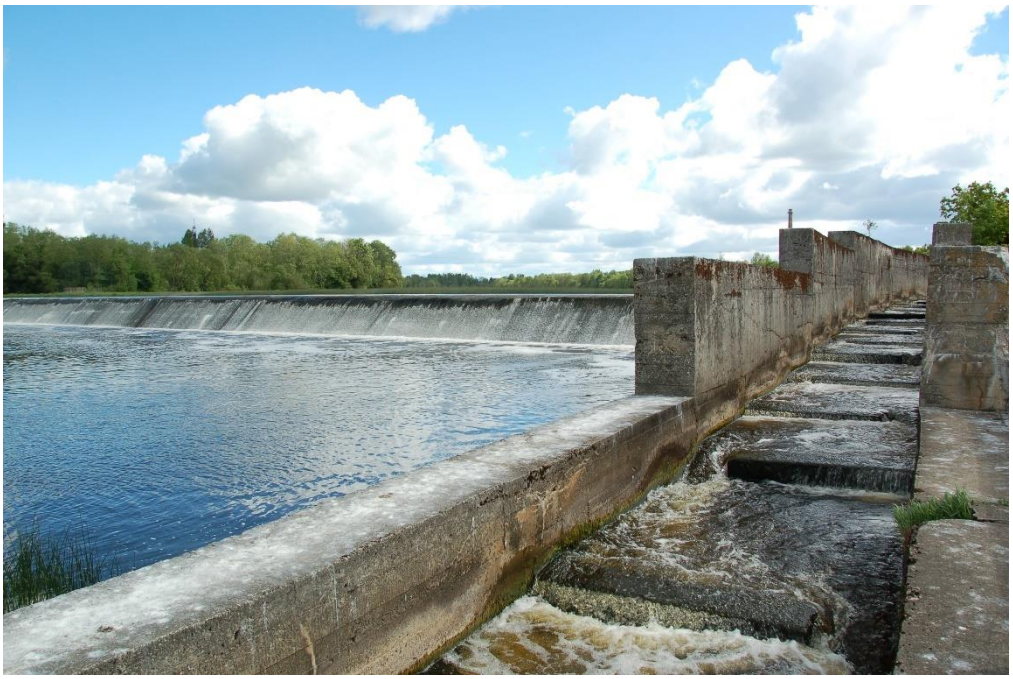
- Raise awareness and education of rural communities in the value of inland fisheries as a source of income diversification through recreational fishing and eco-tourism, in addition to traditional agricultural practices of crops and livestock production;

- Place greater focus on local development for the benefit of local communities, including empowering local communities to manage their river and lake resources;

- Learn to adapt in a changing environment, namely identify climate change impacts on freshwater resources and fisheries;

- Cut the red tape by:
    - Simplifying bureaucracy surrounding public funds for inland fisheries, including better access to EC EMFF funding
    - Improving pathways to funding for habitat restoration and/or fisheries development

- Support the development of alternative livelihoods for local communities that promote aquatic conservation and sustainable inland fisheries management.



Dedicated passages can allow fish to cross dams and other obstacles

SESSION 4: SHARED COUNTRY EXPERIENCES

Presentation title: Room for the River: river and flood plain restoration along the downstream part of the Rhine in The Netherlands and Germany serving multiple purposes
Presented by: Steven Visser, Visser Water Management, The Netherlands

Summary of presentation

After the last big flood in 1953, the Dutch built the Delta Works and the Netherlands more or less closed off the delta from the sea. Which is good for safety, but the ecology and natural balance of the system decreased dramatically. The Netherlands are now in a transition process of re-opening parts of the delta to restore nature and support fish migration.

There are basically 4 main factors influencing Dutch water management:

- The irreversible subsidence of the land caused by permanent drainage.
- In response to the subsidence of the surface, they had to protect themselves with dikes. They developed polders and reclaimed lakes to increase the agricultural land.
- The increasing vulnerability to floods and saline water intrusion.
- Impact of climate changes: through mitigation (following the Paris agreement) & adaptation through a nationwide second Delta Programme with an investment of more than 1 billion per year anticipating a sea level rise of 1 m in 2100.

Based on new scientific analysis the Dutch recently started the discussion to discuss options of an increase in sea level rise up to more than 3 m in 2100. This will drastically change the existing water safety strategy and spatial planning of the country. It's a political breakthrough that such options are on the table for discussion and that these scenarios will eventually be part of the adaptation strategies. But for now, the Dutch water policy is to invest in water management to cope with a sea level rise of 1 m in 2100.

Water safety strategy 'Room for the River'

The flood in 1953 was the main driver of building the impressive Delta Work structures in the south western part of the country. However, over time and with new threats, like climate change, a new strategy was needed.

The Netherlands agreed on the concept of 'Room for the River', a program with two goals: water safety and spatial quality:"

- **Water safety,** the program draws up a package of measures to obtain the agreed safety level in 2015. Along with a long-term vision to plan future measures.
- **Spatial quality,** flood protection measures were developed in such a way to create synergies with other objectives. Taking into account ecology, biodiversity, urban and municipal development, recreation, etc.

The total investigation, planning, decision making, and design phase took more than 25 years. It took 6 years to arrange all permits, exemptions and the legal procedures for obtaining the land (expropriation) and to prepare the execution and construction phase. And finally, last year the latest construction works were finalized. The program 'Room for the River' has been accomplished. But they are already in the preparation phase of a new program, based on the climate change scenarios mentioned earlier, working on the delta does not stop.

The last decade, a large package of measures has been executed. For example, the re-development of the floodplains, creating a more natural flood plain, lowering the floodplain bed, moving the embankment backwards in order to create more flow capacity as well as a boost in natural river landscapes. In this way, a more robust river system has been created, with room for water and for nature. Very interesting and spectacular is the combination of water safety and urban development in Nijmegen, close to the German border. Here, the flow bottleneck in the Waal (main stem of the Rhine) has been solved by creating a new river and an urban island in the river. This has boosted the city's water front and created more safety upstream. Another measure is to lower the groynes, to be able to accommodate more water when necessary.

Water Framework Directive (WFD)

The last 10 years, the water managers also invested in measures to comply with the WFD. They are now half way through the implementation of the second River Basin Management Plan. One of the most important and innovative characteristics of the WFD is the river basin approach, essential for downstream located countries, as water quality does not respect official administrative borders between countries or provinces.

The lower Rhine basin has basically only one free and open connection to the North Sea, but this is also one of the busiest ports of the World. The other connections are blocked with a large shipping docks, dikes or sluice gates to keep out the salt water. Here, fish migration is possible, but it is still very difficult for migratory fish to migrate from the sea to the spawning grounds and vice versa, but the Dutch took up this challenge and put fish migration on the table of the decision makers in the basin.

Starting with a very limited access from the sea and the major rivers to the regional water system in 2009, towards more, and more access in 2015. Aiming to open all major routes in 2027. This is the WFD objective for fish migration and the fish migration measures are part of the WFD Programme of Measures to be executed before 2027.

Opening of the Haringvliet sluices

Since 1971, the main connection of the Rhine and Meuse rivers with the North Sea has been blocked by the Haringvliet sluices. This structure was part of the Delta Works after the 1953 flood. Water safety and fresh water supply for agriculture were the main objectives, but the biodiversity decreased drastically. The whole salt-brackish-fresh water system was damaged. After years of discussion, also within the International Rhine Commission, and political pressure, the partly opening (in Dutch ‘de kier’) of the main connection of the Rhine with the sea was negotiated with all stakeholders.

The official opening ceremony took place mid-November 2018. The main advantage is that the opening will create a brackish water system downstream of the dam, which is necessary for migratory species to migrate. From an ecological and biodiversity perspective a new development of the area is within reach. At the moment, a large joint venture of public and non-governmental organisations are jointly working together to re-establish a more natural estuary to boost the ecological potential, taking into account other interest, such as fresh water supply, water safety and recreation.

The Sturgeon

One of the most endangered fish species in the world: the Atlantic European Sturgeon. Can it happen that the sturgeon will return to the Rhine, as the salmon did?

Yes, the water quality of the Rhine has been improved, the habitat and their spawning grounds are better accessible, based on two experimental releases it is know that downstream migration is possible and yes, with the Haringvliet sluices partly opened, their migration routes are improved. But the Rhine is heavily used for shipping and commercial and non-commercial fishery is a threat.

Presentation title: Activities and experiences on river restoration in Austria

Presented by: Veronika Koller-Kreimel, Ministry of Environment and Sustainable Tourism, Austria

Summary of presentation

Due to large investments into sewerage systems and waste water treatment plants within the last decades, most of the Austrian rivers are achieving the environmental objective as required by the EU Water Framework Directive (WFD). But flood protection measures and hydropower use have led to significant alterations of hydromorphological conditions. That's why the ecological functionality is significantly reduced in more than 50% of the Austrian rivers, to the point that they do not meet "good ecological status" according to WFD.

Fish have proven to be usually the most sensitive biological quality element regarding hydrological or morphological pressures in Austrian rivers. Near natural habitats are largely missing because the morphological conditions have been significantly altered in 30% of the river net (catchment > 10 km^2). In 4% of those, the riverine character was even changed to a more stagnant form due to impoundments and in 10% of the rivers, significant flow deficits can be observed; in some cases, the water depth is so low that fish cannot pass through the water body at certain times of the year. Moreover 28 000 barriers are fragmenting rivers, blocking fish migration and disrupting habitat connectivity. That is the main reason why two-thirds of Austrian fish species are endangered.

River restoration is therefore a big challenge for Austrian water management. A strategy was developed in the First River Basin Management Plan in 2009. This strategy comprises several fields of activities:

- The development of tools/instruments to support the selection and implementation of the most cost-effective measures, for example;
  - "Catalogue of mitigation measures to reduce the impact of hydromorphological pressures";
  - "Guidance on the design of upstream fish migration aids";
  - Method defining the ecological flow in case of water abstraction. The e-flow consists of a base flow, which must be available all year to ensure type specific habitats and pass ability as well as a dynamic aspect. The latter one must reflect natural dynamics over the year to fulfil specific functions like natural bed-sediment relocation, development of type specific substrate compositions, sufficient stream velocity in times of spawning migrations and diverse habitat demands of individual age classes of key organisms. This method was codified by a National sublaw.

- Prioritisation for the implementation of measures considering ecological, economic and administrative criteria. Including a phased implementation of measures, starting with the "no regrets" measure (e.g. restoring river continuity and appropriate flows), which is the first phase used for morphological improvements. This allows for an adaptive management approach and helps to avoid disproportionate costs;

- Closing knowledge gaps with research studies (e.g. downstream fish migration, mitigating hydropeaking in heavily modified water bodies, sediment management);

- Clarify financing of restoration measures.

River restoration planned for prioritised rivers in Austria for the period 2009–2015 was successfully implemented. River continuity was restored at 1 000 migration barriers and flow conditions were improved downstream of 200 hydropower stations. Morphological restoration projects were realised at more than 250 sites for example by removing embankments, lowering banks, reconnection of side arms, new creations of spawning grounds, reconnection of disconnected floodplains etc.

Implementation of projects was subsidised by the Federal Environmental Fund and additional regional government funds. Synergies with flood protection activities also contributed significantly to increase habitat diversity. Extensive restoration projects were designed and implemented in larger rivers as well as in the Danube and its main tributaries supported by the EU-LIFE funding source.

Experiences gained during the last years lead to recommendations regarding a successful implementation of hydromorphological mitigation measures to increase habitat diversity for fish in particular.

Presentation title: Status of long-distance migratory fish species (sturgeons, shads) in Lower Danube Region

Presented by: Mirjana Lenhardt, University of Belgrade, Department of biology and inland waters protection, Serbia

Summary of presentation

There are approximately 30 000 fish species worldwide of which only 165 species are migratory. Migratory fish species have complex life history and possibilities to return to their natal habitats to complete their life cycle. They can move alone or in schools from their place of birth to their growth habitats and during spawning migrations. Based on scientific research the key role in their return to natal place has use of magnetic fields, environmental cues, and olfactory memory. Migratory fish species are important as fishery resource and they have economic, cultural and natural values. Migratory fish species are under high anthropogenic pressure that induced decreases of their populations in many European rivers. The main threats are over-exploitation and river modifications, especially dam building, which harm the ecosystems essentially for fish migration. There is a need for better knowledge about rivers and environments that is used by migratory fish species to achieve their effective protection. There is also a need to improve our knowledge of fish stocks and fish physiology. Migratory fish species cross international borders which make their management more difficult. Ecosystem restoration and protection as well as protection of migratory fish species requires collaboration among many stakeholders: local, state and regional agencies, conservation organizations, research institutions, the navigation company, and the hydroelectric company where new technologies can help to restore rivers.

The Danube still has 863 km of free running river with the first barrier represented by the Iron Gate II dam. Three anadromous sturgeon species (beluga sturgeon, *Huso huso*, Russian sturgeon, *Acipenser gueldenstaedtii*, and stellate sturgeon, *Acipenser stellatus*) and two shads (Pontic shad, *Alosa pontica*, and Black Sea shad, *Alosa tanaica*) still migrate in this part of the Danube River from the Black Sea. Three sturgeon species are 'Critically endangered' in accordance with IUCN (International Union for Conservation of Nature) Red List while Pontic shad and Black Sea shad are 'Vulnerable' and 'Least Concern', respectively. The main threats for sturgeons are over-fishing due to well prized caviar and the illegal fishery from 2006 when a ban proclaimed on sturgeon catch in Lower Danube Region. Dam building and river modification for navigation and other purposes are the second main threat. Even after, Action plan for Danube sturgeon (Action Plan, 2006) and Action plan for sturgeons in Romania, Bulgaria and Serbia (Lenhardt, Hegedis and Jaric, 2005) were completed, there is still inadequate implementation of them with the main problems relating to control of the illegal fishery and monitoring programs. Concerning shads, the main problem is different status for these species in different countries and a lack of management harmonization and coordination in Lower Danube Region. In contrast to sturgeons where internet presentations about activities relating to their status and investigations have been developed, there is lack of data for shads and there are no specialized internet presentations for these species (Lenhardt *et al.,* 2012) even though shads contribute to the local economy and regional foodways and culture.

Nowadays, there is a need in ecology for large-scale collaboration that is highly interdependent, transdisciplinary, cross-sectoral collaborations blending basic and applied sciences (Vermeulen, Parker and Penders, 2013). Efficient management of migratory fish species could be achieved only within international network of scientists with interdisciplinary approach and implementation of different research practices. Research practice could be transformed through the development of new technologies, databases, and new governance and communication strategies. An example of such a collaboration is the currently running Interreg Project MEASURES. This project aims to pave the way for the establishment of ecological corridors through identifying key habitats and initiating protective measures along the Danube and its main tributaries. A methodology for migratory fish habitat mapping will be developed and tested. A harmonized strategy (including prioritization) for the restoration of ecological corridors will be developed and will support implementation in future management plans. Two pilot actions are envisaged: (1) identify and map key habitats, (2) restocking of two native species to conserve their genetic pool. A network for concerted restocking of targeted species will be established, as well as a manual for the operation of broodstock facilities. A MEASURES Information System will be created to facilitate access to information for experts, decision makers and the general public. Concrete input into the next drafts of policy- and management plans (e.g. river basin- and flood risk management plans) will secure the translation of project outcomes into sustainable management of relevant sites restoring ecological corridors.

Presentation title: **German experience in restoration of longitudinal continuity of large rivers**
Presented by: **Marq Redeker, CDM Smith, Germany**

Summary of presentation

Fish passes have been installed worldwide at migration obstacles and natural barriers for over 300 years, and in German rivers for more than 130 years to ensure the upstream passage of fish. Historically, fisheries management and thus fishway engineering focused on the high-value and game species, specifically salmon in the US and Europe, and sturgeon in Russia. Hence, fish passes which were built in Germany and other European countries in the 20th century were mostly designed for the passage of these high-performance species, e.g. Atlantic salmon, brown trout/ sea trout and shad. The conditions in these "traditional" fishways are unsuitable for small or weak-swimming fishes (i.e. for many potamodromous species) because migrating fish traversing velocity barriers are forced to swim at speeds greater than their maximum sustained speed. These fishway designs do not provide passage for a wide spectrum of species.

The last three decades have seen an increase in global awareness of the need for all fish species to migrate to fulfil successful life cycles. In Europe, since 1992, three pieces of EU legislation have forced the focus of fisheries management and fish protection to expand beyond the commercially relevant salmonids to include other diadromous species and course fish: (a) the Habitats Directive, (b) the Water Framework Directive - WFD, and (c) the Regulation establishing measures for the recovery of the stock of European eel. The free passage of all migratory fish is a key requirement of the WFD and is used as an indicator for assessing whether water bodies are meeting the 'Good Ecological Status' (the main objective of the WFD in all EU freshwater water bodies by 2027). Overall, the necessity for free movement of diadromous and potadromous fishes is now acknowledged around the globe.

Following substantial investments in public and industrial wastewater treatment from the 1960/1970s and subsequent river quality improvements, more and more fish passes were built in Germany from the 1980s, mostly on small to medium-size rivers. This prompted the German Association for Water (DWA, formerly DVWK) to develop fish pass guidelines for Germany. These were first published in 1996 (DVWK-M 232 "Fish passes – Design, Dimensions and Monitoring", translated into English by the FAO in 2002). In 2005 the DWA issued guidelines on "Fish Protection Technologies and Downstream Fishways – Dimensioning, Design, Effectiveness Inspection". The upstream fish pass guidelines were entirely revised in 2014 and published as standard DWA-M 509 "Upstream Fishways and Hydraulic Structures Passable for Fish" (an English translation is in progress), which replaces the 1996 guidelines.

Today, the issues associated with upstream fish passage are relatively well understood and a broad range of fishway solutions is available. Modern guidelines (e.g. the DWA-M 509 and the U.S. Fish and Wildlife Service "Fish Passage Engineering Design Criteria", USFWS 2017), promote multi-species fishway designs with species-specific criteria. These guidelines instruct that the geometric criteria should accommodate an adult fish of the largest prevailing or

target species; the hydraulic criteria are based on the swimming performance of the species concerned - accordingly fishways are designed to accommodate the weakest swimming prevailing or target species. Fishways in Germany have and are being designed and built following this design philosophy for eight years now, since the draft DWA-M 509 was published. The most prominent example is Germany's largest fishway at Geesthacht near Hamburg, designed to pass sturgeon which are being reintroduced in the Elbe River.

Germany has more than 200 000 fish migration barriers (average distance of 1.8 and 4.7 km between barriers) and around 7 300 hydropower plants in its river systems. According to the Federal Environment Agency, only around 10% of the upstream passage restoration measures have been completed in Germany in the first cycle of the WFD implementation, whereas 40% have not yet started.

All large rivers in Germany are owned and managed by the Federal Waterways and Shipping Administration (Wasserstraßen- und Schifffahrtsverwaltung - WSV). The network of WSV's inland waterways amounts to 7 290 km and includes 253 sizeable barriers (weirs), of which many incorporate ship locks and hydropower plants. Following changes in German federal water law, the WSV is responsible for upstream fish passage maintenance and restoration in its waterways since 2010. An initial prioritization concept in 2010 categorized the fish passage restoration measures according to the WFD cycles. It was assumed that 45 fish pass projects should start construction or be completed before 2015. However, to date, only 8 fish passes have been constructed (1 by WSV, 7 by third parties), one fish pass is currently being built, 6 large pilot facilities and 21 other fish passes are still being designed by WSV (5 projects are undergoing planning approval), 7 projects undergoing design are managed by State Authorities, and 11 projects have been or are at risk of being stopped. The reasons for the delay in implementation will be outlined in the presentation.

Yet, several fish passes have been built on large German rivers, either by State authorities or hydropower companies. On the Rhine River that partially forms the German-French and German-Swiss borders, French and Swiss hydropower companies have built some large fishways in cooperation with the German river authorities.

Besides the "hands-on" design and construction of fish passes there are several ongoing scientific programs or projects because fishway science, engineering and practice are still evolving (worldwide) and fish passage is not yet an entirely proven technology. Results of past research and implementation suggest that the development of effective fish passes requires biological knowledge of fish behaviour when encountering variable flows, velocity and turbulence, combined with hydraulic and civil engineering knowledge and expertise to develop facilities that provide suitable hydraulic conditions for fish. In general, biological understanding of the requirements of fishway design lags behind the engineering advances and specific ecological issues are still being investigated, e.g. biomechanisms, energetics and population dynamics. In recent years a new bioengineering science discipline "ethohydraulics" has evolved, initially implemented at Karlsruhe University (KIT). The aim of this discipline is to derive guidelines for a more environmentally compatible hydraulic engineering practice based on the research and understanding of the needs of the aquatic fauna,

especially fish.

Fish protection and safe downstream passage has recently come to the fore, in face of the WFD requirements around river continuity. As fish passage efforts have largely focused on upstream passage, downstream fish passage technologies are much less advanced and are in need of research. Several systems of varying efficacy exist to prevent fish from being entrained in water intakes. Physical barriers that exclude fish from turbine intakes are the preferred technology in Germany. However, as yet, no country has found a satisfactory solution to downstream migration problems, especially where large installations are involved, such as turbines and spillways which are major factors that impede downstream movement.

Presentation title: Possibilities of rehabilitation of indigenous Danube sturgeon species in Hungary

Presented by: Bela Halasi-Kovacs, Research Institute for Fisheries and Aquaculture, HAKI, Hungary

Summary of Presentation

The Hungarian section of the Danube drainage provided natural habitats and important migration route for Danube sturgeon species until river regulation. They constituted a remarkable and systematic element of the Hungarian fish fauna. The Hungarian section of Danube and its tributaries provided suitable environmental conditions for five Ponto-Caspian sturgeon species: sterlet (*Acipenser ruthenus*), Russian sturgeon (*Acipenser gueldenstaedtii*), ship sturgeon (*Acipenser nudiventris*), stellate sturgeon (*Acipenser stellatus*) and beluga (*Huso huso*). The sterlet completes its entire lifecycle within fresh water, however the other species are considered as anadromous ones.

At present, besides the sterlet with Euro-Serbian distribution area, the four Ponto-Caspian sturgeon species are known from sporadic occurrences in Hungarian section of Danube drainage (Halasi-Kovács and Harka, 2012). Based on the frequency of occurrence data for Russian and ship sturgeon in Hungary, it can be assumed that there may be freshwater populations of these species that complete their entire lifecycle within freshwater habitats.

In the last 25 years there were several verified records of Russian sturgeon in different locations along the Danube (Guti 1997; 2000). These individuals were not sexually mature, possibly indicating the existence of a potamodromous population in the middle Danube. The presence of ship sturgeon is also sporadic, although it has more validated records from the Mura and Drava system in the last few years. By contrast, there has no information of occurrence data (in the last 25 years) for the beluga and stellate sturgeon.

The main reason of the decline and disappearance of sturgeon species within the Danube River basin are various anthropogenic effects, e.g. extensive river regulations, degradation of spawning sites, establishment of dams, water pollution, overfishing, poaching etc. Another, emerging conservation issue for

native sturgeon stocks, is the interspecies hybridization, and spreading of non-indigenous sturgeon species. Verified captures of the Serbian sturgeon (*Acipenser baeri*), and paddlefish (*Polyodon spathula*) have been documented within the middle section of Danube drainage (Holčík 2006; Holčík *et al.* 2006; Simonovič, Maric and Nikolic 2006; Ludwig *et al.* 2008). The Serbian sturgeon individuals are capable of interbreeding with indigenous sterlet stocks. The occurrence of these hybrid sturgeons in the Danube could be explained by escapes from aquaculture production areas, non-conscious stocking activities as well as natural hybridization due to the population decline of sturgeon species. This further weakens the natural populations. Based on these facts, all four indigenous sturgeon species are considered as “Critically endangered” by the IUCN Red List.

The population decline of these species is a critical issue that requires urgent actions to determine operative tools that support strengthening the natural populations.

The HAKI has a sturgeon ex-situ live gene bank, which allows them to initiate and participate in the rehabilitation programs. The gene bank contains sterlet, Russian, stellate and beluga sturgeon strains from Danube River basin and additional, Serbian sturgeon, paddlefish, Russian sturgeon and sterlet from different origins. This gene bank could enable researchers in HAKI to carry out scientific studies to assist in the rehabilitation of Danube sturgeon species.

The gene bank was established by HAKI in the 80’s and its sterlet gene stock was formed from captured fish originating from Hungarian sections of the Danube and Tisza rivers. Therefore, these fish are utilized as a “reference” population. At HAKI, genetic research on sterlet is being carried out to gain preliminary knowledge on the genetic structure of the captive broodstock in relation to that of wild fish, originating from recent catches in the middle Danube section. The results are to be used for broodstock management to prevent inbreeding and/or outbreeding and the loss of rare alleles/genotypes to maintain genetic diversity of Sterlet population in gene bank stock and the Danube River.The HAKI has elaborated a species conservation plan for sterlet in the Middle Danube and performed several stocking actions to support its natural populations.

Besides the population genetic studies there are further ongoing research activities involving sturgeons like, the investigation of different rearing technologies on the physiological and immune status of sterlet by the examination of stress parameters. The findings of this research will help to achieve the good practice of restocking programs. Currently certain environmental factors are being investigated (temperature, light conditions, salinity) that determine the sex of sturgeons. This will be linked to the potential effects climate change has on the populations of Danube sturgeons. Furthermore, the HAKI is involved in an environmental DNA study where the objective is to detect biological traces (DNA) of rare species such as Ship sturgeon.

The HAKI also participates in international co-operation program MEASURES (Managing and restoring aquatic ecological corridors for migratory fish species in the Danube river basin).

It is necessary to distinguish between short and long term conservation actions. Short term actions should focus on restocking activities that involve the use of gene banks to main genetic biodiversity. With long term actions providing tools that can really support strengthening the declined natural population.

However, the population rehabilitation of Danube sturgeons in the Danube river basin can only be effective if there is a strong and coordinated international cooperation among the Danube countries. Such conservation action could be a transnational network of ex-situ sturgeon gene banks with coordinated operation.

Presentation title: Rivers as Blue and Green corridors with a focus on the Mura and Sava rivers
Presented by: Mitja Bricelj, Ministry of Environment and Spatial Planning, Slovenia

Summary of presentation

Eco-connectivity is one of the natural hydro-geographical characteristic of river basins, costal and marine areas. Eco-connectivity is important for good ecological status and healthy and reproductive waters and seas. Pressures and impacts caused by economic activities from agriculture, industry, urbanisation, transport and energy sectors are significant on water/coastal and marine environment on regional, national and global level. Programmes for Adaptation of Development to Climate Changes are challenging but yet, provide opportunities for smart solutions. The Integrated Coastal Zone Management (ICZM) and Marine Spatial Planning (MSP) are modern tools that bring the Green corridors (to connect important terrestrial habitats) and Blue corridors (costal and marine habitats) together and are at the centre of sustainable development and Adaptation to Climate Change Programmes.

Presentation title: Lagoon management as the main instrument for their conservation
Presented by: Mimoza Cobani, Fisheries and aquaculture expert, Albania

Summary of presentation

Albanian coastal lagoons represent a precious natural heritage. Since Illyricum times, lagoon fisheries have been very important in coastal zones providing local populations with an important source of food. Remnants of fishing activities in Illyricum tribes' dwellings (fish bones, fishing tools, bone and bronze hooks, iron and bone harpoons, boats, etc.) are the witness of the existence of ancient fisheries cultures.

Coastal lagoons are particular aquatic sites within the Albanian hydrographic network and represent a very important environment and multiple assets, both at the ecological and economic level. It is estimated that coastal lagoons are the most productive ecosystems, owing to their position between land and sea. In countries with high biodiversity, such as Albania, the contribution of wetlands is essential. Their protection and their preservation have been identified as a priority not only by environmental institutions, but also by numerous non-governmental organizations.

The precarious state of coastal lagoons and the lack of a proper management are widely recognized among administrators and scientists. There are no strategic and specific management plans for coastal lagoons in Albania.

The proper management of such peculiar areas could take place by preparing a "Roadmap for lagoon management" and integrating them in the existing legislation. Also, involving local administrations, organizations, associations and relevant stakeholders in light of present and future pressures including climatic change, increased urbanization and industrialization is an effective way to preserve biodiversity and ecosystems and ensuring full implementation of the above measures.

Presentation title: Concept and objectives from the Aquaculture Demonstration Center in Constanta

Presented by: Victor Nita, National Institute for Marine Research and Development 'Grigore Antipa', Romania

Summary of presentation

BACKGROUND

Mussel culture has been known since the last century. The development of technologies based on scientific observations was possible only a short time after advancing the knowledge of the physiology and ecology of molluscs.

World production of farmed bivalves increased from 3.3 million tonnes in 1990 to nearly 20 million tonnes in 2010, with an annual average increase of 11%.

The annual quantity of mussels harvested in the Romanian Black Sea coast area amounts to approx. 15 tonnes (estimated value), and the only existing mariculture farm, S.C. MARICULTURA S.R.L., can produce annually approx. 5 tonnes of cultured mussels.

RESULTS

The Shellfish Aquaculture Demonstrative Center in Constanta is a part of the well-established research facilities of the National Institute for Marine Research & Development "Grigore Antipa" (NIMRD), Constanta, Romania. NIMRD has semi-pilot scale production installations (with potential for expansion in the future) and takes advantage of existing infrastructures and expertise to share knowledge and to improve cooperation. It meets the establishment criteria about the nature and functions of the S-ADC as recommended during the WGBS Constanta Meeting (2017):

1) It is a regional hub able to respond to Black Sea countries' needs & expectations for aquaculture development;
2) Raising awareness at every level on the aquaculture potential, among others, in terms of economic opportunity for coastal communities, source of sustainable seafood & contribution to the conservation of ecological services provided;
3) Useful tool for local and national administration to assess new aquaculture projects proposals;
4) Cooperative approach and knowledge sharing of best farming practices;
5) Attract the interest of the private sector to invest on aquaculture activities instrument whose results should offer further employment opportunities;
6) Be pivotal to launch aquaculture pilot projects in specific areas of the Black Sea;
7) Follow an ad hoc, integrated & holistic approach, focus on the Black Sea region;
8) Consider the different level of national aquaculture development & requirements;
9) Take into the account the diverse ecological & environmental conditions in the Black Sea area;
10) Build upon the various expertise/disciplines available in the Black Sea riparian countries.

The demonstration production module for mussel culture is based on the long-line technology and has two components: long-line system on sea floats and boats, and shore facilities (analytical laboratories and purification). This module forms the basis of training activities in the field of mussel culture and covers all aspects of the production cycle.

The target groups and beneficiaries of the S-ADC activities are:

1) national and local management authorities/administration involved in aquaculture planning, management, sanitary control;
2) private sector, especially the small-scale producers with limited investment capacity, potential & existing investors, small farmers including coastal fishers;
3) public institutions & other organizations (e.g. NGOs) to increase their awareness on the relevance of aquaculture in particular for its potentiality;
4) scientific existing networks which could benefit from specific aquaculture training courses national & international R&D organizations dealing with aquaculture existing & future partnerships between fisheries actors & other local private & public stakeholders.

The first short term activity of the S-ADC was the "Demonstrative Training on Mussel Farming", carried-out between 17-28 September 2018 in Constanta, Romania, involving trainees from Bulgaria, Georgia, Turkey, Ukraine and Romania, from research organizations, authorities and the business sector. Representatives from the sanitary-veterinary authorities also attended and were engaged in discussion regarding certifications aspects of shellfish waters. The aim of the training was to enhance the theoretical and practical knowledge, focusing on legal and administrative issues.

CONCLUSION

The first S-ADC course focused on the holistic approach of the steps to establish the sector. It was focused to bring together people from different levels of the decision making in order to fill the gap between them so as to support the sector development from the "farm to the fork" of the consumer. The industry development has multi-scale and multidimensional levels, as a socio-ecological system depending on the captured-based approach of aquaculture.

The next step is from the holistic approach to focus on a certain module development, targeting on techniques and skills to support essential principles for Allocated Zones for Aquaculture (AZA) Development. In order to achieve this target, a review of the existing tools for AZA could be used in conjunction with shellfish zone specifications.

Key points identified from session 4

- Generational shifts in attitudes of scientists, politicians, private and public interest groups allow for initiatives to focus more on environmental protection and conservation;
- Increase the positive perception of initiatives relating to river and fish habitat restoration, through education, media campaigns, information to policymakers on positive contributions from inland fisheries to national income;
- Encourage action and responsibility at all levels (international, regional and national);
- Facilitate transnational cooperation in management of lakes and rivers that cross international boundaries, especially regarding conservation of highly migratory fish species;
- Apply forward thinking approaches:
    - Blue Growth and Green Growth connectivity - integrated management
    - Eco-tourism and recreational fisheries as alternative income sources
    - Focus must first address river habitat restoration, then focus on fish conservation

Fishing is an important source of income for communities along rivers and lakes

RECOMMENDATIONS

In conclusion of the Round Table discussions, the following list of recommendations were complied. It is envisaged that these recommendations will be implemented into future initiatives and management plans and assist in Governments and intergovernmental policy making.

- Enhancing the recovery of inland fish stocks:
  - Restore river continuity to facilitate natural rejuvenation of migratory species
  - Establish a gene bank to maintain genetic diversity
  - Focus on species with high economic value to support local communities

- Development of aquaculture to satisfy the market demand:
  - Support development of value-added products to raise incomes from fisheries
  - Implement effective management measures to reduce predator damage to cultured fish
  - Promote the role of producer organisations to increase marketing capacity

- Gaining greater public involvement:
  - Improve transnational initiatives to jointly manage cross-border freshwater resources
  - Promote long-term commitment and engagement with local communities
  - Policymakers should insure connections with all stakeholders, from scientists to fishermen

- Improving communication techniques:
    - Raise awareness of positive outcomes of initiatives on habitat restoration
    - Adapt and apply techniques based on the target audience, i.e. adults versus children

- Foster the development of inland fisheries:
    - Policymakers and researchers should continue open and transparent dialogue with all stakeholders
    - Identify and fund alternatives to fishing activities (diversification of rural community income) to reduce stress on endangered species
    - Introduce sustainable fishing methods (e.g. selective gears)
    - Promote culture-based fisheries where feasible to insure aquatic biodiversity and conservation of endangered species
    - Strengthen cooperation between fishermen and scientists to identify problems and find feasible solutions
    - Enforce fisheries control systems, especially aimed at reducing illegal, unreported and unregulated fishing (IUU)

- Create online knowledge-sharing platforms:
    - Tailor platforms to specific users e.g. scientists or stakeholder community
    - Enhance awareness and use of already existing platforms for knowledge sharing (e.g. EIFAAC, EUROFISH, FAO Committee on Fisheries (COFI), etc)

- Call for coherent and reliable data on inland fisheries (including recreational) to support informed policy decisions
    - Improve data collection techniques for inland fisheries production and stock assessment
    - Quantify the value of inland fisheries, including the socio-economic value and environmental contribution

- Identify conflicts of river use:
    - Valuation of alternative uses such as hydropower dams for energy, flood control management, crop irrigation, canals for transportation, etc,
    - Improve river continuity through dam decommission or building fish passes

- Integrate new technologies (Industry 4.0) into current practices:
    - Improve efficiency of production and increase market share by adapting and deploying new technologies, including Internet of Things, cloud computing, machine learning and artificial intelligence.

Reference List

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Annex 1 – Biographies

Antonin Kouba
Vice-dean
Science and Research at the Faculty of Fisheries and Protection of Waters, University of South Bohemia

Antonín Kouba is a Vice-dean for Science and Research at the Faculty of Fisheries and Protection of Waters at the University of South Bohemia in the Czech Republic. He is mainly focused on a wide variety of crayfish-related issues including biology, ecology, distribution, conservation management, ethology, growth, intensive juvenile crayfish culture, crayfish plague, as well as their utilization in biomonitoring and toxicology. His current focus also includes pet trade as a prominent pathway of non-indigenous crayfish species introductions. He has published ca. 100 articles in the area.

Bela Halasi-Kovacs
Director
NAIK Research Institute of Fisheries and Aquaculture (HAKI)

Béla is the director of NAIK Research Institute of Fisheries and Aquaculture (HAKI). He has twenty years experiences in pond aquaculture management and fisheries management of Hungarian surface waters. His research area is the community ecology of fishes. As the director of HAKI he organizes the research strategy in the institute. The major research directions in the institute are the aquaculture technologies development, fish genetics, fish feeding, fish immunology and hydrobiology, including the nutrient cycling of fish ponds, their ecosystem services and fisheries management of natural surface waters. Besides organizing the research activities, he also leads the innovation and extension works of the HAKI. Béla Halasi-Kovács is an honorary associate professor of Szent István University, Faculty of Agricultural and Economic Studies and Member of the Presidency of the Hungarian Aquaculture and Fisheries Inter-Branch Organisation (Ma-Hal).

Carolyn Rosten
Researcher
Norwegian Institute for Nature Research (NINA)

Carolyn Rosten is a researcher at the Norwegian Institute for Nature Research (NINA). She graduated with a PhD in fish ecology from Durham University, UK in 2005, and has worked with applied aspects of fish ecology since then. Her current interests and competence are within ethology, migration, conservation, habitat use and life history strategy. Carolyn draws upon NINAs experience with research-based manage-ment of Atlantic salmon to contribute to conservation of sturgeon species in the Danube.

Cathal Gallagher
R&D
Inland Fisheries Ireland

As Head of Research and Development in Inland Fisheries Ireland (IFI), Cathal works with a team of applied researchers in the development and delivery of a range of research projects and in the provision of advice to government and stakeholders on all matters relating to Ireland’s unique inland fisheries resources. He also served two terms as Chair of European Inland Fisheries and Aquaculture Commission (EIFAAC) and currently acts as the EU representative to NASCO’s (North Atlantic Salmon Conservation Organisation) International Atlantic Salmon Research Board (IASRB).

Christian Wolter

Senior scientist
Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB)

Dr.-Ing. Christian Wolter is senior scientist, by training fisheries engineer and now working as fish ecologist at the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB) since 1992. His research interests comprise river ecology, river rehabilitation, fish-based environmental assessment, process-based understanding of river fish dynamics as well as environmental history. He is leading the river fish ecology lab at IGB and is the speaker of IGB's cross cutting research domain "human aquatic environment interaction". CW is teaching "protection of endangered species" at Humboldt-University, Berlin.

Cristian Badiu

Policy Officer
European Commission, DG MARE

Cristian joined the European Commission (i.e. DG Maritime Affairs and Fisheries/DG MARE) in 2011 where he worked as Policy Officer for the EFF and EMFF Operational Programs for Romania, Bulgaria and Malta. He has a long working experience in both private and public sector. Cristian started his career at the European Institute of Romania (EIR), where he coordinated the Phare teams of experts assessing EU integration impact in the areas of employment, social policy and regional development. He also acted as Chief Editor of the Romanian Journal for European Affairs in 2002. Later he entered the Romanian public service as a Programme Manager for Bilateral Assistance in the Ministry of Finance followed by a new role as Head of Unit in the Ministry of Agriculture coordinating the SAPARD Programme. Before joining DG MARE Cristian acted as EU funds' consultant with Deloitte Romania and worked as lobbyist for various multinational companies and NGOs. He holds an MA in International Relations from the Central European University in Budapest and an MA in European Economics and Politics from the Sussex European Institute.

Cristina Sandu

Coordinator
Danube Sturgeon Task Force (DSTF)

Dr. Cristina Sandu is the coordinator of the Danube Sturgeon Task Force (DSTF), established in the frame of the EU Strategy for the Danube Region - Priority Area 06 Biodiversity (DSTF – EUSDR PA 06) with the aim to foster sturgeon revival. Born in July 1966, she graduated in chemistry in 1989 at the Polytechnic Institute Bucharest, and 5 years later joined the Institute of Biology Bucharest of the Romanian Academy, where she works since over 20 years as researcher in freshwater ecology. She took her PhD in 2005 and was involved in several international projects, cooperating with research teams, policy level, NGOs and local communities from the Danube Region. Since 2009, as representative of the International Association for Danube Research, she cooperates with the International Commission for the Protection of the Danube River (ICPDR) for the Danube River Basin Management Plan. Elected in January 2012 as DSTF coordinator, she led the preparation of Sturgeon 2020 Program for sturgeon conservation in the Danube River Basin and the adjacent Black Sea and contributes actively to its implementation. She is seeking for synergies with major regional stakeholders, aiming to support the recovery of these iconic species and ensure an environmentally friendly development of the area.

Ekaterina Tribilustova

Senior Market Analyst
Eurofish Internation Oganisation

Ekaterina, started operating in the field of market analysis for fisheries and aquaculture products in 2005 performing tasks for Innovation Norway in Italy and Norwegian Seafood Council. After being a marketing consultant in Globefish (FAO) and producing several publications, she started in Eurofish International Organisation, being a part of the global FISHINFO Network. From 2007 and until present, she has been the key Market Analyst and expert for various economic analyses in catching, post-harvest and aquaculture sectors in different countries. She has performed various projects for Food and Agriculture Organization of the United Nations, the European Commission (Directorate-General for Maritime Affairs and Fisheries - DG MARE), the Norwegian Seafood Council, General Fisheries Commission for the Mediterranean, European Bank for Reconstruction and Development, the Ministry of Agriculture, Food and Environment of Spain, ARPA Asociados, Cluster for Fisheries in Third Countries in Spain, the Ministry of Agricultre of Croatia, Swiss Import Promotion Programme, and other organisations.

Gilles Van De Walle

Team Leader
Farnet

Gilles van de Walle is Team Leader of the FARNET support unit, the technical assistance team to DG MARE for the implementation of the Community Led Local Development (CLLD) approach of the European Maritime and Fisheries Fund (EMFF). CLLD continues the area-based approach initiated by Axis 4 of the EFF and brings additional and innovative opportunities that will enable local communities to scale up the effects of the 10000+ projects supported between 2007 and 2014. Gilles is a fisheries and aquaculture economist by training with 15 years of extensive and diverse professional experience in this field, including hands on experience on both commercial fishing boats and fish farms. He is also former head of the project unit of the international organization EUROFISH.

Ivan Zavadsky

Executive Secretary
International Commission for the Protection of the Danube River (ICPDR)

Mr. Ivan Zavadsky works in the Permanent Secretariat of the International Commission for Protection of the Danube River as Executive Secretary to this Commission since August 2013. He worked for the Slovak Government in different senior management positions in the fields of environment and water management for more than 15 years. Since 2001 until 2007, he managed two UNDP/GEF regional projects in the Danube River Basin and Black Sea region assisting 17 countries in addressing the nutrient pollution and ecological rehabilitation of the Black Sea from eutrophication. Then he worked for the GEF Secretariat, responsible for complex regional projects on international waters. At the GEF Secretariat he has led the development of the GEF IW Strategy for the next, the 6th GEF cycle. He has a master's degree in water management and a post-gradual degree on water management economics from the Slovak Technical University in Bratislava.

John Valbo Jorgensen

Fisheries Resources Officer
FAO

During John's 20 year career he has mostly worked on inland fisheries including: Fish migrations, larval drift, fisheries value chains and fish consumption surveys, fisheries assessments and using local knowledge for fisheries management. He has published in both scientific and popular media including peer reviewed articles, book chapters, newspapers and magazines. He has a M.Sc. from the University of Copenhagen.

John is currently Fisheries Officer with FAO and he has been working with the organization for 14 years, during this time he has been involved with fisheries projects all over the world and has been actively engaging with the several regional fisheries bodies. He is currently based in Rome, but has also been posted at the FAO Subregional office for Meso-America in Panama, and before working with FAO in several countries in the Asian region.

Luchian Florin Costel

Administration Department Manager
SC Rompescador SRL

Luchian Florin Costel is the manager of the Administration Department for the company SC Rompescador SRL located in Constanta, Romania. He is also the vice president of the Association of the Fishermen in port Tomish and a member of the Executive Committee of Black Sea Advisory Council.

Marina Piria

Head of Department
University of Zagreb

Marina Piria graduated in Agricultural Sciences at the University of Zagreb, Faculty of Agriculture in Zagreb, Croatia. At the same University she obtained PhD in Fisheries in 2007. From 2017 she works as full professor at University of Zagreb, Faculty of Agriculture. From 2018 she acts as head of Department of fisheries, beekeeping, game management and spec. zoology at the same University. She is involved in teaching undergraduate and postgraduate studies in several subjects related to fisheries, ichthyology and freshwater fish ecology and biology. Her main topic of research is fish ecology and biology with focus on invasive and non-native fish species. She gained experience at several institutions abroad; recently, at Massey University she was involved in New Zealand fish monitoring studies. Currently she is involved in several scientific projects related to fish invasiveness. She is elected member of EIFAAC/FAO Technical and scientific committee (2013 – now). She has published 36 WoS core collection scientific papers and more than 80 other publications as: Scopus sci papers, monographies, congress papers and abstracts and technical studies.

Marq Redeker

Business Development Manager
CDM Smith Consult, Germany

Marq is a Civil Engineer, specialized in water management and hydraulic engineering, with 22 years international work experience in river basin management and consultancy for public and private clients. His special interests include fish passage, river restoration and flood risk management. In 2003 Marq completed a post-graduate MBA-level degree in Business Engineering with a thesis on an economic analysis according to the EU Water Framework Directive.
Marq has been involved in water management strategies and water policy issues. He's been engaged in the development of fish passage best practice guidelines since 2002. In 2014 he assumed the chairmanship of the Expert Committee on Fishways of the German DWA.
Marq joined CDM Smith in 2016. His responsibilities include development and expansion of CDM Smith's national and international water business and services portfolio, implementation of strategic concepts, and provision of technical expertise and peer reviews.

Mimoza Cobani

Fisheries and aquaculture specialist

Mimoza is a fisheries and aquaculture specialist from the Albania. Having completed her master's focusing on "Poly-culture in fish farming" at the start of the 1980's, Mimoza has worked for nearly 40 years in the government and private sector. For the last 20 years Mimoza has been working for Albanian ministries. She has worked in the Fishery and Aquaculture Inspectorate for 15 years and been a Fishery and Aquaculture expert. During that time, Mimoza has worked on several publications for the FAO. Although she is now retired, Mimoza is still an expert consultant for local projects focusing on fisheries and aquaculture. Mimoza is also an active member of several boards including the National Focal Point of FAO-SIPAM and of the National Focal Point of AdriaMed programme.

Mirjana Lenhardt

Professor
Institute for Multidisciplinary Research and Institute for Biological Research University of Belgrade

Mirjana Lenhardt is a research professor at the Institute for Multidisciplinary Research and Institute for Biological Research University of Belgrade, Serbia. She has more than 30 years' experience working as researcher in the field of ichthyology, fish ecology, eco-toxicology and fish biochemistry. The part of her work was devoted to endangering factors of sturgeon species populations and their protection as well as to investigation of non-native fish species. Dr Mirjana Lenhardt has published more than 70 papers in International Citation Index journals and 7 chapters in books. She is a Expert Group Leader for Fishery/Fish Biology of International Association for Danube Research.

Mitja Bricelj

Ministry for Environment and Spatial Planning

Mitja Bricelj, Ph.D., is a geographer. Main focus: Regional approach in water resources. He is a member of the Ministry for Environment Republic of Slovenia, co-founding member of International Sava River Basin Commission, coordinator of Coastal Area Management Program Slovenia (UNEP/MAP 2004-2007), President of the Bureau of Barcelona Convention (2005-2008), Head of International Commission for Protection Danube River/ICPDR (2010), from 2014 coordinator of Environmental Pillar of European Strategy for Adriatic Ionian region /EU SAIR. He is also an author of three independent publications and numerous articles; former president of Geographic Society of Slovenia.

Pao Fernández Garrido

Events coordinator
World Fish Migration Foundation

Pao Fernández Garrido is an engineer specialized in fishway design, river restoration and dam removal projects. In 2013 she started working as a fishway designer and later she combined it working for World Fish Migration Foundation for projects as World Fish Migration Day as the worldwide events coordinator, Dam Removal Europe as content and database specialist and for AMBER (Adaptive Management of Barriers in European Rivers, Horizon2020) in the collection of all the river barrier inventories in the European continent.

Predrag Simonovic

Professor
University of Belgrade – Faculty of Biology

Professor Predrag Simonovic is a lecturer in Vertebrate Zoology, Systematics and a reader in Ichthyology (Introduction to Ichthyology and Introduction to Fisheries Sciences) at the University of Belgrade – Faculty of Biology. Research group he leads works through the Center for Genotyping of Fisheries Resources on phylogeography, systematics and fishery management of salmonids in the Western Balkans region, as well as on impact of alien fish species and water quality assessments. Center was founded in Spring 2012 and hosted researchers from the Western Balkans region interested in collaboration. Analyses of brown trout populations aim to help in their sustainable management and conservation of their indigenous stocks in the region.

Radu Suciu

Sturgeon conservation consultant
DSTF and IAD Romania

Radu Suciu retired in year 2018 as senior researcher from the Danube Delta National Institute (DDNI). He graduated fishery and aquaculture engineering, in 1976, with a PhD in fish genetics from Lower Danube University of Galati, in 2005, and has worked with applied aspects of fish breeding and fish ecology since then. He was the founder of the Sturgeon Research Group (SRG) at DDNI, in 1994. As CITES Scientific Authority for Sturgeons of Romania, the SRG of DDNI was the main scientific adviser of the Romanian Ministries of Agriculture and Environment on sturgeon fishery and conservation management during 2001 – 2018. His main interests and competence are within genetics, migration behaviour and habitat use of early life stages and adult Danube sturgeon. Most recently (2018) Radu was involved in training of students and field surveys of spawning and nursery sites of sturgeons in the Rioni River, Georgia.

Reinhold Hanel
Director
Thünen Institute of Fisheries Ecology

Reinhold Hanel is Director of the Thünen Institute of Fisheries Ecology in Bremerhaven, Germany since 2008. He received a PhD in Marine Ecology from Innsbruck University, Austria, in 2001, was a postdoctoral researcher at the Department of Physiological Chemistry of the University of Würzburg and Junior Professor for Fisheries Biology at the Leibniz Institute of Marine Sciences at Kiel University. He is Associate Professor at Kiel University, 1st Vice President of the European Inland Fisheries and Aquaculture Advisory Committee (EIFAAC) of the FAO, German Delegate to the FAO Committee on Fisheries (COFI), the FAO COFI Subcommittee on Aquaculture and German representative to the EIFAAC/ICES/GFCM Working Group on Eels (WGEEL). His main research interest is in changes in ecosystem structure and function and their impacts on the management of living aquatic resources. Management concepts also become protection concepts when it comes to preserving sensitive migratory fish species or protecting genetic diversity in aquatic stocks.

The Thünen Institute of Fisheries Ecology is nationally and internationally one of the leading institutions in European eel research. Nationally, it is responsible for the monitoring of yellow and silver eel condition in all German river basin districts within the Data Collection Framework (DFC). In addition, Reinhold Hanel initiated the re-establishment of research on oceanic life stages of freshwater eels in the Sargasso Sea. As a participant in the international Galathea expedition in 2007 and as Chief Scientist of four international scientific surveys on board R/V Walther Herwig III in 2011, 2014, and 2017 as well as on board R/V Maria S. Merian in 2015, he significantly contributes to a better understanding of the oceanic conditions defining the eel spawning grounds, of temporal shifts in abundance of eel early life-history stages as well as of the migration behaviour of matured silver eels released in open ocean conditions. Recent eel related research initiatives include the projects AalPro (Artificial Reproduction of the European Eel) as well as the development of hyperbaric swimming tunnels with respirometer function as part of the AUTOMAT project funded through the innovation program of the German Federal Ministry of Food and Agriculture and the project SPEER (The swimming physiology of the European eel under regulable hyperbaric conditions) funded by the German Research Foundation (DFG). He further coordinates the EelConSenSus project, a study on “The European eel biology, migration and sustainable management” financed by the Directorate-General for Internal Policies of the European Parliament.

Roswitha Stolz
Senior lecturer
Ludwig Maximilien University

Roswitha works as a senior lecturer at the Department of Geography, Ludwig-Maximilians-University of Munich (LMU). She graduated with a PhD in geography and remote sensing at LMU in 1996 and has since then mainly worked on the impacts of environmental change on the hydrological cycle and the possibilities of monitoring water and vegetation related issues with remotely sensed data, in addition to lecturing. She has been engaged in several large research projects regarding the global change impacts on the water cycle in river basins and works with the International Commission for the Protection of the Danube River (ICPDR).

Steven Visser

Water management consultant
Visser Water Management

Since 1996, I am working as a senior water resources management expert, providing technical- and policy support in the field of water management, hydrology, irrigation and drainage, flood control and water quantity and water quality management. I am working as an independent water management consultant since October 2008, both in the Netherlands and abroad. In total, I have over 20 years of experience in water management projects at home and abroad (Netherlands, Palestine, Kyrgyzstan, Pakistan, Bangladesh, Vietnam, Nigeria, Trinidad and Tobago). I work mainly for national and regional authorities, such as ministries, provinces and water boards. In addition, I am working as a senior water management advisor for the World Bank and FAO..

Tudor Ionescu

Director
Research and Development Centre for Sturgeon, Aquatic Habitats and Biodiversity

Tudor Ionescu is a researcher at the “Dunarea de Jos” University of Galati since 2008 and Director of the Research and Development Centre for Sturgeon, Aquatic Habitats and Biodiversity since 2016. The area of research is focused on IN-SITU research and monitoring of migratory fish species (especially sturgeons) and their aquatic habitats from the Danube and the Black Sea. In the last 10 years, Tudor was involved in several projects which had as objective the protection and conservation of Danube migratory fish species. The research activity has the purpose to identify the causes that have affected critically endangered fish species and to find solutions for their conservation.

Veronika Koller-Kreimel

Deputy Director
National and International Water Management

Dr. Veronika Koller-Kreimel holds a Doctoral degree in biology from University of Vienna and has been working at the Austrian Federal Ministry of Sustainability and Tourism (former Ministry of Agriculture, Forestry, Environment and Water Management) since 1991 as a senior expert on freshwater ecology and since 2010, Deputy Director for National and International Water Management. Prior to this Veronika was a Project Manager for Aquatic Ecology at the Federal Institute of Water Quality, Vienna-Kaisermühlen

Current responsibilities include:
• Steering of EU Water Framework Directive implementation for surface waters in Austria (river and lake typology, water body delineation, pressure and impact analysis, development of biological and hydromorphological assessment methods, monitoring networks, assessment of ecological status/ecological potential, HMWB designation, restoration and mitigation measures)
• Development of the National River Basin Management Plan and Programme of Measures with regard to surface waters
• National Expert on hydropower and ecology

Activities on EU level and Danube Basin include:
• Austrian representative in several EU CIS Working Groups and Task Groups (e.g. ECOSTAT, E-flow, POM, Hydromorphology, etc.)
• Since 1996: Austrian representative in Expert Groups of the International Commission for the Protection of the Protection of the Danube River • Since 2007: Chair of the Hydromorphology Task Group.

Victor Nita

Senior researcher
National Institute for Marine Research and Development 'Grigore Antipa'

Nita has a PhD in Aquaculture from USAMV Bucharest and works as a senior researcher at the National Institute for Marine Research and Development 'Grigore Antipa' in Constanta, where he heads the Aquaculture Laboratory. Prior to this Nita obtained a Master’s degree in Biodiversity Conservation and Environmental Protection. Nita is a peer reviewer for the journals “Aquaculture, Aquarium, Conservation and Legislation” and “Advances in Environmental Sciences”.

Victoria Chomo

Senior Fisheries and aquaculture officer
Regional office for Europe and Central Asia, FAO REU

Victoria Chomo has a PhD in Economics and specializes in post-harvest fish value chains (certification, traceability, markets and trade) as market-based tools for promoting sustainable fisheries and aquaculture production and consumption. As Senior Fisheries and Aquaculture Officer in the FAO regional office, she is Secretary of two FAO regional fisheries bodies (EIFAAC and CACFish) whose mandates are to assist Governments to sustainably develop inland fisheries and freshwater aquaculture resources in Europe and Central Asia.

Annex 2 – List of participants

	Country	Name	Organisation/Company
1	Albania	Mimoza Cobani	Fisheries and aquaculture expert
2	Albania	Ardita Gjerasi	Ministry of Agriculture and Rural Development
3	Albania	Fadil Gjuta	Ministry of Agriculture and Rural Development
4	Armenia	Ter-Isahakyan	Ministry of Agriculture
5	Armenia	Tigran Aleksanyan	Ministry of Agriculture
6	Austria	Veronika Koller-Kreimel	Ministry of Environment and Sustainable Tourism
7	Austria	Ivan Zavadsky	International Commission for the Protection of the Danube River
8	Austria	Steve Chaid	ORF Stars
9	Azerbaijan	Salamat Nadirov	Department for Reproduction and Protection of Aquatic Bioresources at Reservoirs
10	Belgium	Gilles Van de Walle	FARNET Support Unit, European Commission
11	Belgium	Cristian Badiu	DG MARE, European Commission
12	Bosnia and Herzegovina	Amir Lubovac	Ministry of Foreign Trade and Economic
13	Bosnia and Herzegovina	Bozica Bojovic	Ministry of Foreign Trade and Economic
14	Bulgaria	Tihomir Stefanov	National Museum of Natural History, Sofia
15	Croatia	Marina Piria	University of Zagreb, Faculty of Agriculture / EIFAAC
16	Czech Republic	Antonin Kouba	Research Faculty, University of South Bohemia
17	Denmark	Ekaterina Tribilustova	EUROFISH
18	Denmark	Aina Afanasjeva	EUROFISH
19	Denmark	Thomas Jensen	EUROFISH
20	Denmark	Brit Jensen	EUROFISH
21	Denmark	Toni Bartulin	EUROFISH
22	Denmark	Mark Verlaan	EUROFISH
23	Estonia	Liis Reinma	Ministry of Rural Affairs
24	Georgia	Archil Partsvania	Ministry of Agriculture
25	Georgia	Nino Chobaniani	Georgian Fish Farmers Union
26	Germany	Christian Wolter	Leibniz-Institute of Freshwater Ecology and Inland Fisheries
27	Germany	Marq Redeker	CDM Smith
28	Germany	Reinhold Hanel	Institute of Fisheries Ecology / EIFAAC
29	Germany	Roswitha Stolz	Ludwig Maximilien University
30	Germany	Gabriela Costea	Leibniz-Institute of Freshwater Ecology and Inland Fisheries
31	Hungary	Bela Halasi-Kovacs	Research Institute for Fisheries and Aquaculture, HAKI
32	Hungary	Gyula Kovacs	Department of Fish Biology, HAKI
33	Hungary	Victoria Chomo	FAO REU
34	Ireland	Cathal Gallagher	Research and Development for Inland Fisheries / EIFAAC
35	Italy	John Jorgensen	FAO
36	Latvia	Inese Bartule	Fisheries Department of the Ministry of Agriculture
37	Latvia	Ruta Medne	Institute of Food Safety, Animal Health and Environment ”BIOR”
38	Lithuania	Laima Vaytonite	Department of Fisheries of the Ministry of Agriculture
39	Lithuania	Valdas GeČys	Fisheries Service, Ministry of Agriculture
40	Lithuania	Tomas Kazlauskas	Fisheries Service, Ministry of Agriculture

41	Moldova	Galina Curcubet	State Enterprise "Republican Center for Animal Breeding and Reproduction"
42	Norway	Carolyn Rosten	Norwegian Institute for Nature Research
43	Romania	Cristina Sandu	Danube Sturgeon Task Force
44	Romania	Luchian Florin	Dobrogea North Maritime Fisheries Federation
45	Romania	Victor Nita	National Institute for Marine Research and Development 'Grigore Antipa'
46	Romania	Gheorghe Constantin	Ministry of Waters and Forests
47	Romania	Tudor Ionescu	Dunarea de Jos University of Galati
48	Romania	Radu Suciu	DSTF and IAD
49	Romania	Cristina laura Munteanu	WWF DCP Romania
50	Romania	Camelia Ionescu	WWF Romania
51	Romania	Lorena Dediu	Dunarea de Jos University of Galati
52	Romania	Cătălin Platon	Romfish - National Fish Farmers Association
53	Romania	Buhai Sidor Dragos	Dobrogea North Maritime Fisheries Federation
54	Romania	Iulia Rodica Grecu	Dunarea de Jos University of Galati
55	Romania	Tetiana Maievska	Research and production centre «Forel»
56	Romania	Gabriela Grigoras	Museum complex of natural sciences, Galati
57	Romania	Baboianu Grigore	Acces 21 Association
58	Romania	Isabelle Metaxa	Dunarea de Jos University of Galati
59	Romania	Docan Angelica	Dunarea de Jos University of Galati
60	Romania	Irina Cernisencu	Danube Delta National Institute for Research and Development
61	Romania	Madalina Gabriela Rosca	Incdm g.antipa constanta
62	Romania	Madalina Tudorache	University of Bucharest
63	Romania	Stanescu Stelian	NIHWM
64	Romania	Ion Navodaru	Institutul National de Cercetare Dezvoltare Delta Dunarii
65	Romania	Daniela Strat	University of Bucharest, Faculty of Geography
66	Romania	Marian Paraschiv	Danube Delta National institute - Tulcea
67	Romania	Paula Posan	
68	Romania	Iuliana Florentina Gheorghe	Ecological university of boucharest
69	Romania	Viorica Ratcu	
70	Romania	Maereanu Maeilena	Danube research consulting
71	Romania	Carmen Andrei	River Administration of the Lower Danube Romania (AFDJ)
72	Romania	Adrian Ionascu	S. E. Aquaterra
73	Romania	Paul Molnar	WWF
74	Romania	Simona Mihailescu	Institute of Biology Bucharest of Romanian Academy
75	Romania	Romeo Stoicescu	Ajvps Sibiu
76	Romania	Grigore Davideanu	University "al.I.Cuza" iasi, natural history museum
77	Romania	Andreea Harceag	Ministry of Waters and Forests
78	Romania	Carmen Georgeta Nicolae	University of Agronomic Sciences and Veterinary Medicine of Bucharest
79	Romania	Laurentiu Ion	National Agency for Fisheries and Aquaculture
80	Romania	Romeo Catalin	Media/Press

81	Romania	Nicolai Craciun	Faculty of biology, University of Bucharest
82	Romania	Adriana Petcu	State Secretary, Ministry of Waters and Forests
83	Romania	Mioara Costache	Statiunea de cercetare pentru piscicultura Nucet
84	Romania	Nicolae Dimulescu	National Agency for Fisheries and Aquaculture
85	Romania	Emilia Radu	Institute of Biology Bucharest
86	Romania	Ovidia OPRIS	Ministry of Agriculture and Rural Development
87	Romania	Anca Finantu	Ministry of Waters and Forests
88	Romania	Galan Catalin	Ministry of Waters and Forests
89	Romania	Relu Giuca	University of Bucharest - Research Center in systems ecology and sustainability
90	Romania	Cristina Alina Dumitrache	Institute of Biology Bucharest of Romanian Academy
91	Romania	Kety Balaci	National Agency for Fisheries and Aquaculture
92	Romania	Adrian Ion	Media/Press
93	Romania	Stanescu Dragos	Media/Press
94	Romania	Mioara Costache	Nucet Fish Farming Research and Development Station
95	Romania	Camelia Balaci	
96	Romania	Daniela Costa	
97	Romania	Dănuț Alexandru Potor	State Secretary, Ministry of Agriculture and Rural Development
98	Romania	Badilita Alin Marius	
99	Russia	Oleg Perevalov	FSBSI Azov Research Fisheries Institute
100	Serbia	Predrag Simonovic	University of Belgrade
101	Serbia	Mirjana Lenhardt	Univerisity of Belgrade, Department of biology and inland waters protection
102	Slovenia	Mitja Bricelj	Ministry of the Environment and Spatial Planning
103	Spain	Pao Fernandez Garrido	World Fish Migration Foundation
104	The Netherlands	Steven Visser	Visser Water Management
105	Turkey	Nadir Uslu	Ministry of Agriculture and Forestry
106	Turkey	Nuri ÇELİK	Ministry of Agriculture and Forestry
107	Ukraine	Tetiana Yakovlieva	Aquaculture and Reproduction of Water Bioresources of the State Agency of Fisheries of Ukraine
108	Ukraine	Yurii Sharylo	Methodological and technological center of aquaculture

Yellow indicates speakers.

Annex 3 – Workshop Agenda

Regional Conference on
River habitat restoration for inland fisheries
in the Danube River basin and adjacent Black Sea areas

13-15 November 2018, Bucharest, Romania

Opening remarks: **Adriana Petcu, State Secretary, Ministry of Waters and Forests, Romania**
Audun Lem, Deputy Director Policy and Resources Division, Fisheries and Aquaculture Department, FAO
Nicolae Dimulescu, President of National Agency for Fisheries and Aquaculture, Romania
Aina Afanasjeva, Director, EUROFISH

KEYNOTE ADDRESS
Role of Inland fisheries for food security, livelihoods and rural rejuvenation
Victoria Chomo, Secretary of EIFAAC
FAO Regional Office for Europe and Central Asia, Budapest, Hungary

Moderator: Steve Chaid, ORF Stars, Austria

I. VALUING INLAND FISHERIES RESOURCES

- Sturgeon 2020 – how can a conservation program bring benefit to local communities?
  Cristina Sandu, Danube Sturgeon Task Force (DSTF), Romania
- Restoration of river connectivity in Romania
  Gheorghe Constantin, Ministry of Waters and Forests, Romania
- Non-native crayfish species in the region and their effects on the environment
  Antonín Kouba, Research Faculty, University of South Bohemia, Czech Republic
- The invasive *Rapana venosa* and alternative fishing methods and species in the Black Sea
  Luchian Florin, Dobrogea North Maritime Fisheries Federation, Romania
- Restoration of Ireland's valuable inland fisheries resource
  Cathal Gallagher, Research and Development for Inland Fisheries, Ireland / EIFAAC
- An overview of the European trade focusing on the Danube species
  Ekaterina Tribilustova, EUROFISH, Denmark

Q & A and Conclusions

II. CONSERVATION AND MANAGEMENT

- Ecosystem approach to inland fisheries
  John Jorgensen, Food and Agriculture Organization of the United Nations (FAO), Italy
- Adaptation to climate change in the Danube Region
  Roswitha Stolz, Ludwig Maximilien University, Germany
- A century of sturgeon fisheries, Danube sturgeon where to?
  Tudor Ionescu, Research and Development Centre for Sturgeon, Aquatic Habitats and Biodiversity, Romania
- Habitats of sturgeons in the Lower Danube River and the North Western Black Sea: status of knowledge and perspectives for restoration
  Radu Suciu, DSTF and IAD, Romania
- Danube Sturgeon: Strategies and actions towards their conservation
  Ivan Zavadsky, International Commission for the Protection of the Danube River (ICPDR), Austria
- Eels habitat and combatting IUU fishing
  Reinhold Hanel, Institute of Fisheries Ecology, Germany / EIFAAC

- Invasive alien freshwater fish species in the Danube – implications for management.
  Marina Piria, University of Zagreb, Faculty of Agriculture, Croatia / EIFAAC
- River habitats restoration experiences at European level
  Christian Wolter, Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Germany
- Importance of telemetry in the detection of fish habitats
  Carolyn Rosten, Norwegian Institute for Nature Research (NINA), Norway

Q & A and Conclusions

2nd day: **III. REGULATORY FRAMEWORK**

- Hydro-morphological alterations versus sustainable management of fish stocks
  Predrag Simonović, University of Belgrade, Serbia
- Connecting fish, rivers and people. Opening swim-ways around the world from local to global
  Pao Fernandez Garrido, World Fish Migration Foundation, Austria
- European Maritime and Fisheries Fund (EMFF) support to inland fisheries
  Cristian Badiu, DG Mare, European Commission, Belgium
- FLAGs: community led development in EU inland waters
  Gilles Van de Walle, European Commission, FARNET Support Unit, Belgium

Q & A and Conclusions

IV. SHARED COUNTRY EXPERIENCES

- Room for the River: river and flood plain restoration along the downstream part of the Rhine in The Netherlands and Germany serving multiple purposes
  Steven Visser, Visser Water Management, The Netherlands
- Activities and experiences on river restoration in Austria
  Veronika Koller-Kreimel, Ministry of Environment and Sustainable Tourism, Austria
- Status of long distance migratory fish species (sturgeons, shads) in Lower Danube Region
  Mirjana Lenhardt, University of Belgrade, Department of biology and inland waters protection, Serbia
- German experience in restoration of longitudinal continuity of large rivers
  Marq Redeker, CDM Smith, Germany
- Possibilities of rehabilitation of indigenous Danube sturgeon species in Hungary
  Bela Halasi-Kovacs, Research Institute for Fisheries and Aquaculture, HAKI, Hungary
- Rivers as Blue and Green corridors with a focus on the Mura and Sava rivers
  Mitja Bricelj, Ministry of Environment and Spatial Planning, Slovenia
- Lagoon management as the main instrument for their conservation
  Mimoza Cobani, Fisheries and aquaculture expert, Albania
- Concept and objectives from the Aquaculture Demonstration Center in Constanta
  Victor Nita, National Institute for Marine Research and Development 'Grigore Antipa', Romania

Q & A and Conclusions

V. ROUND TABLE DISCUSSIONS AND CONFERENCE RECOMMENDATIONS

- River habitat restoration as key measure to strengthen European Inland Fisheries: long-term perspectives and solutions

Mitja Bricelj, Ministry of Environment and Spatial Planning
Veronika Koller-Kreimel, Ministry of Environment and Sustainable Tourism
Gheorghe Constantin, Ministry of Waters and Forests
Radu Suciu, DSTF and IAD
Pao Fernandez Garrido, World Fish Migration Foundation
Cristina Sandu, Danube Sturgeon Task Force (DSTF)
Cathal Gallagher, Research and Development for Inland Fisheries / EIFAAC
Reinhold Hanel, Institute of Fisheries Ecology / EIFAAC
Victoria Chomo, FAO REU
Ekaterina Tribilustova, EUROFISH

- Round up, conclusions
  Closure of the conference

3rd day: Field visit to Nucet Research and Development Station
Hosted by the Government of Romania

Regional Conference on river habitat restoration for inland fisheries in the Danube river basin and adjacent Black Sea areas

Conference Proceedings
13–15 November 2018
Bucharest, Romania

Inland waterway management is complex and faces unique challenges as inland waterways have a variety of users. The mixture and overlap of local, regional, national and at times international regulations exacerbate the problem of managing inland waterways. The Danube is an international river flowing through many European countries and its health has direct impact on environmental conditions in the Black Sea, especially for migratory species that require the sea and river habitats for parts of their life cycle.

These proceedings present the results of the regional conference organised by the FAO Regional office for Europe and Central Asia in partnership with the International Organisation for the Development of Fisheries and Aquaculture in Europe (EUROFISH) and the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC) and hosted by the Ministry of Agriculture and Rural Development and the Ministry of Waters and Forests of Romania. This publication gathers the scientific and policy information and outcomes of this regional conference for wider distribution. The long abstracts were written by the invited speakers, and the proceedings are intended as a useful collection of information focusing on river habitat restoration and inland fisheries of the European continent, with specific examples from the Danube river basin.

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