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EUROPEAN INLAND FISHERIES AND AQUACULTURE ADVISORY COMMISSION

Thirty-first Session

Killarney, Ireland, 22 – 24 June 2022

**Main findings and recommendations from the EIFAAC International
Symposium, Killarney, Ireland, 20-21 June 2022**

Report of the EIFAAC Symposium on Advances in Technology, Stock Assessment and Citizen Science in an Era of Climate Change

I. INTRODUCTION

1. The Symposium on Advances in Technology, Stock Assessment and Citizen Science in an Era of Climate Change was organized on 20 and 21 June 2022 in conjunction with the Thirty-First Session of EIFAAC in Killarney, Ireland. The Symposium was organized by Inland Fisheries Ireland and the Department of the Environment, Climate and Communications. The Symposium was convened by Dr. Cathal Gallagher and chaired by Inland Fisheries Ireland staff. The Symposium was attended by 105 participants from 14 countries. The main documentation comprised six invited papers and 35 experience papers and 15 posters.

2. In his welcome remarks to the Symposium, the TD (member of parliament) and Chair of the Oireachtas Committee for the Department of the Environment, Climate and Communications Mr. Brian Ledden referred to the importance of EIFAAC's role in the provision of advice to inland fisheries and aquaculture sector. Deputy Ledden further remarked on how the sharing of knowledge and expertise is critical in our efforts to protect and conserve our aquatic resources, particularly in an era when climate change is the abiding and most difficult challenge for us. Dr. Cathal Gallagher of Inland Fisheries Ireland (IFI) then introduced the objectives of the Symposium:

3. The Symposium had five major themes, which were:

- (i) Inland fish stock assessment
- (ii) Developments in freshwater fish monitoring technologies with an emphasis on non-destructive methods
- (iii) The problems and challenges of climate change and its impacts on inland aquatic resources and fisheries
- (iv) Citizen science
- (v) Aquaculture - traditional freshwater systems vs recirculation systems

4. On behalf of EIFAAC, Mr Raymon VanAnrooy invited the Symposium participants to continue their active contribution to the work of EIFAAC and to use the opportunities provided by the Symposium to exchange experiences and research findings, and to bring their findings, conclusions and recommendations to the attention of the Commission.

II. SUMMARY OF THE SYMPOSIUM

SESSION 1: Inland fish stock assessment

5. This session aimed to discuss quantitative approaches to assessment and management of inland fisheries and fish stocks, with a focus on: (i) Data collection and monitoring requirements for stock assessment, (ii) Data-limited assessment methods relevant to inland commercial and/or recreational fisheries, (iii) Assessment of predation, e.g., cormorant, impacts on freshwater fish stocks, and (iv) Model-based approaches to inland fisheries management, e.g., MSE, harvest control rules etc. The session was chaired by Dr. Sam Shephard (Inland Fisheries Ireland).

6. The session comprised 13 presentations of which 10 had a regional perspective and 2 demonstrated national level experiences with stock assessment approaches and methods in EIFAAC Member countries Croatia, Denmark, Finland, Germany, Ireland, Northern Ireland (UK) and Serbia.

Summary overview:

7. Stocking is a long-held paradigm in inland recreational fisheries and often considered a panacea by angling groups. Scientific evidence suggests that stocking is frequently unsuccessful but there are still strong social pressures on angling groups and managers to introduce fish. This needs to be a process of knowledge sharing and coproduction in which users and scientists collaborate to explore management options and to establish evidence-based interventions and conservation norms. More useful tools may involve creating additional habitat e.g. dead wood and littoral zones.

8. Further discussion took place looking at habitat development and the need for Ecosystems management. Species conservation focused on of brown trout, eel and lamprey and included a discussion around population modelling. New and novel stock assessment methodologies and monitoring were introduced including assessment of populations in catchment which have limited available data and the use of eDNA.

9. Predation on fish stocks by mink and cormorant was identified as an important conservation issue. There was strong support from delegates for a 'call to action' by EIFAAC and the development of a region-wide cormorant management plan to address the issue of cormorant predation, which has devastated fish stocks in Denmark and elsewhere.

SESSION 2: Developments in freshwater fish monitoring technologies with an emphasis on non-destructive methods

10. The monitoring of fish populations is an essential tool for quantifying population abundance and composition and assessing impacts of anthropogenic pressures. The session explored conventional and new sampling methodologies with a view to sharing knowledge and expertise on gathering data, while avoiding damage to the fish.

11. This session was composed of 9 presentations and was chaired by Prof. Dr. Jan Kubecka Institute of Hydrobiologu, Czech Republic.

Summary Overview:

12. This session discussed the methods for monitoring fish populations as an essential tool for quantifying population abundance and composition and assessing impacts of anthropogenic pressures. Approaches and case studies using passive and active telemetry were presented. Interesting discussions took place around presentations on the use of eDNA, DNA, UV light and hydroacoustic technology as non-invasive techniques to support monitoring and to increase understanding of fish species conservation and habitat usage.

13. The session participants agreed that for species such as the Arctic char, the classical taxonomy based on morphology is not appropriate for management and conservation and it fails to recognise unique biodiversity within the species. For this species, an “integrative taxonomic” approach is more appropriate.

SESSION 3: The problems and challenges of climate change and its impacts on inland aquatic resources and fisheries

14. This session aimed to highlight existing research and share experiences related to approaches to assess impacts of climate change with a focus on species, spatial and habitat vulnerability, thermal performance and tolerance of fish species, mitigation measures and environmental flows.

15. This session was composed of 9 presentations and was chaired by Dr. Faye Jackson (Marine Scotland).

Summary overview:

16. The session emphasized the critical ecosystem services that inland fisheries provide to communities in Europe and worldwide and the important subsistence, cultural, and economic value of inland fisheries. Freshwater rivers, streams, and lakes that fish occupy are however faced with many challenges, including climate change, and have become one of the most threatened ecosystems on the planet. Fish are an important indicator of the health of aquatic ecosystems, and an improved understanding of how they are affected by changing climate conditions is critical to understanding the future of these ecosystems and identifying adaptive management strategies.

17. The session contributed to the growing body of empirical research and conservation actions that are being employed to tackle these challenging problems. Detailed presentations covering the vulnerability of freshwater fish species to climate change, spatial variability in water temperature, impact of heatwaves on the thermal regime in rivers, thermal refuges in lakes, changing pressure of barriers due to climate change, increase in magnitude of pressures (e.g. parasites), understanding ecosystem services using stakeholder engagement methods, change in somatic growth of pike-perch due to changing environmental conditions and linking hydrothermal regimes and environmental flows in regulated rivers, were delivered.

18. The session discussed knowledge gaps related to fish species and climate change (e.g. what can be done to make fish communities resilient to climate change, how do we minimize exposure and sensitivity to climate change and maximize adaptive capacity amid uncertainty; what actions are most likely to be successful in the long term and where should these actions be implemented).

19. The session participants recommended that all interested parties should join the EIFAAC project addressing the impacts of climate change on inland fisheries.

SESSION 4: Citizen Science

20. The goal of this session was to discuss the involvement of citizens in recording our natural environment. Citizen science has been around for centuries, e.g. amateur meteorologists and ornithologists; however modern-day citizen science with the engagement through technology is a growing movement and this has broadened opportunities to expand our knowledge of the natural environment. The session sought to explore the potential of Citizen science as a cost-effective tool to obtain fishery information over large spatio-temporal scales to support fisheries management, e.g. to contribute to stock assessments in inland waters.

21. This session was composed of 9 presentations and was chaired by Dr. Joe Pecorelli (Zoological Society of London).

Summary overview:

22. This session discussed involvement of the public and stakeholders in monitoring fish migration, data collection for management decision making, catch reporting by anglers, communication methods related to reporting aquatic invasive species, and inland fisheries data collection methodologies from Finland, Germany, Ireland, Latvia and the Western Balkan counties. Good study design based on early and sustained engagement with the citizen scientist was identified as critical to the success of a project. The building of a trusting relationship between the project scientist and the stakeholder (Citizen Scientist) was identified in a number of presentations as a key message. It is also worth noting that the use of angler 'creel data' while often sparse, can offer managers insight into the status of stocks.

SESSION 5: Aquaculture - traditional freshwater systems vs recirculation systems

23. Aquaculture is one of the world's fastest growing agri-food sectors and has the potential to provide the world's population with quality and healthy fish products. Research has shown that some traditional methods of aquaculture production affect the environment negatively. The goal so this session was to review how environmental restrictions to minimise pollution, focus on sustainability, food safety and cost effectiveness have been among the drivers of recirculation aquaculture systems (RAS) developments.

24. This short session was composed of 3 presentations and was chaired by Dr. Jamie Downes (Marine Institute, Ireland).

Summary overview:

25. The session presentations dealt with advances in RAS (Recirculation Aquaculture Systems) and identified benefits and challenges of this approach to aquaculture, as well as with specific RAS systems used for salmon. RAS systems were identified as offering increased productivity while providing a more environmentally sustainable approach to aquaculture when compared to traditional flow through freshwater systems. It was identified that the skill sets required to manage RAS systems are radically different to those required for existing (flow-through tank culture) systems with more technical and engineering support required. The session identified the lack of global standards to support the RAS with differing approaches been taken as each new development takes place.

III. CONCLUSIONS AND RECOMMENDATIONS

26. The Symposium demonstrated scientific advances in technology, stock assessment and citizen science in an era of climate change, on inland fisheries and aquaculture. Some of the research presented brought novel ideas and approaches that can be of use for the whole EIFAAC membership. Despite the COVID-19 pandemic in recent years, which restricted travel and constrained working together, inland fisheries research has continued and resulted in new insights.

27. The conclusions of the symposium can be summarized as follows:

- Stocking of inland water bodies is often considered as the best management tool to ensure sufficient stocks for recreational and commercial users. Stocking is the number one investment by anglers in Germany and probably also in other countries. Other management tools, such as harvest regulations, habitat improvement, increasing size limits, and constraining anglers efforts, may be more successful in the long-term. Scientific evidence suggests that stocking is frequently unsuccessful, but that there are strong social pressures on angling organizations and inland fisheries managers to introduce fish.
- Fish predation by cormorants and American mink continues to increase in various Scandinavian countries. The effects of this predation on brown trout, Atlantic salmon smolt, and grayling is detrimental for the stocks of these species. There are practical tools available to reduce predation on fish; the use of which is hampered by some EU directives. Scientists conclude that there is an urgent need to take stock of fish predation by cormorants and other predators throughout Europe, as the problem is wider than just Scandinavia.
- Data limited stock assessment and inland rivers and lakes monitoring methods are being developed and experimented. The use of eDNA, DNA, UV light, and hydroacoustic technology as non-invasive techniques to support monitoring and to increase understanding of fish species conservation and habitat usage is increasing rapidly.
- Advances in sampling methodologies and taxonomy in inland fisheries research, using genetic markers, crispr-cas technologies and eDNA are made and applied more widely throughout Europe.
- Citizen science is becoming more popular in recreational fisheries and inland fisheries conservation research. The use of user friendly APPs in Citizen science projects is increasing rapidly. Citizen Science projects are per definition longer-term projects as first a relationship of trust needs to be built between the project scientist and the stakeholder (Citizen Scientist).

28. It was recommended that the 31st EIFAAC session discusses and considers the following:

- The development (technical) guidelines on responsible stocking of fish in inland waters.
- The promotion of ecosystem based management approaches for inland waters, involving relevant stakeholders and supported by interdisciplinary fisheries research and management methods that link economic, sociological and psychological expertise with traditional biological/ecological data expertise.
- The development of new water quality monitoring and stock assessment technologies for inland water bodies and catchment areas that add to conventional monitoring and sampling methods and tools and support long-term, cost-effective monitoring to meet EU

Water Framework Directive, EU Habitats Directive and Climate Change Strategy monitoring requirements.

- That EIFAAC take an active coordinating role in advocating for European wide cormorant management, to reduce cormorant predation of fish species, including EU Habitats Directive protected fish species, by organizing a stock-taking conference, developing a management plan and organizing a “Call to Action”.
- The development of standards for recirculation aquaculture systems (RAS) to reduce failures in RAS designs and risks for RAS investments, and increase access to finance and insurance for aquaculture entrepreneurs interested in RAS technologies.