



H.F.R.I.
Hellenic Foundation for
Research & Innovation

Description of the funded research project
2nd Call for H.F.R.I. Research Projects
to Support Post-Doctoral Researchers

Title of the research project: Estimation of Environmental Flows using Unmanned Aerial Vehicles and Acoustic Equipment based on fish habitat requirements – FlowTech

Principal Investigator: Dr. Christina Papadaki

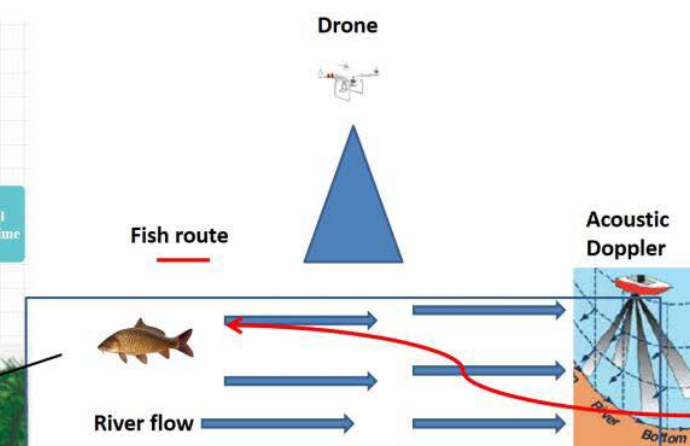
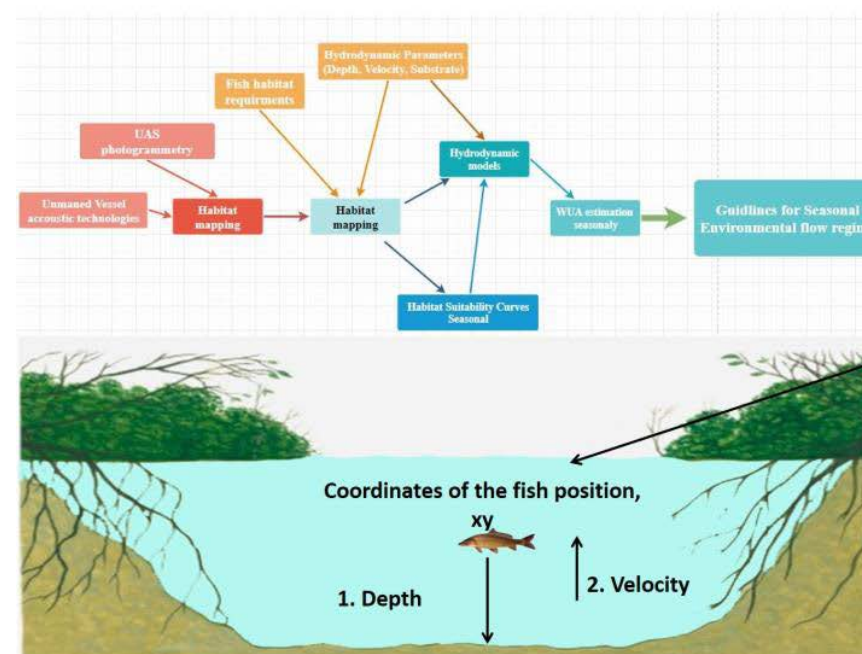


Scientific Area: Environment & Energy

Country: Greece

Host Institution: Hellenic Centre for Marine Research (HCMR)

Project webpage
(if applicable): under construction

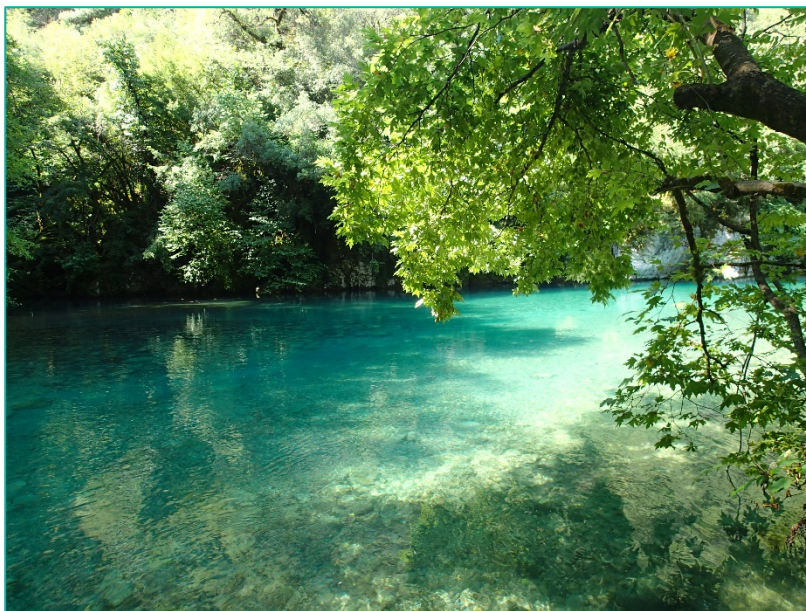


Budget: 189,634 €

Duration: 36 Months

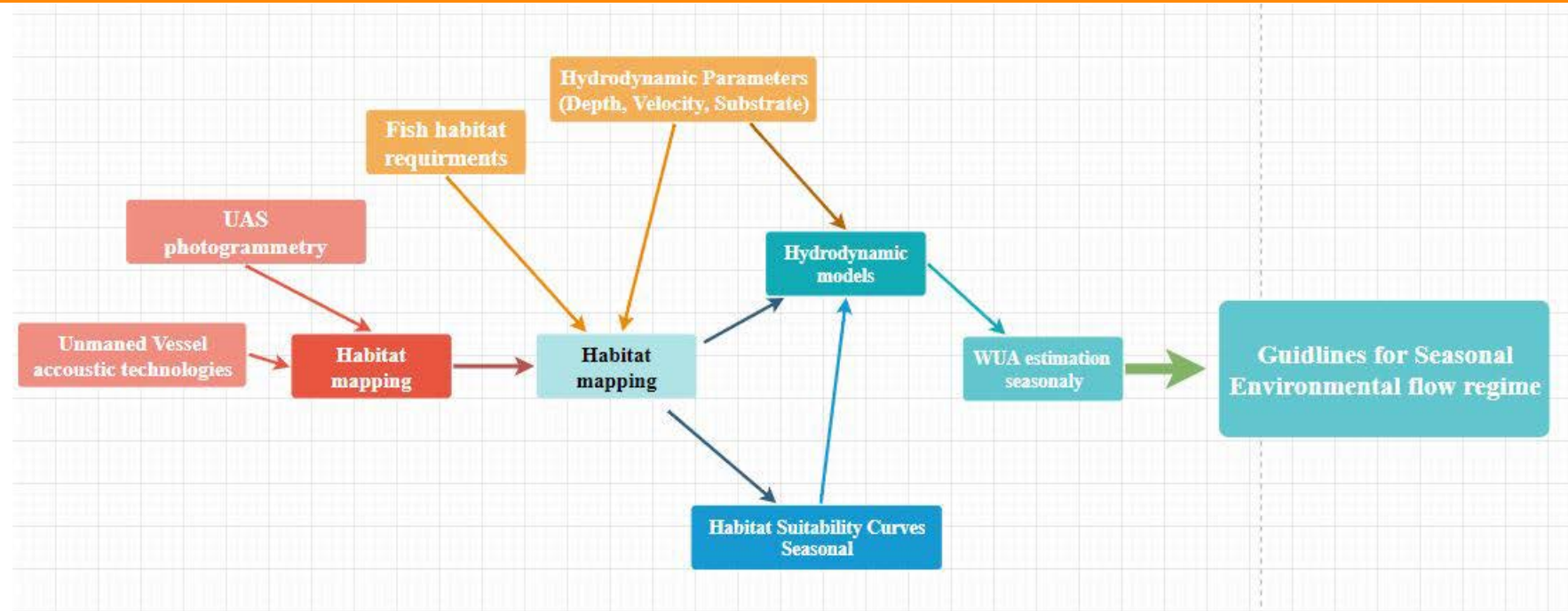
Research Project Synopsis

Environmental flows represent the water required to sustain freshwater and estuarine ecosystems, and the human livelihood that depend on these ecosystems. All components of a flow regime including floods, medium and low flows are important and influence the river ecosystems. River straightening for flood control and/or navigation purposes, water abstractions, water flow regulations (dams, weirs, sluices, and locks), morphological alterations, and the disconnection of flood plains are all hydromorphological pressures that alter the natural flow regime of rivers. With so many competing needs for water, there is an urgent need to develop sustainable environmental flow management guidelines to manage the risk associated with alterations to the flow regime. A great majority of water supply planners worldwide have already begun to address the water needs of river ecosystems proactively by reserving some portion of river flows for ecosystem support. These restorative and protective actions require development of scientifically credible estimates of environmental flow needs. Priority should be given to better address over-abstraction of water, the second most common pressure on European Union, and to recognize that water quality and quantity are intimately related within the concept of 'good status' of the EU Water Framework Directive. The primary aim of this project is to develop hydroecological modelling tools and habitat suitability models using state-of-the-art technology, for estimating aquatic habitats' water requirements that will take into consideration both the ecosystem functions and services as well as improved water management practices for environmental flows estimation. Moreover, the project actions will facilitate the implementation of the relevant legislation including the Water Framework Directive – 2000/60/EC.



Project originality

In FlowTech a cutting edge technology for the estimation of fish habitat criteria, as part of a physical habitat simulation approach is proposed with main objective to achieve an efficient, cost-effective, rapid alternative or complement to classic labor-intensive technics. Unmanned Aerial System (UAS), which is comprised by a fixed-wing airplane and high resolution RGB cameras, will contribute to physical habitat identification through the development of detailed Digital Terrain Models (DTMs) by applying photogrammetric techniques. Moreover, an Unmanned Vessel will be constructed that will host acoustic technologies for depth and velocity measurements based on the fish locations, combined with a Real-time kinematic (RTK) positioning system, to enhance the precision of position data (up to 1 cm accuracy). For the identification of the fish species, a camera aimed perpendicular to the substrate, will be also attached in the Unmanned Vessel. Substrate data will be also collected based on the dominant substrate type (within a circumference of 15 cm centered on the fish). To ensure comprehensive coverage of the area, the aforementioned new approach will be applied in transects perpendicular to the flow, over the total length of the representative river reaches. Moreover, techniques which have traditionally been used (i.e. snorkeling, electrofishing) for fish habitat measurements (Papadaki et al., 2016; Heggnes and Saltveit, 1990; Martínez-Capel et al., 2009) will be also applied for the validation of the new approach.



Expected results & Research Project Impact

The major research need for this project is stimulated by the fact that there is limited experience regarding estimation of environmental flow regimes worldwide, apart from minimum ecological flow thresholds (Nikghalb et al., 2016). Regarding Greek rivers, the impacts on aquatic ecosystems from flow regulation by dams constructed especially before 1995, are major and in several cases irreversible due to the absence of suitable ecological flow provisions (Tegos et al., 2014). No sooner than 2008, Greek legislation establishes minimum ecological flow standards, focusing especially on the outflow of small hydropower plants (Official Journal of the Hellenic Republic 2464B/2008), without addressing the requirements of aquatic communities, apart from an extra rule introduced in 2011 (Official Journal of the Hellenic Republic 518B/2011), relative to ichthyofauna which is under a special conservation status. Integrating environmental flows in the Greek water management poses a challenge for the years to come, particularly considering that these flows still have not contemplated for all the Greek River Basin Management Plans as an environmental demand, but as an environmental restriction to water use. Under the framework of this project, progress will be reported on the environmental flows with prospect to contribute most effectively to sustainable freshwater management on a country level. It is also expected to broaden the relative audience including water resources managers, decision makers, scientists working in the fields of ecology and water resources management, engineers that design hydraulic works and environmental policy makers, Non-governmental organizations in the fields of Environment, public administrators in the water permits offices, researchers and students working on aquatic sciences to embrace social-ecological sustainability that balances freshwater conservation needs with human well-being.

More specifically

- A free tool for the estimation of environmental flows with free access to the public, hosted in IMBRIW-HCMR site (<http://imbriw.hcmr.gr/en/tools/>) and the project's site
- Publications in peer-review International Journals and 2 announcements in International Conferences

The importance of this funding

Funding of FlowTech, a research project which involves cutting-edge technology, is essential in order to retain a smooth implementation of experimental applications and activities, with the purpose to produce new scientific knowledge and conclusions. At the same time, it gives the unique opportunity to cooperate in an interdisciplinary scientific group, which is most beneficial both for my personal development and our scientific research. Last but not least, I cannot ignore that this funding is going to offer me new experience as the principal investigator on this project, which among others will add to my qualifications in the demanding field of job seeking.





H.F.R.I.
Hellenic Foundation for
Research & Innovation

COMMUNICATION

185 Syggrou Ave. & 2 Sardeon St. 2
171 21, N. Smyrni, Greece
+30 210 64 12 410, 420
communication@elidek.gr
www.elidek.gr