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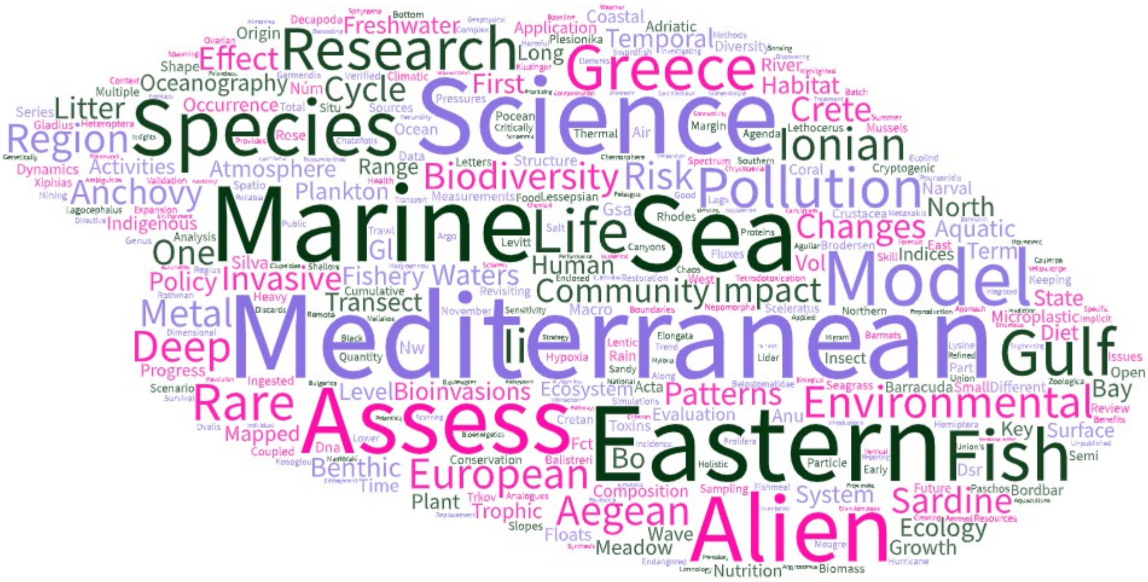

Institute of Marine Biological Resources and Inland Waters (IMBRIW)

INSTITUTE REPORT 2018-2021

Executive Summary

The Institute of Marine Biological Resources and Inland Waters (IMBRIW) is one of the three institutes of the Hellenic Centre for Marine Research (HCMR) and it was formed in 2012, as a result of the amalgamation of two institutes of the Centre (out of the five existing at that time): the Institute of Marine Biological Resources (IMBR) and the Institute of Inland Waters (IIW). The previous institutes are now constituting the two sectors of the Institute. Nowadays, IMBRIW operates at three locations: Anavyssos and Argiroupoli in Attica, and Heraklion in Crete.

The mission of IMBRIW is to: (a) support the conservation and management of aquatic biological resources, habitats and ecosystems and the provision of their services for future generations, (b) provide advice and services to national, Mediterranean, EU and other International bodies on environmental conservation and management, and (c) raise public awareness on issues related to the conservation of aquatic biological resources, habitats and ecosystems.

In the above context, IMBRIW: (a) carries out multidisciplinary and integrated field, laboratory and experimental, basic and applied research; (b) implements monitoring and scientific assessments and predictions of the status of fish and shellfish stocks in Greek waters; (c) conducts ecological quality assessments and monitoring of inland waters; (d) provides advice for the sustainable exploitation of fisheries resources in Greek and Mediterranean waters and for the sustainable management of freshwater resources; (e) undertakes specific pilot studies, developing new tools and designing management and conservation plans on specific issues for national, Mediterranean and EU institutional bodies and (f) disseminates information and knowledge on major achievements through publications and a variety of organized events. To this end, IMBRIW closely co-operates with the other two Institutes of HCMR.

IMBRIW has a variety of computing equipment, as well as laboratory and field equipment that is adequate to fulfil its mission. In addition, IMBRIW is the main user of the Research Vessel (R/V) PHILIA for collecting field data. In regard to laboratory facilities, these include ten main laboratory units. To facilitate research work, the Institute has constructed and harmonized a central database system including all data that have been collected within the framework of the various projects undertaken.

The Institute encompasses two research groups that correspond to its two sectors, i.e. the Marine Biological Resources (MBR) and the Inland Waters (IW) research groups. The IMBRIW personnel carries out research work under the following topics:

- Biology, ecology and life-history of aquatic organisms and fisheries resources
- Biodiversity, conservation and environmental restoration
- Ecological status assessments and monitoring of surface waters

- Integrated river basin management
- Fisheries ecology and Ecosystem Approach to Fisheries Management
- Fisheries dynamics and capture
- Population modeling and stock assessment

During the evaluation period the IMBRIW personnel fluctuated from 157 to 184 people with more than 50% of them being scientists and technicians occupied in various projects, with fixed time contracts. The permanent researchers fluctuated from 25 to 27, in terms of number.

IMBRIW personnel had participated in various European, other International and National research projects involving numerous partners, which has resulted in building a broad network of collaborations with Research Institutions, Universities, Conservation Bodies, Management Bodies and other types of organisations. Although the closest collaborations are with organizations from the Mediterranean area, mainly from EU countries, there are also numerous collaborations with scientists and organizations from Central and Northern European countries, the USA and the Middle East. At the national level, there is a strong collaboration with most Universities with relevant scientific fields, with NGOs, with the Fisheries Research Institute (located in Kavala), as well as with private companies. Cooperation with stakeholders was a priority of the Institute. During 2018-2021, several projects involved professional or recreational fishers, decision makers, NGOs, the Mediterranean Advisory Council (MEDAC), local and regional authorities or included stakeholder meetings and events that strengthened the collaboration with end users.

The academic output of the IMBRIW scientists during the 2018-2021 period included a total of 355 peer-reviewed papers, 182 publications in international conferences proceedings, 21 book chapters, 3 books, and 84 other conferences. Overall, IMBRIW received a total of 19,368 citations over the evaluation period, based on information retrieved from Scopus. The IMBRIW personnel published in more than 70 journals, some of which are among the best and most prestigious in the field with impact factors > 10, such as *Earth-Science reviews* (12.413), *Water Research* (11.236) and *Global Change Biology* (10.863), or with impact factor (IF) > 7, such as *Environmental Pollution* (8.071), *Science of the Total Environment* (7.963), *Fish and Fisheries* (7.218), and *Chemosphere* (7.086).

The annual governmental funding of IMBRIW during the 2018-2021 period ranged from 1.63-1.75 Meuros. Over the same period, the income from competitive grants showed a significantly increasing trend, from 5.3 Meuros in 2018, to 7.9 Meuros in 2021 (50% increase). Projects financed under the Greek National Strategic Reference Framework (NSRF) had the most important contribution (80-90%) to the income from competitive grants.

Περίληψη

Το Ινστιτούτο Θαλάσσιων Βιολογικών Πόρων και Εσωτερικών Υδάτων (ΙΘΑΒΙΠΕΥ) είναι ένα από τα τρία ινστιτούτα του Ελληνικού Κέντρου Θαλάσσιων Ερευνών (ΕΛΚΕΘΕ) και ιδρύθηκε το 2012, ως αποτέλεσμα της συγχώνευσης δύο ινστιτούτων του Κέντρου, από τα πέντε που υπήρχαν εκείνη την εποχή: του Ινστιτούτου Θαλάσσιων Βιολογικών Πόρων και του Ινστιτούτου Εσωτερικών Υδάτων. Τα παραπάνω αποτελούν πλέον τους δύο τομείς του Ινστιτούτου. Σήμερα, το ΙΘΑΒΙΠΕΥ δραστηριοποιείται σε τρεις τοποθεσίες: Ανάβυσσο και Αργυρούπολη Αττικής και Ηράκλειο Κρήτης.

Η αποστολή του ΙΘΑΒΙΠΕΥ είναι: (α) να υποστηρίξει τη διατήρηση και διαχείριση υδάτινων βιολογικών πόρων, οικοτόπων και οικοσυστημάτων και την παροχή των υπηρεσιών τους στις μελλοντικές γενιές, (β) να παρέχει συμβουλές και υπηρεσίες σε εθνικούς, μεσογειακούς, ευρωπαϊκούς και άλλους διεθνείς φορείς για τη διατήρηση και διαχείριση του περιβάλλοντος, και (γ) να συμβάλλει στην ευαισθητοποίηση του κοινού σε θέματα που σχετίζονται με τη διατήρηση των υδάτινων βιολογικών πόρων, οικοτόπων και οικοσυστημάτων.

Στο παραπάνω πλαίσιο, το ΙΘΑΒΙΠΕΥ: (α) πραγματοποιεί διεπιστημονικές και ολοκληρωμένες έρευνες πεδίου και εργαστηρίου, (β) αξιολογεί την κατάσταση των αλιευτικών αποθεμάτων και πραγματοποιεί προβλέψεις, (γ) διενεργεί αξιολογήσεις της οικολογικής ποιότητας των εσωτερικών υδάτων, (δ) παρέχει συμβουλές για τη βιώσιμη εκμετάλλευση των αλιευτικών πόρων στα ελληνικά και μεσογειακά ύδατα, καθώς και για τη βιώσιμη διαχείριση των εσωτερικών υδάτων, (ε) υλοποιεί πιλοτικές μελέτες, αναπτύσσει νέα εργαλεία και σχεδιάζει σχέδια διαχείρισης για εθνικούς, μεσογειακούς και ευρωπαϊκούς θεσμικούς φορείς, και (στ) διαχέει σχετικές πληροφορίες και γνώση μέσω δημοσιεύσεων και ποικίλων οργανωμένων εκδηλώσεων. Για τους σκοπούς αυτούς, το ΙΘΑΒΙΠΕΥ συνεργάζεται στενά με τα άλλα δύο Ινστιτούτα του ΕΛΚΕΘΕ.

Το ΙΘΑΒΙΠΕΥ διαθέτει τον απαραίτητο εξοπλισμό (εργαστηριακό, υπολογιστικό, κλπ) για την εκπλήρωση των δραστηριοτήτων του. Επιπλέον, το ΙΘΑΒΙΠΕΥ είναι ο κύριος χρήστης του ερευνητικού σκάφους ΦΙΛΙΑ για τη συλλογή δεδομένων πεδίου. Όσον αφορά τις εργαστηριακές εγκαταστάσεις, αυτές περιλαμβάνουν δέκα κύριες εργαστηριακές μονάδες. Για τη διευκόλυνση του ερευνητικού του έργου, το Ινστιτούτο διατηρεί ένα κεντρικό σύστημα βάσης δεδομένων που περιλαμβάνει όλα τα δεδομένα που έχουν συλλεχθεί στο πλαίσιο διαφορετικών έργων.

Το Ινστιτούτο περιλαμβάνει δύο ερευνητικές ομάδες που αντιστοιχούν στους δύο τομείς του: των Θαλάσσιων Βιολογικών Πόρων και των Εσωτερικών Υδάτων. Οι ερευνητικές δραστηριότητες του προσωπικού των ερευνητικών ομάδων εστιάζονται στα ακόλουθα θέματα:
- Βιολογία, οικολογία υδρόβιων οργανισμών και αλιευτικών πόρων
- Βιοποικιλότητα, διατήρηση και αποκατάσταση του περιβάλλοντος
- Εκτιμήσεις οικολογικής κατάστασης και παρακολούθηση επιφανειακών υδάτων
- Ολοκληρωμένη διαχείριση υδατικών λεκανών απορροής
- Αλιευτική οικολογία και οικοσυστημική προσέγγιση στην αλιευτική διαχείριση
- Πρότυπα αλιευτικής δραστηριότητας
- Μοντελοποίηση πληθυσμών και εκτίμηση αποθεμάτων

Κατά την περίοδο αξιολόγησης το προσωπικό του ΙΘΑΒΙΠΕΥ κυμάνθηκε από 157 έως 184 άτομα και την πλειοψηφία του προσωπικού αποτελούσαν επιστήμονες και τεχνικοί που απασχολήθηκαν σε διαφορετικά έργα, με συμβάσεις ορισμένου χρόνου. Οι μόνιμοι ερευνητές κυμάνθηκαν από 25 έως 27.

Το προσωπικό του ΙΘΑΒΙΠΕΥ έχει συμμετάσχει σε μεγάλο αριθμό, εθνικών, ευρωπαϊκών και άλλων διεθνών προγραμμάτων, με αποτέλεσμα τη δημιουργία ενός ευρέως δικτύου συνεργασιών με Ερευνητικά Ιδρύματα, Πανεπιστήμια, Φορείς Διαχείρισης, κλπ. Αν και οι στενότερες συνεργασίες γίνονται με οργανισμούς από τον χώρο της Μεσογείου, κυρίως από χώρες της ΕΕ, υπάρχουν επίσης πολυάριθμες συνεργασίες με επιστήμονες και οργανισμούς από χώρες της Κεντρικής και Βόρειας Ευρώπης, των ΗΠΑ και της Μέσης Ανατολής. Σε εθνικό επίπεδο, υπάρχει ισχυρή συνεργασία με τα περισσότερα Πανεπιστήμια με συναφή επιστημονικά πεδία, με ΜΚΟ, με το Ινστιτούτο Αλιευτικής Έρευνας (με έδρα την Καβάλα), καθώς και με ιδιωτικές εταιρείες.

Η συνεργασία με όλους τους εμπλεκόμενους φορείς (stakeholders) στα αντικείμενα δραστηριότητας του ΙΘΑΒΙΠΕΥ ήταν μεταξύ των προτεραιοτήτων του Ινστιτούτου. Κατά τη διάρκεια του 2018-2021 υπήρξε σε πολλά έργα συνεργασία με επαγγελματίες και ερασιτέχνες ψαράδες, περιφερειακές, εθνικές και ευρωπαϊκές αρχές διαχείρισης, ΜΚΟ, καθώς και με το Μεσογειακό Συμβουλευτικό Συμβούλιο σε θέματα Αλιείας (MEDAC). Στα πλαίσια των παραπάνω συνεργασιών το προσωπικό του ΙΘΑΒΙΠΕΥ συμμετείχε ενεργά σε πολυάριθμες συναντήσεις και σχετικές εκδηλώσεις που ενίσχυσαν την επικοινωνία με τελικούς χρήστες των ερευνητικών αποτελεσμάτων.

Η ακαδημαϊκή παραγωγή των επιστημόνων του ΙΘΑΒΙΠΕΥ κατά την περίοδο 2018-2021 περιελάβανε 355 εργασίες με κριτές, 182 δημοσιεύσεις σε πρακτικά διεθνών συνεδρίων, 21 κεφάλαια βιβλίων, 3 βιβλία και 84 άλλα συνέδρια. Συνολικά, το ΙΘΑΒΙΠΕΥ έλαβε 19.368 επιστημονικές αναφορές, με βάση τις πληροφορίες που ανακτήθηκαν από το Scopus. Το προσωπικό του ΙΘΑΒΙΠΕΥ δημοσίευσε σε περισσότερα από 70 περιοδικά, μερικά από τα οποία θεωρούνται από τα καλύτερα του τομέα με συντελεστές αντίκτυπου > 10, (Earth-Science reviews (12.413), Water Research (11.236) και Global Change Biology (10.863), ή >7 (Environmental Pollution (8.071), Science of the Total Environment (7.963), Fish and Fisheries (7.218), και Chemosphere (7.086).

Η ετήσια κρατική χρηματοδότηση του ΙΘΑΒΙΠΕΥ κατά την περίοδο 2018-2021 κυμάνθηκε από 1,63-1,75 ευρώ. Την ίδια περίοδο, τα έσοδα από ανταγωνιστικά προγράμματα παρουσίασαν σημαντική αυξητική τάση, από 5,3 εκατ. ευρώ το 2018, σε 7,9 εκατ. ευρώ το 2021 (50% αύξηση). Τα έργα που χρηματοδοτήθηκαν από το Ελληνικό Εθνικό Στρατηγικό Πλαίσιο Αναφοράς (ΕΣΠΑ) είχαν τη σημαντικότερη συμβολή (80-90%), όσον αφορά στα έσοδα από ανταγωνιστικά προγράμματα.

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1 Introduction and Background

1.1 Brief History of the Institute

The Hellenic Centre for Marine Research (HCMR) resulted from the merging of the Institute of Marine Biology of Crete (IMBC) and the National Centre for Marine Research (NCMR) in 2003, with five institutes (Fig. 1). In 2012, the Institute of Marine Biological Resources (IMBR) and the Institute of Inland Waters (IIW) merged to form the Institute of Marine Biological Resources and Inland Waters (IMBRIW), now constituting the two sectors of the Institute. Professor K. Stergiou officially assumed his duties as Director of IMBRIW on November 2013 until end of July 2021. Since then, Dr. G. Tserpes is the Deputy Director of the Institute, while the procedure of the election of the new Director is underway. IMBRIW operated initially at three locations (Agios Kosmas and , Anavyssos, Attica and Heraklion, Crete) up to July 2018, when its section located in Agios Kosmas, moved to new facilities at Argyroupoli.

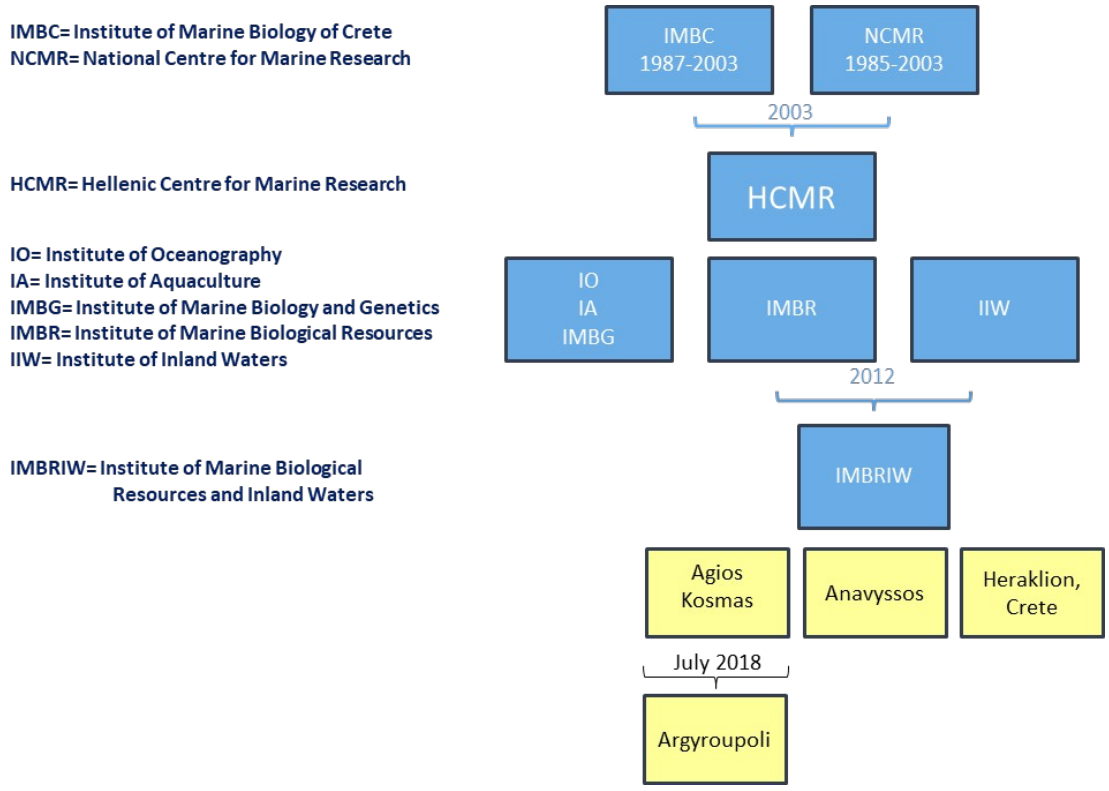

Figure 1. The history of IMBRIW. Yellow boxes indicate today's regional units.

1.2 Mission, Scientific Identity and Distinctive Character of the Institute

IMBRIW is the leading institution in Greece on aspects related to fisheries, marine ecology and inland water research. Its geographical scope of activities extends to most European countries, the Middle East and northern Africa, with a key role in the Mediterranean region.

The mission of IMBRIW is to: (a) support the conservation and management of aquatic biological resources, habitats and ecosystems and the provision of their services for future generations, (b) provide advice and services to national, Mediterranean, EU and other International bodies on

environmental conservation and management and (c) raise public awareness on issues related to the conservation of aquatic biological resources, habitats and ecosystems.
The main goals of IMBRIW are the production of knowledge related to structural and functional aspects of inland and marine ecosystems, and the high trophic level components (including fisheries) of marine ecosystems, and the application of this knowledge for integrated river basin and coastal zone management, ecosystem-based fisheries management and biodiversity conservation. A key element is the development and application of state-of-the-art tools for ecological monitoring, weather forecasting, hydrometeorological, water quality and ecological modelling.
IMBRIW (a) carries out multidisciplinary and integrated field, laboratory and experimental, basic and applied research; (b) implements monitoring and scientific assessments and predictions of the status of fish and shellfish stocks in Greek waters; (c) conducts ecological quality assessments and monitoring of inland waters; (d) provides advice for the sustainable exploitation of fisheries resources in Greek and Mediterranean waters and for the sustainable management of freshwater resources; (e) undertakes specific pilot studies, developing new tools and designing management and conservation plans on specific issues for national, Mediterranean and EU institutional bodies and (f) disseminates information and knowledge on major achievements through publications and a variety of organized events. To this end, IMBRIW closely co-operates with the other two Institutes of HCMR.
More specifically, IMBRIW's research scope includes:

Biology, ecology and life-history of aquatic organisms and fisheries resources
Biodiversity conservation and environmental restoration
Ecological status assessments and monitoring of surface waters
Integrated river basin management
Fisheries ecology and Ecosystem Approach to Fisheries Management
Fisheries dynamics and capture
Population modelling and stock assessment

The main assets of IMBRIW are the multidisciplinary research covering both earth and biological sciences, through the involvement of scientists from various fields in joint projects, and a holistic ecological background and perspective that covers a broad scope with respect to the scientific areas handled.

1.3 Scientific Orientation of the Institute

a. Current scientific directions and thematic priorities

During the current period of evaluation, IMBRIW research priorities focused on:

- Increasing its international role by strengthening its membership in International Organizations, research networks (e.g. ERANET, EUROMARINE, LTER) and Working Groups
- Enhancing its academic reputation by publishing in high-profile journals and training MSc and PhD students in IMBRIW
- Fully utilising the multidisciplinarity of research staff
- Increasing its policy-relevant advisory role (e.g. Management Plans, specific requests/contracts at the National, Regional and EU level) and dissemination activities at the National, Regional and European level and, thus,

- Ultimately attracting more EU and National funds, and funds from Non-governmental agencies, and addressing high-order research questions.

Specific research priorities of IMBRIW during the evaluation period (2018-2021) included:

Aquatic biodiversity, conservation, and alien species

Biodiversity analyses of demersal fisheries' exploited communities

Exploration of the geographical distribution of inland water fish species (both native and introduced) with conventional fish survey methods and the environmental DNA technique, and description of species assemblages in the hydrographic basins of Greece

Identification of new freshwater species, using morphological and genetic techniques

Identification of cryptic species, using morphological and genetic techniques, such as the environmental DNA method, for the taxonomic validations of vulnerable or endangered taxa

Investigation of anthropogenic impacts on habitats and freshwater biota (e.g. construction of dams, water abstraction, sand/gravel abstraction, pollution) and determination of appropriate restoration actions

Application of functional ecological approaches

Ethological studies (fish behavioural studies, experimental studies on the competitive interactions between invasive and native species)

Dynamics, trends in pathways/vectors of introduction of invasive species, raising public awareness, biology of alien species, fishing exploitation potential of alien species. The Institute is coordinating and managing the Hellenic Network on Aquatic Invasive Species (ELNAIS; elnais.hcmr.gr)

Study of mesopelagic fish assemblages, distribution, abundance and biology

Effects of alien species on coastal stocks, gears and economic performance of the coastal fisheries

Hydro-ecological modelling and climate change

- Development of food-web models, specifically "Ecopath with Ecosim" and "OSMOSE" to explore ecosystem structure and functioning and perform management and environmental simulations
- Individual Based Models (IBMs) have been developed in which biogeochemical models are linked with anchovy and sardine bioenergetics to explore population dynamics under current and future (i.e. climate change) situations
- Density dependence and the structure of the planktonic food web in relation to food consumption and prey selection by small pelagic fish
- Development of a rapid prediction tool of aquatic quality and a nutrient classification system
- Application of various habitat-hydraulic models for assessing the ecological flow regime in rivers as a management measure supporting ecosystem functioning.

Hydro-meteorological modelling and climate change

- Research on improving operational numerical weather forecasts
- Research on the development of a fully coupled atmosphere-ocean wave system
- Research on the development of a fully coupled hydro-meteorological modelling system
- Numerical modelling to simulate the relevant processes controlling hydrology and water

quality at a catchment scale for environmental and river basin management, including climate and land use change scenarios; water budget models; dynamic groundwater models for exploring the pathways of aquatic pollutants; modelling software for simulating the entire hydrologic cycle at a catchment scale and for simulating hydrochemistry in surface waters.

Development of techniques for assimilating surface observations to produce high operationally high-resolution atmospheric analysis fields

- Generation of high-quality atmospheric analysis dataset that can be used as the forcing to drive wave, ocean hydrodynamic, and hydrological models and the baseline data for environmental impact assessment studies
- Application of coupled meteorological and hydrologic models for the estimation of flood hazardous areas

Technology development

- Development and testing of Internet of Things (IoT) "smart telecommunication networks" (based on LoRa, SigFox and nb-IoT protocol telemetry systems) for the environmental monitoring in the marine and freshwater aquatic environments (coastal aquaculture, rivers, reservoirs, river deltas etc.)
- Testing of new fishing gear materials (twines, threads etc.) and for aquaculture nets
- Testing of new trawl fishing techniques using combination of pelagic doors and bottom otter trawl nets
- Improvement of gear selectivity to minimize the capture of juveniles, reduce discards, prevent biodiversity loss, and thereby reduce the fisheries footprint
- Development of experimental gears Modified fishing gear for the capture of invasive alien species (e.g. *Lagocephalus sceleratus*, *Pterois miles*)

Sensitive ecosystems/Priority species and habitats

- Deep-water resources, deep-water fisheries, deep-water habitats
- Essential fish habitat suitability modelling, at the Mediterranean scale, for several small pelagic and demersal species
- Studies on the ecology and biology of fish species, assessments of habitat requirements and determination of habitat conditions of threatened species and populations
- Protection of endangered species and formulation of management plans for species and habitats through conservation and restoration projects

  Genetic variation studies of different populations of endangered fish species to define separate "evolutionarily significant units" within each species to be conserved separately

  Population assessment of freshwater species using the less invasive environmental DNA method

  Actions to improve the conservation status of threatened freshwater fish species (habitat enhancement actions, fish population translocations and alien species eradication for River fauna restoration, breeding of safety stock fish populations in HCMR aquaria)

  Actions for the baseline study and protection of Marine Protected Areas (MPAs) (e.g. Gyaros MPA)

Ecosystem management, fisheries exploitation, spatial planning and socio-economic dimensions

- Development of harmonised methodologies for coherent and relevant environmental status assessments (e.g. indices for WFD, MSFD)
- Monitoring, through the EU DCF (EUMAP), of population age and length structures, fleet dynamics, fishing effort, landings and socio-economic data, as well as pilot studies on recreational fishing, vulnerable species/habitats and stomach content analyses
- Fishing Capacity Assessment
- Marine litter on the seafloor and ingested by marine organisms
- Interactions between fisheries-aquaculture-environment
- Marine Spatial Planning (MSP) as a tool to minimize conflicts between human uses
- Socio-economic studies of the fisheries sector, economic valuations, elaboration of integrated coastal zone management tools for sustainable development
- Carrying capacity estimations for coastal activities and projects
- Fisheries socio-economic and bio-economic studies
- Consumer profiling

Life history and early life history patterns

- Early life history surveys (e.g. composition, distribution)
- Investigation of the importance of trophic conditions on stock reproductive potential of small pelagics in the Mediterranean in the context of the daily egg production
- machine learning applications in life history studies (e.g. age identification, species detection)

Stock assessment

- Stock assessments for developing Management Plans, as well as in the frame of GFCM and Scientific, Technical and Economic Committee for Fisheries (STECF)
- Application of data-poor stock assessment techniques

Charismatic megafauna

- Monitoring of marine mammals and turtles strandings in Greece, with a corresponding database
- Interactions between fisheries and charismatic megafauna

Fisheries impacts

- Discarding practices in fisheries, with emphasis in contributing to the revised CFP goals related to reduction/banning discards in EU waters. Assessment of the implementation/success of the Landing Obligation in National and EU waters
- Evaluation of the impact of trawling on the seabed and how can this impact be reduced using less damaging gears or alternative techniques

Monitoring and conservation of aquatic resources

- Continuation and progressing research activities on ecological status biomonitoting and assessment, and relevant methodologies for streams and rivers, particularly regarding chemical-physicochemical (nutrients) and biological quality elements (diatoms, macroinvertebrates, fish), as required for the Water Framework Directive (WFD). Development of methodologies and biological indices adapted to the country's characteristics

for the ecological status classification of inland waters. Standardization of sampling procedures and field protocols. Development of river typologies and the designation of reference conditions for a number of river basins using the spatially based approach

- Expansion of research on ecological status and monitoring including new indicator attributes (riparian habitats, macrophyte vegetation and diatoms, ecosystem functioning indicators), new methods of ecosystem health diagnosis (screening-level assessment procedures) and new water body types (temporary rivers and ponds, urban streams, lakes and lagoons)
- Implementation of the National WFD Monitoring Program for rivers to assess their ecological quality, (2018-2023), at 490 stations throughout Greece
- Development of a network of automatic, telemetric monitoring stations in rivers for real time-monitoring of water level, discharge and physico-chemical parameters (pH, Temp., electrical conductivity and dissolved oxygen)

Hydrogeochemical and Biogeochemical research

- Research on stream water composition as defined by chemical weathering, hydrological variability, atmospheric deposition, climate change and human impacts
- Research on biogeochemical processes (e.g. photosynthesis, respiration, carbonate dissolution/precipitation, nitrification, denitrification, ammonification) controlling nutrient levels of inland waters during desiccation and flooding using automatic monitoring, autosampling and field experiments

Integrated management of aquatic resources

- Research on the factors and processes driving the origin, forms, levels and dynamics of nutrients in minimally disturbed areas
- Application of water quality monitoring, apart from riverine systems, also in Lakes and river deltas by utilizing remote sensing techniques to develop predictive algorithms
- Assessing multiple stressor effects on freshwater ecosystems emphasizing on intermittent rivers for implementing conservation and management plans.
- In regard to temporary water bodies (rivers, streams and ponds), innovative research was developed, focusing towards the understanding of processes driving changes in hydrology, aquatic quality and biota
- Identification of pressures, assessment of the state and impacts (application of the DPSIR principle) and management scenarios within Integrated Water Resources Management Plans and River Basin Management Plans
- Use of stable isotopes to study ground-surface waters' interactions, flow regimes and water budgets.
- integrated coastal zone management and conflict resolution
- Human studies and socioeconomic analyses

Social activities on environmental conservation

- Scientists of IMBRIW have spearheaded environmental protection initiatives related to unsustainable environmental legislation, or developing projects with serious impacts on the environment.

b. Support schemes for the reported directions and priorities

All IMBRIW research activities are accomplished in the frame of competitive grants and given the existing limitations in the national budget, there is not any other scheme or structure for the short- or long-term support of specific directions and priorities. In this context, all research activities are dependent on the financial support from various national and international sources (the Greek National Strategic Reference Framework, EU - Horizon, various services, etc). Certainly, certain horizontal actions, such as the central database system, are always able to serve the reported directions and priorities, but without specific funds their contribution is rather minimal.

1.4 Self-assessment and Future Planning

a. Assessment of current strengths and weaknesses (SWOT analysis)

IMBRIW's strengths include the implementation of state-of-the-art interdisciplinary research at both national and international level, often in consortia involving a large number of research organisations. These strengths create new opportunities in IMBRIW's involvement in wider range and multifaceted projects. Furthermore, the wide environmental education and awareness activity potential allows a stronger future involvement of IMBRIW in this area with higher scientific output, as well as larger benefits at both the level of environmental awareness and relevant socioeconomic aspects.

Projected threats such as the continued lack of recruitment of permanent staff, coupled with low and disproportional salaries, is expected to accentuate current weaknesses such as the high average age of researchers and the low number of permanent personnel. Continuation of centrally imposed stifling bureaucracy and constant changes in the National legal framework is expected to continue creating problems in project implementation, resulting in mission drift. Gaps in flow of national structural funds between successive framework programmes and/or reduced International funding within IMBRIW's research fields is expected to enhance brain drain.

Figure 2. SWOT analysis (Strengths – Weaknesses- Opportunities – Threats) for the IMBRIW.

b. Summary of the actions to maintain and augment the scientific excellence of the Institute

The main research activities and topics that are provisioned to maintain and augment the scientific excellence of the Institute are the following:

- Develop state-of-the-art monitoring techniques and methods with the use of e-DNA tools, Unmanned Aerial and Surface Vehicles, stable isotopes and IoT sensors.
- Optimise ecological status assessment indices to improve understanding of pressure - impacts relationships and support adaptive management decisions
- Use of stable isotopes to track pollution sources to support targeted Programs of Measures within the River Basin Management Plans
- Develop tools and methodologies for river fauna restoration through freshwater organism translocations
- Develop freshwater ethology research
- Develop coupled hydraulic-hydrometeorological models at a fine spatial and temporal resolution to facilitate flood forecasting at both local and National scales
- Improve the early warning capabilities for floods, droughts and water pollution with the use of automatic monitoring stations at a national level
- Develop habitat suitability models for key fish and macroinvertebrate species to support the establishment of minimum ecological flows at a national level
- Study climate change impacts on aquatic ecosystems' functioning with the use of stable isotopes and hydroecological models
- Develop site-specific methodologies regarding the implementation of ecological flows and levels
- Further develop AI techniques, machine learning and deep learning for studying fish biology (e.g. otolith readings), ecology (species distribution modelling) as well as for remote applications in fisheries Monitoring, Control and Surveillance
- Develop operational large-scale ecosystem models for management support and assessment

- Advance Management Strategy Evaluation (MSE) to quantify the effect of specific management options to increase societal impact and support policy, stakeholders and co-management
- Develop models and tools to forecast the effect of climate change on communities, populations as well as sensitive species and habitats

c. Needs and assumptions for carrying out the envisioned plan

- Infrastructures

To achieve the aforementioned research activities the following infrastructure and personnel is needed:

- Stationary echosounders for monitoring hypoxic layers based on small pelagic fish water-column positioning in highly impacted areas
- Deep-water sampling devices (automatic robots, AUVs) for multi-level sampling (e.g. echo acquisition, video observation, sensing, water sampling) of the mesopelagic zone
- Low-power, wide band mini autonomous transceiver to be used with existing transducers in order to extend acoustic surveys to lakes and shallow waters using light-weight vehicles (AUVs or boats)
- Unmanned Aerial Vehicles (UAVs) to perform photogrammetric surveys and monitor aquatic habitats changes and basic water quality indicators (e.g. turbidity, Chlorophyll a)
- Automatic, telemetric monitoring stations to expand the relevant network in rivers and lakes for establishing early warning systems for water related disasters (i.e. floods, droughts, water pollution)
- Laboratory equipment for ecological status assessment of rivers by assessing ecosystem functioning processes (nutrient cycling and coarse particulate organic matter decomposition)
- Swimming flume and shuttle box experimental tanks for fish swimming performance and behavioural experiments
- Stable isotopes equipment to study food-webs, hydrologic processes, and biogeochemical cycles.
- E-DNA equipment to develop non-harmful, state-of-the-art ecological monitoring capabilities
- High performance computing infrastructure for the operational use of hydrometeorological, hydraulic and hydroecological models.

- New Researchers and Support personnel

Given the envisioned plan for the future activities of the Institute several new researchers and support personnel are necessary, in the following fields:

- hydrology-hydraulics with emphasis on forecasting, operational models
- environmental and ecological monitoring with the use of stable isotopes
- environmental and ecological monitoring with the use of e-DNA techniques
- environmental surveillance and monitoring by using Remote sensing approaches and UAVs
- freshwater fish biology and ethology
- benthic ecology, with emphasis on freshwater benthic diatoms
- AI and remote monitoring for fisheries
- fisheries oceanography with emphasis on climate change
- stock assessment, including MSE and application of data poor approaches.
- Marine Spatial Planning

- fisheries acoustics
- fish biology and ichthyology
- microplastics and fisheries-derived plastics
- stakeholder engagement and co-management
- GIS applications and spatial analysis

2 Organizational Structure

2.1 Institute Organogram

Management structure

- *Director*

Professor Konstantinos I. Stergiou has attended special training courses in Portugal (NATO ASI on Operational Fisheries) and USA (Summer school on Ecological Time Series, Cornell University). During 1985-1994, he held a position as a research associate at the National Centre for Marine Research (NCMR, now HCMR, Greece), whereas during 1995-2001 he served as an Assistant Professor, since 2001 as an Associate Professor and since 2006 as a Professor at the School of Biology, Aristotle University of Thessaloniki. He teaches both under-graduate and graduate courses on Ichthyology, Fisheries Biology, Fisheries Resources and Management and Time-Series Analysis. He was elected as director of IMBRIW in November 2013. He supervise(d)s 18 MSc and 7 PhD theses and co-supervise(d)s 13 PhD theses. He was the Director of the Laboratory of Ichthyology, School of Biology, during 2007-2013. He has research interests on fish life-history and population dynamics, fisheries ecology, modelling and forecasting, management and conservation, bibliometrics and scientific performance, and environmental ethics. Overall, he has participated in 28 national and international projects and has co-ordinated 9 European Union (EU) projects. He was a member of the EU STECF committee (1997-2002) and the Coordinator of the Fishery Science Task of CIESM (International Commission for the Scientific Exploration of the Mediterranean Sea). During 2001-2004, he was the Head of the CIESM Subcommittee on Living Resources and during 2004-2007 the co-Chair of the CIESM Committee on Living Resources and Marine Ecosystems. He acted as the National Coordinator of FishBase for Greece (since 1998) and since 2004 is the representative of the Aristotle University (School of Biology) in the FishBase Consortium. He has participated in the Steering Committee of 8 national or international Symposia/Congresses and organized-coordinated three CIESM Workshops. He serves on the Editorial Board of the journals Fisheries Research (up to 2013), Ethics in Science and Environmental Politics (now co editor-in-Chief) and Journal of Biological Research. He is also a contributing editor of the journal Marine Ecology Progress Series and Associate Editor for the FishBase Section (responsible for 'Short Communications in Ichthyology') in the journal Acta Ichthyologica et Piscatoria (up to 2017), Associate Editor for the journal Mediterranean Marine Science and Academic Editor of the journal Plos-One. He was the editor (or co-editor) of 5 theme sections for the journal Marine Ecology Progress Series and for 5 theme sections for Ethics in Science and Environmental Politics. He has contributed more than 170 papers in peer-reviewed journals, 24 book chapters, two books, as well as more than 290 other publications (i.e. conference proceedings, special publications, newspaper and magazine articles, technical reports). Recently he was listed among the top 50 (out of about 1800) scientists of the Aristotle University of Thessaloniki. For more information see Google Scholar Stergiou (https://scholar.google.gr/citations?user=k8hb4pIAAAAJ&hl=el&oi=ao).

Dr. George Tserpes was appointed Deputy Director of the Institute in July 2021, after the resignation of Prof. Stergiou. Dr. George Tserpes holds a position of Research Director in the Institute and his main research interests refer to the Biology, Ecology and Dynamics of fish populations. He has coordinated/participated in 65 National and International projects and has authored/coauthored more than 180 scientific publications in peer-reviewed journals, book chapters and conference proceedings. He has participated in several International Scientific Groups including the Scientific, Technical and Economic committee for Fisheries (STECF) of EU and various STECF Sub-committees. Currently, he is the international coordinator of the Mediterranean International Trawl Survey (MEDITS) and since 2003 he coordinates the Mediterranean Swordfish Working Group of the International Commission for the Conservation of Atlantic Tunas (ICCAT). Since 2019 is also coordinating the Working Group on Stock Assessment of Demersal Species (WGSAD) of the General Fisheries Commission for the Mediterranean (GFCM).

- *Advisory Board*

IMBRIW's Advisory panel consists of the following scholars:

1. Daniel Pauly, Professor, University of British Columbia, Vancouver, Canada (https://scholar.google.gr/citations?user=b6s1NfkAAAAJ&hl=el&oi=ao)
2. Rainer Froese, Senior Scientist, Leibniz-Institut für Meereswissenschaften IfM-GEOMAR, Kiel, Germany (https://www.geomar.de/mitarbeiter/fb3/ev/rfroese/) (https://scholar.google.gr/citations?user=pRM9V4EAAAAJ&hl=el)
3. Howard I. Browman, Principal Research Scientist, Institute of Marine Research, Storebø, Norway (http://www.imr.no/om_havforskningsinstituttet/ansatte/b/howard_browman/en) (https://scholar.google.co.uk/citations?user=-PlTzi0AAAAJ)
4. Klement Tockner,Director General of the *Senckenberg Society* for *Nature Research* and Professor for Ecosystem Sciences at *Goethe-University*, *Frankfurt am* Main, Germany (https://www.senckenberg.de/en/about-us/organisation/director-general/)
5. Ian Cowx, Professor, Hull International Fisheries Institute (HIFI), UK (https://scholar.google.gr/citations?user=fYuwBeoAAAAJ&hl=el&oi=ao)
6. Karim Erzini, Associate Professor, University of Algarve, Algarve, Portugal
7. Laurnce Kell, Population dynamics expert, ICCAT (https://scholar.google.gr/citations?user=tm4QWvsAAAAJ&hl=el&oi=ao)

We have to note here that the advisory board has not been officially mobilised on an annual basis as was initially planned. It has only been occasionally consulted on a personal basis for specific topics or issues. This is partially because of the economic crisis which in the early years (2013-2016) greatly affected/constrained the budget of HCMR (and thus of IMBRIW) and primarily because of the fact that IMBRIW did not have its own budget up until 2020.

- *Organogram*

Figure 3 presents the organizational structure of IMBRIW. The backbone of the Institute is the Director who receives input from external and internal advisers, Large Projects co-ordinators and Heads of Regional Units.

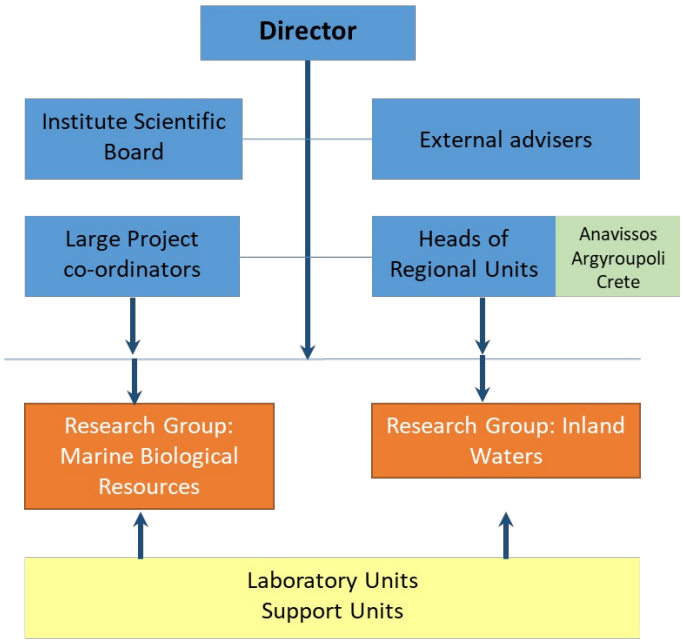

Figure 3. Organizational structure of IMBRIW.

- *Further analysis on the management structure and operations*

IMBRIW includes two main sectors, the Inland Waters Sector and the Marine Biological Resources Sector, located in three geographic regions, Anavyssos-Attica, Argyroupoli-Attica (located in Agios Kosmas until July 2018,) and Crete. Thus, the following management strategies promote the regular communication of all staff in order to effectively advance the quality of IMBRIW:
Every two years researchers and functional scientific personnel elect five members of the internal Scientific Board and the rest of the tenured personnel elect one member of the Council. The Council has an advisory role to the Director and includes researchers from all three regional branches. It meets monthly with the Director and discusses all main matters and issues arising and schedules plans and actions. One important outcome has been the publication of two codes of conduct, one on scientific publication co-authorship (available online on IMBRIW's webpage http://imbriw.hcmr.gr/en/authorship-of-papers-imbriw/) and another one on data sharing (which will be published shortly).

The Deputy Director, after a recommendation by the Director, is appointed by the Board of Directors of HCMR. Up to now, a rotation scheme was planned so that Researchers from all three geographic areas in which IMBRIW is located undertake the role of Deputy Director. The Deputy Director closely co-operates with the Director.

The Heads of the Regional Units are in frequent interaction and contact with the Director. These researchers take care of everyday issues arising locally. The Director is based in Argyroupoli and

visits Anavyssos and Crete regularly where he meets and discusses with all the staff. In addition, there are regular sector, inter-regional and/or thematic meetings, as well as internal project team member meetings. Furthermore, an internal regulation issued by the Director promotes the participation of scientists from at least two regions in all proposals submitted, consolidating expertise and cooperation. Finally, in the case of structural research projects (e.g. ANATHALLOI) all the researchers of IMBRIW are involved, and thus all researchers regularly meet, interact and collaborate, contributing to the multi-disciplinarily and complementarity of expertise.

Currently, there is no Greek legislation on the division of responsibility and authority regarding multi-sited institutes. Therefore in addition to those actions listed above, research unit supervisors and supervisors of the large projects regularly interact with the Director and Deputy Director, depending on the occasion.

There is no administrative body within the institute apart from secretarial support. Administrative support is provided by the Centre. In order to overcome administrative delays and/or internal bureaucracy, which at times can be pressing and/or critical, the Institute's secretary team does provide support to avoid risks and ensure regulatory compliance.

The effectiveness of the Institute's organizational structure and system of governance is improved through periodic and systematic review conducted by the Director and the Institute Scientific Board, which as discussed above changes every two years, as well as indirectly through the intermediate and final evaluation of the director (which is in effect through legislation since 2016). In addition, the Institute's organizational structure and system of governance is thoroughly reviewed every 5 years during the thorough self-evaluation. IMBRIW's organizational structure and system of governance was also planned to be reviewed by the external advisory committee, a fact that however was not realised so far, because of financial constraints.

2.2 Research Groups

The Institute encompasses two research groups that correspond to the two IMBRIW sectors, i.e. the Marine Biological Resources Research group and the Inland Waters Research group (https://imbriw.hcmr.gr/)

The Marine Biological Resources Research Group carries out scientific work on the:

Biology, ecology and life-history of marine organisms and fisheries resources i.e. demersal organisms, small and medium pelagics, large pelagics, mesopelagics, marine cetaceans and reptiles, population dynamics, mortality, feeding, spatiotemporal distribution, abundance, behaviour, migrations, acoustics, tagging, early life history, i.e. taxonomic identification, age, growth, dispersal, abundance-daily egg production and diversity, marine alien species

Fisheries ecology and Ecosystem Approach to Fisheries Management, i.e. fisheries-aquaculture-environment interactions, adult/juvenile spatio-temporal bathymetric distribution, geographic distribution, conservation of non-fisheries resources, integrated coastal zone management (ICZM) including design and management of artificial reefs and marine protected areas, ecological modelling and simulations of fisheries exploitation scenarios in an ecosystem context, monitoring through the Marine Strategy Framework Directive (MSFD)

Fisheries dynamics and capture, i.e. monitoring through the EU Data Collection Framework (DCF), fleet dynamics, landings, stock assessments, new fisheries resources, small-scale and trawl gear selectivity, fishing technology, discards, Vessel Monitoring System (VMS) and Automatic Identification System (AIS) monitoring, socio-economics, development of management plans

Modelling and assessment, i.e. various age-based and global production models, time series models, habitat suitability models, Individual Based Models (IBM), Ecopath-with-Ecosim, Database and Geographic Information System (GIS) applications.

The Inland Waters Research Group carries out scientific work on the:

Biology, ecology and life-history of freshwater organisms, i.e. age, growth, diet, reproduction, breeding.

Freshwater biodiversity conservation and environmental restoration, i.e freshwater organisms' taxonomy, distribution, abundance, genetic structure of populations, conservation of endemic freshwater fish, habitat restoration, freshwater alien species and their interaction with native species

Ecological status assessments and monitoring of surface waters following the provisions of the Water Framework Directive (WFD), i.e. development of river typology schemes, establishment of reference conditions, selection of metrics for assessing ecological degradation, definition of the metric scale to assess deviation from reference conditions

Integrated river basin management, i.e. integrated water resources management at the catchment scale employing ecological quality assessments, numerical modelling to simulate processes driving hydrology and water quality and to produce management scenarios, study of 'hot moments', i.e. droughts and floods, and their effects on aquatic communities, predictability of water cycle, through studying air-sea-land interactions and coastal water processes and optimal integration of meteorological (WRF, Eta), hydrological (WRF-HYDRO, MIKE) and hydraulic (2-D HEC-RAS) models with observational data, statistical evaluation of model results, Database and Geographic Information System (GIS) applications.

2.3 Research Facilities and Support Units

2.3.1 Buildings

During the current evaluation period, IMBRIW facilities were housed in three buildings, occupying a section of the HCMR facilities, with the following surface area used solely by IMBRIW personnel:

- Anavyssos (Attica) 390 m^2 (terrain 4,000 m^2)
- Heraklion (Crete) 500 m^2 (terrain 10,000 m^2)
- Argyroupoli (Attica) 1,655 m^2

2.3.2 Infrastructures – Research Units – Core facilities

In July 2018, the section of IMBRIW located in Agios Kosmas was moved to a new, modern building in Argyroupoli that has greatly increased its operational capacity given that it almost tripled its space and all its laboratories were redesigned and equipped with state-of-the-art infrastructure. The total surface of the buildings occupied by IMBRIW at Anavyssos, Argyroupoli and Heraklion (Crete) for the evaluation period was 2,545 m^2. IMBRIW has a variety of computing equipment (see section 2.3.3),

as well as laboratory and field equipment that is adequate to fulfil its mission (Fig. 4). In regard to laboratory facilities, it includes ten main laboratory units (Fig. 5).

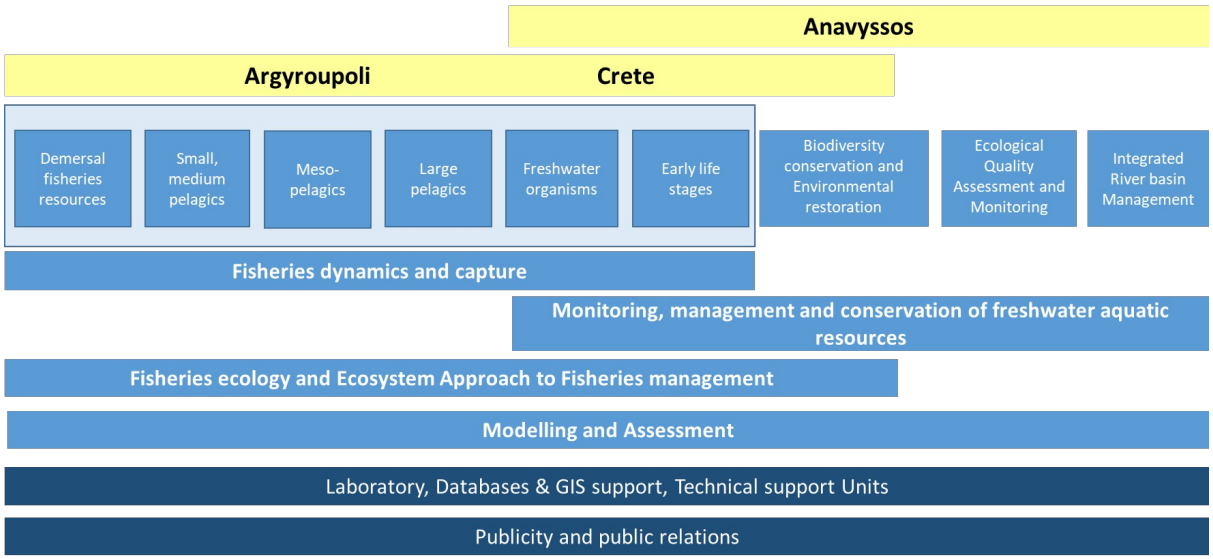

Figure 4. IMBRIW research structural scheme, during the evaluation period, with the location of regional units (yellow), Research units (light blue) and laboratory and support units (dark blue).

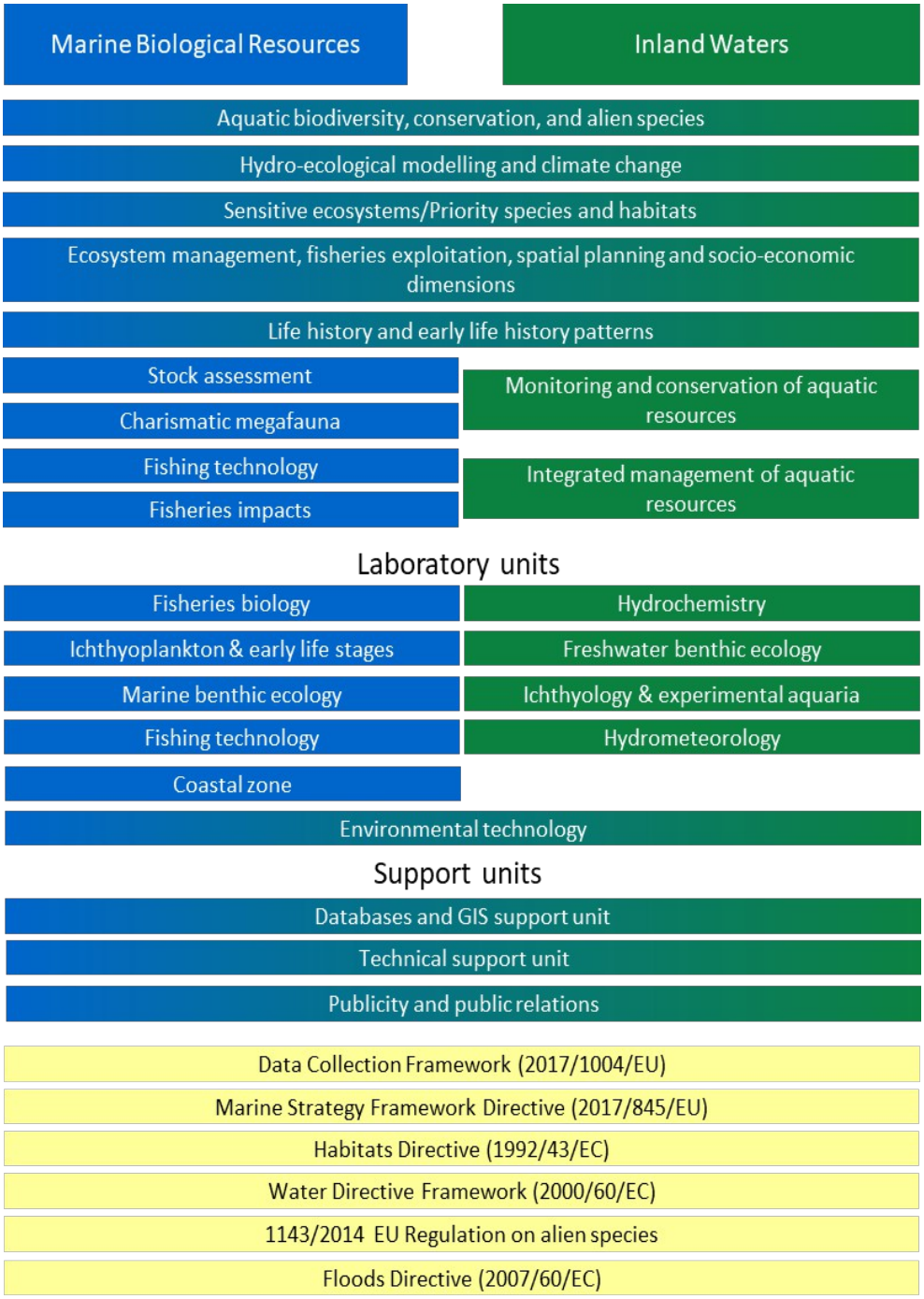

Figure 5. Detailed IMBRIW research structural scheme with a description of laboratory units and large Framework programs.

IMBRIW is the main user of the **Research Vessel (R/V) 'PHILIA'** for collecting data in the field. R/V 'PHILIA' is also hired by third parties to conduct fisheries research, since it is the only vessel in Greece equipped with instruments (sampling and sensing) for such activities. A non-exhaustive list of the vessel's equipment includes fishing gears, fish plankton–nets, CUFES egg sampler, water samplers, instruments for measurements of abiotic parameters as well as new generation SCANMAR sensors for monitoring trawl position and architecture (Trawl Speed sensor, Depth sensor, TrawlEye, Catch Sensor, Door-Temperature sensor). The hydroacoustic system that the vessel carries is a state-of-the-art, hull-mounted, four frequency (38, 120, 200 and 333 kHz) SIMRAD EK80 wideband system which (i) allows to expand the operational spectrum of organisms, targeted especially in plankton

aggregations, thus, coupling acoustic and plankton research (ii) improve the acoustic bottom characterization which can be used for habitat mapping, while (iii) the wideband capabilities of the transducers allow better signal-to-noise ratio, add a new dimension to the collected data, and is the primary tool for active research in the fisheries acoustics community. The R/V 'PHILIA' has already been used for fisheries research by other organizations and state authorities (e.g. the state of Libya before the current evaluation period), while there are plans for it to be used by institutions in Saudi Arabia and Cyprus. Recently (2021), the R/V 'PHILIA' has been reconstructed, extended by 5 m and technologically modernized using grants achieved by IMBRIW personnel; this upgrade greatly expands its operational and research capability (see also section 2.3.5). In addition, IMBRIW also uses HCMR's Remotely Operated Vehicles (ROVs) for benthic fisheries community studies.

IMBRIW has constructed and harmonized **a central database system** (Fig. 6) including all data that have been collected within the framework of all projects undertaken (i.e. environmental, conductivity, temperature, and depth (CTD) and satellite data, raw data on abundance indices, length-frequencies, age distribution, reproduction, larval species composition, adult species composition, fleet effort and landings by metier, fleet activity, VMS & AIS data, Mediterranean International Trawl Survey (MEDITS), and all other data collected within the DCF, WFD, and MSFD, including all the annual data published by the Hellenic Statistical Authority). In addition, a new state-of-the-art database following the WFD requirements, has been developed in the Inland Waters sector that includes biological (fish, macroinvertebrates, diatoms, aquatic macrophytes and riparian vegetation), habitat, physicochemical, chemical and hydrological data from all Greek river basins (https://watermonitoring.hcmr.gr/). This database will be integrated into the central database at a later stage. Although raw data (i.e. detailed data per sampling event) are directly available only to the national administration and EU, aggregated data are available to the public upon request (according to the Code of Conduct on data sharing, see section 2.3.6).

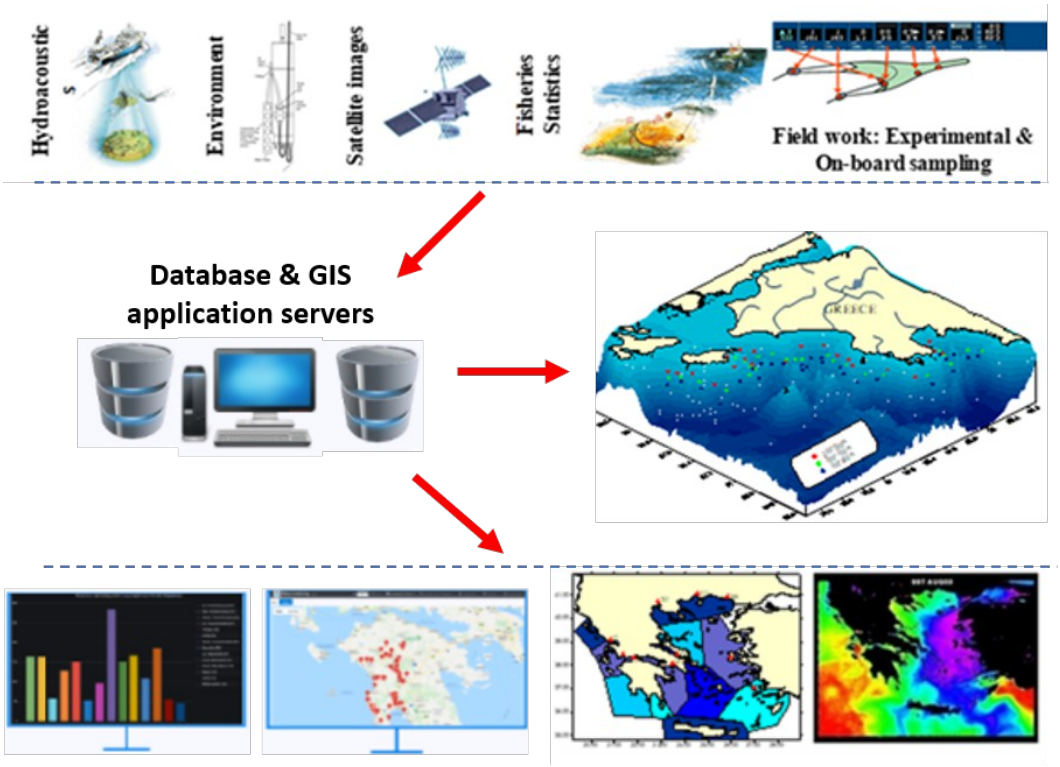

Figure 6. Schematic presentation of the IMBRIW database.

The facilities of the Institute are regularly used by research partners from various EU and international projects, mediating the exchange of know-how. In addition, the facilities of IMBRIW are also used for the training of university students (i.e. undergraduate, M.Sc., Ph.D. studies).

2.3.3 Computing facilities

These include a Database server, an Application server, a GIS server, a S-Plus server, High performance workstations, Routers, Firewall, Switches, LAN-NAS backup, UPS, Software (ORACLE, PostgreSQL, PostGIS, S-Plus, SPSS, Statistica, R, Primer, ArcGIS, DELPHI, Paradox, Image analysis, hydroacoustics, Microsoft Office, ADOBE, Corel GEOPRO, HYPACK, Myriax Echoview and other specialised software), one BladeSystem c7000 enclosure with 16 HP Proliant BL460c G1 server blades: 10 E5345 (20 Quad-Core Intel Xeon 2.3 GHz Processors) and 6 E5405 (12 Quad-Core Intel Xeon, 2.0 GHz Processors) connected with an HPE MSA storage of 40 TB disk capacity, two HPE ProLiant DL360 Gen10 rack servers with two Intel Xeon-Gold 5115 10-core and 192 GB RAM connected with an HPE MSA storage of 20 TB disk capacity, 4 Linux-based Workstations, Computerized Image Analysis Systems linked to cameras and microscopy systems.

2.3.4 Other Facilities

A mobile hydrogeochemical laboratory (vehicle) was purchased in 2015 which is fully equipped with all the necessary infrastructure for analysing water samples in the field.

A simulation room has been developed in the premises of HCMR Argyroupolis to facilitate decision making and visualization of the Institute's modelling platforms and monitoring schemes. Among other things, the data from the automatic monitoring stations in rivers and lakes are stored and managed in this simulation room.

The ichthyology and experimental aquaria unit was equipped, within the period 2018-2021, with 12 new aquaria units (150-200 L) that currently host eight native fish species (seven of them threatened) and one alien species for experimental purposes, as well as several smaller aquaria for fish larvae rearing. Also, the unit was equipped with a 120 L experimental tank for fish behavioural experiments.

The following HCMR facilities are also used by IMBRIW: R/V AEGAEO, R/V ALKYON, local library (technical report of research projects depot; data sheets from NSSG; CV's etc.), HCMR library, Administration offices equipped with VoIP central telephone system, computers and fax, meeting rooms for lectures/project meetings and large amphitheatre (150 seats), storage areas for sampling gears and samples.

Both Athens and Crete staff have free full access to electronic journals/publishers and libraries through the central HCMR library (https://library-opac.hcmr.gr/). Moreover, the HCMR library runs a central repository of HCMR staff publications (https://okeanos-dspace.hcmr.gr/). Local (Argyroupoli, Anavyssos and Crete) libraries also act as depot for final/technical reports of research projects, print journals, multimedia applications and other publications.

2.3.5 Changes in the evaluation period

During the evaluation period, the following large-scale changes in equipment and facilities took place:

- IMBRIW, in the frame for the innovation of the Research Infrastructure, was funded for the "Reconstruction and Modernization of Research Vessel (R/V) PHILIA" (https://rephil.eu/en/), which is a synergy between HCMR and the School of Naval Architecture and Marine Engineering of the National Technical University of Athens (NTUA). The vessel was extended by 5m (Figure 7), new spaces were added and old ones were expanded, the naval systems were modernised, while the scientific equipment was updated by purchasing a CTD profiler, a Rosette sampler and a multi-beam hydroacoustic system. As an outcome of this project, which began in 2017 and ends in 2022, the R/V PHILIA now constitutes a modern platform capable of performing modern multidisciplinary research in the aforementioned fields. The vessel allows Research Groups from different marine research areas (e.g. fisheries, plankton research, benthos, chemical oceanography, physical oceanography, etc) to work together and reinforces the existing collaboration with Universities and other research units for joint operations. In addition, the upgraded operational ability of the vessel permits the expansion to international operations, especially in the east Mediterranean and the Red Seas.
- A new fleet of Unmanned Aerial Vehicles (UAVs) has been purchased, consisting of two fixed wing airplanes and four quadcopters that carry a variety of sensors including RGB, thermal and multispectral cameras, as well as Lidar systems. Moreover, a Unmanned Surface Vehicle (USV) has been developed in 2021 to assist in hydraulic, hydrologic and water pollution studies. This fleet is currently used for hydromorphological and habitat mapping and will be used in the future for discharge measurements and detection of soil erosion and water quality monitoring

Figure 7. R/V PHILIA (left) before and (right) after her reconstruction.

2.3.6 Access policies for the Institute's Facilities and Infrastructures

- *Access policy for researchers*

The access policy for the Institute's infrastructure is determined by the governing body of the infrastructure in collaboration with the Scientific Council and the Director of the Institute. Access is granted after written applications which are examined by the above responsible bodies and a justified decision is made. The common practice is to facilitate the use of infrastructure if this is not negatively affecting the infrastructure or the Institute itself.

- *Access policy for firms and third parties*

IMBRIW facilities and infrastructures are accessible after an application procedure, through the HCMR Board of Directors. Applications are assessed based on a case by case criteria, nevertheless, applications from scientists of public bodies are almost always accepted. Regarding accessibility to IMBRIW data, a Code of Conduct on data sharing, which controls all relevant issues, is under development and about to be finalized.

2.4 Scientific Council

The Scientific council of the Institute during the evaluation period was composed of 5 regular members (Researchers A or B) and one member without voting rights (Technical - Scientific personnel). Particularly, the regular members were Elias Dimitriou, Anastasios Papadopoulos, Paraskevi K. Karachle, Stelios Somarakis and Stefanos Kavvadas, and Konstantia-Nadia Papadopoulou was the no voting member.

The Scientific council convenes regularly (approximately once per month) and discusses important issues related to the operation and development of the Institute. The members of electoral committees for new research vacancies or promotions were selected by the scientific council while intellectual properties rights and data sharing rules were established based on plans submitted to the Director of the Institute. The strategic plan of the Institute and the self-assessment report of the period 2013-2017 as well as the present one were partially prepared by scientific council members. Prioritisation of the Institute's new infrastructure and equipment were proposed for potential funding by the scientific council after discussion with the Institute's researchers. Dissemination activities and particularly the Institute's webpage and collaborative activities between Institutes were organised and designed with the contribution of the scientific council members.

Apart from the regular meetings, several requests by the Director or HCMR Administration were tackled in ad-hoc meetings for supporting the decision-making process at the Institute or HCMR level.

2.5 Personnel

Table 2-1: Permanent Researchers

Researcher Name	Position[1]	Year joining the Institute	Year departing from the Institute	Year(s) of promotion
Conides Alexios	A	1994 (D)	2033	2011 (A)
Dimitriou Elias	A	2007 (C)	2040	2011 (B) 2016 (A)
Economou Alcibiades	A	1996 (C)	2018	2006 (A)
Giannoulaki Marianna	A	2007 (C)	2039	2011 (B) 2016 (A)
Kapiris Konstantinos	A	2007 (C)	2019	2011 (B) 2016 (A)

[1] Research personnel A, B, C (this includes Researchers and Specific Operations Scientists (ELE))

Researcher Name	Position[1]	Year joining the Institute	Year departing from the Institute	Year(s) of promotion
Machias Athanassios	A	2003 (B)	2026	2007 (A)
Papadopoulos Anastasios	A	2007 (C)	2034	2011 (B) 2016 (A)
Skoulikidis Nikolaos	A	1994 (D)	2025	2008 (A)
Smith Christopher	A	2003 (B)	2028	2007 (A)
Somarakis Stylianos	A	2007 (B)	2035	2013 (A)
Stoumboudi Maria	A	1995 (D)	2030	2008 (A)
Tserpes Georgios	A	2003 (B)	2026	2008 (A)
Vassilopoulou (Celia) Vasiliki	A	2006 (A)	2026	2006 (A)
Zenetos Argyro	A	2005 (A)	2020	2005 (A)
Anastasopoulou Aikaterini	B	2006 (D)	2034	2014 (C) 2020 (B)
Damalas Dimitrios	B	2015 (C)	2034	2020 (B)
Gritzalis Konstantinos	B	2016 (B)	2027	
Kalogianni Eleni	B	2016 (C)	2031	2021 (B)
Karachle Paraskevi	B	2013 (C)	2040	2018 (B)
Lefkaditou Evgenia	B	2016 (B)	2026	
Zogaris Stamatios	B	2016 (C)	2037	2021 (B)
Karaouzas Ioannis	C	2019 (C)	2043	
Kourantidou Melina	C	2020 (C)	2052	
Tsagarakis Konstantinos	C	2018 (C)	2046	
Kapantagakis Argyris	ELE A		2021	
Kavvadas Stefanos	ELE A	1999 (C)	2024	2008 (A)
Mytilineou (Chryssi) Chrysoula	ELE A	1989 (C)	2025	2003 (A)
Petrakis Georgios	ELE A	1989 (C)	2026	2003 (A)

Table 2-2: All Personnel

Personnel Totals	2018		2019		2020		2021	
	Male	Female	Male	Female	Male	Female	Male	Female
Researchers[2]	18	9	18	9	17	10	16	9
Collaborating University Faculty	1	0	1	1	1	0	1	0
Adjunct, part-time, visiting Researchers	0	0	0	0	0	0	0	0
Staff Scientists and Technicians (permanent)	14	10	14	10	14	10	14	10
Post-doctoral Researchers (on contract)	0	1	0	1	0	1	0	2
Research Associates (on contract)	38	49	41	47	50	50	54	52
PhD Students (on contract)	0	1	0	1	0	1	0	1
Administrative Personnel (permanent or on contract)	1	8	1	8	1	9	1	9
Master and Undergraduate Students	6	3	3	2	7	4	6	8
Other Personnel	1	0	1	0	1	0	1	0
Total	**79**	**81**	**79**	**79**	**91**	**85**	**93**	**91**

3 Administration and Management Policies and Practices

a. Policies and practices for financial management and Access policies to Facilities.

HCMR is a public research center and the financial management scheme followed, is common for the whole center. The financial management of HCMR is separated into two main modules. The Greek State is funding the salaries of permanent staff and a small fraction of the operating costs (*e.g.* electricity, water, telephony, etc.). Then, the so called "Special Account for Research Grants (SARG, known as ELKE)" is an autonomous financial department, with responsibility to manage all other income (from research grants, studies, services, etc) and expenses of the center. Hence, the institutes do not have any means and are not directly involved in the financial management of these funds. The SARG is staffed with specialized personnel (permanent and under contract), and its expenses and all other operating costs of the center not covered by the Greek State, are paid through the overheads on the research and service grants of HCMR. The maximum overhead rate allowed by law (N4485, art. 59) is 25% of the total budget of a grant, but the actual amount varies,

[2] From Table 2-1

depending on the funding organization and scheme. National projects foresee relatively small overhead rates, usually corresponding to less than 10% of the total project cost.

Regarding the institutes of HCMR, a small portion of the project overheads (an overhead rate of 2%) is allocated for operating and development expenses of the corresponding institute, and it is credited to the institute's overhead account. The distribution of the IMBRIW common expenses (not including salary costs) paid by its overhead account, together with the operational costs paid from the global HCMR overheads, for the period 2018-2021, appear in Table 4-3 in this platform.

Funding of IMBRIW during the reporting period ranged between 5,6 and € 7,3 million € (Table 4-4 in the platform), showing an increasing trend over the years. The highest cost regards personnel, with the cost of the permanent staff being 25% of the total expenditure and the cost of the non-permanent personnel corresponding to 32%.

Access fees to the IMBRIW facilities do not apply for internal users, while a scheme including fees for the use of the facilities and services (calculated with the assistance of an auditor) is under preparation. This scheme will be primarily used for external users.

b. Management of the Human Potential

In HCMR, there is not any institute specific management scheme of the human potential. HCMR implements Greek and European legislation and respects principles of transparency and equality. Regarding the selection process for personnel recruitment, case specific criteria are defined for evaluation, and the selection of staff is carried out following an open call/announcement, which is posted on the HCMR website and in DIAVGEIA (site for announcements, operating under the Greek Ministry of Digital Governance). The eligibility criteria of the candidates correspond exclusively to academic, professional and scientific capacity. Regarding the grading of the qualifications of the candidates, the Supreme Council for Civil Personnel Selection (ASEP) standard is followed. An interview is also included, when it is considered necessary. Elements that will be evaluated are predetermined in an objective and transparent way. Nominations are evaluated by an Evaluation Committee and each candidate has the right to submit an objection, which is examined by the competent Objections Committee.

Regarding support policy for newly recruited scientific personnel, unfortunately there is no start-up funding, or other types of financial support due to budget limitations. However, it is recognized the necessity to establish such a support policy, particularly for newly recruited researchers, and it is planned to examine the feasibility of funding relevant actions through the institute's overhead account.

c. Measures for promoting Equality, Diversity and Inclusion

There is no separate institute policy for these aspects, and the Institute follows what is established for the HCMR as a whole.

The HCMR aims to provide equal opportunities for new staff and equality in the workplace. For this purpose, a Gender Equality Plan (GEP) has been recently established (2022), in order to ensure fair access and equality for all staff categories (research, managerial, technical, administrative and support staff). The GEP is in accordance to Greek and European laws and does not only limit equality to gender bias, but also considers other inequality grounds such as disability, age, sexual orientation, religion or ethnicity, etc.

The HCMR GEP legitimizes and protects every strategy aiming to achieve gender equality within the Center and implements the following actions:

- Encouraging balanced gender representation in job applications through gender-neutral vacancy descriptions.
- Ensuring gender balance in decision-making processes and bodies, by inclusivity in decision-making by not allowing gender discrimination enabling women to participate women in participating in the process.
- Integrating the gender dimension in research and innovation content.

HCMR has managed to achieve a balanced gender representation in its personnel and the same is valid for IMBRIW, as it can be seen in Table 2-2 of the platform. The gender ratio (males/females) of the institute in the reporting years ranged from 0.97-1.07.

Regarding the salary levels of Researchers and Specific Operation Scientists, the Greek law 4472/2017 is applied. For the rest of the staff (scientists, technicians and other supporting personnel) whether employed on a permanent contract or on a fixed-term contract, the amount of remuneration is set by the Law 4354/2015, so as to avoid any discrimination.

d. Policy and Regulations enforcing Ethics in Research and Scientific Integrity

In principle, there is no separate institute policy for these aspects and IMBRIW follows what is established for the HCMR as a whole. Only in the case of the scientific data management plan the institute is developing it own policy, given that there is nothing relevant established for the whole HCMR.

Ethics Committee

The HCMR's Ethics Committee was established just recently (2021) in accordance with Law 4521/2018 (articles 21-27) in order to provide, at an ethical level, a guarantee of the reliability of the research projects carried out at the HCMR. The Ethics Committee checks whether a research project is carried out with respect for fundamental human rights, the autonomy of the persons involved, their privacy and personal data, and the care of the natural and cultural environment. It also monitors compliance with generally accepted principles of research integrity and the criteria of good scientific practice.

In addition, the mission of the Ethics Committee is to assist in the harmonization of HCMR's research practices with the legislation, rules and regulations of the European Union and international law.

Personal Data Protection Policy (GDPR)

The HCMR has fully complied with the current legislation (European Data Protection Regulation and Law 4624/2019 on Personal Data) and implements a comprehensive program for the Protection of Personal Data, in order to fully ensure the protection of employees, associates and all stakeholders. HCMR cooperates with a private company that advises and trains the person in charge of personal data protection in relevant matters and information security, in order to guarantee compliance with the legislation. Two meetings are already scheduled (distance learning) for training at 05/04/2022 and 07/04/2022.

Scientific Data Management Plan

As already mentioned in chapter 2.4.3 IMBRIW has established a central database system including all data that have been collected within the framework of the various projects. Although raw data (i.e. detailed data per sampling event) are directly available only to the national administration and EU relevant authorities, aggregated data are available to the public upon request following the

procedures mentioned in the under-development Code of Conduct on data sharing (see section 2.3.6).

e. Partnerships, strategic alliances

- Participation in networks of excellence

ECOAST - New methodologies for an ecosystem approach to spatial and temporal management of fisheries and aquaculture in coastal areas.

ESENIAS - East & South European Network for Invasive Alien Species. HCMR participates in the core group of the network as a National Scientific Contact point, and has been collaborating with the network under the frame of scientific projects, organisation of Conferences, etc

HCMR is a member of EuroMarine; EuroMarine is a European marine science network launched in 2014. It represents the merger of the scientific communities of three former European Networks of Excellence: EUROCEANS, Marine Genomics Europe, Marine Biodiversity and Ecosystem Functioning (MarBEF).

- External Collaborations, Networking, Linkages (at Local, National & International level)

All researchers participated in European, other International and National research projects involving numerous partners, which has resulted in building a broad network of collaborations with Research Institutions, Universities, Conservation Bodies, Management Bodies and other types of organisations. Many of these projects have led to topical high-profile publications and further networking and proposals/participation in new projects in multidisciplinary consortia with leading WP/task roles. More information on research projects is given in sections A-4.2 and A-4.3.1.

The closest collaborations are with organizations from the Mediterranean area, mainly from EU countries (e.g., Spain: IEO, AZTI, IMEDEA, CSIC, University of Barcelona; Italy: CNR, ISPRA, OGS, COISPA, NISEA Società cooperativa, CIBM, UNIVPM, SZN, France: IFREMER, CNRS; Croatia: IZOR, University of Zagreb, University of Split) as well as with organizations from the Eastern Mediterranean and the Balkans (e.g., Serbia: University of Belgrade; Slovenia: Jožef Stefan Institute; Czech Republic: Masaryk University; Institutes, private companies and Universities from Cyprus, Bulgaria, Romania, Montenegro, Kosovo, Albania). Also, numerous collaborations with scientists and organizations from Central and North European countries (e.g., Germany: Institute HZM and the Technical University of Munich; Norway: IMR; Belgium: the University of Leuven, ILVO, University of Ghent; UK: CEFAS, the Zoological Society of London, University of Hull, University of Derby, University of West England; Denmark: DTU-Aqua, University of Aarhus), the USA and the Middle East (mainly Institutions from Turkey and Saudi Arabia) have been established. At the national level, there is a strong collaboration with most Universities with relevant scientific fields (mainly the Universities of Athens, Thessaloniki, Crete, Patras, Aegean, and the Technological University of Western Greece), with NGOs (e.g., WWF, Hellenic Ornithological Society), with the Fisheries Research Institute (located in Kavala) as well as with private companies.

Cooperation with stakeholders was a priority of the Institute. During 2018-2021, several projects (e.g., COST ALIEN-CSI, EC-IAS, LIONHARE, 4ALIEN, Gyaros MPA, PANDORA, Co-managed NTZ/MPAs, SEAwise) involved professional or recreational fishers, decision makers, NGOs, the Mediterranean Advisory Council (MEDAC), local and regional authorities or included stakeholder meetings and events that strengthened the collaboration with end users.

Several researchers also pursued short visits in institutions abroad for training and scientific collaboration (e.g., AZTI-Spain; CNR-Italy; IEO-Spain; IFREMER-France, CSIC-Spain; OGS-Italy, IMEDEA-Spain; IMR-Norway).

Furthermore, IMBRIW researchers have regularly participated in international workshops and working groups organized by ICES (e.g., WGCOMEDA, WGFAST, WGACEGG, WGCEPH, WKVALMU, WKAMDEEP, WKMSEL, WGBIOP, WGITMO, WKMESOMETH, WKBEDPRESS, WKLOSS, WKTRADE, WGFBIT), FAO GFCM (e.g., stock assessment meetings e.g., WGSASP, WGREDCORAL), ICCAT, STECF (Expert Working Groups related to stock assessment, socio-economics, common fisheries policy, methodological issues of the DCF), EU and other organizations (e.g., DG ENV TG Seabed, EWG of Drin River Basin Management, ECOSTAT committees for WFD implementation), as well as in MEDIAS and MEDITS annual meetings. Many of them acted as invited experts, moderators,chairs, national delegates of focal points in working groups or in committees (e.g., Moderator in the GFCM - Subregional Committee for the Adriatic Sea, SRC-AS; international scientific advisory board of the NGO "Sustainable Samothraki"; chair of the ICCAT Mediterranean swordfish Group; chair of the MEDITS Steering Committee; co-chair of the ICES WKVALMU).

IMBRIW researchers are members (e.g., FishBase, ESENIAS network on alien species, European Centre for River Restoration, Waterwiki.net, COST actions, Greek Focal Point in the Expert Working Group Monitoring and Information Exchange for the Drin Core Group) or even chairs of international associations and networks (e.g., Network of experts on the effect of Lessepsian species on Fisheries of the Eastern Mediterranean" of the FAO-EastMed Project).

Several researchers are members of journal editorial boards (e.g., *ICES Journal of Marine Science*, *Marine Ecology Progress Series*, *PlosOne*, *Scientia Marina*, *Hydrobiologia*, *Frontiers in Marine Science*, *Mediterranean Marine Science*, *Acta Ichthyologica et Piscatoria*, *Turkish Journal of Fisheries and Aquatic Sciences*) and/or organised special issues in scientific journals on selected hot research topics. Two researchers are members of the STECF, one since 2003 and one since 2019. Finally, the Director is a permanent member of the EFARO (Organization of the directors of the European Fisheries Institutes) which is important for the collaboration with leading institutions in this field.

The above is reflected in the high number of publications of IMBRIW members that were co-authored with international teams in high level journals and symposia, in which IMBRIW researchers had the leading role in many of them.

- Participation in national and European infrastructures

The Institute participates in the National Research Infrastructure: 'Hellenic Integrated Marine and Inland Water Observing, Forecasting and Offshore Technology System, HIMIOFoTS', which is

adopted in the National and European Roadmap for Research Infrastructures (https://www.esfri.eu/national-roadmaps). The first phase of HIMIOFoTS is already funded by the General Secretariat of Research and Technology. Within the frame of "Reconstruction and Modernization of Research Vessel (R/V) PHILIA", which is a synergy between HCMR and the School of Naval Architecture and Marine Engineering of the National Technical University of Athens (NTUA) under ESFRI, that began in 2017 and is close to conclusion, (R/V) PHILIA now constitutes a modern platform capable to perform modern multidisciplinary research.

In 2021, a collaboration between the Sector of Inland Waters and EMODNET started by offering to this EU network important data from the automatic monitoring stations of IMBRIW, regarding river discharges to the sea. The data from the associated stations are now embedded in the EMODNET official database and offered to the public.

f. Scientific exchanges and collaborations

- During the evaluation period, several seminars, invited lectures, and thematic seminars have been planned. More specifically:

i. Internal Seminars. A series of internal seminars were organised to present state-of-the-art research efforts in important topics regarding biodiversity conservation, water resources management and fisheries. All the newcomer scientists in the Institute present their past research experiences and discussions to promote new research activities in emerging fields are discussed among the personnel.

ii. Horizontal Thematic Seminars-Training Schools

1. "Engaging Citizen Scientists into spotting, reporting and understanding Marine Alien Species", April 1-3 2020, Herakleion, Crete, GREECE. Organised within the COST Action CA17122-ALIEN CSI " Increasing understanding of alien species through citizen science". CANCELLED (due to the COVID-19 pandemic).
2. Members of the Institute organise a summer school in Samothraki every year (except 2020-21, due to COVID restrictions), focusing on sustainable island management, with the collaboration of BOKU Vienna (https://boku.ac.at/en/) and other academic institutions under the framework of the Sustainable Samothraki initiative (http://sustainable-samothraki.net/)

iii. Invited Speaker Lectures at HCMR

1. Dr Baran Yoğurtçuoğlu (Hacettepe University, Ankara, Turkey) - Feeding habits and trophic levels of turkish freshwater fishes

iv. Invited Speaker Lectures by HCMR scientists

1. Karachle PK (2018) The IUU guests: Increasing, Unstopped, Unbounded aliens in the Mediterranean. 4th Symposium on EuroAsian Biodiversity, Kiev Ukraine
2. Karachle PK (2018) Marine Protected Areas: a sanctuary for marine life. International Marine & Freshwater Sciences Symposium, Antalya Turkey
3. Kalogianni E., (2018). "Fish Biodiversity in Greek Inland Waters- Conservation, Applications" Key lecture, International Scientific & Practical Conference on the Biological Estimation of the Water Quality "Trans-Regional Environmental Awareness for Sustainable Usage of Water Resources" Athens Meeting (06th – 19th May 2018).

4. Karachle PK, Pantazi M, Zenetos A (2021) Biology on the spotlight: comparing traits between alien and native Mediterranean fishes. LifeWatch ERIC Workshop “e-Science for NIS Research”, online
5. Trichkova T, Uludağ A, Tomov R, Karachle PK, Vladimirov V, Kalcheva H (2021) ESENIAS & DIAS: Ten years of cooperation and networking on invasive alien species in East and South Europe. Joint ESENIAS and DIAS Scientific Conference and 10th ESENIAS Workshop, Ten years of cooperation and networking on invasive alien species in East and South Europe, online
6. Karaouzas I., 2019. Cross-border rivers of Greece: Ecological quality and environmental problems. Conference title: Pollution and water quality management at the level of river basins, November 28, 2019, Thessaloniki, Aristotle University of Thessaloniki. Project: Sustainable management of transboundary water resources
7. Skoulikidis N., 2019. Balkan rivers - Pressing environmental challenges. Wild Rivers International Science Symposium, Titrana, Albania, October 18, 2019
8. Smith C., Papadopoulou N., 2019. Challenges and threats of economic activities for land-sea interfaces. Ecosystem-based responses to Mediterranean biodiversity challenges. PANACEA. Rome 7 May 2019.
9. Anastasopoulou A., 2018. Addressing the Marine Litter problem on Biota. International Technological Science and Design Symposium, Giresun, Turkey, June 27-29.
10. Anastasopoulou A., 2018. “Marine litter on organisms and on the seafloor of the Ionian Sea. Pilot actions. Life DEBAG Conference, Athens, Greece, 7 December.
11. Anastasopoulou A., 2021. “Marine Litter on the seafloor of the Greek Seas: problem and Actions. 3rd Ocean Decade Laboratory, Workshop on marine litter in the Mediterranean “Towards a clean and sustainable Mediterranean Sea”, 18 November 2021, Virtual.
12. Anastasopoulou A., 2021. “Highlighting the problem of Marine Litter on the biota and the environment. Panhellenic Association of Bioscientists. March 19-20, On line.

- Collaborations between the Research Groups within the Institute.

The collaboration between the two Research Groups was mainly strengthened through the project ANATHALLOI “Development of management tools for marine and lake ecosystems” which focused on the development of ecosystem models that made use of available and new information on the diversity of communities, biology and ecology of species and abiotic parameters and demanded the exchange of expertise between the two groups. In addition, members of the two Research Groups collaborated for studies in transit ecosystems, for data analysis and for applying techniques which are considered common in one of the two Groups but novel in the other Group. As a result, a series of Journal publications with the participation of both Research Groups was produced during the evaluation period:

- Moutopoulos, D.K., M.Th. Stoumboudi, A. Ramfos, K. Tsagarakis, K.C. Gritzalis, O. Petriki, A. Patsia, R. Barbieri, A. Machias, K.I. Stergiou, D.C. Bobori. (2018). Food web modelling on the structure and functioning of a Mediterranean lentic system. Hydrobiologia, 822(1), 259-283. https://doi.org/10.1007/s10750-018-3685-x
- Varkitzi, I., Vassiliki Markogianni, Maria Pantazi, Kalliopi Pagou, Alexandra Pavlidou and Elias Dimitriou (2018). Effect of river inputs on environmental status and potentially harmful phytoplankton in a coastal area of eastern Mediterranean (Maliakos Gulf, Greece). Mediterranean Marine Science, [S.l.], p. 326-343. ISSN 1791-6763, doi:http://dx.doi.org/10.12681/mms.14591
- Mentzafou, A., Conides, A., Dimitriou, E. (2020). Climate change assessment impacts on the coastal area of maliakos gulf, Greece. Journal of Water and Climate Change, 11(4), 1235–1249. https://doi.org/10.2166/wcc.2019.209
- Papantoniou, G., Giannoulaki, M., Stoumboudi, M. T., Lefkaditou, E., Tsagarakis, K. (2021). Food web interactions in a human dominated mediterranean coastal ecosystem. Marine Environmental Research, 105507.

- Petriki, O., Moutopoulos, D.K., Tsagarakis, K., Tsionki, I., Papantoniou, G., Mantzouni, I., Barbieri, R., Stoumboudi, M.T., 2021. Assessing the Fisheries and Ecosystem Structure of the Largest Greek Lake (Lake Trichonis). Water, 13(23), p.3329.
- Tsionki, I., Petriki, O., Leonardos, I. D., Karachle, P.K., Stoumboudi, M.T. (2021). Length-weight relationships of 6 fish species caught in a Mediterranean lake (Trichonis-NW Greece). Journal of Applied Ichthyology.
- Vagenas, G., Stoumboudi, M.Th., Petriki, O., Andriopoulou, A., Tsionki, I., Karachle, P.K. (2022). Dietary patterns of five freshwater fish species in a large Mediterranean lake. Journal of Freshwater Ecology, 37 (1): 203–220.

- Interdisciplinary collaborations with Groups of other Institutes of the Center or Partner organizations.

Collaborations across HCMR Institutes (or Groups of other HCMR Institutes) is a common practice as many projects are interdisciplinary and require contributions from several fields of expertise. This is achieved through (i) joint proposals/projects with the participation of two or even three Institutes, (ii) the cooperation of Directors within the Board of Directors, (iii) the formation of multi-disciplinary units and sub-groups initiated by individual researchers and/or the Scientific Councils of the Institutes, as well as (iv) through informal collaborations (e.g. side works within projects, co-supervision of students, provision of samples for analysis, knowledge exchange). An indicative list of IMBRIW projects including participants from other Institutes includes the projects: WFD, CLIMAFISH, Gyaros-MPA, WEST COASTS 2021-2023, (Institute of Oceanography, IO); 4ALIEN, COASTAL, (Institute of Marine Biology, Biotechnology and Aquaculture, IMBBC); LIONHARE (IO and IMBBC). Similarly, IMBRIW researchers participated in the following projects coordinated by other Institutes: NAUTILUS, MSFD, MUSES, ABIOMMED, MEDREGION, MEDCIS, (IO), VIOAXIOPOIO, LagoMEAL, EXPLIAS, PERFORMFISH (IMBBC). Several additional informal collaborations were held within the IMBRIW projects ANATHALLOI, MESOBED and others. As an outcome of the above, numerous conference and peer-reviewed publications were produced; the full list of Journal articles resulting from such collaborations is provided in Annex I.

4 Financial Situation of the Institute

The governmental funds (regular budget) of IMBRIW during the 2018-2021 period fluctuated from 1.63 to 1.75 Meuros, while the EU projects' matching funds illustrated a significant decline and were diminished in the year 2021 (Table 4.1). On the contrary, the income from competitive grants over the same period illustrated a significantly increasing trend, from 5.3 Meuros to 7.9 Meuros (50% increase).

Table 4-1: Governmental Funds

	2018	**2019**	**2020**	**2021**
Regular Budget	1.617.440,48	1.646.721,45	1.709.467,66	1.636.227,37
Matching Funds	108.109,60	83.508,19	49.824,26	0
TOTAL	**1,725,550.08**	**1,730,229.64**	**1,759,291.92**	**1,636,227.37**

Table 4-2: Competitive Grants

	2018	2019	2020	2021
Greek Programmes (NSRF)	4,306,916.56	4,615,044.46	5,702,797.68	7,148,263.34
EC Programmes	745,854.42	454,451.76	549,695.25	519,316.72
Other International	129,843.23	93,217.09	162,631.92	98,935.58
Private Funding	48,060.00	129,242.00	100,198.00	17,000.00
Other	57,290.04	45,635.93	93,891.51	191,501.29
TOTAL	**5,287,964.25**	**5,337,591.24**	**6,609,214.36**	**7,975,016.93**

Table 4-3: Common Expenses (not including Salary Costs)

	2018	2019	2020	2021
Operational costs (electricity, water etc.)	84,718.25	72,372.00	75,217.24	160,355.20
Buildings & maintenance			467.60	
Instruments & maintenance	932.73	1,682.48	16,296.87	3,715.45
Educational (e.g., invited speakers, journal subscription etc.)	60.34	84.15	889.82	95.83
Travel	247.79	3,344.01	671.57	2,846.13
Other	875.43	18,227.53	41,245.46	29,895.09
TOTAL	**86,834.54**	**95,710.17**	**134,788.56**	**196,907.70**

Table 4-4: Operational Costs for Facilities and Infrastructures (if applicable - to be filled for each facility)

	2018	2019	2020	2021
Salary cost from Central Budget	1.617.440,48	1.646.721,45	1.709.467,66	1.636.227,37
Salary cost of non-permanent staff	1.766.564,64	2.213.977,93	2.224.795,59	2.306.343,96
Instruments & maintenance	40.428,62	209.509,42	523.476,11	840.639,08
Consumables	115.102,64	95.101,53	355.730,47	245.279,31
Other	2.076.099,56	2.493.922,11	1.856.806,11	2.249.316,81
TOTAL	**5.615.635,94**	**6.659.232,44**	**6.670.275,94**	**7.277.806,53**

The operational costs (table 4-4) also increased during the evaluation period but with a lower rate (30%) in comparison to the income increase from competitive grants (50%) over the same period. At the end of the evaluation period the income from competitive grants was 10% higher than the total operational costs (including salary costs of all personnel).

5 Results & Achievements

5.1 Bibliometric Output

During the period of 2018-2021, the academic output of the IMBRIW included a total of 355 peer-reviewed papers, 182 publications in international conferences proceedings, 21 book chapters, 3 books and 84 other conferences. Overall, IMBRIW received a total of 19,368 citations over the period of 2018-2021 based on citations retrieved from Scopus. During the current evaluation period, the IMBRIW personnel published in more than 70 journals, some of which are among the best and most prestigious in the field with impact factors > 10, such as *Earth-Science reviews* (12.413), Water Research (11.236) and Global Change Biology (10.863), or with impact factor (IF) > 7, such as Environmental Pollution (8.071), *Science of the Total Environment* (7.963), *Fish and Fisheries* (7.218), and *Chemosphere* (7.086).

Table 5-1: Bibliometric Output

	2018	2019	2020	2021	TOTAL
Journal Publications	90	102	69	93	354
International conference proceedings	87	36	19	40	182
Other conferences	25	39	8	12	84
Book chapters	7	1	4	9	21
Books - monographs	3	0	0	0	3
TOTAL	212	178	100	154	644
Citations	3817	4346	5033	6172	19368

Journals Impact Factor

Figure 8 illustrates the distribution of bibliometric indices for the Journal Publications, specifically (i) the distribution of Impact Factors (IF) in the form of violin and box plots, and (ii) the percentage distribution in quartiles. The quartiles of the journals were retrieved from Scimago Journal & Country Rank (SJR; www.scimagojr.com) for the subject areas "Earth and planetary science", "Agricultural and Biological Science", "Environmental Science", "Multidisciplinary", or from other subject areas in few cases that the journals didn't fall under these four categories. Average and median Impact Factor (IF) for the Institute's Journal articles during the evaluation period was 3.589 and 3.103 respectively, while 59% of articles were published in Q1 and 30% in Q2 journals (Figure 8).

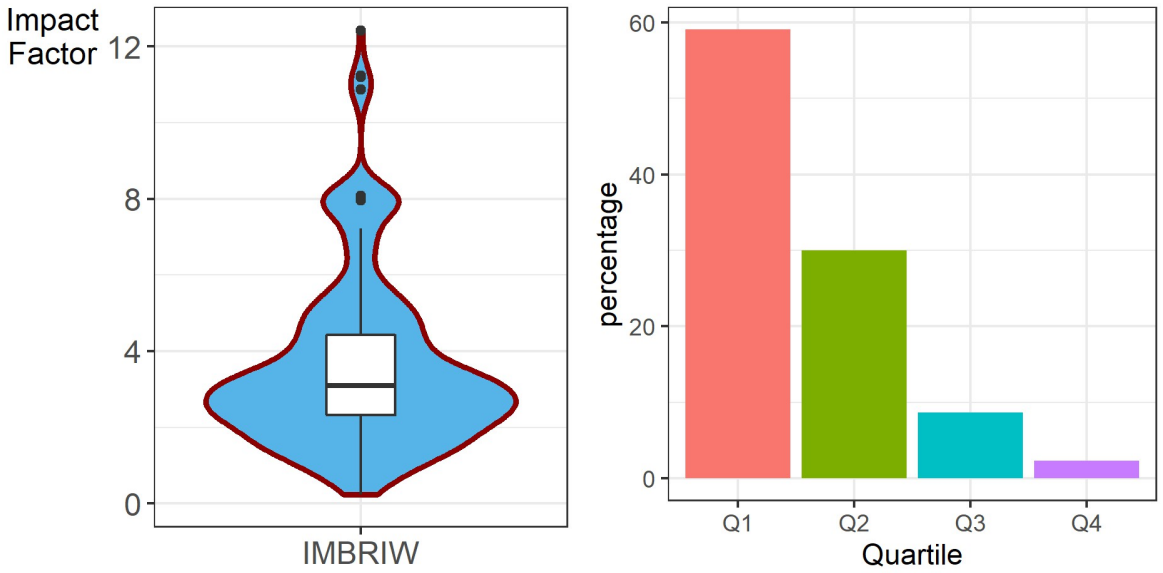

Figure 8. Distribution of (left) Impact Factors presented in violin and box plot, and (right) quartiles of the journals that the articles were published.

5.2 Training and Educational Activities

Many researchers taught in undergraduate and postgraduate classes and supervised numerous M.Sc. and Ph.D. theses strengthening collaboration with academic members and institutions. They also participated in training courses and organised relevant summer schools. A description of these activities is given below.

Table 5-2: Number of students trained in the Institute or supervised by members of the Institute

	2018	2019	2020	2021	Total
Ph.D. students trained	30	33	31	32	43
Ph.D. students awarded a degree	1	4	5	1	11
M.Sc. students trained	10	7	6	11	24
M.Sc. students awarded a degree	6	4	2	1	13
Undergraduate theses supervised	1	2	7	6	11
Internships	11	21	16	15	63

a. PhD Programs

During the current evaluation period 43 Ph.D. students were supervised by IMBRIW members (Table 5-2), a continuously increasing figure during the last decade (from 16 in 2013 to more than 30 annually during the current evaluation period). The ongoing and granted Ph.D. theses cover the following fields:

- Ecosystem approach to fisheries management in the Aegean Sea
- Effects of water column environmental gradients on the benthic communities
- Potential Fishing Zone monitoring and forecasting in the Greek seas with the use of remote sensing data
- Spatial and temporal distribution of bottom trawl discards in Mediterranean Sea
- Changes in Mediterranean Biodiversity - Impact of Human Activities and Climate Change
- Diversity of the non-commercial benthic invertebrates and structure of the benthic biocenoses of the main fishing grounds of the Hellenic seas
- Distribution patterns of invasive alien species in the Aegean Sea
- Identification of early stages of fish development by genetic methods
- Spatiotemporal distribution of fishing activities compared to environmental characteristics of the coastal zone of Western Greece
- Effects of bottom trawl fishing gear selectivity on fish populations, fisheries and biodiversity
- Biology and Ecology of the invasive species *Lagocephalus sceleratus* and *Prerois miles*
- Effect of developmental temperature on the heart, swimming performance and fecundity of zebrafish *Danio rerio*

- Patterns of body shape allometric growth in seabream. Normal phenotype and skeletal deformities
- Identification of seabream stocks in the Greek Seas. Morphological and genetic diversity
- Study of the major abiotic and biotic factors influencing the size spectrum of pelagic organisms
- Sources of phenotypic variation in seabream larvae. Development of morphological and genetic indices of fish quality
- Climate change and sustainable fisheries: interactions and challenges
- Regulation of fish fecundity types in changing environments: the case of species of genus Alosa
- Patterns and trends of demersal communities in the Greek Seas
- Developing dynamic energy budget (DEB) models for small pelagic fishes in the Southern Benguela
- Study of the climatic changes in the North Aegean Sea and their effects on the ecosystem dynamics
- Study of biology and ecology of the Elasmobranchs of the order Rajiformes in the Eastern Ionian Sea
- Development of methodology for the utilization of the Greek fishing vessel monitoring system in order to support the sustainability of Greece's fishery resources
- Functional characteristics and ecology of the Mediterranean catches: linking the characteristics with the environment and the ecosystem functionality
- Technical Intelligence and Applications in Population Dynamics
- Identification of critical characteristics of the Greek fisheries and development of methodology for improving their monitoring and management
- Conservation biogeography of aquatic organisms by using novel sampling methods
- Ontogenetic development of the Louros River Cyprinids
- Ecomorphology of the inland waters' fishes inhabiting the middle and lower sections of Greek rivers
- Tracking changes in protection of Greek Key Biodiversity Areas
- Theoretical and applied issues of aquatic biodiversity in Greek Islands
- Development, Reproduction and ethology of the endemic freshwater fish Valencia spp.
- Development and Application of Assimilation techniques of Hydrometeorological remotely-sensed data in meteorological and land-surface models
- Desert dust interactions with the atmospheric environment: The dust aerosols’ role on cloud nucleation and precipitation
- An analysis of hydrometeorological and climatic pressures on the Greek river water bodies
- An investigation of the environmental state of the coastal zone that incorporates a river system, as the outcome of air-land-sea interaction processes, and the development of a tool for its integrated management
- Alien species of fish in the river waters of Greece
- An analysis of hydrometeorological and climatic pressures on the Greek river water bodies
- An investigation of the environmental state of the coastal zone that incorporates a river system, as the outcome of air-land-sea interaction processes, and the development of a tool for its integrated management

- Development of methodology for the assessment of the ecological flows downstream of water abstraction works
- Impacts of climate change on the biological quality, diversity and productivity of river ecosystems, using benthic diatoms
- Biodiversity of macro-invertebrate species in freshwater aquatic ecosystems on islands in the Aegean Sea: Patterns, Processes, Threats and Predictions

b. Master programs

HCMR co-organizes and operates together with the Department of Biology of the University of Crete an Inter-Institutional Postgraduate (Masters) Programme in "*Environmental Biology*" (https://www.biology.uoc.gr/postgraduate/EnvBiol). Two IMBRIW researchers are members is of the Inter-Institutional committee of the Programme, which is responsible for various organisation and administration issues.

In addition HCMR participates in the Inter-Institutional Postgraduate Program of the University of Athens "*Oceanography and Management of the Marine Environment*" (https://oceanography.geol.uoa.gr). An IMBRIW researcher is actively involved in the administration of the course as a member of the Inter-Institutional committee.

A close collaboration with the Biology Department of the Aristotle University of Thessaloniki has been established with many researchers teaching in the Postgraduate Program "*Applications in Biology*" (direction "*Fisheries Biology and Management*") but this collaboration is not yet formally established.

In the period 2018-2021, 13 students trained in the institute and supervised by members of the Institute were awarded a Masters degree, while the Theses of 11 more post-graduate students are ongoing. The Masters theses cover the following fields:

- Food-web modelling of marine ecosystems
- Species Distribution Modelling of mesopelagic fish
- Patterns of genetic diversity of mesopelagic fishes in the Greek Seas
- Ovarian histology in mesopelagic fishes
- Spatial approach to the nestings ecology of golden eagle on the island of Crete
- Ichthyoplankton analysis in the North Aegean and correlation with environmental factors
- Age and growth of cephalopods
- Species habitat suitability modelling
- Age and Growth of small pelagic fishes
- Reproduction of small pelagic fish
- The effect of exercise on morphology and skeleton of *Danio rerio*
- Long term sublethal effects of the blue-green alga on structure and function of zebrafish
- Deep learning for automating fish age prediction from otolith images
- Morphometry and biology of marine invasive species
- Reproductive Biology of Lessepsian species
- Ecohydraulic environmental flow assessment in arid river basins

- Investigation of the role of fertilizers in soil and water quality
- Ecomorphology of native and alien fishes of Pinios River
- Water Resources Management

c. Undergraduate Theses and Internships

IMBRIW researchers supervised internships of 63 students during the Evaluation period 2018-2021 (Table 5-2). The majority (54 undergraduate and three post-graduate) were from the following Greek Universities: Aristotle University of Thessaloniki (Department of Biology), National and Kapodistrian University of Athens (Department of Biology, Department of Geology), University of Crete (Department of Biology), University of the Aegean (Department of Marine Sciences, Department of Environmental Sciences), Western Greece University of Applied Sciences (Fisheries & Aquaculture Technology Department),University of Thessaly (Department of Ichthyology and Aquatic Environment), University of Patras (Department of Biology, Department of Environmental and Natural Resources Management), Technological Educational Institute of Ionian Islands (Department of Environmental Technology), Harokopio University (Department of Geography), University of Ioannina, Agricultural University of Athens, National Technical University of Athens, Athens University of Economics and Business, Technical University of Crete, University of Western Athens. Six additional undergraduate internships were from universities abroad, namely the Agrocampus Ouest (France), University of Toulouse (France), Friedrich-Alexander University (Germany), Munster University (Germany), University of Salento (Italy), Massachusetts University (USA). Activities of the interns spanned across almost all fields of the Institute, both Marine and Inland waters.

Members of the Institute supervised the bachelor theses of 11 students in the following fields:

- Spatial distribution of stranding incidents of small cetacean species
- Biology of the demersal species *Capros aper* in Saronikos Gulf
- Estimation of morphological parameters from fishes in the Greek Seas
- Composition, biological aspects and early life stages of cephalopods in the Hellenic Seas
- Reproductive biology of mesopelagic and alien pelagic species in the eastern Mediterranean
- Morphometry and reproduction of crustaceans
- Contribution of the biology of Serranus hepatus
- Contribution to several biological aspects of Etmopterus spinax (Linnaeus, 1758) in the Eastern Mediterranean Sea.
- Contribution on the morphometry and reproduction of Squilla mantis (Linnaeus, 1758) in the Aegean and Ionian Sea.

d. Other Mentoring activities and actions to support career development of the trainees

- Number of NSF (IKY), NFRI (ELIDEK) and other scholarships overall

The first HFRI (ELIDEK) call for post-doc researchers opened in 2017, the evaluation of the proposals was completed in 2018 and two IMBRIW post-doc researchers were funded. One post-doc researcher was also funded under the second HFRI call for post-doc researchers.

- Participation in (inter)national educational University programmes

IMBRIW researchers gave lectures in the undergraduate and/or postgraduate programmes of the Aristotle University of Thessaloniki, National and Kapodistrian University of Athens, Harokopio University, University of Crete, Hellenic Open University and the University of the Aegean.

They also supported the bachelor theses of students from the University of the Aegean (Department of Marine Sciences, Department of Environmental Sciences), the University of Crete (Department of Biology) and Western Greece University of Applied Sciences (Fisheries & Aquaculture Technology Department). Apart from the Universities and the Departments already mentioned, IMBRIW researchers supervised M.Sc. and Ph.D. theses from postgraduate programs organized by the Mediterranean Agronomic Institute, the National Technical University of Athens, the Agricultural University of Athens, the Technical University of Patras and the University of Ioannina.

At the international level, IMBRIW researchers supervised M.Sc. and Ph.D. theses from the University of Cape Town, the Universita Politecnica delle Marche, the University of Barcelona and the University of Essen, and participated in the examining committee of Ph.D. theses from the Universita degli Studi di Cagliari and the University of Karachi.

- Actions to support career development of the trainees.

IMBRIW initiated the Samothraki Summer School, a course designed as a ten-day attendance of the summer school in Samothraki Island with the aim to learn and apply aquatic ecology and social ecology approaches in a local setting, while supporting current research and building synergy with the UNESCO Biosphere Reserve process. It is co-organized with the Vienna Institute of Social Ecology (Alpen Adria University, Austria). The course gives students the opportunity to engage in a real-life project and utilise their scientific training to support the process further, namely the creation of a management plan with a set of activities towards sustainability, and a science plan for further research on the island that would also meet local interests.

IMBRIW researchers also trained scientists in Centres for Professional Training and Centres for Environmental Education, the National Centre for Public Administration and Local Government.

5.3 Innovation and Intellectual Property

a. New IP, patents generated during the period

A patent was submitted in 2017 and was granted in 2018 (patent no 20170100391). “Fishnest: an apparatus for protecting juvenile fish”.

A list of the projects (acronyms and full title or a short description) implemented during the period 2018-2021 is provided in Annex II. For more information see: https://imbriw.hcmr.gr/category/projects/research-projects-2019-present.

b. Other commercial activities

Close Collaboration with a start-up, IT company (https://exm.gr/) was realized under the project Open ElioT (https://www.openeliot.com/en/) in which IoT solutions for environmental monitoring have been developed by using open architecture hardware and IoT platforms that are about to lead in the creation of a spin-off company in the near future.

5.4 Awards and Distinctions

Apart from being collaborators of FishBase (www.fishbase.org), the largest free on-line encyclopaedia on fish, members of IMBRIW have been working closely with the FishBase Consortium towards improving the overall data quality and the amount of information incorporated in it. As a result, IMBRIW was proposed to undertake the management and co-ordination of LarvalBase, which also runs under the umbrella of FishBase. LarvalBase will be further modified, enriched, and updated by the corresponding experts of IMBRIW working on early life stages of fish. Finally, in 2018, it was proposed that ELNAIS will also be included in FishBase/SeaLifeBase and alien species modules will be under the management of the corresponding team of IMBRIW.

The Institute became a key partner in the National and European Research Infrastructure 'HIMIOFoTS' (https://www.himiofots.gr/) and particularly in the OpenHi.net component. This initiative aims to create a state-of-the-art National Water Quality and Quantity Monitoring platform that will provide near-real time data for the surface water bodies of the country through automatic, telemetric monitoring stations. IMBRIW is responsible for: a) establishing and maintaining the water quality infrastructure and b) providing early warning and water management services to stakeholders and the public.

According to a composite citation index[3], two members of the Institute (i.e. Dr. A. Zenetos and Prof. K. Stergiou) are among the top 100,000 researchers across all fields for their career-long, as well as for year 2020, while additionally two (Dr. N. Skoulikidis and Dr. I. Karaouzas) ranked within the top 2% in their (sub)fields for 2020.

5.5 Societal Impact

a. Dissemination and outreach activities to the public

During the current evaluation period (2018-2021), IMBRIW had original contributions to addressing high-order scientific questions, including alien-species dynamics, status assessment and conservation of endemic freshwater fish, identification of essential habitats–habitat mapping, effect of fishing on marine ecosystems, optimum exploitation of marine stocks, aquaculture-fisheries-environment interactions, restoration of marine habitats, assessment of ecological status in surface waters, structural and functional ecosystem aspects, temporary aquatic ecosystems, integrated river basin management.

[3] Baas, Jeroen; Boyack, Kevin; Ioannidis, John P.A. (2021), "August 2021 data-update for "Updated science-wide author databases of standardized citation indicators"", Mendeley Data, V3, doi: 10.17632/btchxktzyw.3

Indicative of the above is the fact that during the evaluation period, the IMBRIW staff has been actively involved in HORIZON2020, LIFE, COST, INTERREG, EASME/EMFF and DG MARE funded relevant European projects, as well as in other international projects (e.g., MINOUW, **PROTOMEDEA**, DEEPEASTMED, DRUMFISH, MUSES, AMARE, MERCES, CERES, RECOLAPE, RECFISH, STREAM, LIFE EUROTURTLES, ODYSSEA, ARIEL, PORTODIMARE, INSPIRE4NATURE, PANDORA, PLASTIC BUSTERS, MONKEM, AFRIMED, ASRA2, MEDBLAND, EC-IAS, ByCatch, **Med&BS RDB**, STREAMLINE, SEAwise, COASTAL, GLOBAQUA, **JRC-KARLA**)[4] resulting in many original scientific publications (see also section '5.1 Bibliometric output').

Several activities within the projects enhanced public awareness in environmental conservation issues, since the intense public informative campaigns (especially targeting primary and secondary school students) sensitize people to environmental conservation issues and accredits the long-term preservation of valuable resources. Furthermore, IMBRIW researchers participated in training of aquatic and fisheries related courses in Universities and high education establishments as visiting professors (see also section 5.2).

IMBRIW researchers regularly participate as invited speakers in workshops organised by NGOs, fisheries associations, local authorities, etc (see also section 3.f).

In addition, there was an active presence of IMBRIW researchers in the mass media. Special tributes concerning IMBRIW scientific output, consulting and notifying on crisis phenomena and special dedications to the Institute projects were some of the topics. More specifically, publications in the daily printed press (e.g.*"Vima-Science"*), scientific magazines (e.g. "Science"), appearances on TV (e.g. *"SKAI TV"*) or radio (e.g. *"Proto Programma"*) broadcasts and mainly on several news webpages (e.g. *"Newsbeast"*, "Efsyn", "Patris", *"real.gr"*, *"ANT1news"*, etc) contributed to public awareness on various environmental issues, such as conservation and preservation of natural resources (https://imbriw.hcmr.gr/category/articles/ and https://imbriw.hcmr.gr/category/educational-material/). The most influential of these dissemination activities the IMBRIW's work are the articles of Vima-Science (the special section on science of the largest Greek Sunday newspaper "Vima"), as well as the high-profile documentary "THALATTA" created by a team of students from the Department of Biology of the Aristotle University of Thessaloniki.

Indicative videos of IMBRIW's activities are available here: https://imbriw.hcmr.gr/category/video-library/

A series of workshops and informative campaigns have been organised under the framework of various projects (e.g., CLIMEFISH, ANATHALLOI, REPHIL, Open ElioT): https://imbriw.hcmr.gr/category/news/ while active dissemination initiatives were realised through the Institutes' social media: https://www.facebook.com/IMBRIW/

[4] with bold are marked the projects coordinated by IMBRIW members.

b. Services and Applications for public health

The activities of IMBRIW enhance ecosystem services (i.e. by increasing the economic, cultural and aesthetic value of the aquatic and riparian environment, advancing its potential for ecotourism development, increasing the welfare of fisheries communities and protecting public health). This is accomplished through information dissemination, consultancy services and the elaboration of management plans for the sustainable use and conservation of natural resources to the benefit of the society at large.

c. Training and educational activities targeted for the public

The activities of the Institute are characterized by a strong interaction with stakeholders (fisher associations, consumer associations, other associations and public authorities) providing them general and technical advice as well as training on issues related to the conservation of aquatic resources and ecosystems. In several cases, stakeholders (fishers' associations, Developmental Companies, Municipalities, other authorities) participate, through the co-operation with IMBRIW, in EU projects.

d. Other activities with socio-economic impact

IMBRIW:

- provides support and technical advice to the Ministries of Agriculture, Environment and Energy, DG-Mare and MEDAC regarding the implementation of the Landing Obligation and other aspects of the Common Fisheries Policy
- contributes to sound environmental and fisheries policy making, at the regional, national and European levels, through their participation in various council bodies (e.g. Hellenic fisheries council, Hellenic Water Council, ICCAT, GFCM, IUCN, STECF, Drin Core Group)
- coordinates a Multiple Framework Contract for the Provision of Scientific Advice for the Mediterranean and Black Seas, granted by CINEA and DG-MARE, which will be realised through specific contracts for two years (starting in 2021) with the possibility to extend for two more years
- provides scientific advice to NGOs and stakeholders and participates in co-management committees for the development of sustainable fisheries, action plans and the design and implementation of MPAs
- contributes to the permanent relevant committees of the Hellenic Parliament (Fisheries, Environment, Water Resources)
- assists with the fast response to environmental crisis events (e.g. oil spill in Saronikos Gulf, jellyfish blooms and fishing in Korinthiakos Gulf, mass fish kills in Spercheios basin and other areas, strandings of Protected, Endangered and Threatened species)
- is the official database administrator for marine cetaceans and turtles standings in Greece.

Moreover, IMBRIW has developed significant hydrometeorological services and tools such as:

- http://meteo.hcmr.gr/ which provide weather and hydrologic forecasts on an operational basis for the entire country

platforms for the dissemination of research data (https://hydro-stations.hcmr.gr/, https://wfd.hcmr.gr/ποιότητα-φυσικοχημικών-παραμέτρων/, https://wfd.hcmr.gr/category/3drivers/)

tools for the estimation of environmental water requirements (https://imbriw.hcmr.gr/tools/)

Geographical Information System tools for fisheries applications, remotely operated instruments to assess trawling impacts.

IMBRIW also contributes to the creation of new jobs, i.e. scientific and technical personnel are employed either at the Institute or at the implementation sites of the IMBRIW projects, which leads to direct monetary flow to society and to the support of young scientists.

Annex I: Publications resulting from interdisciplinary collaborations with Groups of other Institutes of the Centre

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Annex II: IMBRIW Projects during the period 2018-2021.

Acronym	Title and Information	Amount of Grant
GLOBAQUA	2014-2019. Managing the effects of multiple stressors on aquatic ecosystems under water scarcity. EU FP7-ENV	351,627.6 €
MINOUW	2015-2019. Science, Technology, and Society Initiative to minimize Unwanted Catches in European Fisheries. EU HORIZON 2020 Grant Agreement No.634495	580,000.0 €
PROTOMEDEA	2015-2020. Towards the establishment of Marine Protected Area Networks in the Eastern Mediterranean. EU DG MARE	304,148.3 €
DRUMFISH	2016-2018. Approaches to Management for Data-Poor Stocks in Mixed Fisheries. EU DG MARE	56,532.1 €
MUSES	2016-2018. Multi-Use in European Seas. EU HORIZON 2020	83,992.0 €
AMARE	2016-2020. Actions for Marine Protected Area. EU Interreg	430,000.0 €
MERCES	2016-2020. Marine Ecosystem Restoration in Changing European Seas. EU HORIZON 2020	379,259.4 €
CERES	2016-2020. Climate change and European aquatic Resources. EU HORIZON 2020	180,078.5 €
RECOLAPE	2017-2019. Strengthening Regional Cooperation in the area of large pelagic fisheries data collection. EU DG MARE 2016/22	50,395.8 €
DEEPEASTMED	2017-2019. State of the knowledge of deep-water vulnerable species and habitats in the Eastern Mediterranean. IUCN	37,847.5 €
RECFISH	2017-2019. Recovery of Fisheries Historical time series for the Mediterranean and Black Sea stock assessment. EU EASME/EMFF 2016/032	36,006.0 €
STREAM	2017-2019. Strengthening Regional Cooperation in the Area of Fisheries Biological Data Collection in the Mediterranean and Black Sea. EU DG MARE 2016/22	51,894.3 €
ECOAST	2017-2019. New methodologies for an ecosystem approach to spatial and temporal management of fisheries and aquaculture in coastal areas. National Project (NSRF)	99,704.1 €
LIFE EUROTURTLES	2017-2019. Collective actions for improving the conservation status of the EU sea turtle populations. EU LIFE Grant Agreement LIFE15 NAT/HR/000997	20,161.3 €
DCF 2017-19	2017-2019. National Fisheries Data Collection Project (EC Regulation 199/2008) (2017-19). National Project (NSRF)	3,369,211.6 €
ANATHALLOI	2017-2021. Development of management tools for marine and lacustrine ecosystems. National Project (NSRF) Competitiveness, Entrepreneurship and Innovation 2014-2020	800,000.0 €
ODYSSEA	2017-2021. Operating a Network of Integrated Observatory Systems in the Mediterranean Sea. EU HORIZON 2020	124,081.2 €
REPHIL	2017-2022. Hellenic Research Fleet / reconstruction of the research vessel - PHILIA. National Project (NSRF)	2,722,793.0 €
WFD	2017-2023. Monitoring of the water ecological quality status in the surface water bodies of Greece. Water Framework Directive implementation (2000/60/EC). National Project (NSRF)	16,741,943.6 €
IGI POSEIDON	2018. Monitoring of water ecological status in surface waters for the IGI Poseidon project. Asprofos S.A.	15,740.4 €

Acronym	Title and Information	Amount of Grant
MAB	2018-2019. Water Metabolism and Water Management in Samothraki Island. University of Natural Resources and Life Sciences, Vienna	8,870.0 €
RESILIENT	2018-2019. Population assessment of the Corfu killifish and other Greek endemic freshwater species using established and innovative methods. Zoological Society of London and AG Leventis Foundation	13,735.9 €
MALLIAKOS 2018	2018-2019. The study of the marine biological resources of the Gulf of Maliakos, the impact of climate change on the marine ecosystem and proposed management measures for the optimal exploitation of the fishery resources of the region. National Project (Regional funding)	48,387.0 €
ACHLADA (GEROPOTAMOS STREAM STUDY)	2018-2019. Monitoring and Evaluation of Water Quality in the catchment area of Geropotamos, Florina. Achlada Quarries.	9,840.0 €
CLIMAFISH	2018-2020. Climate change and fisheries impacts on small pelagic fish: dynamic, spatially explicit models in the service of the ecosystem-based fisheries management. National Project (HFRI) Post-doc projects	199,650.0 €
DECAGON	2018-2020. Development, reproduction and ethology of the Greek killifish Valencia sp.. Zoological Society of London and AG Leventis Foundation	4,590.0 €
ARIEL	2018-2020. Promoting small scale fisheries and aquaculture networking in Adriatic-Ionian macroregion. EU Interreg	171,054.0 €
I4SEA	2018-2021. Big Data in Monitoring and Analyzing Sea Area Traffic: innovative ICT and analysis models. National Project (NSRF)	119,148.6 €
PORTODIMARE	2018-2021. GeoPortal of Tools &Data for sustainable Management of coAstal and maRine Environment. EU Interreg	140,000.7 €
FRESQO	2018-2021. Freshness REcording System for fish Quality Observation. National Project (NSRF)	108,594.7 €
MESOBED	2018-2021. MESOpelagic fish: Biology, Ecological role and Distribution of a disregarded trophic link. National Project (HFRI) Post-doc projects no 449	155,000.0 €
OPEN ELIOT	2018-2022. Open Internet of Things infrastructure for online environmental services. National Project (NSRF)	242,800.0 €
GYAROS MPA	2018-2022. "Gyaros MPA" fisheries knowledge survey: assessing a pristine Mediterranean biodiversity hotspot. MAVA foundation	250,000.0 €
INSPIRE4NATURE	2018-2022. International training at the Science-Policy Interface for Researchers in Europe, for Nature. EU H2020, Marie Skłodowska-Curie Innovative Training Networks	220,234.3 €
PANDORA	2018-2022. Paradigm for Novel Dynamic Oceanic Resource Assessments. EU HORIZON 2020	306,250.0 €
PLASTIC BUSTERS	2018-2022. Preserving biodiversity from plastics in Mediterranean Marine Protected Areas. EU Interreg	118,908.0 €
MSFD	2018-2023. National Monitoring Programme for assessing the ‘Good Environmental Status’ (GES) in the Greek Seas, ‘Monitoring the status of marine sub-regions in Greece’. National Project (NSRF). Operational Programme - Transport, Environment and Sustainable Development Infrastructure.	1,959,447.9 €

Acronym	Title and Information	Amount of Grant
SYKE-ALIEN	2019. Updating the report ETC-ICM on alien species in Europe. The Finnish Environment Institute	4,838.7 €
OHRID LAKE WATERSHED	2019. Surveillance monitoring program for the Ohrid Lake Watershed. Global Water Partnership – GWPMED	20,000.0 €
i-ALARM	2019. Weather forecasting services (i-alarm). University of Ioannina	28,800.0 €
JRCKARLA	2019-2020. Landscape elements for water retention in a Mediterranean Environment – The Lake Karla case. EU JRC	36,000.0 €
PACIM	2019-2020. Population assessment of two critically endangered Greek fish species and range assessments of the highly invasive mosquitofish and topmouth gudgeon. Zoological Society of London and AG Leventis Foundation	9,522.0 €
MONKEM	2019-2020. Monk seal conservation in the eastern Mediterranean. MAVA foundation	10,000.0 €
YELLOW FISH	2019-2021. Natural Environment & Climate Change Agency	19,999.0 €
FISH FAUNA - SCHINIAS	2019-2021. Fish Fauna Schinias-Marathon National Park. National Project (Regional funding) Fisheries Department of the Region of Attika, the Schinias Marathon National Park, Ymittos and Southeast Attica Management Body	24,900.0 €
NATURA Crete	2019-2021. Special Environmental Studies and Management Plans for the Natura 2000 Sites of the Region of Crete. OikoM Environmental Studies Ltd	12,000.0 €
AFRIMED	2019-2022. Algal Forest Restoration in the Mediterranean Sea. EU EASME/EMFF grant agreement No 789059	108,000.0 €
COPPERNET	2019-2022. Design and manufacture of innovative types of yarns for the manufacture of fishing and aquaculture materials. National Project (NSRF) Operational Program for Fisheries and Sea	190,640.0 €
AquaIot	2019-2022. Innovative application of smart IoT networks in the interconnection and transfer of environmental data and industrial applications for integrated coastal zone management at AZA level. National Project (NSRF) Operational Program for Fisheries and Sea	198,862.2 €
FLYING TRAWL	2019-2023. Development of an innovative fishing method with the trawl gear using pelagic doors to improve its handling, its durability and reduce the stress on the vessel's electronic equipment. National Project (NSRF) Operational Program for Fisheries and Sea	248,590.0 €
NEW NATURA FISH	2020. Conservation aims of freshwater fishes in Natura 2000. National project (private funding)	4,830.7 €
LARDOS	2020. National Project (Private funding)	4,800.0 €
HELLASFISH	2020-2021. HellasFish project, Stage 1 - Mapping. Marine Stewardship Council, MAVA foundation and Leventis foundation	42,500.0 €
CHEMICAL STATUS BULGARIA	2020-2021. Chemical status assessment methodology reflecting the impacts of the climate changes on the status of surface water including analysis of chemical pressure, impacts, risks and status. World Bank WB12655055	26,612.9 €
ASRA2	2020-2021. Alien Species Risk Assessment. EU	8,064.5 €
MEDBLAND	2020-2021. Synthesis of the landing obligation measures and discard rates for the Mediterranean and the Black Sea. EU EASME/EMFF 2019/1.3.2.6/ SI2.835464	38,375.0 €

Acronym	Title and Information	Amount of Grant
DCF 2020-21	2020-2021. National Fisheries Data Collection Project (EC Regulation 199/2008) (2020-21). National Project (NSRF)	4,031,019.3 €
Ninespine stickleback	2020-2021. National Project (Private funding)	19,500.0 €
SYN-SPERCHEIOS	2020-2021. Barriers to fish movement in the Spercheios river basin. National Project (Private funding)	19,500.0 €
MENALON IoT	2020-2022. Environmental monitoring actions in water bodies and hiking trails in mountainous Arcadia with the use of innovative technologies. National Project (Regional funding) Green Fund	22,000.0 €
ELLL-HYDRO	2020-2022. Remote sensing methodology for assessing roughness coefficient in ephemeral rivers. (NSRF)	45,545.5 €
ATTICAFISH	2020-2022. National Project (Private funding)	14,515.7 €
LAGOFISH	2020-2022. Environmental and fisheries Impact of Puffer Fish Lagocephalus sceleratus. National project (Regional funding) Prefecture of Crete	29,032.3 €
EC-IAS	2020-2022. Invasive Alien Species: Improvement of Understanding and Communication. EU DG ENV	32,024.2 €
ByCatch	2020-2022. Addressing the interaction between SSF and marine megafauna in Greece. MAVA foundation	109,000.0 €
ISOTOPES GR	2020-2022. Monitoring of the National Network of Isotopes in Rivers in Greece. International Atomic Energy Agency-UN	25,000.0 €
Co-managed NTZ/MPAs	2020-2022. Empowering the legacy of Mediterranean Partners: Scaling up co-managed and financially sustainable No-Take Zones/Marine Protected Areas. MAVA foundation	191,604.0 €
ECOHULLCLEAN	2020-2022. Integrated System for Underwater Ecological Hull Cleaning of Vessels. National Project (NSRF) Competitiveness, Entrepreneurship and Innovation (EPANEK) Project code: T2EΔK-05287	370,481.0 €
SAMOS	2020-2022. Study for the construction of a productive underwater park in Marathokampos. National project (Regional funding) Municipality of East Samos	83,064.5 €
PARNON	2020-2023. Improvement Actions for the Conservation Status of Squalius keadicus (Endangered) and Pelasgus laconicus (Critically Endangered) . National project (Regional funding) Management Body of Parnon, Moustos, Mainalon & Monemvasia	57,180.0 €
4ALIEN	2020-2023. Biology and the potential economic exploitation of four alien species in the Hellenic Seas. National Project (NSRF) Operational Program for Fisheries and Sea	336,087.1 €
LIONHARE	2020-2023. Development of innovative measures to document, map and mitigate populations of the invasive species silver striped blaasop (*Lagocephalus sceleratus*) and lionfish species (*Pterois sp.*) in the Greek seas. National Project (NSRF) Operational Program for Fisheries and Sea.	302,834.8 €
GHOSTRAWL	2020-2023. Design, construction and testing of two (2) innovative devices for (a) the reduction of ghost fishing and (b) the increase of trawl selectivity for undersized fish by-catch. National Project (NSRF) Operational Program for Fisheries and Sea	335,400.0 €

Acronym	Title and Information	Amount of Grant
TRIKALA - STATIONS	2021. Establishment of an automatic monitoring network for flood warnings in Trikala Municipality. Ex Machina	18,000.0 €
EASTMED	2021. Special Ecological Assessment at the cross sections of East-Med gas pipeline and river water systems. Asprofos SA	44,500.0 €
Med&BS RDB	2021-2022. Development of the Regional Database for the Mediterranean & Black Seas. EU DG MARE 2020/08	90,138.0 €
AFRESH	2021-2022. Application of Innovative Methodologies for the Wide Range Monitoring of Native and Alien Freshwater Fish of Greece. Bristol Zoological Society and AG Leventis Foundation	31,974.0 €
STREAMLINE	2021-2022. Streamlining the establishment of regional work plans in the Mediterranean and Black Sea. EU EASME/EMFF	24,938.0 €
MONK SEAL	2021-2023. Monk seal conservation in the eastern Mediterranean. Monk Seal Alliance - IUCN	35,000.0 €
DNAseeker	2021-2023. Innovative prototype genetic method for the identification of fish species for the Greek fishery products processing industry. National Project (NSRF) Operational Program for Fisheries and Sea	162,870.0 €
MEDBL-FWC	2021-2023. Framework Contract for the provision of scientific advice for the Mediterranean and the Black Seas. EU/EASME/2020/OP/0021, Ref. Ares(2021)7207279).	3,500,000.0 €
FlowTech	2021-2024. Estimation of Environmental Flows using Unmanned Aerial Vehicles and Acoustic Equipment based on fish habitat requirements. National Project (HFRI) Post-doc projects	189,634.0 €
SEAwise	2021-2025. Shaping ecosystem-based fisheries management (SEAwise). EU HORIZON 2020 Grant agreement ID: 101000318	558,125.0 €