ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

AQUACULTURE

Research and development to improve sustainability, competitiveness and resilience of the whole value chain of aquaculture sector.

The University of Bologna can offer multidisciplinary skills and expertise for research, applied studies and technology transfer in the field.

Research at the University of Bologna covers a wide range of issues:

- Optimization of feed and feeding of farmed fish and their effects on growth performance and gut health
- Evaluation of abiotic factors and farming conditions on performance and fish health
- Reproduction and larval rearing of new species for aquaculture, parentage analysis in breeding program, marker-assisted selection
- Diagnosis, epidemiology, prevention and control of transmissible diseases of farmed fish
- Development of sustainable rearing technologies for mollusks
- Fish quality, nutritional profiling of fish products, sensorial evaluation, freshness evaluation, effects of rearing methods and feed on fish quality, metabolic fingerprinting of fish
- Economics of aquaculture: farm management and marketing

HIGHLIGHTS

The University of Bologna contributes to the European progress in aquaculture research taking part to several European funded projects:

Horizon 2020: **NewTechAqua** - *New Technologies, Tools and Strategies for a Sustainable, Resilient and Innovative European Aquaculture;* **FutureEUaqua** - *Future growth in sustainable, resilient and climate friendly organic and conventional European aquaculture;* **Medaid** - *Mediterranean Aquaculture Integrated Development;* **ParaFishControl** - *Advanced Tools and Research Strategies for Parasite Control in European farmed fish;* **PerformFISH** - *Integrating Innovative Approaches for Competitive and Sustainable Performance across the Mediterranean Aquaculture Value Chain.*

LIFE: **LIFE EEL** - *Urgent measures in the Eastern Mediterranean for the long term conservation of endangered European eel.*

ERA-NET: **Novofeed** - *Novel feed ingredients from sustainable sources.*

The Department of Veterinary Medical Sciences (DIMEVET) in its Bologna and Cesenatico - on the Adriatic coast - locations has specific aquaculture infrastructures for trials *in vivo* on fish or molluscs under controlled environmental conditions to study performance, welfare and health of farmed animals and for diagnosis of fish diseases, studies on viral, bacterial and parasitic fish infections, including zoonoses, histopathology, molecular analyses on aquatic pathogens and gene expression analysis.

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

BLUE BIOTECH FOR MARINE ENVIRONMENT

Applying molecular biology and biochemical methods to marine organisms. Using enzyme and green chemistry processes to convert marine bio-wastes and pollution materials into products.

The University of Bologna can offer multidisciplinary skills and expertise for research, applied studies and technology transfer in the field.

Research at the University of Bologna covers a wide range of issues:

- New exploitation possibilities of marine resources through biotechnological routes aimed at obtaining high-value molecules or composites (i.e. for medical, food, cosmetic applications), thus enacting the "sustainable bio-refinery" concept
- Use of different micro-, meso- and micro-organisms and enzymes for the treatment of natural and man-made (i.e. wasters and by-products) substrates, as much as their use for bioremediation actions
- Mechanisms of calcification processes in marine organisms
- Advanced functional materials from mariculture bio-wastes
- Novel ingredients and additives for aquaculture
- New selfhealing biopolymeric materials from byssus
- Selection of marine bacteria able to produce enzymes and biomolecules active and stable under harsh working conditions
- Development and optimization of innovative processes in packed bed bioreactors
- Biomolecules with antifouling activity
- Algal culture for the production of bioactive molecules with industrial, medical and nutraceutical applications

HIGHLIGHT

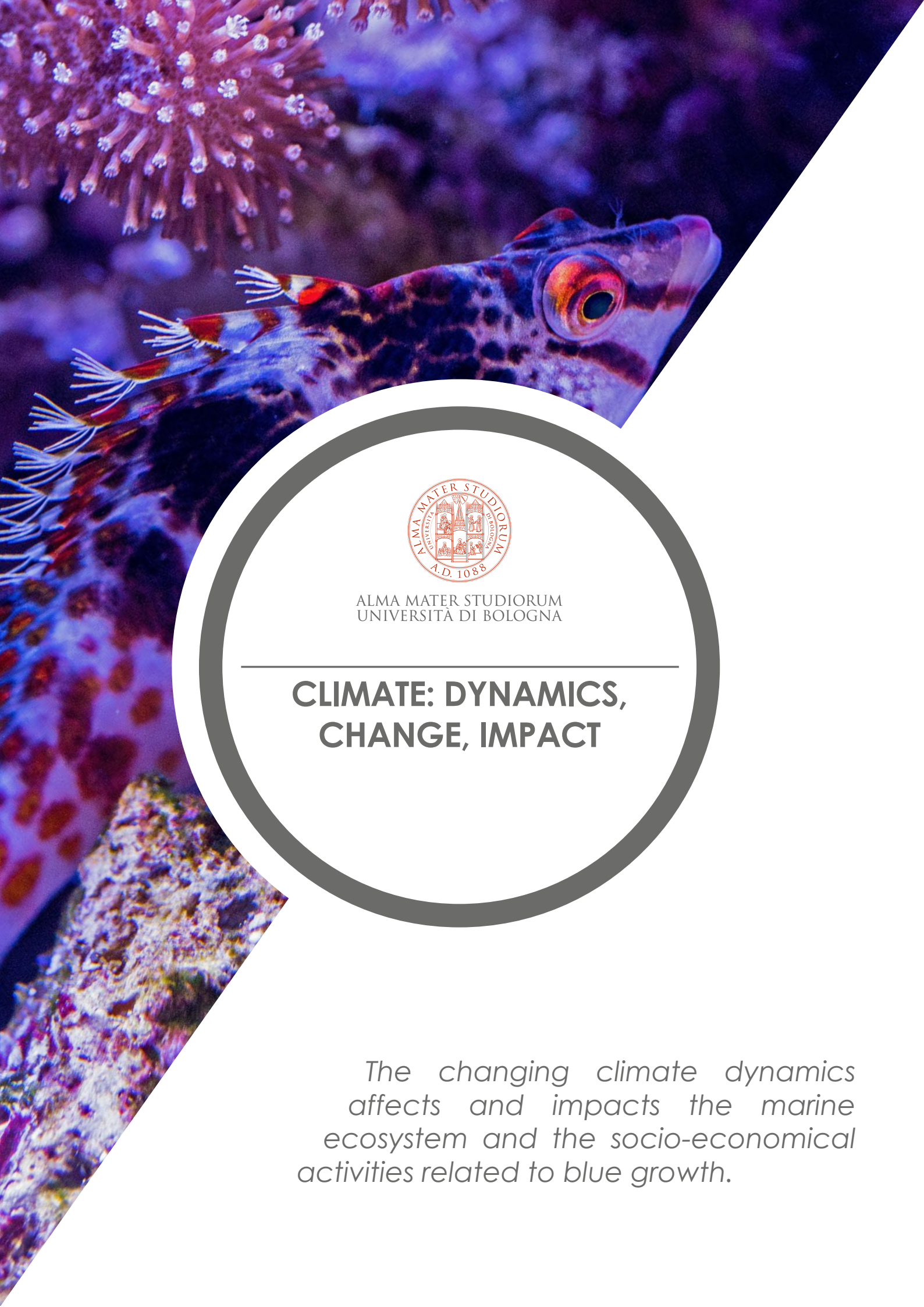
The University of Bologna has been funded at European level over the years through different programs on the marine pollution and water treatment:

H2020: **INMARE** - *Industrial Applications of Marine Enzymes: Innovative screening and expression platforms to discover and use the functional protein diversity from the sea*.

FP7: **KILL SPILL** - *Integrated Biotechnological Solutions for Combating Marine Oil Spills*; **BIOCLEAN** - *New BIOtechnologiCaL approaches for biodegrading and promoting the environmEntal biotrAnsformation of syNthetic polymeric materials*; **ULIXES** - *Unravelling and exploiting Mediterranean Sea microbial diversity and ecology for xenobiotics' and pollutants' clean up2*.

ERA-NET: **Novofeed** - *Novel feed ingredients from sustainable sources*.

Interdepartmental Centre for Industrial Research in Energy and Environment - CIRI Energy and Environment develops and transfers innovative technologies and methods for the control of environmental quality and for the management of natural resources.



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

CLIMATE: DYNAMICS, CHANGE, IMPACT

The changing climate dynamics affects and impacts the marine ecosystem and the socio-economical activities related to blue growth.

The research of the University of Bologna related to climate-ocean dynamics, interactions, impact on ecosystems and on blue-growth related socio-economical structures, spans a wide range of interdisciplinary topics as:

- Data analysis of the ocean-atmosphere interactions. Hindcast (Copernicus re-analyses) and scenario modeling of ocean dynamics under changing climate and anthropogenic pressure to understand general trends
- Data analysis of climate/marine physical, biogeochemical, biological data relevant to ecosystem management and sustainable exploitation of the marine resources
- Defining and projecting interactions (from the molecular to the community level) between local anthropogenic and global climatic stressors (pH and temperature) in coastal ecosystems
- Projecting changes of intertidal sandy shore ecosystem due to the predicted sea level change
- Hindcast/predictions of the past/future climate dynamics and climate change impact on ecosystems and exploitable marine resources (fisheries to recreational activities)
- Effects of climate changes on aquaculture systems
- Tools development for risk assessment, conservation practices, environmental planning and emergencies management
- Analysis of sea level change impact on coastal geomorphology

HIGHLIGHTS

Observing the changing ocean trough observational systems and modeling:
H2020: **SeaDataCloud** - *Further developing the pan-European infrastructure for marine and ocean data management*; **ATLANTOS** - *Atlantic Ocean Observing system*; **ODYSSEA** - *Operating a network of integrated observatory systems in the Mediterranean sea.*
Interreg Italy-Croatia: **ADRIACLIM** - *Climate change information, monitoring and management tools for adaptation strategies in Adriatic coastal areas.*
Impact of changing climate and anthropogenic pressure on the marine environment:
FP7: **MEECE** - *Marine Ecosystem Evolution in a Changing Environment*; **PERSEUS** - *Policy-oriented marine Environmental Research in the Southern EUropean Seas.*
Corals and global warming:
FP7: ERC - IDEAS Project **CoralWarm** - *Corals and global warming: The Mediterranean versus the Red Sea.*
Sustainable coastal ocean management:
OceanGov COST Actions *Ocean Governance for Sustainability – Challenges, Options and the Role of Science.*
Innovative technologies for sustainable use of Mediterranean Sea fishery and biological resources: International PhD program **FishMed-PhD**.

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

FISHERIES

Multidisciplinary and holistic research challenges to assess and sustainably manage fishery resources at multiple ecosystem complexity.

The University of Bologna research activities in fishery sciences aim to provide scientific and political/economic data, and issues to the whole fisheries value chain by transdisciplinary research skills on multiple-scale sea ecosystem complexity. Research issues on coastal and small-medium scale fisheries of the semi-enclosed seas as Adriatic and Mediterranean Seas to oceanic off-shore global stocks and populations are addressed.

Research at the University of Bologna covers a wide range of issues:

- Stock and species assessment of fishery resources, fishing impacts on marine ecosystems
- Fish quality, nutritional profiling of fish products, sensorial evaluation, freshness evaluation, effects of rearing methods and feed on fish quality, metabolic fingerprinting of fish
- Fishery genetics, fishery genomics, fish and fish products traceability, population genetics and genomics, conservation genetics
- Small-scale fishery maritime clusters and development of coastal communities, fishery products market and value chain organization in small-scale and coastal , Fishery management plan and property rights
- Fish parasitology, with specific expertise in biology and epidemiology of zoonotic helminths in fish populations

HIGHLIGHTS

International projects:

- **MEDITS** - *International Bottom Trawl Survey in the Mediterranean.* EU JRC Tender **MEDBLUESGEN** - *Mediterranean blue shark genetics: population genetic study on Mediterranean blue shark for stock identification and conservation.* EU Tender **STOCKMED**; **EU ICCAT GBYP**.
- FP7: **FISHPOPTRACE** - *Fish Population Structure and Traceability*. EU Tender **AQUAGEN** - *Genetic Assignment of Farmed Cod and Sole for Traceability, Biosafety and Environmental Impact Assessment.*
- Interreg Italy-Croatia: **PRIZEFISH** - *Piloting of eco-innovative fishery supply-chains to market added-value Adriatic fish products.*

International PhD programmes:

FishMed-PHD *on Innovative technologies and sustainable use of Mediterranean Sea fishery and biological resources.* **MARES** - *EMJD Programme on Marine Ecosystem Health & Conservation.*

Research centres and laboratories, equipments and infrastructures

The **Department of Biological, Geological and Environmental Sciences (BIGEA) in its Fano location on the Adriatic Sea** is equipped with marine biology and fisheries, laboratories.

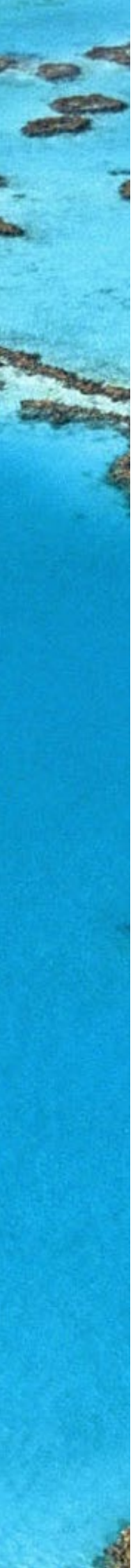
Inter-Departmental Centre for Research in Environmental Sciences (CIRSA)

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MARINE COASTAL CULTURAL HERITAGE

Coastal and maritime regions (CMRs) are among the areas with the richest culture and most diverse cultural heritage. At the same time, they are among the most vulnerable in terms of pressures and risks associated with environmental challenges, new socio-economic dynamics and inconsistent management of cultural heritage (CH) assets.

The University of Bologna research is related to the study, conservation and promotion of tangible and intangible cultural heritage of coastal areas.



Research at the University of Bologna covers a wide range of issues:

- Conservation, restoration, protection and valorisation of tangible heritage assets
- Promotion of local cultural peculiarities
- Intangible cultural heritage related to cultural and creative industries in coastal and maritime regions
- Coastal town-landscape interrelationships
- Marine natural and cultural heritage
- Networks' geography (especially related to knowledge flows, skills, and the evolution of intangible cultural heritage)
- Public history as a means for coastal heritage conservation
- Transnational policies for Marine and coastal cultural heritage protection
- Assessment of the potential impacts of marine hazards to maritime cultural heritage in changing climate conditions and production of maps of risks
- Development of innovative, aesthetic, natured-based methods and eco-designs to coastal defence for marine hazards impacting maritime heritage sites.

HIGHLIGHTS

The University of Bologna is part of the COST Action **OPP** – *Oceans Past Platform* which aims to understand the value to European societies of living marine resource to help shape the future of coasts and oceans. The Platform will lower barriers between human, social and natural sciences and multiply the learning capacity of research environments; enable knowledge transfer into management and policy frameworks.

The University of Bologna is part of **IPERION-CH** - *Integrated Platform for the European Research Infrastructure on Cultural Heritage*: the unique pan-European research infrastructure in Heritage Science by integrating national world-class facilities at research centres, universities and museums.

Interdepartmental Centre for Research in the History, Philosophy and Sociology of Law, and in Legal Informatics (CIRSFID): the center works in a multidisciplinary environment where bioethics, law, computer science, ethics, sociology, and philosophy are brought together to provide the tools with which to explore and analyse the ethical, philosophical, sociological, and scientific issues pertaining to the development of new technologies and their application to medicine, the life sciences, computer science, and law.

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MARINE ECOSYSTEMS, SUSTAINABLE MANAGEMENT AND RESILIENCE TO ANTHROPIC IMPACTS

Developing scientific knowledge, technology, public outreach and capacity building to guide and motivate management actions to preserve marine biodiversity, enhance resilience to a variety of stressors, sustain critical ecosystem functions and services, and energise future sustainability.

Creating safe, resilient and sustainable marine ecosystems is a global objective requiring innovative and coordinated solutions. The University of Bologna addresses the multidisciplinary challenges needed to limit human impacts on marine species and habitats, maintain vital ecosystem services, and promote sustainable natural resource use and human wellbeing.

Research at the University of Bologna covers a wide range of issues:

- Monitoring/modelling the marine environmental status, and developing risk and vulnerability indicators to quantify the effects of human impacts and comply with the achievement of the "Good Environmental state" as from the EU Marine Strategy Framework Directory
- Predicting the adaptation potential of marine socio-ecological systems
- Identifying the ecological and socio-economic mechanisms enhancing the resilience of natural systems to multiple stressors and the provision of ecosystem services
- Designing conservation and restoration strategies, nature-based solutions, and ecosystem-based management
- Tools, include field/lab experiments, genetic and demographic data, environmental metabarcoding, analyses of microbiome interactions, GIS, modelling of coupled physical biogeochemical ocean dynamics, ecosystem services evaluation, marine citizen science and participatory approaches

HIGHLIGHTS

Ecosystem-based solutions for waterfronts, ports & offshore platforms:

H2020 **OPERANDUM** - *OPEn-air laboRAtories for Nature baseD solUtions to Manage environmental risks.* LIFE **MARINA PLAN PLUS** - *Reliable & innovative technology for the realization of a sustainable marine and coastal seabed management plan.*

Interreg Italy-Croatia **CASCADE** - *CoAStal and marine waters integrated monitoring systems for ecosystems proteCtion AnD managemEnt*.

Analysis of fishery stock depletion & evolutionary potential erosion:

H2020 **STOCKMED** - *Stock units: identification of distinct biological units for different fish & shellfish species and among different GFCM-GSA*; EU JRC Tender **MEDBLUESGEN** - *Mediterranean blue shark genetics: population genetic study on Mediterranean blue shark for stock identification and conservation*.

Interreg Italy-Croatia **MARLESS** - *MARine Litter cross-border awarenESS and innovation actions*.

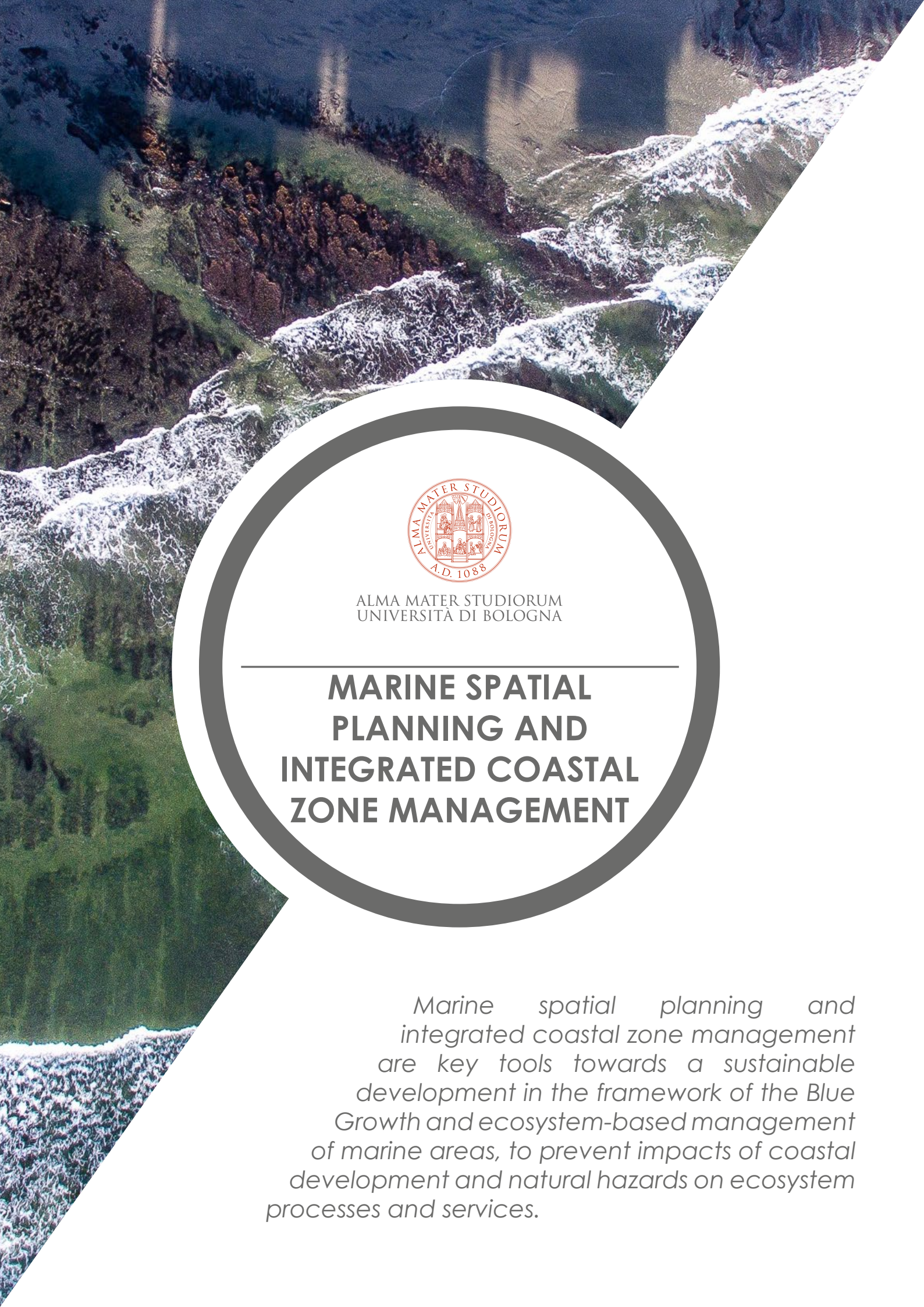
Impacts of marine hazards &, pollutants, including microplastics, gas and oil: . **BURNIMPACT** - *BurnImpact mesocosm experiment in the frame of AQUACOSM scheme*.

Monitoring, conservation & restoration of marine biodiversity:

LIFE NATURE **LIFE EEL** - *Urgent measures in the Eastern Mediterranean for the long term conservation of endangered European eel*.

Interreg Italy Croatia **SUSHI DROP** - *SUstainable fiSHeries wIth DROnes data Processing*.

Interreg Italy Croatia SUSHI DROP SUstainable fiSHeries wIth DROnes data Processing. Interreg Italy Croatia SUSHI DROP SUstainable fiSHeries wIth DROnes data Processing.



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MARINE SPATIAL PLANNING AND INTEGRATED COASTAL ZONE MANAGEMENT

Marine spatial planning and integrated coastal zone management are key tools towards a sustainable development in the framework of the Blue Growth and ecosystem-based management of marine areas, to prevent impacts of coastal development and natural hazards on ecosystem processes and services.

The intensification of traditional economic activities and exploitation of new resources in coastal and marine waters can lead to the overexploitation of resources, the University of Bologna research works on the following issues:

- Identifying the possibility for a coastal development, highlighting the vulnerabilities and priorities for sustainable management of coastal areas, integrating conservation necessities of the natural assets (marine and coastal ecosystems)
- Developing innovative methodologies for ecosystem monitoring and management, risk assessment, protection of marine habitats, species invasions, sustainable fisheries, sustainable coastal defence schemes, mitigation of the impact of oil and gas industries, ecotoxicology and emerging pollutants, harmful phytoplankton blooms impacts on marine organisms and human health
- Designing and planning ecosystem-based management of marine areas with the aim of guarantying the economic and social development as well as preserving the ecosystem processes and services that are essential for their economic development
- Evaluating threats to natural habitats, ecosystems and biodiversity, and preventing conflicts between different users

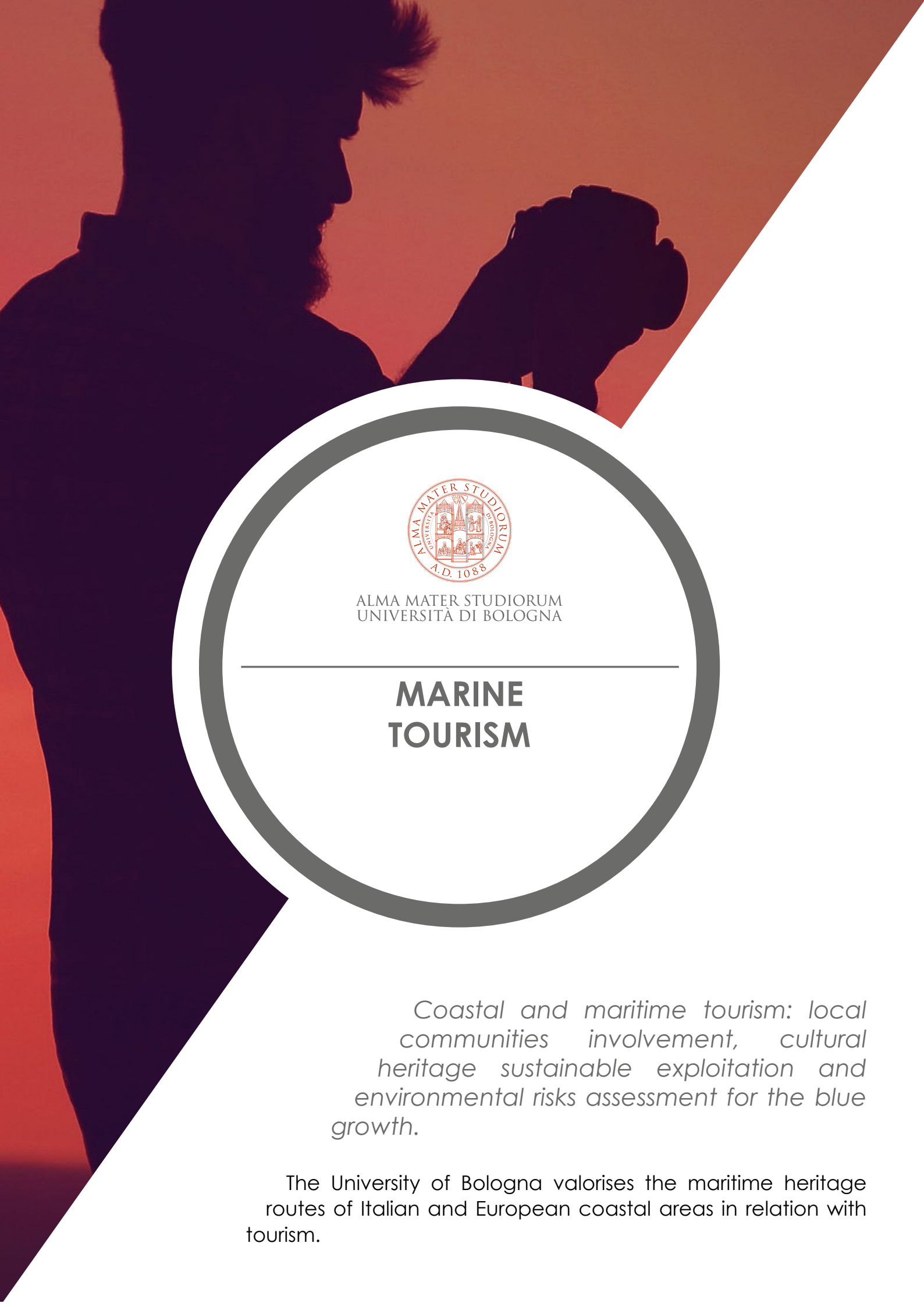
HIGHLIGHTS

Development and application of innovative methodologies to the contamination, quality and risk assessment, and monitoring of coastal ecosystems:

FP7 ERC **CoralWarm** - *Corals and Global Warming: the Mediterranean versus the Red Sea international training in Water and Coastal Management*. FP7 **THESEUS** - *Innovative technologies for safer European coasts in a changing climate*, **MERMAID** - *Innovative Multi-purpose off-shore platforms: planning, design & operation*; **MEECE** - *Marine Ecosystem Evolution in a Changing Environment*. JPI **PLASTOX** - *Direct and indirect ecotoxicological impacts of microplastics on marine organisms*. JPI **SEAMoBB** - *Solutions for SEmi-Automated Monitoring of Benthic Biodiversity*. ITN **MMMPA** - Training Network for Monitoring Mediterranean Marine Protected Areas. **BurnImpact** mesocosm experiment.

Erasmus Mundus Joint Master Degree: **WACOMA** - *Water and Coastal Management*; **FishMed** *Innovative technologies and sustainable use of Mediterranean Sea fishery and biological resource*.

Trans-boundary implementation of the EU Water Framework and Marine Strategy directives: Interreg **ECO GOVERNANCE** - *Ecological foundations for the governance of the Adriatic coastal space: ecology, monitoring and management of transitional aquatic ecosystems*. LIFE **MARINA PLAN PLUS** *Reliable and innovative technology for the realization of a sustainable MARINe And coastal seabed management PLAN*.



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MARINE TOURISM

Coastal and maritime tourism: local communities involvement, cultural heritage sustainable exploitation and environmental risks assessment for the blue growth.

The University of Bologna valorises the maritime heritage routes of Italian and European coastal areas in relation with tourism.

Research at the University of Bologna covers a wide range of issues:

- Involvement of tourism stakeholders in the proactive monitoring and conservation of coastal areas
- Tool development and data analysis of tourist perceptions of the environment
- Evaluation of tourism impact on the marine environment
- Management and conservation strategies of touristic areas
- Development of educational programmes to increase tourists' environmental knowledge and awareness
- Analysis of the Geopolitics of the Adriatic-Ionian Macroregion (tourism and migration)
- Management of Coastal and Marine World Heritage Sites, Cultural Routes of the Council of Europe, contemporary use of cultural heritage in coastal areas
- Economic analysis of sustainable tourism in the Mediterranean
- Planning and managing coastal destinations
- Analysis and projects/programme management of sustainable tourism in the Adriatic and Mediterranean coastal areas contributing to monitoring, impact assessment, educational activities and management plans
- Analyses the use of available resources for local populations and the risk of degradation of natural resources, ecosystems and health that could derive from coastal mass tourism and cruise tourism

HIGHLIGHTS

H2020 **SOCLIMPACT** *DownScaling CLImate imPACTs and decarbonisation pathways in EU islands.* **Adri-Gov** *Adriatic Governance Operational Plan* , **Per Viam** *- Pilgrim Routes in Action*. Erasmus + **HERITAG** *- Higher Education interdisciplinary Reform In Tourism management and Applied Geoinformation curricula*; **HECTOR** *- Heritage and Cultural Tourism Open Resources for innovative training schemes related to the Cultural Routes of the Council of Europe*.

Interreg ADRION **INNOXENIA** *Innovation in Tourism in the Adriatic-Ionian Macroregion*.

Interreg Italy-Croatia: **EXCOVER** *valorising small and unknown towns and sites of the Adriatic Area;* **RECOLOR** *Reviving and EnhanCing artwOrks and Landscapes Of the adRiatic;* **SLIDES** *Smart strategies for sustainable tourism in LIvely cultural DEStinations;* **TEMPUS** *TEMPorary USes as start-up actions to enhance port (in) tangible heritage*.

Centre for Advanced Studies in Tourism of the University of Bologna, established in Rimini. It offers advanced scientific research and professional training in the tourism field under a multidisciplinary perspective, with a particular focus on coastal areas.

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MARINE TRANSPORT TECHNOLOGIES AND INFRASTRUCTURES

Sustainable, safe and environmental friendly technologies and infrastructures for sea transportation of passengers and freight.

Research at the University of Bologna covers a wide range of issues:

- Naval Engineering including eco-development in engineering design process, shipbuilding, maintenance, and operation of marine vessels and structures
- Nautical design and drones based on innovative materials to reduce weight and improve performances
- Marine shipbuilding and manufacturing supporting the complex marine structures for the most challenging applications
- Assessment of safety and environmental aspects of alternative technologies for ship propulsion
- Safety of LNG supply chain for ship propulsion and port machinery fueling
- Design of port areas, focusing on innovative design of breakwaters docks, quays or harbor furnishings
- Environmental effects of ports and their activities, their habitability, and mitigation
- Development of novel eco-engineering designs and technologies for functional, aesthetic and recreational port infrastructures
- Water quality in marina modelling and assessment in the marinas, harbors and sea
- International, European and national legislation on environmental protection for port activities and maritime transport
- Analysis of the legal aspects related to the use of new eco-technologies and new energy efficiency solutions in the transport field

HIGHLIGHTS

The University of Bologna research, efficient networking and training has been funded at International and European level through different funding programs.

Interreg ADRION – V-B Adriatic Ionian - **SUPER-LNG** – *Sustainability Performance of LNG-based maritime mobility*.

Australian Research Council Linkage Projects - *Marine urban sprawl: Using ecology to design multifunctional artificial structures.*

FP7 – **MarUrbe** – *Sustainable Urban Development: solutions to promote the biological and conservation value of marine urban structures*.

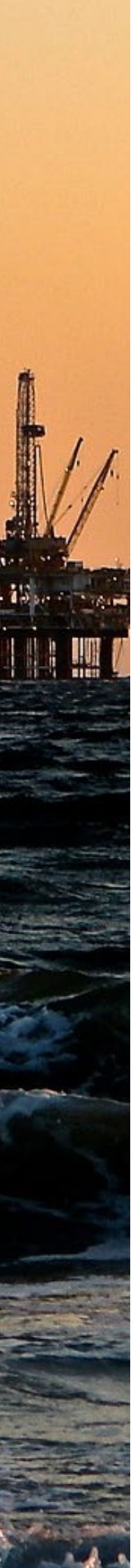
LIFE **Marina Plan Plus** - *reliable and innovative technology for the realization of a sustainable marine and coastal seabed management plan.*

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

MULTI - PURPOSES OFFSHORE PLATFORMS

Technologies and Structures for the integrated exploitation of offshore resources.

The University of Bologna research focuses on the development of innovative solutions for the exploitation of existing or novel offshore structures (including the refurbishment or conversion to different uses of existing or new structures) that could execute different tasks simultaneously: hubs for commodities and people transit, mining, energy production, research stations, fisheries.



Research at the University of Bologna covers a wide range of issues:

- Decommissioning and Reuse options for off-shore installations
- Assessment and mitigation of ecological impacts
- Assessment of feasibility of energy conversion from renewable sources: mini-hydro, waves, wind offshore
- Design of multi-purpose platforms
- Modelling of floating bodies, WEC, wave energy arrays, integration of marine renewable energy devices
- Design and safety assessment of production facilities on top-side platforms
- Hybrid Generation Systems, integrating energy production from fossil and renewable resources
- Offshore chemical conversion systems for the storage and transportation of offshore renewable energy
- Development of interdisciplinary Decision Support Systems for the optimal design of off-shore installations
- International and national legal regulation on multi-purposes offshore marine platforms; spatial planning issues of marine platforms safety and security (Solas Convention, ISPS Code, Rome Protocol)

HIGHLIGHTS

The University of Bologna contributes to the international research progress working on funded projects at European level and developing innovative solutions:

- **COST Action**, to strength trans-national cooperation: **OPP** - *Oceans Past Platform*.
- **FP7 MERMAID** - *Innovative Multi-purpose offshore platforms: planning, design & operation*.
- **SDWED** - *Structural Design of Wave Energy Devices*.
- **Patent.** Deposit N. 102017000134759: Wave Energy Converter device.

Interdepartmental Centres for Industrial Research (CIRI) "Building and Construction" develops and transfers innovative technologies and methods for the design of innovative infrastructures in the sea. With this aim the manages the **Wave-currents basin (18m x 1 m x 1.5m)** where, 3 dimensional waves can be generated in order to test the structures.

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

OCEANOGRAPHIC OBSERVATIONAL AND MODELLING SYSTEMS

Observing and modelling the open ocean and coastal dynamics as well as enhancing modelling tools for a sustainable blue growth.

Research at the University of Bologna covers a wide range of issues:

- Improving existing observational systems (from in-situ to satellite-based systems) and their analysis, with focus on quality control algorithms
- Providing useful innovative tools and products to Authorities and operators involved in disaster prevention and sustainable development
- Improving modelling and prediction systems for research and applications
- Fusion of ocean observations and numerical simulations (data assimilation) to reconstruct past and present-day ocean state and dynamics and to predict future evolution
- Contribution to the implementation of the Copernicus Marine Environment Monitoring Service for the Mediterranean Sea (large scale observing and modelling system)
- Studies of deep sea (2500-3500 m) phenomena and measurement of environmental variables by means of large submarine neutrino telescopes
- Marine water monitoring with optimized and special designed automatic drones for data acquisition. Integration and coordination with underwater units for monitoring and emergencies management

HIGHLIGHTS

The University of Bologna research has been funded at European level through different funding programs: on research, networking and capacity infrastructures.
H2020 projects: **EuroSea** - *Improving and Integrating European Ocean Observing and Forecasting Systems for Sustainable use of the Oceans;* **ATLANTOS** - *Optimizing and Enhancing the Integrated Atlantic Ocean Observing System;* **ODYSSEA** - *Operating a network of integrated observatory systems in the Mediterranean sea*. FP7 projects: **Integ-Risk** - *Early Recognition, Monitoring and Integrated Management of Emerging, New Technology Related Risks.* **KM3NeT – PP** - *Preparatory Phase for a Deep Sea Facility in the Mediterranean for Neutrino Astronomy and Associated Sciences*. **ASTARTE** - *Assessment, STrategy And Risk Reduction for Tsunamis in Europe*.

The University of Bologna is part of relevant networks and operates through high level laboratories and infrastructures.
KM3NeT an European Research Infrastructure, built on the experience manly of ANTARES and NEMO, consisting of underwater neutrino telescopes off the Provencal coasts (2.500 m depth) and off SE Sicily (3.500 m depth). This infrastructure, with the strong participation of the INFN and with the collaboration of UNIBO, is also devised to house instruments for oceanographic and marine biology observations along the sea water column as well as at the deep sea.
Numerical simulation infrastructure at Ravenna and Bologna to develop modeling and data analysis tools.
Network of meteo-marine stations in Eastern Sicily operated by the Physics and Astronomy Department (DIFA) Tsunami Research Team.

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

RISKS AND COASTAL PROTECTION

Protecting our coasts requires accurate assessment of vulnerabilities and risk (i.e. erosion, flood risk and long-term habitat deterioration threatening also the environmental heritage) and methods to select and design the best combination of adaptation solutions.

Coastal areas are vital economic hubs in terms of settlement, industry, agriculture, trade and tourism to mention some key sectors. The University of Bologna research develops a systematic approach to deliver both a low-risk coast for human use and preserved healthy habitats for evolving coastal zones, subject to multiple natural and anthropogenic factors.

Research at the University of Bologna covers a wide range of issues:

- Modelling and forecasting of meteo-marine climate and extreme events, and of processes promoting the coastal vulnerability (subsidence, sea-level rise). Mitigation of related effects such as coastal erosion, flooding, tsunamis and salinization of coastal aquifers
- Design of coastal structures, eco-compatible interventions, multi-functional mitigation measures and non-technological solutions
- Assessment of marine pollution, focusing on synthetic plastics, chlorinated/ non chlorinated xenobiotics and oil spills; and bioremediation measures
- Integrated risk assessment and development of tools for prioritisation of intervention and sustainable decision making useful for relevant authorities
- Contribution to the implementation of national and European directives and laws

HIGHLIGHTS

Design of technological and non-technological innovative adaptation solutions to coastal floods:

FP7 Project **THESEUS** - *Innovative technologies for safer European coasts in a changing climate.*

Development of decision support systems for decision makers to assess impacts and risk:

H2020 Project **BRIGAID** - *Bridging the gap for innovations in disaster resilience*.

Biotechnological **solutions to remediate marine pollution** by means of enrichment/isolation of marine aerobic and anaerobic mixed consortia/pure bacterial strains able to degrade conventional petroleum-based synthetic **plastics, hydrocarbons** and **chlorinated xenobiotics**:

H2020 **INMARE** - *Industrial Applications of Marine Enzymes: Innovative screening and expression platforms to discover and use the functional protein diversity from the sea*. JPI **Plastox** - *Direct and indirect ecotoxicological impacts of microplastics on marine organisms*. FP7 **BIOCLEAN** - *New biotechnological approaches for biodegrading and promoting the environmental biotransformation of synthetic polymeric materials*; **KILL SPILL** - *Integrated Biotechnological Solutions for Combating Marine Oil Spills*; **ULIXES** - *Unravelling and exploiting Mediterranean Sea microbial diversity and ecology for xenobiotics' and pollutants' clean up2*.

Interdepartmental Centres for Industrial Research (CIRI) "Building and Construction" and "Energy and Environment" develop and transfer respectively innovative technologies and methods for the design of innovative infrastructures in the sea and control of environmental quality and for the management of natural resources.