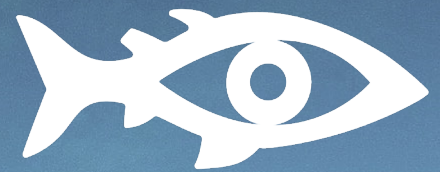


# BRIDGES

Research Program  
Fisheries and biodiversity  
in the Western Indian Ocean  
2023-2033



# PRESENTATION KIT



## A rich, complex but vulnerable region...

The **south-west Indian Ocean** boasts a wide variety of environments that are home to **exceptional biodiversity**. In this region, **small-scale fishing** is a mainstay of many communities' lifestyles and consumption patterns, guaranteeing food security, employment and economic growth.

However, it is one of the **world's most exposed and vulnerable areas to global pressures** such as climate change and the intensification of human activities to satisfy growing global demand for fish resources.

**Marine and coastal ecosystems, and the human societies** that depend on them, are thus heavily impacted, and it is important to identify solutions to help improve their resilience.

## ... at the core of an ambitious research program

The **BRIDGES research program aims to identify solutions that guarantee biodiversity conservation and fair, sustainable fisheries, at the local scale of several study sites and at the regional scale of the south-west Indian Ocean.**

BRIDGES proposes to work with researchers, decision-makers and other stakeholders to initiate transformations towards greater social and environmental justice.

With an innovative, global and integrative approach, the program seeks to evaluate and promote modes of governance and area-based management tools (e.g., marine protected areas) capable of responding to these issues.

BRIDGES was among the 13 winners of wave 2 of the 'Exploratory Priority Research Programs and Equipment (PEPR)' call launched in the framework of the France 2030 investment plan.

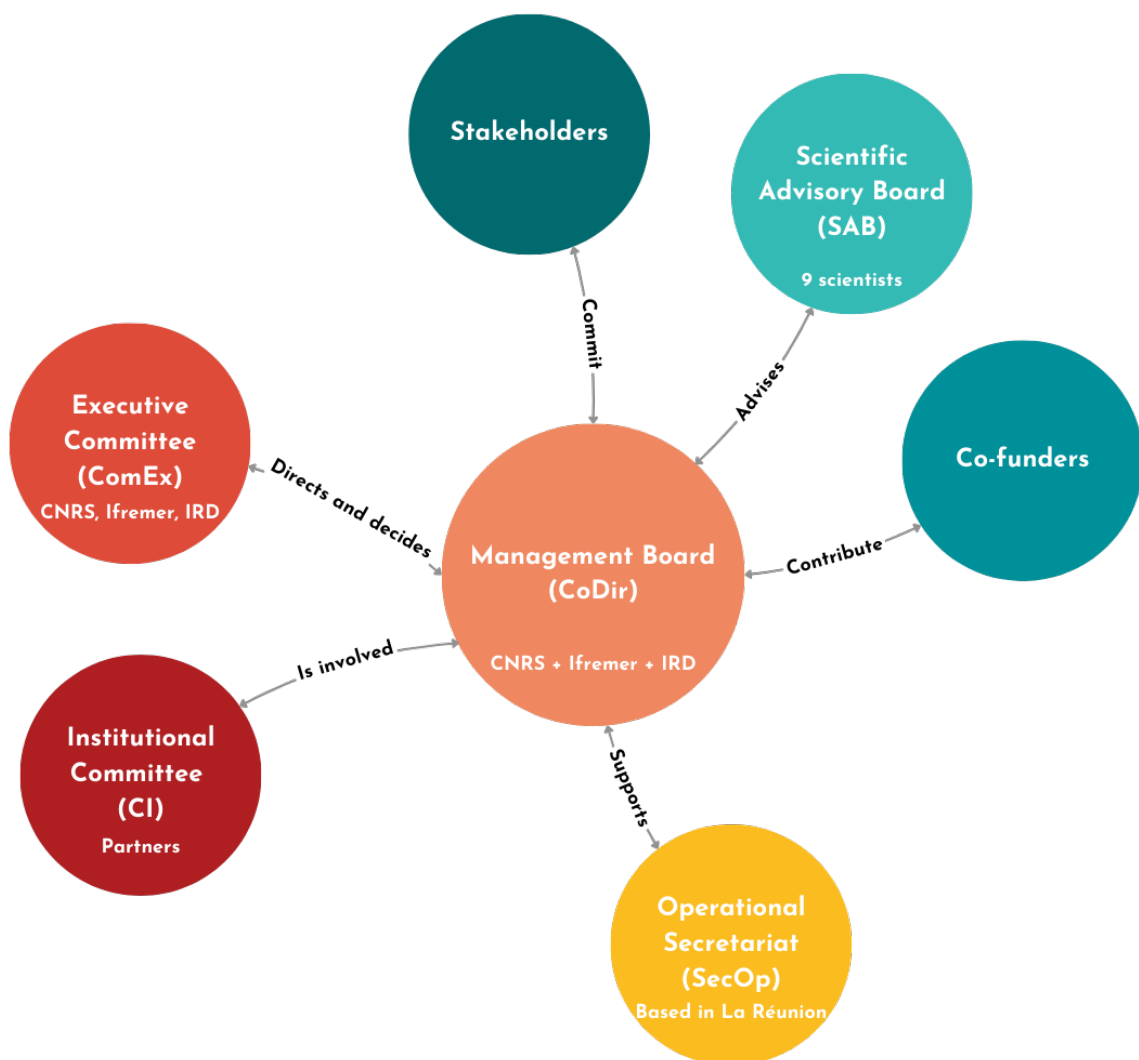
These programs are intended to support emerging transformations in priority areas like the environment or society.



## Governance

The **CNRS**, the **Research Institute for Exploitation of the Sea (Ifremer)** and the **Research Institute for Development (IRD)** jointly run BRIDGES through an Executive Committee of Steering Institutions (ComEx). This is supported by the Institutional Committee (CI) made up of by partners with recognised complementary skills.

The three co-directors make up the Management Board (CoDir) which is supported by an Operational Secretariat (SecOp) in charge of the program's overall coordination. Advice is also provided to the CoDir by a Scientific Advisory Board (SAB). The overall aim is to engage stakeholders and co-funders to ensure BRIDGES has a robust regional and societal basis to work from.





## The co-directors

### Joachim CLAUDET for CNRS



**Joachim Claudet** is a CNRS research professor working at the CRIOBE-PSL laboratory and also an ocean advisor for the CNRS. He specialises in research into the sustainability of coastal and marine socio-ecological systems and uses case studies as input for the management of these systems or meta-analyses as input for public policy-making. The aims of his research are to help solve sustainability issues, identify solutions that are beneficial for nature and people alike, and develop indicators and tools to support the decision-making process. He is the main author of two IPBES regional

evaluation studies and also the upcoming IPBES assessment on transformative change, is a member of the Conseil National de la Protection de la Nature and the Conseil National de la Mer et des Littoraux. Joachim Claudet chairs the scientific councils of the Ocean Climate Platform and MedPAN, the network of managers of marine protected areas in the Mediterranean. He also belongs to many other scientific committees including the French Foundation for Biodiversity Research and Blue Parks and to international working groups like the High-Level Panel for a Sustainable Ocean Economy and the Blue Climate Initiative. Joachim Claudet also directed a collective book published by Cambridge University Press on the subject of marine protected areas.

### Emmanuelle ROQUE d'ORBCASTEL for Ifremer



**Emmanuelle Roque d'Orbcastel** is an Ifremer researcher in the MARBEC joint research unit, leading its drive to promote sustainable marine fisheries and aquaculture from 2015 to 2023. Her specialist research focuses on the interactions between aquaculture organisms and their environment. Emmanuelle Roque d'Orbcastel has coordinated and taken part in 21 funded projects, 12 coastal and deep-sea campaigns and also held the post of laboratory manager from 2011 to 2018. From 2021 to 2023 she was seconded to the Indian Ocean Commission (IOC) and currently coordinates two

lines of research in the south-west Indian Ocean on the impact of plastic pollution on aquaculture and reef fish organisms that are exploited for human consumption (the 'VECTOPLASTIC' ANR project steered by the CNRS; ExpLOI with AFD/FFEM funding



and steered by the IOC). Emmanuelle Roque d'Orbcastel is the Ifremer's Scientific Management Board's thematic referent for the French Overseas Territories and is in charge of coordinating its Action Plan for these territories.

## Frédéric MENARD for IRD



**Frédéric Ménard** is a senior researcher with the Mediterranean Institute of Oceanography joint research unit in Marseille and studies the functioning of tropical marine ecosystems in the context of global change. His research focuses on food webs, fisheries and biodiversity, large pelagic predatory fish and the vulnerability of coastal ecosystems and he is a member of several scientific councils and committees. Frédéric Ménard directed the IRD's OCEANS, Climate and Resources department from 2015 to 2020 but is now its Overseas Scientific Advisor to the current director Valérie Verdier.

He also takes part in the development of the IRD's overseas strategy and action plan. He also manages the 'Outre-mer' PPR steered by the IRD.



# The BRIDGES approach

## Rethinking Area-Based Management Tools (ABMTs)...

These spatialized tools **enable the use of natural marine resources to be controlled within a targeted geographical area**. Once the objectives to be achieved have been collectively defined (e.g., ecosystem restoration, sustainable fisheries, marine conservation), various types of tools can be used to implement appropriate management and monitoring measures: marine protected areas (MPAs) and their level of protection, temporary area closures, protection of certain species, etc...

### ... to meet key challenges:

#### Biodiversity conservation

→ How can we improve the quantity, quality (protection level) and effectiveness of ABMTs?

BRIDGES seeks to set up observatories of coastal and marine social-ecological systems exploited by fisheries, to fuel iterative dialogue with stakeholders and interest groups. The aim is to implement adaptive management to promote biodiversity conservation and sustainable fishing.

*\* A social-ecological system is an interconnected system in which human societies and ecological environments interact and influence each other. It encompasses the relationships between people, communities and ecosystems, emphasizing their interdependence and co-evolution.*

#### Environmental justice

→ What levels of protection promote biodiversity conservation and create benefits for fishing in local socio-ecological contexts?

BRIDGES analyses how management methods and governance of ABMTs can be made more efficient and equitable, by examining public policies and their impact, the conflicts they generate and the role of stakeholders in their formulation.



## Resilience and adaptation

→ How can we ensure that the proposed solutions help to adapt to climate change and are not themselves vulnerable to it?

BRIDGES studies the factors influencing the adaptive capacity of social-ecological systems at different scales ranging from regional analysis to individual fishing households. In particular, this includes the development of risk profiles linked to global change and the analysis of the impacts of ABMTs on the resilience of small-scale artisan fishermen.

## Cooperation and stakeholder networks

→ How can area-based management tools and protected marine areas help improve the links between regions?

BRIDGES tests the hypothesis that networking ABMT tools through coordinated and shared observation of these will enhance their resilience and reinforce regional collaboration. Multi-scale spatial and temporal social-ecological systems (i.e., geophysical, geochemical, biological and social) interconnections will be analysed in the aforementioned study sites. Developing a networked observatory of social-ecological systems will enable researchers to map, quantify and model these processes.

The observation strategy being developed particularly aims to contribute to:

- The coordination of the collection and sharing of data on the state and use of the oceans and of the right climate descriptors,
- A regional approach to social-ecological systems for the usage of resources and to impacts on climate,
- Building local capacity to support the proposed long-term collaborative, regional, interdisciplinary, multi-sectoral and equitable approach.

## Food security and anticipating emerging conflicts

→ How can networks of protected marine areas that are jointly constructed with stakeholders contribute to a more peaceful management of resources at the regional level?

BRIDGES explores the interconnection between the environment, food security and the economy through the role played by ABMTs in how small-scale fishermen can adapt to global change.

To anticipate risks, BRIDGES develops predictive models based on field



approaches such as living-labs which determine and test resilience and sustainability factors.





# The program's actions

BRIDGES research program is structured around:

**6 targeted, linked and interconnected scientific projects** (presentations on the following pages)

- **BRIDGES-INFORMATION:** Building an information system
- **BRIDGES-OBSERVATION:** Collecting and integrating information
- **BRIDGES-AVATAR:** Modelling and exploring probable trajectories
- **BRIDGES-RESILIENCE** : Understanding dynamics with a « living-labs » approach
- **BRIDGES-CO-PRODUCTION:** Co-constructing sustainable transformations
- **BRIDGES-IMPACT:** Monitoring and amplifying BRIDGES impact.

And **2 structuring components**, enabling:

- **BRIDGES-GOVERNANCE:** Managing the program and supporting its partners, capacity sharing in the SWIO from 2025 onwards
- **BRIDGES-TRANSVERSE:** Provide cross-functional support for the program as a whole.

The program's ambitions will be supported and fuelled by **cross-disciplinary scientific activities and a major communications/promotion component**.

- Scientific workshops
- Participatory science collaborative platform
- Partnered research projects – study sites
- Observation campaigns and data acquisition
- Equipments
- International conferences
- Science-society actions
- Knowledge cafés with decision-makers
- Knowledge dissemination and promotion (public: scientists, partners, etc.)



# Transforming governance modes

**BRIDGES supports and funds the capacity sharing and research training of a future generation of researchers and decision-makers in the south-west Indian Ocean with 3 components:**

**1. Training through research**, including master's courses, PhD theses and post-doctoral fellows, opportunities in the various targeted projects, organising meetings and conferences during the programme.

→ **Calls for thesis clusters** will be a core element for this segment. The aim will be to enlarge the community that was initially identified and involved in the construction of BRIDGES. These will involve groups of PhD students and post-doctoral fellows from complementary disciplines applying a variety of approaches, methods and data to a chosen theme and/or complex shared issue.

**2. Strengthening and building masters.** The program is coordinating with universities to bolster and construct master's courses that encourage multi- and trans-disciplinary approaches to social-ecological systems. This includes:

- Setting up an **Indian Ocean regional Master's degree** constructed in collaboration with the University of Réunion and the University of Mayotte and involving teaching, work experience and fieldwork divided between these two territories.
- Funding **excellence M1 and M2 scholarships** for students in the SWIO.
- Reinforcing the **Master's degree in 'Environmental resource management and sustainable development' on the Patsy Campus at the University of Comoros** by financing teaching assignments for academics.

**3. BRIDGES schools and field schools**, organised in collaboration with and intended for the researchers involved in BRIDGES and the many regional partners such as students, young researchers, parks, and reserves and administrations. The aim for these interdisciplinary events is to jointly design and implement solutions and also to promote science in society.



# The study sites

These have been defined as follows:

1. The SWIO regional site: **an offshore site in the Mozambique Channel and south-west Indian Ocean including the Scattered islands** (blue box on the map)

And five coastal sites comprising marine protected areas and the surrounding areas in some cases:

2. **The Comoros** and their four marine protected areas
3. **Mayotte** and its Marine Nature Park
4. The west coast of **Reunion Island** including its Natural Marine Reserve
5. Southern **Mozambique** – from Maputo Bay to Ponta de Ouro.

The integration of a fifth coastal site in **Madagascar** is currently under discussion with the authorities and partners.

## Partners



## Keys figures

**10 years**

A program from 2023 to 2033

**28M€**

budget

**6**

study sites  
in the South-West Indian Ocean



# TP1: BRIDGES-INFORMATION

**Duration:** 24 months

**Leader:** University of Réunion

**Key partners:** Ifremer, CNRS,

Data Terra Research Infrastructure (RI),

OSU-Réunion (Observatory of the Sciences of the Universe)



**BRIDGES-INFORMATION's** objective is to construct an information system that brings together existing data and digital resources that are useful for the study of the socio-ecosystems of the south-west Indian Ocean (SWIO). This will then act as a data and knowledge base for other targeted BRIDGES-linked projects and also for the broader scientific community.

The project aims to find responses to the following scientific questions:

- How can acquired and new knowledge be promoted and disseminated more effectively?
- How can data-sharing for knowledge and action purposes be organised more effectively?
- How can it be ensured that BRIDGES stakeholders actually appropriate the data and services?

**BRIDGES-INFORMATION's** main objectives are to:

- Make data FAIR to reinforce existing capacities and develop new capacities for climate-ocean-resources-users observation,
- Link up with ongoing long-term initiatives at regional, national and international levels,
- Support and provide training in the FAIRisation of digital resources for BRIDGES partners to consolidate a technical and scientific community around the data. This will be carried out in conjunction with BRIDGES capacity sharing segment.

**BRIDGES-INFORMATION's** work is based on an open science approach involving the systematic sharing of data, methods and codes so knowledge commons are accessible to all and encourage the reproducibility of science. For this the project relies on the FAIR principles by which digital resources should be Findable, Accessible, Interoperable and Reusable.

**BRIDGES-INFORMATION** works in a fragmented landscape of data sources. There are a wide variety of types of data, processing methods, quality, associated services (including codes and models) and production sources.

The project draws on :

- Experiences of projects run in recent years like G2OI *Grand Observatoire de l'Océan Indien* (FEDER, FED, Région Réunion, COI, 2020-2023), and Océan Metiss (FEDER, FED, Région Réunion, COI, 2018-2021),





- Existing information systems and data infrastructures in the Indian Ocean like Sextant 'OI' and the Quadrigé IS,
- Clusters and observatories working in the Indian Ocean like the ODATIS Ocean Cluster and the OSU-Réunion.

## Project leaders

**Jean-Pierre CAMMAS** (CNRS, University of Réunion)



**Jean Pierre Cammas** is a CNRS research director at the OSU-Réunion. He is a trained atmospheric physicist whose research has focused on the life cycle of mid-latitude cyclones (1990-2000) and the transcontinental transport of pollutants (2000-2012). As regards research infrastructures, he contributed to transforming the SNO MOZAIC (Measurements of OZone, water vapour, carbon monoxide and nitrogen oxides by in-service Airbus aircraft) into the IAGOS (In-Service Aircraft for a Global Observing System, 2000-2012) research infrastructure.

As the director of the OSU-R and the OMNCG (Observation of Natural Environments and Global Change) Research Federation at the University of Réunion (2012-2023), he worked to establish the OSU-R's Information System and its Digital Strategy Plan. The latter is based on national (AERIS, THEIA and ODATIS) and international (ICOS, ACTRIS) data centres.

**Erwann QUIMBERT** (Ifremer)



**Erwann Quimbert** is an engineer with the Ifremer in Brest with a dual education in Geography and geographic information systems. His training led him to specialise in the environment, research data management and geographical data collection, analysis and dissemination technologies. Currently he directs the Data Terra Research Infrastructure's ODATIS Ocean Cluster. He has a great deal of experience in leading and managing national and European projects. At the national level, he coordinated the 'ANR Flash' COPILOTE project ('Certification Ocean Data Cluster' towards the

certification of ODATIS Ocean Cluster Data Centres and Services). At the European level, he has contributed his marine data management expertise to many projects for which he directed tasks or work packages. These include EMODnet chemistry (2017-2023), ENVRI FAIR (2019-2022), Mission Atlantic (2020-2024) and Geo-INQUIRE (2022-2026).



## TP2: BRIDGES-OBSERVATION



**Duration:** 120 Months

**Project leaders:** CNRS, IRD, University of Western Brittany (Brest)

**Key partners:** University of Réunion,  
University of Mayotte, University Paris 1, University of Nantes,  
National Museum of Natural History (MNHN)

**Key international partners:** University of Maputo (Mozambique), University of Comoros

The objective of the **BRIDGES-OBSERVATION** targeted project is to define and implement a long-term interdisciplinary observatory of the marine social ecological systems (SES) in case study countries. To achieve this objective, the observation strategy will be optimized throughout the entire observation chain including data collection, processing, validation, storage, dissemination, and re-use phases, by i) combining frugality and efficiency procedures, ii) making data available for all stakeholders in the WIO region, and iii) developing frameworks, tools, and innovative platforms in an adaptive way.

Interdisciplinary research (i.e., physical oceanography, chemistry, ecology, fisheries, and human and social science) will support that initiative at multiple scales both in space and time.

**BRIDGES-OBSERVATION** also aims to respond to the requirements for coordinating the observation chain with existing observatories in the case study countries and building up local capacity through a collaborative and equitable approach. Specifically current observation systems will be articulated in coastal sites in Réunion Island, Mayotte, Mozambique, Comoros, and in the south-west Indian Ocean regional site (including the Mozambique Channel). Relevant connection with similar initiatives within the WIO region will be given high consideration.

The top priorities of the **BRIDGES-OBSERVATION** project are the following:

- To define the “ideal” observatory through:
  - surveys and critical analysis of the existing systems,
  - the identification of key parameters and indicators,
  - planning and monitoring observation systems.
- To carry out data collection for estimating a common set of indicators in the study sites using standardized methods within and across the study sites,
- To optimise, adapt, and sustain the overall observation strategy.
- The project will benefit from the consortium's experience in defining and implementing sustainable, interdisciplinary marine observatories such as the ILICO Research Infrastructure, among others.



The operational approach of the **BRIDGES-OBSERVATION** project is firmly oriented towards FAIR (Facilitated implementation, Accessible, Integrative, and Respectful) observation processes.

## Project leaders:

### Christophe DELACOURT (University of Western Brittany, Brest)



**Christophe Delacourt** is a professor at the University of Western Brittany (Université de Bretagne Occidentale - UBO) and assigned to the Geo-Ocean Laboratory (UMR-6538) that he directed from 2012 to 2016. He is also a scientific delegate with CNRS Earth & Space where he is in charge of coastline, coastal and overseas research. He co-founded the DYNALIT National Observation Service and the ILICO research infrastructure which he co-directed from 2016 to 2022.

His research focuses on the transfer of sedimentary matter from catchment areas to the deep ocean and at different timescales. For the purpose of his work, he develops methodologies and instruments for multi-sensor land/sea remote sensing (passive remote sensing: hyper-spectral, thermal infrared, active remote sensing - acoustic, lidar, radar) and also multi-platforms (satellite, plane, drone, ship). These are used to quantify matter transfers and thus enhance our understanding of the processes that underpin these according to the associated risks. He works in interaction with colleagues from different scientific communities including geographers (risks), biologists (coral environments), engineering scientists (sensors and information processing) and physicists (erosion processes). More recently he was involved in setting up interdisciplinary observatories like SNO Dynalit, IR ILICO, SOERE Trait de Côte.

### Marc LÉOPOLD (IRD)



**Marc Léopold** has a PhD in fisheries economics from the University of Western Brittany (UBO) and is assigned to the IRD at the ENTROPIE research unit (UMR 9220) as a fishery scientist. He investigates the dynamics of coastal fisheries systems in countries in the South, particularly in the south-west Indian Ocean where he was assigned from 2017 to 2021. More specifically his research focuses on social ecological interactions, resource and fisheries assessment methods, fishery management effectiveness, and governance processes with particular focus on spatial temporal dynamics. He uses interdisciplinary and transdisciplinary research approaches that involve collaboration with stakeholders and action-oriented projects. Applications include collaborative and participative monitoring methods of the

status of fish and invertebrate resources and fishing activities in data-poor contexts with limited institutional and scientific capacities. Since 2020, he has co-led the fisheries component of the Mikaroka International Laboratory in Madagascar.



## TP 3: BRIDGES-AVATAR

**Duration:** 10 years

**Project leader:** CNRS

**Key partners:** Ifremer, IRD, Météo-France, Sorbonne University



**BRIDGES-AVATAR** aims to create the right foundations for a 'digital avatar' to simulate the two types of social-ecological systems studied in the BRIDGES programme. This consists of modular scientific tools used to generate and analyse:

- (1) system trajectories in different contexts of climate, economic and societal change,
- (2) existing spatial management methods and tools,
- (3) possible future outcomes associated with different management scenarios for the systems under study.

The trajectories simulated by the BRIDGES avatar are intended to serve as input for the management strategies put in place at the study sites by administrators and decision-makers. This avatar could ultimately be used to help extend the digital twin of the natural ocean system developed by Mercator-Ocean International at the European scale.

The first phase of **BRIDGES-AVATAR** will be implemented from 2024 to 2030 with the objective of producing a set of validated modelling tools and a first set of numerical trajectories associated with scenarios. These will be used to model the dynamics of social-ecological systems. The other PCs (particularly BRIDGES-RESILIENCE and BRIDGES-CO-PRODUCTION) will be able to use the digital avatar to simulate other sets of scenarios during the programme's last 4 years.

**BRIDGES-AVATAR** will use innovative approaches that combine quantitative models describing natural and socio-economic systems with broader qualitative approaches that describe socio-economic contexts and the governance thereof. This approach incorporates major scientific advances with high-resolution modelling of the coupled ocean-atmosphere and regional social-ecological systems. It also takes human needs for natural resources (food, habitats) into account along with human impacts on marine ecosystems like pressure caused by fishing, urbanisation, climate change, and so forth.

**BRIDGES-AVATAR** integrates social-ecological systems to work towards developing a digital avatar of the Ocean. The idea is for this to promote and encourage an approach featuring stronger collaboration between scientists and ocean users. The project is based on existing numerical models focusing on various components:

- Ocean circulation (NEMO, CROCO)
- Atmosphere and waves (WRF, WW3)
- Biogeochemical and marine ecosystems (PISCES, APECOSM) including fishery





models (ISI-Fish)

- Small-scale fishing (CORECRAB)
- Climate change projections (BRIO).

The aim moving forwards is to consolidate these models, develop missing components, enhance their interoperability and make them available for use.

## Project leaders :

### Pierre BRASSEUR (CNRS)



**Pierre Brasseur** is a senior CNRS researcher (DR1) who currently works at the Institute of Environmental Geosciences which he founded in 2016 and directed until 2020. His scientific expertise covers ocean circulation modelling, data assimilation in numerical models and coupling physical, biogeochemical and ecosystem models, the study of ocean circulation variability using satellite observations, designing satellite and in situ observation systems and the implementation of operational ocean analysis and forecasting systems. He is the author of 90 peer-reviewed publications and book chapters and has an h-index of 39 with over 4500

citations. In 1998 he was awarded the CNRS bronze medal.

From 2006 to 2013 he chaired Mercator Ocean's scientific council, also coordinating R&D activities for the EU's MyOcean projects from 2009 to 2014. From 2008 to 2013 he was a member of the international steering team for GODAE (co-chair of the Marine Ecosystem Prediction Task Team), now OceanPredict. He has co-chaired and is still a regular member of the Copernicus Marine Service's Scientific and Technical Advisory Committee (STAC). He was also a member of the French Space Agency's (CNES) scientific programmes committee until 2024, provides expertise for the regular process of the UN World Ocean Assessment and is a permanent member of Météo-France's scientific committee.

### Stéphanie MAHÉVAS (Ifremer)



**Stéphanie Mahévas** is a researcher at Ifremer in the MARBEC joint research unit, where she is responsible for the ambition "Proposing tools for the conservation of marine biodiversity and anticipating emerging risks". She specializes in the mathematical modeling of fisheries to evaluate spatialized fisheries management scenarios in a socio-ecosystemic approach. She co-designed ISIS-Fish (isis-fish.org), a platform for modeling the spatial and seasonal dynamics of marine populations and fishing fleets, used in numerous coastal socio-ecosystems (Atlantic, Mediterranean, Eastern Indian Ocean). She is responsible for the

development and networking of ISIS-Fish users. Author of a book on sensitivity analysis methods and coordinator of the Mexico network, her approach is to design



models of a complexity adapted to the issues at stake and the data available, and to assess their strengths and weaknesses so that they can be used in an operational context. Through the coordination of research projects involving participatory approaches and collaborations with artists, Stéphanie strives to transfer academic productions to society.



## TP4: BRIDGES-RESILIENCE

**Duration:** 120 months

**Leader:** Ifremer

**Key partners:** University of Réunion, University of Mayotte, IRD



**BRIDGES-RESILIENCE's** objective is to provide knowledge for sustainable and fair spatialised management of coastal resources. This mainly involves the subsistence fishing socio-ecosystems of the south-west Indian Ocean. The project will use a transdisciplinary, living-lab territorial approach to untangle the cause-and-effect relationships that underpin the sustainability of Nature's Contributions to People (NCP's) thanks to a socio-ecosystemic management approach.

The project aims to answer the following scientific questions:

- How does spatially explicit management of coastal and marine resources influence ecosystems functioning?
- What is the role of fishing play in delivering Nature's Contributions to People?
- What is the impact of climate change on fisheries and to what extent spatially explicit management of marine resources can help mitigate these impacts?

**BRIDGES-RESILIENCE's** priority goals are to:

- Understand the complex interactions between fishing activities and ecosystems functioning to identify Area-Based Management Tools (ABMTs) that can simultaneously support sustainable fishing practices, biodiversity conservation, and socio-ecological resilience.
- Evaluate the role of fisheries and aquaculture in the sustainability of 'Blue Foods' for the south-west Indian Ocean's coastal communities.
- Assess the impact of climate change on coastal fisheries.
- Analyse fishers' adaptive strategies in response to ABMTs and assess their long-term implications for human well-being.
- Integrate modelling tools and participatory workshops to evaluate governance intervention scenarios and, explore potential trajectories for socio-ecological systems.

**BRIDGES-RESILIENCE** applies a transdisciplinary 'living-lab' approach to bridge the gap between socio-ecological research and sustainability science. Scenario assessments will be carried out along with governance experiments aimed at developing sustainable development pathways. The project will work with local stakeholders to implement and test transformative initiatives capable of responding to local challenges while also contributing to sustainability goals.

**BRIDGES-RESILIENCE** works in a context of limited information available on processes that can lead to sustainable use of coastal and marine resources, which represent a significant challenge in terms of project management.

The project's work is based on (among other elements)

- The CORECRABE project, to carry out a transdisciplinary evaluation of mangrove



- crab fisheries in Madagascar,
- The MANFAD project, to develop a tool to help manage Fish Aggregating Devices (FADs),
  - The BioEOS project, to develop observation tools for the characterisation of coastal biodiversity's spatio-temporal dynamics,
  - The Afrimaqua international research network, to promote the development of sustainable, nutrition-sensitive marine aquaculture in Africa. The end goal is to contribute to food and nutritional security, help reduce poverty and generate income,
  - The MIKAROKA International Joint Laboratory (LMI, IRD) in Madagascar. This involves the Fisheries and Marine Sciences Institute (IH.SM) in Toliara, the National Centre for Oceanographic Research (CNRO) in Nosy-Be and, more recently, the University of Antsiranana,
  - The African Interdisciplinary Laboratory in Sustainable Nutrition-Sensitive Marine Aquaculture (LIMAQUA) International Joint Laboratory (LMI, IRD) in Southern Africa jointly managed by the Department of Environment, Forestry & Fisheries (DEFF) and the MARBEC joint research unit.

## Project leaders

**Quentin SCHULL** (Ifremer)



**Quentin Schull** co-directs BRIDGES-RESILIENCE. He is a researcher at the French Research Institute for Exploitation of the Seas (Ifremer) MARBEC unit. He is a specialist in evolutionary ecophysiology and uses multidisciplinary approaches ranging from the genome to the organism which are also at the intersection between individuals, populations and environments, the aim being to study these subjects' sensitivity and robustness in a context of global change. His work aims to dissociate the effects of natural and anthropogenic

constraints while promoting the coexistence of man and nature to ensure the sustainability of the marine socio-ecosystem and, more broadly, to achieve sustainable management of resources. Over the last 12 years, his research has combined experimental approaches under controlled conditions with field experiments and in situ monitoring, working in a variety of ecosystems - from the tropics of the south-west Indian Ocean, French Polynesia and Indonesia to more temperate zones of the Mediterranean Sea and the sub-Antarctic's polar regions. The MARBEC research unit focuses on societal issues related to marine biodiversity and its uses. The unit has two more specific aims, firstly to develop tools for conserving biodiversity and anticipating emerging risks and secondly to promote sustainable marine fishing and aquaculture.

**Stéphanie D'AGATA** (IRD)







**Stéphanie D'Agata** is the co-director of BRIDGES-RESILIENCE. She is also a researcher at the IRD's ENTROPIE laboratory, working at the European Institute for Marine Studies (IUEM) in Plouzané, France. For the past 13 years, Stéphanie's research has concentrated on human-environment interactions in coastal socio-ecosystems, the overall aim being to identify effective solutions to help preserve these ecosystems, ensuring their sustainability and promoting the well-being of inhabitants. Her work is interdisciplinary in its approach,

combining community and functional ecology, conservation biology, biogeography, fisheries science and human ecology to characterise human-environment interactions in coastal ecosystems, with particular focus on artisanal or subsistence fisheries in Madagascar. This approach studies how ecological and socio-economic scales are interwoven to enhance understanding of socio-ecological systems. In more practical terms she integrates empirical data from ecological, environmental, fisheries and socio-economic observations that are combined with statistical modelling tools to evaluate the direct and indirect associations between the multi-scale determinants of the dynamics of coastal socio-ecosystems. She belongs to the ENTROPIE research team, based on Réunion Island and in New Caledonia. Among other subjects, this unit's work focuses on studies of the spatial and temporal dynamics of biodiversity patterns and the sustainable conservation of marine biodiversity in Indo-Pacific socio-ecological systems.



## TP5: BRIDGES-CO-PRODUCTION

**Duration:** 120 months

**Leader:** IRD

**Key partners:** MNHN, Univ. Nantes, the CNRS, INRAE, IRIS,

Univ. Comoros, Univ. Mayotte, Univ. Eduardo Mondlane, Univ. Réunion, Univ. Toliara.



**BRIDGES-CO-PRODUCTION's** objectives are to enhance our understanding of the stakeholders involved in maritime governance and analyse tensions and divergences in coastal and marine spatial planning. This includes an analysis of local stakeholders' practices, strategies and projects. The idea is to understand stakeholders' interactions and generate spaces for dialogue regarding the management of marine protected areas. Analyses of power relations combined with various types of knowledge mobilization is intended to support the definition of alternative trajectories for the socio-ecosystems concerned in terms of sustainability and equity criteria.

This targeted project aims to find responses to the following scientific questions:

- How can we understand the dynamics of maritime management from the standpoint of stakeholder practices and maritime environment, so as to co-construct oceanic futures?
- How do power relations influence public action and maritime planning mechanisms, and how can socio-environmental justice guide decisions?
- What participatory mechanisms are best suited to the objectives of shared governance? What are their effects?

**BRIDGES-CO-PRODUCTION** bases its approach on transdisciplinarity and the adaptation of participatory mechanisms to local and regional contexts. It takes power relationships and controversies into account to transform socio-ecosystems in a more effective, fair and sustainable way.

**BRIDGES-CO-PRODUCTION 's** priorities are to:

- Study the normative frameworks for the management of coastal and maritime areas at different scales to find out more about multi-scalar governance and spatial or social (dis)continuities,
- Analyse uses to enhance our understanding of the access to maritime areas, their resources and their environmental impact,
- Study the shared governance mechanisms implemented in the marine protected areas of the region and put forward an analysis of the trajectory of participatory



mechanisms,

- Jointly construct participatory mechanisms and develop management principles adapted to these case studies that can generate dialogue, help information circulate and encourage sustainable and inclusive transformations.
- It is based on:
  - The DIDEM ('Dialogue Science-Decision-Makers for the Integrated Management of the Coastal and Marine Environment in the Western Indian Ocean') project, jointly funded by the IRD, the French Facility for Global Environment (FFEM), the International Development Research Centre (IDRC) and the Monaco Exploration Society from 2021 to 2024, notably in the Comoros, Mozambique and Madagascar.
  - The RECOS ('Resilience of Coastal Ecosystems of the south-west Indian Ocean') project jointly funded by the French Development Agency Agence Française de Développement (AFD), the FFEM and the VARUNA project funded by the AFD that studies scientific societies' relationships.
- Existing partnerships and results.

As a complement to these initiatives, TP5 will be based on fieldwork with partners and will apply qualitative, quantitative and multi-scalar approaches. This is intended to enable researchers to develop a detailed framework for the analysis of stakeholders including their practices and strategies and provide socio-environmental justice indicators to help jointly produce sustainable trajectories for marine socio-ecosystems.

## Project leaders

**Stéphanie DUVAIL** (IRD)



**Stéphanie Duvail** is a geographer and senior researcher working with the IRD. Her research concentrates on coastal zone management in Africa with specific focus on floodplains, deltas and estuaries. She studies land-sea interactions by looking at the effects of dams on ecosystems and rural economies that are located downstream of the infrastructures. More generally, her research focuses on aspects of water and resource sharing and land and coastal planning issues associated with these. She has carried out research in transdisciplinary teams using participatory approaches in Kenya, Tanzania and Mozambique.



## Tarik DAHOU (IRD)



**Tarik Dahou**, is an IRD senior researcher who studies the political anthropology of governance of maritime spaces and resources in the Maghreb and Sub-Saharan Africa. His research ranges from study of global public policy standards to how these are transposed nationally in specific territories. It also includes an analysis of the subjective dimension of these policies based on a study of local maritime stakeholders' representations and practices. This approach is dedicated to take the interactions between the dynamics of trade, fisheries and the environment into account as they determine maritime resources' uses and ownership rights. His

multi-scalar approach leads to examine power relations across sectors of activity, regulatory institutions and spaces and thus shed more light on the social construction of such rights.

## Brice TROUILLET (Nantes University)



**Brice Trouillet** is a professor of geography at the University of Nantes who specialises in the social geography of the marine environment. His research concentrates on the dynamics of human activities at sea and on maritime governance, particularly maritime spatial planning. His work is based on the spectrum of Science & Technology Studies and critical approaches and uses the example of fishing activities in the context of maritime spatial planning to study more specifically the interweaving of power relations and knowledge in (geo)technological resources like data, types of knowledge, planning documents or cartographic

representation. The end goal is to shape the 'socio-technical arrangements' that mediate relations with the marine 'environment'. Also in this area of research, he is increasingly focusing on informational issues (production, processing, representation, circulation, use) and the associated issues of power, drawing on thinking and results from the Digital Geographies.



## TP6: BRIDGES-IMPACT



**Duration:** 10 years

**Leader:** IRD

**Key partners:** INRAE, CNRS, University of Mayotte, University of Reunion, Labos 1point5

BRIDGES carries out research into the marine social-ecological systems of 6 study sites to analyse existing site management strategies and contribute to multi-stakeholder dialogue, thus helping to initiate fair and sustainable transformation processes.

**BRIDGES-IMPACT** aims to help understand, monitor and amplify those transformations and the processes involved. This targeted project will also assess the impacts of BRIDGES actions. Its innovative approach involves working over a 10-year period on the regional scale of the south-west Indian Ocean.

This project will guide BRIDGES stakeholders towards common definitions and objectives. This implies extensive and regular co-production and coordination work.

**BRIDGES-IMPACT's** priorities are to:

- Amplify the impact of the other TPs and of BRIDGES as a whole, particularly by supporting stakeholders in defining desirable future outcomes;
- Contribute to knowledge on the impact that research - and more specifically transdisciplinary research - can have on the transformation of marine social-ecological systems;
- Contribute to reducing BRIDGES' environmental footprint by raising awareness among its scientific community, calculating carbon footprints, and jointly constructing reduction strategies;
- Train facilitators in the SWIO region to set up workshops aimed at reducing environmental impacts.

**BRIDGES-IMPACT's** work is mainly based on:

- Analysis of past transdisciplinary research projects carried out in the SWIO to find lessons and recommendations for BRIDGES;
- Methods for assessing the impact of research, like ASIRPA-Temps Réel, that will be adapted and implemented in each study site.

This project will work closely with the other TPs to integrate their results effectively into impact assessment templates and enable them to enhance the impact of their work throughout the programme.





## Project leaders

### Rodolphe Devillers (IRD)



**Rodolphe Devillers** is an IRD senior research scientist, deputy director of the ESPACE-DEV research unit and will be head of this project. His research focuses on applying geographical approaches (like a geographic information system and spatial ecology/statistics) to marine sciences and conservation. Rodolphe Devillers has extensive experience of work combining marine protected areas (MPAs), fisheries and sustainability sciences which are the focus subjects for BRIDGES. In the last 20 years he has led over 40 research projects including large-scale international initiatives, with his

research focusing on the south-west Indian Ocean region in recent years. His interdisciplinary background has made him used to working at the interface between the natural and social sciences in the marine science field. He has a strong scientific record with around a hundred publications and has (co) supervised 11 PhD students and 4 post-doctoral fellows.

### Adrien Comte (IRD)

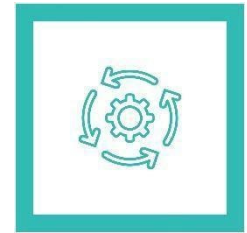


**Adrien Comte** is an IRD scientist based at the LEMAR research unit in Brest and will be the co-director of this project. He is an ecological economist and sustainability scientist whose research focuses on the challenges of measuring sustainability and evaluating climate change mitigation and adaptation policies in marine socio-ecological systems. Adrien Comte also has extensive experience at the interface between science and policy through consulting work for the FAO, policy briefs with the Ocean & Climate Platform or involvement with working groups with the French Biodiversity Office, the National Biodiversity Observatory and the Ministry in charge of environmental affairs. More recently, Adrien

has worked on several projects involving the development of indicators, dashboards and accounting systems for enhanced measurement of the sustainability of different territories and countries to assess public policies and provide scientific input for decision-makers. He has published a dozen interdisciplinary and international research articles.



# BRIDGES-TRANSVERSE



**Duration:** 108 months

**Leader:** CNRS

**Key partners:** Ifremer, IRD, MNHN

**BRIDGES- TRANSVERSE** provides transversal support for all program activities, meeting the following objectives:

- Promote the connectivity of scientific work within BRIDGES, through the funding of interface and transversal activities to BRIDGES targeted projects (TPs), and with a concern for the pooling of means and resources.
- Respond to emerging needs and new opportunities for collaboration
- Strengthen interactions with stakeholders
- Support the activities of the Operational Secretariat on cross-cutting activities, such as implementing the communication strategy, setting up cross-TP activities and workshops, and capacity sharing.

## Planned actions:

- From 2024:
- Creation of a cross-functional Human Resources Department, including the recruitment of 3 engineers over the duration of the program to support cross-TP activities (2026)
- Creation of a collaborative participatory science platform (2026)
- Support for capacity sharing in scientific computing
- Funding for the deployment of equipment to meet cross-functional needs
- Funding for the acquisition of observational data to complement PC forecasts and achievements, including an observational mission to the Scattered Islands (2027)
- Launch of an offshore campaign project "Capacity sharing and networks" (2026)
- Contribution to partnership research projects on workshop sites (from 2026)
- Support for transversal cross-TP activities along the way: thematic meetings and summer schools, cross-TP workshops
- Support for the implementation of the global communication plan to meet the objectives and regional and international outreach of BRIDGES



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