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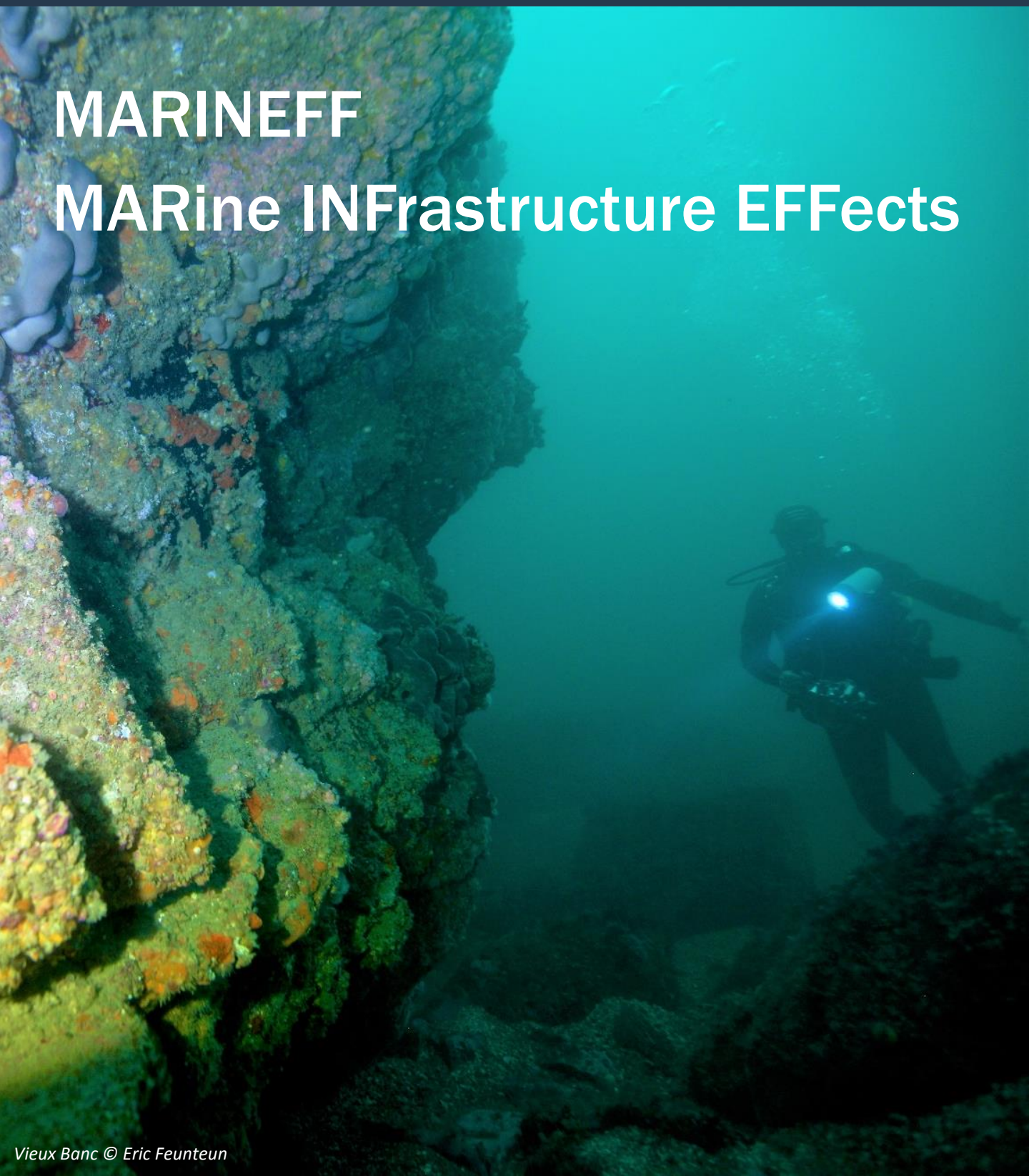


MARINEFF
infrastructures maritimes biomimétiques



Edition 3
February 2020

MARINEFF MARine INFrastructure EFFects



How to get involved

If you are interested in keeping up to date with all current project activities, you can subscribe to mailings, follow us on Facebook, Twitter, or LinkedIn or visit the news section of the website. If you are interested in attending a workshop, please contact Jess Bone, Bournemouth University.

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Mailings sign-up

To sign-up to future Marineff mailings, including this quarterly newsletter, click [here](#).

Please note, upon sending an email to this address, you will be automatically signed up to the Marineff mailing list and included in future newsletter communications. Information on how your data is handled can be found at:

www.ciria.org/marineff

To unsubscribe from mailings, please click [here](#) and enter your email. If you are subscribed, this will remove you from the database.



Further information

To find out more about the Marineff project, go to:

<http://marineff-project.eu/>

In this issue

Deployment sites – an in-depth look at the deployment locations for the eco-engineering modules and why they were chosen

Women in Marineff – we learn more about the women who work on the Marineff project within the fields of marine biology, engineering and materials science

University of Caen Normandy: in focus – a brief profile about the French partner University of Caen Normandy

In a nutshell

Welcome to the third edition of the Marineff project's dedicated newsletter. We hope all our readers enjoyed the festive period and have had a good start to the new year. We've been busy manufacturing all the eco-engineering modules over the winter and are getting ready for deployment this spring. We're excited to start the new decade leading research into more sustainable coastal development.

In this newsletter we share more about the deployment sites that will be home to the four eco-engineering modules. Readers will get to find out why those sites in the Channel have been selected and learn more about their existing ecology and biodiversity. Readers will also meet the women of the Marineff project, as part of celebrating International Women's Day (8th March 2020).

And finally, French partner University of Caen Normandy share more about their academic institute, their involvement in the project and their expertise within the field of marine biology and ecology.

Diving deeper into the deployment sites

Marineff has been working hard behind-the-scenes securing a total of eight confirmed deployment sites for all four of its state-of-the-art eco-engineering modules. In addition to gaining permission from landowners, port authorities and stakeholders, the site must also have the right conditions; salinity, depth, seabed type and so on. This has been a lengthy process but we are hopefully on track for a flurry of activity to get all 219 units in the water this spring!



Restoring native oysters back to the Solent

The oyster prism modules will be deployed in the Solent, a 20 mile strait of water separating the Isle of Wight from mainland UK. Historically, the Solent once supported the largest native oyster (*Ostrea edulis*) fishery in Europe, peaking in 1978 with a harvest of 15 million oysters. The Solent oyster fishery has been in decline since the 1980s and had commercially collapsed by 2013 for a number of reasons; habitat availability, disease mortality, predation, water quality, fishing and the interactions among these factors.

The Blue Marine Foundation, a Marineff project associate, began deploying cages of mature oysters to produce larvae in the Solent in 2017 as part of the 5 year Solent Oyster Restoration Project. Marineff project partner, the University of Southampton, has collaborated with Blue Marine Foundation to coordinate restoration efforts in the Solent area with Marineff's own prism oyster settlement modules. By deploying these in the Solent, Marineff is aiding the settlement of local native oyster larvae by providing conditions found to be optimum for oyster settlement.

Twenty-six oyster prism modules will be deployed sub-tidally within the historic habitat range of the native oyster in the Solent. Drop-down camera and side scan sonar have revealed the seabed consists of the sand, mud, gravel and shell favoured by the naturally occurring Solent oysters.

Finding space for 150 artificial rockpools

Three deployment sites on both the UK and French coasts will be home to 150 artificial rockpools, and as Marineff's only intertidal eco-engineering module, finding the ideal locations has been no mean feat. Pools will be arranged so that marine biologists at Bournemouth University can investigate the effect of distance between pools on the colonisation of the surrounding wall and the pools themselves. This will provide crucial information to help coastal engineers integrate artificial rockpools into future development.

In the UK, both sites required 80 metres of uninterrupted, featureless concrete seawall to accommodate the experimental array in the UK's narrow tidal range. Despite the many miles of hard engineering on our coasts, there were only a handful of places which met Marineff's requirements; Poole Harbour, Dorset and Bouldnor, Isle of Wight will have 50 pools installed at each site.

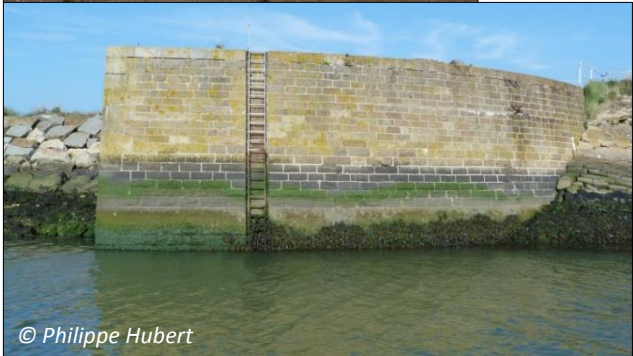
In France, the Ouistreham site is slightly different; with just 15 metres of stone-based sea wall available, the experimental design has been amended accordingly, taking advantage of France's much larger tidal range.



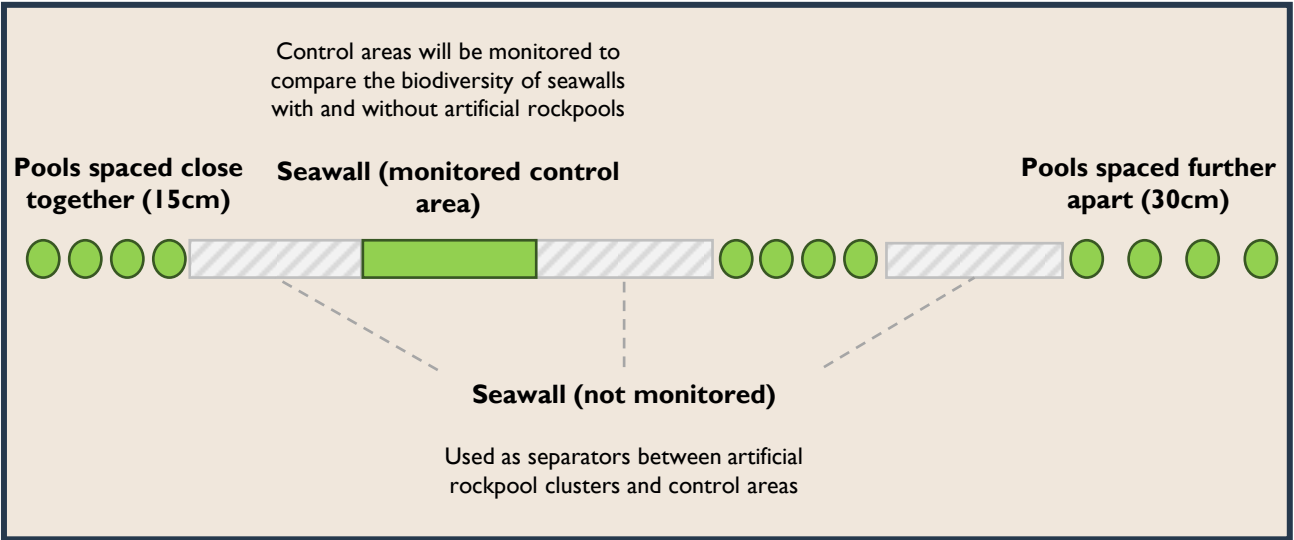
Poole Harbour (UK) site at low tide



Bouldnor (UK) site at low tide



Ouistreham (FR) site



An example of a sub-section of the UK experimental design

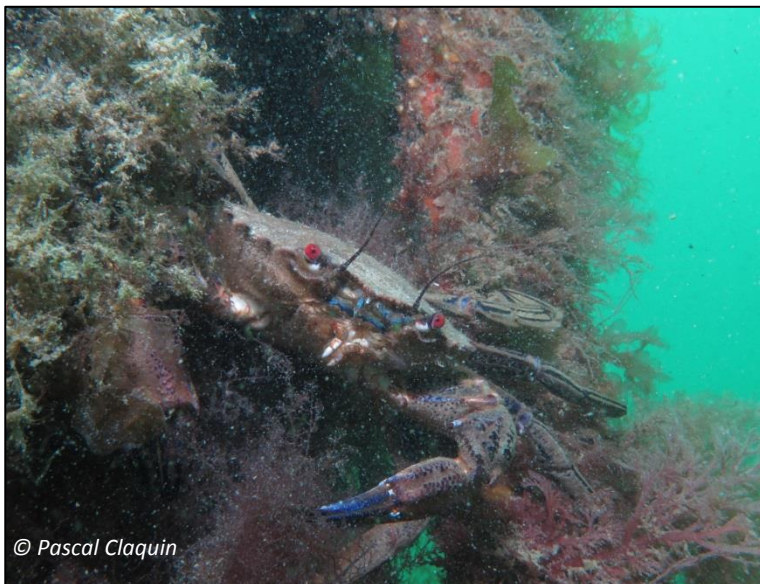
Deploying the breakwater modules

Following manufacture over winter, 36 breakwater modules are ready to be deployed off the coast of France. Twelve will be deployed off the coast of Bernières-sur-mer in a high-energy environment in a north-south alignment. The seabed at this site is predominantly sandy with some rocky outcrops. Twenty-four breakwater modules will be deployed within the comparatively low-energy Cherbourg harbour.

All breakwater modules are being deployed local to existing artificial reefs from the RECIF project, so the sites are well known to marine biologists at University of Caen Normandy. There will be three metre gaps between each module for divers to navigate between them easily during monitoring. Their orientation (north-west – south-east off

Bernières-sur-mer, west-east in Cherbourg harbour) optimises their exposure to the currents, and also the larvae they carry to maximise colonisation by marine species. Both plain control and enhanced experimental modules are alternated in two rows to prevent grouping and any bias that might cause.

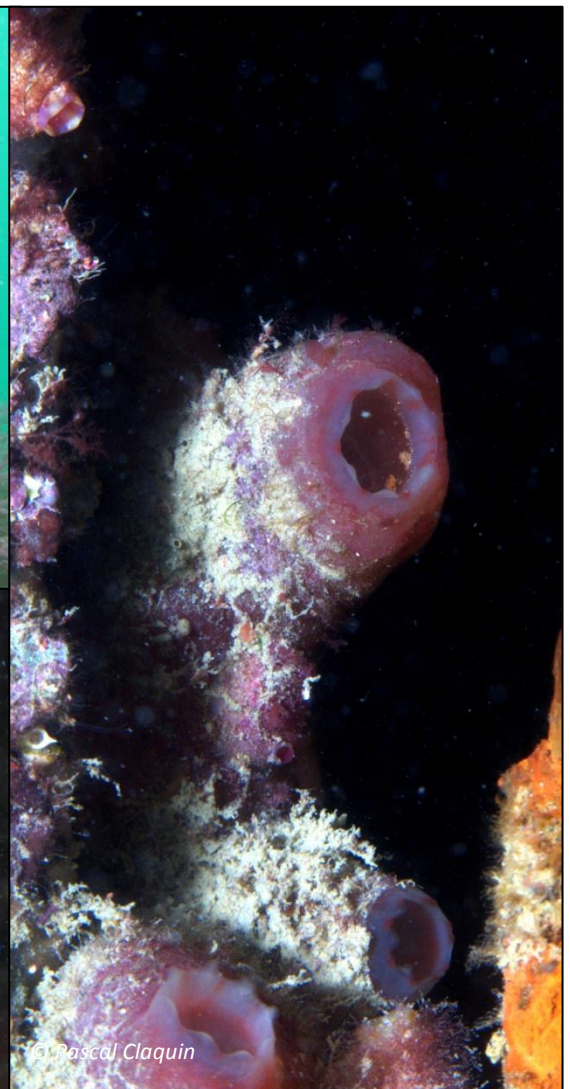
Their deployment in predominantly sandy seabeds will provide a new hard substrate that will enable the attachment of sessile species such as barnacles, and seaweeds, enriching the local sandflats. The RECIF artificial reefs in Cherbourg Harbour already host a rich biodiversity (see images below) and it is anticipated the breakwater modules will be equally successful.



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Fauna found on the existing artificial reefs in Cherbourg harbour. Top left, clockwise: velvet swimming crab (*Necora puber*); red sea squirt (*Ascidia mentula*); tompot blenny (*Parablennius gattorugine*)

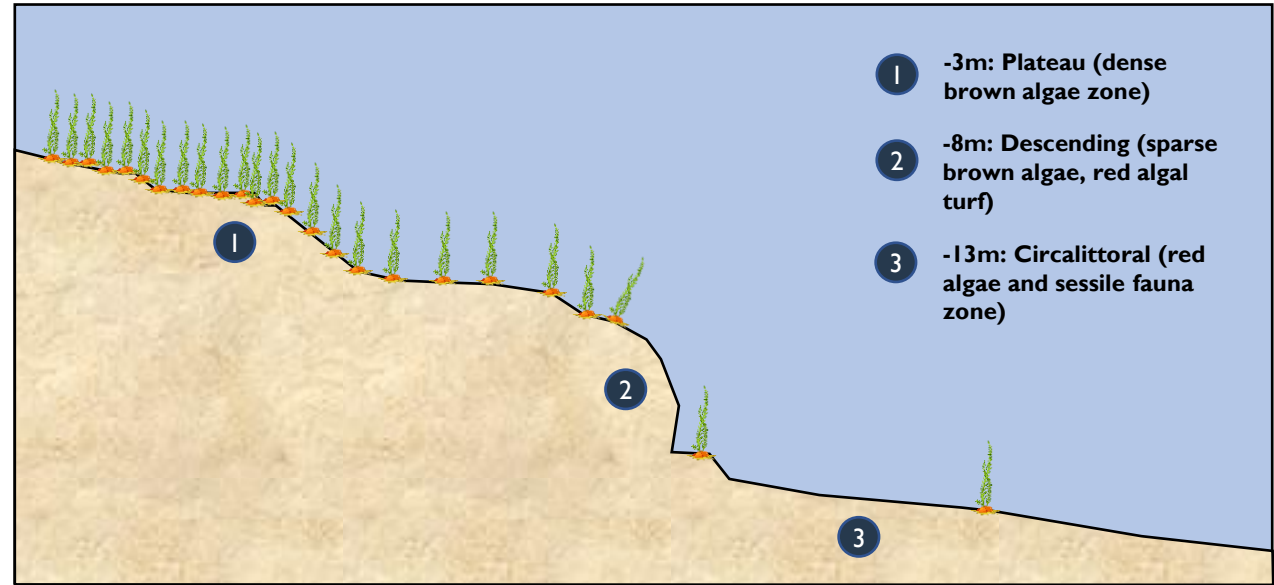
Installing the boat mooring modules

The Marineff boat mooring modules will be deployed in three sites off the coast of Dinard to capture the large coastal gradient of the bay. The area is popular for diving but unfortunately, very few dive sites have fixed moorings that allow dive vessels to attach to them and so the sites chosen will benefit from dedicated boat moorings provided by Marineff. The aim for the Marineff boat mooring modules is to reduce the impact of scouring caused by the anchors dropped by dive vessels. The proximity of the modules to natural reefs makes it easier to monitor both at the same time, so the ecology and biodiversity of both natural reefs and boat mooring modules can be compared.

The Bizeux, Buharats and Vieux Banc sites all share the same subtidal rocky reef substrate at depths of -3m, -8m and -13m respectively. Dense brown algae forests in the shallower reefs of Bizeux give way to reefs dominated by red algal turf in Buharats. The deepest deployment site of the Marineff project, Vieux Banc, is dominated by sessile fauna, such as sponges, and patches of kelp.



Images of the deployment sites and their fauna; Bizeux (top) and Buharats (bottom)



General biotopes of the boat mooring module sites (adapted from the work of Pierre Thiriet)

Introducing the women of the Marineff project

To celebrate International Women's day on the 8th March 2020, the women of the Marineff project have provided short biographies of their professional backgrounds and their duties within the project. These will be focused around the fields of marine biology, engineering and materials science.

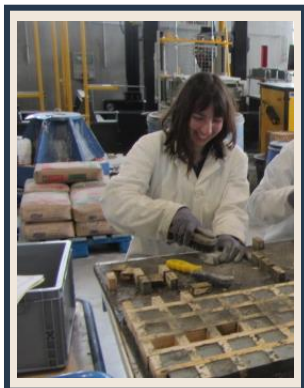


Aurélie Gerault – ESITC Caen

I am an R&D engineer in the project team in charge of the Marineff project. I am based at ESITC Caen. Caen is the city where I have completed all my studies since my Bachelors degree. In 2015, I completed my thesis in radiobiology. My studies have allowed me to acquire many skills in different fields and at different levels. My wish has always been to be at the forefront of my scientific field. Today, I participate in the creation of many research projects in the construction field and follow-up their progress. In the Marineff project, my role is to lead the partnership and provide it with all the useful information to ensure the smooth running of the project. I am the contact between the partners and the program funder.

Zoë Holbrook – University of Southampton

I am a Leverhulme Trust Doctoral scholar studying at the Marine and Maritime Institute at the University of Southampton based at the National Oceanography Centre. Blue Marine Foundation is conducting a European flat oyster (*Ostrea edulis*) restoration project in the Solent, and my multidisciplinary PhD is looking at the implications of restoring this species. The Marineff project has allowed me to conduct extensive fieldwork in the area and offers an effective network of fellow ecosystem restoration enthusiasts. My thesis will quantify the survival, development and physiological quality of the *O. edulis* individuals laid on the seabed, predict spat fall based on predictions of larvae dispersal by a Lagrangian particle-tracking model, quantify the ecosystem services provided by restoring the *O. edulis* population in the Solent, and develop management recommendations for future bivalve restoration projects.



Marine Georges – ESITC Caen, University of Caen

I'm a PhD student in 2nd year of Civil Engineering at ESITC Caen (France). I have a Research Master's degree in Marine Sciences from the University of Caen (Normandy, France). Within the Marineff project, I am working on the optimization and preparation of concrete specimens. I also carry out durability tests of materials immersed in the marine environment.



Amel Bourguiba – ESITC Caen

I'm a lecturer and researcher at ESITC Caen and I'm working on concrete mix optimisation for the manufacturing of the eco-engineering units as part of the Marineff project. I undertook my university education in Tunisia. I obtained an engineering degree in analytical chemistry and instrumentation. I wanted to continue my studies in the field of research, so I did a thesis in joint supervision in chemistry and civil engineering between the Faculty of Sciences of Tunis and the University of Cergy Pontoise. I graduated in 2016. My thesis allowed me to develop knowledge and skills in the field of building materials. Since then, working within the Marineff project has allowed me to discover another field of research which is marine biology.

Jess Bone – Bournemouth University

I'm a marine biologist and Research Assistant for the Marineff project and I'm based at Bournemouth University (UK) where I also studied both my Bachelors and Masters degrees in marine ecology. I've enjoyed the interdisciplinary element of Marineff as it has given me the opportunity to learn more about engineering and materials science which has complemented my contributions in designing the Marineff pool. I'm also responsible for the Marineff newsletter. Having grown up and studied on the south coast of the UK, I champion British marine wildlife and have a soft spot for the intertidal invertebrates. I am also secretary for the Poole Harbour Study Group.



Violeta Monteiro Ramos – University of Exeter

I am a Geologist who started her research career with a PhD and a Post-Doc focusing on the investigation of concrete degradation due to the presence of reactive aggregates. Currently I am working as a Research Fellow at the University of Exeter (UK). The participation on the Marineff project enables me to contribute with my knowledge in the characterization of the mineralogy and microstructure of concrete and its raw materials using petrography, scanning electron microscopy, XRD, Qemscan, among other techniques. This will allow me to monitor how the materials perform technically as well as with respect to bio-colonisation and biodiversity upon immersion in the sea and, thus, to contribute to the development of ecologically viable coastal infrastructures for protecting habitat and biodiversity in the Channel.



University of Caen Normandy: in focus

Three research units, BOREA (Biology of the ORganisms and Aquatic Ecosystems), LUSAC (University Laboratory of Applied Sciences of Cherbourg) and M2C (Continental and Coastal Morphodynamics), as well as the Centre for Research in Coastal Environment (C.R.E.C.) - marine station of the University of Caen, located in Luc-sur-Mer, bring their expertise to the MARINEFF project. Research teachers, engineers, technicians, post-doctoral fellows and a doctoral student are involved in the Marineff project.

The BOREA and M2C units are in charge with the support of the C.R.E.C. of environmental monitoring of the project's Normandy sites: Cherbourg, Bernières-sur-Mer and Ouistreham. The University implements boats and a team of scientific divers. The dive teams provide *in situ* sampling and measurements to characterize the biodiversity and productivity of new ecosystems developing on the marine infrastructure immersed as part of the project. They have standardized protocols in place that can then be applied to other sites. Experiments on larval fixation and

biofilm development are also carried out in mesocosms. The University also provides environmental monitoring of the artificial rockpools in Ouistreham.

All of this work on zoobenthos, microalgae and macroalgae, *in situ* and in mesocosms, use a wide range of instrumentation (modulated fluorimeters, benthic chambers, 3D camera) and the means of the University's CMABIO3 microscopy center. Indicators of trophic interactions are also being developed by M2C as part of the project.

The LUSAC, located in Cherbourg, is involved in the characterization of the materials used in the design of the project's marine infrastructure. These characterizations relate to samples of concrete before and after immersion (3 months, 6 months, 9 months, etc.). Typical characterizations are structural (MEB analysis, porous distribution), microstructural (DRX, MEB, EDS...) and thermal (ATG). The objective of the analyses involved is to highlight the influence of immersion duration on structural and microstructural properties.



Francis Orvain
MC BOREA



Christophe Lelong
MC BOREA



Alexis Ngueteu Kamlo
Post-doc LUSAC



David Houivet
LUSAC



From left to right: Isabelle Mussio (MC BOREA), Jean-Claude Dauvin (PR emeritus M2C), Anne-Marie Rusig (MC BOREA), Baptiste Vivier (Doctoring BOREA), Pascal Claquin (PR BOREA), David Lemeille (Tech CREC), Jean-Paul Lehodey (Tech CREC), Maxime Navon (Post-Doc BOREA)