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MARINEFF
infrastructures maritimes biomimétiques

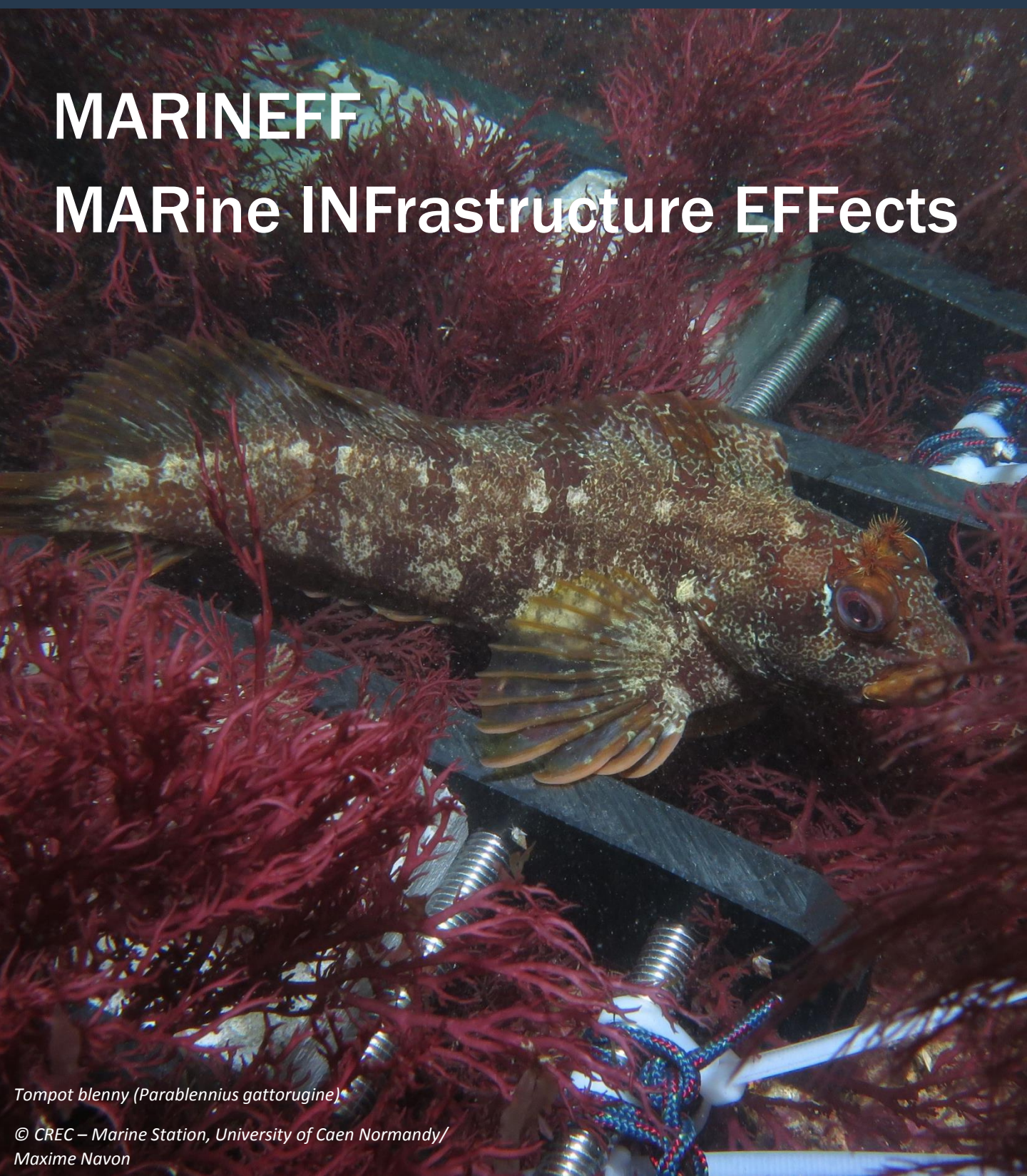


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MARINEFF

MARine INFrastructure EFFects



Tompot blenny (Parablennius gattorugine)

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Maxime Navon

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](#).

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/>



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In a nutshell

Welcome to the fourth edition of the Marineff project’s dedicated newsletter. **We sincerely hope all our readers are keeping safe, well and are staying home.** We have had to cease manufacture at present but anticipate continuing later in the year. Subsequently, our monitoring schedule for our eco-engineering modules will also be postponed but there is still much to look forward to once activity starts up again!

In this newsletter we share more about the variety of innovative manufacturing methods used to create our eco-engineering modules. Readers also get the opportunity to learn more about other Interreg projects that are confronting similar issues with slightly different solutions. We will also share some of the events the Marineff team has been to, giving stakeholders and the public an opportunity to discover more about this exciting field of science.

And finally, UK partner University of Exeter share more about their facilities and team at the Camborne School of Mines at their Penryn campus, their involvement in the Marineff project and their expertise within materials science.

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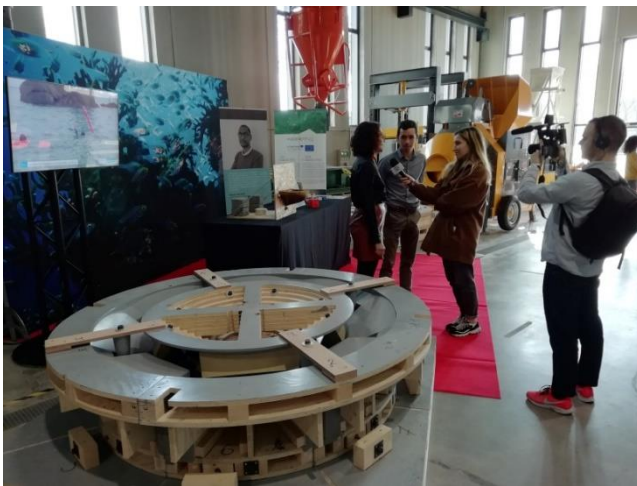
A brief profile about the UK partner University of Exeter

Events

Showcasing the Marineff project

Prior to social distancing restrictions, the Marineff team were attending and hosting events sharing the amazing work we have planned. Below is a showcase of the most recent events, demonstrating our eco-engineering modules to

the general public and key stakeholders. Though we have seen a lot of cancellations over recent weeks, we are taking this opportunity to plan our next events and develop fun and engaging ways of showcasing the Marineff project in the future.



The Marineff exhibit including boat mooring formworks

ESITC Caen hosts J'NOV 2020

On 6th and 7th March, the Marineff project was presented at ESITC's annual J'NOV event which celebrates engineering and technology innovation and trade. The ESITC Marineff team unveiled all the eco-engineering modules that have been developed since the project began in early 2018, including a finished artificial rockpool, the boat mooring formwork and a miniature 3D printed prototype of the breakwater module!

French National Museum of Natural History presents Marineff project at PROME2R

Marineff was presented at PROME2R in Saint Malo, a conference that aimed to promote research and support innovation surrounding the shellfish aquaculture industry. Marineff contributed knowledge about recycling and reusing shellfish by-products, such as the use of crushed shell aggregate in concretes.



© Benoit Salaun

Valentin Danet sits among fellow experts at the PROME2R conference

Caen Yacht Club turns out in force to learn more about Marineff

ESITC Caen visited members of Caen Yacht Club on 30th January to give a presentation about the Marineff project. With over 50 attendees showing up to find out what the Marineff project will be doing along their coast, it was a very successful event!

Bournemouth University presents at coastal eco-engineering webinar

Bournemouth University presented the Marineff project in a successful online webinar hosted by CIRIA 'Coastal Eco-Engineering: Boosting Britain's Biodiversity' on 4th February getting over a hundred viewers. This webinar drew on expertise from a variety of scientists in the field, gaining perspectives from ecologists, engineers and asset owners. If you missed it, you can watch it by [clicking here!](#)



ESITC Caen presents the Marineff project to Caen Yacht Club





Reef blocks have the potential to mitigate for loss of natural reef habitats and enhance food production, coastal infrastructure and recreational amenity. 3D printing technology offers considerable scope to increase the complexity of textures and voids to create block structures that may be more effective than concrete blocks which are currently being submerged.

Though deployment has been postponed for most of the project partners, Bournemouth University managed to deploy their reef blocks in early March; crabs moved in overnight! We are very excited to see what else they find in the coming months.

Introducing Ecostructure and 3DPARE, fellow Interreg projects innovating eco-engineering solutions

3D Printing artificial reefs in the Atlantic (3DPARE)

The [3DPARE project](#) is working to deploy and monitor artificial reef blocks in the Atlantic ocean which have been designed and fabricated using innovative 3D printing technology and sustainable, low-impact bio-receptive materials.



A 3D printed reef deployed in Poole Bay, UK (top left) with a velvet swimming crab using one of the tunnels (above).

Climate Change Adaptation through Ecologically Sensitive Coastal Infrastructure - Ecostructure

[Ecostructure](#) is raising awareness of and researching eco-engineering solutions to the challenge of coastal adaptation to climate change by providing developers and regulators with accessible tools and resources, based on interdisciplinary research in the fields of ecology, engineering and socioeconomics.

Ecostructure aims to promote the incorporation of secondary ecological and societal benefits into coastal defence and renewable energy structures, with benefits to the environment, to coastal communities and to the blue and green sectors of the Irish and Welsh economies. Ecostructure is an operation to be delivered directly by an interdisciplinary partnership bringing together expert staff from five leading research-intensive universities in Wales and Ireland.



Two concrete mixes being trialled for crevice units.

GOT A FEW MINUTES TO SPARE?

You can help Ecostructure by doing a quick eco-engineering perception study by clicking here:

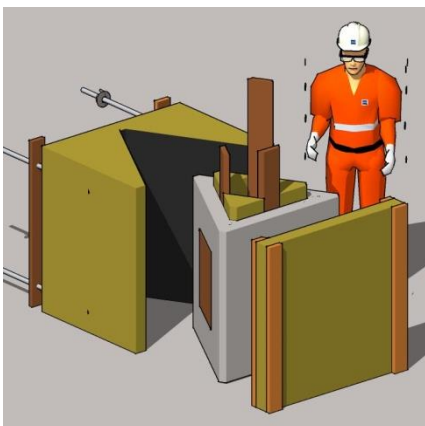
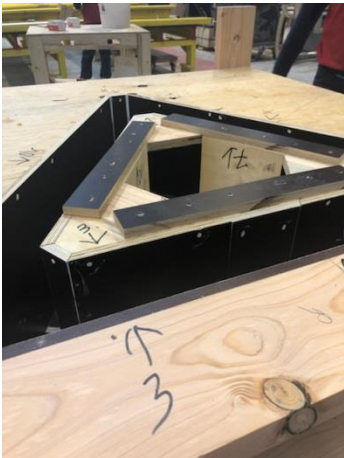
bit.ly/ecostructure

Manufacturing 219 eco-engineering modules



Producing over 200 bespoke concrete eco-engineering modules is no small feat, and at the start of 2020 we were well underway with our schedule to deploy in the first half of this year. Our plans have sadly been postponed but in the meantime we can share with you how we go about manufacturing these unique and innovative eco-engineering designs.

Top left: the rebar frame in the formwork for the breakwater module. Top right: concrete is poured into the formwork. Bottom left: a breakwater module sets in the formwork. Bottom right: How the breakwater module will appear once the formworks are removed.



The Oyster Prism and Breakwater Modules

The oyster prism and breakwater modules will both be manufactured as single units in a similar way by French partner TPC. Steel rebar frames are used to reinforce the structure and are placed in the custom-made wooden formworks. Concrete is poured into the formworks and is allowed to set. Once set and ready to be deployed the formworks will be dismantled, revealing the finished module underneath.

Top left: the wooden oyster prism formworks ready for concrete pouring. Top right: concrete will be poured into the formworks. Bottom: how the oyster prism module will appear once the formworks are removed.

The Artificial Rockpools

The artificial rockpools, produced by Isle of Wight based company Artecology, are cast in custom fibreglass moulds with Vicat Prompt cement and sharp sand ballast. The marine-grade steel T bar bracket is aligned with the mould so it is cast within the rockpool when the concrete is poured. The mould is lined with large bubble wrap which creates a texture on the rockpool exterior of 25mm diameter pockets.

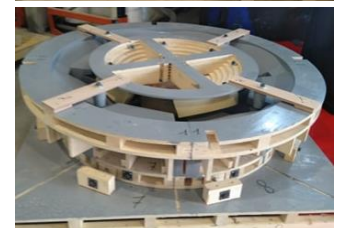
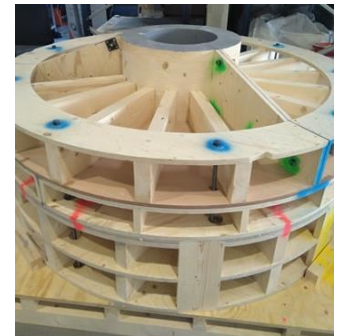
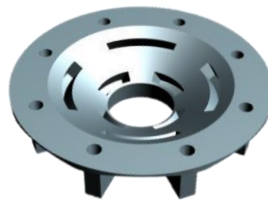
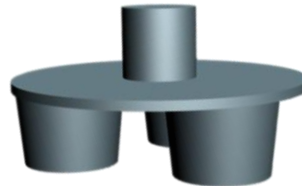
This concrete mix sets within about 25 minutes and is very malleable, allowing for hand-finished features that lend themselves very well to microhabitats. To produce 150 artificial rockpools, this process was streamlined by using a second mould pressed into the concrete to create the 10cm deep pool that can retain 1.5L of seawater! These robust rockpools are now ready to deploy later this year.



Top left: Nigel from Artecology prepares the mould. Top right: the bubblewrap and bracket ready in the mould. Bottom left: a rockpool finishes setting in the mould. Bottom right: finished Marineff pools awaiting deployment.

The Boat Mooring Modules

The boat mooring modules will be manufactured by project partner ESITC Caen. The boat mooring module is possibly the most challenging module to manufacture due to its unusual shape and variety of features, such as tunnels and grooves. The custom-made wooden formworks will be used to produce the module in three parts which will be assembled after each component has set. The base will be made from a denser concrete to ensure the module is heavy enough to anchor boats, and the other two sections will be made using a different bio-receptive concrete.



Top, middle, bottom respectively: the base, middle and top formworks of the boat mooring module.

University of Exeter: in focus

The University of Exeter engages in MARINEFF through the Camborne School of Mines. The department is a truly interdisciplinary unit that integrates mining engineering with earth and

environmental sciences. Researchers are engaged in projects that span mine and quarry design, fundamental and resource geology, climate change, mineral processing, societal and environmental impacts of resource and construction industries. The institution has engaged in many EU projects through Interreg, Horizon 2020 and the Research Funds for Coal and Steel.



From left to right: Professor Jens Andersen (Head of Research), Professor John Coggan, Dr Kate Littler, Dr Ian Bailey, Dr Rich Crane, Dr Gavyn Rollinson, Dr Violeta Ramos

The University of Exeter brings expertise in mineralogy and geotechnical engineering to the MARINEFF. We investigate the mineralogy and microstructure of raw materials and concrete products during the lifetime of the project. This includes aggregates, seashells and cements, as well as the concrete mixes that are used in the eco-friendly marine infrastructures. As part of our work, we monitor how the concretes perform upon their immersion in the sea. The team at the University of Exeter carries out the investigations using state of the art research equipment. The materials are prepared into microscope slides and examined by optical and Scanning Electron Microscope. Close visual examination is required to characterize the

mineralogy and examine microfractures, pore spaces and other microtextures in the materials. Cold Cathodoluminescence Microscopy allows us to examine mineral growth structures (e.g. during curing, response to immersion); XRD (X-ray diffraction) spectrometry aids in the identification of microcrystalline mineral phases, especially polymorphs. The electron-probe microanalyser is used to gain information about chemical distributions; and the QEMSCAN[®] adds information on mineral abundances, associations and particle size distributions. In addition, we carry out other standard tests to evaluate concrete carbonation and the presence of organic impurities in the seashells.



Left: A petrographic microscope. Right: A QEMSCAN[®]