

## Natural Environment Group (NEG) Project Bidding Pro Forma

Please complete all sections and read the eligibility criteria and timescale at [http://www.solentems.org.uk/natural\\_environment\\_group/NEG\\_Projects/](http://www.solentems.org.uk/natural_environment_group/NEG_Projects/).

Project Title:	<b>Tackling the microplastic pollution – testing a new biocomposite material as artificial filtration device, in Chichester Harbour</b>
Project Sponsor/Lead (and full contact details):	<p>Sponsor: <b>Claire Armstrong, Oliver Chipperfield Friends of Chichester Harbour, c/o Harbour Office, Itchenor, Chichester, PO20 7AW, <a href="http://www.friendsch.org">www.friendsch.org</a></b></p> <p>Lead Investigator: Dr. Corina Ciocan University of Brighton, <a href="mailto:C.Ciocan@brighton.ac.uk">C.Ciocan@brighton.ac.uk</a> Cockroft Building 332, Lewes Road, Brighton BN1 4GJ</p>
Project Description and Objectives:	<p>Glass reinforced plastic (GRP) has found various applications across many industries, due to its qualities: lightweight, strength, inert, low maintenance. The original success in the 1960's in boat building saw the marine market as the largest user, in that GRP fulfils over 80% of the overall marine composite demand (Dokos, 2019). Unsaturated polyesters and vinyl esters dominate the plastic component, alongside phenolic and epoxy compounds, which make up approximately three-quarters of the GRP (López <i>et al.</i>, 2012). This <b>plastic element of the GRP</b> material is presumably <b>contributing to the existing microplastic ubiquity in the aquatic environment</b>, through boat hulls natural weathering, cutting, scraping and abrasions. Reports on GRP impacts on the aquatic/coastal environment are beginning to emerge (Ciocan et al, 2020, Simon Bray, IMO report 2019). Aquatic ecosystems and especially estuarine habitats, where fine sediments and organic material bind with contaminants, are known as sink for many contaminants, including microparticles. GRP particles (microplastics and glass fibres) are yet to be characterised in terms of size, density, shape, chemical composition, charge etc – all important features modulating the microparticles' transport, sedimentation and potential ingestion by aquatic species (i.e. oysters, mussels, rag worms). <b>Our University of Brighton group is at the forefront</b> of the research into the fate and effects of GRP, through established collaborations with Chichester Harbour Conservancy, Friends of Chichester Harbour, Boatbreakers Gosport, Chichester Marina. Recent data (Ciocan et al 2020) show <b>sediment contamination with GRP in Chichester Harbour</b> (Fig1), fibreglass accumulation in oyster tissues and devastating impact on zooplankton (Fig.2,3). <b>An organic environmentally friendly material has</b></p>

**been developed** at the University of Brighton, as part of a Master student project (Ms Claude Annels), containing activated carbon with known **affinity for marine pollutants** (heavy metals and some microplastics fractions). The capacity of this biocomposite to adsorb/absorb GRP shards/powder, present in the water column or sedimented, is yet to be tested in the natural environment.

This project aims to:

- a) Improve the formulation of the biocomposite, through the addition of lignin or/and hemp fibres, to strengthen the material and enhance its capacity to withstand powerful mechanical stress (currents/tides) in the aquatic environment (Master student project);
- b) Deploy the biocomposite in selected areas around Chichester Harbour, (we will use seaweed-like moulds to create natural shaped biocomposite and attach it to buoys/pontoons)- (collaboration with Friends of Chichester Harbour charity and Conservancy);
- c) Survey/quantifying the ad/absorption capacities of the biocomposite, by sampling fragments of the material at set intervals. Laboratory analyses to determine heavy metal accumulation and microplastics/glass fibres attached to the biocomposite (collaboration with Uni of Portsmouth and Uni of Southampton).



Fig.1. Fibreglass shards present in the sediment collected from Dell Quay, March 2020. (photo C.Annels)

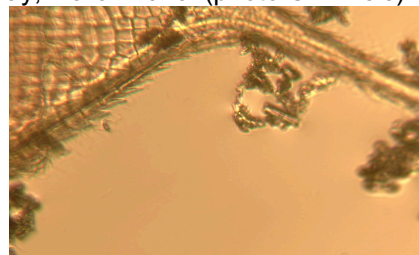


Fig.2. Microplastics from GRP attach to the tail of water fleas, increasing their weight and impairing their swimming abilities (laboratory test, photo C.Ciocan)

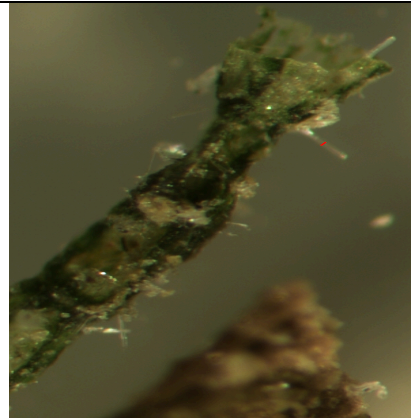


Fig.3. Fibreglass embedded in small pieces of seaweed can be easily transported away from the contamination site (sample from Dell Quay, March 2020, photo C.Annels)

Alongside partners in Chichester Harbour, we will also collaborate with colleagues from Southampton University (Dr. Simon Bray) and University of Portsmouth (Dr. Fay Cuceiro) to identify the best **locations for the material deployment** and to develop the appropriate methods for the **quantification of contaminants attracted/attached to the biocomposite**. Additionally, this material could offer an immediate **alternative nursery habitat**, due to the texture, shape and position in the water column. **Underwater cameras** are going to be deployed in the area to capture the behaviour of local fauna and their interaction with the seaweed shaped biocomposite. The images will be shared with collaborators and sponsors and can be used **for scientific and educational purposes** (student projects, online teaching). A promotional video can also be produced to advertise the project.

What is the value of the project to the Solent European Marine Sites (SEMS), other designated sites or areas of conservation interest?

Our University of Brighton group recently published a scientific article, highlighting for the first time the environmental contamination with GRP (in Chichester Harbour) and the exposure induced adverse effects in aquatic organisms. Our findings suggest that **oysters, mussels and water fleas are affected by the GRP dust** from the boatyards and there is potential for this contaminant to enter the food web. One of the GRP plastic component is poly diallyl phthalate; **phthalates have been acknowledged as potent toxicants**, with impact on reproductive system in humans.

To quantify and attempt to reduce this contamination in Chichester Harbour, we intend to deploy the biocomposite material in selected areas, **especially nearby active boatyards and oyster beds**. Chichester Harbour has been designated under several international and national conservation statuses including Area of Natural Beauty (AONB), RAMSAR wetland, Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA); it also falls within the Solent Special Area of Conservation (SAC). In addition, Emsworth channel, Thorney channel and Chichester channel are listed as shellfish protected areas in England – and these sites are to be selected for our project. If the initial trials show success, we intend to

	develop the project further, seeking financial support for a PhD and intellectual patent IP.
Project Outputs:	The scientific outcomes are the Master student dissertation and a scientific article published in an international journal. We also intend to apply for a patent for the biocomposite material should the testing yields positive results. Above all, the project will produce unique data regarding plastic and fibreglass pollution and transport in Chichester Harbour; video recordings will be used as education materials for ecologists, students and public.
Project Timescale and Milestones:	9 months period, development, deployment, survey, analysis, and report. March – May'21 biocomposite development and site surveying April- July'21 deployment and sampling (biocomposite fragments plus water/sediment) Sept-Nov'21 sample analysis and data collection and interpretation Ongoing survey and potential alteration of the biocomposite formulation; method development and validation; data collection, end of project report and potential documentation for patent.
Overall Project Cost (£): <i>Please detail other funding sources secured/sought.</i>	Overall cost of the project is £3500 to cover for the chemical reagents, travel costs, sample analyses, underwater cameras. The project will be part supported by the Friends of Chichester Harbour charity.
Funding contribution sought from NEG (£): <i>The amount requested should be match funded.</i>	£2000 The project will go ahead without the NEG support, however there will be only a slight improvement of the biocomposite formulation, a very limited testing in the natural environment (one site only) and a limited set of analyses (microscopy). No funds available for underwater cameras and complex sample analysis.
Will the project still go ahead without NEG funding?	
Geographical coverage of the project: <i>The project must cover some aspect of the coastal or marine environment of the Solent.</i>	We intend to deploy the material in Chichester channel (Dell Quay and Itchenor) and Emsworth channel – in locations close to active boatyards, however the sites will be decided through consultations with partners.
Please list any project partners:	Friends of Chichester Harbour, University of Portsmouth, Dr. Simon Bray (University of Southampton), Chichester Harbour Conservancy, Chichester Marina, Dr. Fay Cuceiro (Uni of Portsmouth).
Additional information to support the Bid:	The biocomposite material has passed a series of tests at SeaLife Centre Brighton in 2019: the material is inert and it doesn't alter the water quality even after 40 days submersion. No confounding issues with possible contaminants from the biocomposite have been detected.

## Submission date:

Please email completed forms to [info@solentforum.org](mailto:info@solentforum.org) by the 28 February.