



**Porcupine Marine Natural History
Society
Annual Conference 2015
SPECIES HOME AND AWAY**

at the
Institute of Marine Sciences, University of Portsmouth

Programme and book of abstracts

Porcupine Marine Natural History Society

Annual Conference March 2015

SPECIES HOME AND AWAY

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PROGRAMME

Friday, 27th March 2015

08:00 Registration opens

09:00 Coffee

09:30 Welcome from Prof. Graham Galbraith (Vice Chancellor of the University of Portsmouth)

09:40 Housekeeping

09:50 **Alex Ford**- Exploring the amphipod island (*Keynote*)

10:20 **Alice Bowles**- Ballast water management

10:40 **Tim Ferrero**- MCZs and the Hampshire and Isle of Wight Wildlife Trust

11:00 Coffee (posters)

11:40 **Marianne Wootton**- Cruising the world by *Pseudodiaptomus marinus*: from East Asia to northern Europe

12:00 **Anna Holmes**- New records of trans-Atlantic rafting molluscs

12:20 **Oliver Minto**- The influence of acute hyposaline exposure on the biofouling assemblages of Millbay Marina (Plymouth)

12:40 **Rob Clark**- A revised approach to management of commercial fisheries in European marine sites

13:00 Lunch (posters)

14:00 **Douglas Herdson**- The other silver darlings: lesser known species of pelagic fish in British and Irish waters

14:20 **Ken Collins**- Solent marine non-native marine species, can we stem the tide?

14:40 **Laetitia Gunton**- A comparison of macrofaunal nematode and polychaete assemblages inside the Whittard submarine canyon and on the adjacent slope (NE Atlantic)

15:00 **Andy Gale**- The ancient origins of the modern deep sea fauna

15:20 Coffee (posters)

16:00 **Martin and Sheilah Openshaw**- Underwater recognition of individual *Raja undulata* and their return to a communal site

16:20 **Ross Griffin**- Applying stereo baited remote underwater (BRUV) techniques to monitoring offshore environments

16:40 **Melisa Vural**- Increased movement of the keystone predator, *Heliaster helianthus*, due to differences in turf morphology

17:00 **Rebecca Summerfield**- Advanced imaging of marine life

17:30 Finish

19:30 Conference Dinner at the Spice Island Inn, Old Portsmouth

Saturday, 28th March 2015

09:00 Coffee

09:30 **Paul Naylor**- What are they doing? Capturing marine animal behaviour with underwater photography (*Keynote*)

10:00 **Gordon Watson**- CoCoast: a new citizen science project

10:20 **Roger Herbert**-300 years of sustained observations of the alga *Padina pavonica* in the UK - a story so far

10:40 **Penny Martin**- Shallow water ...but a steep learning curve

11:00 Coffee (posters)

11:40 **Stephanie Deane**- The Pacific oyster: Making itself at home in the UK

12:00 **Tammy Horton**- The Discovery Collections: Cataloguing without a Curator.

12:20 **Andrew Powell**- What is natural? Non-native species and the palaeoecology of Poole Harbour.

12:40 **38th Annual General Meeting** of Porcupine MNHS

13:00 Lunch (posters)

14:00 **Joanne Preston**- Invasive Caprellids in the Solent European Marine Site (SEMS), Langstone Harbour, UK.

14:20 **Susan Chambers**-Saline lagoons- an unusual home

14:40 **Ann Thornton**-“Think I’ll go eat worms.....”: Does nutrient pollution transform upper trophic levels of estuarine food webs?

15:00 Coffee (posters)

15:40 **David Clare**- Species substitutions, biological traits and the functioning of the seabed

16:00 **Alex Callaway**- Folkestone Pomerania: maps and mobile features

16:20 **Ceri James**-Black Bream nesting habitat in the English Channel, UK

16:40 **Tammy Horton and Roni Robbins**- A celebration of Roger Bamber’s life

17:10 Finish

Sunday, 29th March 2015

10:00 Field Trip to Southsea Marina (morning) and Farlington Marshes Nature reserve (afternoon).
Meet at IMS at 10:00

ABSTARCTS OF ORAL PRESENTATIONS

In order of presentation

Exploring the amphipod island (Keynote)

A. T. Ford

Institute of Marine Sciences, School of Biological Sciences, University of Portsmouth, Ferry Road, Portsmouth, Hampshire, UK, PO4 9LY

There are approximately 10,000 described amphipod species making up about one seventh of all the known recorded crustaceans. They are found in marine, freshwater and terrestrial habitats and contribute greatly to the functioning of many ecosystems. The parasite communities of amphipods have provided some of the more seminal research articles on host manipulation and extended phenotypes in evolutionary biology. *Echinogammarus marinus* (Leach, 1815) is a highly abundant intertidal species found from southern Portugal up to Iceland and northern Norway. Until recently it was relatively underrepresented in the ecological literature; however, it has subsequently risen to the fore as a key model species for molecular studies having had its transcriptome and genome sequenced. Amphipods can be infected with many parasites including microsporidia, paramyxians, trematodes, acanthocephalans, nematodes, gregarines and numerous protozoan ciliates, all of which can have dramatic effects of their biology and subsequent population dynamics. This study will highlight some of the interestingly epifaunal and infaunal parasitic communities found in and on the island of "*E. marinus*" and highlight how these have inadvertently helped applied ecotoxicological studies.

Ballast water management

A.Bowles

ABP Marine Environmental Research Ltd, Quayside Suite, Medina Chambers, Town Quay, Southampton, Hampshire SO14 2AQ

Alice Bowles is a marine consultant working for ABPmer. She has a keen interest in non-native species and their spread and introduction in ballast water. This presentation will discuss what ballast water is, the problems associated with ballast water, why it needs to be managed and the Ballast Water Management Convention (BWMC). Alice has worked on a number of projects reviewing the implications of the BWMC for ports and has also completed an internship at IMarEST where she drafted a Ballast Water Guidance Manual.

Water is used as ballast to stabilise vessels at sea. Ballast water is pumped-in which reduces stress on the hull, provides transverse stability, improves propulsion and manoeuvrability, and compensates for weight lost due to fuel and water consumption. It is then discharged during transit. While ballast water is essential for safe and efficient modern shipping operations, it may pose serious ecological, economic and health problems due to the multitude of marine species carried within it. These include bacteria, microbes, small invertebrates, eggs, cysts and larvae of various species. The transferred species may survive to establish a reproductive population in the host environment, becoming invasive, out-competing native species and multiplying into pest proportions. The spread of invasive species is now recognised as one of the greatest threats to the ecological and the economic wellbeing of the planet.

The BWMC aims to reduce the threat of invasive non-native species through setting performance standards for discharged ballast water, based on agreed numbers of organisms per unit volume. The BWMC has not yet been ratified due to a number of perceived problems with the Convention. These include a lack of treatment systems, costs of equipment and implementation, installation capacity, sampling and analysis, guideline robustness and political will. These will be discussed further along with an overview of system alternatives.

MCZs and the Hampshire and Isle of Wight Wildlife Trust

T. Ferrero

Hampshire & Isle of Wight Wildlife Trust Beechcroft House, Vicarage Lane, Southampton SO32 2DP

It is a significant time for marine conservation around the UK. The Marine and Coastal Access Act 2009 provided for the creation of Marine Conservation Zones (MCZs), a new type of protection for important and vulnerable marine habitats and species. Right now a Defra consultation is deciding on the future designation of up to 37 recommended MCZs around the coast of England, ten of which are in the South East, to add to the 27 MCZs designated late in 2013.

Transforming the concept of MCZs into practical conservation areas has proven to be a long and at times difficult process involving many stakeholders and a mass of biological data on habitats and species alongside information on heritage, archaeology, recreation, tourism, industry and economics.

Tim Ferrero will discuss the work of the Hampshire and Isle of Wight Wildlife Trust in the development of MCZs and campaigning for their designation. The talk will discuss what MCZs mean for marine conservation, the importance of the sites currently under consultation and the challenges and opportunities for management of MCZs into the future.

Cruising the world by *Pseudodiaptomus marinus*: from East Asia to northern Europe

M. Wootton and U. Jha

Sir Alister Hardy Foundation for Ocean Science, The Laboratory, Citadel Hill, Plymouth, PL1 2PB, UK,

Pseudodiaptomus marinus is a small calanoid copepod, a type of microscopic crustacean, which is native to East Asia. Over the last 50 years it has spread across the Pacific to the west coast of the USA and, in 2007, was reported in the Mediterranean: its first record in European waters. The Continuous Plankton Recorder survey is *longest* running and most geographically expansive marine ecological survey in the world and has been sampling plankton in the North Atlantic and North Sea, on a monthly basis, for over 50 years. The CPR survey has a strong history of detecting and monitoring non-native planktonic taxa (for example the phytoplanktonic diatom *Odontella sinensis* and the zooplanktonic water flea-like *Penilia avirostris*) and in October 2011 recorded its first ever *P. marinus*, on a sample from the southern North Sea. It has been suggested that in 2010 *P. marinus* was first brought to the southern Bight of the North Sea and Calais harbour by ballast water, possibly via cable ships. In CPR samples *P. marinus* has persisted in late autumn/winter for the last 3 years and during this time has spread northwards, from the southern North Sea to the southern Skagerrak. Studies of previous geographical records suggest that this microscopic alien is not only able to tolerate a wide range of temperatures and salinities, but is capable of adapting its behaviour in response to reduced oxygen concentrations: indicating the likelihood of further spread into the North Sea and potentially the Baltic.

New records of trans-Atlantic rafting molluscs

A. Holmes

National Museum Cardiff, National Museum Cardiff, Cathays Park, Cardiff, CF10 3NP

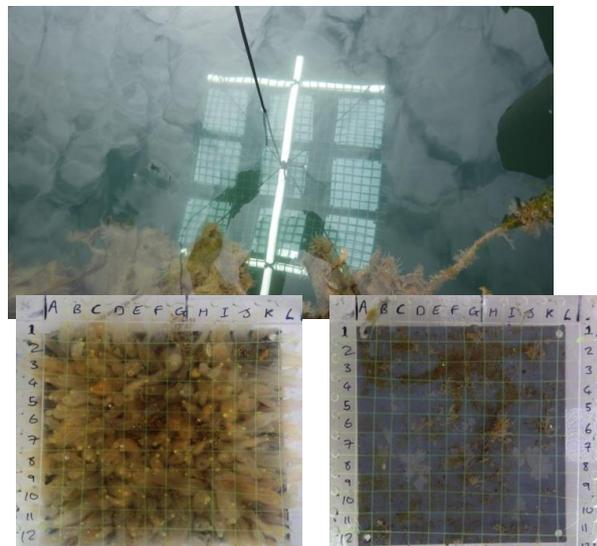
In Winter 2013-14 severe gales impacted the south and west coasts of the UK washing up anthropogenic waste onto several beaches. Amongst the waste items were numerous plastic bait pots containing live molluscs, amongst other phyla. The origin of the mollusc species was determined as West Atlantic from North Carolina through to Brazil. Most of the mollusc species are new records for the UK and are in such low numbers that establishment in the UK is highly unlikely, especially in our cold waters. However, if sea temperatures continue to rise could this be a means of dispersal for west Atlantic species in the future?

The influence of acute hyposaline exposure on the biofouling assemblages of Millbay Marina

O. Minto

University of Plymouth, Drake Circus, Plymouth, Devon PL4 8AA

The recent and exponential growth of international shipping and recreational boating industries has contributed to the transport of non-native species throughout the globe. The biofouling of ships hulls and niche areas within them acts as a significant vector for this process. Transport of species out of their native ranges presents a myriad of ecological implications, often carrying negative effects to food webs and ecosystem services. Ecological damage associated with traditional antifouling techniques, coupled with new legislation banning their use, has created demand for the development of non-toxic antifouling practises. The effectiveness of acute hyposaline stress as a complementary non-toxic method to mitigate biofouling is assessed. With global climatic change inducing regional alterations in precipitation patterns and elevated ice melt, the salinity of coastal areas is predicted to alter in future years. The changes in the community composition of macrofouling assemblages when exposed to low salinity treatments and differential responses of native and non native species within them will be assessed. How will this impact species that call the British coastline home? Will they be more likely to be displaced by species from a far?



A revised approach to management of commercial fisheries in European marine sites

R. Clark

Southern Inshore Fisheries and Conservation Authority, 64 Ashley Road, Parkstone, Poole, Dorset, BH14 9BN

Introduction

This talk describes the revised approach to the management of commercial fisheries in European Marine Sites with particular focus on the process of assessing risk to the conservation objectives of these sites and the delivery of management by the Inshore Fisheries and Conservation Authorities in England.

Marine Protected Areas and European Marine Sites.

The term 'European Marine Sites' (EMS) collectively describes Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) that are covered by tidal waters and protect some of our most important marine and coastal habitats and species of European importance. SACs contain animals, plants and habitats that are considered rare, special or threatened within Europe while SPAs protect important bird species. These sites are designated under the EU Habitats and Birds Directives respectively and form part of the European-wide Natura 2000 network of internationally important sites. EMS are an important component of the Marine Protected Area (MPA) network in the UK.

Article 6 is one of the most important articles in the Habitats Directive as it defines how Natura 2000 sites are managed and protected Paragraphs 6(1) and 6(2) require that, within Natura 2000, Member States: take appropriate conservation measures to maintain and restore the habitats and species for which the site has been designated to a favourable conservation status; Avoid damaging activities that could significantly disturb these species or deteriorate the habitats of the protected species or habitat types. Furthermore, as a consequence of Paragraphs 6(3) a competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which—(a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in combination with other plans or projects), and (b) is not directly connected with or necessary to the management of that site, must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.

Revised Approach

In order to ensure that EMS receive the requisite level of protection, and ensure compliance with The EU Birds and Habitats Directives, Government has decided to revise the approach to the management of commercial fisheries affecting EMS. Building on existing management measures, this will ensure that all existing and potential commercial fishing activities are subject to an assessment of their impact on EMS

Assessment of Risk to the EMS by fishing activity has been through a matrix type approach. This shows, at a generic level, the effect fishing gear types have on the conservation objectives for the relevant features for which EMS have been selected or designated. This generic matrix ("The Matrix") provides regulators with an indicator as to whether:- a. the activity requires priority management measures to be introduced to protect that feature without further site level assessment on the impacts of that activity on that feature or; b. a further assessment may be necessary.

Risk Classification

Under The Matrix fishing activities will be classed as Red, Amber, Green or Blue according to the potential or actual impact of the gear type on the feature(s) for which a site has been designated.

Summary and comment

The revised approach to the management of commercial fisheries in European Marine Sites has meant that in a short period of time IFCAs, working closely with their partners in DEFRA, Natural England and the Marine Management Organisation, have , transformed the management of fisheries in some of our most important marine areas. The fast pace of the change in approach has created challenges for the important inshore fisheries and identified, in some cases, gaps in the data on the location, extent, condition and impacts of certain fisheries activity.

The local resolution and accountability of IFCAs however means that, in accordance with the principles of the localism agenda and the duties in the Marine and Coastal Access Act (2009) important improvements in the management of our near shore waters has been achieved in a short period of time. Looking to the future, as regards to EMS, IFCAs continue to work with local communities to deliver the objectives of the 'Amber Risks' and seek to deploy traditional (boat assets) and novel (inshore vessel monitoring systems) to achieve compliance with the regulations to protect these sites.

The other silver darlings: lesser known species of pelagic fish in British and Irish waters

D. Herdson

Marine Fish Information Services

The pelagic fisheries are Britain's largest fishery, but they are often ignored. And most pelagic fish are in one of three families the Clupeidae or herrings, Scombridae the mackerel and tunas, or the Carangidae – Jacks and trevallies. But most people are only aware of three species the herring, pilchard and mackerel. However, horse mackerel (*Trachurus trachurus*), stocks are large and have in recent years increased to sustain a fishery in the southern North Sea. The North Sea tuna fisheries have gone but we still have tuna in British waters. Unfortunately for our fishermen, the large majority are young Bluefin Tuna, which are protected under EU regulations. Large shoals of Anchovies in winter off the Devon and Cornwall coasts are becoming more frequent; and their occurrence off NE England has been put down to climate change. The Atlantic Chub Mackerel *Scomber colias* (= Spanish Mackerel *Scomber japonicus*) has occasional years when it is regularly found with mackerel. The small tuna the bonito, *Sarda sarda*, occurs some years and from July to October 2014 juveniles were regular in shoals of mackerel, presumably feeding on the then common shoals of small clupeids. The seventh Derby *Trachinotus ovatus* was caught amongst a shoal of Anchovies off Rame Head (SE Cornwall) in November 2014. While the small mesopelagic Silversides occasionally turn up in shallow waters, it could be one of the commonest fish in British and Irish Waters. The crowning glory is the large billfish - swordfish, Spearfish and Marlins that rarely turn up around our coasts.

Solent marine non-native marine species, can we stem the tide?

K. Collins, J. Mallinson, S. Deane, A. Jensen

Ocean and Earth Science, University of Southampton

The Solent marine species assemblage is most definitely not “natural”. The introduction of the slipper limpet, *Crepidula fornicata* in the 1860’s changed the soft muddy seabed of Southampton Water to effectively a “rocky” seabed colonised by a wide variety of hard substrate species, often themselves non-native such as the ascidian *Styela clava*. We can trace individual introductions to new trade routes or wars. The importing of Pacific oysters, *Crassostrea gigas* to France has “accidentally” introduced a suite of attendant species which have spread cross channel with recreational craft, notably the brown algae: *Sargassum muticum* (1971) and *Undaria pinnatifida* (1994). Recently confirmed new species to the Solent are the ascidian *Corella eumyota* and the red alga *Grateloupia turuturu*. The Pacific oyster has become established on the hard intertidal eastern shores of Southampton Water but is not showing the invasive trait of those established on the Essex and Kent shores. Darwin’s barnacle, *Elminius modestus*, introduced to the Solent in the 1950s has largely outcompeted the native species, and more recently the Manilla clam *Ruditapes philippinarum* has effectively replace the native *Tapes sengalensis*.

With funding from the UK Darwin Initiative Collins and Mallinson have been working with the Charles Darwin Foundation, Galapagos on marine invasive species and there hosted the recent International Workshop on Marine Bioinvasions of Tropical Island Ecosystems to both inform the Ecuadorian government authorities of the local conclusions and draw attention to the issues internationally. The Galapagos marine reserve, a UNESCO World Heritage Site is highly valued for its unique biodiversity and value to tourism, thus prevention of marine invasions is a priority with attendant monitoring and rapid response plans. At a lower level we have the Solent European Marine Site, does this deserve comparable protection?

A comparison of macrofaunal nematode and polychaete assemblages inside the Whittard submarine canyon and on the adjacent slope (NE Atlantic)

L. M. Gunton^{1,2}, Gooday A.J.¹, Glover A.G.², Bett B.J.¹

¹National Oceanography Centre, Southampton, UK., ²Natural History Museum, London, UK.

Submarine canyons are considered to be deep-sea biodiversity “hotspots”, harbouring an increased abundance and diversity of benthic fauna compared to the adjacent slope. Nematodes are a common component of deep-sea macrofaunal samples (>300 µm fraction). However, because they are generally regarded as part of the meiofauna, macrofaunal-sized nematodes are rarely studied. Polychaetes, on the other hand, are macrofauna *sensu stricto* and a major element of this size fraction in the deep sea. Nematodes and polychaetes have distinctly different ecological and life-history characteristics. This study examines whether the two groups of worms have different community-level responses to environmental conditions inside a submarine canyon and on the open slope.

Replicate megacores were obtained at three sites in different branches of the Whittard Canyon (NE Atlantic) and one site on the adjacent slope to the west of the canyon, all located at 3500 m water depth. Abundance was highest in the Eastern branch (polychaetes, 6249 ind m⁻²; nematodes 517 ind m⁻²) and lowest on the adjacent slope (polychaetes, 2744 ind m⁻²; nematodes 164 ind m⁻²). Multivariate ordination based on Bray-Curtis similarity of polychaete families grouped the Central and Eastern branches together and the Western branch with the slope site. A similar analysis for nematode genera grouped all branch sites together and distinct from the slope site. Polychaetes and nematodes were both most diverse on the slope and least diverse in the Eastern branch, but the second most diverse sites were different (polychaetes, Central branch; nematodes, Western branch). Analysis of polychaete and nematode feeding types revealed a higher abundance of omnivores in the canyon branches and deposit feeders on the open slope. Both assemblages were different in the canyon branches and on the open slope, but exhibited different patterns between canyon branches, possibly reflecting a closer association of nematodes with the canyon sediment.

The ancient origins of the modern deep sea fauna

A. Gale

School of Earth and Environmental Sciences, University of Portsmouth

Recent hypotheses, based on biogeographic distribution patterns and molecular clock estimates, support a relatively recent (latest Mesozoic or early Cenozoic) date for the origin of the highly diverse present day deep sea fauna. It has been argued that the deep sea biota underwent extensive extinction during Jurassic and Cretaceous Ocean Anoxic Events, when ocean basins became partially anoxic, and was also significantly affected by temperature changes to deep ocean water during the Cenozoic (warming at the Paleocene-Eocene Thermal Maximum; cooling since the Oligocene). It has also been suggested that, following these extinctions, the deep sea was repeatedly re-colonised by immigration of taxa from shallower water habitats. In the absence of direct fossil evidence, all these hypotheses are highly speculative. The problem has been the absence of truly ancient deep sea deposits which might yield fossil evidence. The recent discovery of Early Jurassic and Cretaceous bathyal deposits (i.e. formed in >500m water depth) containing fossils provides evidence which supports an alternative hypothesis, that a significant part of the deep sea biota dates back to the early Mesozoic (200-250 Ma), because they contain remains of echinoderms and other groups which at the present day are restricted to bathyal and deeper settings. It therefore appears that the deep sea fauna is highly resilient to environmental change, and that a significant component is truly ancient in origin. Some groups have undoubtedly colonized deep habitats more recently, because they have only evolved in more recent times, exemplified by octopods and irregular echinoids. There is also strong evidence that some elements of shelf faunas originated in the deep sea - taxa which have successfully invaded shallower water habitats.

Underwater recognition of individual *Raja undulata* and their return to a communal site

M. Openshaw and S. Openshaw

Although undulate rays (*Raja undulata*) are on the IUCN Red List of Threatened Species, they are known to be patchily distributed in the English Channel with sites of local abundance. They are occasionally encountered by divers in areas of Poole Bay and along the Dorset coast. The identification of one particular site in Dorset where *Raja undulata* are commonly seen provides an opportunity to repeatedly observe them in their natural habitat. Photographic techniques have been used to record the pattern on the upper surface of numerous fish. Using widely available image processing packages, individual rays can be identified with confidence and in several cases their size estimated by use of photographic scales. Repeated diving on the site provides an opportunity to build a body of data and observations. Using the photographic techniques and analysis it is possible to identify individual undulate rays that return to the site over prolonged periods, including fish that have been present in successive years.

Applying stereo baited remote underwater (BRUV) techniques to monitoring offshore environments

R. Griffin

Ocean Ecology Limited, Unit 5 Severnside Park, Epney, Gloucester, GL2 7LN

Offshore wind farm development remains in its relative infancy. As a result of the Environmental Impact Assessment (EIA) process the negative direct and indirect ecological impacts of the construction, operation and decommissioning phases of offshore windfarm developments are mostly described. However the introduction of structures associated with offshore renewable developments such as turbine foundations, scour protection and cable rock armour may bring benefits increasing local fish and shellfish populations through provision of new habitat, refuge and increased availability of food. To date fish communities at offshore wind farms have been assessed using conventional sampling techniques such as otter trawling, scientific beam trawling and deployment of gill nets. The nature of these methods and their often destructive impact make them unsuitable for use within the close vicinity of turbine installations, associated sub-sea cables and on sensitive habitats. The use of stereo Baited Remote Underwater Video (BRUVs) provides a novel means of collecting robust and fit for purpose ecological data on motile fauna at close proximity to offshore renewable structures. This study was conducted at Walney I Offshore Windfarm (WOW) located in the Irish Sea west of Walney Island and assessed species relative abundance, diversity and age structure of fish and other motile fauna within benthic habitats at locations of varying distance from turbine installations in WOW using a BRUV system. The BRUV system consisted of two calibrated Canon high definition video cameras within PVC underwater housings, mounted at a fixed position on a galvanised steel frame with a 90 cm bait pole with bait comprised of oily fish. The study aimed to demonstrate the feasibility of the use of BRUV technology as an alternative non-invasive method of assessing relative abundance, diversity and age structure of fish and other motile fauna in the temperate offshore environments of the North Eastern Atlantic.

Increased movement of the keystone predator, *Heliaster helianthus*, due to differences in turf morphology

M. Vural

University of Plymouth, Drake Circus, Plymouth, Devon PL4 8AA

Heliaster helianthus is a keystone predator and is the ecologically most important starfish in the mid-low intertidal zone, along the coast of Chile. It determines the abundance and lower limit as well as preventing the monopolisation of its main prey, the mussel *Perumytilus purpuratus*. This zone is also an area where the turf-forming alga, *Gelidium chilense* thrives; forming mats of algae that suit the settlement of *P. purpuratus*. Previous studies show that the settlement of *P. purpuratus* is linked to the turf height, which is determined by the upwelling patterns in the region. Taller turf (4 cm) is linked with intense upwelling, which is associated with less mussel settlement. This study aimed to determine the displacement of *H. helianthus* in relation to turf morphology. Transplant experiments were carried out and the movement of *H. helianthus* on *G. chilense* was tracked. While the manipulation of the starfish altered their movement, the starfish moved greater distances when placed on taller turf. This is important due to the predicted changes in enhanced upwelling, resulting in changes to turf. Understanding the starfish behaviour is crucial for determining the changes to their prey choice and community structure.

Advanced imaging of marine life

R. A. Summerfield

Core Research Laboratories, Natural History Museum, London

Modern imaging techniques are allowing us to view marine life in novel ways, to give both quantitative and qualitative results to a range of research questions. This talk will give a brief overview of current imaging techniques with examples, before diving in to the some of the varied marine projects I have been involved in as part of the Core Research Laboratories team at the Natural History Museum. These projects cover a variety activities from public engagement, to investigating close coupled host-parasite relationships.



Figure 1. Fluorescence image of copepod parasites on a polychaete host. Taken on Nikon A1 confocal microscope

Figure 2. Rendering of a microCT scan of a harbour porpoise fetus, highlighting the density of ear bones in red.

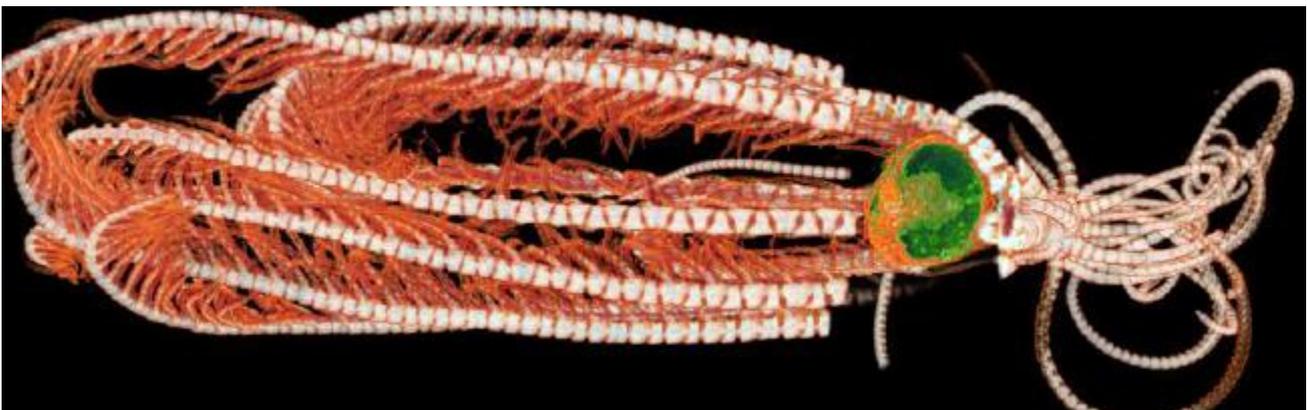


Figure 3. Rendering of a microCT scan of a crinoid with the gut segmented in green.

What are they doing? Capturing marine animal behaviour with underwater photography (Keynote)

P. Naylor

Why do crabs graze chalk? How do different wrasse species interact? How do cuttlefish use colour-change when hunting? When do sand stars produce spawning bulges? Our common marine animals display these and many other fascinating aspects of behaviour. Photographic sequences recording underwater observations will be used to show some of these intriguing aspects, attempt to answer the questions and pose further ones.

CoCoast: a new citizen science project

G.J. Watson

Institute of Marine Sciences, University of Portsmouth

Newcastle University has successfully run the Big Sea Survey project for the last three years. It has trained over 350 volunteers in intertidal ecological surveying, who have worked over a coastal stretch of 150 miles from St Abbs to Saltburn; 70% of those trained have been retained. This talk explains the background to a proposal submitted to Heritage Lottery Fund (decision May 2015) for funding to support the CoCoast programme that will contribute to a national picture of ecological coastal and marine change through a standardised, coherent framework. Partner hubs will be Universities of Newcastle, Portsmouth, Bangor, Hull, MBA, SAMS and MCS as well as involvement from CEFAS, NHM and many other partner organisations. For further details please contact Dr Jane Delany, PI, university of Newcastle.

300 years of sustained observations of the alga *Padina pavonica* in the UK - a story so far

R. J.H. Herbert¹, L.Ma¹, A. Marston², W. F Farnham³

¹Faculty of Science & Technology, Department of Life and Environmental Sciences, Bournemouth University, Talbot Campus, Fern Barrow, Poole, Dorset, UK, BH12 5BB.

² Isle of Wight Council Local Biological Records Centre, Fairlee Road, Newport, Isle of Wight, PO30 2QS.

³ Institute of Marine Sciences, University of Portsmouth.

Understanding long-term persistence and variability in populations of species can help predict their future survival and growth. However sustained observations that enable investigation of responses to multiple variables are exceedingly rare. Here we examine and interpret a remarkable record of the alga *Padina pavonica* (Phaeophyceae) from 1680-2014 at its northern border on the south coast of England (50°N, 1°W). Over this period, which extends from the middle of the Little Ice Age to the present, there has been considerable variability in sea temperature and storminess. We identified a significant number of sites when the continuity of the record ceased in the second half of the 19th century, which coincided with cooler conditions and climatic instability. To interpret these changes we also investigate the species response to inter-annual differences in sea temperature and disturbance due to storm events, which can cause dislodgement of clumps and localised sand-smothering. Growth, production of tetraspores and recruitment were measured at different sites over three years which had low and high spring temperatures. Delayed growth due to a cooler spring resulted in smaller fronds and a lower production of tetraspores by early summer. In the warmer year, rapid frond growth caused increased sensitivity to damage and dislodgement by summer storms, which also limited spore production. Higher temperatures combined with summer storms can therefore have antagonistic effects. Vegetative perennation and propagation combined with higher production of tetraspores during warmer and less stormy years appears to have enabled population persistence and explained the longevity of the historic record.

Shallow water ...but a steep learning curve

P. Martin

An illustrated talk showing a glimpse of what can be seen in the shallow waters around the Orkney Islands and describing an enthusiastic snorkeler's journey discovering and observing many marine species around the easily accessible coastline.

Photos illustrate the diversity of habitat and marine species in Orkney waters and includes short descriptions of stauromedusae species, nudibranchs found unexpectedly in a ferry harbour, jellyfish and hydromedusae blooms and a comparison of species found in different eel grass beds.

It will also include a description of how an amateur was helped to identify different species by posting photos of sightings on the Marine Facebook pages and by becoming involved in Seasearch .

The Pacific oyster: making itself at home in the UK

S. Deane

Ocean and Earth Science, University of Southampton

The Pacific oyster is native to Japan and Korea but a popular species for aquaculture in the UK. Introductions of Pacific oysters into the UK occurred as early as 1890 as a response to declining stocks of commercially viable, native oyster. During this time, Pacific oysters were shipped over from France to grow-on in UK estuaries, where water temperature regimes allowed for oyster growth but inhibited reproduction. Since then water temperatures have risen with global warming, and as a consequence reproduction has been evident in farmed stocks. Aggregations of wild Pacific oysters have been found coinciding with aquaculture production along the southeast and southwest coasts of the UK since the 1990s, and more recently wild aggregations have established in the southeast and south of England, apparently spreading out from areas of aquaculture.

Concerns have been raised that reproductively active oysters will create naturalised aggregations, which might disrupt local coastal ecosystems. This is of particular concern in areas of protected habitat where the development of dense aggregations might compromise the conservation status of that area. Pacific oysters are a fecund species with each female oyster having the potential to release up to 50 million eggs into the water column. Following a planktonic dispersal phase, larvae settle amongst conspecifics allowing for high densities to establish. In this situation a consolidated hard substrate or reef, may form and alter the pre-existing habitat. To date, however, only one such reef has established in UK waters and the importance of ecological control on this invasive species is now being investigated. Furthermore the presence of Pacific oysters on mudflats provides stability and hard substrate for colonisation, providing the potential for an increase in species richness and biodiversity.

The Discovery Collections: cataloguing without a curator

Tammy Horton

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The Discovery Collections (<http://noc.ac.uk/data/discovery-collections>) are an internationally important historical collection of deep-sea marine invertebrate and fish specimens. The first samples were collected in the Southern Ocean by *RRS Discovery*, the ship used by Captain Robert Falcon Scott for his first Antarctic expedition in 1901. The collections are now split, with early material collected up to 1975, at the NHM London and material collected since then housed in a climate controlled warehouse in the grounds of the National Oceanography Centre, Southampton (NOC). This poster details the process of curation and cataloguing of an important large collection of deep-sea samples known as 'The ECOMAR collection' (a 4-year project studying the fauna of the Mid-Atlantic Ridge; <http://www.oceanlab.abdn.ac.uk/ecomar/index.php>) which comprises >1300 lots. The cataloguing was supported in part by the NatSca Bill Petit Memorial Fund.

What is natural? Non-native species and the palaeoecology of Poole Harbour

A. Powell

Poole Harbour Study Group

Poole Harbour formed some 5000 years ago due to rapidly rising sea levels of the Flandrian transgression. Throughout its history it has been subject to a variety of anthropogenic impacts and in the last two hundred years these have included significant introductions of non-native species of plants and animals. Some of which have come to dominate the ecology of large parts of the harbour. These introductions continue to the present day. Set against this dynamic environmental history the present day rapidly rising sea levels and climate warming will certainly result in further significant changes to the ecology of Poole Harbour. This raises important conservation issues. Evidence for the changing ecology of Poole Harbour comes from a variety of disciplines and sources. However a more detailed understanding of the past history and present status is necessary to provide a baseline against which future changes may be recorded and predicted as well as providing important guidance for long-term management and conservation . The use of palaeoecological records to provide a longer term perspective to address conservation issues relating to climate change and biological invasions is already well established in terrestrial ecosystems.

Invasive Caprellids in the Solent European Marine Site (SEMS), Langstone Harbour, UK

J. Preston

Institute of Marine Sciences, University of Portsmouth

Little is known of the molecular ecology of native and invasive species of Caprellids (Crustacea, Amphipoda) in the SEMS. Recent observations of the invasive species *Caprella mutica* Schurin, 1935 (Japanese Skeleton Shrimp) in Langstone Harbour have been confirmed using molecular and taxonomic techniques, establishing a new eastward limit of *Caprella mutica* in southern UK waters. The implications of this biogeographical range expansion of *C.mutica* are discussed. These results form the basis for a proposed long-term monitoring project to establish the distribution of invasive Caprellids in surrounding harbours. For several ecological and conservation reasons, it is important to determine the impact of this aggressive invasive on native species, their habitats and ecosystems.

Saline lagoons- an unusual home

S. Chambers

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Saline lagoons are a priority habitat under the EU habitats directive and have a specialist fauna and flora. An overview of the sites in the UK and a case study in the Uists, Outer Hebrides provide an interesting example of this unique habitat. There are large gaps in our knowledge which is a challenge for monitoring programmes.

Think I'll go eat worms.....": Does nutrient pollution transform upper trophic levels of estuarine food webs?

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Nutrient pollution of estuarine environments is a global conservation concern. Increases in nitrates and phosphates, resulting from land run-off (both agricultural and urban) together with sewage input leads to eutrophic conditions within the intertidal mudflats associated with estuarine ecosystems.

A consequence of increased nutrient levels is the development of macro-algal blooms. Extensive mats of opportunistic green algal species (eg. *Ulva* sp., *Chaetomorpha* sp., *Cladophora* sp.) develop from April with coverage greatest during July and August. These mats can be extensive and some areas have biomass $>2\text{kg m}^{-2}$, currently regarded as a 'tipping point' for detrimental ecological impact under the Water Framework Directive. Subsequent deterioration of algae can lead to the development of hypoxic/anoxic conditions within the sediment that can impact upon the invertebrate community within. Changes in the functional ecology of the intertidal benthic macrofauna could have implications for the estuarine food web. I investigated potential impacts on upper trophic levels by analysing changes in invertebrate abundance under increasing algal biomass then monitoring the behaviour of predatory wading birds in the same study areas. Any reduction in the condition status of EU designated bird populations may have financial implications for the UK's binding agreements under current legislation.

Poole Harbour supports nationally and internationally important populations of overwintering wading birds. These birds arrive in September to feed on the species-rich intertidal mudflats prior to returning to their breeding sites the following spring. Wading bird behaviour has been analysed at three sites around Poole Harbour during the winter period (September – March). Six species (curlew (*Numenius arquata*), black-tailed godwit (*Limosa limosa*), oystercatcher (*Haematopus ostralegus*), redshank (*Tringa totanus*), dunlin (*Calidris alpina*), and shelduck (*Tadorna tadorna*)), were selected for more detailed study. I found that some species (eg. curlew) are adapting to the presence of *U. lactuca* and actively foraging and feeding within the algae.

Species substitutions, biological traits and the functioning of the seabed

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The morphology, behaviour and life-cycle of an organism (its biological traits) determine how it interacts with its environment. Therefore, when the identities or densities of species change within an ecosystem, the associated change in the traits will determine the impacts on ecological functions (e.g. carbon and nutrient cycling). Many of these functions, in turn, underpin the provision of ecosystem services to society (e.g. climate regulation and food production).

Biological traits analysis (BTA) was used to investigate how 40 years of change in two North Sea benthic communities has influenced the expression of traits that drive key ecological functions. Trait composition was found to be statistically indistinguishable across periods that differed significantly in the species assemblage. Temporary alterations to trait composition did, however, occur at both sampling stations; with the station located inside the grounds of a trawl fishery recovering faster than the one located outside the main area of fishing activity.

The results suggest that density compensation ('substitutions') by characteristically similar species act to buffer changes to ecological functioning over time. However, the functioning of the seabed may be subject to disruption due to substitutions of dissimilar species or uncompensated population fluctuations. The rate at which ecological functioning recovers from perturbations appears to be dependent on environmental context; e.g. previous exposure to disturbance.

Folkestone Pomerania: maps and mobile features

A.Callaway

Cefas, Pakefield Road, Lowestoft, Suffolk NR33 0HT

In accordance with the Marine and Coastal Access Act 2009, the UK is committed to the development and implementation of a network of Marine Protected Areas (MPAs). As part of this commitment, within English territorial waters and offshore waters of England, Wales and Northern Ireland, Marine Conservation Zones (MCZs) will form part of this network.

Due to the scarcity of survey-derived seabed habitat maps in UK waters, assessments of data for site recommendation were necessarily made using 'best available evidence', which included historical data, modelled habitat maps and stakeholder knowledge of the areas concerned. It became apparent that the 'best available evidence' on features for which some sites had been recommended as MCZs was of variable quality. Consequently, Defra initiated a number of measures aimed at improving the evidence base, one of which took the form of a dedicated survey programme, implemented and co-ordinated by Cefas, to collect and interpret new survey data at selected rMCZ sites.

Here we detail the process data acquisition and the resulting site verification through to baseline monitoring plans and the consequences of repeat survey and temporal disparity between data sets. This has implications for map creation in areas with mobile features and offers an opportunity to explore what maps really

Black Bream nesting habitat in the English Channel, UK

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The construction of nests for spawning on the sea bed by black bream off the coast of southern England has produced a distinctive pitted landscape which is particularly well imaged on sidescan sonar records. The sidescan sonar records have enabled the location, extent and form of black bream nests to be mapped. Sub-bottom shallow seismic records and regional geological studies have provided the context and evidence for the construction of nests in particular localities. The geophysical evidence and interpretation has been ground truthed by diving, video and still photography.

In spring each year black bream migrate to shallow coastal waters within the study area. Once inshore the black bream form spawning congregations. Larger male black bream seek characteristic sea bed surfaces which enables them to build or excavate individual 'nests' as depressions on the sea bed in the hope of attracting a mate. Male black breams use their tail during nest building to remove unconsolidated and relatively fine mobile sediment on the sea bed surface layer to expose bedrock or compacted gravel to form the floor of these nests.

Sea bed substrates and features which have been correlated with black bream nests include thin sand and gravel, and gravel on bedrock, some have been on sea bed adjacent to reefs and wrecks. The bedrock they have been noted on includes Cretaceous Chalk and Tertiary Bracklesham Group sediments.

Individual bream nests are typically between 1–2 m² and 5–30 cm in depth. Collectively they form distinctive groups of pitted features numbered in tens and hundreds on the sea bed. Where bedrock is exposed as very low linear scarps, groups of nests are seen on the shallow dip slopes behind these scarps.

Once a female bream has selected a suitable nest she will lay her eggs in a thin layer within the nest; bream eggs are sticky and become strongly attached to the substrate. After the female has laid her eggs the male fish will fertilise them, the male fish will then guard the eggs until they hatch to protect them from predators such as crustacean and to ensure siltation of the nest does not occur. However, this philopatry does make the adults susceptible to fisheries exploitation. Unmolested juvenile bream will remain in the vicinity of the nest sites until they are 7–8 cm in length; they then disperse but remain in the inshore areas for 2–3 years, when may attain approximately 20 cm in length.

Black bream are protogynous hermaphrodites, at sexual maturity they develop female sexual organs then later, as they grow, they become male. When the bream become sexually mature, as females, they recruit into the adult stock and range into the wider English Channel to feed. It is expected that the bream exhibit site fidelity, perhaps returning to the same sites to spawn annually.

Black bream are not subject to ICES stock assessment, they are not classed as a pressure stock for EU fisheries management purposes and no Total Allowable Catch is prescribed. As a non-quota species the fish is fished inshore and offshore in net and trawl fisheries, notably in the eastern channel area by pair trawlers. There is currently no minimum legal landing size for black bream under European Union Technical Regulations; as protogynous hermaphrodites such measures can have a counterproductive effect. The vulnerability of the nesting sites means that they are suitable candidates for protection through spatial management measures.

In 2013 Kingmere was designated under UK legislation as a protected area or Marine Conservation Zone (MCZ) under the Marine and Coastal Access Act, 2009. Black Bream are a feature of the designation of the 47 km² MCZ and management measures are being developed to protect this fish at this key breeding site. Effective management of the site will support the sustainable development of the fishery.

A celebration of Roger Bamber's life.

R. Robbins and T Horton

ABSTARCTS OF POSTERS

In alphabetical order of first author

Not all poster contributors submitted abstracts in advance

The development of Baited Underwater Video systems (BUV) to evaluate relationships between fish assemblage, benthos and habitat variables in Southern UK coastal waters

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Baited underwater video systems (BUV) collect spatial and temporal patterns of abundance, size and fish assemblage composition of various species. They were developed from the original concept of time-lapse still photography used to assess fish assemblages in the deep sea. In the late 1990's, the system was adapted as a shallow water system for monitoring reef fishes specially for assessing and monitoring the recovery of carnivorous fishes in the marine reserves.

BUVs are commonly used in Australia and New Zealand, however, the UK has yet to fully utilise the technology within its coastal waters. The UK also lack evidence to support marine conservation planning decisions and the capacity to monitor and assess the long term effect of designated MCZs and European Marine Sites (EMS). BUVs offer a non-invasive remote monitoring method which has been successfully utilised elsewhere for the assessment and monitoring of many Marine Protected Area (MPAs).

While BUV is a recognised validated means of estimating predator fish abundance, there are still general sampling issues in need of consideration such as size selectivity, bait plume effects, several behavioural considerations and detectability. This project aims to develop a standardised system configuration which looks to reduce these biases in European waters, where turbidity and weather limits survey capability.

***Dikerogammarus haemobaphes* in the UK: Have high intersex incidences affected their invasion?**

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Dikerogammarus haemobaphes (Eichwald, 1841), is an effective predatory amphipod from the Ponto-Caspian region, which has spread through Europe and is now recognised as an extremely successful and established invader of British waterways. *D. haemobaphes*, also known as the 'demon shrimp', invaded the British Isles 2 years after the infamous 'killer shrimp' (*Dikerogammarus villosus*, Sowinsky, 1894) but is already more widespread. It was recently reported that male Demon shrimp from some UK populations displayed a high prevalence (~50%) of male intersexuality (visible brood plates on otherwise normal looking males). The study also investigated the internal parasites of *D. haemobaphes* at several locations in British waterways and made comparisons with the now threatened *Gammarus pulex* natives, revealing that invasive and native populations have distinct parasitic profiles. In particular native amphipods carried parasites which require a more complex life-cycle than their invasive cousins. The high prevalence of intersexuality in *D. haemobaphes* was linked to a microsporidian parasite (*Dictyocoela berillonum*). This particular study aims to expand on the former by covering a great number of locations across the demon shrimps current range and determine whether there is variation in parasite communities and intersex prevalence. Preliminary results suggest that intersexuality is high across the UK invasive range and might indicate the inability of alien parasite strains in feminising in UK waters.

Microplastic trophic transfer between crabs and mussels

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This study investigated the trophic transfer of microplastic from mussels to crabs. Mussels (*Mytilus edulis*) were exposed to 0.5 µm fluorescent polystyrene microspheres, and then fed to crabs (*Carcinus maenas*).

Tissue samples were then taken at intervals up to 21 days. The number of microspheres in the haemolymph of the crabs was highest at 24 hours (15 033 ml⁻¹ ± SE 3146), and were almost gone after 21 days (267 ml⁻¹ ± SE 120).

The maximum amount of microspheres in the haemolymph was 0.04% of the amount to which the mussels were exposed. Microspheres were also found in the stomach, hepatopancreas, ovary and gills of the crabs, in decreasing numbers over the trial period. This study is the first to show 'natural' trophic transfer of microplastic, and its translocation to haemolymph and tissues of a crab. This has implications for the health of marine organisms, the wider food web and humans.

Developing biomarkers for the effects of environmental levels of selective serotonin reuptake inhibitors (SSRIs) on camouflage ability in crustaceans

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The effects of antidepressants in the environment are starting to generate considerable interest amongst environmental toxicologists due to the fact that neurohormones, for which the drugs are designed to interact, control a large amount of biological processes. This study aimed to develop biomarkers for effects of the selective serotonin reuptake inhibitor (SSRIs), fluoxetine (FLX), and its impact on chromatophore expression in the common sand shrimp *Crangon crangon*. Adult shrimp were exposed over 1 week at two concentrations (10ng/L & 1000ng/L) and the chromatophore expression was recorded after 1 hour, 1 day and 1 week on white and black substrates, thus testing their ability match their background. Specimens became significantly darker on darker background and lighter on light backgrounds as one might expect with their ability avoid predation. Significant differences were observed in the chromatophore scores between concentrations ($p < 0.01$) and the colour background ($p < 0.001$). Discriminate analysis was able to significantly separate groups into clusters relating to colour of substrate but interestingly clustered the shrimp exposed to 1000ng/L FLX on a black background along with those white backgrounds indicating an inability for these shrimp to change colour at these exposures. The utility of this technique to study neuroendocrine disrupting chemicals is discussed.

The biological effects of ionizing radiation on crustacean species: combining field studies in lakes of varying contamination at Chernobyl with laboratory experiments

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The biological effects of environmentally relevant radiation doses on crustacean species will be investigated. There is a paucity of information pertaining to chronic, low dose effects of ionizing radiation on aquatic invertebrate species. Such studies are necessary to predict and mitigate the impact of radioactive releases on aquatic ecosystems. Consequently, this has been identified as a priority area for future research within both scientific and regulatory communities. The crustacean subphylum comprises greater than 66,000 species of ecological and commercial importance. A number of regulatory organisations have selected a marine crustacean as a reference organism used to optimise and inform environmental radioprotection. Advancing knowledge within this subphylum will directly inform the formation of environmental radioprotection frameworks. The aims of this research are threefold; a) To assess the impact of ionising radiation on the reproductive fertility, behaviour and DNA integrity of crustacean populations b) To establish the translational value of laboratory studies to field populations c) to compare the radiosensitivities of freshwater and marine crustacean species. A marine and freshwater species of the genus *Gammarus* (*Echinogammarus marinus* and *Gammarus pulex* respectively) will be exposed to the beta emitter phosphorous-32 at dose levels of 0.1, 1 and 10 mGy/d⁻¹. Analysis of male gamete number and viability will be conducted in order to ascertain reproductive fertility using dissection and fluorescent staining methods respectively. The single-cell gell electrophoresis method will be used to assess DNA integrity. Laboratory exposures will be coupled with field studies of the freshwater isopod, *Asellus aquaticus*, collected from seven sites along a gradient of contamination in Belarus and Ukraine. Potential radiation effects will be assessed using fluctuating asymmetry, population data and genetic diversity as markers of phenotypic and genetic effects respectively. These findings will aim to enhance the field of aquatic invertebrate radioecology and guide the formation of environmental radioprotection frameworks.

Biofouling, Biodiversity and Business

J. Greig, A. Bessell, E. Capasso

Fugro EMU Limited

Marine growth includes species of flora and fauna able to colonise submerged structures. Awareness of its effects, in terms of the transfer of species and physical loading on structures, is increasing worldwide. Changes in associated ecosystems and services have been recorded in conjunction with the spread of some invasive species, therefore, actions to counteract their spread are considered necessary. Efforts to eradicate such species are expensive and often ineffective, so, where possible, prevention of their transfer is the preferred approach. However, this is not straight forward due to the, generally, opportunistic nature of these organisms; different approaches to prevention and/or eradication are potentially required for different species. Effects on physical structures are evaluated based on marine growth as a whole, with additional species of concern considered where necessary. Relevant legislation within countries subscribing to the main conventions and drivers has recently been on the increase in particular in relation to the management of the introduction and spread of non-native species. In order to comply with increasing legislation and to reduce liability, businesses are considering the use of biosecurity measures. A variety of measures are employed, covering a range of costs and efficiencies. Marine growth measurements are starting to appear as add on services to commercial oceanographic studies, however, the efforts are largely ad hoc and uncoordinated, causing a diversity of estimates. Due to limited raw data, marine growth coefficients are often used within engineering calculations. These tend to be very conservative, and their combined usage is causing overcompensation in engineering design. With awareness and concern for biofouling and biosecurity increasing, this review provides an overview on a number of the notable biofouling species and commonly utilised biosecurity measures; reference to marine growth raw data collection is also made as well as to the use of coefficients, which are employed to maximise the efficacy of engineering design.

Poole Harbour, a home away from home for the Manila clam

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The Manila clam was introduced into Poole Harbour in 1988 for the purpose of aquaculture under the condition that it would not be able to successfully reproduce. Within four years of its introduction it had successfully reproduced and by 2004 it was classed as naturalised in the Harbour creating a commercially viable fishery. Since the creation of this fishery, the Minimum Landing Size has been reduced from 40mm down to 35mm, which presents the perfect opportunity to study the impact of a reduction in MLS on a non-native species. The naturalisation of the Manila clam also provides the perfect opportunity to study the influences of environmental conditions on a non-native species. The Holton Mere population of Manila clams was sampled on a regular basis between April 2009 and August 2012 and compared with historical data prior to the reduction in MLS and with other populations of Manila clams. Environmental conditions including water temperature, dissolved oxygen and blue green algal abundance were recorded continuously for a period of 12 months in order to determine their influence on clam condition index. The reduction in MLS and subsequent fishing activity has led to the removal of the majority of clams above 35mm and has reduced the maximum size attained by the Holton Mere population of clams. The maximum density of clams at Holton Mere is significantly lower than other populations of Manila clams. All of the environmental parameters measured by the study were found to correlate with clam condition index, however a multivariate statistical approach determined that water temperature had the highest influence on clam condition index.

Effects of pharmaceuticals on the rag worm *Nereis virens*

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Recent advances in environmental chemistry techniques have revealed an increasing number of pharmaceuticals in marine waters and sediments. Most of the studies examining the effects of these compounds are limited to acute toxicity and not long term non-lethal impact. In this study we examine the effect of relevant pharmaceuticals on the polychaete, *Nereis virens*'s, ability to regenerate. This capability is used by most polychaetes to replace lost parts and is crucial to a species resiliency, yet nothing is known about the effect of xenobiotics on regeneration. Initially, we determine the important time points involved in regeneration: wound healing, blastema and pygidium formation, and then segmental replacement. We will use these time points to develop an assay assessing compounds likely to affect regeneration. This characteristic has been shown to be controlled by nerve development and hormones, hence initially the proof of concept studies will use a compound already known to be an endocrine disrupter, ethinylestradiol (EE2). This will be compared to a negative control and a positive control of copper. Once the assay has been developed we can test a variety of compounds with endocrine and neurological effects in both long term and short term assays. This work is part of a larger study into the impact of long term pharmaceutical exposure on polychaetes.

Are anthropogenic influences increasing biodiversity in an Indonesian Mangrove?

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Mangrove forests are one of the worlds most threatened ecosystems. Currently anthropogenic influence poses the greatest threat to mangrove forests and their habitats. For one population of fiddler crabs in the Wakatobi Marine National Park, Southeast Sulawesi, anthropogenic influence seems to be increasing the biodiversity rather than the normal effect of decline. Fiddler crabs have been identified as a keystone species, which can be used as an indicator of ecosystem health. Studies have linked the activities of *Uca* to nutrient cycling and primary productivity within mangrove habitats.

In this area the highest level of sympatry in fiddler crabs has been recorded, with eleven species coexisting in a 50m² area on the fringe of the mangrove. Quantitative sampling reveals that although all species may occur on the same shore, populations of each species remain discrete, with species occupying micro-niches. The high levels of alpha diversity seen at this research site are likely to be driven by factors specific to the habitat. Anthropogenic factors seem to be directly altering the ecosystem, allowing crabs to dwell in places which would otherwise be unsuitable for the particular species'; such as unnatural shading provided by man-made structures. These changes increase the site heterogeneity, therefore contributing to a greater range of niches.

Re-use of waste shells

B. Robinson

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The RECIF project aims to improve the English Channel ecosystem by re-using waste by-products (empty shells) from the shellfish industry. Empty shells are being used in the development of innovative building materials for artificial reefs. Durability, porosity and strength of shell concrete are being investigated. The project presented here is investigating the biological colonisation of the innovative shell concrete and if this material could provide a more bio-diverse and productive artificial reef. By taking underwater photographs this project is quantifying the diversity and changes in the community colonising the shell concrete over time. In-situ photography allows a time-series of colonisation to be created and disturbance to the shell concrete community to be minimised. Both shell and non-shell (control) concrete blocks were deployed on Poole Bay Artificial Reef (12m) in May 2014. Unfortunately this area of seabed has been subjected to high levels of commercial fishing activity impacting the experimental set-up. The measures to protect the colonisation trials from disturbance by dragging ropes especially from whelk fishery and gears are described in detail. An increasingly abundant and diverse community developed on both the shell and non-shell concrete blocks. Laboratory measurements from recovered test blocks indicate greater biomass on the shell concrete, presumably to the presence of biogenic shell material exposed at the surface.

The invasion of *Caprella mutica*

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Non-native species introductions are the second most important anthropogenic threat to biodiversity globally, after habitat destruction. In the UK marine non-native species have not yet had significant adverse effects to the local ecosystems and have therefore been largely understudied (Ashton, 2006).

Caprella mutica are native to Japan and Eastern Russia, but have spread through much of the world, first appearing in Scotland in 2004, they have since spread to some other parts of the UK. *C.mutica* is a large caprellid species with wide tolerances, aggressive behaviour and a wide variety of eating strategies. It has been shown to outcompete native species and there has been some evidence to suggest it may be having impacts elsewhere.

The following poster will expand on the spread of *C.mutica*, including the traits which make it such a successful invasive species, problems its invasion may cause and its potential for further expansion. Including new data, confirming the presence of *C.mutica* in Langstone harbour, where it has not previously been documented.

Evidence for non-native seaweeds in Wales: documenting threats to marine habitats.

K. Slade

Amgueddfa Cymru-National Museum Wales (NMW)

Non-native seaweeds are establishing in British waters at an increasing rate, their effects ranging from insignificant to highly invasive. There are now 22 non-natives in Wales, including eight which are invasive and three new since 2009.

Quality data supported by herbarium specimens is needed to document our changing marine flora. Untapped data from herbaria provide evidence for the rate of spread of non-natives. A 1985 specimen of invasive *Sargassum muticum* in NMW is evidence for its earlier arrival to Wales than previously recorded.

Specimens help to identify long established non-natives to evaluate introduction rates. Following taxonomic clarification (Provan, 2007), specimens of *Codium fragile* subsp. *Fragile* (*tomentosoides* strain) in NMW need reinvestigation to inform on its arrival and spread in Wales. Help is needed to gather evidence of seaweeds (especially non-natives) in Wales.

Wood treated with furfurylated alcohol inhibits attack by marine wood borers.

C. Slevin, S. Cragg, T. Hebbes

Institute of Marine Sciences, University of Portsmouth P

Wooden structures in seawater are susceptible to attack from wood borers such as teredinidae and limnoriidae. Preservation with creosote or chromated copper arsenate (CC A) has provided economically viable protection against borer attack, but recent legislation such as the EU directive (European commission 2003), limits the use of such preservatives in the marine environment. Tropical hardwood species that display natural durability to borer attack often come from unsustainable sources and logging is therefore restricted. The aims of this project were to test the durability of two sustainable wood species treated with one of three chemical formulas. Both laboratory and field test conditions were used as Laboratory trials are able to overcome many confounding factors that can often skew results of field based trials. Laboratory trials are able to provide fast results under optimal conditions. Field trials provide a realistic comparison of results.

Assessing variability in intertidal mudflat macroinvertebrate communities: what are the causes and consequences of change in the context of conservation?

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As intertidal mudflat macroinvertebrates are a feature of conservation interest in Marine Protected Areas (MPAs) throughout the UK, the variability in these communities and drivers of change are explored using the Solent region, on the south coast, as a case study. This study incorporates past, present, and future elements and the exploration of taxonomic, functional, and physiological characteristics of the invertebrate communities. This study will thereby provide a rigorous and comprehensive assessment of these communities, which will feed into the effective conservation of mudflat communities in MPAs. *Past*: temporal variability in mudflat communities is explored at local and regional scales using an extensive collection of historic and contemporary intertidal survey datasets from the region. Identification of faunal relationships with equally extensive historic environmental datasets indicates environmental drivers of change in the communities. *Present*: an extensive intertidal survey was conducted in order to relate the present distribution of faunal communities to existing environmental conditions, including contamination of sediments (e.g. trace elements and persistent organic pollutants). *Future*: climate change will be a key driver in mudflat communities into the future. While a majority of climate change studies have focused on gradual sea temperature rise and ocean acidification, extreme climate events are expected to increase in frequency, intensity, and duration as a result of climate change. Mesocosm studies are used to explore the mechanisms by which heat wave events might impact mudflat invertebrate communities through an evaluation of physiological impacts in single species trials and identification of 'winners' and 'losers' in community trials. The comprehensive approach undertaken in this study will provide valuable insight on the ecology of mudflat macroinvertebrate communities and will therefore help to inform their conservation. Details on methodology and progress to date will be presented.

Aquaculture of sea anemones for the marine aquarium trade

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The current fishery activities of the marine aquarium trade are raising concerns over sustainability. The majority of livestock supplied to hobbyists is taken from the wild, and as the hobby grows due to advances in husbandry and technology, wild populations face over-exploitation. Unlike the marine hobby, around 90% of freshwater ornamental species are currently cultured in captivity, and therefore aquaculture has been suggested as a potential solution to the sustainability problems the marine ornamental trade is facing. However, development of commercially viable techniques for many species has been difficult. This is due to bottlenecks forming at key stages as a result of complicated life histories and also the time taken to grow to marketable size.

This project will aim to investigate if asexual propagation of sea anemones can be used as a technique to culture popular species within the marine ornamental trade on a commercial scale. If successful, the project will generate income for the UK economy through the sponsor UK Bred Ltd, whilst providing an alternative to wild harvest of anemones – therefore reducing the impact the trade is currently having on coral reefs. Methods developed may also be used in future replenishment of wild stocks. Finally, it is hoped that this study will encourage further exploration of aquaculture methods for other marine ornamental invertebrates including temperate species.

Global pattern analysis of marine benthic invasion

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Aim: Given the massive area of marine invasions across the globe, there are numerous studies regarding this topic, yet there are only 4% of them that represent the benthic ecosystems. As an outcome, there has been no quantitative global analysis of the patterns of invasion in this area. Here, we present preliminary results from the first such global analysis.

Method: Global data on benthic invasion were collated from peer-reviewed literature. Data were retrieved from the ISI Web of Knowledge from the year 1970 to 2014 and we manually searched for information on 596 articles including the year of introduction, taxonomic composition of the NIS, arrival mechanisms and geographical distribution (longitude and latitude).

Results: The initial analysis has generated several obvious patterns of invasion: i) largest number of invaders is known from Temperate Northern Atlantic followed by Temperate Northern Pacific and Temperate Australasia; ii) most NIS are from the phylum arthropoda and mollusca, whereas NIS in taxonomic groups dominated by microorganisms are rare; iii) the major means of introduction is international shipping followed by aquaculture; iv) the rate of introduction showed an increased pattern over the years.

Conclusion: We understand that the patterns of benthic invasions explained here only signify a rough measure currently. However, we hope that this research can be used as a tool for comparing marine invasions globally. Apart from that, the differences in the spatial and taxonomic effort (biases in data) in the study of NIS caused comparing patterns across taxa and regions to be not as accurate as could have been wished.