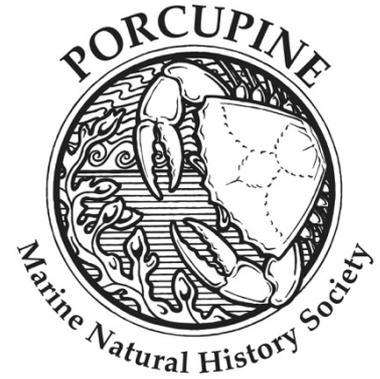


Marine Life in a Changing World

Porcupine Marine Natural History Society

Annual Conference



National Museum of History, St Fagan's, Cardiff
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Abstracts

15 years of the Great Eggcase Hunt

Cat Gordon

Conservation Officer (The Shark Trust)

Since its inception in 2003, the Great Eggcase Hunt has utilised the collaborative power of citizen scientists to better understand oviparous (egg-laying) elasmobranchs. What started as a way to educate the public about shark conservation developed into an effective way of collating data on the diversity and broad distribution of oviparous elasmobranchs found in British waters (and beyond). In the 15 years that this Shark Trust initiative has been running, over 200,000 mermaids purses have now been recorded.

When the project began, it was essential to identify which eggcases belonged to which species. We've since been able to update eggcase descriptions and develop an identification key to incorporate changes in skate taxonomy. However, to this day there are still some deeper water species which we don't have type specimens for. There have also been some aberrant specimens and outliers reported over the years – demonstrating that there is still much to learn.

Skates (Rajidae) are important commercial species around the British Isles, yet there is currently limited information to aid the identification of potentially important habitats, such as spawning and nursery grounds. The static life history phase of an oviparous species leaves them at risk to human disturbance and so understanding the location of egg-laying sites and habitat preference is vital when considering spatial protection. Work is currently focused on overlaying eggcase records with records of juvenile skate to build a better picture of overall species distribution. The Great Eggcase Hunt is a prime example of how citizen science engagement can support broader scientific initiatives in areas where data may be otherwise limited.

Sharks, rays and DNA: how genetics can help us investigate the secret populations of sharks and rays in the UK

Samantha Hook

Manchester University

Sharks and rays (group: Elasmobranchii) comprise of over 1000 species found in every ocean on the planet, including the seas surrounding the UK. The group has survived five mass extinctions, yet in the current changing world over a quarter of all sharks and rays are now classified as threatened with extinction. Overfishing, specifically for shark fins, has been the largest contributor to shark decline, with an estimated 200 million sharks being killed every year. Due to life history traits such as late sexual maturity, all elasmobranchs are particularly vulnerable to the effects of overfishing. The race is now on to protect elasmobranchs from further declines, and today genetics are playing a key role in helping us

understand how elasmobranchs are connected on a regional and global scale, to help better manage populations. Here we delve into the applications of genetics which are helping us understand species diversity and populations, and lastly we show how genetics can identify illegal, unregulated and unreported trade of sharks and rays in the UK.

Angel Shark Project: Wales

Jake Davies

Zoological Society of London / Natural Resources Wales

Angel Shark Project: Wales is a pioneering new project with 13 key partners, led by the Zoological Society of London (ZSL) and Natural Resources Wales (NRW). The aim of the project is to safeguard the Angelshark in Wales through fisher-participation, heritage and citizen-science. This collaborative project will unlock vital information on Angelsharks, through working alongside coastal communities, commercial and recreational fishers and citizen science volunteers across Wales.

Milford Haven Seasearch 'plus plus'

Kate Lock and Blaise Bullimore

Seasearch South and West Wales

Milford Haven waterway is a ria-estuary, an uncommon estuary type restricted in the UK to southwest England and Wales. It is the only ria in Wales and the largest ria-estuary complex in the UK; it is of considerable marine ecological significance and one of the best examples of a ria system in Britain. It hosts the largest port in Wales and the third largest in the UK.

Milford Haven is one of the most well studied marine areas in the UK. The waterway has attracted naturalists for many decades and some aspects of its marine biology have been thoroughly and repeatedly described. Subtidal areas only accessible by diving have been surveyed since the 1960s focused in the upper Haven or at a small suite of locations; the only Haven-wide diving survey is thirty years old.

Thirty Seasearch diving survey days have been completed in the Milford Haven Waterway between 2004 and 2015. In total, 104 individual volunteer divers completed 287 survey forms for 43 site areas extending from Llangwm Ferry in the upper reaches of the Daugleddau through the length of Milford Haven to St Ann's Head on the western side and Sheep Island on the east side of the entrance of the Waterway.

In addition to substantially increasing baseline knowledge of seabed habitats and species distributions in the Waterway, surveys have recorded priority species and habitats, non-native and invasive species and notable rare and scarce species. The knowledge of the presence of these species and their locations are particularly useful.

Seasearch divers, Natural Resources Wales marine staff, the Pembrokeshire Marine SAC Officer and the Milford Haven Waterway Environmental Surveillance Group project manager have worked closely together and this partnership working has allowed the surveys to target areas effectively. The species and habitat data and the considerable collection of digital images stored can be used to support management planning and assessment of proposed developments for the area.

Diving conditions in the Cleddau estuaries and Milford Haven Waterway are challenging and careful dive planning is needed. Poor underwater visibility is common but the richness of the waterway's marine wildlife and the records, photographs and experience acquired by Seasearch divers in the Haven are rewarding and make the effort worthwhile.

Skomer's scallops and sediments – some good news

Phil Newman

Natural Resources Wales

Skomer Marine Conservation Zone (formerly known as Skomer Marine Nature Reserve) has benefited from fishery byelaws put in place in 1990 when the site achieved formal designation. These byelaws prohibit the use of dredges or beam trawls within the site and also prohibit the taking of either of the two main commercial species of scallop. Monitoring carried out by the Natural Resources Wales team at Skomer MCZ shows how not only the scallop population, but also the sediment fauna have changed since the byelaws came into force.

Mobilisation of sediment-bound contaminants and effects on marine life in Milford Haven Waterway (MHW)

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The aim of this presentation is to show some of the potential environmental impacts from oil spills, effluents, and engineering works in a deep water marine inlet /estuary in SW Wales, UK. The site of up to four oil refineries and an oil-fired power station since 1960, MHW is also the site of two large liquefied natural gas (LNG) import terminals and a combined cycle gas-turbine (CCGT) power station since the mid-2000s. MHW lies within a Special Area of Conservation (SAC) designated under the EU Habitats Directive. A range of monitoring programmes has been conducted since the late 1960s largely by the Field Studies Council (FSC). Since 1992, much of this work is being funded and coordinated by the MHW Environmental Steering Group (MHWESG). Results of chemistry monitoring show that a peak in sediment polycyclic aromatic hydrocarbons (PAHs) and heavy metals contaminants occurred in late 2007 /early 2008, one year after the highest rate of fine sediment dredging ever undertaken in MHW. Sediment quality guidelines predicted biological impacts throughout MHW in 2007-8. The simultaneous results summarised below support those predicted biological impacts. The *Porcupine Marine Natural History Society Newsletter* 34 reported monitoring by the FSC of limpets *Patella vulgata* and starfish *Asterina* spp., which showed decreased densities in 2007 at sites near the mouth of MHW. Natural Resources Wales reported counts outside MHW of grey seal *Halichoerus grypus* pups that by 2007 were at their lowest since the late 1980s. Wetland Bird Survey (WeBS) counts coordinated by the British Trust for Ornithology (BTO) showed that shelduck *Tadorna tadorna* and wigeon *Anas penelope* both declined in MHW in the winter of 2006-7. Under contract to MHWESG, the Pembrokeshire Coast National Park Authority counts of shelduck broods in spring showed reduced numbers after each episode of dredging, particularly in 1993, 2007, and 2009 onwards. Winter wigeon numbers recorded by WeBS also declined in 2010 especially around the lower Pembroke River, during further dredging and the commissioning of the new CCGT power station. Both shelduck and wigeon largely depend on muddy sediment substrate respectively for mud snails *Hydrobia* spp. and seagrass *Zostera* spp. It appears that after dredging nearby, sediment deposition with high concentrations of PAHs and heavy metals temporarily deprived these birds of their preferred food. Most of the above changes equalled or exceeded those seen after the *Sea Empress* oil spill in 1996, the largest ever in MHW. All of the above species are of course subject to population dynamics and community ecological factors, and to natural and anthropogenic stressors, including climate change. As a result, the various peaks and troughs in species' densities may be circumstantial, and are in any case a mix of national, continental or even global causes. However, contemporaneous with and adjacent to the sediment

contaminant work, the Marine Biological Association (MBA) was contracted by MHWESG to assess body burdens of PAHs and heavy metals in mussels *Mytilus edulis* and ragworm *Hediste diversicolor*. The MBA results support the hypothesis that contaminants remobilised by dredging have indeed caused measurable impacts during fine sediment transport and after resettlement of the sediment, particularly in Angle Bay and Pembroke River. The spatial and temporal trends across sediment and biota data are thus satisfactorily explained by a source-pathway-receptor model. This sediment contaminant remobilisation involves historical, persistent and toxic contaminants that in terms of current inputs to MHW have been long-since reduced.

The role of Seasearch citizen science in the designation and management of UK MPAs

Jean-Luc Solandt

Principal Specialist, Marine Protected Areas, Marine Conservation Society

Whilst the UK has been embarking on a massive development of Marine Protected Area (MPA) designations, from 3 such sites in the 1980s to over 297 now, we've been diving to provide the information to underpin such designation. For over 30 years, Seasearch has been training, and recording with a unique (for Europe) group of dedicated volunteer divers, amassing over 750,000 species and habitats records –making it the second largest marine dataset in the National Biodiversity Network – all of which are publicly available for download and use. Emerging from the ground-breaking JNCC project 'Mermaid' (or the Marine Nature Conservation Review) that came to a halt in 1998, it has provided 2 distinct roles – (1) in engaging and utilizing a network of amateur naturalists to collect data that is validated and inputted to 'Marine Recorder' to provide a picture of biodiversity unmatched in shallow nearshore habitats, and (2) to then be used for MPA designation and management. In 2010, it was Seasearch data that provided the evidence for many key reef sites in Dorset, Devon and Cornwall to be designated, whilst bespoke Seasearch projects to record crawfish and pink seafans have had success in illustrating key distributions of species that are surrogates for over-fishing and habitat protection. We've been active in the protection and remediation of seagrass beds (recording the impact of eco-moorings), helped with geo-referencing vulnerable maerl distributions in Falmouth and Jersey, and influenced local campaigns to protect the rich Manacles MCZ in southern Cornwall. Data makes a difference, and when citizens are involved in that collection, it is all the more powerful.

Status of Marine Protected Areas (MPAs) in Wales

Gill Bell

Head of Conservation Wales, Marine Conservation Society

It may look good on paper, with a total of 139 Marine Protected Areas (MPAs) in Wales, covering over 4,200 square miles, which is 69% of the inshore waters or 50% of all Welsh waters, but on the ground there are fundamental issues. The National Assembly for Wales highlighted some of these, in its MPA inquiry¹, which prompted Welsh Government to develop a MPA Network Management Framework² and Action Plan³ in 2018, as well as a duty⁴ to produce the MPA review in January 2019⁵ but unlike England, there are currently no plans to adapt a whole site approach⁶. The Wales National Marine Plan is expected to be published in 2019 and will for the first time, bring all marine activities under one plan. Welsh Ministers now have extended marine conservation duties⁷ out to the median line and there are plans to support the completion of UK Ecologically Coherent Network^{8,9} by filling the gaps within the Welsh network with Marine Conservation Zones in the inshore and offshore. But what does this actually mean in terms of management for protected species and habitats within those sites?

Natural Resources Wales' indicative site assessments¹⁰ identified 45% of features within Welsh MPAs are in unfavourable condition and 9% in 'unknown' status. The Assessing Welsh Fisheries Activities (AWFA)¹¹ identified potentially damaging activities back in 2016 however to date, there have been no new measures to prevent these activities taking place within European Marine Sites. Case studies will demonstrate some of the issues facing both those tasked with their management and protection of particular site features.

¹ <http://www.assembly.wales/laid%20documents/cr-ld11159/cr-ld11159-e.pdf>

² <https://beta.gov.wales/sites/default/files/publications/2018-09/marine-protected-areas-network-management-framework-for-wales-2018-2023.pdf>

³ <https://beta.gov.wales/sites/default/files/publications/2018-10/marine-protected-areas-network-management-action-plan-for-wales-2018-2019.pdf>

⁴ <https://www.legislation.gov.uk/ukpga/2009/23/contents>

⁵ <https://beta.gov.wales/report-marine-protected-areas-mpas-2019>

⁶ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

⁷ <http://www.legislation.gov.uk/ukpga/2017/4/contents/enacted>

⁸ <https://www.cbd.int/>

⁹ <https://www.ospar.org/convention>

¹⁰ <https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/indicative-feature-condition-assessments-for-european-marine-sites-ems/?lang=en>

¹¹ <https://naturalresources.wales/about-us/our-projects/marine-projects/assessing-welsh-fishing-activities/?lang=en>

Can consumers save cod and other North East Atlantic species? The role of consumers in protecting our oceans.

Bernadette Clarke

Cardiff University & Marine Conservation Society

Globally, marine fisheries face numerous pressures, including: overfishing of many fish stocks linked to a rising global demand for seafood; mismanagement; declining habitat status with implications for marine biodiversity support; climate change and; pollution.

In response to these and related pressures, the sustainable seafood movement has evolved, using market-based approaches to influence consumer choices to increase the sustainability of the seafood supply chain.

This presentation will highlight key issues within the existing literature around sustainable seafood consumption, market-based approaches and behaviour change. Proposing a mixed methods approach (including questionnaires and interviews), and using the Marine Conservation Society's Good Fish Guide as a case study, this research will evaluate the knowledge and use of seafood guides in the UK, their effectiveness in motivating pro-environmental or sustainable seafood consumption and thus their value as conservation and educational tools. The study will also consider how the use of the guide may influence purchasing of sustainable fish, within the wider context of environmental and social food movements, including the sustainable seafood movement.

This work will make a contribution to the wider area of behavioral change research and the more limited research area of sustainable seafood consumption. It will also make an original contribution to research of seafood guide use in UK and to understanding of how the impact of seafood consumption can be managed through interventions such as seafood guides to improve marine conservation and resource protection.

Aqua cultures: different views around the big blue

Dr Sara Barrento

Swansea University, Biosciences Department

Life on Earth started deep down in the Oceans. It flourished and colonized the planet. Many of us live in coastal communities – 37% of humans to be precise. Many livelihoods depend on the sea. This talk will present two different projects about Aqua Cultures: 1) AquaTED - a digital storytelling education project about fisheries and aquaculture, and 2) SMARTAQUA – aquaculture beyond food. The AquaTED project focus on explaining global aquaculture within the wider fisheries and food production contexts, it outlines regional differences with a focus in Thailand. The SMARTAQUA project aims to steer the expansion of non-food businesses in Wales – it focuses on cleaner fish, the ornamental fish industry, and aquafeeds (feed for aquatic organisms). From Thailand to Wales I will share different views on how we see and use the oceans to nurture us.

Somerset Wildlife Trust's Intertidal Survey Project

Rebecca MacDonald

Somerset Wildlife Trust

The Somerset coastline stretches from Brean Down in the north to Glenthorne in the west, covers 73km and is very dynamic. It is under increasing pressure from a number of development schemes and this, along with a lack of baseline data for the intertidal zone, led to a growing concern that poor decision making could irreversibly impact local and nationally important habitats and species. In response to this, Somerset Wildlife Trust began the first intertidal survey in 2017 in order to establish a baseline dataset that could be used to inform management decisions. Over the past two survey seasons, data has been collected on rocky shores and is beginning to expand our understanding of the species and habitats found there. The survey work is ongoing and is moving onto the next stage which involves the development of a biotope map that will be available online. Alongside the survey work, local community engagement events have been taking place to expand local understanding, and last year this developed into the Somerset's Brilliant Coast project that also offers Wild Beach to local schools and parish-based coastal engagement schemes.

Bouncing Boulders and Buoyant Seaweeds: Teasing human from natural disturbance on rocky intertidal shores

Elisabeth Morris-Webb¹, Martin Austin¹, Tim D'Urban-Jackson¹, Guy Walker-Springett¹, Harry Goudge², Mike Kaiser¹, Freya St. John³, Stuart Jenkins¹

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Impacts of unregulated activities within Marine Protected Areas (MPAs) may undermine the objectives for which the MPAs were instigated. UK governments have started investigating these impacts within their MPA network but gathering evidence of activities that are not actively managed is particularly problematic when activities have persisted prior and subsequent to MPA designation. The current research aims to develop a simple indicator of human impacts on algal dominated boulder communities

within protected areas, building on previous work by Natural Resources Wales. Most disturbance of algal dominated, often sensitive, boulder communities on sheltered, tide swept shores is assumed to be anthropogenic (human). Rocks are disturbed whilst collecting animals for food, bait, research or for recreational interest. If rocks are replaced in the wrong position their diverse under-boulder communities dry out and algae become trapped under the rock, creating an anoxic environment instead of a sheltered refuge for a variety of mobile species. This research uses novel accelerometer technology to differentiate between natural and anthropogenic disturbance. Counter to expectations, the presence of large algae causes drag on rocks that is sufficient to displace them. This unexplored form of natural disturbance on sheltered shores could become more prolific with increasing storm frequency and severity. Policy makers and site managers must consider all sources of disturbance in a protected area, including from currently unregulated activities. This talk will present the preliminary results of this ongoing project and explore how novel technology could be incorporated into human disturbance indicators. Ensuring all disturbance is accounted for will minimise the risk of mistakenly attributing disturbance to anthropogenic activities, whilst mitigating potential conflict between stakeholders and managers.

Project Seagrass

Richard Unsworth

Swansea University & Cardiff University

Seagrass meadows provide vital fisheries habitat and store vast amounts of carbon in their sediments. Since the start of the industrial revolution our growing human imprint on the coasts of the UK has led to extensive loss of these productive habitats. Loss of seagrass continues in many places in the UK and they remain in a perilous state with long-term seagrass recovery limited. Reversing their long-term loss requires intervention through targeted restoration. Although seagrass restoration has become an extensive in many parts of the world it remains unproven in the UK. Since 2013 we have been conducting a range of laboratory, desk and field experiments and studies aimed at refining seagrass restoration for their use in the UK. In this talk we will describe these experiments and studies and how their results are being used to construct the UK's first major seagrass restoration project.

Atlantic Herring (*Clupea harengus* L.). Spring spawners in Milford Haven – a separate population?

Dave Clarke

Swansea University

Atlantic Herring (*Clupea harengus* L.) have spawned in Milford Haven during the spring for hundreds of years. This paper will describe spawning habits and known spawning locations as well as the morphological characteristics of the stock. Past data collected during the early 1980's will be compared with present data collected during 2018, demonstrating changes in growth and mortality rates, as well as changes in abundance. The paper will further describe ongoing work to characterise stock characteristics throughout the Bristol Channel and Celtic sea areas, and help determine whether the Milford fish are a genetically discrete population or part of a wider metapopulation.

Working in the dark: understanding environmental issues in deep sea mining

Becky Hitchin

Joint Nature Conservation Committee

Deep sea mining is a new and technologically challenging industry fuelled by humanity's ever increasing need for metals. The Clarion-Clipperton Fracture Zone is an area of deep sea off Hawaii that is a primary target for one type of deep sea mining, that of collection of polymetallic nodules. The UK is leading the way in challenging global environmental expectations, making sure that science and environmental stewardship is out at the forefront of this industry's unique and peculiar growth.

Reading between the lines: what long-lived clams can tell us about past climate variability

Professor Ian Hall

Cardiff University

Despite numerous lines of evidence there is still a great deal of uncertainty surrounding our understanding of what drives variability in the Atlantic Meridional Overturning circulation (AMOC) and what influence this variability has on the wider climate system. The analyses of annually-resolved absolutely-dated sclerochronological records, derived from long-lived marine bivalve molluscs, spanning past centuries to millennia can provide novel insights into past AMOC variability. These emergent data highlight there is significant multi-decadal to centennial scale variability in AMOC strength throughout the last millennium and that a subtle reduction in AMOC strength was likely a driving force behind the transition between the Medieval Climate Anomaly-Little Ice Age transition (along with solar and volcanics). These data further suggest that a significant proportion of AMOC variability is externally forced. This work highlights the potential power of large spatial networks of sclerochronological records and proxy-model integrated approaches at reconstructing and understanding past ocean variability. These approaches will help to constrain uncertainties in the numeric climate models and ultimately facilitate more accurate predictions of future climate variability.

Invasion pathways of the fireworm *Eurythoe complanata* (Polychaeta: Amphinomidae) and the potential role of the aquarium trade in its spread

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The fireworm *Eurythoe complanata* is a polychaete annelid long thought to be a cosmopolitan species, present across the Atlantic, Pacific and Indian Oceans. However, a phylogeographic study revealed that previous records encompassed two morphologically identical cryptic species within an *E. complanata* complex, one from the Pacific Ocean and another from the Atlantic Ocean, along with an additional species that has now been differentiated (*Eurythoe laevisetis*). The alien presence of at least two of these species is recorded within the Mediterranean Sea, with routes of introduction likely consisting of shipping and entry through the Suez Canal. However, little is known about the invasion pathways of *E. cf. complanata* within the aquarium trade. This talk outlines the journey of one individual observed in an aquarium at National Museum Wales (sourced from a domestic reef aquarium) from its potential origin in the Indian Ocean, to a pet store in South Wales, most likely through 'hitchhiking' upon coral. It will be briefly discussed how the *E. complanata* complex will be able to tolerate a

changing ocean environment due to a number of invasive traits, which could possibly lead to an expansion of their current geographic range in the future.

Ecostructure – promoting ecologically-sensitive design of marine artificial structures

Ally Evans¹ & the Ecostructure Project Team¹²³⁴⁵

¹Aberystwyth University, ²Bangor University, ³Swansea University, ⁴University College Dublin, ⁵University College Cork

Artificial structures are common features in the marine environment and are becoming increasingly prevalent for protecting shorelines and supporting marine industries. Through the Ecostructure project we are investigating the ecology of marine artificial structures, their effects on the natural environment, and methods of enhancing their biodiversity value. The overarching aim is to raise awareness of ecologically-sensitive design possibilities for structures in the marine environment, by providing developers and regulators with accessible tools and resources for evidence-based planning and decision-making. I will present an overview of the project and highlight some of the ecological enhancement experiments underway or planned around Wales, including some preliminary results. Ecostructure is a 5-year EU-funded collaboration between five leading research institutions in Ireland and Wales – bringing together ecologists, engineers, geneticists and social scientists.

In out, in out, wave your legs about! Cirral activity of barnacle species in response to temperature change

Amy Collard

Tutor, FSC Pembrokeshire (Field Studies Council)

Since 2016 Dale Fort Field Centre has been offering a lab practical for students that investigates the effect of temperature on the cirral beats of barnacles. Small barnacle covered rocks are collected from a local shore and a simple water bath is set up to manipulate the temperature of the seawater. Results of different species will be discussed and links made to known distribution patterns and the possible impacts of the warming ocean.