

PROCEEDINGS OF THE

2ND MILLPORT
SYMPOSIUM

MARINE RESEARCH
WAKINE KEREUKEH

SYMPOSIUM
PAMBOBINW





Foreword

Jack Lucas

Facing out into the Clyde Sea from the southeast shores of the Isle of Great Cumbrae, the buildings that comprise Millport Field Centre have historic significance in the annals of marine research and education. From the early days where scientific work was conducted from a floating laboratory, through the construction of Millport Marine Biological Station in 1897 to the establishment of the Scottish Marine Biological Society in 1914; the station has been a beacon for researchers and natural historians wishing to study the properties and inhabitants of the ocean. Building on decades of pioneering work as the University Marine Biological Station Millport, FSC Millport continues to act as gateway to the marine environment for thousands of students each year and contributes to our current understanding through the hosting of international research students and collaboration with other research institutes.

Since its reformation in 2014 under the banner of the Field Studies Council, one of the driving aspirations of the centre and its staff have been to pull away the veil of exclusivity that can often surround prestigious scientific institutions and open the doors to a wider variety of learners. In keeping with the FSC's motto of 'bringing environmental understanding to all'; the centre now provides education opportunities for all ages, from primary school residentials and high school science trips to university field courses, professional natural history courses and family holidays. The site has seawater-fed laboratories, a research vessel, scientific library, conference facilities, custom-built research facility and its own museum and aquarium to be put to use exploring the marine realm.

The Millport Marine Research Symposium was conceived with the aim of bringing marine science to as many people as possible. The breadth and quality of presentations on offer reflects the diversity and wonder of our coastlines and ocean, bringing together academics, conservationists, researchers, artists and students to celebrate our marine heritage. From plastics to poetry, dolphins to disasters, fishing to field courses; this year's Symposium covers the full spectrum of what can be defined as 'marine research' and serves as a reminder of the importance of integrating different disciplines and specialisms to truly understand our impact on the ocean and its impact on us...

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Welcome to FSC Millport: A History of the Marine Station

Alex MacFie

Head of Centre – Field Studies Council (FSC Millport)

ABSTRACT

Marine research in Millport can be traced back as far as 1885 to a floating laboratory called the Ark, moored at Port Loy off Farland Point which housed specimens from the Challenger Expedition. The expedition was named after the modified naval vessel HMS Challenger, who with adaptations including the removal of 17 guns and installation of laboratories, sailed almost 70000 nautical miles exploring the previously untouched depths of the ocean and facilitated the discovery of almost 4700 new species. The famous marine biologist Sir John Murray oversaw the cataloguing of over 4000 of these specimens. This was the first time that scientists had collected specimens and samples from the deep sea, having previously thought that below 200m was a dead zone. Measurements were made using lengths of rope marked in 25 fathom intervals to 'plumb the depths'.

The Ark was brought to the island by David Robertson, a famous Scottish naturalist and geologist who had grown up in Ayrshire, qualified in medicine in Glasgow yet maintained a passion for Millport and its natural history. Numerous scientists came to Ark to study and Robertson began to establish Millport as a significant area for marine biological research. He persuaded professionals and the business community from Glasgow to fund a permanent research and education station and laid the foundation stone. It was opened in 1897 as the Millport Marine Biological Station and although Robertson died before the building was complete he did leave his collection of specimens to the marine station and the museum and aquarium were named in his honour. In 1904 Scotia, the research ship of the Scottish National Antarctic Expedition, landed at the Keppel Pier to be greeted by a crowd of 400 and a telegram from King Edward VII. This expedition, led by natural scientist William Spiers Bruce was an enormously successful scientific expedition identifying 212 new species. Spiers Bruce had already worked with Murray to help classify specimens from the Challenger expedition.

The Scottish Marine Biological Association was established at Millport Marine Biological Station in 1914 and our existing library collection houses much content from the SMBA which subsequently moved to Dunstaffnage Bay and became the Scottish Association of Marine Science (SAMS). The station was taken over by the University of London in partnership with Glasgow University in 1970 and renamed the University Marine Biological Station Millport. It continued to educate cohorts of students for many decades and to gain a worldwide reputation in marine research. UMBSM was closed at the end of 2013 due to the withdrawal of Higher Education funding but the station was reopened under new ownership as FSC Millport early 2014, still providing opportunities for scientists to collect data and undertake research whilst also expanding its education programme to include people of all ages studying the natural environment. The centre has seen significant growth over the past few years and we hope that this will continue for many years to come, whilst continuing to be a flagship institute for marine research and education.

BIO

With a passion for the outdoors Alex has a background in successfully establishing and growing public sector projects and third sector organisations aimed at increasing educational opportunities for young people and adults. After many years working for local authority in which work targeted at disadvantaged young people was cited by Curriculum for Excellence as examples of best practice and used by the Scottish Executive to demonstrate effective and successful working practice, Alex moved into community development where her work was awarded Scottish Social Enterprise of the Year 2014 and Leadership Academy status 2015 whilst being cited by Sports Leader UK as an outstanding example of best practice. An honours degree in Commerce from the University of Birmingham followed by a post grad in Education from Glasgow University combine well with onsite marine biology experts to create the perfect conditions for the continued growth and success of FSC Millport where she has been since 2016.

Natural Disasters in Coastal and Riverine Environments – International Perspectives

Dr Azra Meadows OBE & Professor Peter Meadows

Honorary Lecturers - *Institute of Biodiversity, Animal Health & Comparative Medicine, School of Life Sciences,
University of Glasgow*

Abstract

Natural disasters are becoming more prevalent with changing weather anomalies. As global warming and threats of sea level rise intensify, the environment and the rapidly increasing human population will face major challenges in the near future. Adaptation and resilience to changing weather patterns will become a major priority. This includes natural disasters in coastal and riverine environments with their impact on humans and associated ecosystems. It also covers tsunamis, earthquakes, floods and landslides.

Work in developing countries has assessed the impact of the 2005 earthquake and the 2010 floods in Pakistan. The country's development has been reduced by many years causing loss of livelihoods, infrastructure and economy. In 2010 the Scottish Government South Asia Development Programme funded a three-year project to develop community disaster management and rehabilitation skills. This covered education and training in disaster preparedness and livelihood programmes, a 'Disaster Preparedness Manual' (in English and in Urdu) and a DVD.

The Scottish Government's Humanitarian Fund funded a six-month project in Swat to build 250 green housing units after the 2010 floods. The joint collaborator for both projects was the CeO of Heritage Foundation Pakistan, Mrs Yasmeen Lari.

The Asian Development Bank funded a US\$36million six-year project from 2007 to 2013 on 'Sindh Coastal Community Development'. These coastal fishing villages have no clean drinking water or sanitation. During the monsoons they experience storms and cyclones. The interventions which will help these communities include planting mangrove trees, and upgrading marine and freshwater fish hatcheries. They also include shellfish and seaweed culture. Renewable energy devices and flood rescue centres were also identified.

The British Council and Higher Education Commission Pakistan 'INSPIRE' programme has funded a one-year project 'Indus River Natural Resource Management'. This focussed on the sustainable management and ecosystem services used by rural communities. It also considered the environmental impact of risks and their mitigation.

Research has also focussed on underwater avalanches in the deep-sea, and on the impact of seagrass beds on flooding, for example in the Clyde estuary. The appearance of the coastal island of Surtsey off the Icelandic coast in 1963, and the 2013 Zalzal Koh Island off the Baluchistan coast have also had dramatic impacts. The most recent examples are the 2018 Sulawesi Island earthquake and tsunami in Indonesia. Finally, witness the Great Highland Fault along Loch Ness as a potential mega hazard for the whole of Scotland.

Dr Azra Meadows OBE & Professor Peter Meadows

Honorary lecturers - *Institute of Biodiversity, Animal Health & Comparative Medicine, School of Life Sciences, University of Glasgow*

Dr Azra Meadows OBE

Honours

- 2002 British Muslim's Achievement Award, at the House of Lords, London, for "Promotion of Educational Activities between the United Kingdom and Pakistan".
- 2008 OBE in the Queen's Birthday Honours for "Services to UK and International Community Relations".
- 2013 UK Pakistan Society Award. Azra and Peter Meadows were awarded the UK Pakistan Society Award for contributions to "The Advancement of Public Knowledge and Understanding of Pakistan".

Peter Meadows Sitara-i-Quaid-i-Azam

Honours

- 1995 Geotechnical Medal by the UK Institution of Civil Engineers.
- 2005 Sitara-i-Quaid-i-Azam for "Services to Education and the Environment" by the Islamic Republic of Pakistan. The Sitara-i-Quaid-i-Azam is one of the highest awards given by the Islamic Republic of Pakistan to foreigners, only two or three being awarded annually.



Azra Meadows and Peter Meadows are Honorary Lecturers at the University of Glasgow in the Institute of Biodiversity, Animal Health and Comparative Medicine, where Peter Meadows was Senior Lecturer for many years. Azra Meadows has been a lecturer in Environmental Management in the Department of Civil and Environmental Engineering, University of Bradford, and a Research Fellow in the Department of Civil Engineering, University of Glasgow, UK. They are both Fellows of the Royal Society of Biology, and Chartered Biologists. Azra Meadows and Peter Meadows have an international record of research, teaching and advice in marine and freshwaters on environmental sustainability, natural hazards, rural communities, clean water issues and biodiversity. They have also published widely on the impact of biological activity on the geochemistry and geotechnics of soils and sediments.

Azra and Peter Meadows have written well over 160 research articles and edited a number of conference volumes. These include jointly editing 'The Environmental Impact of Burrowing Animals and Animal Burrows' 1991 Oxford University Clarendon Press, and 'The Indus River: Biodiversity, Resources and Humankind', 1999 Oxford University Press, Pakistan. Azra has been a Trustee and Member of Council of the Zoological Society of London with particular interests in conservation in developing countries, and a member of the Environment Committee of the Royal Society of Biology. She is Chairperson of the Scottish Pakistani Association, and involved in major fund-raising initiatives in Scotland for the 2005 earthquake in northern Pakistan and the 2010 floods. Azra and Peter Meadows have worked for many years in Pakistan, where they work jointly with universities and NGO's including WWF, IUCN, and Heritage Foundation on rural communities in the coastal zone and in the northern mountainous areas – those affected by the October 2005 earthquake. In 1999 Azra and Peter Meadows jointly led the 44-person, three-month, Royal Geographical Society/Linnean Society International Hindu Kush Expedition to Chitral.

Since 2000 they have coordinated and led a number of international DFID/British Council HEL and DelPHE projects on rural community development and natural hazards in Pakistan. These have focussed on sustainability and resilience of rural communities in the coastal zone and mountain regions. In 2006 they acted as consultants to the Asian Development Bank on a US\$35 million project on coastal zone community development in Sindh Province, Pakistan. Azra and Peter have also been joint co-ordinators of two Scottish Government funded programmes on disaster management and preparedness in Pakistan. These projects have been jointly led with Mrs Yasmeen Lari, CEO of Heritage Foundation, Pakistan. The first project involved building more than 250 post-disaster emergency homes in Swat KPK. The second focussed on providing disaster management and guidance to village communities especially women and children, in the Siran Valley, KPK. A bilingual "Disaster Preparedness Manual" and DVD for rural communities was also published as a sustainable output of the second project. Recent programmes include a British Council/HEC INSPIRE Transnational Education Programme jointly with Shah Abdul Latif University, Khairpur, Sindh. This has been to develop and present a three-week intensive postgraduate Career Development course on "Indus River: Natural Resource Management".

The Clyde Marine Mammal Project

David Nairn

Director & Founder - Clyde Porpoise C.I.C.

ABSTRACT

Clyde Porpoise c.i.c. is a grass-roots environmental project based in upper Clyde, engaged in long term marine mammal surveys. In the past three years it has conducted over 8,000km of surveys in local, Irish Sea and West coast waters. We work with volunteers, various organisations and research partners to promote and raise awareness of Clyde marine mammal conservation. The project has gathered a fine scale acoustic data set that is now being used to inform the marine spatial planning framework.

The project has an ongoing community outreach component and has introduced over 200 volunteers including student, community, refugee and family groups to visual and acoustic marine mammal surveys aboard its 40 foot survey vessel. We have developed an ongoing program with the North Ayrshire Council Biodiversity Officer to deliver biodiversity awareness training to Local Authority Councillors as part of their continued professional development commitments. We also deliver a rolling program of talks and presentations, and coordinate a community marine sightings database. We provide a low cost survey platform and facilitate field data collection for university students. To date we have provided data to a Heriot Watt student for an Honours project to determine baseline abundance of porpoises in South Arran MPA. The project has also provided data for Strathclyde University students to develop click classifiers that will be used with acoustic signal processing software to increase the detection and better understand porpoise acoustics. Most recently, a University of St Andrews MSc student has submitted his thesis on fine scale distribution and hotspot analysis of porpoises in upper Clyde, based on data gathered via the project. The project is looking to further develop strategic partnerships to fulfil its long terms.

The project is working in partnership with FSC Millport to develop a volunteer and community participation centre based in the disused specimen supply buildings at Farland Point on Cumbrae. This location can provide an all-weather sightings station and will form a terrestrial hub for various environmental projects, including projects on adjacent designated habitats. The community based project would not have been possible without the support from North Ayrshire Ventures Trust, Firstport.org.uk. We greatly appreciate the valued expertise from our various academic partners and research professionals who have made an ongoing commitment to the project. We would like to thank the local communities and individuals who have contributed and value the work our project undertakes.

BIO

David Nairn has an Aquatic Bioscience degree from Glasgow University. He then conducted research at SMAS/UHI in partnership with SEAFISH Industry Authority on sensory organ development in halibut larvae. After working with water ranger team at Loch Lomond and Trossachs National Park he set up a sea school in Greece and conducted eco-tourist based marine surveys around Sporades National Park. He is a commercial skipper / offshore yachtmaster Instructor and mixes his passions for sailing, science and field work. How varied interests have now manifested into the Clyde Porpoises c.i.c. project. Through necessity, he has become an environmental campaigner and is an active community councillor in his home village of Fairlie. He's got a wee dug called Doogie.

Scientific Videos: Teaching Critical Analysis & Digital Capabilities through Film Making

Dr Anna Nousek-McGregor

Lecturer - Institute of Biodiversity, Animal Health & Comparative Medicine, School of Life Sciences, University of Glasgow

ABSTRACT

Critical analysis of published content is essential in any discipline, but frequently students struggle to engage with the process with appropriate depth. This skill is typically taught through journal clubs or small group discussions where some students actively participate and others do not, making teaching and practicing this skill difficult in large groups.

In this work, I suggest an alternative method of exploring critical analysis where students read a randomly assigned peer-reviewed research article and create a video that presents the central message of this article. This method has been carried out from 2014-2018 with University of Glasgow Animal Biology students at FSC Millport during their Level 3 Marine Biology field course.

Overall, engagement has been exceedingly high and students have enjoyed the exercise. This method also strengthens their digital capabilities, although more study is needed to explore their awareness of this connection. Furthermore, this method appears to be successful in engaging students in the process of critical analysis and is an excellent addition to our field course.

BIO

Anna's research background centres around the study of passive acoustic monitoring for aquatic animals but is also interested in the use of soundscapes as a measure of habitat complexity. More recently, her work has included studying the effects of noise on other animals as well as those in freshwater environments, and the use of acoustics to monitor cryptic animals in a number of habitats. She leads several marine biological field courses at Millport each year.

Anna also is actively involved in pedagogical research, primarily around active learning through technology, digital capabilities and employability. She completed a PhD at Duke University on energetics in North Atlantic right whales, an MPhil from the University of St Andrews on killer whale vocal signatures and a MEd from the University of Glasgow on developing an online professional presence.

Teaching 'Ocean Literacy' on Marine Field Courses

Dr Mark Ward

Project Manager - Somerset Wildlife Trust

ABSTRACT

In recent years marine science educators across the world have been working together to ensure that awareness of the marine environment and humans impacts on it are given a much higher profile both in formal education and amongst the wider citizenship. The concept of Ocean Literacy is based on core principles that should underpin good marine science education and community engagement.

The Field Studies Council is a leading provider of residential field courses in the UK. The post-16 biology courses it delivers at its coastal centres give an ideal opportunity to increase students' ocean literacy above and beyond curriculum needs.

Several studies have been carried out on students attending FSC coastal centres (including at Millport) to evaluate how courses can increase knowledge of the Ocean as well as potentially increasing emotional connections and eliciting individual behaviour change.

These studies have been linked to focus training for FSC tutors on both how to deliver Ocean Literacy and how to encourage the development of deeper environmental values. To these ends new resources have been made and tailored to embed ocean literacy in the courses.

The preliminary results show that students' knowledge of marine issues and their scientific understanding of ocean systems does indeed seem to be improved. The impact of FSC courses on emotional and behavioural change is less obvious and less easy to measure. This raises interesting questions about the academic nature of field courses and the influence of wider societal values on students.

BIO

Mark Ward is a marine biologist who has taught and developed field courses and resources both with a marine focus and with wider environmental outcomes for over 25 years both through working as a tutor and trainer for the Field Studies and through partnerships with other organisations such as the European Marine Science Educators Association (EMSEA), the British Ecological Society (BES) and the Lottery funded Outdoor Laboratories 'OPAL' project. He currently works for the Somerset Wildlife Trust as their 'Somerset's Brilliant Coast' project manager.

Mark has published material on a variety of marine topics and written chapters for textbooks focussing on marine education.

Eavesdropping on the Subsea: Rethinking Our Relationship with the Ocean?

Dr Rebecca Collins

Lecturer - Edinburgh College of Art, School of Art, University of Edinburgh

ABSTRACT

Cultural, political and economic representations of the sea instil common understandings of the ocean as timeless, often deceptively romantic, and fundamentally unknowable. Evidence of past activity, from whaling to offshore trading, fishing and the oil industry leaves little lasting visible traces of their activity. Despite, or perhaps because of this, works from Jules Verne's *20,000 Leagues under the Sea* (1870) to John Wyndham's *The Kraken Wakes* (1953) and the films of Jacques Cousteau (1956-1999) show that life underneath the surface is both intriguing and appealing to the popular imagination. The sea, an area out of view, beyond or below the public imaginary, has long been the ideal place to lose, hide or bury bodies, objects or technologies. The acoustic turn within the humanities offers the possibility to consider aural approaches to the deep sea. Recent developments in sound technologies make images of the seabed to recover artefacts we didn't know we had lost.

This presentation will consider how a site specific based arts practice of listening in on the ocean floor might enable the development and identification of narrative techniques which can, hopefully, begin to shift cultural representations of the ocean.

BIO

Dr Rebecca Collins is an award-winning artist researcher working at the intersection between contemporary performance and sound studies. She is a lecturer in contemporary art theory at the University of Edinburgh with expertise in aural attention, site specific art practices and research methodologies motivated by listening. This is evident in her PhD thesis entitled 'On Becoming Audience: Performing Aural Attention' and her recent publication 'Aural Spatiality and Sonic Materiality' published in leading peer-reviewed journal Contemporary Theatre Review. This presentation builds on work Collins has been developing as part of 'Stolen Voices' (see www.yourstolenvoice.com), a practice-led research project which used eavesdropping as a methodology for site-based thinking about the coast of the UK. Re-locating the investigation from the shore to the ocean depths marks a new direction for this work. Rebecca is co-organiser of Women In Sound/Women On Sound (WISWOS), a research network which tackles inequality and gender bias in the sonic arts. She is an associate artist at Aberystwyth Arts Centre and with Newcastle-based theatre makers Cap-a-Pie. She is a member of the Association for the Study of the Arts of the Present, the Theatre and Performance Research Association (TaPRA) and Artea, an interdisciplinary research group based in Spain.

Robert Walsh

Field Support Officer - *Capturing Our Coast* / Marine Conservation Society

ABSTRACT

Citizen science projects have been proven to be incredibly effective in ensuring a change in policy and raising public awareness to problems within the marine environment. With an array of citizen science projects available within the UK, showcasing the effectiveness through the results gathered is highly important in providing the evidence needed to continue to make change. Marine Conservation Society is showcasing 25 years of the Great British Beach Clean and Beachwatch and a reflection on the progress of one of the largest, well-known citizen science projects will be explored to what has been achieved more recently. Beachwatch highlights that the majority of litter items found during the surveys comprise of plastic components in addition to the mass of microplastics and fragments which end up being collected and retrieved. Non-sourced materials are often comprised of these fragments which can be identified at the point of production depending on what is available. The specific target audience and the field work associated within can influence research and provide a framework for bolstering environmental, political and industrial change. Projects such as Big Seaweed Search, Capturing Our Coast and Jellyfish Watch provide abundance information which can be used to monitor environmental change by utilising key species or common species typically found within specific regions or locations. Citizen science projects enable public inclusion whilst ensuring that areas or locations which might have a deficit in collected data are able to be included in the project. For Capturing Our Coast, Ayrshire did not have any data until April 2017, but the work of Capturing Our Coast has since changed that. Big Seaweed Search and Jellyfish Watch also have limited data for the Ayrshire and Clyde regions – meaning there is still plenty of work to still be achieved for research purposes. Ayrshire has multiple SSSI's (Special Sites of Scientific Interest) designated due to specific marine species – either fauna or flora. These are highly important for the use of monitoring changing baselines in abundance through climate change or through fluctuations in environmental variables. Incorporating long-term temperature loggers will enable more environmental information to be gathered alongside biodiversity abundance and species richness. Specific species such as *Corallina officinalis* (Coral Weed) are particularly susceptible to increasing temperatures and stretches of coastline are also highly vulnerable to marine invasive species introduction and settlement due to changing conditions. *Sargassum muticum* (Japanese Wireweed) is one such species settling in and around Ayrshire's coastline.

Bio

I am a freelance marine ecologist voluntarily surveying in Ayrshire. I recently worked as a Field Support Officer for the Ayrshire area alongside several organisations during the project Capturing Our Coast. I trained and supported volunteers in marine species identification and survey methodology – improving their understanding of the overall marine environment. I have been a Sea Champion with the Marine Conservation Society since March 2015, taking part in numerous beach cleans in Ayrshire and up within Cramond since. The data that I continue to collect both within MCS and following on from the end of Capturing Our Coast will be used for improving policy and protection within the SSSI sites around Ayrshire. I have been shortlisted for the Nature of Scotland Awards 2018 in the RSPB Young Nature Champion Award. I am highly passionate about the marine environment and understand the importance of field work in achieving these goals.

SCRAPbook: Mapping Scotland's Coastal Litter

Sophie Green

Technical Coordinator - SCRAPbook Project, Moray Firth Coastal Partnership

ABSTRACT

Increasing scientific, media and societal interest in coastal litter pollution, coupled with policy commitments such as the Marine Litter Strategy (2014) and the Marine Strategy Framework Directive (2008) highlight the importance of understanding our coastal litter problem. In response, the Scottish Coastal Rubbish Aerial Photography (SCRAPbook) project was established; a collaboration between the Moray Firth Coastal Partnership, the Marine Conservation Society and Sky Watch – UK Civil Air Patrol. The combination of these organisations provides a unique and novel skill set with the capability to deliver a comprehensive methodology for the identification, classification, mapping and cleaning of coastal litter.

Using aerial imagery collected from light aircraft, SCRAPbook will deliver a baseline overview of the distribution of coastal litter on Scotland's coasts for the first time. Continued monitoring will play a crucial role in developing our understanding of where, and why litter is accumulating and persisting on Scottish coasts. Such insight will play an important role in the realisation of clean, healthy, safe, productive and biologically diverse marine and coastal environments that meet the long term needs of people and nature (Marine (Scotland) Act 2010).

This presentation summarises the methodology applied and share some initial findings from the first phase of the project.

Bio

Sophie has a background in Marine Geosciences and Oceanography, with ten years' experience as a Marine Geoscientist at the British Geological Survey (BGS), contributing on a range of projects from mapping seafloor habitats to contribute to Marine Conservation Zones designation to running offshore drilling campaigns for the International Ocean Discovery Program (IODP).

Sophie is currently on Sabbatical from the BGS, as Technical Coordinator for the SCRAPbook (Scottish Coastal Rubbish from Aerial Photography) project – combining research, mapping and engagement skills to contribute to the evidence base for marine and coastal plastic pollution.

Marine Microplastic Pollution: The Clyde in Context

Dr Natalie Welden

Lecturer - School of Interdisciplinary Studies, University of Glasgow

ABSTRACT

Marine microplastic pollution is a global environmental issue, affecting a broad range of taxa and habitats. To date, its documented detrimental effects include uptake by biota, disruption to feeding behaviour, reduced digestive efficiency and the transfer of hydrophobic contaminants, although the extent of this latter effect is currently much debated. Despite observations of microplastics throughout the marine environment, their distribution is highly patchy, affected by a range of factors including currents, bathymetry, and salinity. The Clyde Sea, a fjord-like estuary on the west coast of Scotland, has previously been a focus of a range of microplastic research. It receives micro- and macroplastic debris from a range of industrial and domestic sources, including the city of Glasgow. Once introduced into the Clyde Sea, areas of slow-moving deep water, low salinity surface waters and low tidal energy alter the rates of microplastic transport and deposition by affecting the number of microplastics in the water column and their aggregation in deep-water sediments. As a result, increased levels of microplastic have been recorded locally. Previous studies have revealed more microplastic in biota from the Clyde Sea when compared to populations from different areas; for example higher microplastic uptake by langoustine (*Nephrops norvegicus*) in the Clyde when compared to other Scottish populations (Welden and Cowie, 2016), and in fish species caught in the Clyde when compared to those caught in the Thames (McGoran *et al.*, 2018). The Clyde is also home to numerous species seen to ingest plastic in other areas, which may also be at risk of higher microplastic ingestion and may be a suitable target for future study. The increased level of microplastic observed in the Clyde Sea highlights the need to establish robust baselines and ongoing monitoring is essential to ascertain the changing impacts on this vulnerable habitat and the ecologically and economically important resident species. Additionally, the Clyde Sea may prove an important model ecosystem for establishing future microplastic effects, indicating the potential environmental impacts should we fail to curtail the introduction of microplastic and plastic wastes over the coming decades.

Bio

Natalie began her research on microplastics here in Millport, studying their formation, distribution, and uptake throughout the Clyde. After a brief stint as an FSC Tutor she worked her way from York, to the Open University in Milton Keynes then down to Portsmouth, before deciding that the south was far too crowded, packing everything in a van and running back to Dumfries. She now lectures in Environmental Science and Sustainability at the University of Glasgow and continues her research into the effects of microplastics in fisheries (contributing to the recent Food and Agriculture Organisation report on microplastics in fisheries and aquaculture) and on the degradation and fragmentation of traditional and “degradable” polymers, she also works closely with organisations such as the women’s institute to publicise and develop solutions to the problem of microplastic fibre pollution.

What are the Key Beach Characteristics that Influence Industrial Plastic Pellet Pollution in the Firth of Forth Estuary, Scotland?

Jennifer Pearson

Postgraduate MSc Student - Strathclyde University

ABSTRACT

Industrial Plastic Pellets are the raw material of the plastic product industry. They are cylindrical plastic granules with a diameter of 0.2-0.5cm. Pellet spills occur throughout the industrial process and lead to pellet accumulations along coast-lines where they cause ecological damage. Pellet pollution on beaches in the Firth of Forth estuary has been recognised by past research and environmental groups but pollution level has not been documented. This research establishes base-line data for pellet pollution within the estuary for summer 2018 and aims to evaluate the influence of key beach characteristics in pellet pollution on beaches. By positively associating high pellet pollution levels with particular characteristics, clean-up strategies can be improved. The vegetation lines of 18 beaches along the coast-line of the Firth of Forth were surveyed for industrial plastic pellets using the Timed Count Method in May, June and July 2018. The data was evaluated to establish temporal fluctuations in pellet numbers and pellet spatial patterns. Total pellet numbers were estimated for each beach and a pellet pollution scale was established. According to these results, three beach characteristics were considered: beach location, beach aspect and length of vegetation line.

Pellets were found on 16 of 18 beaches. Four were considered 'heavily polluted'. There were no significant regional temporal fluctuations within the study period but fluctuations at beach level suggested pellet movement. Beaches on the north shore had a significantly higher number of pellets. The central estuary had the highest level of pollution, suggesting the source of these pellets was in-land, local sources. On the north shore, the general spatial pattern showed that as distance from this source increased, pellet pollution concentrations decreased. Beach aspect appeared to have little effect on pellet accumulation. Beaches with a vegetation line longer than 500m were found to be less likely to have high levels of pellet pollution. Beaches that demonstrate each of these characteristics are most likely to have high pellet pollution levels. Pellet pollution levels vary with beaches that only possess 2 or 3 and so further study is required to understand how the characteristics interact.

BIO

Jenny Pearson has just recently completed her MSc in Sustainability and Environmental Studies at the University of Strathclyde; and previously to that, she studied for her BSc (hons) in Applied Bioscience and Zoology at the University of the West of Scotland. She is very passionate about protecting the natural environment, particularly against that harmful effects of plastic - this is what inspired her recent dissertation. She is currently a Volunteer Coordinator at 'Glasgow Over Plastic'. They are a youth-led community interest group trying to create real systemic and social change in Glasgow, with the overall aim of making Glasgow a city that is free of plastic waste. Jenny also volunteers for the RSPB at her local nature reserve Baron's Haugh, where she contributes towards conservation projects and surround herself with wonderful wildlife and people. Jenny has also recently been accepted onto a Keep Britain Tidy programme as a #litterhero ambassador – she is excited about the platform this will give her to make a positive change within the local community.

Plastic Poetics: Marine Waste in Contemporary Poetry

Dr Alexandra Campbell

Early Career Research and Teaching Fellow – *School of Literatures, Languages and Cultures, University of Edinburgh*

ABSTRACT

This paper examines the prevalence of marine waste in contemporary Atlantic poetry. Taking a mildly archipelagic approach, my talk today will trace the arrival of different waste-materials that wash ashore across the length and breadth of a relatively small cluster of islands in the northeast Atlantic Ocean. Across the works of contemporary poets in the UK and Ireland, the seemingly obsolete objects of plastic bags, nylon rope, and rubber ducks take on new dimensions of cultural value as they reach the shoreline. In drawing attention to these ‘surreally malevolent’ materials, these poets make visible the otherwise invisible and offshore narratives of waste that currently populate the world’s oceans. However, while the repeated gathering and salvaging of waste within these poems does well to alert us to the global scale of the plastics crisis, the dominance of the ‘surface’ narrative within these poems prompts further analysis in terms of how the crisis of marine pollution is still very much approached from a terrestrial and anthropocentric, rather than an oceanic and multispecies perspective.

What does the continued framing of ocean crisis through the arrival of materials onshore do to our comprehension of the degradation of deep-sea marine environments? Does the continued cultural fascination with littoral spaces within contemporary poetry, perhaps override or distract from other troubling oceanic narratives that circulate offshore? Furthermore, how might poetic engagements with ocean plastics allow us to not only consider questions of disposal and dispersal in general, but grant us an opportunity to access the invisible yet pervasive petro-capitalist world system that produces this plastic in the first place?

BIO

Alexandra Campbell is currently an Early Career Research and Teaching Fellow at The University of Edinburgh. Her research emerges at the intersection of several critical discourses including critical ocean studies, the environmental humanities and world literature perspectives. She is particularly interested in ecologies and poetics of the sea and is currently working on her first monograph, provisionally titled 'Hydropoetics: Atlantic Modernity, World Ecology and the Techno-Ocean', which examines the cultural and historical parameters of oceanic resource exploitation in contemporary North Atlantic writing, focusing on discourses of extraction, disposal, and transmission at sea.

Monitoring Seabirds on Ailsa Craig

Crystal Maw

Reserves Manager – RSPB Dumfries and Galloway

ABSTRACT

The RSPB has been monitoring Ailsa Craig since 2004. It's a spectacular island that packs a punch, hosting one of the largest collection of seabirds in the UK, including the third largest gannet colony, at 34,000 pairs. Although many of the species on the island have suffered the same declines seen nationally, birds such as the lesser black backed gull and the kittiwake, there have been some success stories to celebrate.

The story of the puffin is a dramatic one; there are records from the 1800s that tell of the skies darkening with puffins, and that they were once collected in their thousands for food and feather bedding. With the building of the lighthouse and intensive quarrying for granite came supply boats carrying rats. The first rat recorded on Ailsa was 1889, and within 40 years puffins no longer bred on the island. After a massive effort to successfully rid the island of rats in the 90's, puffins once again returned to Ailsa, and our monitoring has shown that they are steadily increasing and spreading their nesting areas as the years go on. This shows that birds can start to bounce back when successful conservation measures are taken.

Another highlight, as much for the journey as the result, was the search for the Manx shearwater. These elusive birds had never been confirmed breeders on the island, and negotiating the Ailsa terrain to prove it has been a challenge. With over 80% of their global population occurring on only 3 main colonies in the UK, the Manx shearwater is vulnerable. Finding them on Ailsa helps inform studies on Manx shearwater habitat preferences, as well as adding another home island for them, safe from rats. This presentation will cover the often frustrating pursuit of the 'Manxies', and at last the triumph of finding them using night vision equipment and a lot of deduction!

Future work for the RSPB will be to maintain the island 'rat free' with a biosecurity plan in place and a task force on hand to respond to any incursion. Our continued monitoring will also inform our advisory work on the decennial quarrying for the famous Ailsa Craig granite.

Bio

Crystal volunteered with the RSPB whilst at university studying wildlife conservation. She managed to get a job with them in her final summer, working at the Loch Garten osprey centre in the Cairngorms. She fell in love with Scotland there and then, and has been working her way around the RSPB Scottish sites since then. She been lucky to work at some really beautiful and remote reserves in the Hebrides, trying to improve habitats for chough and corncrake. Crystal loves the diversity of where she is now, working as site manager for the RSPB Galloway reserves, which are ancient oak woodland, the Wood of Cree, Ken Dee marshes and Kenmure Holms on Loch Ken, the best places to see the declining willow tit, Scotland's very busy southern point, the Mull of Galloway, and the spectacular island of Ailsa Craig. Crystal currently leads research trips to Ailsa Craig several times a year, amongst her work at the other Galloway reserves.

30th Anniversary Year Update: Dive Surveys of the West Coast and Wider Scotland

Natalie Hirst

Scotland Coordinator – *Seasearch*

ABSTRACT

This year Seasearch celebrates its 30th anniversary of volunteer led marine data collection around the UK. Seasearch carries out training and surveys with volunteer divers to collect marine species and habitats data that is open source and totally accessible by all, for conservation purpose. As our anniversary year, this year has been exceptionally busy with numerous dive trips, training days and events attended; a summary of which is given below.

One of the major dive trips carried out earlier in the year during the still snowy month of March was a survey of the Loch Carron MPA. Loch Carron has been a recent emergency designated marine protected area, in response to damaging fishing practices witnessed by local fishermen and community members. Harmful scallop dredging witnessed in areas of sensitive Flame shell beds (designated as Priority marine features), was investigated by Seasearch divers. Thanks to the well-established techniques used by Seasearch in the form of the recognised surveyor form, the data could be relied on like for like, in terms of government survey options and meant the process was quickly actioned in record time. The dedication of those divers involved to carry out this worked off their own back, is incredible and shows that we still have as ‘small voices’ the ability to make big differences in the world of ‘big policy’.

A further highlight this year, has been the rare opportunity to be on a Seasearch expedition to the outlier islands off Northern Scotland. One of the aims of Seasearch is to try fill data gaps, either in geographically hard to reach places or spots not normally recreationally dive; and the extreme North coast certainly ticks both those boxes! Unfortunately due to unfavourable weather we were unable to reach the outer islands, but were rewarded with stunningly diverse dive sites around Cape Wrath and Orkney, demonstrating some of the unique environments the extremely exposed shores have and even gifted us with underwater finds of live skate egg cases which we are currently trying to improve records of in order to improve the Skate and Ray designated MPA evidence base.

All in all it's been an amazing year, and still not finished with winter sealoach dives to further develop training on the cards for November and December, and I would like to thank all those volunteers involved making this year something to remember.

BIO

Natalie is in her 3rd year as Scotland Coordinator for Seasearch, since beginning as a Seasearch Observer in 2005. Natalie runs her Seasearch Coordinator duties alongside working as a Marine Consultant in the renewables sector, based in Glasgow. Prior to joining Seasearch Natalie previously worked as a scientific diver and author on the MPA assessment process around Scotland, and as an independent consultant carrying out environmental surveys around the UK and abroad. Currently Natalie's focus is on researching benthic communities in particular PMF biogenic reefs such as Horse Mussels and Limaria, which form part of Seasearch's target goals for data collection around Scotland.

The Future of Bottlenose Dolphins (*Tursiops truncatus*) on the East Coast of Scotland

Jack Lucas

Senior Tutor – Field Studies Council (Millport)

Postgraduate MSc(Res) Student – Sea Mammal Research Unit, Scottish Oceans Institute, University of St Andrews

ABSTRACT

The bottlenose dolphin population on the East coast of Scotland is a small, isolated and genetically-limited population (Thompson *et al.* 2004) that is the only population of such species in the North Sea and the furthest North in the world; at the true limit of their geographic range. The current population status is listed as vulnerable, and despite a range expansion in recent years the population seems to be stable or increasing (Cheney *et al.* 2018). Individuals are known to range from the Moray Firth down to the Northumberland coast (Arso Civil 2014) and are increasingly being encountered outside of the Moray Firth SAC. In addition to being protected under a web of national and international legislation, bottlenose dolphins are not only crucial for maintaining ecosystem health and but can also act as sentinels of the marine environment.

This work will update various key vital rates for the population including abundance, fecundity and survival rates for adults and calves. A Population Viability Analysis (PVA) examination will be used to conduct a sensitivity analysis assessing the extent to which changes in population vital rates and species parameters can effect population growth rate. In addition, PVA's will be used to simulate several 'catastrophe' scenarios of various potential threats and the corresponding impact on growth rate and probability (if any) of extinction. The East coast population is exposed to a myriad of potential threats, including disturbance from ecotourism, shipping, military and oil and gas exploration; changes in prey available due to overfishing and climate change; habitat alteration by dredging and offshore renewables and are potentially susceptible to health issues arising from disease, industrial/agricultural discharge and oil spills. All of these can be incorporated into population forecasts.

BIO

Jack is a marine biologist and Senior Tutor at Millport Field Centre. His teaching ranges from school science residentials and university marine ecology field courses to more specialist professional courses on ornithology, marine fieldwork techniques and wildlife excursions. Graduating with a BSc from Plymouth University in 2015, he has worked with several marine research organisations around the world, including projects in New Zealand, Australia, The Bahamas and here in the UK. His research interests focus primarily on marine mammals and seabird ecology; namely their distribution, abundance and conservation. Jack also works for a variety of volunteer research and rescue organisations; his roles include working as an Offshore Researcher and Wildlife Officer for MARINELife, a Stranding Responder for the Scottish Marine Animal Stranding Scheme, a Marine Medic for British Divers Marine Life Rescue and as a European Seabirds at Sea Surveyor for the CalMac Marine Awareness Programme.

Jack is currently pursuing a postgraduate research degree with the Sea Mammal Research Unit in St Andrews, and his thesis examines the population ecology of the bottlenose dolphin population living on the East Coast of Scotland.

The Purpose of Porpoise around Fish Farms

Texa Sim

Postgraduate PhD Student – Scottish Association for Marine Science & University of the Highlands and Islands

ABSTRACT

The harbour porpoise (*Phocoena phocoena*) has a widespread coastal distribution throughout the northern hemisphere, where there is potential for interaction with anthropogenic activities. In Scotland the species may interact with an expanding Atlantic salmon (*Salmo salar*) aquaculture industry. Scottish salmon farms are mainly situated on the west coast, northern and western islands which also have some of the highest harbour porpoise densities in Europe. Possible impacts to the species have been brought further into focus through the recently proposed Inner Hebrides and Minches Candidate Special Area of Conservation (cSAC). This protected area will cover 13,539km² of porpoise habitat and has significant overlap with existing salmon farm sites.

The impacts of salmon farms on the harbour porpoise are not well understood, and study efforts mainly focus on the effect of Acoustic Deterrent Devices (ADDs) deployed to prevent seal depredation. These may induce habitat displacement in harbour porpoises, or conversely cause habituation where individuals have been exposed to long-term use. However, the extent of these impacts on porpoises in Scotland is presently unclear. The significance of other factors, such as wild fish aggregations, has also received limited attention to date.

To address these knowledge gaps, the present study will use Passive Acoustic Monitoring (PAM) to identify whether harbour porpoise occur near Scottish salmon farms, and if so, establish temporal variation in usage patterns. Additional PAM will investigate evidence of behaviours such as foraging. Potential attractants such as wild fish aggregations will also be assessed using a combination of video and acoustic techniques. Finally, the effects of ADDs on porpoise occurrence and behaviour will be assessed, providing further understanding of the West of Scotland population. The study will ultimately present multiple small-scale, site-specific examinations on the relevance of salmon aquaculture to harbour porpoises in Scotland, with an aim to inform activity management within the cSAC.

BIO

Texa Sim is a cetacean scientist, specialising in the ecology, ethology and socio-biology of these incredible marine mammals. She completed my BSc. Marine Biology at the University of Aberdeen, and continued her studies through a MSc. Marine Biology at Bangor University, Wales. She is delighted to find herself studying a PhD through the Scottish Association for Marine Science (SAMS) on the West coast of Scotland, and enjoy having the rivers, mountains and sea on her doorstep. Texa's PhD will attempt to determine the occurrence of harbour porpoises around Scottish sea farms, with a focus on acoustic techniques to answer questions about their behaviour.

The Effect of Changing Ocean Conditions on Barnacle Feeding Morphology

Rhona MacGregor

Undergraduate BSc Student – *University of Plymouth*

The IPCC (intergovernmental Panel on climate change) are predicting as much as a 3C increase in sea surface temperatures and a decrease of salinity of up to 1.5psu annually (IPCC 2014). *Semibalanus balanoides* are an abundant barnacle on the west coast of Scotland and the Isle of Cumbrae. They filter feed through the use of cirral, extracting zooplankton from the sea. Climate change being as complex as it is makes it particularly hard to predict the impact on individual organisms.

This data aims to investigate how two factors that will be effected by climate change (temperature and salinity) would impact of *S.balanoides* cirral morphology. *S.balanoides* were collected from Keppel Pier, Millport in April 2018 and subjected to a selection of different treatment combinations (control, increased temperature, decreased salinity and both increased temperature and decreased salinity) before being dissected and having their ramus length measured. Preliminary findings suggest that salinity has the greatest effect on cirral morphology but that as time increased there were decreases in all cirral lengths, it is unclear whether there are any significant differences. Work is now being done at the University of Plymouth to look at regional and species variation in adaption to the same conditions.

Early Stage Microbial Biofilm Formation and Biodegradation Rates of Monolayer Graphene Polyethylene Terephthalate and Polyethylene Terephthalate Composite Films in the Marine Environment

Thomas Clough

Undergraduate BSc Student – *Lancaster University (Blackpool & Fylde College campus)*

The advent of the graphene era promises numerous remarkable applications from improved biosensors and electronics to anti-fouling paint and enhanced packaging materials, often as synthetic polymer composites. However, we are currently in a global plastic pollution crisis due to our historic dependence on synthetic polymers and lack of environmental foresight in their usage.

This investigation focuses on the potential environmental impacts and degradation rate of graphene polymer composites within the marine environment via comparative analysis with polyethylene terephthalate. Previous graphene and graphene oxide environmental impact and risk assessments have thus far failed to address the influences of graphene being inadvertently introduced to the marine environment as marine debris.

Quantitative analysis of monolayer graphene polyethylene terephthalate and polyethylene terephthalate films was performed on weight, density, buoyancy, hydrophobicity, biofilm coverage and culturable colony forming unit parameters over a 5-week submersion period at Fleetwood Dock, England and statistically manipulated to determine a daily rate of change value for early-stage degradation and biofilm colonisation. Opportunistic heterotrophic bacteria were found to colonise monolayer graphene polyethylene terephthalate films at a significantly lesser rate than on polyethylene terephthalate films, potentially alluding to antibacterial resistive qualities in graphene polymer composites. However, monolayer graphene polyethylene terephthalate films degraded significantly more rapidly than polyethylene terephthalate films, especially in terms of buoyant integrity, which could represent future challenges in debris interception, accelerated sedimentation, bioaccumulation and biomagnification.

Investigating Impacts of EU CFP Landing Obligations on Shetland Fisheries

Clare Hill

Postgraduate PhD Student – *Scottish Association of Marine Science*

Negotiations for Britain's exit from the European Union (Brexit) could have huge implications for UK fisheries. A move away from European Union Common Fisheries Policy could present positive opportunities for Scottish fisheries to establish more effective and reactive fisheries management systems – managing sustainable stocks alongside economic growth.

This research aims to determine how the Landing Obligation (LO) (aka the Discards ban) may affect both the ecosystem and economics of Shetland fisheries. This will be achieved by building an Ecopath with Ecosim (EwE) model representing the food-web of the northern North Sea (ICES Division IVa). The model will incorporate catches, discards and fish diets as well as functional groups such as seabirds and cetaceans.

Shetland food-web biodiversity and trophic interactions project (2017) conducted by NAFC Marine Centre gathered diet data for commercial target species important for Shetland fisheries. Initial comparisons of this recent diet data for the northern North Sea and data for whole North Sea suggest that small gadoids are a more important prey species for cod and monkfish in the waters surrounding Shetland than for those in the greater North Sea. Also from initial analysis cod populations surrounding Shetland seem to have a larger range of prey species in comparison to cod in the greater North Sea.

Prior to any policy adaptation, it is imperative to understand current factors affecting fish stocks and model how these factors may influence future stocks. Using ecosystem network analysis to explore marine systems we are able to evaluate past and present dynamics to estimate future impacts of the UK leaving the European Union.

Observations of Rough-toothed Dolphins (*Steno bredanensis*) in The Bahamas Suggests Long-term Site Fidelity on a Navy Sonar Range

Jack Lucas

Senior Tutor – *Field Studies Council (Millport)*

Rough-toothed dolphins (*Steno bredanensis*) inhabit deep water environments often associated with island archipelagos. Despite being widely distributed in warm temperate and tropical waters, few populations have been well documented. Longitudinal studies in Hawaii have found resightings of individuals suggesting a small population with high site fidelity. Here we present new information on the occurrence of this species in the western Atlantic, and evidence of their site fidelity to the Great Bahama Canyon, an area which includes the US Navy's Atlantic Undersea Test and Evaluation Center (AUTC).

Photo-identification data were collected from 1995 – 2013 during 20 sightings of *S. bredanensis*. Sightings occurred year-round and group size ranged from four to 40 individuals (mean 18.6, sd = 9.3). Notably, nine encounters occurred on AUTC's weapons ranges where military sonar is regularly used. Eight sightings consisted of multiple species aggregations including short-finned pilot whale (*Globicephala macrorhynchus*, n=6), melon-headed whale (*Peponocephala electra*, n=3), Fraser's dolphin (*Lagenodelphis hosei*, n=2) and pan-tropical spotted dolphin (*Stenella attenuata*, n=1). Over 4500 photographs were examined but analyses were later restricted to only high quality photographs of individuals with nicks so that right and left side catalogues could be pooled, resulting in the identification of 135 distinct individuals. Thirteen individuals were sighted in multiple years, with up to 12 years between resightings. The majority of resightings occurred on the AUTC range (11 of 13) where eleven dolphins were seen in 2 consecutive years and two dolphins were sighted in 3 years over an 8-year time span, supporting long-term site fidelity to the navy range.

This work highlights the importance of longitudinal photo-identification studies and supports similar findings from Hawaii. Most importantly, it suggests that more intensive work on the AUTC range may be useful in monitoring the status of this species on the navy range where their abundance may be low.

Incorporating Uncertainty Analysis and Fishers Knowledge into the Construction of Ecosystem Models

Jacob Bentley

Postgraduate PhD Student – *Scottish Association of Marine Science*

For complex ecosystem models to be used as tools to inform management, their development should incorporate all available data and stakeholder knowledge to address inherent uncertainty. We included long-term stomach records and stakeholder knowledge (food webs and fishing effort trends) into an ecosystem model of the Irish Sea (developed as part of the first ICES Integrated Benchmark Assessment, WKIrish). We show that this data altered our perception of the ecosystem and improve the statistical fit (AICc) of model dynamics to observed data. Diet based uncertainty analyses derived from Linear Inverse Modelling techniques enabled stronger inferences to be drawn from Ecosystem Network Analysis indicators for the Irish Sea food web.

The addition of stakeholder knowledge provided altered ecosystem perceptions. Stakeholders distinguished multiple flows between discards and consumers, which were not directly identified in the fish stomach records, leading to higher estimations of system recycling. The addition of stakeholder fishing effort drivers increased the models capacity to replicate historic trends when used in conjunction with ICES fishing effort data and environmental drivers (temperature and North Atlantic Oscillation). Steps such as these and the availability of open-source long-term datasets are essential to address the uncertainty in complex models and achieve greater uptake beyond academic purposes.

A Marine Station for Millport: The Changing Face of a Research Institute

Dr Natalie Welden

Lecturer - *School of Interdisciplinary Studies, University of Glasgow*

The story of the Marine Station at Millport is one of passionate amateurs, renowned scientists, societies, universities and charities. It has been the home of researchers and students, the stopping off point for arctic and tropical adventures, and the pride of a small island. Following his success in bringing The Ark to the Clyde Sea, the renowned “Cumbrae Naturalist” David Robertson petitioned Glasgow’s industrialists for the funds to build a permanent marine station on Cumbrae. From its early days the Marine Station was involved in bringing marine biology to the public, training teachers and students from Scotland and beyond.

The Marine Station also served as a destination for other boat based adventures; in 1904 it celebrated the return of the Scotia and Dr William Speirs Bruce's Scottish National Antarctic Expedition. Over the years the station has hosted many memorable names; from Sheina Marshall, among Millport’s most notable scientists and one of the first women to be made a Fellow of the Royal Society, to the writer presenter, and broadcaster Mark Carwardine. Now managed by the Field Studies Council the field centre welcomes family groups, leisure learners, schools, and universities to the island.

Through open events, day visits, and residential courses, the FSC is attempting to continue the legacy of the The Ark; teaching marine science, encouraging ocean literacy, and passing on a passion for the marine environment.

Summary of the Field Excursions

Several presenters and members of the audience stayed overnight and participated in two field sessions on the day following the Symposium. This is a summary of each session and what was found...

ROCKY SHORE ECOLOGY

The first session involved a visit to the nearby exposed rocky shore of Farland Point, a 5 minute walk from the field centre, at low tide. The tide, whilst not being a particularly low (0.84m) allowed the group to find and record a variety of intertidal species and learn about their ecology and taxonomy. Various samples were collected for identification back in the lab or for display in the centre's in-house aquarium. A variety of bird life and some friendly local seals were also encountered. The species list was subsequently uploaded onto the website iRecord for the records to become incorporated into the National Biodiversity Network (NBN) database. Full details of the survey can be found on iRecord under the centre's activity, some of the more interesting finds are pictured below.

PLANKTON SAMPLING

The second session involved retrieving plankton samples from the historic Keppel Pier (whilst watching the local common dolphin) using nets with different mesh sizes to capture both phytoplankton and zooplankton. The specimens were then examined using compound and dissecting microscopes in addition to a video microscope to show the organisms on a screen. The group also took a closer look at some of the rocky shore organisms that were brought back, such as encrusting sea mats (*bryozoans*) and *hydroids*.



Viviparous Eelpout
Zoarces viviparus



Common Starfish
Zoarces viviparus



Copepod
Copepod sp.



Beadlet Anemone
Actinia equina



Flat Periwinkle
Littorina obtusata



Blue-rayed Limpet
Patella pellucida



Sea mats
Electra pilosa
Flustrelidra hispida



Northern Gannet
Morus bassanus

Closing remarks

The authors have kindly agreed to have their work presented in this form and have provided biographical information on request for readers who were not fortunate enough to speak to them in person on the day of the event or wish to gain insight into their background. Contact details for authors have not been made available in this document, however the institutions or organisations of the authors has been listed for reference and if for any reason further contact details are needed, please enquire with the field centre. Many of the speakers will also be back for 2019 with further updates on their projects.

After compiling feedback from both presenters and audience members, it has been decided that future Symposiums will be titled simply 'Millport Marine Symposium' without the 'Research'; to reflect the diversity of content on offer. Whilst much of the work submitted is research-based, topics range from conservation, outreach, literature, wildlife and history; so to represent these other fields and to encourage non-academic parties to attend, the 2019 Symposium title will be adjusted accordingly.

Based upon the success of this year's symposium, the 3rd Millport Marine Research Symposium will be hosted in the autumn of 2019 on the equivalent dates. The themes for next year's Symposium have yet to be established, but as with the 2018 event we are aiming to attract a diverse and holistic collection of presentations and posters. It is our hope that the Symposium will grow to become the Clyde forum for any and all marine-themed discussion, from tiny Scottish lochs to the immense open ocean, from tropical coral reefs to the frozen polar wastes. A call for abstract submissions will be issued late spring / early summer 2019, with a provisional programme available from August onwards.

To find out more about the centre and the area, the courses and teaching we provide or the facilities available please visit the website, call us directly at the centre enquiries please or email our admin team.

To receive updates and news about the symposium and other related FSC events you can to subscribe to our email list at:

eepurl.com/ddDhaz



www.field-studies-council.org/centres/scotland/millport



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Conferences and Events



Millport Field Centre is the perfect venue for conferences and events with a 100-seat lecture theatre, en suite accommodation, on-site bar, 6 work spaces, bespoke catering options and optional field excursions. We have hosted the Porcupine Natural History Conference, Pan-European Duck Symposium, Whalefish Professional Development Training, Ayrshire Federation of Historical Societies Conference, Biological Recording in Scotland Conference, RSPB working groups, weddings, workshops and employee away days to name but a few.

Marine Science Camps



These camps, run in partnership with the Marine Biological Association (MBA), are for young people between 16 and 24 years old who are interested in marine biology and marine science. Snorkelling, wildlife, lab experiments and fieldwork!

Adults & Professionals



Our centres host a range of science and natural history courses for all abilities and include:

- Marine Biological Sampling
- Marine Mammal and Seabirds
- Rocky Shore Invertebrates
- Scottish Island Seabirds
- Marine Plankton
- Seaweed Identification

Primary and Secondary



Curriculum-specific field courses for school children of all ages! These include adventure and nature residentials for primary and scientific field courses for secondary, focussing on Biology, Geography and Environmental Science.

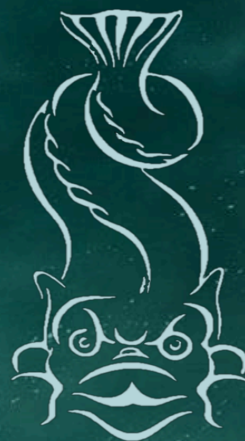
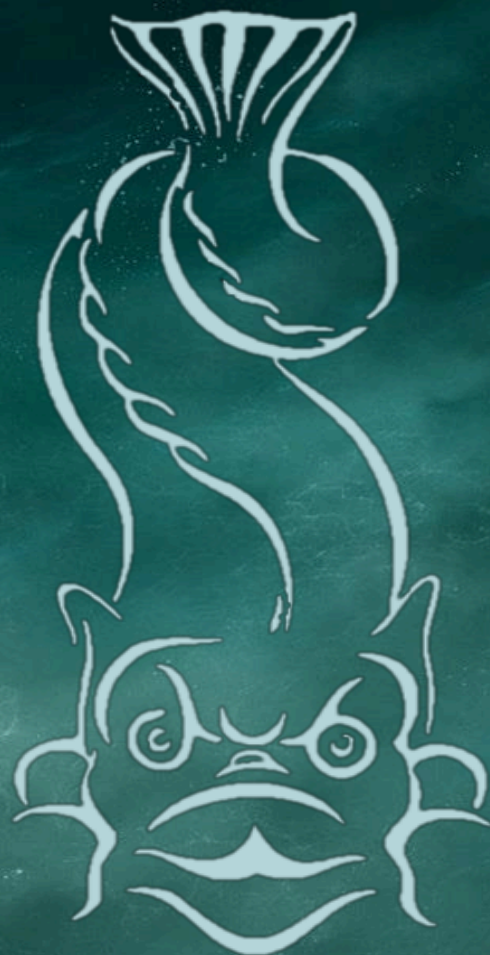
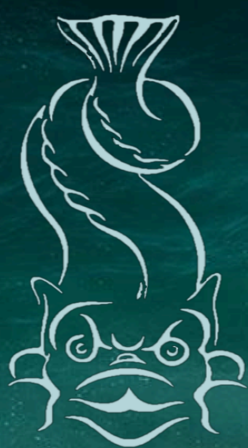
University



The facilities and equipment available in addition to specialist tutor-knowledge make the FSC the perfect venue for undergraduate and postgraduate studies. In-house aquaria, a fully-stocked kit store, microbiology lab and a research vessel capable of deploying a range of oceanographic sampling equipment.

Our experienced Tutors have a breadth of experience in marine science and education and can tailor new courses to meet individual group's needs.





PROCEEDINGS OF THE

2ND MILLPORT MARINE
RESEARCH SYMPOSIUM

