Proceedings of the

3rd Millport Marine Symposium

FSC MILLPORT

Foreword

Jack Lucas
Senior Tutor, FSC Millport

This year has been an incredibly important one for our marine environment. The Intergovernmental Panel on Climate Change (IPCC) released the 'Special Report on the Ocean and Cryosphere in a Changing Climate', providing the world with stark warnings on the effect of human-induced climate change on our oceans and coastlines. On 4th July, following a decision by the UK Parliament to do the same, the FSC's Board of Trustee's joined many other organisations around the county to declare a 'climate emergency'. The FSC have set ambitious targets to reduce its carbon impact by 40% by 2020, having already reached a landmark goal of achieving more than 50% of total energy use coming from non-fossil fuel sources, such solar and biomass. The charity continues to lead the way in environmental education and sustainable development, whether this is through educating students on the impact of climate change or pollution, informing people of how their actions can make a difference or by implementing systematic changes at a centre-level to ensure our operations are more environmentally-friendly. It is with this attitude that the FSC approaches its 4th Millport Marine Symposium; full of enthusiasm and passion for bringing scientists and the public together to learn about people and projects that can change the world…

The historic Millport Marine Station continues its legacy as pioneering base for marine research. Over the years, and its various incarnations, thousands of undergraduates, scientists and academics have contributed to our knowledge of the marine environment from this beautiful location. Now, under the banner of the Field Studies Council, we are adding families, school pupils, adult learners and members of the public to this list, whilst continuing to support our university cohorts and postgraduate researchers! One of the driving aspirations of the centre and its staff is to pull away the veil of exclusivity that can often surround prestigious scientific institutions and open the doors to a wider variety of learners. The Millport Marine Symposium is the perfect forum for this, and this year over 70 people came together, on a sunny weekend and overlooking the magnificent Firth of Clyde, to celebrate our shared marine heritage.

This year's symposium is particularly apt, as in a few months we will enter 2020 and begin Scotland's Year of Coasts and Waters. The bi-annual Themed Year for 2020 will spotlight our marine environment and waterways, to promote and celebrate public engagement with this crucial part of Scotland's nature and culture. Looking ahead to next year, the country will be awash with marine-themed events, both commercial and environmental, and it is our aim that the FSC's 4th Millport Marine Symposium will be up there as a 'must-see' event for anyone wishing to find out what exciting projects are going on around our coastline and how they can get involved.

Contents

Welcome to FSC Millport: A History of the Marine Station

Alex MacFie

Acting Head of Region for the Field Studies Council / Head of Centre at 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. A Commerce degree from the University of Birmingham followed by a postgraduate degree in Education from Glasgow University combine well with the onsite marine biology experts to create the perfect conditions for the continued growth and success of FSC Millport.

A Regional Marine Plan for the Clyde: Opportunities for Science

Fiona Mills

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Abstract

The presentation examines the close links between science and marine planning by considering various aspects of the work involved in developing a regional marine plan. The key drivers from legislation at the EC, UK and Scottish levels include the improvement of the condition of the marine environment, use of the Ecosystem Approach, and aiming to have clean, healthy, safe, productive and biologically diverse oceans and seas. Marine planning is a process to analyse and organise human activities in marine areas to achieve environmental, economic and social objectives. It provides a framework for effective decision-making and management of marine activities and sustainable use of marine and coastal waters. Scotland's National Marine Plan was adopted in 2015 and regional marine planning is being rolled out starting with the Shetland Islands, the Clyde and more recently the Orkney Islands.

The process for developing a regional marine plan involves several stages and there is a need for the use of sound science throughout the process. Initially the Assessment draws on the latest monitoring and scientific understanding available from the Government, regulatory agencies and scientific papers to describe the condition of the region. There are sections on the physical characteristics of the region, the condition of the region in terms of whether it is 'clean and safe' and 'healthy and biologically diverse' and finally on the 'productive' aspect of socio-economic activity in the region including pressures and impacts. The Assessment included information boxes about the condition of ecosystem services. This key part of the process relies on having scientific knowledge and understanding in place and of course there are gaps in our knowledge which are indicated within the Assessment. These provide an opportunity for future scientific work.

The plan itself is developed using a set of Guiding Principles which include sustainable development; the Scottish Government definition of this includes 'using sound science responsibly'. The plan supports delivery of Good Environmental Status under the Marine Strategy Regulations 2010. The plan also uses the Ecosystem Approach which aims to take account of how nature works, recognise the benefits that nature provides and involve people in decision-making. The first two parts of this has close links with natural sciences and the latter requires input from social scientists. A further guiding principle promotes the multiple responsible use of marine space and this is any area of opportunity for science to consider more efficient use of marine space with multiple use between sectors.

The presentation also considers the work of Clyde 2020, a project initiated in 2014 by the Cabinet Secretary to identify, test and implement practical actions which may contribute to the renewal of the Clyde marine ecosystem. A steering group was formed and it was immediately clear that a Research Advisory Group was also required in order to advise on scientific knowledge and ongoing research. The focus of the work to date has been on marine litter and particularly plastics as well as the condition of fish stocks and seabed habitat. The Research Advisory Group gave advice to the Clyde 2020 steering group in June 2016 which recommended several priorities for research work to support the project. Several PhDs have been done and are ongoing which focus on issues identified by Clyde 2020. Again this is evidence of the importance of working closely with scientific colleagues to ensure any management initiatives are based on sound science.

Finally the presentation looks at the Action Plan being developed by the Clyde Marine Planning Partnership for work required following adoption of the Clyde Regional Marine Plan. Whilst still in early draft, there will be areas identified for further scientific work to support implementation of the plan and to inform future iterations of the plan. In conclusion, scientific research and understanding is a key component of the work involved in developing and implementing a regional marine plan and it is important for marine planners to clearly indicated priorities for future research to support their work. Research gaps are available to view at www.clydemarineplan.scot in the Clyde Marine Region Assessment and on the Clyde 2020 page. The report on the condition of the seabed habitat, fish and shellfish and accompanying animations developed by the Clyde 2020 project are also available on the website.

Bio

Fiona Mills is the Clyde Marine Planning Partnership Manager working with a wide range of stakeholders to develop the Clyde Regional Marine Plan. The key stages of work so far have been: establishing Governance for the Partnership by writing a constitution and operational guidelines; producing the Clyde Marine Region Assessment which considers the condition of the region and pressures/impacts from human activities; and developing the pre-consultation draft of the Clyde Regional Marine Plan. Fiona is particularly keen to ensure that CMPP work includes engagement with a wide range of local stakeholders who have a direct interest in the sustainable management of the Clyde Marine Region, including local communities, and that there is an appreciation of the importance of protecting ecosystem services, which we rely on for our survival and wellbeing. Fiona has a master's degree in Marine Resource Development and Protection from Heriot-Watt University and started with the Firth of Clyde Forum as Project Officer in 2009. Prior to this she worked for many years in international business management. During a sabbatical, Fiona volunteered for dive survey work in various parts of the world and from this came a desire to work in the sustainable use of marine resources back home in Scotland. Fiona is a member of the MASTS Marine Planning and Governance Forum. In any spare time from a busy work and family life, Fiona enjoys tennis, skiing and is currently doing a course in practical philosophy.

Grassroots and Government; the Future of MPA's

Paul Chandler

Executive Director of Community of Arran Seabed Trust (C.O.A.S.T)

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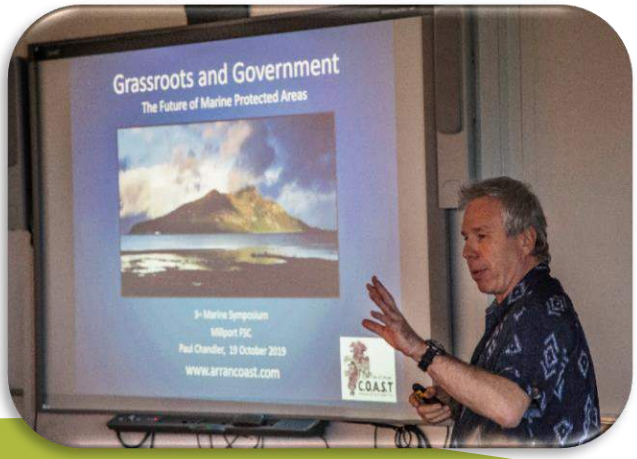
Abstract

Two local divers, Howard Wood and Don MacNeish, founded COAST in 1995 after witnessing the decline in fish stocks in the Clyde due to overfishing and the destruction of precious seabed habitats by bottom trawling and dredging. Their mission - to restore and protect the seas around Arran by establishing an area where no fishing of any sort is permitted- a No Take Zone. Thirteen years of hard campaigning followed before finally, in 2008, our community achieved protection with the Lamlash Bay No Take Zone. In 2016, we achieved the South Arran Marine Protected Area - extending this area to nearly 300km2 to exclude scallop dredging but allow for other, potentially more sustainable, fishing methods in various zones.

We have two key current projects, which are our visitor centre (Octopus Centre) and the MPA Management Project. This is a COAST project to establish and implement an effective model for an MPA management system for the South Arran MPA. The MPA Management Project will establish a knowledgeable and collaborative South Arran and Clyde region MPA Management Working Group. The MPA Management Working Group will undertake MPA Governance analysis of the legal framework and social and economic incentives to ensure that an effective management plan is built. To date Edinburgh Law School and COAST have produced four legal briefing papers which are feely available for all stakeholders to make use of https://www.arrancoast.com/saving-our-seas-through-law/ The aim is to produce a bottom-up model of MPA governance and management, which transforms the top-down mind-set, policy and actions of government and regulatory bodies to establish a sustainable and adaptive MPA management system. COAST continue to work as members of Clyde Marine Planning Partnership to ensure MPA management and spatial management of fishing is included in the statutory 2020 Clyde Marine Plan and implemented effectively. The scientific monitoring work will ensure the working group and management model is responsive to shifts in the ecosystem. Our partners in this monitoring work are primarily York University and Glasgow University, and more recently Blue Marine Foundation. We will roll-out advice, training, education and outreach on the MPA Management Model to other members of the Coastal Communities Network around the coast of Scotland and others as it is clear that Government will and can only implement progressive change with strong support from local communities, and that communities need to continue to drive Government to deliver effective and resilient marine management.

Bio

Paul is a geoscientist, scuba diver and marine environmentalist who has worked in the UK, Europe, the Americas, the Middle and Far East, and Africa. He is a passionate advocate for a healthy, diverse, productive and beautiful marine environment for all. Paul originally trained as a geologist at Aberystwyth University and worked for the British Geological Survey, while a Research Assistant at Exeter University. He has a 34 year career in oil and gas exploration, remote sensing and environmental monitoring and mapping. As a life-long advocate on marine conservation issues, and seeing the damage to the marine environment at first hand as a diver, he joined COAST as the Executive Director in June 2017, where he oversaw the completion of their MPA visitor centre, The Octopus Centre. Paul is a SeaSearch diver, the COAST representative on the Clyde Marine Planning Partnership, and a Coastal Communities Network representative on the SEPA Finfish Advisory Panel, Aquaculture Sub-Group, Seabed Reform Sub-Group and national Wrasse Working Group. He initiated the Management Plan Project for the South Arran MPA, which builds on the scientific monitoring undertaken with universities over several years.



Spatio-temporal Patterns in Marine Debris on America's West Coast.

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Abstract

Reports of marine debris first occurred in the 1970's, with the quantities increasing exponentially since then, with estimates now reaching into the millions of tonnes. Marine litter has become a big environmental concern in the public conscience, with a number of schemes set up to try and remove debris. The aim of this project was to understand the factors which influence debris densities on America's west coast, with this knowledge helping to identify debris sources and help to develop schemes to prevent debris entering the marine ecosystem in the first place.

Previous research has shown a variety of influence factors, from the time of year, local and regional populations (within 5km and 50km of the coastline), weather and local river/estuary flow rates. This project used a generalized additive mixed modelling approach to assess whether any of these factors, individually or in combination, influenced the debris densities across 49 sites along the coasts of California, Oregon and Washington State. These sites are monitored as part of NOAA's Marine Debris Monitoring and Assessment Project, a citizen science project running since 2012, where volunteers remove all macro-debris (2.5cm and above in diameter) along a transect along the length of a beach.

Plastic was, on average, the most abundant type of debris across shorelines, although there was significant variation between shorelines, suggesting local industry or population is responsible for the debris. This is supported by the significant variation in densities between sites, suggesting some shorelines have conditions more prone to debris accumulation. The models showed that human population within 5km of a survey site significantly influenced debris densities, as well as wind speed and direction.

The findings of this project were significantly different to past research. Temporal factors, population within 50km of a survey site and local river proximity and flow rates did not influence debris density. Therefore future research should focus on repeating this modelling approach to assess the patterns in marine debris across other locations, so that a global picture can be built of influential factors and sources, hopefully leading to prevention of debris inputs.

Bio

Anna has recently completed an MSc in Wildlife Biology and Conservation at Edinburgh Napier University and previously studied a BSc in Zoology with Animal Behaviour at Bangor University. Prior to her MSc, she worked at FSC Millport as the centre's Technician and Education Assistant, developing a love for all things marine which inspired her recent research project. Anna's previous research has been varied, from jaguar prey preferences to marine debris, but she have always used large datasets to conduct desk-based projects - and has just snuck out into the field in her own time! She am passionate about sharing the natural world with others through a variety of mediums, from social media to more formal education, and particularly enjoys working with volunteers, supporting them in their passions and enabling environmental changes.

Using Experimental Trawling to Assess the İmpact of Mussel Dredging on the Benthic Ecosystem

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Abstract

Ecosystem-based fisheries management (EBFM) accounts for the effect of fishing on the entire ecosystem. In bottom-contacting fisheries, the concern for the ecosystem is impacts to the seafloor. In the Limfjord, Denmark, a culturally and economically important blue mussel fishery occurs in an area designated as a Habitats Directives Special Area of Conservation (SAC). To meet conversation objectives, trawl fisheries are subject to strict spatial restrictions, which aim to reduce the cumulative impacts of the fishery on seabed habitats. Here we used a BACI experiment to determine if experimental mussel dredging resulted in short term effects to benthic communities. Using diver collected benthic samples, our results show that dredging caused an immediate decline in the density and species richness of benthos within the direct footprint of the dredge (i.e. the dredge track). Density and species richness also decline, but to a lesser degree, in the areas immediately adjacent to the dredge tracks, indicating that dredging resulted in the indirect mortality of benthos. After a period of four months, species richness has not recovered to pre-impact conditions, whilst density has recovered. Although limited consensus is shown for BACI designed fishing impact studies. Our results are consistent with showing that sampling within physically impacted areas, using divers, results in a decline in benthos. Thus, estimating the impact from fishing gear requires accurate sampling within the physically impacted area. Furthermore, the results also indicate significant indirect mortality, which is not currently considered in the calculation and management of dredging in the Limfjord.

Bio

Kat is a PhD student with the National Institute of Aquatic resources in Denmark, where she is researching fishing gear impacts to benthic ecosystems. The aim is to quantify the effect of different fishing gears in sandy habitats, to use as a basis for fisheries management advice. In 2018, Kat completed her Master's degree at the Technical University of Denmark in Aquatic Science and Technology. During her masters, she conducted a research project in Fiji on the impact of a Locally Managed Marine Protected Area on an artisanal fishery. In 2015, Kat received First Class Honours in my BSc degree in Marine Biology and Oceanography from Plymouth University. Inspired by a great Professor, her research interests were in coral microbial communities, and led to a year as an intern at the Australian Institute of Marine Science. Kat is grateful to have had the opportunity to experience many scientific disciplines, and work on research projects around the world, which has been fundamental in the development of her career.

The Challenges of Marine Polar Datasets

Sarah Reed

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Abstract

A talk on the trials and tribulations of how we at the Scottish Association of Marine Science (SAMS) collect scientific data in both the Northern and Southern hemispheres. As a technician, we are responsible for collecting data from various marine instruments, robotics and sampling equipment. One of the big projects we are involved with is working on the British Antarctic Survey Research Vessel on board the RRS James Clark Ross where we have conducted 6-week research cruises over the past 3 years to collect data as part of the Changing Arctic Ocean Programme, which is funded by the Natural Environment Research Council. The CAO programme started in February 2017 with four large projects (Arctic PRIZE, ARISE, ChAOS, DIAPOD) funded by NERC. A further 12 projects joined the programme in July 2018, co-funded by NERC and the German Federal Ministry of Education and Research. Each one investigates different aspects of the Changing Arctic Ocean. Combined, the projects involve 32 research institutions and organisations in the UK and Germany, and more than 200 scientists. The Polar Regions are tricky places to conduct scientific fieldwork, so what goes wrong and what goes right? What sort of data do we collect and how is it used? A talk covering everything from Sea Gliders, ROVs, CTDs, Oxygen Titrations, microplastics and many more. The aim of working in the Polar Regions is to start to answer some key questions from an ecosystem-based approach. With the focus on developing a quantified understanding of the changes happening by answering questions on what controls the spatial and temporal structure and functioning of polar ecosystems, biogeochemical cycles and how this will affect the Polar Regions in the future.

Bio

Sarah is a marine biologist and oceanographer and previously worked as a Marine Assistant at the BAS Rothera Research Station. She currently works on the DIAPOD project analysing the lipid content of copepods to investigate how climate change affects the dominant Arctic zooplankton. Sarah also works as a marine tech for SAMS completing 3D modelling, oxygen titrations, and launching sea gliders. One of her big jobs at the moment is managing the SAMS' research vessels. Everything from maintenance, service, crew training, risk assessments, coding and organising scientists and their survey plans. Her pastime interests include racing gliders around the country, riding a bike or rock climbing - anything outdoors!

A Baseline Survey of Burrowing Seabirds on Bird İsland, Falkland İslands

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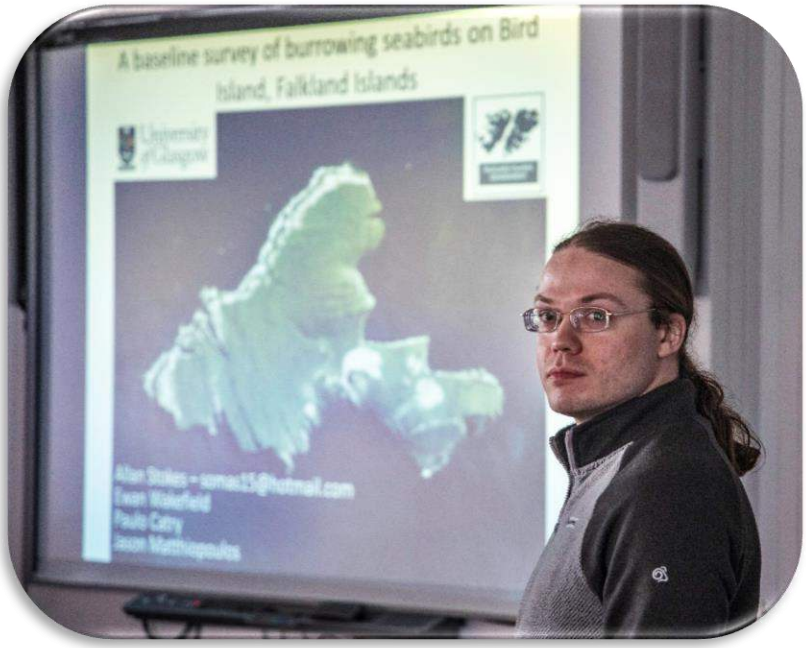
Abstract

Accurate population size and distribution estimates are vital for evidence-based conservation but, many marine species are difficult to survey. Habitat information, which can often be measured remotely, can improve population estimates based on sparse survey data. Both thin-billed prions (*Pachyptila belcheri*) and Wilson's storm petrels (*Oceanites oceanicus*) are wide-ranging, circumpolar seabirds that nest on remote sub-Antarctic islands. Although abundant at sea, few of their colonies have been surveyed making their regional status uncertain.

Using plot sampling, we carried out the first systematic survey of burrowing petrels on Bird Island, Falklands Islands. Conventional density-based estimation suggests 612,000 (95% CI 461,000 – 760,000) *P. belcheri* burrows are present. A habitat selection model shows that burrow density varies with satellite-sensed green and short-wave infrared reflectances, which are proxies for vegetation and moisture, respectively. Using this model, we map burrow density across the island and predict that 649,000 (95% CI 538,000 – 1,070,000) burrows are present, making Bird Island the second largest *P. belcheri* colony in the Falklands and home to approximately 17% of the species' global population. Density based estimates indicate that 9,160 (CI 5,590 & 12,720) *O. oceanicus* burrows are present. Modelling *O. oceanicus* burrow density was impractical due to the sample size limitations. The habitat-based modelling techniques we develop here could be used to estimate the abundance and distribution of UK seabirds and many other difficult to survey marine species.



Bio

Allan recently completed a BSc in Zoology at the University of Nottingham and an MRes in Ecology and environmental biology at the University of Glasgow. His Master's project involved modelling niche partitioning and species abundance and distribution. He has a keen interest in spatial ecology and is currently working on publishing his Master's thesis and finding a PhD that includes a substantial amount of interesting fieldwork.

Seabirds Count: Taking Stock of Britain and Ireland's Seabirds

Daisy Burnell

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Abstract

In 2015 the Seabird Monitoring Programme (SMP) partnership launched the 4th breeding seabird census for Britain and Ireland, Seabirds Count. Its aim: to increase our understanding of how seabird numbers have changed over the last 15-20 years. Current annual monitoring trends, which use annual data from a sample of colonies in the UK and predict how the population has changed year to year, suggests many of our resident seabirds are in decline. However, the picture is a complex one. The fates of some seabird species can be considerably different compared to others in the UK. These differences can also be seen within species, with some species increasing in one country but declining in another, this is also happening at the colony level within the same country. We have the unique opportunity to explore both the change in seabird populations over time and how they may have changed on a geographical scale. Additionally, without these long-term data sets, questions such as; has climate change influenced seabird populations, or, has the introduction of invasive predators changed the distribution of seabirds, cannot be answered.

In order to deliver this current census, all the known (over 10,000) seabird colonies in Britain and Ireland need to be surveyed. This is no small task and is further complicated by the existence of methods and timings that are specific to each of the 25 seabird species included. However, given the long-standing history of these censuses, each colony has been mapped and information on the methods used for each site retained to ensure surveyors are reproducing the same survey. Therefore, even with such a far-reaching survey, that has a significant citizen science element to coordinate, the comparability of the data between each census is ensured.

With the appointment of census coordinator and increased publicity, to help engage with the volunteer community, survey coverage increased two-fold during the last two seasons, compared to the first three. By in large due to the incredible efforts of the volunteer surveyors, but also through the generous donation of funds from the marine renewables sector. This coverage trend continues increase by the day, as more data gets added to our online database, and the outlook for completion is looking positive for Seabirds Count.

Bio

Daisy is currently co-ordinating the 4th breeding seabird census for Britain and Ireland, a project developed by the Seabird Monitoring Programme partnership and lead by the JNCC. Prior to working for the JNCC, she spent five years studying at the University of Aberdeen. The first four gained her a BSc in Marine Biology, and the last an MSc in Applied Marine and Fisheries Ecology. Daisy's passion for seabirds, and their conservation, was sparked during her MSc research thesis, which looked at the foraging behaviour of fulmars during the breeding season, in relation to proposed marine renewable sites. In Daisy's view, there is nothing quite like spending 3 weeks on an uninhabited island off Orkney, catching and tagging fulmars and then downloading GPS data showing some of the incredible distances they cover!

On Passage: Volunteer Seabirds at Sea

Danni Thompson

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Abstract

Seabirds are the most threatened group of birds, facing pressures such as climate change, by-catch, pollution, overfishing, disturbance and invasive species. As they spend most of their lives at sea, it is vital that we monitor them in this environment but at sea surveys require a boat which can be expensive and logistically challenging. As a result, at sea surveys have often been opportunistic with very little, if any, regular monitoring.

The CalMac Marine Awareness Programme is an initiative operating in the west coast of Scotland, designed to raise awareness of the marine environment. The ferries are used as platforms for citizen science, gathering data on presence and densities of marine species as well as raising awareness among both visitors and locals using the routes. Volunteer Seabirds at Sea (VSAS) is the ornithological branch of this initiative, coordinated by JNCC. Using standard European Seabirds at Sea (ESAS) methods, JNCC has developed a mentoring scheme so that volunteer surveyors can progress and develop their skills whilst collecting high quality, standardised data on the densities and distribution of seabirds at sea. 2019 was the pilot year of the citizen science project, with volunteers surveying three routes on the Scottish west coast once a month between April and September. The project was deemed a success and continual feedback and review allows us to further refine and develop the programme for the future. Potentially hundreds of birds can be seen on each survey, so good data management is of vital importance. We have developed a new database and a data entry app to allow for quicker and easier data collection and submission. The data can be used to assess trends in distribution, abundance and phenology, and once in the ESAS database they can also be used for general monitoring and management, assessments for offshore industry and for academic use or research.

To our knowledge, VSAS is the only regular offshore seabird data being collected in Scotland, and even the UK, and as far as we know, it is one of only two citizen science ESAS projects collecting long-term regular data anywhere in Europe. With such a unique opportunity to gather a wealth of information, we are keen to maintain and expand our monitoring. With more surveyor training courses planned for early 2020, we would like to increase our pool of surveyors which will allow us to expand our routes around Scotland and potentially elsewhere.

Bio

Danni is a Seabird Ecologist for the JNCC, working on all aspects of seabird monitoring such as the Seabird Monitoring Programme (SMP), Seabirds Count census and VSAS. Her career began with an undergrad in Wildlife Conservation at the University of Kent, followed some years later by an MSc by Research in Biodiversity Management looking at the effects of climate change on the breeding phenology of newts. She has had a varied career, from working with the homeless and coordinating volunteers, to invasive species eradication and wildlife rehabilitation, but a passion for wildlife conservation has always prevailed. A defining role was working as the Ranger on Handa Island for two seasons, managing the remote reserve and monitoring its internationally important seabird colonies, which sparked a new obsession. Fond of scientific research, she has a particular interest in population-level impacts of anthropogenic threats on wildlife, and in her spare time she is currently investigating the effects of plastic nest incorporation on seabirds. She is also the Membership Secretary for the Seabird Group, a keen photographer, and an active volunteer for a range of citizen science projects such as moth trapping, bird ringing, BBS and WeBS.

Understanding Population Growth Rates of Bottlenose Dolphins in Scotland

Jack Lucas

Postgraduate Research Student with the Sea Mammal Research Unit / Senior Tutor at FSC Millport

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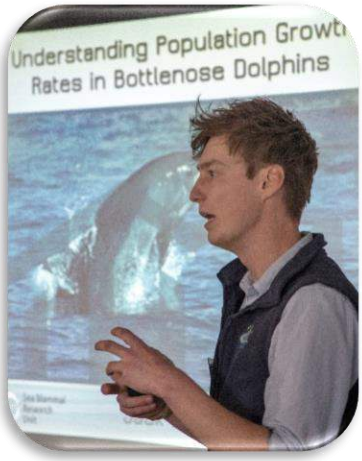
Abstract

The rates at which wild populations grow or decline, and what factors are most responsible for these changes, is of great interest to conservation biologists. There are many modelling tools available to explore these patterns, but they rely on robust life history information and accurate assessments of population vital rates for these predictions to be reliable. Population Viability Analysis (PVA) is a technique whereby this biological information can be input for a given species and then used to stochastically simulate the growth of a wild population over a certain time frame. Researchers can then assess the relative impact of changes to these input parameters on the population growth rate, using a standardised sensitivity analysis. One can also model the impact of 'catastrophes' to the population, such as oil spills or diseases.

Bottlenose dolphins (*Tursiops truncatus*) are well known coastal species and are important to the UK both economically and ecologically. The population on the East coast is a small, demographically isolated population with a broad range that includes some of Scotland's most developed coastline and busiest waterways. This current work updates key population vital rates such as abundance and survival rates for the population, and then consolidates existing life history information for the species to carry out a PVA.

Using processed photo-ID data between 1989 and 2017 the current abundance of dolphins on the East coast of Scotland was calculated using mark-recapture techniques at 225 individuals. This supports our current understanding of an increasing population, which the PVA predicated to continue to grow if factors remain the same. The sensitivity analysis highlighted reproductive success and the sex ratio at birth to be the most influential factors affecting the population growth rate, along with female mortality, minimum age of reproduction for females and calf mortality showing the next highest impacts, respectively. Catastrophe modelling, such as that of an oil spill based on the known impact of previous incidents, suggested that it could negatively affect the growth rate by 114% and reverse the upwards population trajectory.

Further investigation of potential disasters to the East coast population will be carried out in this project, along with a more detailed report on which factors are most applicable to conservation efforts.



Bio

Jack is a marine biologist and the 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 sampling techniques and guided wildlife excursions. Graduating with a BSc in Marine Biology from the University of Plymouth in 2015 he has worked with several marine research organisations around the world, including projects in New Zealand, Australia, The Bahamas and at home 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 Mentor for the CalMac Marine Awareness Programme.

Jack is currently pursuing a postgraduate research degree with the Sea Mammal Research Unit in St Andrews. His thesis examines the population ecology of the bottlenose dolphin population living on the East Coast of Scotland and the impact of life history parameters and vital rates on the growth of the population. He can usually be found identifying wildlife on the shores of Cumbrae or off exploring the mountains and islands of the West coast.

St Andrews to Shetland, the Tales of Two Top Predators: Killer Whales and Harbour Seals

Emily Hague

Research Assistant at the Sea Mammal Research Unit

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Abstract

The 'Harbour Seal Decline Project' investigates the regional decline of harbour seals (*Phoca vitulina*, also called common seals) across Scotland, with the aim to get a better understanding of population dynamics and the potential drivers of the decline. Between 2001 and 2006, the population in Orkney and Shetland declined by 40%, indicating harbour seals in these areas experienced substantially increased mortality or very low recruitment over this period. This presentation will discuss potential reasons for the regional decline of harbour seals, and describe some of the work ongoing at the Sea Mammal Research Unit as part of the investigation, funded by the Scottish Government.

Working on this project, combined with Emily's passion for exploring Scotland whilst camping in her 4x4, led to the development of the 'On the Killer Whale Trail' blog, which she will present during this presentation. The blog documented her exploratory adventure to Shetland to look for killer whales (*Orcinus orca*), with a particular focus on observing predation on harbour seals. Any observations were relayed to 'ECOPredS', (www.ecopreds.wordpress.com), a project based at SMRU hoping to utilise citizen science to investigate the energetic consequences of orca predation on seals. Emily's trip was kindly funded by the Des Rubens and Bill Wallace Grant (the John Muir Trust) and Sea Changers, with both funds available for other adventure seekers to apply for! Emily will present anecdotes and footage from the Shetland trip, and discuss how others might get involved in the project.

Bio

Emily's research interests mainly focus on long-term temporal changes in marine mammal habitat use, with an interest in this developing after working as a research assistant studying the northern resident killer whale population of BC. Emily completed her studies in marine biology, specialising in both marine mammals and fisheries, at the University of St Andrews and then the University of Aberdeen. Since then, she has worked on numerous projects at the Sea Mammal Research Unit, with focus on the long term monitoring project of the east coast of Scotland bottlenose dolphin population and the range expansion of this population. Emily also works at SMRU Consulting, the marine mammal consultancy body of SMRU. Emily's various interests manifested into 'On the Killer Whale Trail', a science adventure based blog documenting her 4x4 camping trip to Shetland to look for killer whales, with the blog continuing to document her adventures exploring Scotland's coastline.

Rescuing Stranded Marine Animals in Britain

Samantha MacFarlane

Area Coordinator (Clydeside and Ayrshire) for British Divers Marine Life Rescue (BDMLR)

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Abstract

British Divers Marine Life Rescue (BDMLR) is a voluntary network of trained marine mammal medics who respond to call outs from the general public, HM Coastguard, Police, RSPCA and SSPCA and are the only marine animal rescue organisation operating across England, Wales and Scotland. Not only are we called upon by the other emergency services, but we also train their staff.

BDMLR was formed in 1988, when a few like-minded divers got together in response to the mass mortality of Harbour seals in the Wash area of East Anglia, to do what they could for the rescue effort. We have recently celebrated 30 years of marine mammal rescue. BDMLR is a registered charity and is operated entirely by volunteers. Our rescue teams are on call 24 hours a day, 365 days a year. We have a wide range of equipment strategically placed throughout the country to deal with strandings of marine animals, oil spills, fishing gear entanglement and in fact any type of marine animal in trouble. This includes rescue boats, equipment trailers, whale and dolphin pontoon sets, a whale disentanglement kit and each area have a medic kit with essential supplies.

Although our name mentions divers, you don't have to be a diver to be a supporter or medic. Our medic base covers all walks of life and includes teachers, plumbers, executives, managers, retail staff, secretaries, builders, photographers... the list goes on and on. All you need is a positive attitude, don't mind being wet and cold, and are able-bodied. The rest we teach you on our Marine Mammal Medic Course.

Bio

Samantha obtained her bachelor's degree in Marine Biology from the University of Glasgow in 2010, before returning the following year to complete a masters in Coastal Science and Management. She joined British Divers Marine Life Rescue shortly after graduating, initially starting as a medic and then becoming voluntary area coordinator for Clydeside and Ayrshire in 2013. In 2014 she began her role as outreach coordinator with the Scottish Sea Angling Conservation Network, providing marine science education programmes to the public on the network's main projects such as the Scottish Shark Tagging Programme. Samantha also volunteers for other marine organisations such as the Scottish Marine Animal Stranding Scheme and Marine Conservation Society. In 2017 Samantha took a step back from work to start her family and is now a proud mum to Jessica, 2 and Katie, 12 weeks. She very much looks forward to returning to the field of marine science!

The Biggest Shark in the West: The Behaviour and Movement Ecology of Basking Sharks

Professor Rupert Ormond and Dr Mauvis Gore

Co-directors at Marine Conservation International

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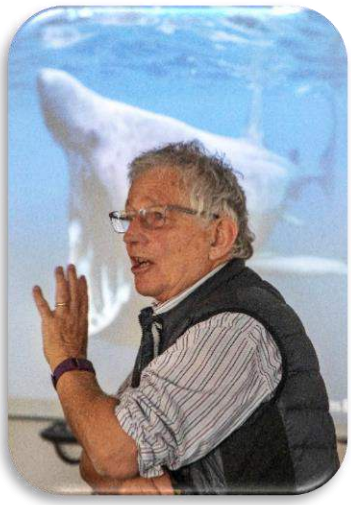
Abstract

We started the research described here when at the University Marine Biological Station, Millport. At that time, protection of the species had only recently been introduced, following decades of exploitation, and relatively little was known about their behaviour and ecology. They were familiar from their habitat in summer of feeding on plankton in the surface layer of the ocean, and were previously supposed to hibernate inactive in deep water, although, based on patterns of sighting and early tagging data, it was assumed that in summer they migrate north through coastal shelf waters, returning south in the autumn. From 2004 onwards, we undertook boat-based survey work in both the Firth of Clyde and around the Inner Hebrides islands of Mull, Coll and Tiree. In the Clyde numbers remained low, but in the Mull area abundance steadily increased, revealing a hotspot between Coll and Tiree, where aggregations were observed in late summer, with similar patterns of abundance being observed by other researchers. During surveys we also collected quality photographs of basking shark dorsal fins enabling us to apply photo-identification methods to estimate population abundance. Results indicated that at times 1000 or more sharks might be present in the Mull study area, while numbers present in the north-east Atlantic might be an order of magnitude higher.

To investigate movement patterns, from 2006-11, we tagged basking sharks, mostly on Coll, with pop-up PAT satellite tags, which remained on the sharks for up to 6 months before being released. Data showed that most sharks ranged widely across the Hebridean shelf, with some moving further north, before most then moved south again, although some individuals were still in Scottish water as late as December. More recent tagging during 2012 – 2015 by the University of Exeter, using more advanced SPOT (GPS) and SPLASH tags has confirmed these findings. In addition, one of the sharks we tagged crossed the north Atlantic to Newfoundland, while another moved south-west to the Azores. Combined with comparable tagging by the Massachusetts Institute of Fisheries these observations suggest some larger individuals may circulate widely around the northern Atlantic. Out PAT tags also revealed patterns of diving behaviour. Many individuals showed diurnal vertical migration, presumed to result from their following zooplankton into deeper water by day. But among our sharks reverse diurnal migration was more frequent.

Since little is still known of the species mating and pupping behaviour, we also investigated the social behaviour of sharks in the Coll-Tiree aggregation. Groups may form within which close following of one individual by another is often observed and suspected to be pre-courtship behaviour, with, as in other shark species, males following females. However, working in collaboration with Basking Shark Scotland, we found that both leading and following shark were equally likely to be male or female, suggesting the prime benefit of such behaviour may be related to feeding. Nevertheless, linked to the importance of the larger area as basking shark habitat, Scottish Natural Heritage (SNH) has this year proposed its designation as The Sea of the Hebrides Marine Protected Area.

Bio



Professor Rupert Ormond was Director of the University Marine Biological Station at Millport (UMBSM) from 1999 – 2006. Previously he was senior lecturer at the University of York, having initially run a marine station in Sudan, following completion of his PhD at Cambridge. Subsequently he has been chief scientist to the Save-Our-Seas Foundation and Honorary Professor at the Heriot-Watt University, Edinburgh. His co-worker and wife, Professor Mauvis Gore, was also previously at UMBSM and is now also an Honorary Professor at Heriot-Watt. She gained her PhD at the University of West Indies and was then a researcher in the US, Switzerland and Germany. They both initially specialised in the ethology of coral reef fishes, though Mauvis has also worked on cetaceans and primates, and Rupert especially on corals and coral conservation. In 2006 they established a specialist agency, Marine Conservation International, through which they have undertaken a series of marine conservation projects in the Red Sea, Indian Ocean and Caribbean, many concerned with the behaviour and conservation of sharks.

Rare Marine Species Records on the Up and Smarter Ways of Recording Them

Natalie Hirst

Seasearch Coordinator for Scotland

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Abstract

Seasearch has been working with volunteer divers for over 30 years to collect data on marine species and habitats from all around the UK. We utilise tried and tested methods, along with formal training, mentorship and quality checks to ensure the data is easily transferable to national governing body standards. Importantly the data is available to all and over recent years is predominately being utilised for marine protected area designation.

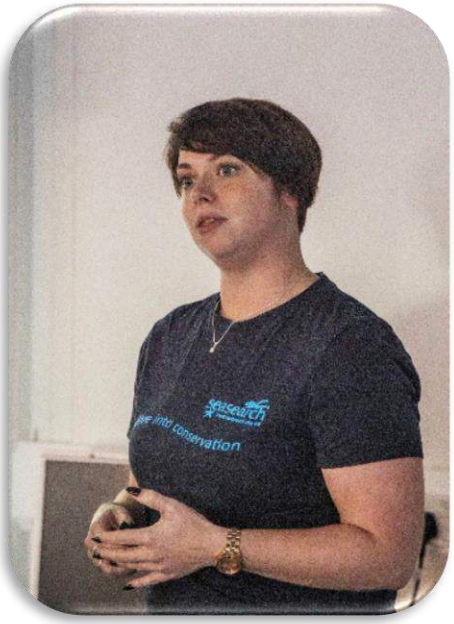
So with all this data, we hope to see in coming years a change in species abundance in and around protected areas; a change we are already starting to see! However it still has to be investigated if some of these rarer species counts are really increasing or are we now a more aware and engaged population that is getting better at recording them?

The occurrence of weird and wonderful species and habitats such as whales, jellyfish and deep sea environments are more frequently appearing in our news streams and with more and more divers owning underwater cameras, our ability to query records and identify strange creatures post-dive is also increased. Such examples include the Red Blenny. With only a handful of records previously known from Scotland, after running a specialist fish ID course with info on appropriate habitats, one of our Seasearch divers was lucky enough to record 2 of these curious little fish in one dive and another individual in a second dive! All because they now knew more about specifically where to look.

Further encouraging increases in records come from counts of skate eggs, vital for understanding the reproductive cycle and territories of skate in order to inform MPA areas. Currently we do not have a true answer to whether these increases are due to effort or designation, however one thing is for sure we have a wealth of data to now help us understand in the future and the efforts of enthusiastic people power demonstrate what can be achieved if we all get involved!

Bio

Natalie is in her 4th 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.



Coastal Citizen Science – Ayrshire and Beyond

Robert K. Walsh

Sea Champion for the Marine Conservation Society (MCS)

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Abstract

Capturing Our Coast (CoCoast) was a UK-wide project raising awareness and delivering a monitoring protocol to observe changes in abundances to common species to our coastlines. This citizen science project ran from 2015 – 2018 and brought large numbers of volunteers from local community groups around the UK coastline to better understand the ecology and different species to be found there. Twinned with projects such as Big Seaweed Search, CoCoast aimed to better understand changes in species abundances through monitoring, especially during what is now officially classed as a "climate crisis" in Scotland. The continued work by Robert Walsh and volunteers from across Ayrshire is to assess the abundances of 25 different species as well as the widely known non-native invasive species (INNS) *Sargassum muticum* (Japanese Wireweed). Discussions for various uses post-removal of this invasive species for a better environmental use. Around Ayrshire there are several Special Sites of Scientific Interest (SSSI's) which are designated by Scottish Natural Heritage (SNH) due to environmentally important species and habitats. Within Ayrshire, one such indicator species is *Corallina officinalis* (Coral Weed) which is highly vulnerable to changes in temperature.

There has been an increased focus on the work carried out by volunteers in a variety of different citizen science projects and the development of future partnership projects within MCS both nationally and within local and regional areas. Projects such as the Great British Beach Clean have shown increased numbers of participants (volunteers) and number of beaches being utilised in the project year upon year. Results from 2018 have provided an understanding that plastic, glass and cigarettes are among the top 3 items commonly found within Scottish beaches. This has led to partnership projects and changes to legislation such as a ban on single-use disposal cups; ban on the use of plastic in cotton bud sticks; 'Butts On Beaches' involving partnership with ASH Wales targeting cigarette butts on beaches; as well as the current role of a Deposit Return System currently in consultation process for Scotland. Citizen science projects are promising for biodiversity as more people in 2019 are recording jellyfish sightings than previous years. With next year being Year of the Ocean for Scotland, there feels a wind in the air for keeping an eye on coastal citizen science projects within Ayrshire and Scotland as a whole to see what members of the public are able to continue to contribute their time, effort and evidence for changing legislation for the future.

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.

Evaluating the Role of Citizen Science in Biological İnvestigations

Fiona Day

Tutor at FSC Pembrokeshire

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Abstract

Considering recent and predicted ecological changes (caused by global climate change), baseline monitoring of biological diversity becomes an extremely useful record to have. Citizen science provides a unique, low-cost, high output method of attaining large data sets which has already been implemented in several studies. They are used by major bodies such as the Natural History Museum, OPAL and the RSPB. Despite this concerns lie with the accuracy of the data – can volunteers really produce real data? In this study various aspects were investigated, firstly the current public opinion about citizen science, how we can train volunteers carrying out surveys, and the kinds of method suitable for biological monitoring by citizen scientists. This report finds a generally good level of public literacy in terms of the existence and the potential of, citizen science. Participant confidence significantly increases once a volunteer has carried out a survey – but this does not show any relationship with accuracy. It is concluded that estimation of abundance must be embedded with training and validation methods, and it is recommended further work is carried out into robust online training and validation.

Bio

Fiona is a seasonal tutor at FSC Dale Fort. She graduated from Plymouth University in September 2019 with a BSc in Biological Sciences. Fiona was formerly a Higher Education Placement Student at Dale Fort. Her interests lie in ecology, marine biology, citizen science, and public engagement.

During her time as a placement student she carried out biological monitoring on a non-native seaweed (Sargassum multiculum). Her work was presented at the Dale Fort Marine Symposium in 2018 and published in Field Studies Journal later that year. Fiona continues her work with biological monitoring as biodiversity co-ordinator at Dale Fort. Her dissertation explored the theme of citizen science and its role in biological monitoring. This work is under review for publishing in the next year. Fiona is passionate about citizen science and making environmental education accessible to all, engaging learners of all ages in her role.

Themed Years & 2020 – The Year of Scotland's Coasts and Waters

Richard Walsh

Themed Years Team Leader, Tourism and Major Events Division, Scottish Government

Richard.Walsh@gov.scot

Abstract

Background

To make delegates aware of the current work across Scottish Government, public body partners, Scotland's tourism and events sector and other key sectors in preparation for the next Themed Year, the Year of Coasts and Waters in 2020. Running since 2009, the Scottish Government's programme of Themed Years provides a focus for co-ordinated national activity that helps to spotlight Scotland's greatest tourism assets – our landscapes and scenery, our food and drink, our history and culture, our expertise in staging events and our skilled and passionate workforce. Themed Years are designed to give the Scottish visitor economy an edge in the highly competitive global tourism market. They galvanise partners and create a strong collaborative platform to promote Scotland and our valuable attributes. The core external proposition for each year is centred on the promotion of domestic and international tourism and the development of the events industry in Scotland.

The Year of Coasts and Waters 2020

Now running in alternate years, the next Themed Year, the Year of Coasts and Waters in 2020 (YCW2020) encourages responsible engagement and participation from the people of Scotland and our visitors. It will be presented to our visitors (domestic and international) across four cross cutting strands:

- Our Natural Environment and Wildlife
- Our Historic Environment and Cultural Heritage
- Activities and Adventure
- Food and Drink

Scottish Government Role

The Scottish Government also recognise that any Themed Year should be viewed as an opportunity to add profile to non-tourism related policies and/or activities that align to the focus of the year. In line with previous Themed Years, YCW2020 therefore presents an opportunity for building a collaborative platform: enabling a number of partners to work in closer collaboration to achieve shared goals, create an increased, wider, awareness of their work and achievements and generate stronger partnership working moving forward. The presentation aims to provide delegates with more detail on this approach, the events and activities already planned for Year of Coasts and Waters 2020 and to consider the opportunities it offers for their participation, thereby creating stronger partnership working.

Bio

Richard joined the Civil Service in 1987, working in a range of HR and operational posts in social security together with HQ policy roles in London and Newcastle. He moved to the Scottish Office in 1998 to help set up the Food Standards Agency in Scotland and from 1999 worked for four years in the Scottish Parliament as a Committee Clerk dealing with transport, rural affairs and latterly equal opportunities. Returning to the Scottish Government in 2003 he worked on health reform, public bodies' policy and then policy on the scrutiny and inspection of public services before moving to Tourism policy in mid-2011. Since 2011 Richard had policy responsibility for a number of tourism sub-sectors including marine and coastal tourism, business events and the impact of the collaborative economy on Scotland's visitor economy before assuming responsibility for Themed Years policy at the start of 2019.

Highlights of the Conference

The symposium gathered together outside the Allen Lecture Theatre overlooking the Firth of Clyde

Kylie the Common Dolphin greeting conference participants just offshore from the centre

Professor Des Thompson, Chair of the FSC Trustees, kicks off the conference with a few thought-provoking words on the state of the UK's environment

The group enjoy a guided wildlife tour around some of the Clyde islands aboard the centre's Research Vessel *Actinia*

The audience settled in the lecture hall as talks begin for the day

Summary of the Field Excursions

Several presenters and members of the audience stayed overnight, and along with some keen locals, day visitors and staff from the FSC Millport Education Team, a party of around 25 embarked on a day of exploration around the Cumbrae coastline to observe some of the wildlife and habitats right on our doorstep. The weather was glorious (although what else could it possibly be when on the West coast of Scotland?!) and the perfect setting to discover what species live in beaches, tidepools and coastal waters of the Clyde. What follows is a short summary of what the group found…

Plankton Sampling

After breakfast, the group met in the Allen building and headed out to the historic Keppel Pier, landing site of the Scotia, to deploy plankton nets into the sea to retrieve samples to view back in the lab. Whilst the group retrieved the samples, Kylie the resident common dolphin could be seen surfacing in the background and there were plenty of seabirds for the group to identify. The specimens were then examined using compound and dissecting microscopes to get a closer look at these incredible creatures. Both phytoplankton and zooplankton were identified, and due to the time of year the samples were dominated by the dinoflagellates from the *Ceratium* genus.

Rocky Shore Ecology

Tearing their eyes away from the microscopes, the group reassembled and gathered equipment to head down to the local rocky shore, Farland Point, for the morning's low tide. After a short introduction to the area by Senior Tutor Jack Lucas and a briefing on how to explore the rocky shore safely and find the most organisms, the group embarked on a 'bioblitz'; a citizen science term used to indicate a search for all species in a given area. A huge variety of intertidal creatures were found, and due to the number of experienced marine biologists on hand the specimens were identified quickly and their amazing life histories shared with the group.

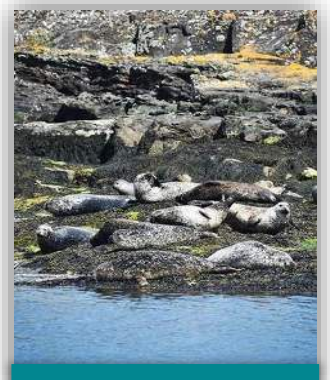
Worm Pipefish
Nerophis lumbriciformis

Common Starfish
Asterias rubens

Green Sea Urchin
Psammechinus miliaris

Curlew
Numenius arquata

Green Leaf Worm
Eulalia viridis



Harbour Seals
Phoca vitulina

Plankton Sample
Ceratium spp.

Common Brittle Star
Ophiothrix fragilis

Photos by Jack Lucas

Closing Remarks

The staff at FSC Millport would like to thank all the conference participants for a memorable and enjoyable weekend. Special thanks, of course, go to our wonderful cohort of speakers who were kind enough to agree to share their marine experiences and expert knowledge with us. The hugely positive feedback from the audience, both verbally on the day and formally via our surveys, is entirely down to our presenter's efforts to make their talks stimulating and exciting for an audience that ranged from school children to retired residents and everything in between! An additional thanks to our session chairs, who managed to keep everyone on time and the sessions running smoothly. Finally, a thank you to David Palmer for providing the photos of each presenter and some group photos taken during the conference.

The speakers have agreed to share their contact details in this proceedings document (email addresses can be found at the top of each page, below their names and titles) should anyone wish to contact them for further information. Alas there is never enough time for everyone's questions to be asked in person at these sort of events! Rather than collect a handful of completed papers for inclusion in this proceedings document, as is customary for some scientific conferences, we have again opted to include just the abstract and bio in order to have everyone represented. This information should serve as a reminder of the content for those that attended and a summary of each presenter's background and current project for those that could not make it, but may wish to explore some of the content further. Many of our speakers presented on behalf of organisations, and full details of their work can usually be found on the relevant websites

Looking ahead, the 4th Millport Marine Symposium will take place on the equivalent dates next year, with a call for abstracts send out early in the year and a full programme of speakers available in the spring. Based on the success of this year's event, with the number of guests approximately doubling from last year, we will pull out all the stops to ensure next year's Symposium is even bigger and better. The 2020 Year of Coasts and Waters for Scotland will be the perfect backdrop to bring professionals, students and the public together to celebrate our shared marine heritage.

We hope to see you all next autumn for the next symposium, and in the meantime please do check out our website and social media feeds below for other events and courses at FSC Millport!

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/locations/millport

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3rd Millport Marine Research Symposium

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