



ANNUAL
REPORT
2011-12

Front cover:

Shot from the bow of the SAMS Research Vessel *Calanus*. Photo: Andy Crabb, SAMS filmmaker in residence.

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The Scottish Association for Marine Science



#ScotMarineInst

Editor

Dr Anuschka Miller
SAMS, Scottish Marine Institute, Oban,
Argyll PA37 1QA, UK

T: 01631 559000 F: 01631 559001
E: communications@sams.ac.uk

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Rory MacKinnon, SAMS

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Our main partners



The Scottish Association for Marine Science

ABOUT US

SAMS (The Scottish Association for Marine Science) is a learned society with around 300 members who share an interest in marine science. SAMS is a charity (009206) and a Company Limited by Guarantee (SC009292) registered in Scotland.

SAMS' mission is to work towards improving the knowledge about and the sustainable stewardship of the marine environment through research and education. The organisation maintains three strategic partnerships: it is a founding partner of the University of the Highlands and Islands, a collaborative centre of the UK's Natural Environment Research Council and a member of the Marine Alliance for Science and Technology for Scotland.

SAMS operates the Scottish Marine Institute at Dunstaffnage near Oban where 150 employees conduct research and provide education and services in marine science. Six departments deliver the mission: there are four science departments (Biogeochemistry and Earth Science; Ecology; Microbial and Molecular Biology; Physics, Sea Ice and Technology), an education and an infrastructure department. Much of SAMS' research is conducted within four research themes: Arctic Seas; Dynamic Oceans; Marine Renewable Energy; and People and the Sea. Education delivers a BSc (Hons) Marine Science, BSc (Hons) Marine Science with Arctic Studies, MRes Ecosystem-Based Management of Marine Systems, MSc by Research, trains around 30 PhD students and provides a range of short courses for professionals.

Services to business are delivered through SRSL, a wholly owned commercial subsidiary company (SC224404). SAMS also operates a business incubator known as the European Centre for Marine Biotechnology (SC205318) that hosts tenant companies.

The Association is governed by an independent non-executive Council elected by SAMS' members at the Annual General Meeting. Council is supported by the Board of Council and a number of committees (research; education; finance; audit). Board and committees are made up from Council members and executive staff. The audit committee also includes independent members. SAMS business is conducted in accordance with the Articles and the Memorandum of Association.

SAMS Council members are the non-executive directors of the company and trustees of the charity.

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Director's Introduction



ABOVE: Artist's impression of the completed European Marine Science Park next to SAMS. Image courtesy of HIE.



It seems difficult to believe that this is my fourth annual report as Director of SAMS. As the adage says, "time goes fast when you're having fun" and working with such a professional team is a source of huge satisfaction. As many visitors remark, SAMS is a place with a buzz and there is a huge amount of creative energy around that makes the long hours worthwhile.

Those of you who have visited our site recently will have witnessed a major construction project. Alongside the Sheina Marshall building, our new education facility, an even bigger building is taking shape. This is the first stage of Highlands and Islands Enterprise's new European Marine Science Park, an ambitious venture to encourage the development of a knowledge-based marine economy in northern Argyll. For SAMS, this highlights the importance we give to maximising our impact on regional economic growth; particularly important as the UK struggles to climb out of economic stagnation. Together with HIE, we are doing our best to invest in a brighter future and

doing so in a manner that takes advantage of our skills and knowledge and the rich potential of our geographical setting. And we are pursuing an overall goal of sustainable development, taking care to exploit our natural assets without trashing them.

SAMS in 2012 is increasingly entrepreneurial and this is beginning to translate into new kinds of science and a more diverse income. But, like our educational and research programmes, it all runs on quality science and we are making no compromises in our core values. We are strongly independent but value our partnerships highly: with the University of the Highlands and Islands, as a delivery partner to the UK National Oceanography Centre, and with other Scottish institutions through MASTS and SAGES. And we are now adding a new partnership: with the UN University, based in Tokyo and Bonn.

Why am I so upbeat at a time of one of the worst economic recessions in post WW2 history? Well, despite the gloomy economic situation which certainly makes it harder to win public sector funding, there is growing interest in the value of our marine assets. There are major investments in renewable energy for example and this has brought to the forefront our excellent work on the potential of algal biofuels and our impact studies of marine wave, wind and tidal energy. Expansion of marine aquaculture is on the horizon and a lot of good science will be needed to develop this in harmony with natural ecosystems and the other users of the sea. We need to know a lot more about

marine ecosystems in order to exploit them to their potential and to protect them from further decline; some of the sea areas we are surveying with our multibeam equipment haven't been mapped since 1851! Our work doesn't stop at studying marine processes, marine organisms and ecosystems however. People are an important part of marine systems too and our social research is aiming to help maintain employment and understand and respect cultural values. Away from our shores, there is increasing demand for our work abroad and we seem to be continuously dispatching scientists and equipment to the Arctic, to Papua New Guinea and to remote places in Africa, the Far East and South America.

A good time to be a marine scientist? This is why we are helping more people into a career in this field. Our new Sheina Marshall building is already bustling with undergraduate, Masters and PhD students and this refreshing wave of enthusiastic young people regularly washes over the Oban night life. But our work doesn't end there and we are keen to rebuild SAMS' work as a learned society; a very modern one that touches the lives of people, young and old, in Scotland and beyond. Soon we will be able to celebrate the opening of our Scottish Ocean Explorer Centre... but you will have to wait for the next Annual Report to learn all about that! Meantime, thank you SAMS members and supporters for keeping our institution as dynamic and creative as it was 127 years ago.

*Professor Laurence Mee
Director of SAMS*

Science Highlights

Arctic Seas



THE ROLE OF FJORDIC CIRCULATION TO THE STABILITY OF GREENLAND GLACIERS



ABOVE: Sampling in Kangerdlugssuaq Fjord, Greenland from a chartered fishing boat.

Loss of ice from the Greenland Ice Sheet (GIS) has accelerated in recent years, and is a major contributor to global sea level rise. The region of greatest loss from the GIS is in the south-east, where calving from marine-terminating glaciers dominates the mass loss. Accelerated ice loss from these glaciers, which typically sit at the head of long, deep fjords that extend as troughs across the continental shelf, has been attributed to warmer oceanic conditions, both in deeper Atlantic-origin waters, and in shallower Arctic-origin waters. These warmer water masses are circulated through the fjords to the glacier fronts, leading to

enhanced melting and instability of the calving margin.

In 2010 and 2011 oceanographers from SAMS (**Inall**, **Cottier** and **Venables**) joined glaciology colleagues from Swansea University on three separate expeditions to fjords in south-east Greenland. The measurements from the first of these, in Kangerdlugssuaq Fjord during late summer 2010, have been used to diagnose the circulation and to quantify the role of fjord circulation in transporting oceanic heat along the axis of the fjord towards the glacier. These measurements have revealed highly

turbulent upper layers atop more intermittently turbulent deeper layers, and have been used to construct layer-wise heat and salt budgets.

This work has spawned a successful NERC small grant proposal (**Cottier/SEATREX**) to examine further aspects of the SE Greenland glacier outlets and the role of cross-shelf bathymetric troughs in the delivery of warm oceanic waters into the fjords. The work in Greenland builds on experience gained in working in the fjordic environments of both Scotland and the Svalbard archipelago.

The challenges of research into such glacier-ocean interactions were explored during a Scottish University Research in Glacial Environments (SURGE) workshop hosted by SAMS in January 2012.

This project is a collaboration between oceanographers at SAMS and glaciologists at Swansea University.

Relevant publication

Cottier *et al.*, 2012, Arctic fjords: a review of the oceanographic environment and dominant physical processes. In Howe, JA *et al.* (Eds) Fjord Systems and Archives, Geological Society of London, special publication, 344, 35-51.

VARIABILITY IN ARCTIC OCEAN SEA ICE MELT RATES

Sea ice extent at the end of the summer melt season has been used as a measure of the state of the Arctic Ocean sea ice field since the beginning of the satellite record in 1979, with the minimum pre-2012 occurring in 2007. A significant fraction of the sea ice lost from the Arctic Ocean during the extreme ice-loss year of 2007 was the result of a positive feedback loop between increased solar heating of the ocean surface and reduced sea ice cover, leading to bottom ice melt rates that were as much as ten times larger than were observed a decade earlier.

The second lowest minimum sea ice extent to date was observed in 2011, when the ice extent exceeded that of 2007 by only 7%, and during which the Chukchi Borderland (CBL) experienced a massive decline in sea ice concentration.

Phil **Hwang**, colleagues at SAMS, and collaborators at the Korea Polar Research Institute (KOPRI), deployed an array of SAMS ice mass balance (IMB) buoys from the new KOPRI icebreaker *Araon* in the CBL during late summer 2011. Analysis of the differences in the solar heating contribution to cumulative bottom ice melt of two instrumented ice floes provides a cautionary



note to the 2007 results. Extension of the isolated ice melt observations of 2007 to region-wide inferences hinges on whether such measurements are representative of ice-melt at a larger, aggregate or regional scale. This study showed that differential ice drift and spatial variability of solar heating in the marginal ice zone leads to large variability in the cumulative heat loss, and limits our ability to extrapolate from single-point measurements.

This work was supported by a Royal Society grant to Phil Hwang and KOPRI collaborators. It is part of an ongoing collaboration between SAMS and KOPRI which is continuing under EU funding through the Arctic, Climate Change, Economy, and Society (ACCESS) project, including further IMB buoys deployments from *Araon* in the Amerasian Basin in summer 2012.

DETECTION OF OIL UNDER SEA ICE

With the recent decline in summer time sea ice extent, economic activity within the Arctic Ocean is on the rise through shipping, tourism and resource extraction, amongst other activities. With the rise in economic activity comes the increased likelihood of environmental disaster such as oil spills. The traditional methods for identification and mitigation of oil spills in open water are difficult or impossible to apply in ice-covered seas, so there is an urgent need to develop methods appropriate for these conditions. In the past, attempts to detect oil under sea ice focused on sensing the oil from above, and entailed seeing through the ice to the layer of oil trapped at the ice/water interface.

The Detection and Mapping of Oil under Sea Ice (DAMOS) project, led by Jeremy **Wilkinson** of SAMS with partners at the Woods Hole Oceanographic Institution (WHOI) and the US Army Cold Regions

Research and Engineering Laboratory (CRREL), conducted a set of novel experiments of under ice oil detection with an intentional release of oil beneath a layer of sea ice in an outdoor tank at CRREL in New Hampshire (USA) in January, 2012.

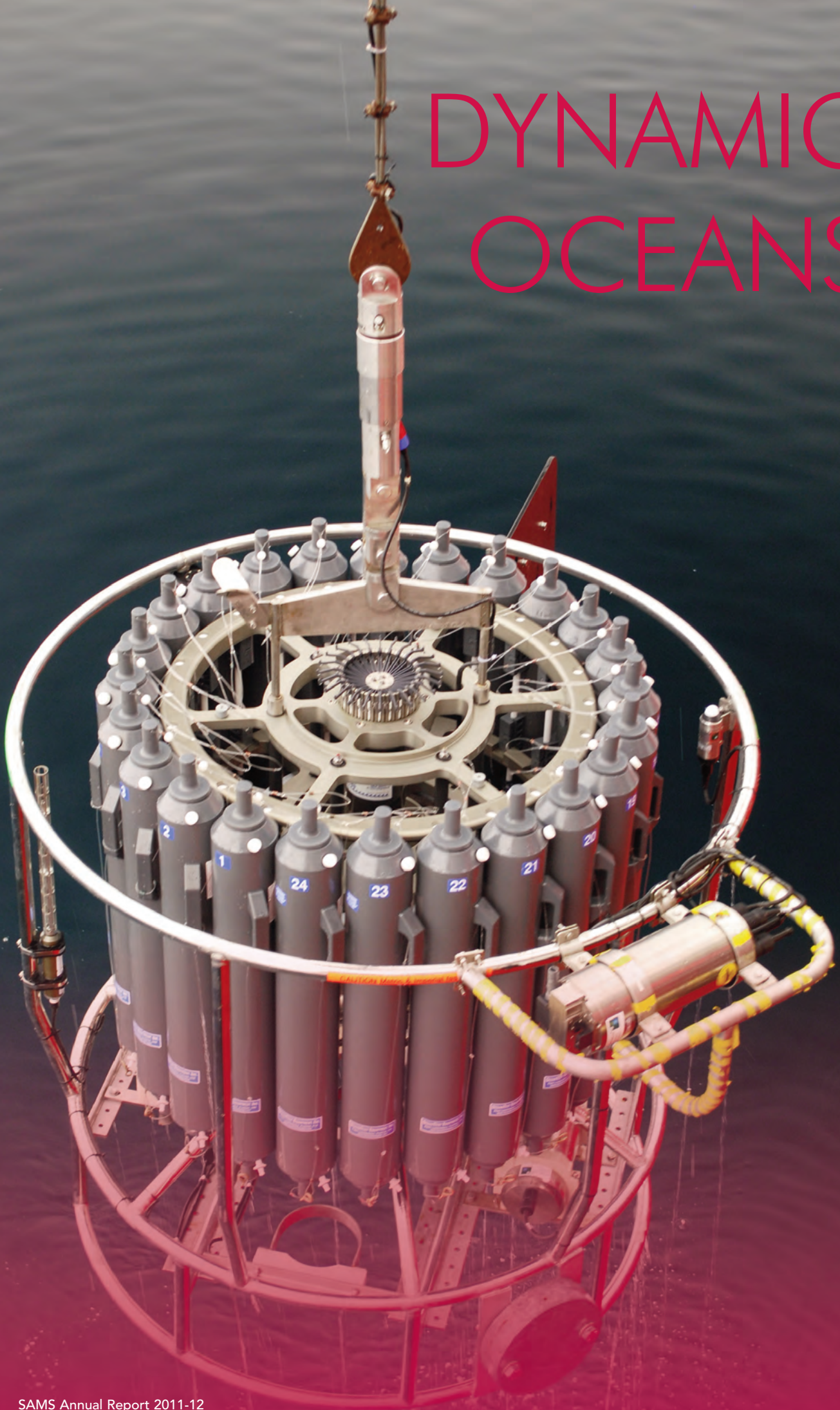
Based on the principle that acoustic energy will be reflected at an interface between materials with different impedances, a 1.1MHz echo sounder was deployed upward-looking beneath the sea ice to measure the reflections from the water/ice interface prior to introduction of oil, and from the water/oil and oil/water interfaces after the oil was leaked into hollows on the under side of the ice. The echo sounder sat on the bottom of the tank together with a suite of other devices, including a sheet laser system and a high dynamic range camera. The camera system provided measurements of the horizontal extent of the oil, however the

echo sounder also enabled the measurement of the thickness of the oil patch to a resolution of 0.14 cm.

The analyses of these first measurements are ongoing, but promise to transform the approach to oil spill management in the Arctic and open up a new application for Unmanned Underwater Vehicles as platforms for the oil detecting sensors.

The first experiment at CRREL was funded by the US Oil Spill Recovery Institute, and further experiments are planned for both the new cold room facility at SAMS and the Hamburg Ship Model Basin (HSVA), with funding from the EU through the Arctic, Climate Change, Economy, and Society (ACCESS) project.

DYNAMIC OCEANS



THE RELATIONSHIP BETWEEN PHYTOPLANKTON DISTRIBUTION & WATER COLUMN CHARACTERISTICS IN NORTH-WEST EUROPEAN SHELF SEA WATERS

Phytoplankton underpin the marine food web in shelf seas, with some species having properties that are harmful to human health and coastal aquaculture. Pressures such as climate change and anthropogenic nutrient input are hypothesized to influence phytoplankton community composition and distribution. Yet the primary environmental drivers in shelf seas are poorly understood.

To begin to address this in north-western European waters, scientists at SAMS led by Keith **Davidson** assessed the phytoplankton community composition in light of measured physical and chemical drivers during the "Ellett Line" cruise.

Spatial variability existed in both phytoplankton and environmental conditions, with clear differences not only between on and off shelf stations but also between different on shelf locations. Temperature/salinity plots demonstrated different water masses existed in the region. In turn, principal component analysis (PCA) of the measured environmental conditions clearly discriminated between shelf and



oceanic stations on the basis of dissolved inorganic nitrogen and dissolved silica (DIN:DSi) ratios. The phytoplankton community was diatom dominated, with multidimensional scaling (MDS) demonstrating spatial variability in its composition. Redundancy analysis (RDA) was used to investigate the link between environment and the phytoplankton community. This demonstrated a significant relationship between community composition and water mass as indexed by salinity (whole community), and both salinity and DIN:DSi (diatoms alone). Diatoms of the *Pseudo-nitzschia seriata* group (see image left) occurred at densities potentially harmful to shellfish aquaculture, with the potential for toxicity being elevated by the likelihood of DSi limitation at most stations and depths.

Relevant publication

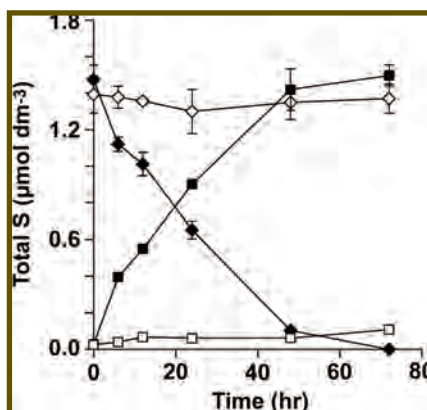
Fehling et al., 2012, *PLoS ONE*, 7(3) e34098. doi:10.1371/journal.pone.0034098

DMS OXIDATION: A NEW SOURCE OF ENERGY FOR MARINE BACTERIA

The production of dimethylsulphide (DMS) in the oceans has, for a long time, been considered to be an important component of a natural climate feedback system. Research led by SAMS Principal Investigators (PIs) Angela **Hatton** and David **Green** has now shown that the oxidation of DMS to DMSO is the major pathway controlling the amount of DMS available in surface waters.

These results are important for understanding how DMS is made and lost, and they provide a compelling explanation for all the DMSO in surface waters. Even more importantly, the research shows that these bacteria are able to exploit this pathway using the two electrons – effectively, free energy – for growth.

Finally the research team discovered that the speed of this process is influenced by carbon dissolved in the sea water, suggesting that dissolved organic carbon may control when, where and how DMS is removed from surface ocean waters.



ABOVE: DMS oxidation by a marine bacterium shows removal of DMS by oxidation and concomitant production of DMSO. Bacterium *Muricauda* sp. DG1233 was incubated with 1.5 $\mu\text{mol dm}^{-3}$ DMS and glucose (filled symbols) or without glucose (open symbols).

Diamonds = DMS ($\mu\text{mol dm}^{-3}$); Squares = DMSO ($\mu\text{mol dm}^{-3}$). Error bars represent 1 SD of the mean of triplicate samples.

Relevant publications

Green et al., 2011, *Applied and Environmental Microbiology*, 77 (9), 3137-3140.

Hatton et al., 2012, *Biogeochemistry*, DOI 10.1007/s10533-012-9702-7.

Hatton & Green, 2011, *Planet Earth* Winter edition.

QUANTIFYING AND MONITORING POTENTIAL ECOSYSTEM IMPACTS OF GEOLOGICAL CARBON STORAGE



Reducing greenhouse gas emissions is one of the great challenges of our time and it is vital that we come up with methods to solve this problem as a matter of urgency.

Carbon Capture and Storage (CCS), i.e. capturing the CO₂ before it is emitted into the atmosphere and then pumping it back into sub-seabed reservoirs, is one mitigation method that is attracting significant international effort and attention. To evaluate the diversity of options, we must also study the implications and potential impacts of such methods.

The purpose of the NERC funded QICS project (Quantifying and Monitoring Potential Ecosystem Impacts of Geological Carbon Storage) is to improve understanding of the sensitivities of the UK marine environment to a potential leak from a carbon capture and storage system.

Within this four year project SAMS PI Henrik **Stahl** along with colleagues from the Plymouth Marine Laboratory, National Oceanography Centre Southampton, British Geological Survey, Durham University, Bristol University, Edinburgh University and Heriot-Watt University investigate the nature and probability of a leakage, quantify the environmental impact potential, test

methods of monitoring, and design improved predictive models of impact.

During early spring 2012 a 350m long bore hole was drilled from a base at Tralee Caravan Park into the sediment 12m below the sediment-water interface of Ardmucknish Bay in the vicinity of SAMS to conduct the world's first controlled *in situ* release study.

Over the summer CO₂ gas will be released through this borehole from a shore based pop-up laboratory into the sediments for a period of five weeks. The impacts of this CO₂ leaking into the ecosystem will be quantified and the recovery of the marine environment will then be carefully monitored.

This *in situ* experiment is providing a unique opportunity to study effects of CO₂ leakage on the ecosystem in shallow sediments under 'real-life' conditions.

Furthermore, it allows the involved scientists to test 'state-of-the-art' technology for detection and monitoring of CO₂ leakage and generated data will be used for assessing and validating models for CO₂ dispersion in the sea.

THE PACE OF SHIFTING CLIMATE IN MARINE AND TERRESTRIAL ECOSYSTEMS

Climate change challenges organisms to adapt or move to track environmental changes in space and time.

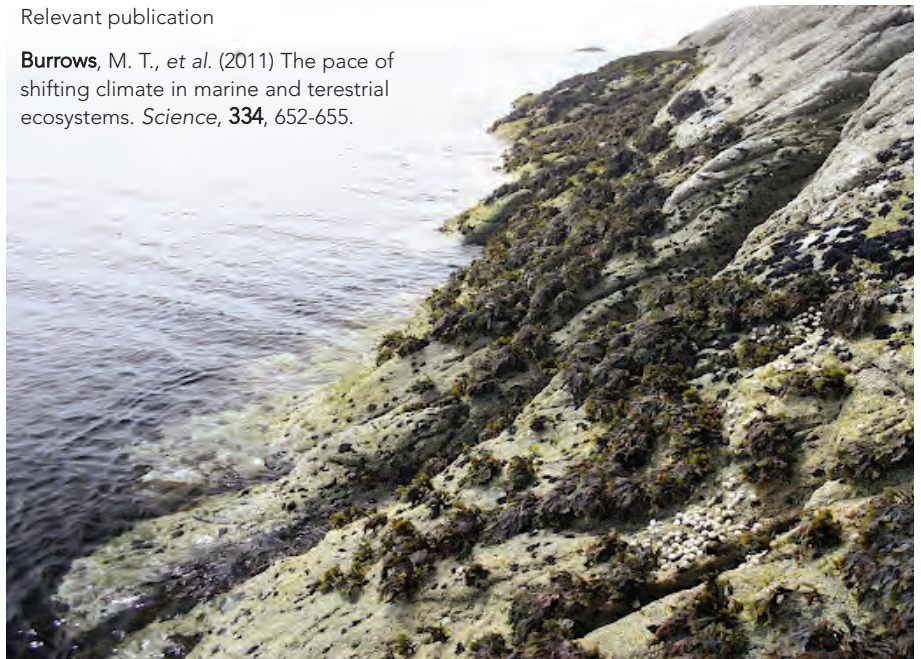
Research led by SAMS PI Mike **Burrows** used two measures of thermal shifts from analyses of global temperatures over the past 50 years to describe the pace of climate change that species should track: the velocity of climate change (geographic shifts of isotherms over time) and the shift in seasonal timing of temperatures.

Both measures are higher in the ocean than on land at some latitudes, despite slower ocean warming.

These indices give a complex mosaic of predicted range shifts and phenology changes that deviate from simple poleward migration and earlier springs or later falls. They also emphasize potential conservation concerns, because areas of high marine biodiversity often have greater velocities of climate change and seasonal shifts.

Relevant publication

Burrows, M. T., et al. (2011) The pace of shifting climate in marine and terrestrial ecosystems. *Science*, **334**, 652-655.



FROM SEAWEEDS TO NEW CONCEPTS ON VACCINATION

When attempting to identify the strategies used by seaweeds to overcome infectious agents, SAMS PI Claire **Gachon** and SAMS Bursary recipient Antonios Zambounis discovered a fascinating and unique mechanism used by the small filamentous brown alga *Ectocarpus siliculosus* to increase the diversity of some of its proteins (Fig 1).

The implications of this finding are far-reaching because comparable mechanisms are only known from the so-called adaptive immune system of humans and vertebrates. The adaptive immune system underpins our resistance to many infectious agents and its properties are exploited in medical and veterinary procedures such as vaccination or the design of treatments against infectious diseases. Of course, the work is also immediately relevant to the rational design of breeding and crop protection strategies in marine seaweed aquaculture.

In collaboration with the Aberdeen Oomycete Group, we have also been pioneering DNA sequencing of the marine algal pathogen *Eurycasmas dicksonii*. This work resulted in new clues about the strategies used by the pathogen to colonise its algal host (Fig. 2) and is being up-scaled thanks to a NERC New Investigator grant awarded to Claire Gachon.

Altogether, this year has been both extremely busy and productive, with contributions made to four other peer-reviewed articles on topics as diverse as biofouling, DNA fingerprinting, and marine fungi.

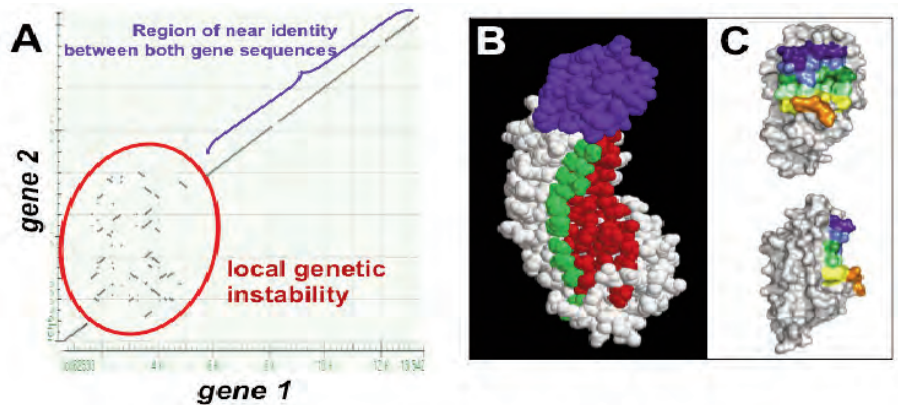


Fig. 1: Genetic variation in the alga *Ectocarpus siliculosus* similar to the system underpinning antibody diversity in vertebrates¹.
 A) Targeted genetic instability leaves a highly unusual signature within the DNA sequence of two related genes (red circle). B) The underpinning mechanism specifically induces changes in the region of the protein that putatively interacts with pathogens (highlighted in red and green). C) Our findings are strikingly similar to the targeted variation of vertebrate antibodies (highlighted on a frontal and side view). The latter mechanism allows the immune system to rapidly adapt to pathogens that vary constantly in order to escape detection. (C - reproduced from Herrin et al., 2008, PNAS, 105, 2040-2045).

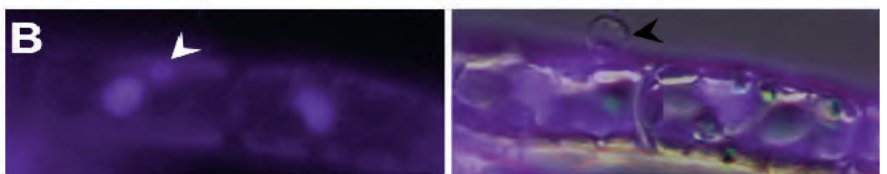
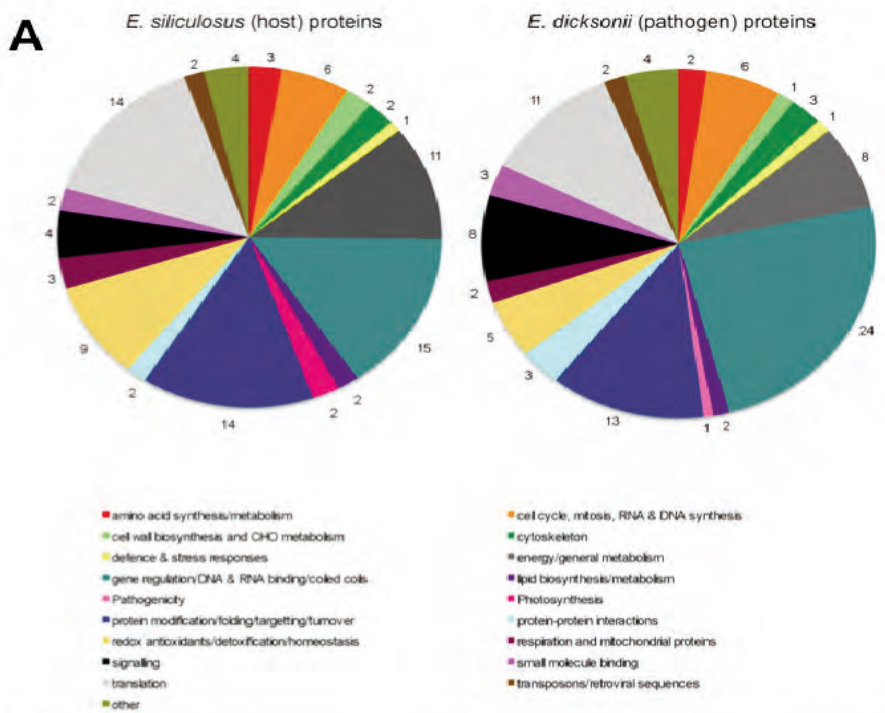


Fig. 2: The first molecular insight into the infection strategies of the pathogen *Eurycasmas dicksonii*².
 A. Overview of protein groups present in *E. dicksonii*, compared to its algal host. B. Candidate proteins involved in specific aspects of the infection were identified, such as the early migration of *E. dicksonii* (white arrowhead) towards the nucleus of the infected algal cell (in blue) from the earliest stages of infection. The black arrowhead on the right shows the infectious *E. dicksonii* spore attached at the surface of the algal cell.

Relevant publications

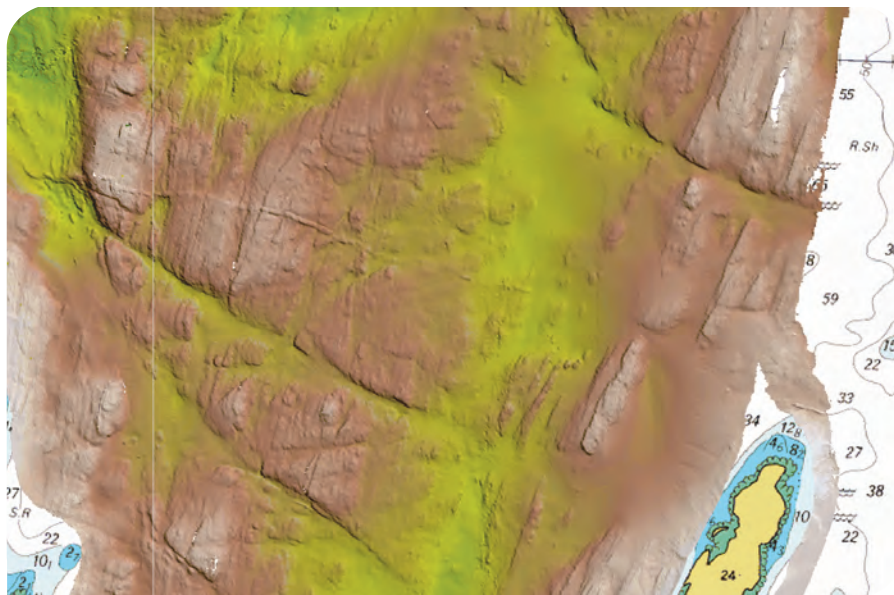
- Zambounis A, Elias M, Sterck L, Maumus F & **Gachon CMM** (2012) Highly dynamic exon shuffling in candidate pathogen receptors. What if brown algae were capable of adaptive immunity? *Molecular Biology and Evolution*, 29 (4), 1263-1276.
- Grenville-Briggs L*, **Gachon CMM***, **Strittmatter M**, Sterck L, **Küpper FC**, and van West P. (2011) A molecular insight into algal-oomycete warfare: cDNA analysis of *Ectocarpus siliculosus* infected with the basal oomycete *Eurycasmas dicksonii*. *PLoS1*, 6, e24500. (*: equal contribution)

MAPPING THE SEAFLOOR OFF THE WEST COAST: MAREMAP & INIS HYDRO

The SAMS research vessel RV *Calanus* had two multibeam echo sounders installed for producing highly accurate maps of the seafloor. These systems use a wide 'fan' of sound to measure the depth of the water, and hence the shape of the seabed.

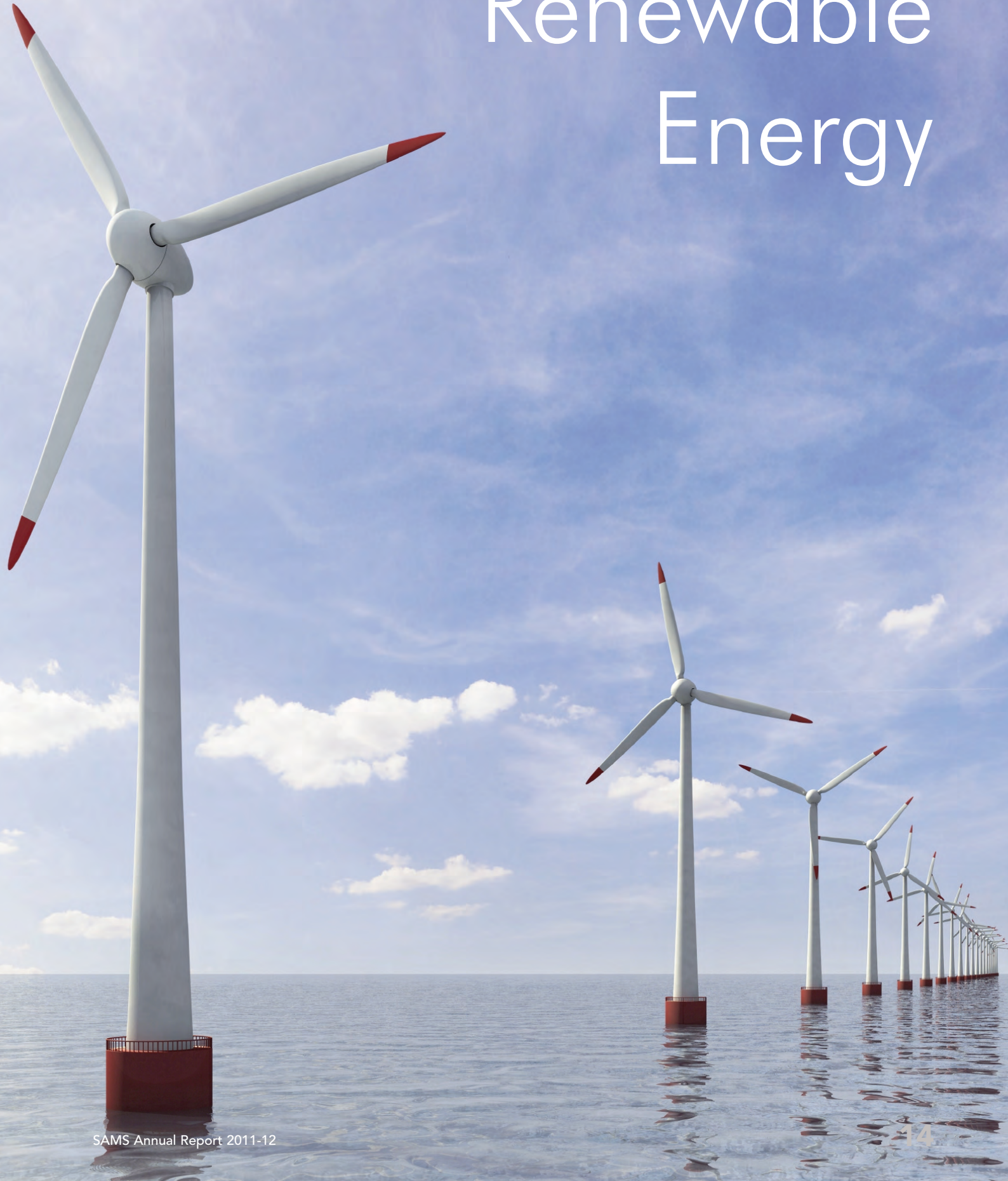
Systematic mapping of the Firth of Lorn is led by PI John **Howe** as part of the EU-funded INIS Hydro project (Ireland, Northern Ireland and Scotland Hydrographic Survey). This work aims to enhance the existing nautical charts produced by the UK Hydrographic Office and examine the unique marine geology of the area from Oban to Jura. For more on INIS Hydro, please visit www.inis-hydro.eu. This work is part funded through the MAREMAP initiative.

MAREMAP (Marine Environmental Mapping Programme) is a NERC programme aiming to bring together institutes with an interest in oceanographic mapping. SAMS is a co-lead partner with the British Geological Survey and the National Oceanography Centre. See www.maremap.ac.uk for more.



ABOVE: View of the seabed in the Sound of Jura showing exposed, current swept bedrock and sediment patches. View is approximately 8km across and water depths are between 70-30m (yellow & green – red and white).

Marine Renewable Energy



SUSTAINABLE MARINE ENERGY THROUGH RESEARCH AND INNOVATION

The marine renewables research theme combines the multidisciplinary skills of our four established research departments (Ecology; Microbial and Molecular Biology; Biogeochemistry and Earth Science; Physics, Sea Ice and Technology) to provide expert scientific research and advice to help harness the potential of the marine power from coastal seas.

Our expertise feeds into the sustainable development, regulation and capacity of a variety of established and emerging technologies.

Our efforts are focussed into three areas.

(1) Understanding how large kinetic devices (tidal-stream, wave and offshore

wind) will interact with the fauna and flora in the environment.

(2) Exploring the potential to generate biofuels from seaweeds and ranging from digestion and fermentation to large-scale mariculture.

(3) Discovering the potential to produce biodiesel and biobutanol from unicellular algae.

Our activities range from fundamental research to client led commercial consultancy but also include student training through a vibrant cluster of fourteen PhD students. The first cohort are now in their final year of study and their results are beginning to have impact.

This section carries four examples of PhD student work in this theme in the past year.

Finally, with Scotland being the focus for many of the emerging marine renewable technologies, it was fitting for the country to host the world's first conference on how these might impact other users of the sea, human and natural. The meeting, titled Environmental Interactions of Marine Renewables 2012, was held in Kirkwall, Orkney in May. SAMS-UHI were an organising partner and sent 17 staff to present talks, posters and workshops along with 180 other participants at this first-of-a-kind international conference.

*Ben Wilson
Renewables Theme Leader*

WHAT CAN NAVIGATION BUOYS TEACH US ABOUT BIOFOULING ON MARINE ENERGY DEVICES?



by ADRIAN MACLEOD (PhD candidate)

A joint collaboration between SAMS and the Northern Lighthouse Board allowed the first Scotland-wide survey of epibenthic (fouling) communities on navigation buoys. These are useful and established proxies for future offshore artificial structures.

The study areas were within or adjacent to sites currently under development for marine renewable energy devices and made a more complete knowledge of the location of indigenous and non-native species possible.

The results of this innovative study showed that the geographical region in which buoys were located had the largest influence on what colonised these structures while the rate of water flow past them had surprisingly little effect. These offshore observations have paved the way for controlled experimentation in the SAMS aquarium.

INTERACTIVE MARINE SPATIAL PLANNING: SITING TIDAL ENERGY ARRAYS AROUND THE MULL OF KINTYRE

by KAREN ALEXANDER (PhD candidate)

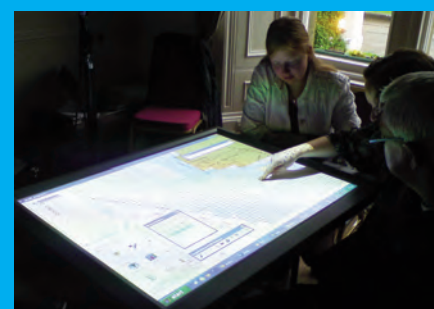
This research project investigates potential conflicts between tidal energy development and marine stakeholders.

We identified important gaps in existing marine spatial data and helped fill these through interactive input from stakeholders.

The project also developed a novel method for implementing marine spatial planning,

using tidal energy as a case study. This approach is based on mapping with a real-time interactive touch-table device (see image on right) combined with stakeholder workshops.

This method was used to articulate 'local knowledge' of the marine environment and to facilitate negotiation within the marine spatial planning process.



PROGRESS OF THE BIOMARA PROJECT

As global fossil fuel supplies dwindle and atmospheric carbon dioxide concentrations rise, pressure is on to find viable biofuel alternatives to petroleum-based products. This quest is being further stimulated by legislation; the European Parliament is calling for 10% of road transport fuel to come from renewable sources by 2020. In addition, the Scottish Government has set a target of 30% of all energy needs coming from renewables by 2030.

At present approximately 90% of the world's biofuel production is bioethanol, largely produced from sugarcane and maize, and is used as a petrol additive. The remaining 10% of biofuel is derived from plant oils such as rapeseed, soya and palm, which are turned into biodiesel. These first generation biofuels or agri-fuels are a long way from meeting the world's need for energy security and reductions in CO₂ emissions. Furthermore, their cultivation raises environmental and food security concerns.

Future biofuels will inevitably require the production of huge quantities of biomass which will have to be grown covering vast cultivation areas. The oceans cover more than 70% of the world's surface and their extensive coastal regions may be more efficient for growing biomass than land. The marine environment therefore offers the planet's largest area for mass cultivation of biomass and opportunities are already being realised in China and elsewhere.

BioMara has examined the feasibility and viability of producing third generation biofuels from both microalgae and macroalgae and made significant progress in

- (1) exploring the options available for biomass production e.g. natural harvest versus cultivation (see bottom article)
- (2) the use of biomass for anaerobic digestion and bioethanol production (see below)
- (3) understanding control mechanisms in oil production by microalgae



BioMara is a four year UK and Irish project delivered by six research partners under the leadership of SAMS. BioMara is part funded by the EU's European Regional Development Fund through the INTERREG IVA Programme, with additional funding from the Department of Communications, Energy and Natural Resources in Eire, the Northern Ireland Executive, The Scottish Government, The Crown Estate and Highlands and Islands Enterprise. The project will end in December 2012.

TURNING SEAWEED INTO BIOETHANOL

by PETER SCHIENER (PhD candidate)

Seaweed biomass has been evaluated and assessed as a fermentation substrate for bioethanol production. During one season *Laminaria digitata*, *Saccharina latissima*, *Laminaria hyperborea* and *Alaria esculenta* were chemically characterised based on their carbohydrate, polyphenol, mineral and protein content.

Nutritional profiling of each constituent

enables the prediction of optimum seaweed harvesting times, with highest levels of carbohydrates of up to 80% seen in autumn. The main carbohydrates in brown seaweed biomass were laminarin, alginate, cellulose and mannitol, with various degrees of fluctuation.

Saccharification of seaweed polymers into fermentable substrate has been the main focal area of this project. Application of

cellulosic and hemicellulosic enzymes against acid processing has been evaluated with enzymatic treatment outperforming a dilute acid saccharification process. In addition, microorganisms of marine origin have been screened for their enzymatic contribution to the saccharification stage. As a result a marine bacteria has been identified which has shown to achieve saccharification yields similar to that of a dilute acid hydrolysis.

ECOLOGICAL ROLE OF BEACH-CAST KELP

by KYLA ORR (PhD candidate)

Highly productive kelp beds are a characteristic feature of the Scottish coastline and represent a valuable resource for the production of biofuel. However, extracting kelp from the marine environment would come with a high environmental cost.

Through the Biomara project I have been investigating the ecological importance of beach-cast kelp in light of its potential use for biofuel.

Data collected in the Outer Hebrides over the last three years show that kelp detached from reefs during storms either accumulates on the shore of drifts in the nearshore zone. This kelp-detritus constitutes one of the most valuable food sources to coastal communities in an otherwise food-limited environment.



Results from the study indicate that the decaying kelp is consumed by an abundance of detritivores, both on the beach and in the surf zone, which are in turn preyed upon by

fish and birds. The invertebrates within the kelp form one of the most nutritious and abundant food resources to migrating birds in the area, and likely to be essential for the birds' survival during long journeys.

Ecological modelling results show that if kelp harvesting commenced, there would be an immediate decline in coastal invertebrate and bird life. However, once harvesting ceased invertebrate populations would recover within one year. While predicting the recovery of birds is tricky, models suggest harvesting of kelp would have long-lasting negative impacts on bird populations.

In light of these results it is recommended that any development of the macroalgae biofuel industry should focus on kelp aquaculture rather than the harvesting of natural resources.

PEOPLE AND THE SEA



RAPID POLICY NETWORK MAPPING TOOL

The rapid policy network mapping tool created at SAMS is a novel method for mapping governance structures.

It was developed to deliver an insight for both technical and non-technical users into the lifecycle, relationships and dependencies of policy development. The method was applied to the Marine Strategy Framework Directive and the Water Framework Directive

in different regions and provided a reliable means of mapping the complexity of implementation of legislation. The method has been taken up by other research groups and is currently being applied in several case studies throughout the KnowSeas project and has recently been employed by DEFRA.

Relevant publication

Bainbridge, J. M., Potts, T. & O'Higgins, T. G. Rapid Policy Network Mapping: A New Method for Understanding Governance Structures for Implementation of Marine Environmental Policy. *PLoS ONE*, **6**, e26149, doi:10.1371/journal.pone.0026149 (2011).

THE ATTITUDE OF SCOTTISH FISHERS TO MARINE RENEWABLE ENERGY

Fishers' attitudes and behaviour have been found to influence the success of fishery management measures, compliance with regulations and Marine Protected Areas. This suggests that fishers' attitudes may also affect offshore renewable energy developments.

A survey of fishers' attitudes found that the most important factor influencing fishers' opinions was whether they knew of a nearby offshore development, followed by whether

they operate from the mainland or the islands. Despite concerns regarding the perceived impacts and mitigation the majority of fishers held either neutral or positive attitudes towards offshore renewable energy extraction. The study suggested that knowledge of nearby offshore energy developments may lead to a negative attitude and that gear type, association membership, and experience did not influence attitudes.

Relevant publication

Alexander, K. A., Wilding, T. A. & Heymans, J. J. Attitudes of Scottish fishers towards marine renewable energy. *Marine Policy*, doi:10.1016/j.marpol.2012.05.005 (in press)

NERC SCOPING STUDY ON MARINE BIORESOURCES FOR FOOD



This report used expert review and surveys to provide a review of:

- the scientific drivers related to sustainable exploitation and management of marine bioresources and the environmental science opportunities and challenges that NERC could consider investing in;
- the policy drivers including opportunities related to the 2012 Common Fisheries Policy (CFP) reform process;
- opportunities for knowledge exchange (KE) to apply or adapt current or past NERC research outputs to yield a demonstrable

economic, societal or environmental impact on the sector; and

- NERC research capabilities and expertise in this area.

The results showed that there was low overall awareness of the range of science funded by NERC. With regards to policy drivers, a significant proportion of the industry felt that overfishing was less of an issue due to the reduction of capacity and more regulations and enforcement, while new drivers including ocean acidification, spatial planning and management and issues

related to aquaculture.

The study found that there were significant opportunities to increase the impact of any NERC KE program by co-funding with the Scottish Aquaculture Research Forum and Seafish, both of whom were keen to collaborate.

Finally, the area where responders perceived least progress since the Barange report was the integration of biological, social and economic approaches. To make progress in this area the report recommends improved collaboration between natural, social and economic science practitioners, through better links between NERC's and ESRC's Knowledge Exchange programmes, which would enable natural, social and economic scientists to interact jointly with industry and policy to tackle some of the significant challenges faced by the fishing and aquaculture sectors.

Relevant publication

Fox, C. J., Burrows, M. T., Black, K. and Alexander, K. A. A scoping study on marine bioresources for food - An update of the 2005 science for sustainable marine bioresources report and further consideration of knowledge exchange opportunities in this area of research. 86 pages (NERC, SAMS, Oban, 2012).

CONNECTING COASTAL COMMUNITIES

Connecting Coastal Communities is an art-science collaboration between social ecologist Ruth **Brennan** (SAMS), crofting scholar Iain MacKinnon (Scottish Crofting Federation) and visual artist Stephen Hurrell (Hurrell Visual Arts). Funded by cultural organisation Colmcille, this piece of cultural research engages with island fishermen's way of knowing the marine environment on the Gaelic and Irish speaking islands of Barra (Outer Hebrides) and Arranmore (off the north west coast of Donegal, Ireland). On both islands the fishermen believe that their livelihood and way of living is being threatened by powerful governmental forces who are not listening to them.

A short book - *Duthchas na Mara/Duchas na Mara/Belonging to the Sea* - explores (through text and imagery) the cultural roots of maritime conflict on Gaelic speaking islands in Scotland and Ireland. This book was launched at the Clan MacNeil Gathering on Barra in August 2012.

The information gathered from local fishermen during this project will form the basis of a digital map for each island, which will contain the 'duthchas'/'duchas' or sense of place of each island within it.

Creative Scotland have recently granted £46,000 for a follow-on project in Barra -



Sgeulachdan na Mara/Sea Stories - which will involve island school children in knowledge gathering and also creatively in the design process for the digital map. The aim is to create a dynamic and multi-layered map which reflects the local community's 'way of knowing' their marine environment and which could complement the more static and one-dimensional maps often used by government agencies.

In light of the strong community support on both islands for the Connecting Coastal Communities project and the innovative aspect of a research collaboration between two social scientists and a visual artist, we envisage that this project has the potential to create a model approach which could help other communities express and engage with their natural and cultural heritage in a way which is unique to each community.

PUBLIC OPINION SURVEY ON THE MARINE ENVIRONMENT



A recent policy brief, a product of the KnowSeas project in collaboration with the Oak Foundation, charts public opinion of 7000 people across seven European countries concerning marine values and management approaches.

The results highlight that while the oceans are not considered a priority issue in public opinion, there is a requirement for improved education on the marine environment and a strong call for more civil society involvement in governance.

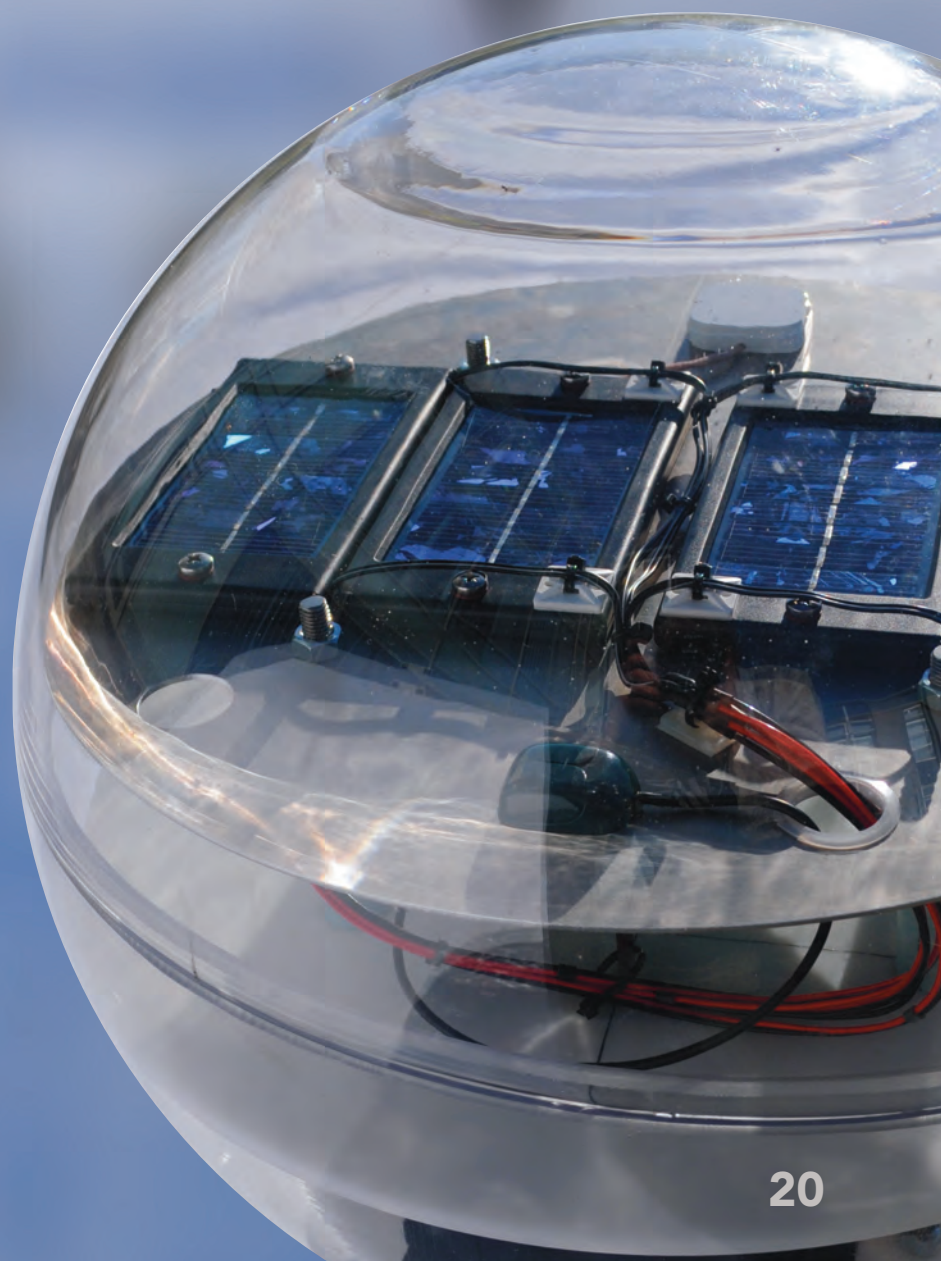
Views across countries differed dramatically in terms of services delivered by marine systems, and views across age cohorts also varied considerably.

The emerging 'ecosystem approach' was important with the public highlighting that non-economic values rank as important as traditional economic activities and outputs.

Relevant publication

Potts T. O'Higgins T. Mee L. Pita C. (2011) *Public perceptions of Europe's Seas - A Policy Brief*. EU FP7 KNOWSEAS Project. ISBN 0-9529089-3-X <http://www.knowseas.com/links-and-data/policy-briefs>

Centre for Smart Observations



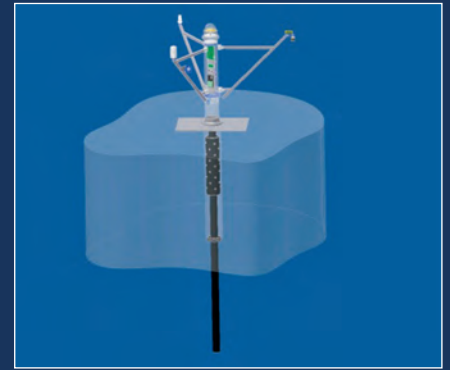
POLAR TECHNOLOGY

The Marine Technology Group has been developing the technology for the first high-rate, high-precision, continuous GPS positioning experiment on sea ice in the Arctic Ocean for the SATICE project (Arctic Ocean Sea-ice and Ocean Circulation Changes Using Satellite Methods) funded by the European Science Foundation.

The new platform is deployed into the ice and collects continuous, dual-frequency carrier-phase GPS data whilst drifting with the ice. Additional geophysical measurements are also collected enabling sea ice drift, freeboard, weather, ice mass balance, and sea-level height determination. The data from these autonomous platforms can be used to determine the platform positions with a precision of a few centimetres in all three dimensions. Such precise information was unavailable previously, especially in the vertical axis. The technology allows us to address new polar science questions about sea ice dynamics

and Arctic oceanography.

The new technology was developed in collaboration with many EU and international institutes, particularly the Marine Technology Unit (UTM) and Institute for Space Sciences (ICE), CSIC, Barcelona, Spain and the Korean Polar Research Institute (KOPRI).



ABOVE: CAD model design of the new SATICE platform.

A recent novel innovation has been the design of an autonomous instrumentation package capable of measuring sea-ice thickness for deployment upon the dog drawn sleds of the indigenous peoples of the Arctic. The device features a suite of sensors that have been integrated with an electromagnetic induction device that can sense the thickness of the sea ice. The system is able to provide measurements of ice thickness with high spatio-temporal resolution. Such data is essential in quantifying the sea-ice mass balance, given that existing satellite based systems are unable to measure ice-thickness directly. Field-campaign results from a prototype device, deployed in the north west of Greenland during three consecutive seasons, have demonstrated successful proof-of-concept.



LANDERS

During the reporting period, the Lander-and-Sensor Group within the Department of Biogeochemistry and Earth Science has been involved in a number of smart observations.

SAMS first cabled real-time observatory was recovered after a successful two year deployment in the deep basin in Loch Etive as part of the HYPOX project. It had measured dissolved oxygen, temperature and conductivity and currents every 10 min at depths of 15m and 125m. The gathered data was automatically transferred via broadband connection to a data base at SAMS and to a central data base for the HYPOX project (www.hypox.net), where it was part of one of the first centralised

European coastal observatory networks with several other observatories.

Within the ongoing QICS project (<http://www.bgs.ac.uk/qics/home.html>) the group successfully deployed a variety of new state-of-the-art sensors and instruments in collaboration with research groups from Japan and the UK as part of a Carbon Capture and Storage (CCS) experiment in Ardmucknish Bay. The experiment was coordinated by Henrik Stahl and simulated an *in situ* CO₂ leakage from a CCS reservoir. The experimental set-up included the deployment of an AUV equipped with a new pCO₂/pH sensor and of an online cabled and several stand-alone stationary platforms

carrying the new pCO₂/pH sensors along a gradient at the CO₂ release site. Hydrophones were deployed to listen for bubbles in the water column around the CO₂ release site and an *in situ* benthic 'transecting profiler-lander' was deployed on several occasions to collect detailed information on the sediment oxygen distribution of the sea floor around the site.

Finally, the group successfully deployed a state-of-the-art eddy correlation lander to study the oxygen uptake of biogenic reefs, on both the Mingualy cold water coral reef and on the mearl beds in Loch Sween.

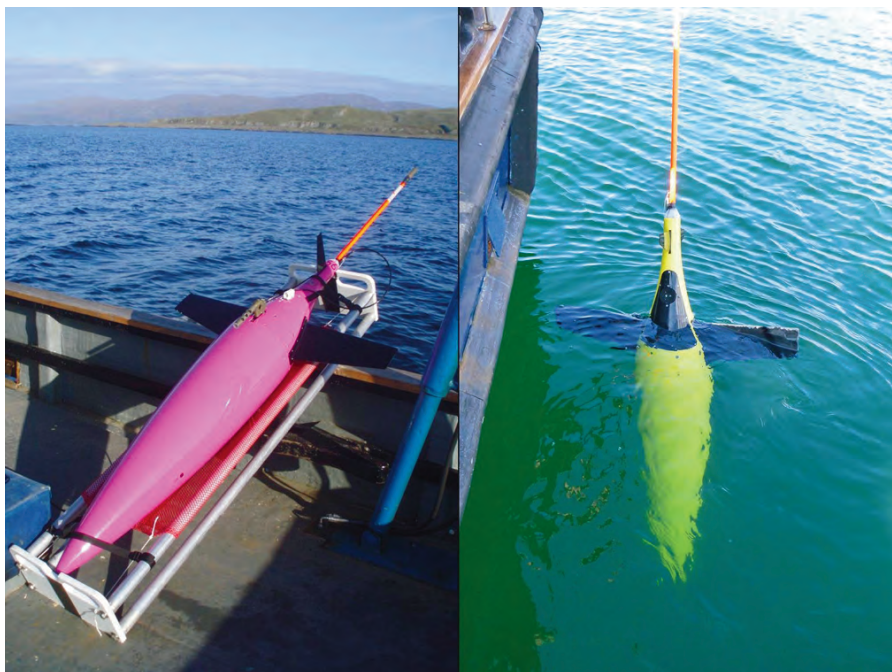
GLIDERS

SAMS is currently operating two Seagliders within the Centre for Smart Observations. These buoyancy-driven unmanned underwater vehicles have been complementing ship-based observations, most recently along the Extended Ellett Line.

During the latest deployment, from Scotland to Iceland and on into Faroese waters, 841 dives were completed, up to a 1000m deep. Overall the Seaglider covered a distance of 2300 km over four months.

Future plans include shelf surveys as part of the FASTNEt project, and more winter missions along the Extended Ellett Line.

Current deployments can be followed at: <http://velocity.sams.ac.uk/gliders/>



AUTONOMOUS UNDERWATER VEHICLES

SAMS Hydroid REMUS 600 Autonomous Underwater Vehicle "Rebus" was in operation in the Firth of Clyde in September 2011 to measure the effects of wind forcing on near-surface ocean structure. The vehicle sampled underwater for 20 hours over four days in the lead-up to and relaxation following the gale force winds with which post-hurricane Katia swept the west coast of Scotland. For this project, the standard suite of ADCP/CTD and shear microstructure was complemented with an upward-looking 1.1 MHz echo sounder, in order to measure bubbles which are injected into the near surface by breaking waves and then organized by 'Langmuir circulation' into quasi-linear vertical curtains with familiar downwind surface streaks.

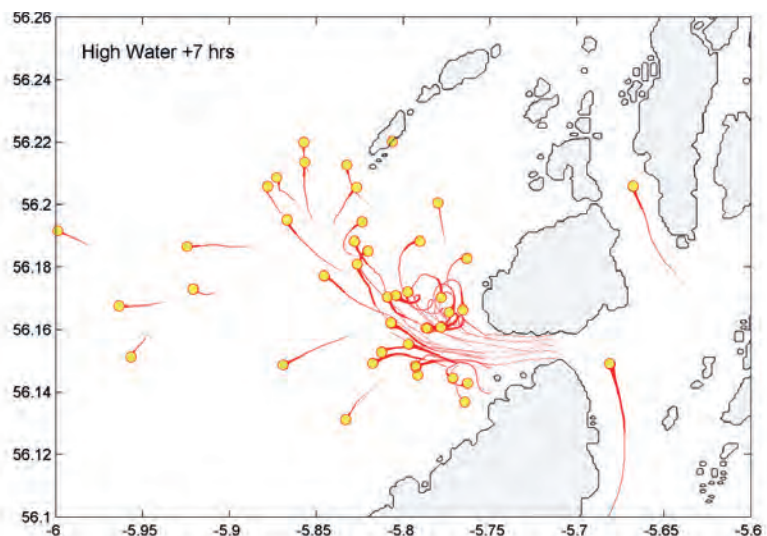
Since coming into operation in summer 2009, *Rebus* has completed a total of 16 missions, including five in the Atlantic gateway to the Arctic in summer 2010, and two missions in May 2011 in the tidal race downstream of the Gulf of Corryvreckan.



ABOVE: SAMS Remus 600 AUV getting ready for action on the R.V. *Prince Madog* in the Firth of Clyde in September 2011.

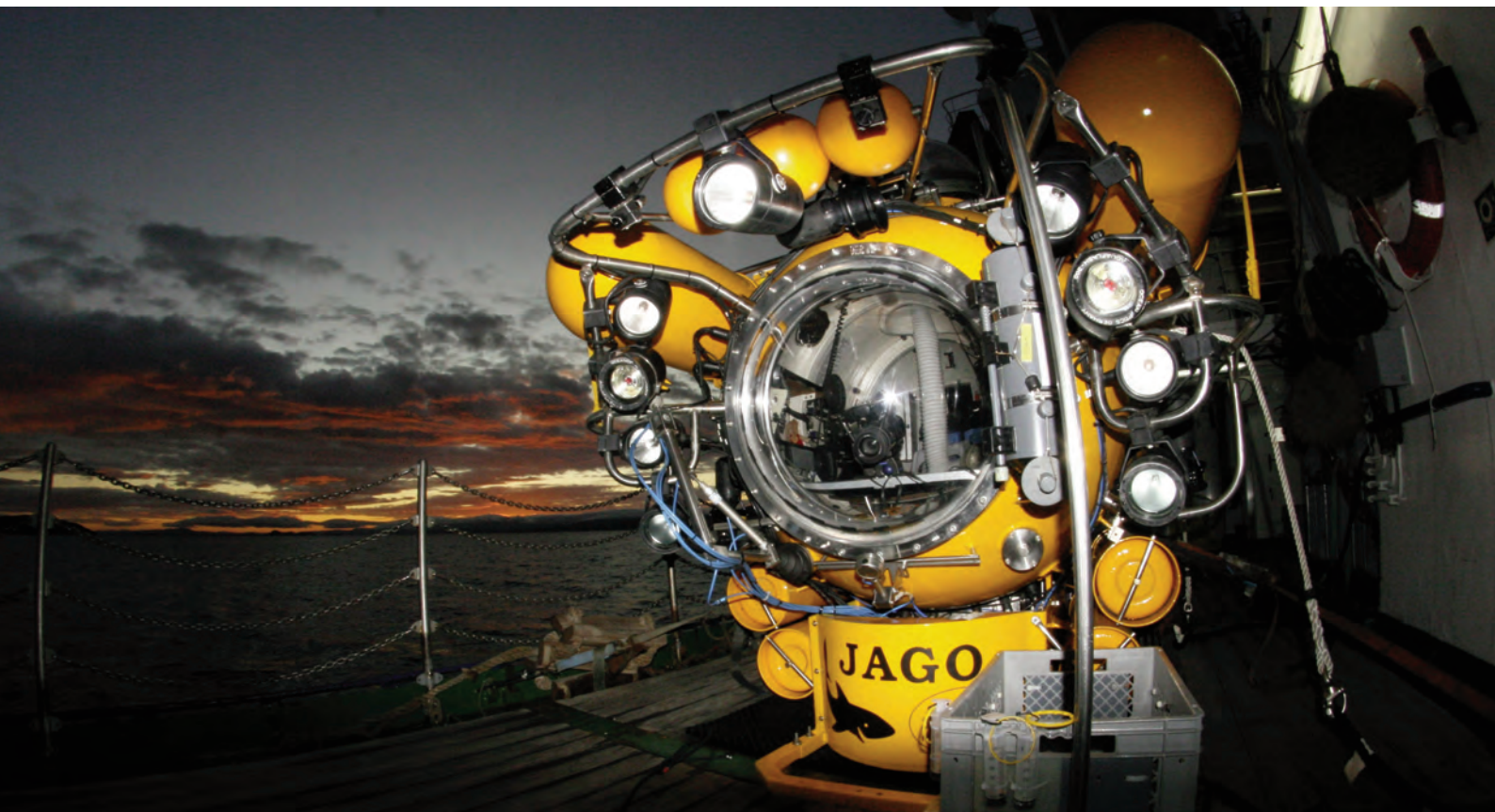
DRIFTERS

For the Great Race NERC project, SAMS developed a new class of coastal drifters that can cope with strongly tidal environments. In highly turbulent tidal locations, traditional drifters with drogues or large sails risk being dragged down by vertical flow as they pass through turbulent boils and overturns. SAMS therefore developed a simple, streamlined drifter design that is minimally affected by both wind and vertical flow and can maintain GPS satellite tracking and GSM (mobile phone) or Iridium (satellite) communications under challenging conditions. Drifter tracks as shown on the image on the right are relayed in real time and can be viewed in the field on a mobile phone. These tracks allow us to map the distribution and dynamics of eddy fields down stream of the Corryvreckan.



Report from Honorary Fellows

Professor J Murray Roberts



ABOVE: Dawn breaks behind the JAGO submersible before a dive to the Norwegian *Lophelia* reefs of Leksa, Trondheimfjord.
Photo: JM Roberts, Heriot-Watt University

Between April 2011 and March 2012 Professor Roberts, who is Professor of Marine Biology at Heriot-Watt University, and his group have continued their research into the functional ecology and biodiversity of cold-water corals.

Following the award of NERC funding through the UK's Ocean Acidification programme (UKOA) Professor Roberts' team have developed a new ocean acidification research facility at Heriot-Watt University where they have been running an 18-month long study examining the effects of ocean acidification and warming on the widespread cold-water coral *Lophelia pertusa*.

Fieldwork for this project took place during RRS *Discovery* cruise 366/367 (May-June 2011) in collaboration with the UKOA pelagic research consortium. Professor Roberts also joined the German BIOACID programme's FS *Poseidon* cruise in September 2011 to *Lophelia* reefs off mid-Norway where the manned submersible JAGO was used to sample and survey reefs at both shelf (Sula Ridge) and fjord (Leksa) settings.

Prof Roberts was a contributing author to the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report on Ocean Systems and in October 2011 joined the Convention on Biological Diversity's

Expert Group on ocean acidification (Montreal, Canada).

Other activities included a new project examining macrofaunal biodiversity in box core samples from the Darwin Mounds gathered during RRS *James Cook* cruise 060 (May-June 2011) and the continued development and analysis of cold-water coral growth and dispersal history across the Atlantic Ocean, a major objective of the Trans-Atlantic Coral Ecosystem Study being completed through the EU's HERMIONE project.

Dr John D M Gordon

My collaboration with Dr Odd Aksel Bergstad, project leader of Patterns and Processes of the Ecosystems of the Northern Mid-Atlantic (MAR-ECO), a Census of Marine Life Project, culminated in the publication of the results of a comparison of the deep-water fish populations of the Mid-Atlantic Ridge with those of the North American and European continental margins.

In the 1980s SAMS and the Institute of Oceanographic Sciences collaborated in deep-water bottom trawl surveys in the Porcupine Seabight, West of Ireland. These surveys were repeated in the early 2000s by the University of Aberdeen using the same trawl and protocols. These surveys,

effectively represent a pre and post commercial fishery scenario and thus provide a unique opportunity to study fishery impacts. The results of comparisons of abundance have already been published. In the early survey the technology to weigh the catch at sea was not available. Length-weight relationships of individual species have now been used to calculate biomass. The comparisons of fish biomass and length-frequencies have now been completed and the results submitted for publication.

I have continued to input into a synthesis of the MAR-ECO and ECO-MAR projects and a paper has been submitted. I also continued as an editor of *Oceanography and Marine Biology: an Annual Review*.

Although no funding is available I continue to archive historical data from both inshore and deep-water trawl surveys.

I intend to fully retire in December 2012.

Publications

Bergstad, O.A., Menezes, G.M.M., Høines, A. S., **Gordon, J.D.M.** & Galbraith, J.K. (2012) Patterns of distribution of deepwater demersal fishes of the North Atlantic mid-ocean ridge, continental slopes, islands and seamounts. *Deep-Sea Research I*, 61, 74–83

Gibson, R.N., R.J.A. Atkinson and **J.D.M. Gordon** (eds.) (2011). *Oceanography and Marine Biology: An Annual Review*, 49, 1-34.

Dr J C A Craik



ABOVE: Terns rising from nests on adapted mussel rafts at South Shian in Loch Creran.

The **Mink-Seabird Project**, which aims to protect important seabird breeding islands from feral American mink, was continued for its seventeenth successive year. The seabirds involved are Common and Arctic Tern, Common and Black-headed Gull, and smaller numbers of Eider, Oystercatcher, Black Guillemot and other species. Less work than usual was carried out because of near-continuous bad weather in May 2011. Mink were controlled at 25 main sites and birds bred successfully at thirteen of these. Results were mixed or equivocal at two, while at ten there were colony failures caused mainly by predation. Mink were responsible or suspected at only two of the ten, while at eight the following predators, alone or in combination, were responsible or suspected: otter, fox, peregrine, herring gull, great black-backed gull, hooded crow and sea eagle. Thus the project succeeded at 13+8 = 21 of the 25 sites.

Mink control by conventional trapping is expensive and time-consuming, so alternative methods of protecting affected seabirds are being sought. The most promising is the use of breeding rafts that

are inaccessible to mink. Mussel rafts at a disused mussel farm at South Shian in Loch Creran have been adapted for this purpose and terns have nested on these, usually successfully, since a single pair raised one young in 1996. In summer 2011 a record number of ca 300 pairs of Common Terns nested on two adapted rafts at South Shian and raised ca 400 young (see photo). This was the largest and most productive tern colony in my large study area, which extends along the mainland coast from Mallaig in the north to West Loch Tarbert in the south. In 2011 this area held a total of 711 pairs of Common Terns which fledged 655 young, so about 42% of pairs and 61% of young were on the South Shian rafts. To build on this success, much of March 2012 was spent building a third raft at South Shian.

A **seawater pond** that I discovered near Oban in March 2010 held a large, dense population of the remarkable swimming seasnail *Akera bullata* (see last report). Regrettably, the pond was destroyed in September 2011. However, small numbers were held in captivity and these have now bred successfully, so not all the population

has been lost. An account of the discovery was published in *Mollusc World*, and another paper has been accepted for publication in the *Journal of Conchology*.

Publications

Mixed clutches at seabird colonies in west Scotland 1996-2009. *Seabird* **23** (2010) (published in 2011): 41-52.

The many faces of *Akera bullata*. *Mollusc World* (March 2012) 6-9.

Review of "A Field Guide to Monitoring Nests" by James Ferguson-Lees, Richard Castell and Dave Leech (BTO). *Seabird* **24** (2011) 110-111.

Results of the Mink-Seabird Project in 2011. Unpublished Report (25 pp).

Press coverage

The mixed clutch work was described in various press reports in April-June 2011, including:

"The cunning cuckoo's guide to child care" in *The Daily Telegraph* on 28 June 2011.

National Capabilities



Culture Collection of Algae and Protozoa

The Culture Collection of Algae and Protozoa (CCAP), located at SAMS, is funded by NERC as a component of its National Capability provision. National Capability enables the UK to deliver world-leading science and to support national strategic needs. Furthermore, it includes the research and development activities which keeps this capability at the cutting-edge.

The CCAP, a UK service collection or Biological Resource Centre (BRC), curates and provides cyanobacterial, protistan and macroalgal cultures, bioinformatic data, services and advice to the scientific community.

Culture service

In 2011/12 we received 720 orders and supplied >1760 cultures to non-SAMS users. Our customers included both public and private sector users for applications as diverse as aquaculture, teaching, and both applied and blue skies research. Our cultures also serve as biological standards in ecotoxicological, product efficacy, or biomedical tests.

Applied research

Applied research (especially algal biotechnology) has continued to be a major growth sector over the past year, with the CCAP contributing through the provision of defined materials (cultures), bioinformatic data, advice, training, patent services and

consultancy for users in the UK and elsewhere. The development of future biofuels has been the most active area in the sector and CCAP has participated in the EU's INTERREG IVA funded BioMara project (www.biomara.org).

In the past year a major screening project has been completed, with the objective of identifying potential production strains for future biofuel production and other lipid-based products.

Much of the recent R&D activity with which CCAP has been involved has focussed on the development of methodological toolkits to facilitate strain selection, strain enhancement and the improvement of productivity.

Identifying and controlling grazers

An additional strand of research, primarily funded by the Carbon Trust, focussed on the issue of loss due to predation. Future micro-algal biofuels will almost certainly be derived from open-pond production systems. These are by definition open to "invasion" by grazers, which have the capacity to devastate micro-algal mass-cultures. There is an urgent requirement for methodologies capable of early detection of grazers in dense algal cultures, so that control strategies can be initiated early before there are significant production losses. A model system employing the marine alga *Nannochloropsis oculata* was challenged by grazers including ciliates,

amoebae and a heterotrophic dinoflagellate. A method was developed using a FlowCAM flow-cytometer that was capable of detecting all the grazers investigated (size range <20 µm to >80 µm in length) in the presence of algae. The system proved very sensitive with detection limits of less than 10 cells per ml for both "large" and "small" model grazers. The system was furthermore capable of finding ciliates in *N. oculata* cultures with biotechnologically relevant cell densities (>0.5 g/l dry wt).

Biodiversity research

In addition to interests in algal biotechnology, work has continued on biodiversity related research with Masters projects undertaken associated with CCAP focussing on the endosymbiont containing ciliate *Paramecium bursaria* and the model diatom *Thalassiosira pseudonana*.

In 2011/12 the diversity of strains held was expanded with the targeted expansion of the collection resulting in the accession of 28 new strains, with four being ex-type cultures (newly described taxa to science): these include both algae and protozoa (details of all holdings and accessions are listed on the CCAP knowledgebase www.ccap.ac.uk).

Dr John Day
Head of CCAP

www.ccap.ac.uk



www.nfsd.org.uk

National Facility for Scientific Diving

The NFSD is an accredited HSE professional diving training centre, an accredited Royal Yachting Association powerboat school and a NHS-registered emergency diver recompression facility. It employs four staff with at least BSc science qualifications. NERC contributes 50% of the funding for the facility.

NERC has been funding a diving centre at SAMS since 1996. The centre formally entered the NERC Services and Facilities portfolio in 2002/3. At its last review in 2008, the NFSD received an overall rating of 95%. The current service-level agreement covers the five years to the end of March 2014. A renewal review will occur during 2013.

The NFSD...

...predominantly supports science projects. Each project is peer-reviewed by a Steering Committee using the NERC grading system and must score 7 or higher on the NERC scale to receive support.

...provides on-going support to (1) the British Antarctic Survey delivering diving support, project management and training); (2) the Centre for Ecology and Hydrology providing diving support and equipment loans; and (3) the National Oceanography Centre, Liverpool for diving support, project management and training.

...provides advice and guidance to NERC Health and Safety on matters related to diving, small boats and snorkelling. The NFSD also reviews all NERC grants that involve diving to ensure NERC complies with its status of *Client* as defined in the 1997 Diving at Work Regulations.

...represents NERC and the wider UK

Scientific Diving community at a number of national and international levels.

Providing services

The NFSD provides divers, equipment, training and scientific/technical support that underpins marine research. The primary level of service delivers practical support for diving-related underwater scientific projects through additional manpower for groups with limited diving experience, total project management for groups without diving experience and/or specialist equipment loans.

On a secondary level, the NFSD ensures proper adherence to Health and Safety legislation as applied to diving at work activities.

The NFSD is the main service provider and the major supporter of research within the UK that involves scientific diving. It also delivers a focussed training programme for scientists and technicians involved with working underwater. In addition to diving services per se, the NFSD also provides support and training in associated small boat operations and in emergency diving medicine.

Supporting national research

The NFSD supports projects that contribute to all of the NERC strategic priority areas. The NFSD is the only diving facility in the world that is supporting such diverse topics as sea-level measurement, water-quality assessment, underwater light measurement, functional ecology, cell biology, animal genomics, palaeoclimatology, ocean acidification, carbon capture and storage, biogeochemistry, eco-physiology, habitat

mapping and maritime science-based archaeology. In addition, the NFSD has maintained a research presence in the fields of diving and hyperbaric medicine.

Current NFSD projects support research conducted by: British Antarctic Survey, Centre for Ecology and Hydrography, National Oceanography Centre, Liverpool and Southampton, Plymouth Marine Laboratory, British Geological Survey, SAMS (2), University of Southampton (2), Heriot-Watt University, Durham University, University of Bristol, University of Liverpool, Bangor University (2), Bournemouth University, Marine Biological Association, University of Plymouth, University of Strathclyde, Aberystwyth University, National University of Ireland, Aberdeen University (2), Cambridge University, Oxford University, Edinburgh University (2), Leeds University, Natural History Museum London (2), St. Andrews University (2), York University, Glasgow University and Ulster University (2). The NFSD also supports collaborative projects with the NERC Field Spectrometry Facility and the NERC Radiocarbon Facility.

2006-12 NFSD output and citation analysis

NFSD-supported research published in the years 2006 to 2012 was collated and grouped according to the journal Thompson-Reuter ISI Impact Factor (IF) for the year of publication. Citations from these publications were tracked from 2007 to end of June 2012 using ISI Web of Knowledge: Since 2006, NFSD support has generated 101 ISI-rated publications that have been cited 1013 times with a current H-index of 18.

Dr Martin Sayer
Head of NFSD

Education



SAMS HIGHER EDUCATION



IDCORE

In a busy year for postgraduate developments, we also welcomed the launch of the Industrial Doctoral Centre for Offshore Renewable Energy (IDCORE). The Universities of Edinburgh, Strathclyde and Exeter have formed a partnership with HR-Wallingford and SAMS and renewables industries to train the very best doctor of engineering (EngD) students. IDCORE's objectives and programme are strongly aligned with the UK Research Councils and the national Energy Technologies Institute; the main funders of the programme.

Postgraduate Research Training

Over the year a further intake of postgraduate students commenced at SAMS: eight new PhDs and one MSc (by research). Half of the new PhDs come through UHI, thanks to their success in drawing funding from Highlands and Islands Enterprise and the European Social Fund; three students are supported by NERC; and one through the 'Prize Studentship' route operated by MASTS (Marine Alliance for Science and Technology for Scotland). Through its leadership of the MASTS Graduate School, SAMS organised the first 'Retreat' for cohorts of postgraduate researchers from across Scotland.

Continuing Professional Development

Our continuing professional development (CPD) programme expanded in its second year of operation. Staff from the Microbial and Molecular Biology, Ecology and IT departments, delivered a number of short courses: ECOPATH and ECOSIM Modelling; Cryopreservation of Marine Algae; Marine Spatial Planning; Algal Culturing Techniques; Harmful Algal Blooms; Marine Aliens; Geographical Information Systems and Mapping; and Database Management. These attracted delegates from across the country, and bode well for future growth in this area of activity.

This has been another noteworthy year of higher education activities for SAMS. Specific areas of activity are reported below. But, it is also of note that the most exciting event of the year was the celebration of 'title' being granted to the University of the Highlands & Islands. As a founding partner of UHI, SAMS has been instrumental in UHI's development. Professors Laurence Mee and Axel Miller were invited to the celebrations and formed part of the ceremonial procession through the streets of Inverness.

This year we also had an unprecedented award presentation. Third year student, Lewis Drysdale, became the first SAMS-UHI student to receive the UHI Student of the Year Award. The citation noted his contribution as a member of the RNLI boat crew; his consistently high grades on the degree programme; and his role in representing his peers on SAMS and UHI committees.



Undergraduate Teaching

The twelfth cohort of UHI undergraduates arrived in September. This provided our largest undergraduate intake since delivery began - 29 new faces - and is testament to the growing reputation of the programme. We held our third formal UHI Graduation Ceremony in September, with graduands and staff donning gowns. Jill McColl gained a first class BSc (Hons) in Marine Science with Arctic Studies, and scooped the SAMS Prize for Overall Achievement; whilst Pete Taylor gained first class BSc (Hons) Marine Science, and was awarded the SAMS Council Prize for Academic Excellence. First class degrees also went to Lewis Miller and Kate Stronach; upper second to Alexandra Peterson and Andrew Olivier; and lower second to Katie McFarlane-Slack. Jamie McRae received a DipHE in Marine Science. Students were presented to James Fraser, Principal and Vice Chancellor of UHI, and an equally entertaining and thought-provoking keynote address was delivered by Professor Lloyd Peck from the British Antarctic Survey.

Postgraduate Teaching

MRes

This reporting period included the launch of the MRes in Ecosystem-Based Management of Marine Ecosystems. This is a University of St. Andrews degree co-delivered at SAMS by staff from across the institution. Beating the first year target, we welcomed thirteen students onto the programme.

*Professor Axel Miller
SAMS Head of Education and
Dean of MASTS Graduate School*

SAMS Research Services Ltd (SRSL)



SRSL is the commercial arm of the SAMS Group and is based at the Scottish Marine Institute. Since beginning trading in 2002, we have delivered independent and high-quality marine environmental survey and consultancy services, underpinned by cutting-edge research. Our mission is to facilitate the sustainable exploitation and management of the marine environment, through the provision of world-class environmental surveying, sampling, monitoring and analysis.

RENEWABLES

Baseline Survey and Environmental Impact Assessment (EIA) services to the renewables industry are core business for SRSL. In these assessments, we combine the biological, coastal process and metocean requirements of an EIA and offer additional expertise by way of modelling capabilities and long term technological solutions.

- Environmental Impact Assessment
- Marine Mammal Services
- Fish, Benthic and Intertidal Surveys
- Metocean Surveys
- Site and Resource Investigation
- Consenting Support Services

SRSL is currently supplying Environmental Impact Assessment services to developers and regulators across four of the main wind and tidal developments off the west coast of Scotland. Our valued clients include Scottish Power Renewables, Scottish and Southern Energy, OpenHydro, Voith Hydro, Pelamis, Marine Scotland, SNH, SEPA, JNCC and many more.

SRSL specialises in marine mammal Encounter Risk Modelling (ERM) and passive acoustic surveys of ambient noise at potential tidal energy development sites. This year we delivered the first Encounter Risk Model to be agreed and submitted to Marine Scotland as part of a tidal energy EIA (MeyGen Ltd) and have several other ERM projects underway.

An experienced EIA and Consenting Manager oversees all SRSL renewables projects to ensure our clients have the best possible understanding of regulatory requirements and expectations. Meanwhile our professional project managers ensure that contracts are delivered to both time and budget.



ABOVE: SRSL is the world leader in best practice and environmental impact assessment of Deep Sea Mine Tailings Placement, working extensively in Papua New Guinea.

SRSL is currently working towards ISO9001:2008 and extensions of scope to ISO17025:2005, as well as participation in various NMBACQ scheme components.

MINING

SRSL is the world leader in best practice and environmental impact assessment of Deep Sea Mine Tailings Placement (DSTP), having assessed three DSTP-permitted mines worldwide. We also have over a decade of experience working with industry, landowners and regulators internationally.

SRSL provides both mine operators and the governmental mining sector with robust environmental baseline surveys involving characterisation and investigation of offshore sites proposed for tailings disposal. Where DSTP is being considered as a possible waste management option, SRSL advises on site suitability and provides best practice advice and mitigation solutions where appropriate. At operational mines, we employ a suite of environmental surveys to determine the impact of DSTP against existing environmental baseline data, whereas at decommissioned mines, we assess both the extent and recovery of impacted sites.

SRSL has conducted environmental assessments of Lihir and Misima mines in Papua New Guinea (2007-2010) and the environmental baseline survey of Basamuk (2008), the site of the proposed Ramu Nickel

mine processing plant. We continue to work in the Basamuk area and were recently commissioned to investigate the possible occurrence of upwelling along the RAI coast (PNG Mineral Resource Authority, 2011-2012).

Our far-reaching involvement with mine operators and the governmental mining sector has allowed us to build up an extensive knowledge base. This base is used to advise on guidelines and help develop new policy for DSTP and environmental monitoring - raising the bar for international best practice. In 2008, SRSL was commissioned by the Papua New Guinea (PNG) Government to author general guidelines for the use of DSTP. These guidelines have now been accepted by the Department of Environment and Conservation, as well as the Department of Mineral Policy and Geohazards in PNG. This year SRSL have been commissioned to develop specific regulatory guidelines for several mines worldwide.

All marine services from SRSL benefit from access to the full range of national capabilities, facilities and equipment at the Scottish Marine Institute, including the National Facility for Scientific Diving, Culture Collection of Algae and Protozoa, European Marine Test Facility, analytical suites, research vessels, aquarium, conference rooms and new business incubator unit.

www.samsrsl.co.uk



Learned Society & Public Engagement

THE STATE OF THE MEMBERSHIP

During the reporting period members received a copy of the annual report inside a flagship brochure about SAMS, were invited to a number of events including the AGM, had the right to apply for a SAMS bursary, could stand for Council, and could consult the SAMS library.

At the end of the reporting period the membership secretary categorically removed any member from the membership who had

not paid for more than one year. This reduced membership numbers by more than a third to a total of 280 compared to the 463 reported in 2010-11. Of these paid up members 228 were ordinary members, 31 corporate members, 21 students, 16 unwaged (including retired) and 1 complimentary member. This development is a cause of concern although many learned societies experience a similar trend of diminishing membership numbers.

Discussions about the future for the membership are ongoing and we are conducting an online review of what the learned society should deliver for its members in the 21st century. All members are encouraged to contribute their thoughts to this debate at:

<https://www.surveymonkey.com/s/SAMSmembersurvey>

MEMBERSHIP MEETINGS

The Annual General Meeting took place on 4 November 2011 at SAMS. It was followed by the 22nd Annual Newth Lecture, delivered by Council member Professor Gideon Henderson from the University of Oxford, on 'Ironing the ocean: the critical role of metals for ocean ecosystems and the global carbon cycle'.

There was one meeting of the Scottish

Marine Group during the reporting period.

The autumn meeting was for the first time held at Perth College UHI and took place on 20 October 2011. It was organised by Professor Anton Edwards and Dr Tom Leatherland. The programme was made up of 10 presentations covering a wide range of topics illustrating current developments in Scottish marine science. The turnout was

as in previous years rather low and dominated by a group of MSc students. No autumn meeting will take place in 2012 to evaluate the need for such a gathering.

The postgraduate spring meeting was combined with the MASTS graduate school meeting and held as part of the Festival of the Sea on 28 May 2012 after this reporting period. It will be reported next year.

SAMS RESEARCH BURSARIES

Antonios Zambounis: I received a SAMS research bursary to support a three-month stay at SAMS from July to September 2010. It was a fascinating scientific experience involving a useful exchange of research ideas. I had the chance to develop a strong collaboration with SAMS scientist Claire Gachon, and to work on several research projects. First, I performed extensive bioinformatics work on the manual annotation of brown and red seaweed genomes. In parallel, I used SAMS molecular facilities to investigate experimentally some hypotheses deriving from these computer

analyses. In particular, I was interested in the characterisation of candidate pathogen receptors of the model brown alga *Ectocarpus siliculosus*. More precisely, I investigated the gene structure and gene expression of pathways involved in algal stress and defence against pathogens.

Finally, I conducted preliminary real-time quantitative PCR work towards the investigation of interrelationships between chronic stress and disease resistance in *Ectocarpus*. Indeed, seaweeds are exposed to a breadth of stresses in their natural

environment including pathogen attack. Therefore, it is likely that the capacity of seaweeds to resist infection in natural conditions is impacted by other stresses that they are exposed to at the same time.

My stay was amazingly productive: my results will feature in five manuscripts, two of which are already submitted to peer-reviewed journals. I would like express my most sincere thanks to all SAMS staff, for giving me the opportunity to develop my work in such a productive and friendly environment.

Table: Research bursary awards to SAMS members during the reporting period

NAME	INSTITUTION	PROJECT TITLE	AWARD
Nienke van Geel	SAMS UHI	Sound of Barra project overview	£1000
Dr Diane Purcell and Dr Maria-Nefeli Tsaloglou	National Oceanography Centre	Early detection of harmful algal blooms in UK coastal waters using molecular methods	£1000
Dr Suzanne MacLachlan	National Oceanography Centre	The sensitivity of the Arctic region to climate change	£ 911
TOTAL			£ 2,911



SAMS PUBLIC ENGAGEMENT

SAMS EMBRACES SOCIAL MEDIA

For a number of years our former undergraduate student Carl Ballentine has been maintaining a Facebook page for 'The Scottish Association for Marine Science'. Following this lead early in 2012 SAMS began to engage with social media more seriously. We chose to engage in particular with two platforms: blogs and Twitter.

Expedition blogs have been in existence at SAMS for many years as they are a tool for those on field expeditions to share their experiences with friends and followers back home. But we now have numerous other blogs that are regular, long-term and topic based. Among these are:

- Musings from the Crow's Nest written by SAMS Director Prof Laurence Mee: <http://scotmarineinst.blogspot.co.uk/>
- Sustainable Seas blog - the first SAMS blog - penned by Dr Tavis Potts: <http://sustainable-seas.blogspot.co.uk/>
- All At Sea written by our postgraduate students: <http://samspostgrads.wordpress.com/>

Also the SAMS UHI undergraduate students studying at UNIS in the Arctic maintain a blog that can be found from the front page of www.sams.ac.uk alongside lists of other, more recent blogs.

As blogs are not integrated into our corporate website, they allow their writers to exercise their academic freedom. And as readers can choose to comment on any blog entry, they offer a platform for genuine discussion at a time that suits all.

Twitter allows followers to keep in touch with the headlines of what goes on at SAMS and in marine science on the whole. We aim to provide our followers with links to interesting new science results, funding opportunities, discussions and events relating to the marine environment. By the summer of 2012 we had picked up around 550 followers. Anyone wanting to follow us, our Twitter name is #ScotMarineInst.

FILMMAKER-IN-RESIDENCE JOINS SAMS

Early in 2012 **Andy Crabb** joined SAMS for an innovative two year filmmaking residency entitled "Òrain na Mara / Songs of the Scottish Sea". This collaborative project is funded by investment from Creative Scotland and will produce two linked sets of four films, based on four marine themes:

- Neart na Mara / The Power of the Sea
- Bladh na Mara / The Food of the Sea
- Slàinte na Mara / The Health of the Sea
- Cumadh na Mara / The Shape of the Sea

The artistic outcome will be four wordless films with music specifically composed by musicians Catriona McKay and Chris Stout to take an international audience on an inventive and experimental journey into the Scottish seas. Andy's project was inspired by



the experimental documentary cinema of Stewart McAllister and Humphrey Jennings (Listen to Britain) and Dziga Vertov (Man with a Movie Camera).

In addition, the filmmaker will work with researchers, students and pupils to produce four web-based documentaries providing the marine science background to the themes of the wordless film while passing filmmaking skills on to his collaborators.

Andy has begun filming for Neart na Mara, with pupils from Oban and Islay High Schools. He has accompanied several projects on fieldtrips and delivered a talk to SAMS staff and students to introduce his residency and screen some examples of his film vision.

MEETING THE PUBLIC: EVENTS

SAMS opened its doors to any curious visitor on Saturday 28 May 2011 with displays from many SAMS researchers, tenant companies and other marine agents active in the area. The open day was the first opportunity for the public to visit the new Sheina Marshall Building. Also the research vessels were open to the public with displays on board and on the pontoon. The event attracted around 600 visitors of all ages and was organised by Helen McNeill. The Lorn Food Market set up outside helping to generate a festive mood, and performances by The Three Wee Crows Drama Company and canoeing trips with Stramash contributed to making the event a family day out celebrating the sea.

At the Big Bang Scotland in Perth on 13 June 2011 SAMS contributed a display stand and workshop introducing hundreds of visiting high school pupils to the topic of ocean acidification (image top p 31).

SAMS also showcased its work outside the Institute, for example on 26 August 2011 at the Argyllshire Gathering and Games where the SAMS display stand focussed on marine pollution.



During the SAMS open day Dr Natalie Hicks shows visitors such as Darcey and Saskia Miller the type of marine organisms that are likely to suffer ill effects from increasing ocean acidification.

In December SAMS held an information evening in Benderloch to highlight upcoming research in Ardmucknish Bay to investigate the effects of potential leaks from carbon capture and storage sites into the marine environment. Dr Henrik Stahl explained the entire project and answered and discussed all points raised by a curious and engaged audience. To maintain the relationship the project kept the local public

informed of developments through a Facebook page, a display at the experimental site, a visit to the local school and a project open day as well as radio appearances and media coverage.

SAMS undergraduate students and STEM ambassadors Tammy Green and Sarah Cresswell held a workshop exploring the rocky shore during the Moray Science Festival in March 2012.

SCOTLAND'S NEXT TOP MARINE SCIENTIST: STEM AND SCHOOL OUTREACH

In the modern world a solid understanding of the fundamentals of Science, Technology, Engineering and Mathematics (STEM) is important to ensure political and business decisions are based on available evidence and to develop a more prosperous future for the Highlands and Islands of Scotland based on a knowledge based economy. SAMS contributes towards this goal in many forms including its support for STEM ambassadors for schools. Approximately 20% of SAMS staff and most our students are trained and verified STEM ambassadors who give up

their time freely to support schools in their endeavour to demonstrate the importance and excitement of science. During the reporting year our ambassadors have visited scores of local schools to talk about food chains, seaweed, pollution, climate change, beach ecology, ocean acidification, marine invasive species, energy from the sea, polar biology, autonomous underwater vehicles, and research ships.

SAMS has also hosted a number of school experience pupils who were shadowing staff

usually for one-week long visits. Many of these pupils came from the local area but we also every year have visiting pupils who are curious about the option of marine science as a career and travel to SAMS from afar.

SAMS staff also deliver talks to community groups on general marine science topics. In the reporting period we visited the SWRI, Argyll and Bute Council and the Oban Rotary Club, while the director held the keynote address at Oban High School's prize giving ceremony.

MESSAGE AMPLIFIERS: MEDIA AND ONLINE

The SAMS website is actively maintained with news features added at least fortnightly and often more regularly. It achieves highly in Google ratings for key search terms. Towards the end of the reporting period SAMS migrated the website address back to www.sams.ac.uk.

SAMS with its diverse research portfolio has a wide range of stakeholders and publics to communicate with and makes extensive use of both the public and trade media. To improve on this further SAMS recruited a former journalist as a communications officer during the reporting period. SAMS research consequently featured on television and

radio and in national and international newspapers and magazines. Most public interest concerned our research on biofuel from seaweed (BioMara project) and the Ardmucknish Bay experiment on carbon dioxide leaking from a simulated carbon capture and storage site (QICS project).

FESTIVAL AND VISITOR CENTRE UPDATE

A second Festival of the Sea was planned and organised during the reporting period and delivered in May 2012; see www.obanseafestival.org for details.

Also the fundraising for The Scottish Ocean Explorer Centre continued and towards the

end of the reporting period the University of the Highlands and Islands Development Trust secured the funding for the project to proceed to development. From autumn 2012 SAMS will thus begin to develop its first visitor and outreach facility at Dunstaffnage

thanks to The Robertson Trust, The Stevenson Family Charitable Trust, The Hugh Fraser Foundation, The Gordon Fraser Charitable Trust, The Steel Charitable Trust, and the Oban Common Good Fund.



INFRASTRUCTURE

RESEARCH VESSELS

2011/12 saw an increase in *Calanus* use of approximately 31% (97 days) but a fall in number of days charged to external customers (largely due to fall in ASSEMBLE bookings). *Seol Mara* use increased by 46% (74.5 days) with a large increase in external customers, mainly Marine Scotland Science. The crewing structure remained the same at two permanent members plus a pool of relief crew, covering use of both vessels.

Vessel activity continued to include SAMS based science, external charter (via SRSL), education (undergraduate and postgraduate), ASSEMBLE, and University field courses. There was a significant increase in vessel use for equipment testing by external organisations. This is in line with the development of the European Marine Test Facility at SAMS. *Calanus* was involved in several bids for bird and mammal surveys related to offshore energy development.

A new winch was fitted to *Seol Mara* and *Calanus* had refurbishments to the plot area to accommodate multibeam survey equipment and improved teaching facilities.

There were several meetings with The Crown Estate to discuss changes to the moorings in Dunstaffnage Bay prompted by requests from other users for increased capacity. It is likely that SAMS will maintain its "exclusion zone" around the pontoon with some reduction to the north. SAMS will also keep the experimental raft site.

Ivan Ezzi
Ships Operations Manager

IT AND INFORMATION SERVICES

SAMS IT & Information Services had a busy year. The major change was the successful migration from the antiquated GroupWise email system to Exchange 2010.

The migration allowed us to virtualise our remaining core systems and drop our reliance on outdated servers. We could thus retire our old Tivoli Storage Manager (TSM) backup system and replace it with a solution that is optimised for virtual environments: VEEAM Backup & Replication. This new backup solution enables us to recover servers in minutes rather than hours. We also upgraded some of our minor systems introducing a new switch based VPN (that allows us to offer varying levels of secure access to SAMS systems) and an upgraded Archive File system with 16TB of storage.

On the data front, we increased our data

development support to both science and commercial work, providing several real-time monitoring systems e.g. for the aquarium, various experiments and our own systems monitoring. We also continue to provide programming and data management services for projects and contracts.

The library service continues to be under-used as more information becomes available online. This is a global trend and we now subscribe only to the electronic versions of several journals as this is a new condition of the deal between our NERC consortium and Elsevier. The benefits of the deal include access to more journals online than we pay for. There are, however, plans to review library services at SAMS to introduce more services that are based on finding and providing access to electronic information sources.

For the moment SAMS ICT have opted out of the UHI ICT shared services initiative due to concerns over autonomy and insufficient support for research and commercial activities. This includes opting out of the cloud based email system that UHI have adopted. However, SAMS continues to rely on the UHI for the provision of our internet access (via JANET), our landline telephony, Microsoft licencing and video conferencing. We also continue to use the UHI helpdesk facility.

Steve Gontarek
Head of ICT

FACILITIES

During the year Facilities improved security at SAMS by installing seven CCTV cameras. We also installed a 2.0 m high security fence with double access gates at either end around our long term storage yard. The gas bottle stock was secured with new gas bottle safety cages.

The Facilities team carried out several maintenance improvements in the aquarium during the year. To reduce condensation we installed an over roof and improved the ventilation of the aquarium annex. We also replaced the old sea water circulating pumps and introduced a second air compressor in the main aquarium plant room.

Other maintenance work included the redecoration of the north facing wing of the John Murray Building, and the replacement of the hostel front door and old timber windows with UPVC. The furniture in the radiochemistry laboratory was upgraded. Additionally Facilities completed 645 help desk minor work requests during the year.

David Mathias
Head of Facilities

HEALTH & SAFETY

Training was provided for staff in the following areas:

- General safety induction
- Undergraduate inductions
- CPD course in cryogenic storage
- Manual handling awareness
- Safety Management in a Research Environment
- First aid at work
- Personal survival training (Glasgow College of Nautical Studies)
- CoSHH database (Chemical Safety Advisor)
- Portable Appliance Testing database and visual inspection
- Crane (HIAB)
- Crane (Overhead travelling)
- Fire Extinguisher
- Fire Marshal
- Pallet truck
- Fork lift
- Gas bottle safety
- Recompression chamber
- Small boat operator.

There were ten reported accidents and one incident, none of a serious nature and none reportable.

Occupational health continued to provide pre-employment screening, medicals, travel advice, GP referrals and a "drop-in" service.

The Head of H&S continued his role on the NERC Safety Management Group. The Deputy Director attended NERC Safety Management Team, NERC H&S Committee and (with Head of H&S) the UHI H&S Committee.

A Display Screen Equipment survey across all staff was undertaken. A review of fire management was carried out and new fire arrangements put in place for the Sheina Marshall Building. The fire safety officer from Strathclyde Fire and Rescue carried out a formal fire safety audit. Ensuing recommendations were addressed and any remedial action placed. A Road Risk procedure was implemented including new risk assessments. Defibrillator training was established and the defibrillator brought into operation.

Ivan Ezzi
Head of Health and Safety

Appendix

SAMS STAFF

1 April 2011 to 31 MARCH 2012

Director

Prof Laurence Mee

Deputy Director

Dr Ken Jones

Associate Directors

Fran McCloskey

Dr Tracy Shimmield

Company Secretary

Elaine Walton

PA to the Director

Lorna MacKinnon

Biogeochemistry and Earth Sciences

Dr John Howe (Head)

Dr Angela Hatton (Deputy)

Dr Robert Turnewitsch

Prof Ronnie Glud

Dr Henrik Stahl

Tim Brand

Dr Arlene Ditchfield

Andrew Mogg

John Montgomery

Leah Morrison

Richard Abell

Andy Reynolds

Morten Larsen

Gangi Reddy Ubbara

Colin Abernethy

Dr Natalie Hicks

Philip Crump

Ecology

Prof Michael Burrows (Head)

Dr Kim Last (Deputy)

Dr Thomas Adams

Karen Alexander

John Bainbridge

Dr Steven Benjamins

Christine Beveridge

Dr Kenny Black

Ruth Brennan

Lars Brunner

Jim Elliott

Dr Elizabeth Cook

Dr Clive Fox

Dr Sheila Heymans

Dr Adam Hughes

Dr David Hughes

Zoe Hutchison

Dr Maeve Kelly

Peter Lamont

Dr Vicki Last

Raeanne Miller

Dr Bhavani Narayanaswamy

Dr Thom Nickell

Dr Tim O'Higgins

Dr Tavis Potts

Dr Ian Rae

Dr Natalia Serpetti

Dr Branka Valcic

Dr Tom Wilding

Dr Ben Wilson

Microbial and Molecular Biology

Dr Keith Davidson (Head)

Dr David Green (Deputy)

Undine Achilles-Day

Avril Anderson

Dr Elanor Bell

Debra Brennan

Christine Campbell

Alison Clarke

Dr John Day

Joanne Field

Dr Claire Gachon

Dr Mark Hart

Dr Svenja Heesch

Dr Frithjof Kuepper

Dr Ray Leahey

Sian Lordsmith

Adrian MacLeod

Eleanor Martin

Sharon McNeill

Cecilia Rad Menedez

Elaine Mitchell

Dr Linda O'Higgins

Michael Ross

Rachel Saxon

Peter Schiener

Dr Stephen Slocombe

Dr Michele Stanley

Sarah Swan

Dr Paul Tett

Naomi Thomas

Andrea Veszelovszki

Averil Wilson

Qian Yi Zhang

Eilidh Cole

Joanne MacDonald

Physics, Sea Ice and Technology

Dr Finlo Cottier (Head)
Dr Keith Jackson (Deputy)
Dr Dmitry Aleynik
John Beaton
Dr Tim Boyd
Dr Andrew Dale
Estelle Dumont
Colin Griffiths
Bernard Hagan
Dr Phil Hwang
Prof Mark Inall
Dr Vladimir Ivanov
Alistair James
David Meldrum
Shane Rodwell
Prof Toby Sherwin
Dr Emily Venables
Dr Jeremy Wilkinson
Dr Chris Old
Dr Ettore Pedretti

Education

Prof Axel Miller (Head)
Dr Lois Calder (Deputy)
Shona Magill
Linda Robb
Joyce Moore
Polly Crooks
Morgan Humphreys
Fiona Wallace

Boats

Chris Ireland
Norman Smith

Business Development

Dr Tracy Shimmield
Dave Gunn
Irene Partridge
Dr Keri Page
John MacDonald
John Hausrath
Rebecca Gore

Communications

Dr Anuschka Miller (Head)
Rory MacKinnon
Helen McNeill
Laila Sadler
Cathy Winterton

Contracts

Derek Black (Head)
Fiona Hart
Angela Anderson
Helen Wilson
Gillian McLuckie
Fiona Wallace
Marieke Steuben

Diving

Dr Martin Sayer (Head)
Elaine Azzopardi
Hugh Brown
Dr Simon Thurston
Janet Duncan

Facilities

David Mathias (Head)
Alasdair Black
Peter Bentley
Brian Clark
John Hill
John Kershaw (Aquarium)
Fraser MacDougall
Kenny MacLean

Finance

Sarah Kennedy (Head)
Liz Campbell
Sharyn Farmer
Lindy Lamb
Lorna Watt
Eugene Tening Ndifet
Claire Smalley

Health and Safety

Ivan Ezzi

Human Resources

Ian Crawford (Head)
Karen Campbell
Jacqueline Cullen
Rachel Culver
Shirley Kersley
Margaret Sime

ICT and Information Services

Steve Gontarek (Head)
Olga Kimmins
Nicola Longman
Nigel MacLucas
Elspeth Norris
Lovro Valcic
Richard Dale

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Azzopardi E and Sayer MDJ. Measurement and recording of depth and temperature in 47 models of diving decompression computer. Proceedings of the 3rd International Symposium on Occupational Scientific Diving 25 *3rd International Symposium on Occupational Scientific Diving*

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Ponti M, et al., Sayer MDJ et al ESDTN - european scientific diving training network: a proposal for the marie curie initial training networks (FP7-PEOPLE-2012-

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Ross JAS, Sayer MDJ and Wilson CM Decompression illness in recreational, professionally trained and shellfish divers. Proceedings of the South Pacific Underwater Medicine Society 40th Annual Science Meeting 44-45 *South Pacific Underwater Medicine Society 40th*

Sayer MDJ. Diving Computers: seeing isn't always believing. Proceedings of the South Pacific Underwater Medicine Society 40th Annual Science Meeting 32 *South Pacific Underwater Medicine Society 40th*

Sayer MDJ, Küpper FC, van West P, Wilson CM, Brown H and Azzopardi E Seaweed and oomycete benthic diversity in the Canadian Marine Arctic: managing scientific diving operations in a remote location. Proceedings of the 3rd International Symposium on Occupational Scientific Diving 10 *3rd International Symposium on Occupational Scientific Diving*

Wilson CM, Sayer MDJ and Ross JAS Case study: the price of diving for scallops. Proceedings of the South Pacific Underwater Medicine Society 40th Annual Science Meeting 42 *South Pacific Underwater Medicine Society 40th*

Tett P, Sandberg A, Mette A, Bailly D, Estrada M, Hopkins TS, Ribeira d'Alcala M and McFadden L Perspectives of Social and Ecological Systems accepted. *2nd International ICZM Symposium, Arendal, Norway*,

Books: Editor

Tett P, (Eds). Sandberg A and Mette A *Sustaining Coastal Zone Systems* 160 Dunedin Academic Press ISBN:9781906716271

Books: Chapters

Boos K, Ashton G and Cook EJ. The Japanese skeleton shrimp *Caprella mutica* (Crustacea, Amphipoda): A global invader in coastal waters. *Invading Nature - Springer series in Invasion Ecology, Vol 6* 129-158 *In the Wrong Place - Alien Marine Crustaceans: Distribution, Biology and Impacts* Springer ISBN 978-94-007-0590-6

Davidson K, McElhiney J, Thomson C, Algoet M and Swan SC. Biotoxin Monitoring in Scotland 57-68 *Scotland's Marine Atlas, The Scottish Government*. The Scottish Government ISBN 987 0 7559 8254 7

Davidson K, Tett P and Gowen R. Harmful Algal Blooms. *Issues in Environmental Science and Technology* 33 95-127 ch 4 *Marine Pollution and Human Health*. Royal Society of Chemistry ISBN 978-1-84973-240-6

Day JG Access to live algal cultures from the British Isles. pp. 25-26. *The freshwater algal flora of the British Isles*. Cambridge University Press

Holliday NP, Quante M, Sherwin TJ, Nolan G, Mork K, Cannaby H and Berry D North Atlantic circulation and atmospheric forcing ICES Co-operative Research Report 8 - 20 (Chap 2) *ICES status report on climate change in the North Atlantic*. International Council for Exploration of the Sea. ISBN 978-87-7482-096-3

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Potts TW. The New Green Deal and KISA: a Global Perspective. 186-214 *The Knowledge Economy at Work: Skills and Innovation in Knowledge Intensive Service Activities* (editors C. Martinez-Fernandez, I. Miles, & T. Weyman). Edward Elgar UK 2011

Potts TW. The rise of eco-labelling in marine resource governance. ch14 *Marine Resources Management* (Eds: Gullett, W., Schofield, C.) LexisNexis, Sydney 2010 ISBN 9780409327441

Tett P and Sandberg A. Introduction 1-28. *Sustaining Coastal Zone Systems* Dunedin Academic Press, Edinburgh ISBN 9781906716271

Tett P, Mette A, Sandberg A and Bailly D *The Systems Approach* 53-78 *Sustaining Coastal Zone Systems*. Dunedin Academic Press, Edinburgh ISBN 9781906716271

Tett P, Mette A, Sandberg A, Estrada M, Ribeira d'Alcala M, Hopkins TS and Bailly D. Conclusions 137-149 *Sustaining Coastal Zone Systems*. Dunedin Academic Press, Edinburgh. ISBN 9781906716271

Tett P, Ribeira d'Alcala M and Estrada M *Modelling Coastal Systems* 79-102 *Sustaining Coastal Zone Systems*. Dunedin Academic Press, Edinburgh ISBN 9781906716271

Multimedia

Day JG List of live algal cultures from the British Isles available from the major service culture collections. DVD supplement to John DM, Whitton BA & Brook AJ (eds) *The freshwater algal flora of the British Isles*. DVD

POSTGRADUATE RESEARCH PROJECTS

Adam Chivers NERC/MASTS. *The Biodiversity and Ecology of Senghor Seamount (N Atlantic)* **Bhavani Narayanaswamy**

Adrian Macleod. ERDF & HIE (SuperGEN) *Provision of refuges for invasive non-native species by marine renewable energy structures.* **Elizabeth Cook, Michele Stanley, John Day**

Ananda Rabindraneth. self funded *Application of bio-acoustic techniques to observe and model arctic zooplankton behaviours.* **Finlo Cottier** Andrew Bierley

Andrew Mogg. NERC *The production and consumption of DMS by marine micro-organisms.* **Angela Hatton**

Anna Kintner. MASTS *Ecology of jellyfish* **Clive Fox**, Andrew Bierley

Ashleigh Currie. NERC. *Quantifying the impacts of ocean acidification on benthic biogeochemistry: Effects of total carbon and nitrogen Turnover rates in marine sediments.* **Henrik Stahl**

Beatriz De Francisco. EPOCA EUFP7 *Physiological effects of ocean acidification and warming on the cold-water coral *Lophelia pertusa*.* **Kim Last**

Carole Shellcock. Biomara - SEUPB *Molecular Aspects of Algal Biofuels for the 21st Century.* **Michele Stanley**

Caroline Carter. SNH *Underwater acoustic interactions between emerging tidal-energy technologies & vulnerable vertebrates.* **Ben Wilson**

Cecilia Rad Menendez. SAMS Oceans 2025 *Phenotypic and genotypic characterization of *Thalassiosira pseudonana* (*Bacillariophyta*) strains.* **Michele Stanley, John Day**

Chad Widmer. MASTS *Ecology of jellyfish polyp stages.* **Clive Fox**, Andrew Bierley

Charlotte Hopkins. Climate Exchange (Scottish Government). *Climate change and Marine Protected Area Management.* **Tavis Potts**, David Bailey

Chris Nall EU FP7 *Marine Invasive Taxa in the North of Scotland – Connections to Marine Renewable Energy Development* **Elizabeth Cook**, Andrew Guerin

Christopher Bell. NERC *The small scales that control the large scales: Retaining the important physics of narrow tidal straits in large scale ocean models of Western Scotland.* **Andrew Dale**

Clare Davies MASTS *Potential for recruitment of non-indigenous species on damaged antifouling surfaces.* **Adam Hughes, Elizabeth Cook**

Clare Johnson UHI/NERC *Tracing Wyville Thomson Ridge Overflow Water in the Rockall Trough.* **Toby Sherwin**

Coleen Suckling NERC *Calcified marine invertebrates: the effects of ocean acidification.* Melody Clark, **Elizabeth Cook** Lloyd Peck

Emily Venables NERC *Internal tides over oceanic topography and their influence on mixing.* **Toby Sherwin**

Gavin Turner NERC *Benthic oxygen exchange across soft & hard bottom surfaces using in situ technology: Case studies from the tropics to the Arctic.* **Henrik Stahl**

Gill Notman NERC *Biodiversity & Ecosystem function: Trophic diversity versus species diversity in intertidal grazers and filter feeders as revealed by stable isotope.* **Michael Burrows**

Greg Moschonos NERC *Organic nitrogen in coastal waters: does it fuel blooms of harmful micro-algae?* **Keith Davidson**

Heiko Moossen SAGES *Palaeoclimate reconstructions from Arctic and Nordic shelf seas: development and application of multiple proxies.* **Finlo Cottier** James Bendle

Iona Campbell ESF *Interactions between macroalgae aquaculture for biofuels and phytoplankton.* **Adam Hughes**

Jaime Davies JNCC *Spatial planning in the deep-sea and the development of a deep-sea Marine Protected Area network in UK waters.* **Bhavani Narayanaswamy** Kerry Howell

John Bainbridge MaREE *Marine spatial planning, innovation & renewable energy. Supporting a transition to sustainable regional economies.* **Tavis Potts**

Karen Alexander Supergen - ERDF/HIE *Offshore power production and marine stakeholders: from understanding conflict to impact mitigation.* **Sheila Heymans, Tavis Potts, Tom Wilding**

Kate MacIntyre NERC *Post-glacial Fjordic landscape evolution: The onshore limits of the Younger Dryas ice sheet, Western Scotland.* **John Howe**

Kyla Orr EU FP7 *Effects of seaweed extraction for biofuel on marine ecosystems in western Scotland.* **Tom Wilding, David Hughes, Sheila Heymans**

Laura Hobbs Norwegian Research Council *Vertical Migration: A Pan-Arctic Perspective.* **Finlo Cottier, Kim Last**, Jorgen Berge

Lisa Eckford Soper NERC *The competitive dynamics of toxic & non toxic ribotypes of the harmful dinoflagellate *Alexandrium tamarense*.* **Keith Davidson**

Louis Clement NERC *Rapid fluctuations in the ocean Meridional Overturning Circulation.* **Stuart Cunningham** Eleanor Frajka-Williams

Marie Porter SAGES *Linking recent variability in Atlantic Ocean circulation & glacier mass balance in Greenland and Norway.* **Toby Sherwin**

Matt Toberman NERC/MASTS *Thin Surface Layers - New perspectives on ocean mixing and colour.* **Mark Inall**

Morgan Humphreys self funded *Assessing effectiveness of diet switching in sea urchins.* **Elizabeth Cook, Adam Hughes**

Morten Larsen NERC *Microniche project* **Ronnie Glud**

Neil Clark NERC *Understanding the Oceanic Methane Paradox: a Microbial Approach.* **Angela Hatton**

Nienke Van Geel MASTS/Harper Macleod/UHI *Understanding Scottish bottlenose dolphin movement patterns: Can visual & acoustic cues be used to ensure that dolphins & construction of marine renewables don't coincide?* **Ben Wilson**

Oluwatosin Obatu ESF *Anaerobic digestion from marine materials: What makes a methanogen happy?* **Angela Hatton**

Peter Taylor ESF Leakage of carbon dioxide from a simulated sub-seabed Carbon Capture and Storage reservoir: potential impacts on benthic biogeochemistry. **John Howe, Henrik Stahl**

Raeanne Miller Supergen - ERDF/HIE Offshore renewable energy structures as artificial islands: implications for dispersal, population connectivity and biogeography of coastal species. **Mike Burrows, Clive Fox, Mark Inall**

Sally Rouse MASTS/Heriot Watt/Scottish Power Renewables. Understanding benthic productivity on artificial structures: Maximising the benefits of marine renewable energy devices. **Tom Wilding**

Sam Jones NERC FASTNET Studentship **Finlo Cottier**

Sarah Hughes UHI/FRS Inflow of Atlantic Water to the North Sea: Variability and Influence on North Sea climate. **Andrew Dale**

Silje-Kristin Jensen MASTS prize Is biotoxin exposure from harmful algae the reason for the decline in harbour seal populations in Scotland? A view through a food chain study. **Keith Davidson**, Ailsa Hall

Susan Evans NERC Dimethylsulphoxide loss pathways in the oceans: The next big question in DMS biogeochemistry. **Angela Hatton, Dave Green**

Suzannah-Lynn Billing ESF Choke Points & Agents of Change for Sustainable Development of Marine Renewables. **Branka Valcic**

Tim Cross York University/ NFSD Variation in the abundance and size of the grazing echinoderm *Echinus esculentus* on a modular artificial reef system, and implications for reef design. **Tom Wilding, Martin Sayer**

Undine Achilles-Day SAMS Oceans 2025 *Paramecium bursaria* and its endosymbionts. **Ray Leakey, Claire Gachon**

Yassir Al-Boureea Private (Saudi Cultural Embassy) Tidal hydrodynamics on the Loch Linnhe Artificial Reef. **Tom Wilding**
Martin Downie

Zoe Hutchison MaREE Sensitivity of biogenic reef forming organisms and commercially important benthic invertebrates in an era of marine renewable development. **Kim Last, Mike Burrows, Ben Wilson**, Angus Jackson

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Income received is for financial year up to March 31st 2012

Project Leader	Title	Funding body	Award
Adam Hughes	SEESEEDER	Genomia Fund	3,307.00
Adam Hughes	SARF 082	SARF	438
Adam Hughes	AT-SEA	EU	236
Adam Hughes	Enrich	EU	20,805.85
Adam Hughes	MASTS Hughes	Scottish Funding Council	500
Adam Hughes	CAMPBELL PHD	ESF	8,576.50
Adam Hughes	IDREEM Admin	EU	1,757.00
Adam Hughes	Holopharm	Genomia Management Ltd	25,529.42
Andrew Dale	STRATHCLOCHY	NERC	43,491.69
Andrew Dale	Great Race	NERC	102,266.82
Angela Hatton	Obata PhD	ESF	6,056.50
Angela Hatton	Mogg PhD (Algal DMSO Prod)	NERC	41
Angela Hatton	MISM	NERC	115,196.87
Anuschka Miller	Festival of the Sea 2013	HIE/A&B Council	364
Anuschka Miller	Songs of the Sea	Creative Scotland	1,200.00
Anuschka Miller	Marine Science Festival 09/11	Argyll and Bute Council/HIE	4,295.00
Axel Miller	Erasmus	EU	6,599.28
Axel Miller	MASTS Grad School	Scottish Funding Council	2,368.00
Axel Miller	MSC DAYTON	University of the Highlands & Islands	3,650.00
Axel Miller	MSC HUMPHREY'S	University of the Highlands & Islands	3,900.00
Axel Miller	SRSL CPD	Various	206.32
Axel Miller	Additional Skills Training	NERC	223
Axel Miller	RAE - Recoverable	University of the Highlands & Islands	958,915.33

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Axel Miller	UHI Teaching BSc	University of the Highlands & Islands	228,223.92
Axel Miller	UHI Course Mgt & Exam Board	University of the Highlands & Islands	8,863.00
Axel Miller	UHI PhD	University of the Highlands & Islands	18,028.92
Axel Miller	Wider Access Retention Premium	University of the Highlands & Islands	4,178.00
Ben Wilson	Acoustic Warning	The Scottish Government	216.4
Ben Wilson	EquiMar	EU	10,325.91
Ben Wilson	Rib Boat	Sea Mammal Research Unit	300
Ben Wilson	PELAMIS	University of the Highlands & Islands	8,200.00
Ben Wilson	X-MED	ESPRC	285
Ben Wilson	SEA SQUIRT	Hambrey Consulting	66
Ben Wilson	Carter PhD	Scottish Natural Heritage	16,124.00
Ben Wilson	Aquatera Tidal Impact	Aquatera Ltd	17,100.00
Ben Wilson	Van Geel PhD	Harper MacLeod LLP	12,310.00
Ben Wilson	Response	NERC	16,629.30
Ben Wilson	Arrays	NERC	2,063.40
Ben Wilson	Theme 4 WP 4.4 Predators and p	NERC	825.47
Bhavani Narayanaswamy	Hermione	EU	1,864.92
Bhavani Narayanaswamy	STAVROS CORE	Stavros Niarchos Foundation	2,064.00
Bhavani Narayanaswamy	Deseo	Individuals	300.01
Bhavani Narayanaswamy	EurocoML Synthesis	Census of Marine Life	1,003.00
Bhavani Narayanaswamy	Eurocoml 2011	Total Foundation	1,082.00

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Bhavani Narayanaswamy	Sloan Synthesis	Alfred P Sloan Foundation	1,697.00
Bhavani Narayanaswamy	SWIOR	NERC	50,809.48
Claire Gachon	DIMBA	EU	10,623.00
Claire Gachon	Oceans 2020 SOFI Meeting	Various	5,406.29
Claire Gachon	GENOMICS	NERC	10,182.12
Clive Fox	Jellyfish II	The Crown Estate	10,246.00
Clive Fox	POPCOD	NERC	6,879.00
Colin Griffiths	TEA-COSI	NERC	7,993.70
Colin Griffiths	Theme 10 S04 Extended Ellett L	NERC	177.47
David Green	Siderophore Extn	San Diego State University	3,975.18
David Meldrum	SEEBECK	NERC	9,657.05
Elaine Walton	UHI Hardship Allowance	University of the Highlands & Islands	2,950.04
Elizabeth Cook	SARF Invasives 088	SARF	98.69
Elizabeth Cook	Aliens II	Esmee Fairbairn	5,802.00
Finlo Cottier	SURGE MEETING	Individuals	2,208.60
Finlo Cottier	Jones PhD	NERC	2,417.00
Finlo Cottier	Panarcive	NERC	33,006.04
Finlo Cottier	Seatrex	NERC	15,427.40
Frithjof Kuepper	Total	Total Foundation	929
Frithjof Kuepper	Eurychasma	NERC	13,601.86
Henrik Stahl	Hypox	EU	44,238.00
Henrik Stahl	Taylor PhD	ESF	8,868.50
Henrik Stahl	Currie PhD	NERC	11,511.64
Henrik Stahl	CCS	NERC	42,504.38
Henrik Stahl	BENTHIC OA	NERC	150,318.08
Jeremy Wilkinson	Access	EU	119,961.50

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Jeremy Wilkinson	DAMOS	Prince William Sound	12,115.14
Jeremy Wilkinson	Satice	ESF	128,367.11
Jeremy Wilkinson	Ice Bell	NERC	52,203.62
John Day	Assemble TA Cons	EU	9,310.00
John Day	Assemble	EU	169,500.40
John Day	Assemble TA	EU	4,173.60
John Day	OSMO ALGAL OIL (I.F.)	PSRE Innovation Fund	4,969.00
John Howe	INIS Hydro	SEUPB	751, 742
John Howe	Theme 1 WP 1.5b MOC Activity	NERC	941.27
Keith Davidson	KARENIA 2011	The Crown Estate	34,622.00
Keith Davidson	FSA PROBES	Food Standards Agency	17,454.00
Keith Davidson	SPAT MEET	The Crown Estate	9,417.00
Keith Davidson	KARENIA II - WP 4	The Crown Estate	1,894.00
Keith Davidson	Karenia III	The Crown Estate	2,937.00
Keith Davidson	Karenia WP5	The Crown Estate	3,400.00
Keith Davidson	KARENIA 2011	The Crown Estate	3,599.00
Keith Davidson	Jellymeet	The Crown Estate	7,207.00
Keith Davidson	Asimuth	EU	51,397.00
Keith Davidson	BPS Paterson	British Phycological Society	1,000.00
Keith Davidson	BIOPOL	BIOPOL EHF	292.2
Keith Davidson	Water	Northern Periphery Programme	40,212.22
Keith Davidson	Moschonos PhD	NERC	9,270.64
Keith Davidson	Lisa Eckford-Soper PHD	NERC	18,697.89
Ken Jones	EMBRC	EU	13,161.00
Ken Jones	New Building Costs	SDB/HIE/ERDF & HIPP	45,811.90
Ken Jones	Oceans 2025	NERC	2,218,049.00

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Ken Jones	Hostel Maintenance	University of the Highlands & Islands	11,295.00
Kenny Black	SARF 086	SARF	916.6
Kenny Black	EFF MINCH	EFF	206.7
Kenny Black	Sea Lice Dispersal in Clyde	EFF	75,817.00
Kenny Black	Aquagris	EU	864.31
Kenny Black	Prevent Escape	EU	42,857.90
Kenny Black	FIG Argos	Falkland Islands Government	10,259.00
Kenny Black	FOGL EIS	Falkland Islands Government	9,228.00
Kenny Black	Billing PhD	ESF	5,723.50
Kenny Black	MaREE	University of the Highlands & Islands	205,298.58
Kim Last	VoRT	MEPF	4,419.00
Kim Last	EPOCA	EU	38,799.44
Kim Last	Hutchison PhD MaREE	University of the Highlands & Islands	23,945.00
Kim Last	MASTS III	University of Newcastle	274
Laurence Mee	GEF	United Nations University	18,796.06
Linda Robb	BSc	University of the Highlands & Islands	400
Lois Calder	ECOSUMMER	EU	9,617.09
Lois Calder	Supergen Plus	University of the Highlands & Islands	391,243.15
Lois Calder	MRES	University of the Highlands & Islands	10,000.00
Lois Calder	UHI Graduate School	University of the Highlands & Islands	27,814.48
Lovro Valcic	IOS APP (I.F.)	PSRE Innovation Fund	5,129.00
Maeve Kelly	SUPERGEN	ESPRC	6,618.04

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Mark Inall	LINSIM	Marine Science Scotland	2,864.00
Mark Inall	UK Marine Environmental Change	Marine Biological Association	5,995.00
Mark Inall	MARICLIM	Norwegian Polar Institute	5,667.00
Mark Inall	Masts	Scottish Funding Council	126,796.20
Mark Inall	MASTS Port	Marine Alliance for Science &	1,167.00
Mark Inall	OSMOSIS	NERC	43,476.36
Mark Inall	FASTNET	NERC	176,457.52
Mark Inall	ECOMAR	NERC	41,487.73
Mark Inall	SASSI	NERC	61,858.80
Mark Inall	DIMES	NERC	21,909.79
Mark Inall	Rapid Watch	NERC	6,478.46
Mark Inall	Toberman PhD	NERC	897.26
Martin Sayer	NFSD 2009-14	NERC	319,510.38
Michael Burrows	Terawatt		110
Michael Burrows	Urbane	MBA/Esmee Fairbairn	3,641.00
Michael Burrows	Larval Quality	NERC	16,080.31
Michele Stanley	FAT ALGAE (I.F.)	PSRE Innovation Fund	1,987.00
Michele Stanley	ENALGAE	Interreg	11,031.00
Michele Stanley	BioMara	SEUPB/HIE/Crown Estate	1,046,564.48
Michele Stanley	Shellcock PhD - Biomara	HIE/SEUPB/Crown Estate	23,141.00
Michele Stanley	Algal Bioenergy SIG Director	Bioscience Network Ltd.	16,121.97
Michele Stanley	NERC KE FELLOWSHIP	NERC	18,360.00
Murray Roberts	TRACES	EU	9,004.00
Murray Roberts	SAGES PhD Douarin	SAGES	7,670.00
Paul Tett	Tett Workshop	European Marine Env. Policy Br	3,066.35
Paul Tett	Nuisance Blooms	DEFRA	2,534.00

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Paul Tett	Ecohealth	CEFAS	17,946.00
Phil Hwang	Travel Arctic Ocean	Royal Society	4,009.00
Phil Hwang	SEA ICE DRIFT HWANG	Meteo France	547
Ray Leakey	ARCBIMOD	NERC	6,818.33
Ray Leakey	OABTT1	NERC	73,804
Robert Turnewitsch	Topodeep	NERC	78,979.38
Ronnie Glud	Greenland Glud	Greenland Climate Research Centre	56,694.00
Ronnie Glud	EDDY	NERC	2,983.65
Ronnie Glud	Microniche	NERC	32,935.00
Ronnie Glud	Turner Phd	NERC	17,028.65
Ruth Brennan	Barra MSAC	The National Trust for Scotland	3,803.00
Ruth Brennan	COAST COMMS	Scottish Crofting Federation	417.78
Sheila Heymans	EDU-KAZ 12	Various	11,000.00
Sheila Heymans	Oak Foundation	Oak Foundation	3,751.00
Sheila Heymans	Orr PhD - Biomara	HIE/SEUPB/Crown Estate	13,863.00
Tavis Potts	SEAGRASS	DEFRA via MBA	5,434.00
Tavis Potts	Litter	MacAulay Land Use Research Ins	1,642.00
Tavis Potts	SPICOSA	EU	13,343.00
Tavis Potts	CREW	University of St Andrews	14,595.00
Tavis Potts	SYSTRENDS	James Hutton Institute	1,112.24
Thom Nickell	EtiveMPA	The Scottish Government	50,845.00
Tim Boyd	SCICEX II	Office of Naval Research Globa	14,379.57
Tim Boyd	Submarine Science	Office of Naval Research	6,932.00
Tim O'Higgins	Knowseas Science	EU	17,032.90

SAMS RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Tim O'Higgins	Knowseas Management	EU	1,546,996.08
Toby Sherwin	THOR	EU	18,769.00
Toby Sherwin	SAGES Phd Porter	SAGES	2,000.00
Toby Sherwin	Glider Workshop	Various	6,762.00
Toby Sherwin	C Johnson PhD Extn	NERC	57.46
Toby Sherwin	Venables PhD	NERC	2,891.00
Tom Wilding	SARF054	SARF	15,076.67
Tom Wilding	Rouse PhD	SPR/Heriot Watt/Masts	1,640.00
Tracy Shimmield	PATENT APP (I.F.)	PSRE Innovation Fund	5,000.00
Tracy shimmield	SAGES	Scottish Funding Council	39,762.00
Tracy Shimmield	Knowledge Transfer	University of the Highlands & Islands	277,132.46

SAMS RESEARCH SERVICES LTD PROJECTS AND FUNDERS

Project Leader	Title	Funding body
Adam Hughes	LIASE	Scottish Salmon Company
Ben Wilson	Islay Tidal Energy II	DP Energy
Ben Wilson	MEYCOLLIDE	MeyGen Ltd
Ben Wilson	RSKforEON	RSK
Ben Wilson	LUSSEAU	SNH
Ben Wilson	Tidal Flow Study	Scottish Government
Ben Wilson	Open Hydro II	Open Hydro
Bhavani Narayanaswamy	SEA7 Analysis	JNCC
Clive Fox	SRSL Fieldwork	Various
Clive Fox	SRSL CPD	Various
Clive Fox	MSC ASS M.M	Moody Marine International
Clive Fox	MEP Assessment	MacaLister Elliott & Partners
Clive Fox	MSC_OT2011	Interek/Moody Marine
Clive Fox	CSVMSC2011	Interek/Moody Marine
Clive Fox	MSC2011_1	Moody Marine International
David Hughes	PEER REV ENTEC	Entec
David Hughes	Gourock EIA	Macaulay Scientific
David Hughes	Marine Biofouling R16	BP Exploaration Operating Co Ltd
David Meldrum	IRIDIUM	World Meteorological Organistaion

SAMS RESEARCH SERVICES LTD PROJECTS AND FUNDERS

Elaine Walton	Visitor Services	Various
Ivan Ezzi	Commercial Boat Hire - Calanus	Various
Ivan Ezzi	Commercial Boat Hire - Seol Ma	Various
John Day	CCAP Commercial	Various
John Howe	Etive Map	Scottish Power Renewables
John Howe	Kerrera Dev Trust	Kerrera Development Trust
John MacDonald	Chilean Mining	Minera Los Pelambres
Keith Davidson	FSA MONITOR	Food Standards Agency
Keith Jackson	SIMBA	Various
Kenny Black	NNRAP II	DEFRA
Kenny Black	OUTPLANT	Scottish Salmon Company
Kenny Black	Depomod Licenses	Various
Kenny Black	Monosaccharide Analysis	Glycomar
Kenny Black	KELPCUT	ITI Energy (Scottish Enterprise)
Kim Last	SABTRAWL	Natural England
Kim Last	SABALV	CEFAS
Kim Last	BEEMS 2010	CEFAS
Lars Brunner	FYNEPLANT	Scottish Salmon Company
Martin Sayer	Recompression Incidents	NHS
Martin Sayer	REEF EIA	Colliers International
Martin Sayer	Technical Support - Grampian	Grampian Health Trust
Ray Leakey	Fugro Congo	Fugro

SAMS RESEARCH SERVICES LTD PROJECTS AND FUNDERS

Ray Leahey	Flow Cytometry	Various
Ray Leahey	FUGRORED	Fugro
Rory Mackinnon	A0 Printer	SAMS
Tim Brand	PSA/LOI	Various
Toby Sherwin	NWAG FSC	North West Approaches Group
Tracy Shimmield	MINE Specific Guidelines	Mineral Resources Authority
Tracy Shimmield	Papua New Guniea	Mineral Resources Authority
Tracy Shimmield	PNG Witness	PNG Government
Tracy Shimmield	Basamuk Upwelling	Mineral Resources Authority

Financial Statements

31 March 2012

Directors

Professor Andrew Hamnett	(President)
Commodore C Stevenson	(Resigned 4 November 2011)
Dr K L Duff	
Dr J M Rogers	
G C McAllister	
Dr C J Phillips	
W T S Speirs	(Resigned 31 December 2011)
Professor M Bownes	
Professor G M Henderson	(Resigned 4 November 2011)
Professor D Paterson	
Professor P H Burkill	
M Gibson	(Chair of the Board to Council)
Mr M R F Wilkins	
R Ferrier	
K Rundle	
S G Cannon	
Professor L E Fleming	(Appointed 1 April 2012)
Professor I G Priede	(Appointed 4 November 2011)
Commodore A A Ross	(Appointed 4 November 2011)

Secretary

E B Walton

Auditors

Ernst & Young LLP
Barony House
Stoneyfield Business Park
Stoneyfield
Inverness IV2 7PA

Bankers

Bank of Scotland
Station Road
Oban PA34 4LL

Solicitors

Wright, Johnston & Mackenzie
302 St Vincent Street
Glasgow G2 5RZ

Registered Office

Scottish Marine Institute
Oban
Argyll PA37 1QA

Registered No. SC 009292

Council report

The Council, who are also Directors of the Charity for the purposes of the Companies Act, for The Scottish Association for Marine Science (SAMS) presents its report and the group financial statements for the year ended 31 March 2012.

SAMS is a company limited by guarantee governed by its Memorandum and Articles of Association. It is registered as a charity with the Office of the Scottish Charity Regulator. Anyone can become a member of SAMS and there are currently 296 including 32 corporate and 21 students (463 in 2011), each of whom agree to contribute £1 in the event of the charity winding up.

SAMS is not permitted by its Memorandum of Association to become a trade union or to distribute profits to its members.

SAMS is a Collaborative Centre of the Natural Environment Research Council and an Academic Partner of the University of the Highlands and Islands.

Results and dividends

The results for the year are detailed on page 9 of the financial statements. The net outgoing resources taken to reserves is £337k (2011 – incoming £4,353k).

Principal activity and review of the business

The principal activity of the group is to promote the study of marine science through research and education.

There have been no changes in principal activity since the last annual report.

Objectives and activities

SAMS mission is “To improve understanding and stewardship of the marine environment, through research, education, maintenance of facilities and technology transfer.”

The results for the year are detailed on page 9 of the financial statements. The net outgoing resources deducted from reserves is £337k (2011: incoming resources of £4,353k).

Charity accounting for capital grants will inflate net incoming resources in the years that capital grants are received as little or no charge is recorded in the same year. In managing the business SAMS considers net income from operations excluding capital grants and related funded depreciation. SAMS continues to achieve a positive result in net income from operations of £268k (2011 - £183k). The net income is higher than budget, this result is considered to be a significant indication that the SAMS business model is working. This is the 4th year in a row that SAMS has achieved an operating surplus.

SAMS prepares an annual report that is made publicly available through our website. This report provides information covering the current and future activities of all areas of the organisation.

Future developments

SAMS is committed to sustaining its status as a collaborative centre for NERC and to providing national facilities for NERC.

SAMS is an Academic Partner of the University of the Highlands and Islands.

SAMS will continue to seek grants and service contracts from new and diverse funds.

Council report

Principal risks and uncertainties

SAMS Council has an established risk management strategy which comprises:

- an annual review of the risks which the charity may face
- the establishment of systems and procedures to mitigate those risks identified in the plan; and
- the implementation of procedures designed to minimise any potential impact on the charity should any of those risks materialise.

Revisions to the Risk Register are considered by the Council, the Board to Council and relevant Committees. The regular process of consideration and review of the appropriateness of the Register is delegated to the Executive Group which reports back to Council through the Board.

Directors

The directors, who served the charitable company as Council Members, during the year are listed on page 1.

Reserves policy

The primary aim of the reserves policy is to ensure that SAMS hold adequate funds to maintain the longer term sustainability of the marine science research undertaken by our scientists and to manage short term volatility in income or liquidity. The policy is designed to ensure that the Association can:

- Continue to meet its ongoing financial commitments within agreed terms of credit
- Deploy the required funds promptly in a planned way to react to new opportunities and strategic decisions undertaken by the Associations' Executive Group
- Ensure that the Association is not forced into short term decisions that might impact on its longer term vision and strategy because of any short term setback, whether operational or in key sources of income, such as NERC funding under Oceans 2025

The policy aims for the Association to hold, in future, in general unrestricted reserves a minimum of 3 months annualised expenditure in order to provide adequate working capital levels for the continued operation of the Association and completion of existing projects.

The accumulated reserves and available funds will be applied towards the objectives of the Association. The Trustees accept that this may involve the use of funds in excess of the income generated in one year while in other years the cycle of the Associations activities does not allow the distribution of all funding received (particularly in respect of capital grants).

A designated fund for fixed assets reflects the need to demonstrate the level of funds required to provide the assets necessary for delivering marine science research. Unrestricted undesignated funds reflect the amount of reserves freely available to spend on any of the charity's purposes, including those stated above. Whilst the total of unrestricted funds is positive, the undesignated element is negative following the creation of the designated fixed asset fund. This exists because of the loan obtained to complete the main research building at the Dunstaffnage site. SAMS will aim to achieve the policy aims stated above but in reality the existence of the long term loan will make their achievement also long term in nature. SAMS is satisfied that this does not affect the sustainability of the Group.

Council report

The council

The members of the Council, who act as trustees and directors, are all guarantors of the company, of an amount not exceeding £1, during the period of their appointment as Council members and for a year after resignation. The Council is appointed in accordance with the Memorandum and Articles of Association, which allows trustees to serve a maximum of two consecutive 3-year terms.

The members of the Governing Council during the year are listed on page 1.

Both the Natural Environment Research Council (NERC) and Highlands & Island Enterprise (HIE) have observer status at SAMS Council meetings.

Any member of SAMS can nominate a new trustee to serve on Council. The SAMS Director has the responsibility to outline the duties and responsibilities to potential trustees. A new trustee is nominated and seconded at the AGM.

New trustees attend a briefing meeting with the SAMS Director or Company Secretary and are provided with the relevant guidance notes from Companies House and the Office of the Scottish Charity Regulator.

SAMS Council meet quarterly with an annual retreat. A new governance structure has now been put in place and the Council is served by a Board and five sub-committees; Finance Committee, Audit Committee, Research Committee, Education Committee and Business Development Committee that now incorporates the SRSL Board. The SAMS Council, the Board and its Committees approve the Group's strategy and the implementation of the strategy is delegated to the Executive Group led by the SAMS Director.

Investment policy and performance

The Council has considered the most appropriate policy for investing funds and has found that short to medium term investment of funds should be held in a mixture of current and investment accounts to optimise interest earned.

Executive group

Management of the Charity is delegated by the Council to the Director and the SAMS Executive Group. The members of the Executive Group during the reporting period were:

Prof Laurence Mee – Director

Dr Ken Jones – Deputy Director

Prof Michael Burrows – Head of Ecology

Prof Mark Inall- Associate Director, Research

Dr Finlo Cottier – Head of Physics, Sea Ice and Technology

Dr Keith Davidson – Head of Microbiology and Molecular Biology

Dr John Howe – Head of Biogeochemistry and Earth Sciences

Prof Axel Miller – Head of Education

Dr Tracy Shimmield – Associate Director, Business Development

Ian Crawford – Director of Human Resources

Fran McCloskey – Associate Director, Corporate Strategy, Performance and Finance

Elaine Walton – Company Secretary

Equal opportunities

The company is committed to provide full opportunity for the development of individuals' talents by using criteria based on merit and job performance alone in employment related decisions. It is further committed to ensure it does not discriminate on grounds of gender, marital status, race, colour, ethnic or national origins, age, religious belief, sexual orientation or disability.

Council report

Directors' statement as to disclosure of information to auditors

The directors who are members of the Council at the time of approving the directors' report are listed on page 1. Having made enquiries of fellow directors and of the company's auditors, each of the directors confirms that:

- to the best of each director's knowledge and belief, there is no information relevant to the preparation of their report of which the company's auditors are unaware; and
- each director has taken all the steps a director might reasonably be expected to have taken to be aware of relevant audit information and to establish that the company's auditors are aware of that information.

Auditors

The audit for the group is out to tender. A resolution to appoint the chosen firm as auditors will be put to the members at the Annual General Meeting.

By order of the Council

President

Statement of Council's responsibilities in respect of the financial statements

The Members of Council (who are directors for the purposes of company law) are responsible for preparing the Annual Report and the financial statements in accordance with applicable law and regulations.

Company law, the Charities and Trustees Investment (Scotland) Act 2005 and regulation 8 of the Charities Financial statements (Scotland) Regulations 2006, requires the Members of Council to prepare financial statements for each financial year. Under that law the Members of Council have elected to prepare the financial statements in accordance with United Kingdom Generally Accepted Accounting Practice (United Kingdom Auditing Standards and applicable law). Under company law the Members of Council must not approve the financial statements unless they are satisfied that they give a true and fair view of the state of affairs of the charitable company and the group and of the surplus or deficit of income over expenditure of the group for that period. In preparing those financial statements, the Members of Council are required to:

- select suitable accounting policies and then apply them consistently;
- make judgements and estimates that are reasonable and prudent; and
- prepare the financial statements on the going concern basis unless it is inappropriate to presume that the group will continue in business.

The Members of Council are responsible for keeping proper accounting records which disclose with reasonable accuracy at any time the financial position of the group and to enable them to ensure that the financial statements comply with the Companies Act 2006, the Charities and Trustees Investment (Scotland) Act 2005 and regulation 8 of the Charities Financial statements (Scotland) Regulations 2006. They are also responsible for safeguarding the assets of the group and hence for taking reasonable steps for the prevention and detection of fraud and other irregularities.

Independent auditors' report

to the members of The Scottish Association for Marine Science

We have audited the group financial statements of The Scottish Association for Marine Science for the year ended 31 March 2012 which comprise the Group Statement of Financial Activities, the Group Statement of Total Recognised Gains and Losses, the Group Balance Sheet, the Balance Sheet, the Group Statement of Cash Flows and the related notes 1 to 18. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom Accounting Standards (United Kingdom Generally Accepted Accounting Practice).

This report is made solely to the members, as a body, in accordance with our appointment under section 44(1)(c) of the Charities and Trustee Investment (Scotland) Act 2005 and Chapter 3 of Part 16 of the Companies Act 2006. Our audit work has been undertaken so that we might state to the company's members those matters we are required to state to them in an auditors' report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to anyone other than the company and the company's members as a body, for our audit work, for this report, or for the opinions we have formed.

Respective responsibilities of Members of Council and auditors

As stated in the Statement of Directors' Responsibilities set out on page 66, the members of Council (who are also the directors of The Scottish Association for Marine Science for the purposes of company law) are responsible for the preparation of the Financial Statements in accordance with applicable law and United Kingdom Accounting Standards (United Kingdom Generally Accepted accounting Practice) and for being satisfied that the financial statements give a true and fair view.

We have been appointed auditor under section 44(1)(c) of the Charities and Trustees Investment (Scotland) Act 2005 and under the Companies Act 2006 and report to you in accordance with those Acts.

Our responsibility is to audit the financial statements in accordance with relevant legal and regulatory requirements and International Standards on Auditing (UK and Ireland).

We report to you our opinion as to whether the financial statements give a true and fair view, have been properly prepared in accordance with United Kingdom Generally Accepted Accounting Practice, and have been prepared in accordance with the Companies Act 2006, the Charities and Trustee Investment (Scotland) Act 2005 and regulation 8 of the Charities Financial statements (Scotland) Regulations 2006. We also report to you whether, in our opinion, the information given in the Trustees' Annual Report is consistent with those financial statements.

We also report to you if, in our opinion, the charitable company has not kept adequate and proper accounting records, if the charitable company's financial statements are not in agreement with the accounting records and returns, if we have not received all the information and explanations we require for our audit, or if certain disclosures of trustees' remuneration specified by law are not made.

We read the Trustees' Report and consider the implications for our report if we become aware of any apparent misstatements with the financial statements.

Independent auditors' report

to the members of The Scottish Association for Marine Science

Basis of audit opinion

We conducted our audit in accordance with International Standards on Auditing (UK and Ireland) issued by the Auditing Practices Board. An audit includes examination, on a test basis, of evidence relevant to the amounts and disclosures in the financial statements. It also includes an assessment of the significant estimates and judgements made by the directors in the preparation of the financial statements, and of whether the accounting policies are appropriate to the charitable company's circumstances, consistently applied and adequately disclosed.

We planned and performed our audit so as to obtain all information and explanations which we considered necessary in order to provide us with sufficient evidence to give reasonable assurance as to whether the financial statements are free from material misstatement, whether caused by fraud or other irregularity or error. In forming our opinion we also evaluated the overall adequacy of the presentation of information in the financial statements.

Opinion

In our opinion:

- the financial statements give a true and fair view of the state of affairs of the charitable group as at 31 March 2012 and of its incoming resources and application of resources, including its income and expenditure, for the year then ended;
- the financial statements have been properly prepared in accordance with United Kingdom Generally Accepted Accounting Practice;
- the financial statements have been prepared in accordance with the Companies Act 2006, the Charities and Trustee Investment (Scotland) Act 2005 and regulation 8 of the Charities Financial statements (Scotland) Regulations 2006; and
- the information given in the Council Report is consistent with the financial statements.

Eunice McAdam (Senior Statutory Auditor)
For and on behalf of Ernst & Young LLP (Statutory Auditor)
Inverness

Group statement of financial activities

for the year ended 31 March 2012

		2012	2012	2012	2012	2011
		Unrestricted funds			Total	Total
	Notes	Undesignated £000	Designated £000	Restricted £000	£000	£000
Incoming resources						
Incoming resources from generated funds:						
Activities for generating funds		286	–	–	286	233
Investment income		–	–	–	–	–
Incoming resources from charitable activities	2	3,343	–	6,769	10,112	14,944
Total incoming resources		3,629	–	6,769	10,398	15,177
Resources expended						
Cost of generating funds	3	9	–	14	23	22
Charitable activities	4	3,179	110	7,360	10,649	10,747
Governance costs		63	–	–	63	55
Total resources expended		3,251	110	7,374	10,735	10,824
Net incoming/ (outgoing) resources before transfers	5	378	(110)	(605)	(337)	4,353
Transfers between funds		(65)	65	–	–	–
Net incoming/ (outgoing) resources after transfers		313	(45)	(605)	(337)	4,353
Fund balance brought forward at 1 April 2011		(742)	4,425	14,397	18,080	13,727
Total Funds carried forward at 31 March 2012		(429)	4,380	13,792	17,743	18,080

Group statement of total recognised gains and losses

for the year ended 31 March 2012

There are no recognised gains or losses other than the net outgoing resources of £337k in the year ended 31 March 2012 and net incoming resources of £4,353k in the year ended 31 March 2011.

Group balance sheet

at 31 March 2012

	<i>Notes</i>	<i>2012</i> £000	<i>2011</i> £000
Fixed assets			
Tangible assets	8	18,172	18,822
Investments	9	–	–
		<u>18,172</u>	<u>18,822</u>
Current assets			
Cash at bank and in hand		1,887	2,664
Debtors	10	2,770	2,502
		<u>4,657</u>	<u>5,166</u>
Creditors: amounts falling due within one year	11	<u>(3,596)</u>	<u>(4,220)</u>
Net current assets		<u>1,061</u>	<u>946</u>
Total assets less current liabilities		19,233	19,768
Creditors: amounts falling due after more than one year			
Loans	12	(1,490)	(1,688)
Net assets		<u>17,743</u>	<u>18,080</u>
Capital and reserves			
Restricted Funds	13(a)	13,792	14,397
Unrestricted funds:			
Undesignated		(429)	(742)
Designated	13(b)	4,380	4,425
Total capital and reserves		<u>17,743</u>	<u>18,080</u>

Chair of the Board: Michael Gibson

President of the Council: Prof Andrew Hamnett

Company balance sheet

at 31 March 2012

	Notes	2012 £000	2011 £000
Fixed assets			
Tangible assets	8	18,145	18,777
		<u>18,145</u>	<u>18,777</u>
Current assets			
Cash at bank and in hand		1,357	2,326
Debtors	10	3,139	2,583
		<u>4,496</u>	<u>4,909</u>
Creditors: amounts falling due within one year	11	(3,408)	(3,917)
		<u>1,088</u>	<u>992</u>
Net current assets			
Total assets less current liabilities		19,233	19,769
Creditors: amounts falling due after more than one year			
Loans	12	(1,490)	(1,688)
		<u>17,743</u>	<u>18,081</u>
Net assets			
Capital and reserves			
Restricted Funds	13(a)	13,718	14,305
Unrestricted funds			
Undesignated		(402)	(696)
Designated	13(b)	4,427	4,472
		<u>17,743</u>	<u>18,081</u>
Total capital and reserves			

Chair of the Board: Michael Gibson

President of the Council: Prof Andrew Hamnett

Group statement of cash flows

for the year ended 31 March 2012

	<i>Notes</i>	<i>2012</i> £000	<i>2011</i> £000
Net cash inflow/(outflow) from operating activities	15(a)	(63)	6,504
Returns on investment and servicing of finance	15(a)	(118)	(129)
Taxation		–	–
Capital expenditure	15(a)	(411)	(5,158)
Financing		(185)	(675)
Increase/(Decrease) in cash	15(a)	<u>(777)</u>	<u>542</u>

Reconciliation of net cash flow to movement in net debt

	<i>Note</i>	<i>2012</i> £000	<i>2011</i> £000
Increase/(Decrease) in cash		(777)	542
Repayment of long term loans		<u>185</u>	<u>675</u>
		(592)	1,217
Net debt at 1 April		788	(429)
Net debt at 31 March	15(a)	<u>196</u>	<u>788</u>

Notes to the financial statements

at 31 March 2012

1. Accounting policies

Basis of preparation

The financial statements are prepared under the historical cost convention modified to include the revaluation of investments, in accordance with applicable accounting standards and the Statement of Recommended Practice "Accounting by Charities" (SORP 2005) issued in December 2005.

Status

The Association is a company limited by Guarantee and not having a share capital. The liability of the members who constitute the Association is limited to £1 per member.

The affairs of the Association are managed by an elected Council of Members, who constitute Directors of the Company for Companies Act purposes. The Association is a registered charity, Scottish Charity Number SC009206, and is not liable to income tax or corporation tax on its income under the Income and Corporation Taxes Act 1988.

Group financial statements

The group financial statements incorporate the financial statements of the company and its subsidiary undertakings for the year ended 31 March 2012. Unless otherwise stated, the acquisition method of accounting has been adopted. Under this method, the results of subsidiary undertakings acquired or disposed of in the year are included in the group profit and loss account from the date of acquisition or up to the date of disposal.

In accordance with section 408 of the Companies Act 2006, The Scottish Association for Marine Science is exempt from the requirement to present its own profit and loss account. The result of the financial year dealt with in the financial statements of The Scottish Association for Marine Science is disclosed in note 14 to these financial statements.

Tangible fixed assets

Individual items of capital equipment are included in the balance sheet only if their cost exceeds £5,000 (including irrecoverable value added tax where appropriate).

Depreciation is provided on all tangible fixed assets at rates calculated to write off the cost or valuation, less estimated residual value, of each asset evenly over its expected useful life, as follows:

Property	–	20 to 50 years
Vessels	–	5 to 30 years
Scientific instruments and equipment	–	2 to 20 years
Computer equipment	–	5 years
Fixtures and fittings	–	5 to 20 years

The carrying values of tangible fixed assets are reviewed for impairment when events or changes in circumstances indicate the carrying value may not be recoverable.

Value added tax

As the group is registered partially exempt for VAT purposes, expenditure and fixed assets are shown inclusive of irrecoverable value added tax where applicable.

Investments

Investments include bank balances for the Yonge Fellowship, and equity investments.

Notes to the financial statements

at 31 March 2012

1. Accounting policies (continued)

Foreign currencies

All foreign currency gains and losses are taken to the income and expenditure account as incurred. Monetary assets and liabilities denominated in foreign currencies are translated at the rate of exchange ruling at the balance sheet date.

Leasing and commitments

Rentals paid under operating leases are charged to income on a straight line basis over the lease term.

Pensions

The Association participates in the Universities Superannuation Scheme (“USS”), a defined benefit scheme which is contracted out of the State Second Pension (“S2P”). The assets of the scheme are held in a separate trustee-administered fund. Because of the mutual nature of the scheme, the scheme’s assets are not hypothecated to individual organisations and a scheme-wide contribution rate is set. The Association is therefore exposed to actuarial risks associated with other organisations’ employees and is unable to identify its share of the underlying assets and liabilities of the scheme on a consistent and reasonable basis and therefore, as required by FRS17 “Retirement benefits”, financial statements for the scheme as if it were a defined contribution scheme. As a result the amount charged to the income and expenditure account represents the contributions payable to the scheme in respect of the accounting period.

For staff that are NERC employees, pensions are fully funded and guaranteed by NERC.

Incoming resources

Income represents NERC core grants receivable in the year, other research income receivable from outside bodies and other miscellaneous income. Other funds received of a revenue nature are credited to deferred revenue income and credited to the Income and Expenditure Account as the related research costs are incurred.

Resources expended

Direct charitable expenditure represents the full cost of the research performed. It includes the cost of direct staff, consumable stocks, indirect costs and the apportioned support costs. Support costs have been apportioned to direct charitable expenditure on a percentage basis of total charitable expenditure. Fundraising and publicity expenditure represents the cost of obtaining funds for research, promoting the work of the Association and recruitment of staff. Governance costs represent the necessity of compliance with statutory and constitutional requirements.

2. Incoming resources from charitable activities

	<i>Unrestricted</i>				
	<i>Unrestricted</i>	<i>Designated</i>	<i>Restricted</i>	<i>Total</i>	<i>Total</i>
	<i>2012</i>	<i>2012</i>	<i>2012</i>	<i>2012</i>	<i>2011</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>
Education and Knowledge Transfer Grants	390	–	277	667	660
Research Income, National Capability and Facilities	2,666	–	6,492	9,158	13,584
Recompression	287	–	–	287	700
	<u>3,343</u>	<u>–</u>	<u>6,769</u>	<u>10,112</u>	<u>14,944</u>

Notes to the financial statements

at 31 March 2012

3. Cost of generating funds

	<i>Unrestricted</i>			<i>Total</i> 2012 £000	<i>Total</i> 2011 £000
	<i>Unrestricted</i>	<i>Designated</i>	<i>Restricted</i>		
	2012	2012	2012		
	£000	£000	£000		
Marketing, publications and newsletters	9	–	14	23	22

4. Cost of charitable activities

	<i>Unrestricted</i>			<i>Total</i> 2012 £000	<i>Total</i> 2011 £000
	<i>Unrestricted</i>	<i>Designated</i>	<i>Restricted</i>		
	2012	2012	2012		
	£000	£000	£000		
Staff costs	1,168	–	4,788	5,956	5,880
Other costs	2,011	110	2,572	4,693	4,867
	<u>3,179</u>	<u>110</u>	<u>7,360</u>	<u>10,649</u>	<u>10,747</u>

5. Net incoming resources

	2012 £000	2011 £000
Net incoming resources are stated after charging:		
Auditors' remuneration – audit services	12	12
– other services	10	8
Depreciation and amortisation	1,061	1,097
Operating lease charges	<u>28</u>	<u>24</u>

6. Remuneration of the members of the council

The non-executive Council members received £8,939 (2011 – £4,728), in the form of reimbursable expenses, in total from the Association during the year. The following directors received remuneration:

	2012 £000	2011 £000
Michael Gibson	19	10
Gordon McAllister	3	3
Dr R A Scrutton	–	2
Charles Stevenson	2	3
Professor M Bownes	3	3
Walter Spiers	2	2
Angus Ross	2	–

Notes to the financial statements

at 31 March 2012

7. Staff costs

<i>SAMS Staff</i>	2012 £000	2011 £000
Wages and salaries	4,253	4,144
Social security costs	347	327
Other pension costs	596	584
	<u>5,196</u>	<u>5,055</u>

The average number of full-time equivalent persons employed by the group during the year was as follows:

	No.	No.
Scientific	93	91
Office management	38	37
	<u>131</u>	<u>128</u>

<i>NERC Staff</i>	2012 £000	2011 £000
Wages and salaries	573	618
Social security costs	43	50
Other pension costs	146	157
	<u>762</u>	<u>825</u>

The average number of full-time equivalent persons employed by NERC working for the group during the year was as follows:

	No.	No.
Scientific	9	10
Office management	5	5
	<u>14</u>	<u>15</u>

Remuneration of higher paid staff earning in excess of £60,000, excluding employer's pension contributions were in the following ranges:

	<i>SAMS</i> 2012 No.	<i>NERC</i> 2012 No.	<i>Total</i> 2012 No.	<i>Total</i> 2011 No.
£60,001 – £70,000	2	–	2	–
£70,001 – £80,000	1	–	1	2
£80,000 – £90,000	–	–	–	–
£90,000 – £100,000	–	–	–	–
£100,000 – £110,000	1	–	1	1

Notes to the financial statements

at 31 March 2012

8. Tangible fixed assets

<i>Group</i>	<i>Property</i> <i>£000</i>	<i>Vessels</i> <i>£000</i>	<i>Fittings and</i> <i>equipment</i> <i>£000</i>	<i>Total</i> <i>£000</i>
Cost:				
At 1 April 2011	19,614	591	7,944	28,149
Disposals	–	–	–	–
Additions	–	12	399	411
Transfers	–	–	–	–
At 31 March 2012	19,614	603	8,343	28,560
Depreciation:				
At 1 April 2011	2,766	532	6,029	9,327
Disposals	–	–	–	–
Charge for year	405	10	646	1,061
At 31 March 2012	3,171	542	6,675	10,388
Net book value:				
At 31 March 2012	16,443	61	1,668	18,172
At 1 April 2011	16,848	59	1,915	18,822
<i>Company</i>	<i>Property</i> <i>£000</i>	<i>Vessels</i> <i>£000</i>	<i>Fittings and</i> <i>equipment</i> <i>£000</i>	<i>Total</i> <i>£000</i>
Cost:				
At 1 April 2011	19,614	591	7,642	27,847
Disposals	–	–	–	–
Additions	–	12	399	411
Transfers	–	–	–	–
At 31 March 2012	19,614	603	8,041	28,258
Depreciation:				
At 1 April 2011	2,766	532	5,772	9,070
Disposals	–	–	–	–
Charge for year	405	10	628	1,043
At 31 March 2012	3,171	542	6,400	10,113
Net book value:				
At 31 March 2012	16,443	61	1,641	18,145
At 1 April 2011	16,848	59	1,870	18,777

Notes to the financial statements

at 31 March 2012

9. Investments

<i>Group</i>	<i>31 March 2012 £000</i>	<i>31 March 2011 £000</i>
Subsidiaries	–	–
Other fixed asset investments	–	–
	<u>–</u>	<u>–</u>

<i>Company</i>	<i>31 March 2012 £000</i>	<i>31 March 2011 £000</i>
Subsidiaries	–	–
Other fixed asset investments	–	–
	<u>–</u>	<u>–</u>

(a) Subsidiaries

	<i>Group</i>		<i>Company</i>	
	<i>2012 £000</i>	<i>2011 £000</i>	<i>2012 £000</i>	<i>2011 £000</i>
Cost:				
At 1 April 2011 and 31 March 2012	<u>–</u>	<u>–</u>	<u>–</u>	<u>–</u>
Impairment:				
At 1 April 2011 and 31 March 2012	<u>–</u>	<u>–</u>	<u>–</u>	<u>–</u>
Net book value:				
At 1 April 2011 and 31 March 2012	<u>–</u>	<u>–</u>	<u>–</u>	<u>–</u>

(b) Other fixed asset investments

	<i>Group</i>		<i>Company</i>	
	<i>2012 £000</i>	<i>2011 £000</i>	<i>2012 £000</i>	<i>2011 £000</i>
Cost:				
At 1 April 2011 and 31 March 2012	<u>53</u>	<u>53</u>	<u>–</u>	<u>–</u>
Impairment:				
At 1 April 2011 and 31 March 2012	<u>(53)</u>	<u>(53)</u>	<u>–</u>	<u>–</u>
Net book value:				
At 1 April 2011 and 31 March 2012	<u>–</u>	<u>–</u>	<u>–</u>	<u>–</u>

Notes to the financial statements

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Company

Details of the investments in subsidiary undertakings held by The Scottish Association for Marine Science are as follows:

<i>Subsidiary undertakings</i>	<i>Proportion of voting holding</i>	<i>Rights and shares held</i>	<i>Nature of business</i>
SAMS Research Services Limited	Ordinary shares	100%	Marine and research support services
The European Centre for Marine Biotechnology	Limited by guarantee	Sole member	Non trading
SAMS Commercial Services Limited	Ordinary shares	100%	Non trading
Scottish Marine Institute	Ordinary shares	100%	Non trading
Marine BioenergyScotland Limited	Ordinary shares	100%	Non trading
SAMS Limited	Ordinary shares	100%	Non trading

SAMS Research Services Limited gift aid all of its taxable profits to The Scottish Association for Marine Science. A summary of the trading results is shown below:

SAMS Research Services Limited

	<i>2012</i>
	<i>£000</i>
Turnover	1,993
Cost of sales and administrative expenses	(1,721)
Interest receivable and other operating income	-
Interest payable	-
Net profit before Gift Aid and tax	272
Amount gifted to charity	(273)
Profit/(loss) for the year	<u>(1)</u>

The assets and liabilities of SAMS Research Services Limited at 31 December 2011 were:

	<i>2012</i>	<i>2011</i>
	<i>£000</i>	<i>£000</i>
Fixed assets	27	45
Current assets	1,224	975
Creditors: amounts falling due within one year	(1,251)	(1,019)
Aggregate share capital and reserves	<u>-</u>	<u>1</u>

The results of The European Centre for Marine Biotechnology for the year ended 31 March 2012 are not material to the group. This company ceased trading on 31 March, 2008.

Notes to the financial statements

at 31 March 2012

10. Debtors

	<i>Group</i>		<i>Company</i>	
	<i>2012</i>	<i>2011</i>	<i>2012</i>	<i>2011</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>
Trade debtors	440	470	–	–
Other debtors	1,089	745	1,089	745
Prepayments and accrued income	1,241	1,287	987	1,121
Due from group undertakings	–	–	1,063	717
	<u>2,770</u>	<u>2,502</u>	<u>3,139</u>	<u>2,583</u>

11. Creditors: amounts falling due within one year

	<i>Group</i>		<i>Company</i>	
	<i>2012</i>	<i>2011</i>	<i>2012</i>	<i>2011</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>
Current instalment due on bank loan (note 12)	201	188	201	188
Payments received in advance	2,761	2,919	2,692	2,689
Taxation and social security costs	240	245	240	245
Sundry creditors and accruals	394	867	275	795
	<u>3,596</u>	<u>4,220</u>	<u>3,408</u>	<u>3,917</u>

The bank loans and overdraft facilities are secured by a bond and floating charge over the whole assets of the company and a standard security over Scottish Marine Institute, Oban in favour of the Bank of Scotland, HIE Argyll and the Islands and the University of the Highlands and Islands.

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at 31 March 2012

12. Loans

	<i>Group</i>		<i>Company</i>	
	<i>2012</i>	<i>2011</i>	<i>2012</i>	<i>2011</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>
Not wholly repayable within five years: £2,900,000 bank loan at 1.25% above LIBOR per annum, repayable in monthly instalments of £25,419 commencing 3 March 2004	1,691	1,876	1,691	1,876
Less: included in creditors: amounts falling due within one year (note 11)	201	188	201	188
	<u>1,490</u>	<u>1,688</u>	<u>1,490</u>	<u>1,688</u>
Amounts repayable:				
Within one year	201	188	201	188
In one to two years	214	201	214	201
In two to five years	734	687	734	687
	<u>1,149</u>	<u>1,076</u>	<u>1,149</u>	<u>1,076</u>
Over five years	542	800	542	800
	<u>1,691</u>	<u>1,876</u>	<u>1,691</u>	<u>1,876</u>

13. (a) Restricted funds

<i>Group</i>	<i>1 April</i>	<i>Income</i>	<i>Expenditure</i>	<i>31 March</i>
	<i>2011</i>			<i>2012</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>
Fixed asset funds	14,394	346	(951)	13,789
Yonge Fellowship	3	–	–	3
Research Projects	–	6,423	(6,423)	–
	<u>14,397</u>	<u>6,769</u>	<u>(7,374)</u>	<u>13,792</u>
<i>Company</i>	<i>1 April</i>	<i>Income</i>	<i>Expenditure</i>	<i>31 March</i>
	<i>2011</i>	<i>£000</i>	<i>£000</i>	<i>2012</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>
Fixed asset funds	14,302	346	(933)	13,715
Yonge Fellowship	3	–	–	3
Research Projects	–	6,423	(6,423)	–
	<u>14,305</u>	<u>6,769</u>	<u>(7,356)</u>	<u>13,718</u>

Capital grants are recognised as restricted income in the year in which they are received and the depreciation on all fixed assets funded by capital grants is recognised as an expense against the restricted fund.

The Sheina Marshall Bequest is an amount left by the late Dr Sheina Marshall OBE, DSC to the Association. The sum bequested was used by the Association to purchase a dwelling property in Oban which is used to accommodate visiting researchers.

The Yonge Fellowship is to commemorate the late Professor Sir Maurice Yonge. Awards will be made from the fund to suitable marine science projects.

Notes to the financial statements

at 31 March 2012

13. (b) Designated funds

<i>Group</i>	<i>1 April 2011 £000</i>	<i>Income £000</i>	<i>Expenditure £000</i>	<i>Transfers £000</i>	<i>31 March 2012 £000</i>
Fixed asset funds	4,425	–	(110)	65	4,380

<i>Company</i>	<i>1 April 2011 £000</i>	<i>Income £000</i>	<i>Expenditure £000</i>	<i>Transfers £000</i>	<i>31 March 2012 £000</i>
Fixed asset funds	4,472	–	(110)	65	4,427

SAMS has designated a reserve for fixed assets. A restricted reserve already exists for fixed assets and this reflects the level of grant funding received for the assets held by SAMS. The restricted reserve does not, however, reflect the full amount of funds held in tangible fixed assets held for the charity's use. The designated fund represents the balance between the net book value of assets held and the restricted reserve.

14. Income and expenditure account

In accordance with the exemption allowed by section 408 of the Companies Act 2006 the company has not presented its own income and expenditure account or statement of financial activities. The net outgoing resources for the financial period attributable to members of the parent undertaking dealt with in the financial statements was £338k (2011 – incoming £4,369k).

15. Notes to the statement of cash flows

(a) Reconciliation of net incoming resources to net cash inflow from operating activities

	<i>2012 £000</i>	<i>2011 £000</i>
Net incoming/(outgoing) resources	(337)	4,353
Net interest paid	118	129
Depreciation and amortisation	1,061	1,096
(Increase)/Decrease in debtors	(268)	778
(Decrease)/Increase in creditors	(637)	148
Net cash inflow/(outflow) from operating activities	<u>(63)</u>	<u>6,504</u>

Returns on investment and servicing of finance

	<i>2012 £000</i>	<i>2011 £000</i>
Interest received	–	–
Interest paid	(118)	(129)
	<u>(118)</u>	<u>(129)</u>

Capital expenditure and financial investment

	<i>2012 £000</i>	<i>2011 £000</i>
Payments to acquire tangible fixed assets	(411)	(5,198)
Disposal of fixed assets	–	40
	<u>(411)</u>	<u>(5,158)</u>

Notes to the financial statements

at 31 March 2012

15. Notes to the statement of cash flows (continued)

<i>Financing</i>	<i>2012</i>	<i>2011</i>
	<i>£000</i>	<i>£000</i>
Cashflow financing for new building	–	(500)
Repayment of long term loans	(185)	(175)
	<u>(185)</u>	<u>(675)</u>

(b) Analysis of changes in net debt

	<i>At 1 April</i>	<i>Cash flow</i>	<i>At 31 March</i>
	<i>2011</i>		<i>2012</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>
Cash at bank and in hand	2,664	(777)	1,887
Debt due within one year	(188)	(13)	(201)
Debt due after one year	(1,688)	198	(1,490)
	<u>788</u>	<u>(592)</u>	<u>196</u>

16. Pensions

The Association participates in the Universities Superannuation Scheme, a defined benefit scheme which is contracted out of the State Second Pension. The assets of the scheme are held in a separate fund administered by the trustee, Universities Superannuation Scheme Limited.

The appointment of directors to the board of the trustee is determined by the company's Articles of Association. Four of the directors are appointed by Universities UK; three are appointed by the University and College Union, of whom at least one must be a USS pensioner member; and a minimum of two and a maximum of four are co-opted directors appointed by the board. Under the scheme trust deed and rules, the employer contribution rate is determined by the trustee, acting on actuarial advice.

The latest triennial actuarial valuation of the scheme was at 31 March 2011. This was the second valuation of USS under the scheme-specific funding regime introduced by the Pensions Act 2004, which requires schemes to adopt a statutory funding objective, which is to have sufficient and appropriate assets to cover their technical provisions. The actuary also carries out regular reviews of the funding levels. In particular, he carries out a review of the funding level each year between triennial valuations and details of his estimate of the funding level at 31 March 2012 are also included in this note.

The triennial valuation was carried out using the projected unit method. The assumptions which have the most significant effect on the result of the valuation are those relating to the rate of return on investments (ie the valuation rate of interest), the rates of increase in salary and pensions and the assumed rates of mortality. The financial assumptions were derived from market yields prevailing at the valuation date. An inflation risk premium adjustment was also included by deducting 0.3% from the market-implied inflation on account of the historically high level of inflation implied by government bonds (particularly when compared to the Bank of England's target of 2% for CPI which corresponds broadly to 2.75% for RPI per annum).

To calculate the technical provisions, it was assumed that the valuation rate of interest would be 6.1% per annum, salary increases would be 4.4% per annum (with short-term general pay growth at 3.65% per annum and an additional allowance for increases in salaries due to age and promotion reflecting historic Scheme experience, with a further cautionary reserve on top for past service liabilities) and pensions would increase by 3.4% per annum for 3 years following the valuation then 2.6% per annum thereafter.

Notes to the financial statements

at 31 March 2012

16. Pensions (continued)

Standard mortality tables were used as follows:

Male members' mortality	SINA ["light"] YoB tables – no age rating
Female members' mortality	SINA ["light"] YoB tables – rated down 1 year

Use of mortality tables reasonably reflects the actual USS experience but also provides an element of conservatism to allow for further improvements in mortality rates. The CMI 2009 projections with a 1.25% pa long term rate were also adopted. The assumed life expectations on retirement at age 65 are:

Males (females) currently aged 65	23.7 (25.6) years
Males (females) currently aged 45	25.5 (27.6) years

At the valuation date, the value of the assets of the scheme was £32,433.5 million and the value of the scheme's technical provisions was £35,343.7 million indicating a shortfall of £2,910.2 million. The assets therefore were sufficient to cover 92% of the benefits which had accrued to members after allowing for expected future increases in earnings.

The actuary also valued the scheme on a number of other bases as at the valuation date. On the scheme's historic gilts basis, using a valuation rate of interest in respect of past service liabilities of 4.4% per annum (the expected return on gilts) the funding level was approximately 68%. Under the Pension Protection Fund regulations introduced by the Pensions Act 2004 the scheme was 93% funded; on a buy-out basis (ie assuming the Scheme had discontinued on the valuation date) the assets would have been approximately 57% of the amount necessary to secure all the USS benefits with an insurance company; and using the FRS17 formula as if USS was a single employer scheme, using a AA bond discount rate of 5.5% per annum based on spot yields, the actuary estimated that the funding level at 31 March 2011 was 82%.

As part of this valuation, the trustees have determined, after consultation with the employers, a recovery plan to pay off the shortfall by 31 March 2021. The next formal triennial actuarial valuation is at 31 March 2014. If experience up to that date is in line with the assumptions made for this current actuarial valuation and contributions are paid at the determined rates or amounts, the shortfall at 31 March 2014 is estimated to be £2.2 billion, equivalent to a funding level of 95%. The contribution rate will be reviewed as part of each valuation and may be reviewed more frequently.

The technical provisions relate essentially to the past service liabilities and funding levels, but it is also necessary to assess the ongoing cost of newly accruing benefits. The cost of future accrual was calculated using the same assumptions as those used to calculate the technical provisions but the allowance for promotional salary increases was not as high. Analysis has shown very variable levels of growth over and above general pay increases in recent years, and the salary growth assumption built into the cost of future accrual is based on more stable, historic, salary experience. However, when calculating the past service liabilities of the scheme, a cautionary reserve has been included, in addition, on account of the variability mentioned above.

As at the valuation date the Scheme was still a fully Final Salary Scheme for future accruals and the prevailing employer contribution rate was 16% of salaries.

Following UK government legislation, from 2011 statutory pension increases or revaluations are based on the Consumer Prices Index measure of price inflation. Historically these increases had been based on the Retail Prices Index measure of price inflation.

Since the previous valuation as at 31 March 2008 there have been a number of changes to the benefits provided by the scheme although these became effective from October 2011. These include:

New entrants

Other than in specific, limited circumstances, new entrants are now provided on a Career Revalued Benefits (CRB) basis rather than a Final Salary (FS) basis.

Notes to the financial statements

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16. Pensions (continued)

Normal pension age

The normal pension age was increase for future service and new entrants, to age 65.

Flexible retirement

Flexible retirement options were introduced.

Member contributions increased

Contributions were uplifted to 7.5% pa and 6.5% pa for FS Section members and CRB section members respectively.

Cost sharing

If the total contribution level exceeds 23.5% of salaries per annum, the employers will pay 65% of the excess over 23.5% and members would pay the remaining 35% to the fund as additional contributions.

Pension increase cap

For service derived after 30 September 2011, USS will match increases in official pensions for the first 5%. If official pensions increase by more than 5% then USS will pay half of the difference up to a maximum increase of 10%.

Since 31 March 2011 global investment markets have continued to fluctuate and following its peak in September 2011 inflation has declined rapidly towards the year end, although the market's assessment of inflation has remained reasonably constant. The actuary has estimated that the funding level as at 31 March 2012 under the scheme specific funding regime had fallen from 92% to 77%. This estimate is based on the results from the valuation at 31 March 2011 allowing primarily for investment returns and changes to market conditions. These are sighted as the two most significant factors affecting the funding positions which have been taken into account for the 31 March 2012 estimation.

On the FRS17 basis, using a AA bond discount rate of 4.9% per annum based on spot yields, the actuary estimated that the funding level at 31 March 2012 was 74%. An estimate of the funding level measured on a historic gilts basis at that date was approximately 56%.

Surpluses or deficits which arise at future valuations may impact on the Association's future contribution commitment. A deficit may require additional funding in the form of higher contribution requirements, where a surplus could, perhaps, be used to similarly reduce requirements. The sensitivities regarding the principal assumptions used to measure the scheme liabilities on a technical provisions basis as at the date of the last triennial actuarial valuation are set out below:

<i>Assumption</i>	<i>Change in assumption</i>	<i>Impact on shortfall</i>
Investment return	Decrease by 0.25%	Decrease by £1.6 billion
The gap between RPI and CPI	Decrease by 0.25%	Increase by £1 billion
Rate of salary growth	Increase by 0.25%	Increase by £0.6 billion
Members live longer than assumed	1 year longer	Increase by £0.8 billion
Equity markets in isolation	Fall by 25%	Increase by £4.6 billion

USS is a "last man standing" scheme so that in the event of the insolvency of any of the participating employers in the USS, the amount of any pension funding shortfall (which cannot otherwise be recovered) in respect of that employer will be spread across the remaining participant employers and reflected in the next actuarial valuation of the scheme.

Notes to the financial statements

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16. Pensions (continued)

The trustee believes that over the long-term equity investment and investment in selected alternative asset classes will provide superior returns to other investment classes. The management structure and targets set are designed to give the fund a major exposure to equities through portfolios that are diversified both geographically and by sector. The trustee recognises it would be theoretically possible to select investments producing income flows broadly similar to the estimated liability cash flows. However, in order to meet the long-term funding objective within a level of contributions that it considers the employers would be willing to make, the trustee needs to take on a degree of investment risk relative to the liabilities. This taking of investment risk seeks to target a greater return than the matching assets would provide whilst maintaining a prudent approach to meeting the fund's liabilities. Before deciding what degree of investment risk to take relative to the liabilities, the trustee receives advice from its internal investment team, its investment consultant and the scheme actuary, and considers the views of the employers. The positive cash flow of the scheme means that it is not necessary to realise investments to meet liabilities. The trustee believes that this, together with the ongoing flow of new entrants into the scheme and the strength of covenant of the employers enables it to take a long term view of its investments. Short-term volatility of returns can be tolerated and need not feed through directly to the contribution rate although the trustee is mindful of the desirability of keeping the funding level on the scheme's technical provisions close to or above 100% thereby minimizing the risk of the introduction of deficit contributions. The actuary has confirmed that the scheme's cash flow is likely to remain positive for the next ten years or more.

At 31 March 2012, USS had over 145,000 active members and the Association had 123 active members participating in the scheme.

The total USS pension cost for the group was £596,000 (2011 – £584,000). This includes £77,000 (2011 – £50,000) outstanding contributions at the balance sheet date. The USS contribution rate payable by the company was 16% of pensionable salaries.

The total JSS pension cost for the group on behalf of NERC employees was £146,000 (2011 – £157,000). This includes £nil (2011 – £13,000) outstanding contributions at the balance sheet date. The JSS contribution rate payable by the company on behalf of NERC employees was 26% of pensionable salaries.

17. Other financial commitments

At 31 March 2012 the company had annual commitments under non-cancellable operating leases as set out below:

	<i>Group</i>		<i>Company</i>	
	<i>2012</i>	<i>2011</i>	<i>2012</i>	<i>2011</i>
	<i>£000</i>	<i>£000</i>	<i>£000</i>	<i>£000</i>
Operating leases which expire:				
Within one year	5	8	5	8
In two to five years	32	19	32	19
	<u>37</u>	<u>27</u>	<u>37</u>	<u>27</u>

Notes to the financial statements

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18. Related party transactions

During the year, purchases totalling £12,000, at normal market prices have been made by group companies from Muckairn Mussels Limited of which Walter Spiers is a director and controlling shareholder. There was no balance outstanding at 31 March 2012.

The company has taken advantage of the exemption in FRS8 not to disclose transactions with wholly owned subsidiaries.



Innovative Independent International

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THE SCOTTISH ASSOCIATION FOR MARINE SCIENCE
SCOTTISH MARINE INSTITUTE
OBAN, ARGYLL, PA37 1QA SCOTLAND UK

T: +44 (0)1631 559000 F: (+44) (0)1631 559001 E: info@sams.ac.uk



www.sams.ac.uk