



SCOTTISH
ASSOCIATION
for MARINE
SCIENCE

ANNUAL REPORT 06-07



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Director Professor G B Shimmield

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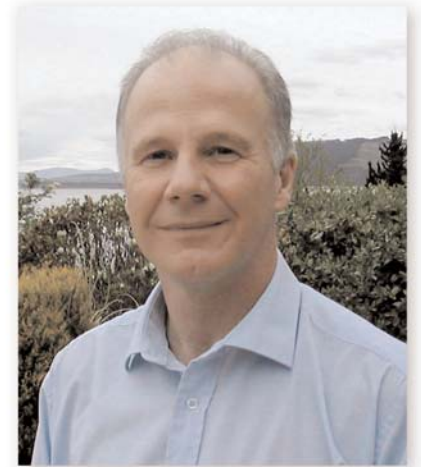
DIRECTOR'S INTRODUCTION

This year's Annual Report marks a significant consolidation of the work of the Association. After several years of audit and strategic funding submissions, we have now been able to take stock of the notable successes of SAMS in grant capture and the initiation of the Oceans 2025 collaborative programme between the seven NERC-funded UK marine science institutions. The combination of the Oceans 2025 strategy, and the new investment via the UHI Millennium Institute (ARC – Addressing Research Capacity supported by the Scottish Funding Council, Highlands and Islands Enterprise and the European Regional Development Fund), means that SAMS has a very positive and vibrant research strategy in place for the next five years. However, in the coming year we will face another major benchmarking audit – the UK-wide Research Assessment Exercise. Work is underway on our submission to the panel on Earth and Environmental Sciences and we are delighted to be returning 35 Principal Investigators, which is a significant increase over the 11 returned in 2001 for assessment. This statistic alone attests to the major growth in capacity and academic resource that is now resident in Dunstaffnage. This Annual Report also has another important statement, notably the significant return to financial stability and an important surplus to contribute to the Reserves of the Association. On this point, I would like to thank sincerely all the staff for their excellent contributions to financial earning and cost control to make this year a financial success.

On the education front, we were disappointed collectively on the failure of the UHI Millennium Institute to be

recommended for Taught Degree Awarding Powers, and University title. This has redoubled everyone's efforts with a potential re-assessment within the next couple of years. For SAMS, we have had a major achievement in the revalidation of the BSc (Honours) in Marine Science, with the approval of an Arctic Science strand. Students can now apply to spend one or two semesters during their third year at the University Centre in Svalbard (UNIS). The degree now also offers a module on underwater scientific SCUBA diving techniques. Both these elements bring significant uniqueness to our degree programme, and hopefully add a major attraction to prospective undergraduate students. Our postgraduate students are steadily completing their theses, largely on time, and with accolades from our visiting External Examiners. Another benchmark of the maturity of the academic education programme at SAMS is the growing employment of SAMS postgraduates in major marine research institutes around the world.

In the area of marine policy debate and the value of marine science to society, this reporting year has seen significant developments. The passage of a Marine Bill through both Scottish and English parliaments, although slow, now seems inevitable. In Europe, the implementation of a Directive on Maritime Policy is imminent, and the House of Commons Select Committee on Marine Science and Technology has been reviewing the status of marine science and its coordination across the UK in the university, research institute and government laboratory sectors. It is still rather early to tell how these major reassessments of marine



science and their contributions to the regulatory process will play out. One thing is clear though: there has never been a more important time to recognise the value of independent, quality research into the marine environment, and for this knowledge to find its way to our elected representatives on whose shoulders the future of safe, healthy and biologically diverse waters around Britain rest. SAMS will play its part in this process, and I thank all those staff and members who have contributed so energetically and purposefully to another highly successful year for the Association.

Professor G B Shimmield

NORTHERN SEAS PROGRAMME NSP



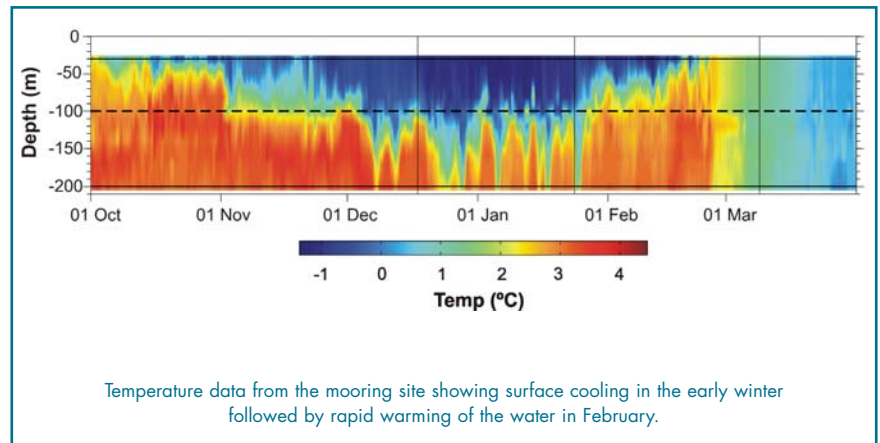
NORTHERN SEAS PROGRAMME NSP

The final year of the Northern Seas Programme (NSP) was a period of integration and synthesis, producing papers for publication and developing new ideas and themes for the forthcoming Oceans 2025 5-year programme starting in April 2007.

The programme has been prescient in recognising the importance of linking north Atlantic processes to those occurring in the European Arctic. During the time of field observations, each year recorded warmer-than-average conditions, extremes in precipitation and sea ice cover, and significant changes in plant and animal biota. SAMS scientists have demonstrated their unique skills in the field and in technology development to deliver some remarkable findings from the deep ocean to the intertidal zone.

The NSP has now set a sound framework for SAMS' contribution in the new Oceans 2025 consortium programme between the seven NERC-funded UK marine laboratories. In many areas of long term observation (rocky shores of Scotland, the Tiree Passage and Ellett Line, and moorings off Svalbard) we will be able to continue collecting and analysing important datasets. However, we will also introduce further synthesis to our studies, using an interdisciplinary approach to evaluate the linkages between physical forcing, environmental change, and response of the biosphere.

A final comment on the NSP is reserved for our contribution to understanding human impacts on the seas around Scotland and extending into the Arctic. We have demonstrated comprehensively, that man's impact can be measured, be it



in the contamination of metals and radionuclides in sediment cores, through benthic impacts of trawling on the sea floor or through mariculture activity, to changes and ecosystem response to climate and physical forcing. Such case examples are required to improve our operational management of marine resources, and to provide much-needed evidence for policy setting and regulation. SAMS will continue to advise local, national and international government on these matters using independent scientific advice and knowledge. The NSP has been cited in the development of the International Polar Year (2007-8), in the new Maritime Policy for Europe, in a potential Marine Bill for England and Scotland, and for the current review into Marine Science in the UK. Our polar work is now of significant interest to the UK Foreign and Commonwealth Office as the Arctic comes into sharp focus under international treaties.

In all, this programme has marked a time of major change for SAMS, and it is fitting that the scientific legacy will provide substantial input to future publications and advice to policy in the coming years.

Graham Shimmiel

SAMS ARCTIC OBSERVATORY DETECTS WINTER WARMING

Since 2002 SAMS has maintained an oceanographic mooring off northwest Spitsbergen close to where warm Atlantic Water flows north into the Arctic Ocean. The purpose of this mooring is to determine how the physical oceanography of that region is changing on monthly to interannual timescales and how this impacts the ecological and geochemical environment. During the winter of 2005-06, the typically sub-zero waters around the coast of Spitsbergen were found to be up to 5 °C warmer than normal; the consequence being a short-lived sea ice cover in the coastal waters. This has provided an important alternative causal factor for Arctic sea ice loss, other than a simple increase in air temperature. SAMS data were combined with observations collected by Dr Frank Nilsen of the University Centre in Svalbard and the results were analysed during his two week visit to Oban funded by The Royal Society together with support from the Norwegian-funded "Mariclim" programme.

Finlo Cottier, Mark Inall & Colin Griffiths

TREE PASSAGE SUSTAINED OBSERVATION

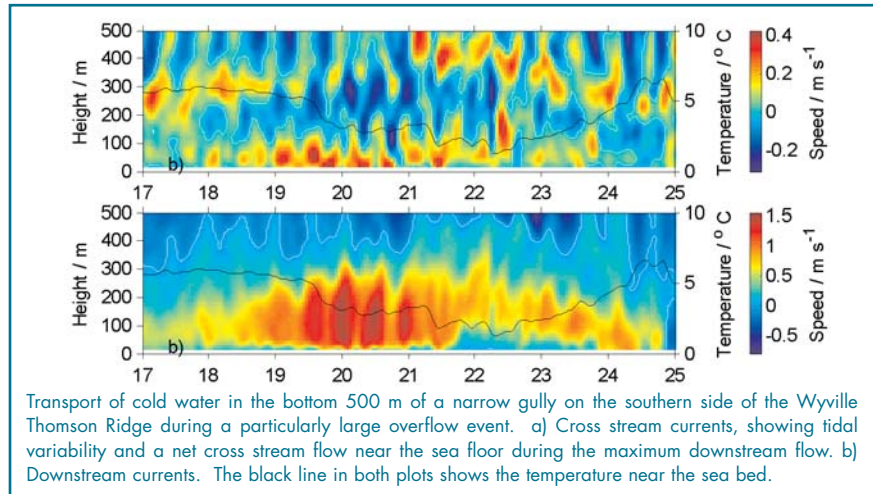
A strong link between the main climatic index of the North Atlantic (the North Atlantic Oscillation Index, or NAO) and the strength of the Scottish Coastal Current has been established by analysis of the 25-year time series collected in the Tree Passage by SAMS. The analysis also revealed the current, which flows northwards along the western coastline of the northern UK, to be twice as strong when compared with previous estimates. Furthermore, although not apparently related to the NAO, the warming trend of the continental shelf waters is shown to be $0.57\text{ }^{\circ}\text{C}$ degree centigrade per decade, whilst the timing of the annual maximum water temperature has been getting progressively later year on year.

Mark Inall, Colin Griffiths & Phil Gillibrand

WYVILLE THOMSON RIDGE OVERFLOW

Recent monitoring of the strength of the Wyville Thomson Ridge overflow, using moored Acoustic Doppler Current Profilers (ADCPs), has revealed that the mean transport of cold undiluted waters from the Nordic Seas into the Rockall Trough is of the order of 0.3 Sv. This flow rate (which is about half that of the Mediterranean outflow) is at the upper limit of earlier estimates and represents a significant contribution to the water mass of the upper 1000 m of the Rockall Trough.

Toby Sherwin



Transport of cold water in the bottom 500 m of a narrow gully on the southern side of the Wyville Thomson Ridge during a particularly large overflow event. a) Cross stream currents, showing tidal variability and a net cross stream flow near the sea floor during the maximum downstream flow. b) Downstream currents. The black line in both plots shows the temperature near the sea bed.

ELLETT LINE CRUISE

In October 2006 SAMS participated in the annual extended Ellett line cruise, from Iceland to Scotland, on RRS Discovery. The cruise revealed that the year on year warming of the surface waters of the Rockall Trough west of Scotland (set against seasonal averages) is continuing at a rate of about $0.2\text{ }^{\circ}\text{C}$ per year. A cooling trend of the deep waters of the Trough, that has persisted since 1975, may have started to reverse in recent years. The Ellett line cruise, which is a collaborative activity with NOCS, is recognised as a standard line by ICES and is the Climate Variability and Predictability (CLIVAR) UK - Iceland carbon/hydrographic section. The data are included in the Marine Climate Change Impacts Partnership (MCCIP) Annual Report Card.

Toby Sherwin

HOLOCENE CLIMATIC VARIABILITY: GLACIAL HISTORY FROM AN ARCTIC FJORD AND SHELF, WESTERN SPITSBERGEN, SVALBARD

An extensive study has been completed investigating the sediment record of Holocene (<10,000 years) climate variation on the marine environment of an Arctic fjord. Sediment cores were collected along a transect in the basins of glaciated Kongsfjorden on the northwestern coast of Svalbard. The cores were investigated using sedimentology, organic carbon, foraminifera and stable isotopes. They were dated using radiocarbon combined with core top ^{210}Pb chronology. The recovered sedimentary sections span a range of ages, reaching a maximum of ca. 6,000 years. The proxy records reveal variations in sedimentary processes, bio-productivity, glacier front position, sea ice conditions, and the hydrographic regime in the fjord. These characteristics are interpreted in terms of regional and global climate changes during the mid-late Holocene. The records reveal warm stable conditions for the three millennia subsequent to 6,000

NORTHERN SEAS PROGRAMME NSP

years ago. Initial cooling occurred between 3,000 and 2,000 years ago followed by intervals of warmer marine conditions between 1,300 and 900 years and 500 and 280 years ago. These episodes briefly interrupted the decreasing trend in productivity in the fjord that culminated in the glacial re-advance of the Little Ice Age around 1450 AD.

Suzanne MacLachlan, John Howe, Tracy Shimmield & William Austin (St Andrews)

ARCTIC ICE ON THE MOVE AND ON THE WEB

Latest advances in satellite communications technology and GPS receivers have been harnessed by the Marine Technology and Sea Ice Groups in the construction of small satellite beacons to track Arctic ice movement in critical areas such as the Nares Strait and north of



A suitcase buoy being deployed north of Svalbard.

Suitcase buoy tracks through Nares Strait superimposed on Google Earth image.



Svalbard. These 'suitcase buoys' can be easily deployed by helicopter and conveniently report their GPS positions by e-mail. The e-mails are processed by a server at SAMS and immediately published on the web. The next stage will be to publish the tracks as a Google Earth overlay.

Jeremy Wilkinson, Duncan Mercer & David Meldrum

TRANSPORT OF POLLUTANT METALS TO THE ARCTIC

The Arctic region is a seemingly pristine, remote environment, yet in the past few decades there has been increasing evidence that it is greatly impacted by anthropogenic metal contamination. The heavy metals can potentially have adverse effects on the health of the biota and indigenous populations, due to their toxicity and bio-accumulative tendencies within the environment. There are three main metal contaminants of major concern, lead (Pb), mercury (Hg) and cadmium (Cd). All have been reported as



The Polar Bear, a species facing the twin threats of toxic metal accumulation and climate change

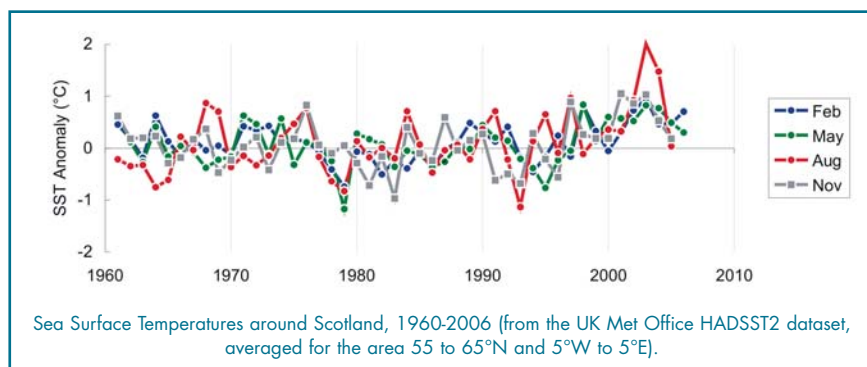
ubiquitous anthropogenic pollutants with elevated concentrations identified throughout the Arctic's sedimentary environment. This research investigates the heavy metal concentration within the Svalbard and Barents Sea regions of the Arctic, utilising marine and lacustrine sediment cores. Further cores were taken from the Voring Plateau. Pb in the cores reflects the changing source of the Pb over time, associated with anthropogenic contamination. The lake sediments reflect atmospheric transport with a Pb isotope signature indicative of an Eastern European input. In contrast, the oceanic Atlantic current shows a western derived Pb signature.

Lindsay Vare, Tracy Shimmield & Kenny Black.

CHANGES IN COASTAL SYSTEMS

A primary theme of the NSP was understanding change in coastal systems and, with the extra help of a NERC Small Grant, we aimed to see whether we could detect any changes in the coastal communities we have been studying since 2001. Since the beginning of the NSP there have been two of the warmest Augusts since 1960 (2003/04) and three of the warmest Februarys since 1960 (02/03/06), with only November 2005 being uncharacteristically cool. In July 2006, we resurveyed 25 rocky shore sites in Scotland previously visited in 2002, 03, 04 and 2005. The abundance of 71 species of plants and animals was assessed at each of these sites, as well as the population density and size structure of the main grazers (limpets *Patella vulgata*)

NORTHERN SEAS PROGRAMME NSP



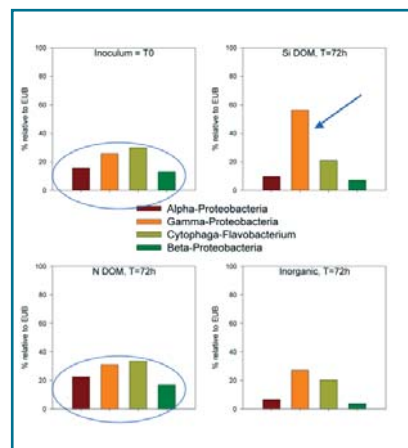
and the biomass of the larger seaweeds. Despite a relatively cool winter (by modern standards) in 2005/06, there was a noticeable increase in warm-water species and decrease in cold-water species on the rocky shores in the area since the earlier surveys. Of the 18 taxa identified as warm water species, 13 increased in abundance over the period and only 3 declined, while for cold water species 7 out of 13 declined and only 3 increased. This pattern of changes among the two groups of species was very unlikely to have occurred by chance (Chi-square = 7.726, $P = 0.0054$). Some changes were very obvious, such as the almost complete loss of mid-shore macro-algae from a large number of sites. It seems that the continued high temperatures since the start of the NSP have resulted in a change in shore assemblages in our region. The UK,

Europe and global nature of these changes is emerging through our links with other projects around the world. We shall certainly be keeping a 'weather eye' on these communities over the coming 5-year programme.

Mike Burrows, Robin Harvey & Linda Robb

PHYTOPLANKTON NUTRIENT LIMITATION AFFECTS BACTERIAL GROWTH AND COMMUNITY COMPOSITION

In coastal and fjordic marine systems the pelagic microbial community is stimulated by a wide range of both inorganic and organic nutrients. Phytoplankton typically utilise inorganic nutrients, and bacteria may utilise both inorganic and organic

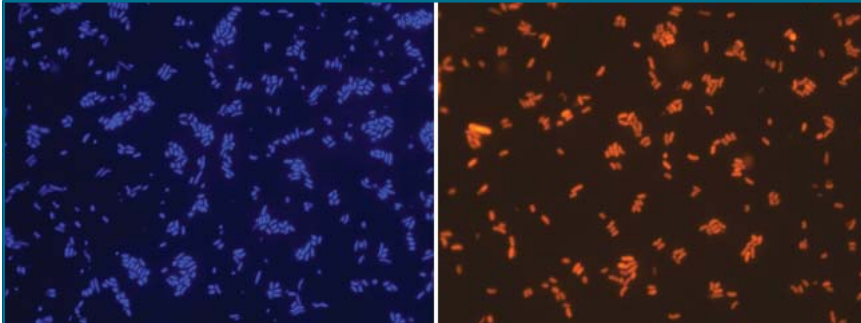


Relative composition of the planktonic bacterial community (EUB) from Loch Creran grown on dissolved organic matter (DOM) derived from nutrient limited phytoplankton. The bacterial composition remains the same after 72 hours growth on DOM from N-limited phytoplankton (bottom left versus top left plots); however, the Gamma-Proteobacteria dominate when grown on DOM derived from Si-limited phytoplankton (top right).

forms of nutrition. Organic nutrients may derive from terrestrial or atmospheric sources, from mariculture, or from the microbial community itself. In this work we examined the influence of inorganic nutrient limitation of phytoplankton on dissolved organic matter (DOM) production and its role in governing the bacterial community.

In many temperate waters, diatoms of the genus *Skeletonema* dominate the phytoplankton spring bloom. The nutrient limited senescent phase of this bloom is a potentially significant DOM source to bacteria. However, the form of nutrient limitation may influence the quantity and quality of this DOM. Typically, the growth of diatoms in the spring bloom may be limited by either nitrogen (N) or silicon (Si). We investigated the effect of both of these forms of limitation on the DOM production by *Skeletonema costatum* and the subsequent utilisation of these

NORTHERN SEAS PROGRAMME NSP



Planktonic bacteria from Loch Creran grown on Si-limited dissolved organic matter. The Gamma-Proteobacteria (orange-stained cells in right hand image) dominated the total bacterial population (blue-stained cells in left hand image).

exudates by a natural bacterial assemblage from Loch Creran on the Scottish West Coast.

S. costatum was found to produce higher concentrations of bulk dissolved organic carbon (DOC) and nitrogen (DON) following Si rather than N limitation (319 μM c.f. 239 μM). However, proportions of low and high molecular weight compounds (which are often used as an index of DOM lability) were similar in both conditions, although the carbohydrate signature of the high molecular weight fractions was different.

The origin (N or Si limited) of phytoplankton DOM extracellular release affected bacterial communities in term of abundance and production rate. In particular, abundance and production were significantly higher (~ 40% and 50% respectively) when the community grew on Si-limited phytoplankton-produced DOM. The form of the DOM also affected bacterial community and taxonomic composition, determined by Fluorescent *in situ* hybridisation (FISH) probe analysis, with a marked domination of Gamma-Proteobacteria in communities that received Si-limited DOM. The experiment demonstrated key roles of resources on bacterial growth, and a marked effect of

substrate on taxonomic composition, suggesting active and rapid adaptation of bacterial consortia.

Romain Pete, Keith Davidson, Mark Hart, Tony Gutierrez, Elaine Mitchell & Axel Miller

PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

Department members: Dr Mark Inall (Head), Mr David Meldrum (Deputy), Dr Tim Boyd, Dr Chris Cromey, Dr Finlo Coffier, Dr Andrew Dale, Dr Martin Doble, Dr Phil Gillbrond, Mr Colin Griffiths, Mr Nick Hughes, Mr Alistair James, Dr Duncan Mercer, Dr Paul Provorot, Dr Toby Sherwin, Dr Ian Sillitoe, Dr Pushkar Wadke, Dr Jeremy Wilkinson, Miss Yingzhaoo Zhou

PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

The department has continued to grow over the last 12 months, with four new ARC appointments. Dr Tim Boyd and Dr Andrew Dale, both physical oceanographers formerly from Oregon State University, joined us as Senior Lecturer in Polar Oceanography and Lecturer in Marine Modelling, respectively. Dr Finlo Cottier became Lecturer in Polar Oceanography and Dr Pushkar Wadke, newly graduated from Sheffield University, joined us as a Post Doctoral Research Fellow in Marine Technology. Two new PhD students joined or registered with the Department: Emily Venables, a Masters graduate from Southampton University and Sarah Hughes, also a Southampton graduate, now employed by FRS Aberdeen as a Physical Oceanographer. Two new ARC support scientist posts are shortly to be filled (Autonomous Underwater Vehicle Technician and Electronics Technician). Duncan Mercer left the technology group for a robotics post at the University of Sydney, Australia, while Yingzhao Zhou resigned to take up a post with NEC in Reading: a new senior post is being advertised to help redress their loss.

Project highlights from our wide range of activities in 2006-7 follow.

MARINE PHYSICS GROUP

ARCTIC MULTI-PARAMETER OBSERVATORIES

During the last year SAMS has expanded its observational capabilities in the Arctic establishing itself as a UK leader in Arctic Shelf Seas observatories. Following the continued success of the moored time

series established in Kongsfjorden, NW Spitsbergen, an identical suite of instruments was deployed in September 2006 in Rijpfjorden in the far north east of the Svalbard archipelago. The instrumentation on the mooring allows us to investigate the interactions between the physical, biological and geochemical processes; particularly in the way they respond to changes in Arctic inflow. Rijpfjorden is representative of true Arctic conditions and the mooring data will allow comparison with the Kongsfjorden site which has a stronger influence from Atlantic Water. Logistics for the new mooring are financed through the Norwegian Research Council and the project is led by Dr Jorgen Berge of University Centre in Svalbard (UNIS). During 2007-8 Dr Berge will spend his sabbatical in Oban integrating with SAMS Arctic research activities.

Finlo Cottier & Colin Griffiths

MODELLING ASSIMILATIVE CAPACITY IN SCOTTISH SEA LOCHS

The Physics group at SAMS is collaborating with Prof. Paul Tett of Napier University, Edinburgh, and scientists at the Fisheries Research Service, Aberdeen, to develop new models of assimilative capacity in Scottish sea lochs. The models are needed to improve the assessments of the biomass of farmed salmon that can be produced in Scottish lochs, voes and coastal waters without causing harmful effects on the local marine ecosystem or the farmed fish. The project began in July 2005 and is due for completion in August 2007.

The new mathematical models will simulate changes induced by fish farm waste products on water quality variables such as dissolved plant nutrients (nitrate, ammonium and phosphate), dissolved oxygen, the transparency of seawater and the amounts of phytoplankton in the water. The evolution of dissolved properties over time is partly a function of the rate at which water in the loch is exchanged with coastal water from outside the entrance. Previous models of assimilative capacity in lochs used very simple estimates of this exchange rate, usually based on tidal flushing of the loch. Our role within the project is to improve the estimates of the rate of exchange of properties, both within different water layers in the loch and with the coastal water outside. To do this, we are parameterizing the complex exchange processes, such as tidal flushing, the estuarine circulation and vertical mixing, by simple mathematical expressions that can be quickly evaluated and used to determine the total exchange rate. The predicted exchange rates will then be utilized in models of biochemical processes being developed by Professor Tett.

Phil Gillibrand & Mark Inall

FAROE-SHETLAND CHANNEL TRANSPORT

An analysis of the northward transport in the surface waters of the Faroe-Shetland Channel over the last decade has demonstrated significant seasonal variability across the channel, which is linked to wind forcing. On average the net transport is strongest in September (~4 Sv) and weakest in spring (~2.5 Sv). This

PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

work has been carried out in collaboration with Fisheries Research Services, Aberdeen.

Toby Sherwin

MARINE TECHNOLOGY GROUP

AUTONOMOUS PLATFORMS: ICE TETHERED PROFILERS, HOMER AND LANDERS

The group is a member of two consortia that have been successful in winning NERC grants for the development of novel measurement systems for polar science. In the first of these, Arctic Synoptic Basin-wide Oceanography, the group will develop, build and deploy a number of ice tethered stations for the measurement of thermal fluxes and thickness changes within the Arctic ice pack during the International Polar Year. In addition to a comprehensive suite of surface measurements, the stations will deploy profilers for making measurements in the sub-ice water column. Two types of profiler will be used: a model already developed by the Woods Hole Oceanographic Institution, and a new SAMS profiler that will sample to much greater depths if required.

The SAMS profiler will draw on experience built up during our development of the Homer seabed-resident profiler, which continues to benefit from an ongoing evaluation and improvement programme. Two Homers will be deployed close to the Antarctic coast during the austral summer 2008-9 under our second successful NERC proposal, the Synoptic Antarctic Shelf-Slope Interactions Study, led by the

University of East Anglia. The Homers will make a year-long series of water column measurements to investigate processes taking place under the seasonal ice cover.

Seabed landers continue to feature strongly in our technology collaborations with other institutes, a notable event during the year being the hosting at SAMS of a major European deployment campaign within the COBO programme, during which scientists from 13 institutes worked together to deploy numerous different landers and to exchange technologies and ideas. A number of new lander-related appointments are to be made within the ARC recruitment initiative, emphasising SAMS' commitment to this important technology.

Alistair James, David Meldrum, Ian Sillitoe & Pushkar Wadke



The Homer profiler being recovered after a successful trial in Loch Etive. An acoustic modem (right side of image) was used to transmit sensor data from the profiler sphere (centre of image) to a surface buoy. An Iridium satellite modem in the buoy then transmitted the data back to the laboratory. The equipment is a prototype of systems that will be deployed in remote and inhospitable locations such as the Antarctic. Photo: Luka Musić

The group continues to be active in evaluating new satellite communications technologies, and this year SAMS has been amongst the first institutes to make extensive use of the new Iridium 9601 modem for the transmission of data from the Arctic under the CryoSat programme. The modem is smaller, cheaper and less energy-hungry than previous models, and has opened up the possibility of extensive use of the Iridium system in ocean and ice observation. In this context, SAMS is leading the WMO Data Buoy Cooperation Panel's Iridium Pilot Project, which will see up to 50 Iridium-equipped drifters deployed in the global oceans as part of an end-to-end evaluation of Iridium as a reliable communications channel for ocean data. The group will also be sponsored to undertake initial trials of the new 2-way Argos communications system launched in October 2006 on board the European METOP-1 satellite. SAMS' reputation and visibility in this area continues to benefit from David Meldrum's ongoing chairmanship of the Data Buoy Cooperation Panel.

David Meldrum & Pushkar Wadke

EFFICIENT NAVIGATION AND MESSAGING TECHNIQUES FOR AUTONOMOUS VEHICLES

A hybrid navigation technique has been developed for the case of autonomous vehicles moving within an unstructured two-dimensional environment. The technique combines reactive path planning and deliberative goal planning through a knowledge-base of way-points, acquired during the exploratory phases of the technique. The deliberative planning

PHYSICS, SEA ICE AND TECHNOLOGY DEPARTMENT

method uses an efficient form of genetic algorithm, whilst the reactive behaviour is derived from an on-line decision-tree learning method. Since the technique does not rely upon the use of a pre-existing map of the environment and the efficiency approach increases with each successive navigation task, the technique has potential in autonomous mapping and data harvesting applications.

Another technique, developed from fuzzy-based entropy methods, permits the reduction of message traffic in resource limited reactive distributed control systems, such as autonomous underwater vehicles. The introduction of the method into an existing control system has demonstrated a reduction in overall energy consumption, whilst maintaining the behavioural response of the original system. The approach is general and provides the potential to extend the operational life of battery powered platforms, such as AUVs, drifters and landers.

Ian Sillitoe

SEA ICE GROUP

This year marked another busy year for the Sea Ice Group with its participation in the EU-funded DAMOCLES programme, a 47 partner Integrated Project for Developing Arctic Modelling and Observing Capabilities for Long-term Environmental Studies. On a national level the NERC funded Cryosat validation Programme enabled scientists from the Group to participate, with other international scientists, in a field campaign north of Canada. During this campaign we deployed 10 drifting ice buoys, and

studied sea ice and snow properties (thickness, density, crystal structure, salinity). Nick Hughes completed a third round of sea ice information updates to the UK Hydrographic Office, Admiralty Pilots publications in September 2006. Areas covered included the St. Lawrence River in Canada, Norway and the east coast of the USA.

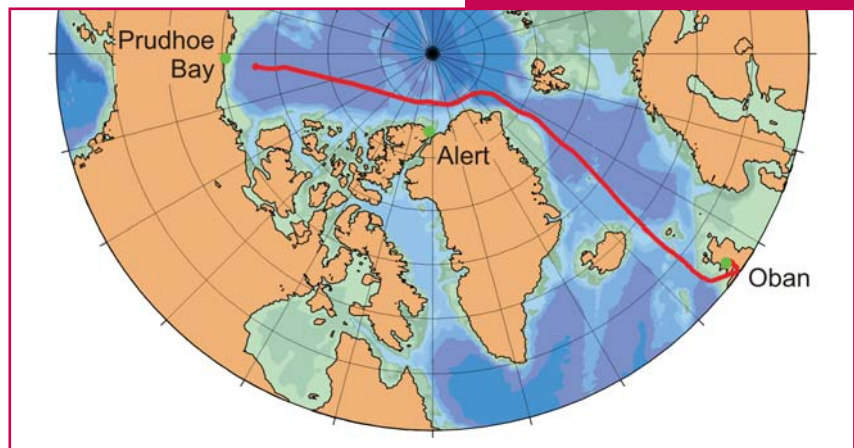
From December 2006 to February 2007 Nick Hughes provided satellite image analysis of the sea ice conditions to the British Antarctic Survey ship RRS *Ernest Shackleton* during its voyage to re-supply Halley Base in Antarctica. This was part of the ESA GMES Polar View project. In March 2007 he participated in his second Royal Navy ICEX (ICe EXercise) on board the submarine HMS *Tireless*. Following this Nick went on to participate in the APLIS/SEDNA ice camp in April along with Jeremy Wilkinson.

or Co-PI in a further six funded International Polar Year programmes.

Jeremy Wilkinson & Nick Hughes



View along the deck of HMS *Tireless* surfaced on 16 March 2007 at the APLIS/SEDNA ice camp in the Beaufort Sea.



This year also saw the funding of a new EU programme 'Understanding the impact of a REduced ice Cover in the ARctic Ocean' (RECARO). This programme involves 20 partners from 10 European countries, as well as Japan and the USA. RECARO is co-ordinated by Wilkinson. Hughes and Wilkinson are involved as PI

Cruise track of HMS *Tireless* during the ICEX exercise

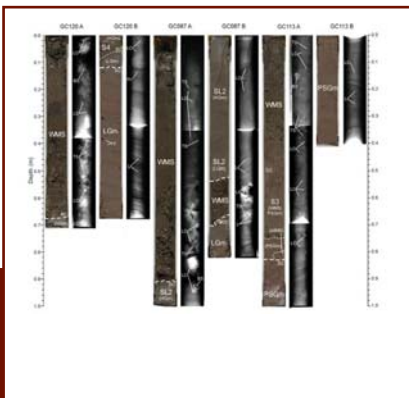
BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

Department members: Dr Tracy Shimmield (Head), Dr John Howe (Deputy), Mr Tim Brand, Miss Katie Deig, Miss Cheryl Haddon, Mr S Mairlyn Harvey, Dr Angelic Hutton
Miss Susan McKinlay, Dr Axel Miller, Miss Terrie Sawyer, Dr Henrik Stahl, Dr Robert Turnewitsch

BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

REVEALING THE DEGLACIAL ENVIRONMENTS OF THE SUMMER ISLES, NW HIGHLANDS

Little Loch Broom is a glacially over-deepened sea loch in the Summer Isles region of NW Scotland, an area formed by a tributary glacier of the Minch Ice Stream during the mid- to late-Pleistocene. This area is the focus of a collaborative project between the British Geological Survey and SAMS to investigate the deglacial history of the region over the last 15,000 years. The study uses seabed surveying and sampling to investigate both the palaeo and modern depositional environments. Core samples were studied at SAMS and reveal the deglacial history of Little Loch Broom. The seafloor survey, obtained by BGS displays a well preserved submarine fjordic landscape, with large glacial moraine complexes at the mouth and centre of the loch. The high-resolution sub-bottom seismic profiles revealed very irregular bedrock and morainal sediment in the loch, covered with up to c. 55 m thickness of sediment



Core photographs and x-ray images of gravity core from Little Loch Broom. Key: S4, Slump deposit; SL2, Slide deposit; S3, Slump deposit; PSGm, Pre-slide glaciomarine sediments; TS, Turritella shell; F, Folded lamination; FT, Faulted lamination.

which thins to less than 1 m on the highs and steep flanks of moraine complexes and sills in both basins of the loch. Slide scars and debris lobes are evident in both basins, evidence for the unstable nature of the slope, as well as thick layers of gas-rich sediment. The sediment cores display five distinct lithofacies, three of which were also sampled as overturned slumps derived from slides: 1) silty-muds; 2) current-winnowed, shell- and pebble-rich muddy-sands; 3) fine-grained glacio-marine clays; 4) laminated glacio-marine clays; 5) glacio-marine layered sands, silts and clays. The work will continue with the dating of these events in order to determine the precise timing of ice-sheet retreat across the NW Highlands during the last 15,000 years.

This work is a collaborative project with Martyn Stoker, Tom Bradwell and Nick Golledge of the British Geological Survey (BGS), Edinburgh.

John Howe, Charles Wilson & Tracy Shimmield.

SEDIMENT DYNAMICS IN THE DEEP SEA: THE WEAK-TIDE ENDMEMBER

Seafloor features such as abyssal hills and seamounts structure the seafloor on spatial scales of kilometres up to tens of kilometres and are ubiquitous in many parts of the world ocean. In addition to quasi-steady inflow, tides interact with these topographic features. In the open ocean such kilometre-scale flow/topography interactions can locally considerably enhance overall current velocities and control the composition of the sediment and, hence, the formation of the

sedimentary record. Therefore, kilometre-scale flow/topography interactions are very likely to also influence the structure and dynamics of benthic (and possibly benthic-pelagic) communities, biogeochemical fluxes across the sediment-water interface, and the interpretation of the sedimentary record. Very little, however, is known about these connections.

To approach this interdisciplinary subject in a systematic manner a study was conducted in a deep-sea environment which is characterized by very weak tides, thus reducing the impact of tidal flow on the interpretation of results. In December 2006 we collected water-column and sediment samples across the Anaximenes seamount in the abyssal Eastern Mediterranean as part of cruise M71/1 of RV Meteor (chief scientist: Bernd Christiansen, University of Hamburg). The natural radioactive particulate matter tracers ^{234}Th and ^{210}Pb , particulate organic carbon and nitrogen, and the inorganic elemental composition of particulate matter were analysed to investigate how the flow/topography interactions are translated into sediment dynamics in such a weak-tide deep-sea environment.

Three specific aspects of the connection between fluid and particulate-matter dynamics are being investigated: (1) How are varying hydrodynamics during the neap-spring tidal cycle reflected in particle composition and dynamics in the near-bottom water column above sloping seafloor? (2) How does the amount of deposited sedimentary material vary across sloping seafloor? (3) How does the bioturbation intensity vary across sloping seafloor?

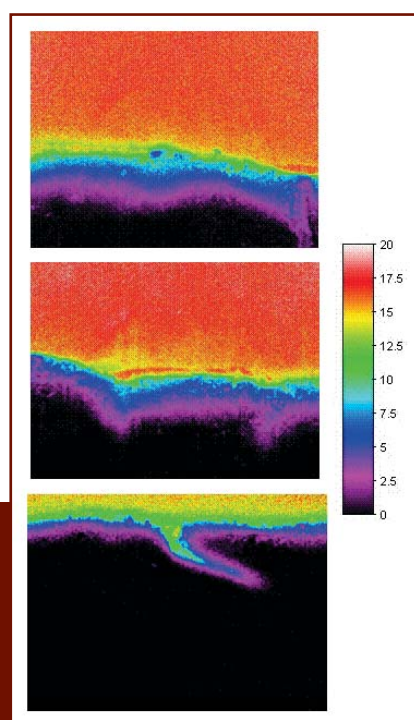
BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

This work is being conducted in collaboration with colleagues from the University of Rostock, National University of Ireland, Galway, University of Hamburg, and the Baltic Sea Research Institute, Warnemünde (IOW).

Robert Turnewitsch

BENTHIC OXYGEN DYNAMICS IN SAGAMI BAY, JAPAN

In close collaboration with the Institute for Research and Earth Evolution at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and MPI-Bremen, two cruises were undertaken during March and December 2006 to Sagami Bay, Japan (~1200 to 1450m water depth). Although this deep-sea environment is in the middle of an oxygen minimum zone (~50 μM O_2 in bottom



Three O_2 planar optode images showing microniches and irrigating fauna at the sediment water interface (scale bar is in % O_2 saturation)

water) with high organic loading, it has an abundant benthic macro- and meio fauna. Despite the depth, it also experiences clear tidal signals and the area is host to a number of cold seeps with their associated faunal communities. A combination of benthic chambers, microelectrode profilers and planar optodes was used to study the benthic oxygen dynamics in Sagami Bay. The instruments were deployed autonomously from the research vessel attached to benthic lander platforms which sank to the bottom by their own gravity. While on the bottom, the instruments were gently relocated by a ROV and measurements were initiated by pressing an external button on the lander.

Results showed an extensive small scale spatial variability in the 2-D oxygen distribution over areas of only a few cm, with O_2 penetration depths from 4.5-11.5 mm and with average O_2 fluxes of 2.8 $\text{mm m}^{-2} \text{d}^{-1}$ in March 2006. Planar optode O_2 images revealed bio-irrigating macrofauna as well as dynamic



Launching the profiling lander in Sagami Bay

microniches induced by sedimenting marine snow aggregates. During the December cruise, the first ever measurements were made with a transecting microprofiler resulting in 155 microprofiles within an area of 330 cm^2 . Furthermore, during this cruise a newly developed Japanese planar optode module was for the first time connected to a permanent underwater observatory (1200m depth) for power supply and online data transfer. Among other things, this week-long deployment showed a significant influence of the tidal signal on the oxygen penetration depth measured from the 2-D O_2 planar optode images.

Henrik Stahl & Ronnie Glud

COLD CORALS - HOT SPELEOTHEM

At first glance the two environments are very different: the chilly murk of the deep Atlantic Ocean would seem to have little in common with the suffocating tropical heat of the Philippines. Yet both locations are targets for our research into paleoclimate and incongruously these places yield a very similar material – the banded carbonate rock that contains a geochemical history of our climate's heartbeat.

Looking for all the world like submarine trees, deep-sea Gorgonian corals such as the bamboo coral *Kearatoisis*, secrete a trunk of calcite which in cross section resembles the annual growth bands of their arboreal counterparts. Measuring trace elements in these layers allows us to reconstruct the history of the deep ocean over the life of the specimen – in this case

BIOGEOCHEMISTRY AND EARTH SCIENCES DEPARTMENT

yielding nearly 300 years of variations in the Florida Current (a major tributary of the Gulf Stream). Magnesium and strontium are both temperature proxies and indicate that the Gulf Stream east of Florida has remained remarkably constant over 3 centuries, even as its more northerly components have weakened. Manganese tells a story of African drought, written in the flux of Mn-rich dust blown across to the Caribbean from central Africa. Lead preserves a history of human pollution since the industrial age, while Barium contains the story of surface marine productivity.

University, Canada), Fred Taylor and Jay Banner (University of Texas)

Dan Sinclair



Revealed unexpectedly in a long exposure photograph, a moss paints these stalactites with subtle mauves and greens near the entrance to a cave in the highlands of Espiritu Santo, Vanuatu.

In the tropical caves etched from ancient coral reef grow speleothems – drip stones deposited when acidic groundwater reluctantly releases a little of the limestone it has devoured. In section, stalagmites are also banded, and like the deep corals these layers of calcite contain a geochemical history – in this case the story of wind and water and their changes as the vast glaciers of the last ice age retreated before a warming earth. Going back 30,000 years, these ancient stalagmites contain an archive of the changes to our climate throughout and beyond the span of human civilisation. This work is being conducted in collaboration with Mike Risk (McMaster

Department members: Dr Kenny Black (Head), Dr Michael Burrows (Deputy), Dr Robert Batty, Dr Elizabeth Cook, Dr Andrew Davies, Dr Symon Dworjanyn, Dr Clive Fox, Dr Sheila Heymans, Mr Robin Harvey, Dr David Hughes, Dr Lea-Anne Henry, Dr Maeva S Kelly, Dr Kim Last, Mr Peter Lamont, Ms Hui Liu, Mr Christian Loenborg, Miss Shona Magill, Dr Lois Nickell, Dr Thomas Nickell, Mrs Heather Orr, Dr Tavis Potts, Mrs Linda Robb, Dr Murray Roberts, Dr Martin Sayer, Miss Coleen Suckling, Dr Tom Wilding, Dr Kate Willis, Ms Averil Wilson, Dr Ben Wilson



The invasive alien *Caprella mutica*

ECOLOGY DEPARTMENT

TIME-KEEPING IN THE MARINE ENVIRONMENT

For the ragworm *Nereis virens*, life is a precarious existence since just about every bird, fish and crab finds it appetising. Fortunately, these predators have set mealtimes; both birds and fish tend to feed during the daytime, whilst crabs feed at night when the tide is high. As *Nereis* has

screened before ideal 'candidate' worms are selected for genetic studies of the basis for this clock.

Through collaborations with molecular biologists at the University of Leicester and biologists at Newcastle University, we have constructed a number of *Nereis* cDNA gene libraries and created a *Nereis* cDNA microarray which has provided

THE DEEP-SEA CORALS OF THE MINCH

The Outer Hebridean Island of Mingulay has a hidden secret. Several miles offshore lies a complex of cold-water coral reefs formed by a single coral species, *Lophelia pertusa*. Discovered in 2003 by SAMS researchers using state-of-the-art sonar techniques, *Lophelia* forms reefs that can



Left: The ragworm *Nereis virens*

Right: 3-D bathymetric representation of the Mingulay reef complex generated using sonar mapping

Far Right: Severe fouling on a recreational vessel in Malahide Marina, Dublin. Photo by Dan Minchin.

to venture out from its burrow to feed at a time when it is safe, it needs something that terrestrial organisms lack – a complex clock which tells the time of tide and the time of day simultaneously. My work has been to understand this biological clock both at the behavioural and at the molecular level. I have developed a device for monitoring the activity of many worms and have found that some animals' out-of-burrow feeding rhythms persist in the laboratory even without any tidal or daily signals, providing evidence for an endogenous (or innate) biological clock. However, many worms have poor cycles of activity - the 'couch potatoes' of the worm world - so large numbers have to be

information on the expression of thousands of genes simultaneously. This microarray has allowed us, for the very first time, to identify genes with tidal 12.4 hour and/or lunar day 24.8 hour periods. We have also found some genes with 24 hour cycling periods which are possibly the same as our own circadian genes. By gaining a better understanding of time-keeping in *Nereis* we hope to improve our understanding of our own biological clock that probably evolved from a much more complex lunar/solar chronometer.

Kim S Last

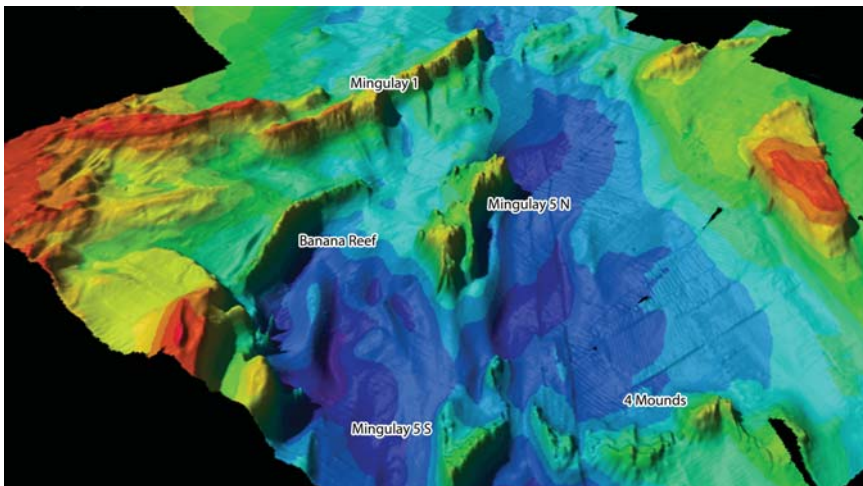
grow as high as a house and extend for several kilometres, but details of their ecology and biodiversity are only now being unravelled. Through the EU-funded 'HERMES' project, Drs Andrew Davies and Murray Roberts have been working closely with Dutch researchers from the Royal Netherlands Institute for Sea Research (NIOZ) to better understand the ecology and distribution of *Lophelia* in the Minch. In 2006, we extended our knowledge of the distribution of corals in the area. In the process we discovered a previously unknown banana-shaped reef and a series of interconnected mounds to the south (Four Mounds, see figure). The corals require a particular set of

environmental conditions in order to grow and to examine what makes the Minch suitable, we deployed recording instruments on moorings and seabed landers. The data showed a cyclic process which appeared to provide the corals with food from the surface. This formed the focus for our 2007 cruise to Mingulay, this time armed with more moorings and landers, current profilers, sediment traps

MARINE ALIENS – THERE ARE MORE OUT THERE THAN YOU THINK!

The intentional or accidental introduction of non-native species by humans is second only to habitat destruction in causing the global loss of biodiversity. Biological invasions can significantly alter the structure of a particular environment. For

Thanks to the research effort, over 130 non-native marine species, both macro- and microscopic, have now been identified in UK coastal waters. Over 70 % of the largest marinas in Scotland are known to contain marine aliens and awareness has been raised regarding hull fouling (recently added to the International Maritime Organisation agenda) and aquaculture as major international vectors



and conductivity, temperature, depth recorders. The data collected will give us valuable insights into the food sources and environmental conditions that make this area suitable for cold-water coral reef development.

Andrew Davies & J Murray Roberts

example, the invading Zebra mussel (*Dreissena polymorpha*) in the Great Lakes, Canada, the non-native European green crab (*Carcinus maenas*) in central California, and the alien green alga *Caulerpa taxifolia* in the Mediterranean Sea have all caused the extinction of native species and fundamentally altered the systems that they invaded. In addition to the biological cost, invading species can also have significant impacts on the economy. Over the last three years, Dr Liz Cook at SAMS has led a UK-wide project on Marine Aliens funded by the Esmée Fairbairn Foundation. Prior to this work, very little was known about the numbers and distribution of marine aliens in the UK.

for the spread of marine alien species.

Liz Cook, Gail Ashton, Richard Shucksmith & Karin Boos

For more information about cold-water corals, please visit: www.lophelia.org

For more information on the Marine Aliens project see www.marlin.ac.uk/marine_alien

MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

Department members: Dr Roy Leckey (Head), Dr Fritziot Küpper (Deputy), Dr Eamon Bell, Mrs Urdine Achilles-Day, Mrs Debra Brennan, Mrs Christine Campbell, Dr Keith Davidson, Dr John Day, Dr Claire Gachon, Miss Gosiá Gai, Dr Tony Gutierrez, Dr David Green, Dr Mark Hart, Dr Vincent Le Fouest, Miss Sharon MacNeill, Ms Elaine Mitchell, Mr Romain Péte, Dr Thomas Proschold, Miss Rachel Saxon, Dr Dermot Sherry, Dr Michelle Stanley, Ms Sarah Swan, Mr Tim Wilkinson

MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

KARENIA MIKIMOTOI: A HARMFUL DINOFLAGELLATE IN SCOTTISH WATERS

The dinoflagellate *Karenia mikimotoi* is a harmful phytoplankton species with the potential to negatively affect, and in some cases kill, farmed fish and other marine fauna. The species can form very dense "red tides" with faunal mortalities resulting from toxin production or anoxia generated by the dense bloom. *K. mikimotoi* is a common component of the summer phytoplankton in Scottish waters, usually at sufficiently low densities that no harmful effects are evident. However, a significant and prolonged bloom of *K. mikimotoi* was observed during 2006. This bloom is thought to be unique in Scottish waters in terms of the large area over which elevated cell densities were observed. Previous blooms in the region in 1980, 1999 and 2003 were, in contrast, restricted geographically to the Clyde Sea lochs, the Orkney Islands and the Shetland

Isles respectively.

The 2006 bloom was detected by the Food Standards Agency-funded marine biotoxin producing phytoplankton monitoring programme, based at SAMS. While previous blooms in Scotland have resulted in fish kills, the major impact of the 2006 bloom was extensive mortalities of benthic organisms. The bloom was first evident on the Scottish west coast in mid July, in Loch Scridain on Mull, and Loch Roag on Lewis. These observations coincided with elevated chlorophyll concentrations that had previously been evident offshore from satellite remote sensing (data supplied by P Miller, Plymouth Marine Laboratory). This and meteorological evidence strongly suggest that the *K. mikimotoi* bloom developed offshore and was advected towards the coast.

As the cell density declined in early August in the Western Isles, increases occurred in the Orkney and Shetland Isles, and also

on the east mainland coast during mid August. The progression of the bloom was generally consistent with cells being transported in the Scottish coastal current. However, the rate of increase of cell numbers and the peak cell density at particular sampling sites was quite variable between sampling locations.

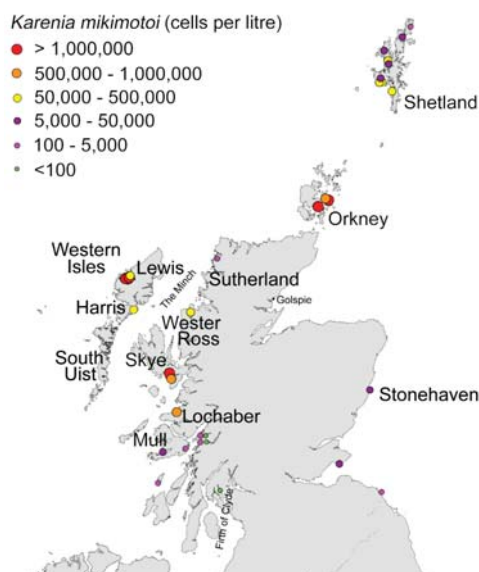
Analysis of the transport of the bloom and the relationship between bloom density (and hence potential to cause harmful effects) and environmental conditions is currently being conducted with Crown Estate funding, using mathematical and statistical models,

Keith Davidson, Sarah Swan, Tim Wilkinson, Christine Campbell, Sharon McNeill & Debra Brennan

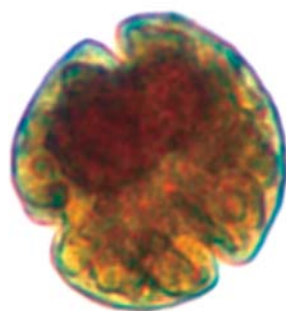
THE DEVELOPMENT AND COMMERCIAL EXPLOITATION OF BIOEMULSIFIERS

Emulsifiers are chemical entities used to mix two immiscible substances, such as oil and water, and are used in many industries worldwide, most notably foods, cosmetics and healthcare. Currently, a significant fraction of the market demand is met by synthetically produced emulsifiers; however an important trend in the food and healthcare industries is to adopt the use of 'natural' ingredients.

Biosurfactants are microbially produced surface-active molecules, of which some have emulsifying activity and are called bioemulsifiers. Both are commercially promising alternatives to the chemically synthesised varieties because of lower toxicities, higher biodegradability and

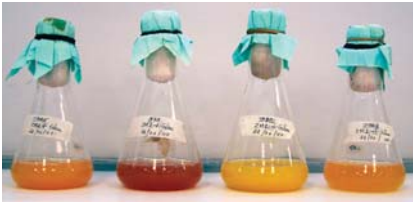


Abundance of the harmful dinoflagellate *Karenia mikimotoi* recorded off the Scottish coast in summer 2006.



The harmful dinoflagellate *Karenia mikimotoi*

MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT



Bioprospecting for novel emulsifiers in diverse marine bacteria.

improved properties such as foaming and stabilisation, and tolerance to wider extremes of temperature, pH and salinity.

Despite the potential advantages of microbially derived biosurfactants, commercial production is often not achieved because of low yields and high production costs. At SAMS, we have developed a suite of marine bacteria that produce novel bioemulsifiers with excellent emulsifying and stabilizing activity. This work, originally funded by local development agencies (HIE/AIE), has now been awarded 'proof-of-concept' funding by NERC to advance development of production methods, enable market analysis and enhance exploitation of commercial opportunities.

Tony Gutierrez & David Green

UNDERSTANDING THE HOW AND WHY OF MARINE BACTERIA: THE GENOMICS APPROACH

Research at SAMS has identified a number of bacteria that repeatedly co-occur with dinoflagellates, and that there is apparently two-way communication between the dinoflagellate and bacteria. It is important to understand how these bacteria may be contributing to dinoflagellate growth with subsequent effects on (i) primary productivity and (ii)

the formation of harmful 'red tides' caused by some species of dinoflagellate.

Accessing all the genes encoded on the bacterial chromosome is one way to begin to understand the 'functionality' of bacteria. A successful application to the Gordon & Betty Moore Foundation Microbial Sequencing Initiative will enable us to sequence the whole genomes of three dinoflagellate-associated bacteria and has already resulted in the delivery to SAMS of ca. 14 million nucleotide base pairs of genetic information. These 'blueprints' of microbial life are now being studied to begin to understand the role of these bacteria in algal-bacterial interactions. For example, this information will guide the identification of potentially important genes that will then be genetically "knocked-out" to identify if gene loss results in an aborted algal-bacterial relationship.

We are using this information, in conjunction with Prof. C Carrano of San Diego SU (funded by the California Sea Grant), to examine the regulation of genes involved in the biosynthesis of iron-binding compounds that are potentially important to the supply of iron to the dinoflagellate host.

David Green & Mark Hart

Table 1. Vital statistics of SAMS' dinoflagellate-associated bacteria.

	DG881	DG893	DG1235
GENOME LENGTH	3,800,634	4,412,179	5,770,561
GENOMIC GC	58.00 %	57.00 %	54.00 %
GENES	3,335	4,127	4,903
CODING	86.12 %	91.00 %	85.51 %
rRNA COUNT	38	45	43

ALGAE AND INNATE IMMUNITY

The brown alga *Ectocarpus siliculosus* has recently become the first seaweed of which the entire genome has been sequenced. In this context, we are studying the molecular basis of the interaction of *Ectocarpus* with the oomycete *Eurychasma dicksonii*. Oomycetes are a group of devastating plant and animal pathogens – including potato blight *Phytophthora infestans*, and the cotton mould fish pathogen *Saprolegnia ferax*, a resurging threat to fish stocks and aquaculture worldwide.

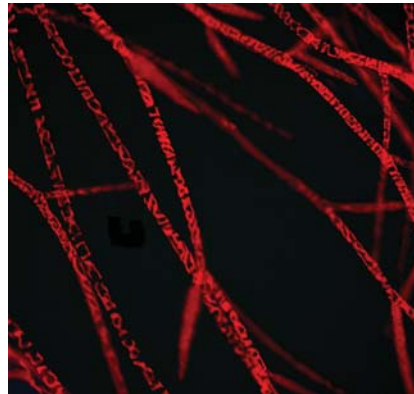
Eurychasma is the marine pathogen with the largest documented host range, infecting all orders of brown algae, and has been observed around the whole Northern Hemisphere in polar and temperate seas. An expedition to Patagonia and the Falkland Islands in early 2007 has established the presence of *Eurychasma* in comparable, macroalgal-dominated ecosystems in cold-temperate climates in the Southern Hemisphere and provided isolates for our research concerning innate immunity in brown algae.

In the laboratory, we have demonstrated that certain *Eurychasma* strains can infect some *Ectocarpus* strains, but not others.

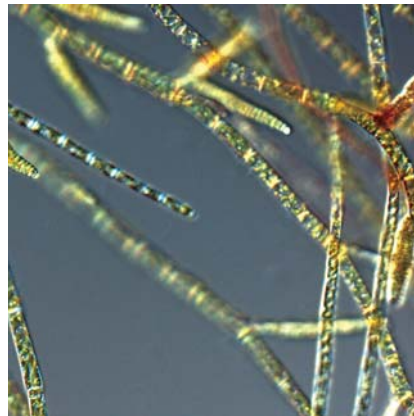
MICROBIAL AND MOLECULAR BIOLOGY DEPARTMENT

Our results suggest that algal resistance against this pathogen involves cell death, i.e. an algal filament sacrifices single, infected cells in order to limit the spread of the disease. Ongoing research aims to dissect the cellular and molecular events of disease and resistance, and in particular, to elucidate the role of defence-related genes in the *Ectocarpus* genome. We are contributing to the annotation of the genome sequence, and SAMS will host the "Ectocarpus 2008" meeting next June.

Claire Gachon, Martina Strittmatter & Frithjof Küpper

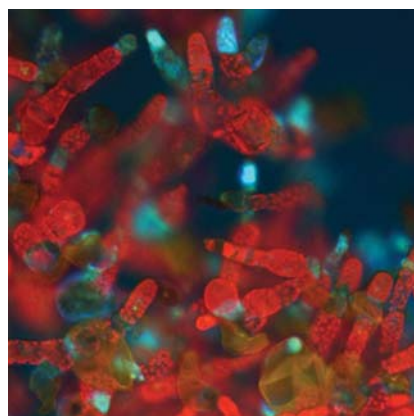


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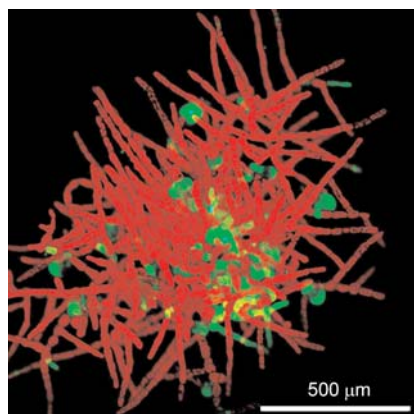


B

A,B: *Ectocarpus siliculosus* (A, UV light; B: interference contrast) has recently become the first brown alga ever to be fully sequenced.



C



D

C,D: *Eurychasma dicksonii* imaged by epifluorescence microscopy. This oomycete pathogen infects the microscopic, haploid gametophyte developmental stages of the North Atlantic kelp *Laminaria digitata* (C) and of the Pacific giant kelp *Macrocystis pyrifera* (D). *Eurychasma* stained in green by CFSE; the algal chlorophyll appears red.

NATIONAL FACILITIES

CULTURE COLLECTION OF ALGAE AND PROTOZOA (CCAP)

CCAP DEVELOPMENTS

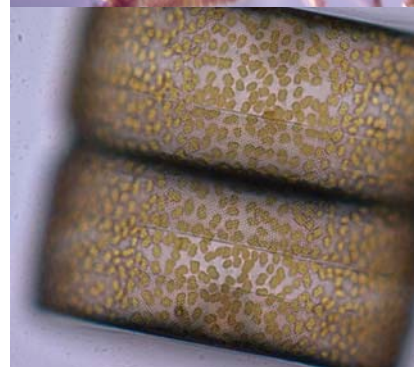
The CCAP currently maintains in excess of 3000 strains of algae (including cyanobacteria) and free-living, non-pathogenic protozoa, with more than 2700 of these being held in the publicly accessible collection. In 2006/07, 202 new strains were added to the Collection, including 14 authentic strains derived from original type material (details of new accessions are listed on the CCAP website www.ccap.ac.uk). The CCAP acts as the UK Service Collection for the provision of cultures and their associated data to the UK and world-wide scientific communities. The demand for CCAP strains and services has continued to increase over the past 12 months with the servicing of 343 customers, provision of 1270 cultures, accession of 5 patent strains, provision of extracted DNA and algal identifications. CCAP has also been active in international Biological Resource Centre capacity building, by helping to organise and teach at an international workshop on algal culture collections at Ege University, Izmir, Turkey in June 2006.

The Collection remains active in algal research and over the last year, it has hosted and supported an increasing range of "in-house" and collaborative research projects. In addition to underpinning SAMS environmental and ecophysiological research, research

relating to algal defence, protistan taxonomy, barcoding and cryobiology were the focal points of studies. Together with its American sister collection, the Culture Center for Marine Phytoplankton (CCMP), and sponsored by the Alfred P. Sloan Foundation, CCAP chaired an international summit meeting to address issues in protistan taxonomy in the context of the barcoding initiatives, bringing together representatives of culture collections, bioinformatics resources, and taxonomists with expertise in all major protistan groups. As a follow-up from this meeting, CCAP currently participates in an international initiative to develop suitable molecular barcodes for the entire breadth of protistan diversity. Within the framework of a long-term effort to provide a state-of-the art identification of its strain holdings, CCAP is also collaborating with taxonomists with expertise in a range of different groups of protists and the data generated by these studies along with images and bibliographic information are being used to populate the CCAP knowledgebase that will enhance services and value to the scientific community.

Frithjof Küpper, John Day, Christine Campbell, Undine Achilles-Day, Debra Brennan, Gosia Gaj, Sharon McNeill, Thomas Pröschold & Rachel Saxon.

For more information on CCAP visit
<http://www.ccap.ac.uk>

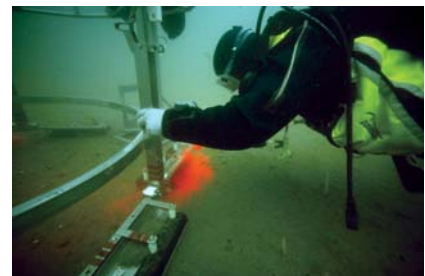
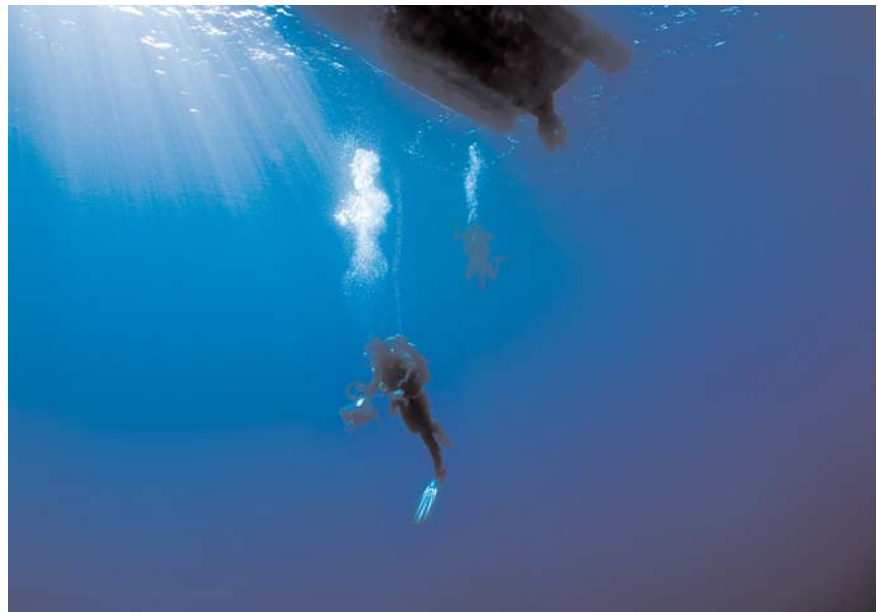


Some of the micro-algae held in the CCAP collection

NERC FACILITY FOR SCIENTIFIC DIVING (NFSD)

The Diving Unit continues to deliver a range of services both in support of underwater science activities and at the national level. The unit hosts the Natural Environment Research Council (NERC) Facility for Scientific Diving and continues to provide emergency hyperbaric treatment for divers with decompression illness. Additional activities include support and training in small boat operations and in emergency diving medicine.

The NERC Facility for Scientific Diving (NFSD) at SAMS provides divers, equipment, training and scientific/technical support that underpins a wide range of interdisciplinary research in the underwater environment. The primary level of service delivers practical support for diving-related underwater scientific projects through providing additional manpower for groups with limited diving experience, total project management for scientists with no diving experience and/or loans of specialist equipment for groups with diving experience but limited resources. On a secondary level, the Facility undertakes to ensure proper adherence to Health and Safety legislation as applied to diving at work activities. This can be through targeted training programmes, communicating advice and guidance for senior management with legal responsibilities for diving at work, undertaking safety audits on behalf of the NERC Health and Safety management structure and facilitating a wider interactive dialogue with others in the higher education field and the UK Health



and Safety Executive. The NFSD is the main service provider and the major supporter of research within the UK that involves scientific diving through its support and maintenance of an extensive underwater research programme, its support for the UK Scientific Diving Supervisory Committee, its interactions with other diving industry bodies, its ongoing diving research and evaluation programme, and its focussed training programme for scientists and technicians involved with working underwater.

In 2006 the NFSD at SAMS received approval from the HSE to run professional diving competence assessments at Dunstaffnage. Run with a scientific emphasis, these assessments teach divers who have dived at work using recreational diving qualifications to obtain a professional diving certificate. This assessment will be incorporated into the UHIMI Marine Science degree as a Diving for Science module in 2007.

During 2006, the NFSD received the Inland and Inshore Diving Contractors' award for underwater scientific achievement.

NATIONAL FACILITIES

NERC funding for the facility is assured until 2009; the Facility will be reviewed in 2008 with a view to continuing support past 2009.

DIVING SUPPORT

In 2006, the diving unit supported 623 person dives (314 separate diving operations) in support of numerous science programmes; the highest total of diving operations supported since 1982. A total of 47 divers were either employed on diving operations or attended some of the NFSD training courses and workshops. These included maintaining fish count and sub-sea temperature time-series, conducting photographic and video surveys, collecting animal specimens, conducting diving equipment trials and mapping artificial reef module deployments. The total bottom time was 8792 minutes for 2006 at an average of 29.8 minutes per diving operation. Of this total, 63% of the bottom time was accrued in the 10-29 metre depth range, 32% was shallower than 10 metres and 6% was 30 metres and deeper.

DUNSTAFFNAGE HYPERBARIC UNIT (DHU)

In 2006, 24 divers suffering from symptoms of suspected decompression sickness were examined at the hyperbaric unit and 18 received treatment. In addition, there were two diving-related fatalities. The divers treated received, in total, 36 separate treatments totalling 155 hours in the chamber. The unit benefits from the excellent medical support it receives from diving medics at the Lorn Medical Centre.

The DHU continues to be part of the National Registration Scheme for Scotland, with staff acting as technical advisers for the scheme. In 2007, the Dunstaffnage chamber will host the annual scientific meeting of the British Hyperbaric Association in Oban.

RYA SCHOOL

The small boat facility continues to provide RYA accredited training programmes. 2006 again saw the provision of a seamanship module for students on the UHI Marine Science degree with all students successfully completing their RYA Powerboat training to Levels 1 and 2. Training was also provided for staff from the University of Edinburgh.

Martin Sayer, Simon Thurston, Hugh Brown & Jenny Beaumont

For more information on NFSD visit
<http://www.nfsd.org.uk>

It has been a busy year at SAMS developing the capacity of the organisation to respond to emerging policy issues. As we are seeing in Scotland, the UK and in the international arena, the development of the oceans for socio-economic activity is increasing leading to a corresponding rise in potential impacts. New uses of the oceans for renewable energy, aquaculture, tourism and conservation are competing with traditional uses such as fisheries, shipping, resources and recreation. Impacts can arise from individual activities but also from the nexus of multiple use and cumulative forces. As a result, new approaches for holistically managing ocean uses are being conceived and implemented in coastal and marine systems. The integration of science with policy is one of the key challenges facing integrated oceans management across the UK and the international context, and SAMS is at the forefront of responding to this change.

In Europe, the European Union and its Member States are parties to more than 100 multilateral agreements relating to marine and maritime affairs. On 7 June 2006 the European Commission adopted its long awaited Green Paper on maritime policy entitled, 'Towards a future maritime policy for the Union: a European vision for the oceans and seas'. Although short on specific detail, the green paper identifies the need for an overarching framework to coordinate maritime issues at the EU level. Debate on a European Marine Strategy Directive reached agreement in December 2006. It is conceivable that the emerging UK Marine Bill and Scottish marine initiatives will respond to these developments and act as implementing instruments for the broader EU initiatives. The impact of these proposals on Scotland's seas was debated at an EU

maritime policy conference held at the Scottish Parliament in December 2006. Almost 100 MSPs, MEPs, Scotland Europa Members and other Scottish stakeholders attended the event to examine the Commission proposals. SAMS was represented at the event by Graham Shimmield and Tavis Potts.

At a national level, there have been several initiatives scoping and debating the way forward for the integrated management of UK and Scottish seas. The UK Marine Bill white paper was released in March 2007 to give effect to its policy direction for moving towards integrated rather than piecemeal ocean management. The white paper identifies five themes for legislative and policy reform including a marine management organisation to deliver marine policies, marine spatial planning mechanism, reform of marine licensing, marine biodiversity conservation reforms and modernising the fisheries management regime. SAMS was represented at the UK Marine Bill green paper and white paper discussions in Glasgow, Edinburgh and London. It is anticipated that drafting of the Bill will continue through 2007 and it will go to Parliament in early 2008. SAMS has consistently contributed to marine policy discussions at the Scottish level. Two important parallel processes evolved through 2006 and 2007 to build the capacity and preparedness for Scottish marine policy reform. The first, the Advisory Group on Marine and Coastal Strategy or AGMACS, was an influential ministerial advisory group consisting of members from industry, conservation, government, research, and community groups. The final report* from AGMACS contained several consensual strategic recommendations to the minister for improvement of the

management of the Scottish marine environment. It is anticipated that these recommendations will be taken up by the new minister and administration. The second process was the 'Report on Inquiry into the Marine Environment' held by the Environment and Rural Development committee – a parliamentary process. SAMS contributed to these discussions with the end results similar to the AGMACS process. While many of the recommendations match those in the UK Marine Bill white paper, important additional ones were the harmonisation of marine data, and development of clear objectives and indicators of the state of the seas.

SAMS will continue to work with the new Scottish administration to push for improved understanding, management and sustainability of the marine system from local to international levels.

Tavis Potts



*This report is available from:
<http://www.scottishexecutive.gov.uk/Publications/2007/03/08103826/0>

SAMS HIGHER EDUCATION

SAMS/UHI MILLENNIUM INSTITUTE EDUCATION ACTIVITIES

This year has, once again, provided noteworthy activity on both the undergraduate and postgraduate fronts.

TAUGHT PROVISION

The seventh cohort of UHI undergraduates arrived in September 2006. In November, our fourth graduation ceremony was held in conjunction with the SAMS AGM. To mark the occasion, two sponsored awards were made: the SAMS Council Prize for Academic Excellence was awarded to Caroline Carter, whose first class honours degree was based upon 31 grade A's (one B) over the 32 modules, while the SAMS Prize for Overall Achievement went to Eleanor Martin, for consistent progress during her degree course. The first ever UHI prize to the SAMS-UHI Student of the Year, was awarded to H3 student, Kate McIntyre, for outstanding academic performance.

During the year, SAMS was awarded the first Comann na Mara bursary – sponsored by popular Celtic band Runrig – for undergraduates to undertake field studies at the European Special Area of Conservation, Lochmaddy Bay, North Uist. The bursary was taken up by H4 Science communication students, Caroline Carter and Tracy White. With tutor, Dr. Anuschka Miller, they visited the site and developed interpretative posters on the primary producers of the area: these were exhibited at the local arts centre during the summer of 2006.



Graduands at the fourth UHI/SAMS BSc (Hons) Marine Science degree congregation at the SAMS AGM. From the left; Eleanor Martin, Caroline Carter, Tracy White and Marie Moore.

A major new development on the teaching front was the creation and development of a Continuing Professional Development (CPD) course for secondary school teachers. Recent research found that the quality of school teaching was the deciding factor for ca 90% of current science students to embark on a science career. Led by Dr. Anuschka Miller, staff produced a weekend course - entitled 'The Day After Tomorrow: Climate change and the oceans' – that was approved for inclusion on the National Register of CPD providers. Seventeen teachers from nine schools across Scotland participated in the event, and provided unanimous support for it to be repeated in future years.

POSTGRADUATE RESEARCH ACTIVITIES

Over the year a further intake of NERC and EU-funded postgraduate students commenced at SAMS, adding to our vibrant research school community. Eleven PhD students and one MPhil student were awarded their degrees and left us for new opportunities in Europe, Australasia and the US. For the first time, we have also

hosted a student on UHI's one-year MSc (by research) programme.

At the invitation of the British Council, a group of 10 of our postgraduates travelled to Tallinn, Estonia to participate in an International Networking of Young Scientists event, themed around 'Marine Environment Protection and Nature Conservation'. The UK participants were paired with colleagues from Estonia, Latvia, Lithuania and Russia for three days of intensive networking activities. The timing of the event coincided with a state visit by HM Queen Elizabeth II, to whom SAMS Director Professor Graham Shimmiel was presented.

Axel EJ Miller

More information on BSc
<http://www.sams.ac.uk/education/bsc>

SAMS MEMBERSHIP ACTIVITIES

As a learned society SAMS has 427 members from three categories. Subscription rates have not changed in the last decade and currently stand at £12 for ordinary members, £5 for students and unwaged ordinary members, and at £60 for corporate members. For their subscriptions, members received two Newsletters and one Annual Report, could apply for the SAMS bursary, could consult the SAMS reference library during working hours, and were invited to the AGM, the Newth lecture and two meetings of the Scottish Marine Group.

SCOTTISH MARINE GROUP

The Scottish Marine Group was organised by Susan Chambers from the National Museums of Scotland. The postgraduate meeting took place on 11 May 2006 in Edinburgh at the National Museums of Scotland, where nine students from seven Scottish universities introduced their research projects. The £100 SAMS prize for the best postgraduate presentation was awarded to Faridah Mohamad from the University of Glasgow for her presentation on manganese in the swimming crab *Liocarcinus depurator* from Scottish inshore waters. At the autumn meeting, held on 26 October 2006 at the University of Stirling, seven invited academics spoke on a variety of topics related to 'Climate Change and the Future for the Marine Environment'.

ANNUAL GENERAL MEETING AND 17TH NEWTH LECTURE

The 92nd Annual General Meeting of the Association took place on 6 November 2006 at Dunstaffnage. A number of new members were elected to Council to



SAMS hosted the 2006 Challenger Conference which attracted 270 delegates.

replace outgoing members as listed in the Council Report of this Annual Report.

As has become tradition, the AGM was followed by the student graduation and then the 17th Newth lecture, commemorating Professor David Newth, a former SAMS President. This year's lecture on 'ice and environmental change' was delivered by Professor Julian Dowdeswell, the director of the Scott Polar Research Institute in Cambridge.

RESEARCH BURSARIES

The following SAMS bursaries were awarded during the past year:

Atul Kumar

Chalmers University of Technology, Sweden. *The practical feasibility of structured light techniques when applied to landers.* **£900**

Dr Mikhail Zubkov

National Oceanography Centre, Southampton. *Quantification of the trophodynamic role of microplanktonic protists in microbial communities.* **£1500.00**

Benjamin Ciotti & Dr Timothy

Targett University of Delaware, USA *How do beach productivity and density control the spatial and temporal dynamics of growth of juvenile plaice?* **£1087**

Scientific meetings and lectures

SAMS hosted the Challenger Society for Marine Science's 12th biennial conference between 11-14 September 2006. This was the first Challenger Society conference at the Association's Oban facilities; we had hosted two past meetings – in 1946 and 1962 – in our former home at Millport. Sessions for the 270 delegates were held in the Corran Halls in Oban and for two afternoons in the conference and meeting rooms at Dunstaffnage. The local organising committee was chaired by Dr Angela Hatton. A two-day meeting on fjord environments followed on from the conference.

SAMS OUTREACH ACTIVITIES

PUBLIC OUTREACH

'Making tremors' was a collaborative science communications project bringing research carried out at the School of Geology and Geosciences at the University of Edinburgh and at SAMS into the public arena at Our Dynamic Earth in Edinburgh. The project was facilitated by the Scottish Initiative for Biotechnology Education and funded by the Scottish Executive. Nine SAMS postgraduate students and researchers were trained in ways of engaging the public, developed activities and materials, and then showed them in different galleries at Dynamic Earth over two weekends in February 2007.

The Edinburgh 'making tremors' participants showcased their work again at the SAMS Open Day on 14 March 2007, when 180 visitors were informed and entertained with displays and talks at Dunstaffnage.

Dr Bob Batty represented SAMS with a display at the 'digital future' conference in Aviemore, and a number of staff developed a hands-on SAMS display for the Oban Games 2006. Dr Ken Jones contributed a SAMS display to the SEPA state of the environment workshop in Edinburgh on 2 October 2006. Engagement with politicians was sought through participation in an exhibition at the Royal Society of Chemistry's Science in Parliament event at Our Dynamic Earth on 1 November 2006.

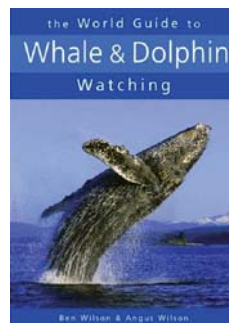
A video on the research SAMS conducts in the Arctic was compiled by Drs Anuschka Miller and Andrew Davies, and showed initially at the Arctic Workshop in London



CCAP staff member Gosia Gaj manning the SAMS interactive display at the 'Making tremors' event.

that SAMS co-sponsored on 31 October 2006. It was thereafter displayed at other events.

A new book on whale watching for a general readership was co-authored by Dr Ben Wilson



Dr Ben Wilson and his brother Angus wrote a book published by Colin Baxter Photography Ltd aimed at a general readership entitled World Guide to Whale and Dolphin Watching. Information leaflets were produced by Dr Elizabeth Cook on marine aliens and marine algae; by Drs Finlo Cottier and Anuschka Miller on SAMS research in the Arctic and by Dr Bhavani Narayanaswamy on the European Census of Marine Life.

Public lectures were delivered on a range of topical subjects over the reporting period: Dr Kenny Black talked about sustainability in aquaculture and Dr Keith Davidson about harmful algal blooms at Thurso's Environmental Research Institute. The Islay Energy Trust invited Dr Toby Sherwin to talk about climate change on the west coast of Scotland, and a similar talk also considering the north of Scotland

was delivered in Orkney at the Shapinsay Renewables Day. Dr John Howe talked about climate change in the Arctic to the National Trust for Scotland in Oban. Dr Andrew Davies gave presentations about cold-water corals to the Scottish Wildlife Trust in Oban, and as part of the biodiversity talk series organised by Scottish Natural Heritage in Oban. Dr Anuschka Miller delivered a public lecture on 'exploring the deep' at the Orkney Science Festival and for the Oban Cancer Support Group. Dr Murray Roberts spoke at the American Association for the Advancement of Science meeting in San Francisco in February about demography and sensitivity of cold-water corals. Dr Liz Cook was invited to speak to the Lochaber Yacht Club on 'marine invasions – the role of recreational yachting'. She also spoke on marine invasive species and climate change to the Clyde Forum and the Scottish Marine Group.

SAMS launched a new website as a shop window for our varied activities and research projects at www.sams.ac.uk.

INSPIRING AND INFORMING THE NEXT GENERATION

SAMS hosted four pupils in receipt of Nuffield bursaries and arranged 5-6 week science projects for them. These pupils came from Oban, Lochgilphead and England, and were supervised by Gill Andrew/Dr Mike Burrows, Christine Campbell/Dr Thomas Pröschold and by Dr Nick Hughes. A further 8 pupils from schools in Scotland and France spent a week at SAMS gaining work experience. SAMS continues to sponsor the 'SAMS cup for outstanding achievements in

SAMS OUTREACH ACTIVITIES



At the SAMS Open Day, PhD student Gill Andrew explains how the geographic range of 'southern' species such as Abalone may extend to Scotland if some predictions of global warming are realised.

science' at the senior prize giving at Oban High school.

We further continued our engagement with the Argyll and Bute Regional Environmental Education Forum, and participated at a 3-day environment fair in Lochgilphead in September 2006. A number of staff also visited primary and secondary schools, while Bowmore Primary School repeated its visit to SAMS in June 2006. Dr Clive Fox explained the principles of science to the Dunbeg Brownies and got them to research noteworthy female scientists. Robin Harvey contributed text and images to a 'Sea Learn' teaching pack that will be sent to all primary schools in Argyll and Bute in August 2007.

SAMS IN THE MEDIA

The media are the most effective way of informing the general public about ongoing research at SAMS. Staff featured on television (EuroNews, BBC 1 Seawatch, BBC 1 Countryfile), participated in radio programmes (BBC

Radio 4 and BBC Radio Scotland) and provided information for press articles for international, national and regional newspapers.

VISITORS TO SAMS

SAMS hosted a fundraising event for a new research vessel in association with the University of the Highlands and Islands Development Trust on 11 August 2006, to which it welcomed, among others, the Dowager Duchess of Argyll. Other notable visitors during the year included Sir Matthew and Lady Farrar (Fishmongers' Company); Rhona Brankin MSP; Professors Anne Glover, Maggie Gill and David Wilson from the Scottish Executive; Lord Young and the German Consul, Ingo H Radcke.

Anuschka Miller

ESTATES AND FACILITIES

Over the past 5 years SAMS has experienced an unprecedented expansion of its staff numbers and, with this, some changes in the demands made upon its estates and facilities to support its science and teaching activities. Whilst the new building has addressed many of these needs, we have recognised that an ongoing programme of refurbishment and replacement will be necessary to improve the facilities within the old building stock and where necessary make new provision. Because of the space limitations for future new development on the site, SAMS commissioned the architects, Argyll Partnership Ltd., to undertake a master plan study of the site and existing building stock a) to review the condition and estimate the remaining working life of existing buildings; b) advise upon the cost effectiveness of refurbishment or new build options to meet the projected needs and c) identify how new building on the site might be accommodated. Amongst the scenarios the architects were asked to consider were a) an increase in research and scientific support staff of approximately 25-30%; b) replacement of diving store and recompression chamber with new facilities better fitted to meet the stringent technical and medical requirements and c) an increase in undergraduate numbers on the marine science degree course to sixty students. The master plan document was received in February 2006 and now forms the basis for future estate development

During the course of the master plan study, the funding for the UHI ARC Programme was confirmed and we were therefore able to move rapidly to implement the 3rd Phase of SAMS site redevelopment by refurbishment of the old administrative



offices and stores to provide new single and multi-occupancy offices for 25 scientific and support staff. This work was completed in January 2007 and all our new ARC recruits are now fully integrated throughout the newly refurbished and existing building. The refurbishment also included replacement of the 30 + year old oil fired boiler in the old building with a plate heat exchanger connected to the boilers in the new building, which allows excess capacity in the modern boiler system to be used to heat the ARC wing. This should lead to savings from energy efficiency and reduced maintenance. New laboratory space for sea ice studies and counting extremely low levels of naturally-occurring radioactivity in environmental samples was also delivered within the ARC wing.

RESEARCH VESSELS

SAMS research vessels, Calanus and Seol Mara continued to serve the needs of SAMS science and the undergraduate teaching and post graduate research of UHI students based at Dunstaffnage. The availability of the vessels, combined with

access to oceanographic equipment, small boats and a well equipped teaching lab, attracted other universities from throughout the UK to use Dunstaffnage as a centre to support their undergraduate and Masters field courses. Calanus and Seol Mara were also chartered to support the fieldwork of the EU COBO programme and carry out oceanographic, acoustic and benthic survey work on the west coast of Scotland on behalf of marine environmental consultancies and the British Geological Survey during the year.

Finally, it is worthy of mention that, after 40 years of service to the Scottish Marine Biological Association and SAMS in a variety of scientific and managerial roles, the Facilities Manager, Mr Jim Watson, retired in April 2007. Jim's contribution to the management of the services team, the vessels and recent new building and ARC developments has been a significant factor in their success.

Ken Jones

2006 saw major changes in most areas within the IT department. ICT was merged with Data Management to become IT & Data Services. Initially this was run jointly by the Data Manager, Steve Gontarek, and the IT support Manager, Katrine Smalley, but by the end of the year Steve Gontarek took over as overall manager of the department. In addition we were joined during the year by a new support person, Nicola Longman, to compliment Nigel MaLucas in front line and technical support. Rory MacKinnon continued providing graphic and web design services.

During the year, most of the major hardware was upgraded and supplemented. At the beginning of the year, SAMS invested in its own Backup and Archiving system, IBM's Tivoli, at a cost of £30K: currently with a capacity of about 2 TB and fully expandable to 5TB and above. This proved its worth in February 2007 when the entire network file system and email required restoring after a major hardware failure. Also during the year the four servers providing the major network file and email services were replaced using SHEFC2 money. At the same time the Storage Area Network (SAN) was upgraded with new disks tripling the amount of file and email storage to 1.5TB. Finally, the Marine Physics group purchased an 8 node ClusterVision Linux cluster for modelling purposes. This was installed in the server room in the middle of the year and IT was given responsibility for administering the machine.



Other events during the year included the departure of the UHI helpdesk from the SAMS data warehouse to Inverness. On the Data services side, the new Intranet was introduced at the end of 2006. Work continued on the new website which eventually became live in the spring of 2007. Poster Printing at SAMS was enhanced by the purchase of a new HP5500 A0 printer, capable of printing in water- and UV-proof inks and on a variety of media.

The NERC funded Data Archiving program continued rescuing and digitising data from a variety of disciplines: sea-ice, deep sea benthic biology, fisheries and inshore biology. This is due to end in April 2008.

Steve Gontarek

POSTGRADUATE RESEARCH PROJECTS

(Funding body and supervisors' names in parentheses; SAMS supervisors in blue)

DEGREES AWARDED DURING THE REPORTING YEAR

Ashton GV, Ph.D, The UHI Millennium Institute (NERC). *Biological invasions-quantifying the impact of alien species on marine ecosystems, using the introduction of the amphipod *Caprella mutica* to the west of Scotland as a case study.* (**Cook EJ**, **Willis K** and **Burrows MT**)

Beaumont J, Ph.D, The UHI Millennium Institute (NERC). *Quantifying biotic interactions with inshore subtidal structures: comparisons between natural and artificial reefs.* (**Sayer MDJ**, **Brown C** and **Shimmiel GB**)

Cox (née MacLachlan) SE, Ph.D, The UHI Millennium Institute (UHI). *Geochemical signals of environmental change in the Arctic: from freshwater lake to the deep ocean.* (**Howe J**, **Shimmiel TM**, **Shimmiel GB** and Austin W)

Cresswell, K, Ph.D, British Antarctic Survey/Open University (BAS). *Penguin-krill interactions at South Georgia – an in situ approach.* (Tarling GA, Trathen P and **Burrows MT**)

Darrock L, Ph.D, The University of East Anglia (NERC). *Dimethylsulphoxide: origin, fate and cycling.* (Liss PS, Malin G and **Hatton AD**)

Dodds L, Ph.D, The UHI Millennium Institute (NERC). *The physiological ecology of the cold-water coral *Lophelia pertusa*.* (**Roberts JM**, Taylor A and **Gage JD**)

Gass S, Ph.D, The UHI Millennium Institute (AFEN). *The environmental sensitivity of cold water corals.* (**Roberts JM**, **Gage JD** and Tudhope AW)

McDonald A, M.Phil. The UHI Millennium Institute (UHI). *Influences on salmonid survival in a Scottish West Highland river.* (**Miller A** and Chisholm N)

Pillans J, Ph.D, Newcastle University. *DMS photochemistry* (NERC). (**Hatton AD**, Uher G and Upstill-Goddard R)

Sanderson JC, Ph.D, The UHI Millennium Institute (UHI). *Reducing the environmental impact of sea-cage farming through cultivation of seaweeds.* (**Kelly MS** and Dring M)

Shelmerdine R, Ph.D, The UHI Millennium Institute (NERC). *Large-scale forcing of coastal communities.* (**Burrows MT** and **Hughes DJ**)

ONGOING RESEARCH

Adey (née Osborne) EA, Ph.D, The UHI Millennium Institute (UHI/HIE). *Distinguishing wild from farmed salmon.* (**Black KD** and **Shimmiel TM**)

Andrew G, Ph.D, The UHI Millennium Institute (NERC). *Biodiversity and ecosystem function: trophic diversity versus species diversity in intertidal grazers.* (**Burrows M**, Hawkins S and McGill R)

Batty P, Ph.D, The UHI Millennium Institute (NERC). *The influence of structural and functional aspects of benthic organisms on bioturbation and ecosystem function.* (**Nickell L**, Solan M, **Nickell T** and **Black KD**)

Bayley S-A, Ph.D, The UHI Millennium Institute (Self-funded). *Towards a brighter future for Scottish salmon - new ideas in socio-economic and political dimensions.* (Smith M and **Miller AEJ**)

Carter C, M.Sc, The UHI Millennium Institute (European Social Fund). *Do marine renewable energy devices give sufficient warning to marine mammals to avoid harmful collisions?* (**Black KD** and Wilson B)

Johnson C, Ph.D, The UHI Millennium Institute (UHI/HIE). *Tracing water masses in the North Atlantic.* (**Sherwin T**, **Shimmiel TM** and Smyth-Wright D)

Law GT, Ph.D, The UHI Millennium Institute (NERC). *Cycling of trace metals of organically-rich sediments off Pakistan and Scotland.* (**Shimmiel TM**, Cowie G, **Shimmiel GB** and Ganeshram R)

Nebot C, Ph.D, The UHI Millennium Institute (UHI). *Human pharmaceuticals in the Scottish marine environment.* (Gibb S, Boyd K and **Black KD**)

POSTGRADUATE RESEARCH PROJECTS

Pete R, Ph.D, The UHI Millennium Institute (UHI). *The influence of organic nutrient perturbation on microbial community dynamics.* (**Davidson K**, **Miller AEJ** and **Leakey R**)

Rodger A, Ph.D, The UHI Millennium Institute (AIE). *Multi-trophic level culture for environmental remediation – active management of aquaculture initiatives for diversification and sustainability.* (**Kelly MS**, **Gillibrand P** and Dring M)

Shields ME, Ph.D, The UHI Millennium Institute (UHI/HIE). *Gradients in benthic community structure and bioturbation along the northern seas continental margins.* (**Hughes DJ** and **Gage JD**)

Shucksmith R, Ph.D, The UHI Millennium Institute (NERC). *Biological invasions: The role of biodiversity in determining community susceptibility to invasion.* (**Cook EJ**, **Burrows MT** and **Hughes DJ**)

Suddick E, Ph.D, The UHI Millennium Institute (UHI). *Impacts of solar UV radiation on freshwater nitrogen biogeochemistry.* (S Gibb, G Uher and **AEJ Miller**)

Vare LL, Ph.D, The UHI Millennium Institute (NERC). *An investigation of temporal trends of pollutant inputs within the Arctic environment: from freshwater lake to deep ocean.* (**Shimmield TM**, **Shimmield GB** and **Black KD**)

Venables E, Ph.D, The UHI Millennium Institute (NERC CASE). *An investigation of mixing in the Faroe-Shetland Channel.* (**M Inall**, **T Sherwin** and W Turrell)

Wilson L, Ph.D, The UHI Millennium Institute (NERC). *Gadoid fish sound production and its role in mate selection, the risk of predation and the impacts of noise pollution.* (**Wilson B**, and **Burrows MT**)

Wilson S, Ph.D, The UHI Millennium Institute (UHI). *Plankton and climate change.* (**Hatton AD**, **Miller AH** and Law C)

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RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
R Batty	Algal mediated turbidity	Seafish	10/05 – 04/07	£31k
K Black	Cod Farming in the Marine Environment	Seafish, Crown Estate, HIE	11/03 – 09/06	£52k
K Black	Risk factors in shellfish harvesting areas	SARF/SEPA/FSA	11/05 – 10/07	£152k
K Black	Intertidal biodiversity Surveillance	Marine Biological Association of the United Kingdom	04/06 – 05/06	£3k
K Black	Ecosystem approach for sustainable aquaculture	EU	01/05 – 02/08	£227k
K Black	Synthesis of aquaculture and marine ecosystems interactions	EU FP6	11/05 – 04/07	£30k
K Black	Environmental management reform for sustainable farming, fisheries and aquaculture	EU FP6	01/07 – 12/09	£18k
K Black	Science and Policy Integration for Coastal Systems Assessment	EU FP6	02/07 – 07/08	£65k
K Black	Bioactive peptides from marine sources - a Nordic network	Icelandic Fisheries Laboratories	06/05 – 09/06	£8k
K Black	Consultancy work	World Wildlife Fund	03/06 – 12/07	£10k
K Black & P Batty	The influence of structural and functional aspects of benthic organisms on bioturbation and ecosystem function (PhD Project)	NERC	10/05 – 09/08	£18k
K Black & E Osborne	Distinguishing wild from farmed salmon (PhD Project)	UHI	08/03 – 07/06	£4k
K Black & R Shucksmith	Biological invasions: The role of biodiversity in determining community susceptibility to invasion (PhD Project)	NERC	10/04 – 09/07	£12k
C Brown	Development of a framework for mapping European seabed habitats	QUB (EU Interreg)	04/04 – 03/07	£108k
M Burrows	Biodiversity and ecosystem functioning: tests using rockpools as natural mesocosms	NERC	01/06 – 12/08	£65k
M Burrows	The consequences of the forecast coldwinter on the biogeographic range and population of intertidal species	NERC	02/06 – 10/06	£16k
M Burrows & G Andrew	Biodiversity and ecosystem function: Trophic diversity versus species diversity in intertidal grazers and filter feeders as revealed by stable isotopes (PhD Project)	NERC	10/04 – 09/07	£15k
M Burrows	Sustainable management of deep-water fisheries and their impact on marine biodiversity	Esmee Fairbairn	01/06 – 12/08	£72k
M Burrows	Marine biodiversity and climate change	English Nature, SNH plus a consortium of 10 other bodies	04/01 – 04/06	£45k
E Cook	Invasive Alga: Controlling the spread of <i>Sargassum muticum</i>	Scottish Executive	01/07 – 12/07	£5k
E Cook	Raising awareness of invasive marine species	Esmee Fairbairn Foundation	04/04 – 03/07	£145k
E Cook & G Ashton	Biological Invasions - Quantifying the Impact of alien species on marine ecosystems (PhD Project)	NERC	10/03 – 09/06	£18k
F Cottier	Ecosystem of the mid-atlantic ridge at the sub polar front and Charlie Gibbs Fracture Zone	NERC	10/06 – 09/10	£191k
F Cottier	International Networking for Young Scientists	British Council	09/06 – 08/07	£10k
F Cottier	International incoming Short Visits 2006	The Royal Society	01/07 – 02/07	£2k
C Cromeey	Mitigating impact from aquaculture in the Phillipines	EU FP6	08/06 – 02/08	£50k
K Davidson	Predicting the progression of harmful dinoflagellate <i>K. mikimotoi</i> along the Scottish coast and the potential harmful impact on fish farming	The Crown Estate	02/07 – 06/07	£58k
K Davidson	Relating harmful phytoplankton to shellfish toxicity and human health	NERC	03/07 – 02/08	£28k
K Davidson	Forecasting initiation of blooms of toxic algae	Interreg IIIB	04/06 – 06/08	£139k
C Gachon	Structuring the European Research Area - human resources & mobility	Marie Curie Intra European Fellowships	09/06 – 08/08	£109k

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
P Gillibrand	European climate of the last Millennium	EU FP6	01/06 – 12/09	£94k
P Gillibrand	The development of modeling techniques to improve predictions of assimilative capacity of water bodies utilized for marine caged fish farming	SARF	07/05 – 06/08	£58k
P Gillibrand	Identifying the risk of deoxygenation in Scottish sea lochs with isolated deep water	SARF	12/05 – 11/06	£20k
P Gillibrand & T Sherwin	Scottish Marine Observatory	FRS	12/04 – 11/06	£5k
S Gontarek	Data rescue and archiving project	NERC	06/03 – 10/06	£225k
J Gordon	Towards accreditation and certification of age determination of aquatic resources	EU FP5	11/02 – 10/06	£3k
D Green	The role of algal-bacterial interactions in determining dimethylsulphide fluxes to the atmosphere	NERC SOLAS	10/05 – 09/08	£170k
D Green	Characteristics of organic microlayer produced aerosols	NERC	06/06 – 05/08	£16k
A Hatton	Methanogenesis in oxygenated marine environments	Nuffield Foundation	03/04 – 06/06	£5k
A Hatton	Unravelling the ocean methane paradox	NERC	02/07 – 09/09	£384k
A Hatton & S Wilson	Biogenic gases in the marine environment (PhD Project)	UHI	08/03 – 07/06	£4k
J Howe	Collaborative Paper on Inner Shelf of the Amundsen Sea	British Antarctic Survey	01/07 – 05/07	£650
J Howe	Hire of the MV Calanus for Shallow Marine sampling programme - Summer Isles	British Geological Survey	07/06 – 08/06	£8k
J Howe & S MacLachlan	Holocene climatic variability: Glacial history from an Arctic fjord and shelf, western Spitsbergen, Svalbard (PhD Project)	UHI	08/03 – 07/06	£4k
D Hughes & M Shields	Gradients in macrofaunal community structure and bioturbation in the Northern Seas region (PhD Project)	UHI	08/03 – 07/06	£4k
D Hughes	12 month PHD extension	NERC	09/06 – 08/07	£18k
M Inall	Provision of mooring deployment, maintenance and analysis	Norwegian Polar Institute	08/05 – 06/08	£48k
M Kelly	Active biological monitoring and removal of toxins in aquaculture ecosystems and shellfish - including the development of a Solid Phase In-situ Ecosystem Sampler and detoxification of shellfish	EU Collective Research Projects	07/06 – 06/09	£105k
M Kelly	Alternative marine sources of protein and oil for aquaculture feeds	The Crown Estate	02/06 – 06/06	£23k
M Kelly	Reducing the environmental impact of sea cage farming through cultivation of seaweeds	HIE	08/06 – 07/08	£147k
M Kelly	The Potential of marine biomass for biofuel	The Crown Estate	01/07 – 06/07	£30k
M Kelly	Larval invertebrate microalgal interactions	EU FP6 Marie Curie	06/05 – 06/06	£72k
M Kelly	To investigate sustainable biological carrying capacities of key European coastal zones	EU	02/05 – 01/07	£100k
M Kelly	Sea urchin production in integrated systems, their nutrition and roe environment	EU	01/05 – 12/07	£193k
M Kelly	Atlantic Arc Aquaculture	Interreg IIIB	12/03 – 11/06	£559k
M Kelly	Multi-trophic level culture for environmental remediation - active management of aquaculture initiatives for diversification and sustainability (PhD Project)	AIE	10/04 – 09/07	£36k
M Kelly	Atlantic Arc Aquaculture Group 2	Interreg IIIB	01/07 – 06/08	£160k
F Kuepper	The role of bacterial symbiotic metabolites in the development of toxic phytoplankton blooms	California Sea Grant	03/06 – 02/08	£5k
F Kuepper	Pioneering post genomics approaches for studying algal host-pathogen interactions, using the <i>Ectocarpus/Eurychasma</i> model	NERC	05/06 – 05/09	£25k
F Kuepper	Transformations, volatilisation & speciation of organic and inorganic iodine in the marine environment	NERC	10/06 – 09/09	£15k
D Meldrum	Arctic Synoptic Basin-wide oceanography	NERC	11/06 – 01/07	£196k

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

Project Leader	Title	Funding body	Duration	Award
AEJ Miller	International Networking for Young Scientists	British Council	10/06 - 10/06	£7k
AEJ Miller	Additional skills training	NERC	10/05 - 09/06	£17k
AEJ Miller	UHI learning & teaching infrastructure	UHI	08/05 - 07/07	£45k
AEJ Miller	Allocation of additional resources for higher education institutions in 2006/07	UHI via Scottish Funding Council	08/06 - 07/07	£4k
AEJ Miller	Ecosystem approach to sustainable management of the marine environment and its living resources	EU FP6	01/06 - 12/09	£233k
AEJ Miller	Socrates-Erasmus mobility grants 2006/2007	UK Socrates-Erasmus Council	07/06 - 09/08	£3k
AEJ Miller	Addressing Research Capacity in the Highlands and Islands (ARC)	Scottish Funding Council, European Regional Development Fund and Highlands and Islands Enterprise	01/06 - 12/09	£5.6m
B Narayanaswamy	EuroCoML core funding	AIE	02/05 - 01/08	£21k
B Narayanaswamy	Making Tremors Project	Scottish Initiative for Biotechnology Education	01/07 - 03/07	£4k
J Roberts	Biodiversity and vulnerability of European cold-water reef ecosystems	EU Marie Curie Fellowship	01/05 - 12/06	£106k
J Roberts	Hotspot ecosystem research on the margins of European seas	EU FP6	04/05 - 03/09	£170k
J Roberts	Deep sea conservation for the UK	Esmée Fairbairn Foundation	03/05 - 02/07	£146k
J Roberts & L Dodds	Collaboration on aquarium culture of cold-water corals (PhD Project)	The Deep	12/03 - 10/06	£15k
M Sayer	Enhancing marine biodiversity with artificial reefs	Project Aware (UK)	07/05 - 06/06	£30k
M Sayer	National Facility for Scientific Diving	NERC	04/06 - 03/11	£990k
M Sayer	NFSD support work	NERC	03/07 - 09/07	£22k
G Shimmiel	EuroCoML core funding	Stavros S Niarchos Foundation	02/05 - 02/08	£241k
G Shimmiel & L Nickell	Coastal ocean benthic observatories	EU FP6	03/04 - 02/07	£163k
T Shimmiel	Scottish Alliance for Geoscience, Environment & Society (SAGES)	Scottish Funding Council	10/06 - 10/10	£293k
T Shimmiel	El Nino Southern Ocean circulation	NERC	01/04 - 12/06	£17k
T Shimmiel & L Vare	An Investigation of temporal trends of pollutants within the Arctic environment (PhD Project)	NERC	10/03 - 09/06	£19k
T Sherwin	Internal tides over oceanic topography & their influence on mixing	NERC	10/06 - 09/09	£15k
T Sherwin	12 month PHD extension	NERC	09/06 - 08/07	£18k
T Sherwin & C Johnston	Tracing water masses in the Rockall Trough (PhD Project)	UHI	08/03 - 07/06	£4k
P Wadhams	Cryosat consortium grant	NERC	02/04 - 02/07	£228k
E Walton	PGDE	UHI	09/06 - 03/07	£10k
T Wilding	Krill as a source of Aquafeeds	The Crown Estate	03/07 - 07/07	£18k
J Wilkinson	Developing Arctic modelling and observing capabilities for long-term environmental studies	EU FP6	12/05 - 11/09	£311k
B Wilson	Distribution, abundance & Population structure of bottlenose dolphins in Scottish waters	University of Aberdeen	05/06 - 09/07	£68k
B Wilson & L Wilson	Gadoid fish sound production and its role in mate selection, the risk of predation and impacts of noise pollution (PhD Project)	NERC	10/05 - 09/08	£20k

RESEARCH GRANTS AND CONTRACT INCOME RECEIVED

SAMS RESEARCH SERVICES LIMITED

Project Leader	Title	Funding body	Duration	Award
R Batty	Peer review role in connection with Feed and sustainability trial (FAST) project	The Crown Estate	11/06 - 04/08	Commercial in confidence
K Black	Non-native Risk Analysis Panel Sub Contract	DEFRA via Central Science Laboratory	12/06 - 03/09	
K Black	Copepod Bioassay: Preliminary investigation of the efficacy of a new compound for treatment of ectoparasitic copepods (seallice) on salmonids	Ectopharma Ltd	09/06 - 10/06	
C Campbell	Produce and despatch cell concentrates to test their efficacy in food manufacturing process	Unilever	01/07 - 12/07	
K Davidson	Provision of an official control monitoring programme for the presence of toxin producing plankton in shellfish production areas in Scotland	Food Standards Agency	09/05 - 08/08	
T Gutierrez	BIOBAC II	AIE	09/04 - 08/06	
J Howe	Multibeam seabed survey and analysis of benthic biota; BUTEC site at Applecross	QinetiQ	04/06 - 08/06	
J Howe	Biota and geochemical survey: BUTEC site at Applecross	QinetiQ	11/06 - 03/07	
N Hughes	Provision of Ice data for inclusion in navigational publications	United Kingdom Hydrographic Office	01/06 - 08/06	
M Inall	Marine instrument development at SAMS	NERC	06/03 - 05/06	
F Kuepper	CCAP culture collection	Commercial sales	Annually	
D Meldrum	Suitcase GPS Iridium Ice Drifter Buoys	British Antarctic Survey	11/06 - 12/06	
D Meldrum	Oceanology International	AIE	03/05 - 04/06	
AEJ Miller	DOC analyses	CEFAS	10/04 - 04/06	
B Narayanaswamy	Photographic and video analysis of SEA/SAC survey data obtained in 2006	Geotek Ltd	01/07 - 04/07	
J Roberts	Norwegian deep water program	Akvamiljo	07/04 - 06/06	
M Sayer	NHS recompression facility	NHS	Annually	
M Sayer	Grampian hyperbaric technical services	Grampian University Hospitals Trust	Annually	
M Sayer	Hyperbaric Chamber Support	Grampian University Hospitals Trust	04/06 - 03/07	
M Sayer	Foster Yeoman Marine Survey 2006	Foster Yeoman Ltd	04/06 - 09/06	
G Shimmield	Knowledge Transfer Officer grant	AIE	03/05 - 02/08	
T Shimmield	Laser ablation analysis on juvenile cod sagittal otoliths	Fisheries Research Services	02/07 - 03/07	
T Shimmield	Triad study Kinlochleven Smelter	URS Corporation Ltd	08/06 - 11/06	
T Wilding	Review of reef effects of offshore windfarm structures and potential for enhancement and mitigation	Plymouth Marine Lab	01/06 - 07/06	
B Wilson	Scottish Executive contract for the provision of additional studies in relation to the SE strategic environmental assessment for marine renewables	Scottish Executive	09/06 - 11/06	
B Wilson	A study for EMEC and Synergie Scotland: Measuring the environmental effects of the acoustic impact of tidal generators	HIE	12/06 - 11/07	
B Wilson	Strategic Environmental Assessment of marine renewable energy development in Scotland	Metoc Ltd PLC	08/06 - 08/06	

SAMS STAFF AT 31 MARCH 2007

Director

Professor Graham Shimmield

Deputy Director

Dr Ken Jones

Physics, Sea Ice and Technology

Dr Mark Inall (Head)

Mr David Meldrum (Deputy)

Dr Tim Boyd

Dr Finlo Cottier

Dr Chris Cromey

Dr Andrew Dale

Dr Martin Doble

Dr Phil Gillibrand

Mr Colin Griffiths

Mr Nick Hughes

Mr Alistair James

Dr Duncan Mercer

Dr Paul Provost

Dr Toby Sherwin

Dr Ian Sillitoe

Dr Pushkar Wadke

Dr Jeremy Wilkinson

Miss Yingzhao Zhou

Ecology

Dr Kenny Black (Head)

Dr Michael Burrows (Deputy)

Dr Robert Batty

Dr Elizabeth Cook

Dr Andrew Davies

Dr Symon Dworjanyan

Dr Clive Fox

Dr Sheila Heymans

Mr Robin Harvey

Dr Lea-Anne Henry

Dr David Hughes

Dr Maeve S Kelly

Mr Peter Lamont

Dr Kim Last

Ms Hui Liu

Mr Christian Loenborg

Miss Shona Magill

Dr Lois Nickell

Dr Thomas Nickell

Mrs Heather Orr

Dr Tavis Potts

Mrs Linda Robb

Dr Murray Roberts

Dr Martin Sayer

Miss Coleen Suckling

Dr Tom Wilding

Dr Kate Willis

Ms Averil Wilson

Dr Ben Wilson

Microbial and Molecular Biology

Dr Ray Leakey (Head)

Dr Frithjof Küpper (Deputy)

Mrs Undine Achilles-Day (part time)

Dr Elanor Bell

Mrs Debra Brennan

Mrs Christine Campbell (part time)

Dr Keith Davidson

Dr John Day

Dr Claire Gachon

Miss Gosia Gaj

Dr David Green

Dr Tony Gutierrez

Dr Mark Hart

Dr Vincent Le Fouest

Miss Sharon McNeill

Ms Elaine Mitchell

Mr Romain Pete

Dr Thomas Pröschold

Miss Rachel Saxon

Dr Damodar Shenoy

Dr Michelle Stanley

Ms Sarah Swan

Mr Tim Wilkinson

Biogeochemistry and Earth Sciences

Dr Tracy Shimmield (Head)

Dr John Howe (Deputy)

Dr Tim Brand

Miss Katie Doig

Miss Cheryl Haidon

Mr S Martyn Harvey

Dr Angela Hatton

Miss Susan McKinlay

Dr Axel Miller

Miss Terrie Sawyer

Dr Henrik Stahl

Dr Robert Turnewitsch

SAMS Honorary Research Fellows

Dr Clive Craik

Dr Robin Gibson

Dr John Gordon

Professor Jack Matthews

Dr Julian Overnell

Dr Tom Pearson

European Census of Marine Life Office

Dr Bhavani Narayanaswamy

SAMS SRSI

Mrs Janet Duncan (part time)

Mrs Joyce Moore (part time)

IT & Data Services

Mr Steven Gontarek (Head)

Miss Susan Drain

Ms Nicola Longman

Mr Rory MacKinnon

Mr Nigel MacLucas

Mrs Katrine Smalley

Activities Manager

Dr Anuschka Miller

Company Secretary

Mrs Elaine Walton

Director's Secretariat

Miss Jane E McLoughlin

Mrs Allison Dawson (part time)

Financial Controller

Mrs Patricia Whyte

Accounts

Mrs Pat Claxton

Miss Sharyn Farmer (part time)

SAMS STAFF AT 31 MARCH 2007

Mrs Inga Hamilton
Mrs Fiona Hart
Mrs Lindy Lamb (part time)
Mrs Lorna Watt

Contracts & Knowledge Transfer

Miss Karen Alexander
Miss Angela Anderson

Health & Safety Adviser

Mr Ivan Ezzi

Personnel

Ms Cris Bonomy
Ms Karen Campbell
Mrs Lorna Thomson (part time)
Miss Jennifer Cook

Reception

Mrs Shirley Kersley (part time)
Mrs Irene Partridge (part time)
Ms Margaret Sime (part time)

Assistant Librarian

Mrs Patricia Thomson (part time)
Ms Olga Kimmins

Aquarium Manager

Mr Alex Keay
Mr John Kershaw

Estates/Ship's Husband

Mr Jim Watson

NERC National Diving Facility

Dr Martin Sayer
Mr Hugh Brown
Dr Simon Thurston

RV Calanus

Mr Roderick MacNeil (Master)
Miss Kirsty Dalby
Mr John MacFarlane
Mr Duncan MacNeill
Mr Norman Smith

RV Seol Mara

Mr Douglas McAlpine
Mr Steven Douglas

Electrical Maintenance

Mr Brian Clark
Mr John Hill

Engineering workshop

Mr Andrew Connelly
Mr Mark Robertson (Apprentice Engineer)

Building Maintenance

Mr Duncan MacKinnon

Storeman

Mr Alasdair Black

SAMS ACCOUNTS

Company Information

Directors

Professor Sir J Arbuthnott	(President)
Mr W Balfour	
Dr P Thompson	
Professor I Boyd	
Professor J I Sprent	
Mr R Thwaites	(resigned 6 November 2006)
Mr I H Townend	
Dr R A Scrutton	
Dr A B MacKenzie	
Commodore C Stevenson	
Mr P A Dryburgh	(appointed 6 December 2006)
Dr K L Duff	(appointed 6 December 2006)
Professor A Ferguson	(appointed 6 December 2006)
Dr J M Rogers	(appointed 6 December 2006)

Secretary

Mrs 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
21 Vincent Place
Glasgow G1 2EQ

Registered Office

Dunstaffnage Marine Laboratory
Oban
Argyll PA37 1QA

Charity Number: SC 009206

Secretary's Report

Secretary's Report for the year ending 31 March 2007

The 92nd Annual General Meeting of Association took place on 6 November 2006 at Dunstaffnage Marine Laboratory and was chaired by Sir John Arbuthnott.

Vice Presidents

The following had been nominated by Council and were unanimously elected to serve as Vice-Presidents for a period of one year.

Professor Sir Frederick Holliday, Kt, CBE, BSc, DSc, FIBiol, FRSE,
Professor A D McIntyre, CBE, BSc, DSc, FIBiol, FRSE,
Sir David Smith, MA, Dphil, FRSE, FRS,
Dr J H Steele, BSc, DSc, FRSE, FRS,
Professor Sir William Stewart, Kt, BSc, PhD, DSc, FIBiol, FRSE, FRS,
Professor S A Thorpe, BSc, BA, PhD, FRS.
Dr Ian Graham-Bryce, MA, BSc, Dphil, FRSE, FRSA, Cchem, FRSC

SAMS Board

The following had been nominated and were unanimously elected to serve as Board members for a period of one year:

Professor R Cormack, (representing UHI)
Lord E Strathcona (representing Fishmongers Co.)

SAMS Council

Mr Roger Thwaites wished to stand down from Council. Four new members were elected: Mr P S Dryburgh, Dr K L Duff, Professor A Ferguson and Dr J M Rogers.

The AGM was immediately followed by the Sixteenth Newth Memorial Lecture given by Professor Julian Dowdeswell, Director, Scott Polar Research Institute, University of Cambridge and entitled "Ice and Environmental Change"

The Board of SAMS also met at Dunstaffnage on 6 November 2006 to discuss SAMS strategy, including the relationships with NERC and UHI Millennium Institute (UHI). Four meetings of Council were held during the course of the year.

The Council was served by the Finance and General Purposes Committee chaired by Mr Ian Townend, and the Research and Strategy Committee chaired by Professor Janet Sprent.

Membership of the Association

At 21 August 2007 total membership was 427 including 35 Corporate and 47 student members.

The Council for The Scottish Association for Marine Science (SAMS) presents its report and the group financial statements for the year ended 31 March 2007.

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 427 including 35 corporate and 47 students (451 in 2006), 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 UHI Millennium Institute (UHIMI).

Principal activity

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

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

The strategies employed to achieve the charities objectives during the year:

- To continue to operate the business at a level that enables a contribution to reserves, through careful management of costs.
- Successfully negotiate the Natural Environment Research Council core funding contract (Oceans 2025) for a further 5 years under the principles of Full Economic Costing.
- Invest in recruitment for our new academic posts through the Addressing Research Capacity award submitted through the UHI Millennium Institute, which in turn will help increase our potential success in the Research Assessment Exercise 2008 funding.
- Negotiating funding of £2.5M through Argyll and the Islands Enterprise to help the Group’s liquidity situation.

- Undertake a full review of governance and management of the Learned Society to ensure its charitable objects, and support to both staff and members, is retained and developed for the future success of SAMS.

Business Review

During 2006/07 financial year SAMS embarked on an expansion programme funded in conjunction with the UHI, Highlands and Islands Enterprise, Scottish Funding Council and the European Regional Development Fund in order to strengthen its research capability. The ARC (Addressing Research Capacity) Project brought funding to SAMS in 2006/07 of £1.1M and will continue to fund SAMS growth until 31 July 2009. During the year the ARC funding enabled SAMS to recruit 14 scientists and 10 Technical support staff. In addition it helped fund the old building refurbishment to accommodate the increase in staff.

SAMS has built on the consolidation exercise of 2005/06 with a surplus of £853k compared to prior year of £165k, although £736k of the surplus is within restricted funds, being used to fund buildings and capital equipment. Comparing the surplus in the unrestricted funds shows a slight decline with £117k in this financial year against £146k prior year.

The charity’s wholly owned subsidiary SRSL had an excellent year returning a profit of £229k (£21k in 2006/07), of which all this profit was gifted to the charity. The improved results of the company are due to the exceptionally busy year with the recompression chamber bringing in revenue of £521k (£296k 2006/07).

Results

The results for the year are detailed on page 8 of the financial statements. The net incoming resources taken to reserves is £853,068 (2006 - £165,353).

The Council confirms that on a fund by fund basis, the assets of £9,045,622 are adequate to fulfil the objectives of the group.

Directors

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

There are no directors’ interests requiring disclosure under the Companies Act 1985.

COUNCIL REPORT

Reserves policy

The policy is to retain sufficient funds required to meet the costs of salaries, insurances and other regular commitments to allow for orderly wind down of the organisation, or to allow for the sums necessary to meet the cost of replacement of computer equipment. For the future, the plan is to continue with the policy of strict budgetary control and maximisation of income in order to further increase the level of unrestricted reserves retained.

The 5-year core research programme that was the subject of the 2001 NERC/SAMS agreement has been extended for a further year adding some certainty for the financial planning of SAMS to April 2007. NERC have invited a submission for a further 5-year strategic programme from April 2007.

Future Plans

SAMS funding proposal to NERC for the replacement of its core strategic programme which ended in March 2007 has been successful. The OCEANS 2025 programme is collaborative with other marine research organisations and begun on 1 April 2007. The final details of the contract should be completed in the autumn of 2007.

The UHI project, Addressing Research Capacity in the Highlands and Islands (ARC) progressed rapidly with the refurbishment of part of the remaining 1967 building completed and the recruitment and the bulk of the capital purchase completed by the summer of 2007.

SAMS is also continuing to work with the UHI to achieve university status. During the year the Marine Science degree was revalidated for five years with the inclusion of innovative modules in diving and in collaboration with the University of Svalbard.

Risk Statement

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 Register of Risks were considered during 2006/07 at meetings of SAMS Council, the Finance and General

Purposes Committee and the SRSL Board. The regular process of consideration and review of the appropriateness of the Register is delegated to the Executive Group which reports back to Council.

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.

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

The members of the Governing Council during the year were:

	Date appointed	Date resigned
Professor Sir J Arbuthnott (President)	2 Nov 2004	-
Mr W Balfour	6 Nov 2001	-
Dr P Thompson	6 Nov 2001	-
Professor I Boyd	4 Nov 2003	-
Professor J I Sprent	4 Nov 2003	-
Mr R Thwaites	4 Nov 2003	6 Nov 2006
Mr I H Townend	4 Nov 2003	-
Dr R A Scrutton	2 Nov 2004	-
Dr A B MacKenzie	2 Nov 2004	-
Commodore C Stevenson	7 Nov 2005	-
Mr P A Dryburgh	6 Dec 2006	-
Dr K L Duff	6 Dec 2006	-
Professor A Ferguson	6 Dec 2006	-
Dr J M Rogers	6 Dec 2006	-

accordance with the Memorandum and Articles of Association, which allows trustees to serve a maximum of two consecutive 3-year terms.

Both the Natural Environment Research Council (NERC) and Highlands & Island Enterprise 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, Professor Graham Shimmield and are provided with the relevant

guidance notes from Companies House and the Office of the Scottish Charity Regulator.

SAMS Council meets quarterly and is served by three sub-committees – Finance & General Purposes Committee, Research & Strategy Committee and Activities Committee. The SAMS Council and its committees decide on strategy and the implementation of the strategy is delegated to the Executive Group led by the SAMS Director. Day to day management of the charity is delegated to the SAMS Director, Professor Graham Shimmield.

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.

Directors' statement as to disclosure of information to auditors

The directors who are members of the board 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.

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

The Members of Council (who act as directors) are responsible for preparing the Annual Report and the financial statements in accordance with applicable law and United Kingdom Generally Accepted Practice.

Company law 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). These financial statements are required by law to 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 company 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 1985. 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.

Auditors

A resolution to reappoint Ernst & Young LLP as auditors will be put to the members at the Annual General Meeting.

By order of the board
EB Walton Secretary

AUDITORS' REPORT

Independent Auditors' report to the Members of The Scottish Association for Marine Science

We have audited the group's financial statements for the year ended 31 March 2007 which comprise the Group Income and Expenditure Account, the Group Statement of Financial Activities, the Group Balance Sheet, the Balance Sheet, the Group Statement of Cash Flows and related notes 1 to 20. These financial statements have been prepared under the accounting policies set out therein.

This report is made solely to the charitable company's members, as a body, in accordance with Section 235 of the Companies Act 1985. Our audit work has been undertaken so that we might state to the charitable 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 charitable company and its members as a body, for our audit work, for this report, or for the opinions we have formed.

Respective responsibilities of directors and auditors

The Members of Councils' (who are also the directors of The Scottish Association for Marine Science for the purposes of company law) responsibilities for preparing the Annual Report and financial statements in accordance with applicable United Kingdom law and Accounting Standards (United Kingdom Generally Accepted Accounting Practice) are set out in the Statement of Council's responsibilities.

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, are properly prepared in accordance with the Companies Act 1985 and that the information given in the directors' report is consistent with the financial statements.

In addition we report to you if, in our opinion, the charitable company has not kept proper accounting records, if we have not received all the information and explanations we require for our

audit, or if information specified by law regarding directors' remuneration and other transactions with the charitable group is not disclosed. We read the Annual Report, and consider the implications for our report if we become aware of any apparent misstatements within it.

Basis of audit opinion

We conducted our audit in accordance with United Kingdom Auditing Standards 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 Members of Council in the preparation of the financial statements, and of whether the accounting policies are appropriate to the charitable group's circumstances, consistently applied and adequately disclosed.

We planned and performed our audit so as to obtain all the information and explanations which we considered necessary in order to provide us with sufficient evidence to give reasonable assurance that 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, in accordance with United Kingdom Generally Accepted Accounting Practice, of the state of affairs of the charitable company and of the group as at 31 March 2007 and of the incoming resources and application of resources of the group, including its income and expenditure, for the year then ended;
- the financial statements have been properly prepared in accordance with the Companies Act 1985; and
- the information given in the Council report is consistent with the financial statements.

Ernst & Young LLP
Registered Auditors
Inverness

GROUP INCOME AND EXPENDITURE ACCOUNT

FOR THE YEAR ENDED 31 MARCH 2007

	Notes	2007 £	2006 £
Turnover			
Continuing operations		8,918,209	7,191,244
Discontinued operations		-	96,019
		<hr/>	<hr/>
Cost of sales		8,918,209 6,019,235	7,287,263 5,559,678
		<hr/>	<hr/>
Gross surplus		2,898,974	1,727,585
Administration expenses		1,940,644	1,625,102
		<hr/>	<hr/>
Other operating income		958,330 117,163	102,483 191,810
		<hr/>	<hr/>
Operating surplus			
Continuing operations		1,075,493	294,293
Discontinued operations		-	96,019
	7	1,075,493	390,312
Interest receivable	10	7,065	3,363
Interest payable and similar charges	6	(229,490)	(228,322)
		<hr/>	<hr/>
Surplus on ordinary activities before taxation		853,068	165,353
Tax on surplus on ordinary activities		-	-
		<hr/>	<hr/>
Surplus retained for the financial year		853,068	165,353
		<hr/> <hr/>	<hr/> <hr/>

Statement of total recognised gains and losses

There are no recognised gains or losses other than the surplus of £853,068 in the year ended 31 March 2007 and the surplus of £165,353 in the year ended 31 March 2006.

ACCOUNTS

GROUP STATEMENT OF FINANCIAL ACTIVITIES

FOR THE YEAR ENDED 31 MARCH 2007

	Notes	2007 Unrestricted funds £	2007 Restricted funds £	2007 Total £	2006 Total £
Incoming resources					
Incoming resources from generated funds:					
Activities for generating funds		117,163	-	117,163	191,810
Investment income	11	6,816	249	7,065	3,363
Incoming resources from charitable activities:					
Northern Seas programme & National facilities		2,808,698	110,615	2,919,313	2,740,854
NERC research grants		462,266	-	462,266	220,746
UHI ARC income		329,369	756,500	1,085,869	-
UHIMI income		925,626	177,276	1,102,902	747,973
Other	2	2,763,114	584,745	3,347,859	3,577,690
Total incoming resources		7,413,052	1,629,835	9,042,437	7,482,436
Resources expended					
Cost of generating funds	3	32,650	-	32,650	27,373
Charitable activities	4	7,236,103	893,354	8,129,457	7,235,124
Governance costs		27,262	-	27,262	54,586
Total resources expended		7,296,015	893,354	8,189,369	7,317,083
Net (outgoing)/incoming resource before transfers and tax		117,037	736,031	853,068	165,353
Taxation		-	-	-	-
Transfers between funds		-	-	-	-
Net movements in funds		117,037	736,031	853,068	165,353
Total Funds brought forward at 1 April 2005		380,788	7,811,766	8,192,554	8,027,201
Total Funds carried forward at 31 March 2006		497,825	8,547,797	9,045,622	8,192,554

GROUP BALANCE SHEET

AT 31 March 2007		2007	2006
	Notes	£	£
Fixed assets			
Intangible assets	9	1,308	2,616
Tangible assets	10	12,917,517	12,569,876
Investments	11	81,150	75,901
		<u>12,999,975</u>	<u>12,648,393</u>
Current assets			
Debtors	12	1,489,639	1,644,638
Cash at bank and in hand		714,668	38,404
		<u>2,204,307</u>	<u>1,683,042</u>
Creditors: amounts falling due within one year	13	<u>3,791,757</u>	<u>3,639,157</u>
Net current liabilities		<u>(1,587,450)</u>	<u>(1,956,115)</u>
Total assets less current liabilities		<u>11,412,525</u>	<u>10,692,278</u>
Creditors: amounts falling due after more than one year			
Loans	14	2,366,903	2,499,724
		<u>9,045,622</u>	<u>8,192,554</u>
Capital and reserves			
Unrestricted funds		497,825	380,788
Restricted funds	15	8,547,797	7,811,766
		<u>9,045,622</u>	<u>8,192,554</u>

GROUP STATEMENT OF CASH FLOWS

AT 31 March 2007		2007	2006
	Notes	£	£
Net cash inflow from operating activities	17(a)	3,633,943	202,402
Returns on investment and servicing of finance	17(a)	(222,674)	(225,182)
Taxation		-	-
Capital expenditure	17(a)	(1,092,905)	(875,814)
Financing		<u>(123,979)</u>	<u>(126,084)</u>
(Decrease)/increase in cash	17(b)	<u>2,194,385</u>	<u>(1,024,678)</u>

COMPANY BALANCE SHEET

AT 31 March 2007		2007	2006
	Notes	£	£
Fixed assets			
Tangible assets	10	12,822,843	12,431,736
Investments	11	41,150	40,901
		<u>12,863,993</u>	<u>12,472,637</u>
Current assets			
Debtors	12	1,518,790	1,546,630
Cash at bank and in hand		554,134	28,552
		<u>2,072,924</u>	<u>1,575,182</u>
Creditors: amounts falling due within one year	13	<u>3,596,143</u>	<u>3,464,752</u>
Net current liabilities		<u>(1,523,219)</u>	<u>(1,889,570)</u>
Total assets less current liabilities		<u>11,340,774</u>	<u>10,583,067</u>
Creditors: amounts falling due after more than one year			
Loans	14	2,366,903	2,499,724
		<u>8,973,871</u>	<u>8,083,343</u>
Capital and reserves			
Unrestricted funds		932,280	577,544
Restricted funds	15	8,041,591	7,505,799
		<u>8,973,871</u>	<u>8,083,343</u>

These financial statements were approved on behalf of the Council on 30 September 2007 and were signed by:

I H Townend Acting Chair of Finance and General Purposes Committee

Reconciliation of net cash flow to movement in net funds

	Notes	2007	2006
		£	£
(Decrease)/increase in cash		2,194,385	(1,024,678)
Repayment of long term loans		123,979	126,084
		<u>2,318,364</u>	<u>(898,594)</u>
Net debt at 1 April		<u>(4,116,186)</u>	<u>(3,217,592)</u>
Net debt at 31 March	17(b)	<u>(1,797,822)</u>	<u>(4,116,186)</u>

NOTES TO THE GROUP FINANCIAL STATEMENTS

1. Accounting Policies

Accounting convention

The accounts 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. Adopting the SORP 2005 has resulted in a number of presentational changes to the Group Statement of Financial Activities, including the reclassification of 2006 comparatives.

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 nor corporation tax on its income under the Income and Corporation Taxes Act 1988.

Basis of consolidation

The consolidated accounts incorporate the accounts of the company and its subsidiary undertakings for the year ended 31 March 2007. 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 consolidated profit and loss account from the date of acquisition or up to the date of disposal. In accordance with section 230(4) of the Companies Act 1985, 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 16 to these accounts.

Depreciation

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	-	50 years
Vessels	-	25 years
Fittings and equipment	-	5 - 10 years
Motor vehicles	-	5 years

Taxation

Income is stated net of Value Added Tax and expenditure includes Value Added Tax where this is not recoverable.

Leasing

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, a defined benefit scheme which is externally funded and contracted out of the State Second Pension. The assets of the scheme are held in a separate trustee-administered fund. It is not possible to identify each institution's share of the underlying assets and liabilities of the scheme on a consistent and reasonable basis and therefore, as required by FRS 17 "Retirement Benefits", the Association accounts 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 who 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.

Investments

Investments include property and bank balances for the Sheina Marshall Bequest and the Yonge Fellowship, and equity investments.

Foreign currency transactions

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.

2. Analysis of income received

	2007 Unrestricted funds £	2007 Restricted funds £	2007 Total £	2006 Total £
Furtherance of objectives				
Research grants	2,118,793	62,014	2,180,807	2,098,802
Research contracts	370,021	-	370,021	351,479
Scientific services	222,460	522,731	745,191	811,807
Sales of cultures	51,840	-	51,840	55,667
Receipt of government grants	-	-	-	259,935
	<u>2,763,114</u>	<u>584,745</u>	<u>3,347,859</u>	<u>3,577,690</u>

NOTES TO THE GROUP FINANCIAL STATEMENTS

	2007 £	2006 £
Project income received		
Physics, Technology & Sea Ice	2,093,131	1,914,583
Ecology	2,287,198	2,212,680
Microbial & Molecular Biology	1,131,144	977,483
Biogeochemistry & Earth Science	1,410,782	1,262,246
Biological Services	16,188	9,474
	<u>6,938,444</u>	<u>6,376,466</u>

3. Cost of generating funds

	Unrestricted funds 2007		2006 Restricted funds £	2007 Total £	2006 Total £
	2007 Staff costs £	Other £			
Marketing, publications and newsletters	15,447	17,203	-	32,650	27,373
	<u>15,447</u>	<u>17,203</u>	<u>-</u>	<u>32,650</u>	<u>27,373</u>

4. Charitable activities

	Unrestricted funds 2007		2007 Restricted funds £	2007 Total £	2006 Total £
	2007 Staff costs £	Other £			
Physics, Technology & Sea Ice	786,978	898,141	1,375	1,686,494	1,858,359
Ecology	1,312,489	683,851	285,739	2,282,079	2,182,751
Microbial & Molecular Biology	574,999	265,787	-	840,786	753,252
Biogeochemistry & Earth Science	547,324	857,813	-	1,405,137	1,275,689
Biological Services	32,013	4,949	-	36,962	26,197
Vessels	220,166	65,227	-	285,393	299,744
Scientific support	139,369	111,510	-	250,879	160,831
Buildings	284,919	450,568	606,240	1,341,727	678,301
	<u>3,898,257</u>	<u>3,337,846</u>	<u>893,354</u>	<u>8,129,457</u>	<u>7,235,124</u>

5. Total charitable expenditure

	2007 £	2006 £
Auditors' remuneration		
- audit services	13,500	12,300
- other services	9,625	18,800
Depreciation and amortisation	741,572	620,324
Operating lease charges - motor vehicles and equipment	81,555	34,974
	<u>846,052</u>	<u>734,398</u>

6. Remuneration of the members of the Council

The non-executive Council members received £7,472 (2006 - £3,836) remuneration, in the form of travel expenses, in total from the Association during the year.

Professor G B Shimmield is a director of the subsidiary undertakings, SAMS Research Services Limited and The European Centre for Marine Biotechnology Limited. Professor G B Shimmield was paid total remuneration of £102,136 (2006 - £96,737) and pension contributions of £13,441 (2006 - £12,350), as an employee of The Scottish Association for Marine Science.

7. Staff costs

	2007 £	2006 £
Wages and salaries	2,307,327	2,071,531
Social security costs	197,407	160,532
Other pension costs	291,936	267,577
	<u>2,796,670</u>	<u>2,499,639</u>

The average weekly number of employees during the year was as follows:

	2007 No.	2006 No.
Scientific	65	54
Scientific services	11	11
Office management	21	12
	<u>97</u>	<u>78</u>

NOTES TO THE GROUP FINANCIAL STATEMENTS

The remuneration of the employees of NERC working for the Association was as follows:

	2007 £	2006 £
Wages and salaries	957,584	946,481
Social security costs	78,623	77,767
Other pension costs	197,369	196,552
	<u>1,233,576</u>	<u>1,220,800</u>

The average weekly number of NERC employees during the year was as follows:

	2007 No.	2006 No.
Scientific	14	15
Scientific services	5	5
Office management	9	10
	<u>28</u>	<u>30</u>

The number of employees who received in excess of £50,000 per annum was as follows:

	No.	No.
£50,000 - £60,000	2	-
£60,001 - £70,000	-	-
£70,001 - £80,000	-	-
£80,000 - £90,000	-	-
£90,000 - £100,000	-	1
£100,000 - £110,000	1	-
	<u>1</u>	<u>-</u>

The total pension contributions paid by the company for the above members of staff were £21,830 (2004 - £25,794).

8. Investment income

	2007 £	2006 £
Interest receivable	7,065	3,363
	<u>7,065</u>	<u>3,363</u>

9. Intangible fixed assets

	Intellectual Property £
Group	
Cost:	
At 1 April 2006 and 31 March 2007	6,540
Amortisation:	
At 1 April 2006	3,924
Provided during the year	1,308
At 31 March 2007	5,232
Net book value:	
At 31 March 2007	1,308
At 31 March 2006	2,616

The estimated useful life of the intellectual property has been assessed as 5 years by the directors of the group.

10. Tangible fixed assets - Group

	Property £	Vessels £	Fittings and equipment £	Total £
Cost:				
At 1 April 2006	12,959,294	416,678	4,255,894	17,631,866
Additions	427,486	-	660,419	1,087,905
At 31 March 2007	<u>13,386,780</u>	<u>416,678</u>	<u>4,916,313</u>	<u>18,719,771</u>
Depreciation:				
At 1 April 2006	1,297,974	416,678	3,347,338	5,061,990
Charge for year	256,374	-	483,890	740,264
At 31 March 2007	<u>1,554,348</u>	<u>416,678</u>	<u>3,831,228</u>	<u>5,802,254</u>
Net book value:				
At 31 March 2007	<u>11,832,432</u>	<u>-</u>	<u>1,085,085</u>	<u>12,917,517</u>
At 31 March 2006	<u>11,661,320</u>	<u>-</u>	<u>908,556</u>	<u>12,569,876</u>

NOTES TO THE GROUP FINANCIAL STATEMENTS

Tangible fixed assets - Company

	Property £	Vessels £	Fittings and equipment £	Total £
Cost:				
At 1 April 2006	12,959,294	416,678	4,025,992	17,401,964
Additions	427,486	-	657,276	1,084,762
At 31 March 2007	13,386,780	416,678	4,683,268	18,486,726
Depreciation:				
At 1 April 2006	1,297,974	416,678	3,255,576	4,970,228
Charge for year	256,374	-	437,281	693,655
At 31 March 2007	1,554,348	416,678	3,692,857	5,663,883
Net book value:				
At 31 March 2007	11,832,432	-	990,411	12,822,843
At 31 March 2006	11,661,320	-	770,416	12,431,736

11. Investments

	Group		Company	
	2007 £	2006 £	2007 £	2006 £
Sheina Marshall Bequest:				
Flat at cost	25,673	25,673	25,673	25,673
Bank balances	13,941	13,692	13,941	13,692
Debtor	1,536	1,536	1,536	1,536
	41,150	40,901	41,150	40,901
Other investments	40,000	35,000	-	-
	81,150	75,901	41,150	40,901

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

Subsidiary undertakings	Holding	Proportion of voting Rights and shares held	Nature of Business
SAMS Research Services Limited	Ordinary shares	100%	Marine and research support services
The European Centre for Marine Biotechnology	Limited by guarantee	Sole member	Advancement of education, research and knowledge in marine science

SAMS Research Services Limited and The European Centre for Marine Biotechnology gift aid all of their taxable profits to The Scottish Association for Marine Science.

	SAMS Research Services Limited 2007 £
Turnover	1,133,059
Cost of sales and administrative expenses	(907,787)
Interest receivable and other operating income	4,366
Interest payable	(39)
Net profit before Gift Aid and tax	229,599
Amount gifted to charity	(230,220)
Taxation	-
Loss for the year	(621)
The assets and liabilities of the subsidiary were:	
Fixed assets	135,982
Current assets	466,583
Creditors: amounts falling due within one year	(530,493)
Deferred government grants	(75,337)
Aggregate share capital and reserves	(3,265)

The results of The European Centre for Marine Biotechnology for the year ended 31 March 2007 are not material to the group.

NOTES TO THE GROUP FINANCIAL STATEMENTS

12. Debtors

	Group		Company	
	2007 £	2006 £	2007 £	2006 £
Trade debtors	321,705	691,977	94,054	343,221
Other debtors	1,050	1,788	1,050	1,749
VAT debtor	12,119	20,406	12,119	20,406
Prepayments and accrued income	1,154,765	930,467	1,077,675	878,174
Due from group undertakings	-	-	338,892	303,080
	<u>1,489,639</u>	<u>1,644,638</u>	<u>1,518,790</u>	<u>1,546,630</u>

13. Creditors: amounts falling due within one year

	Group		Company	
	2007 £	2006 £	2007 £	2006 £
Current instalment due on bank loan (note 14)	145,587	136,745	145,547	136,745
Bank overdraft	-	1,518,121	-	1,518,121
Payments received in advance	3,110,784	1,398,144	3,096,892	1,313,697
Taxation and social security	136,632	141,150	100,672	85,441
Sundry creditors and accruals	398,754	444,997	250,806	410,748
Due to group undertakings	-	-	2,186	-
	<u>3,791,757</u>	<u>3,639,157</u>	<u>3,596,143</u>	<u>3,464,752</u>

The bank loans and overdraft are secured by a bond and floating charge over the whole assets of the company and a standard security over Dunstaffnage Marine Laboratory, Oban both in favour of the Bank of Scotland. HIE Argyll and the Islands also hold a standard security over Dunstaffnage Marine Laboratory, Oban.

14. Loans

	Group		Company	
	2007 £	2006 £	2007 £	2006 £
Not wholly repayable within five years: £2,900,000 bank loan at 1.25% above LIBOR per annum, repayable in monthly instalments of £16,111 commencing 3 March 2004	2,512,490	2,636,469	2,512,490	2,636,469
Less: included in creditors: amounts falling due within one year (note 13)	145,587	136,745	145,587	136,745
	<u>2,366,903</u>	<u>2,499,724</u>	<u>2,366,903</u>	<u>2,499,724</u>
Amounts repayable:				
In one year or less, or on demand	145,587	136,745	145,587	136,745
In more than one year but not more than two years	142,775	136,745	142,775	136,745
In more than two years but not more than five years	547,123	410,235	547,123	410,235
	<u>835,485</u>	<u>683,725</u>	<u>835,485</u>	<u>683,725</u>
In more than five years	1,677,005	1,952,744	1,677,005	1,952,744
	<u>2,512,490</u>	<u>2,636,469</u>	<u>2,512,490</u>	<u>2,636,469</u>

15. Restricted funds

Group	1 April 2006 £	Income £	Expenditure £	Transfer to unrestricted funds £	31 March 2007 £
	Fixed asset funds	7,581,308	1,106,405	606,240	-
Sheina Marshall Bequest	40,901	249	-	-	41,150
Yonge Fellowship	3,093	-	-	-	3,093
Recompression	145,469	521,356	285,739	-	381,086
Argos	40,995	1,375	1,375	-	40,995
	<u>7,811,766</u>	<u>1,629,385</u>	<u>893,354</u>	<u>-</u>	<u>8,547,797</u>
Company	1 April 2006 £	Income £	Expenditure £		31 March 2007 £
Fixed asset funds	7,461,805	1,106,405	570,862		7,007,348
Sheina Marshall Bequest	40,901	249	-		41,150
Yonge Fellowship	3,093	-	-		3,093
	<u>7,505,799</u>	<u>1,106,654</u>	<u>570,862</u>		<u>8,041,591</u>

NOTES TO THE GROUP FINANCIAL STATEMENTS

Capital grants are recognised as restricted income in the year in which they are received and the depreciation 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.

16. Income and expenditure account

In accordance with the exemption allowed by section 230 of the Companies Act 1985 the company has not presented its own income and expenditure account or statement of financial activities. The net incoming resources for the financial period attributable to members of the parent company dealt with in the accounts was £890,258 (2006 – £29,642).

17. Notes to the statement of cash flows

(a) Reconciliation of net incoming resources to net cash inflow from operating activities:	2007 £	2006 £
Operating surplus	1,075,493	390,312
Depreciation and amortisation	741,572	620,324
Decrease/(increase) in debtors	154,999	(162,218)
Increase/(decrease) in creditors	1,661,879	(646,016)
Net cash inflow from operating activities	<u>3,633,943</u>	<u>202,402</u>

Returns on investment and servicing of finance	2007 £	2006 £
Interest received	6,816	3,140
Interest paid	(229,490)	(228,322)
	<u>(222,674)</u>	<u>(225,182)</u>

Capital expenditure and financial investment	2007 £	2006 £
Payments to acquire investments	(5,000)	(35,000)
Payments to acquire tangible fixed assets	(1,087,905)	(848,943)
Proceeds from sale of tangible assets	-	8,129
	<u>(1,092,905)</u>	<u>(875,814)</u>

Financing	2007 £	2006 £
Repayment of long term loans	<u>(123,979)</u>	<u>(126,084)</u>

(b) Analysis of changes in net debt	At 1 April 2006 £	Cash flow £	Other changes £	At 31 March 2007 £
Cash at bank and in hand	38,404	676,264	-	714,668
Debt due within one year	(1,654,866)	1,642,100	(132,821)	(145,587)
Debt due after one year	(2,499,724)	-	132,821	(2,366,903)
	<u>(4,116,186)</u>	<u>2,318,364</u>	<u>-</u>	<u>(1,797,822)</u>

18. Pension commitments to pension fund

The Association participates in the Universities Superannuation Scheme, a defined benefit scheme which is externally funded and contracted out of the State Second Pension. The assets of the scheme are held in a separate trustee-administered fund. It is not possible to identify each institution's share of the underlying assets and liabilities of the scheme on a consistent and reasonable basis and therefore, as required by FRS17 "Retirement Benefits" contributions to the scheme are accounted for as if it were a defined contribution scheme. As a result, the cost recognised within the surplus/deficit for the year in the Statement of Financial Activities represents the contributions payable to the scheme for the year.

The latest actuarial valuation of the scheme was at 31 March 2005. 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) and the rates of increase in salary and pensions. In relation to the past service liabilities the financial assumptions were derived from market yields prevailing at the valuation date. It was assumed that the valuation rate of interest would be 4.5% per annum, salary increases would be 3.9% per annum (plus an additional allowance for increases in salaries due to age and promotion in line with recent experience) and pensions would increase by 2.9% per annum. In relation to the future service liabilities it was assumed that the valuation rate of interest would be 6.2% per annum, including an additional investment return assumption of 1.7% per annum, salary increases would be 3.9% per annum (also plus an allowance for increases in salaries due to age and promotion) and pensions would increase by 2.9% per annum. The valuation was carried out using the projected unit method.

At the valuation date, the market value of the assets of the scheme was £21,740 million and the value of the past service liabilities was £28,308 million leaving a deficit of £6,568 million. The assets therefore were sufficient to cover 77% 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. Using the Minimum Funding Requirement prescribed

NOTES TO THE GROUP FINANCIAL STATEMENTS

assumptions introduced by the Pensions Act 1995, the scheme was 126% funded at that date; under the Pension Protection Fund regulations introduced by the Pensions Act 2004 it was 110% funded; on a buy-out basis (ie assuming the Scheme had discontinued on the valuation date) the assets would have been approximately 74% of the amount necessary to secure all the Universities Superannuation Scheme benefits with an insurance company; and using the FRS17 formula as if Universities Superannuation Scheme was a single employer scheme, the actuary estimated that the funding level would have been approximately 90%.

The company contribution rate required for future service benefits alone at the date of the valuation was 14.3% of pensionable salaries but it was agreed that the company contribution rate will be maintained at 14% of pensionable salaries. Surpluses or deficits which arise at future valuations may impact on the company's future contribution commitment. An additional factor which could impact the funding level of the scheme is that with effect from 16 March 2006, Universities Superannuation Scheme positioned itself as a "last man standing" scheme so that in the event of the insolvency of any of the participating employers in the Universities Superannuation Scheme, 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. The next formal triennial actuarial valuation is due as at 31 March 2008. The contribution rate will be reviewed as part of each valuation. The total pension cost for the group was £489,305 (2006 - £267,577). The contribution rate payable by the group was 14% of pensionable salaries.

19. Capital commitments

	Group		Company	
	2007 £	2006 £	2007 £	2006 £
Capital commitments contracted for	-	430,000	-	430,000

20. Other financial commitments

At 31 March 2007 the group had annual commitments under non-cancellable operating leases as set out below:

	Group		Company	
	Other 2007 £	2004 £	Other 2007 £	2004 £
Operating lease which expire:				
within one year	-	4,874	-	4,874
within two to five years	58,777	39,254	58,777	39,254
	<u>58,777</u>	<u>44,128</u>	<u>58,777</u>	<u>44,128</u>



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