



2020-21

Annual Report

Independent marine science for healthy oceans since 1884

Contents

04 Welcome

06 At a glance

08 Research

18 Education

22 Enterprise

26 Public engagement

28 People

30 Finance

32 Publications

43 Staff list

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Cover image: In a partnership with Seawilding and Project Seagrass we are working towards Scotland's first community-led seagrass restoration at Loch Craignish.



About SAMS

Our vision is an ocean in balance that is healthy and sustainable. We work towards this by...

- **DISCOVERING** new knowledge about the oceans through world-class, transformational research
- **COMMUNICATING** our new knowledge through inspirational education and public engagement and
- **APPLYING** this knowledge through government, business and research partnerships to solve some of the greatest challenges facing our planet

Our research embraces the great challenge of our time: how to provide sustainable food and energy for a growing human population while safeguarding the health, biodiversity and productivity of the natural environment and researching causes, impacts and solutions to climate change. SAMS focuses on marine related aspects of these challenges, conducting research around the world, across disciplines and at all scales with our partners and stakeholders. To ensure any new knowledge we generate is used we educate, inspire, advise and collaborate with all sectors of society: from school children to world leaders.

Founded by Sir John Murray in 1884 in Edinburgh, SAMS is the United Kingdom's oldest independent and dedicated marine science organisation, engaged in research, education and enterprise.

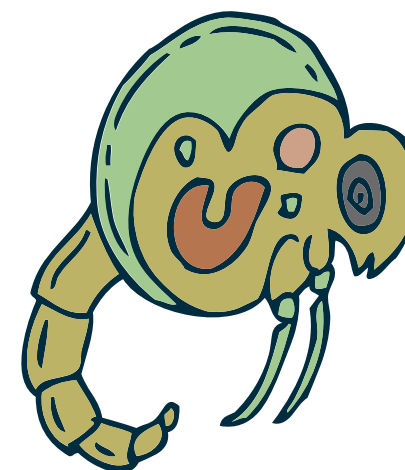
SAMS is a company limited by guarantee governed by its Memorandum and Articles of Association. It is also a registered Scottish charity with a membership.

It operates two wholly owned active subsidiary companies: SAMS Research Services Limited (renamed SAMS Enterprise on 1 April 2021) and SAMS Limited.

SAMS is a founding academic partner of the University of the Highlands and Islands, an Associated Institution of the United Nations University, a delivery partner of UKRI Natural Environment Research Council and a partner in both the Marine Alliance for Science and Technology for Scotland (MASTS) and the Scottish Alliance for Geoscience, Environment and Society (SAGES).

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Scotland | United Kingdom

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Company Number: SC009292



What a year!

Welcome to the SAMS 2020-21 Annual Report: a reporting year like no other!

This is a reference primarily to the **COVID-19 pandemic**, which developed in the early months of 2020. By the week before the start of our business and reporting year on 1st April the UK had come to an almost complete lockdown and standstill. In those early weeks the prospects for SAMS seemed uncertain and potentially bleak. Little did we know that responding to the pandemic would occupy the whole year and beyond. And if this was not a sufficient challenge, the prospect of **Brexit** loomed large and became a reality on January 1st 2021.

Looking back to the early part of the year I can only marvel at how quickly and positively the SAMS community responded to the rapidly changing situation. The UK and Scottish Governments introduced, almost overnight, rigorous limitations on what we could do and these had to be interpreted and translated to accommodate our local requirements. Most staff and students had to work from home for the entire year. This was a great challenge, requiring support and new ways of working and communicating. It also required unprecedented resilience and dedication.

Unlike some organisations, SAMS could not simply shut down. We deliver several essential services that could only be carried out on site. For example we had to maintain our world-leading Culture Collection of Algae and Protozoa (CCAP), a collection of 3000 mostly microscopic organisms, as a national facility. Other colleagues had to keep the numerous animals and plants in our Alan Ansell research aquarium safe while others again kept on monitoring the health of Scotland's

shellfish producing waters. To maintain these essential activities our campus facilities had to remain open, safe and fully functioning and numerous colleagues kept on working on site in a 'new normal'. I must express my sincere gratitude to the on-site team for their perseverance under trying conditions. While numerous individuals could be singled out for praise, I should like to give particular thanks to our Safety, Health and Environment Officer, Chris Clay, our Deputy Director, Professor Axel Miller, and our Facilities Manager, Iain MacCorquodale. Together they have been stage-managing the entire operation of 'lockdown' most effectively, safely and efficiently: Thank you.

I also need to thank our students for their positive response to the COVID challenges and their acceptance of the restrictions. There were extra time pressures on students, both postgraduate and undergraduate, and I know it was not an easy time for some. However, with their personal resilience and support from supervisors, lecturers and the education support team, the student experience, while different and unexpected, was largely successful. Staff teaching on the undergraduate course had to adapt to on-line teaching at a moment's notice and their achievements have been nothing short of inspirational. I think the following quote, which was sent to us from the student association needs no further embellishment:

"I wanted to thank you all for getting us through this semester. It has been challenging for us and I am sure it was not easy for you either. For most of us, this is the first time any global event has really impacted our personal lives. We appreciate that you have helped to keep at least a part of our

everyday life as normal as it could have been. The class reps and I had a chat and we agree that we are happy how things were handled here at SAMS and how you continued to support us to get assessments and the OTAs done. We hope you are getting a little break now. A big thank you!"

Highlands and Islands Student Association (HISA) SAMS Depute & Class Reps

This is not the place to identify all the actions and activities that were needed to be put in place to ensure an effective response to the pandemic, but huge efforts were needed across the entire organisation: from the Chair and members of SAMS' governing bodies; the various management teams; Trades Unions; the Research Areas; line managers etc. No part of SAMS was unaffected and no part of SAMS failed to respond magnificently.

In many ways, this year has seen SAMS at its best. Amazingly, perhaps, despite the challenges SAMS has had a very successful year, as this Annual Report shows. As always, the report can only be a selection of our achievements: for more detail please see the website, and if not already signed up to our online 'Ocean Explorer Magazine' please do so.

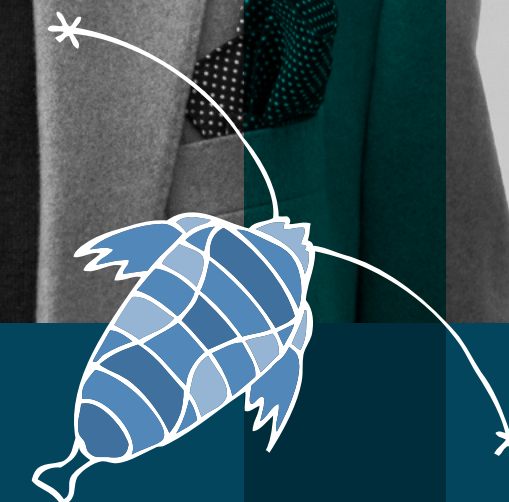
I hope you enjoy reading this report as much as we have enjoyed producing it.



Professor Nicholas JP Owens
SAMS Director

“

Looking back to the early part of the year I can only marvel at how quickly and positively the SAMS community responded to the rapidly changing situation.





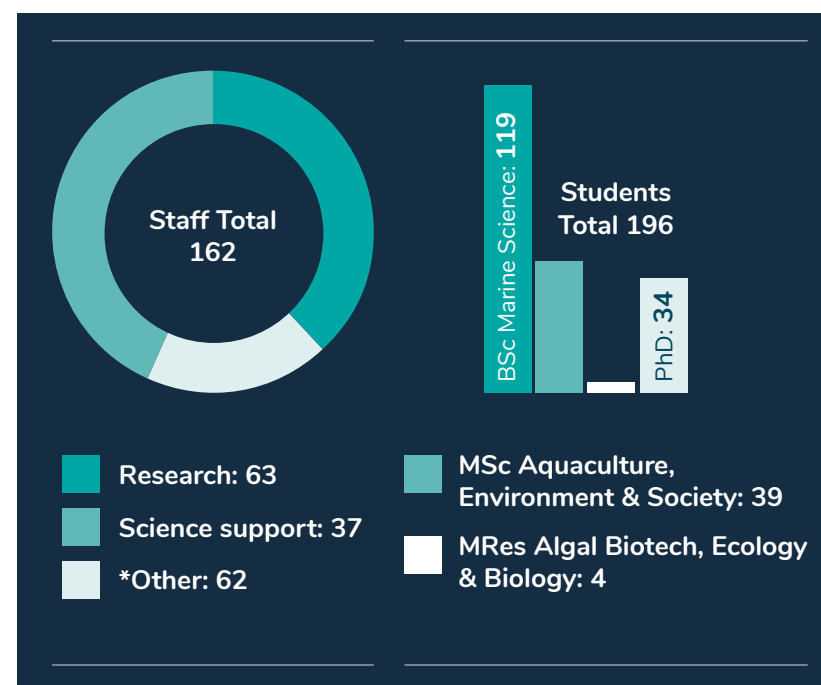
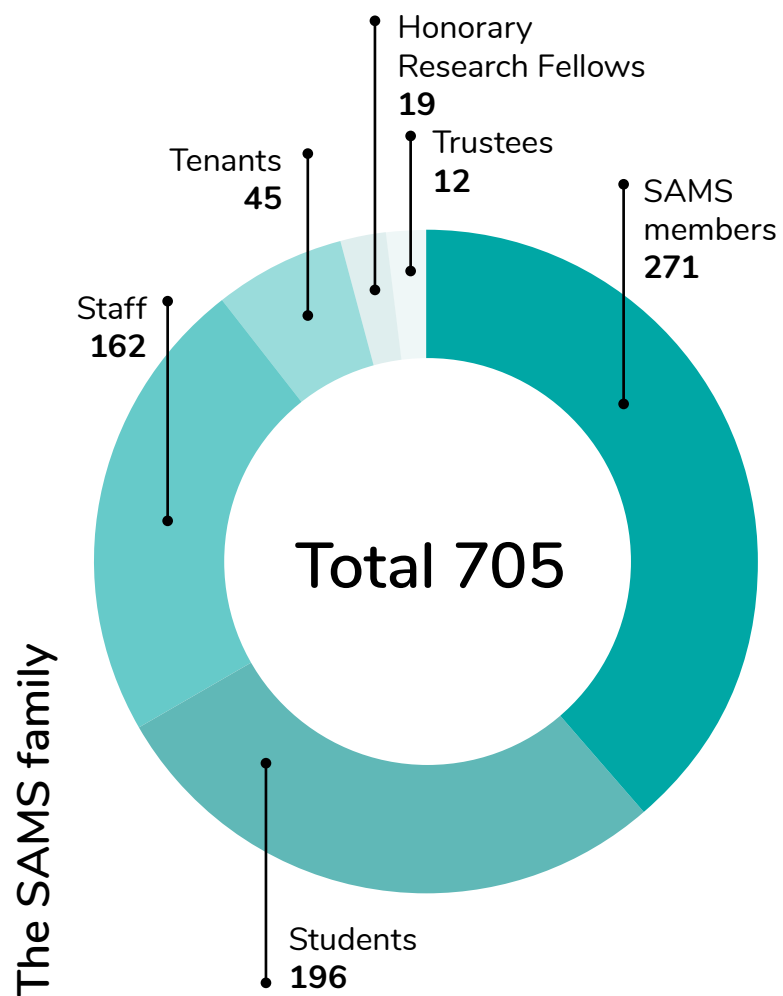
At a Glance

Activities

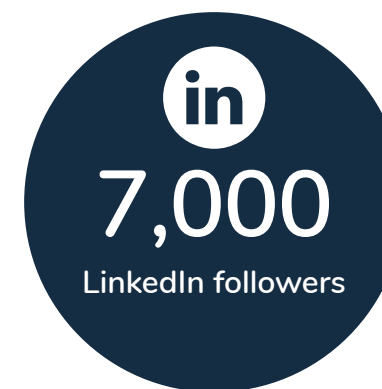
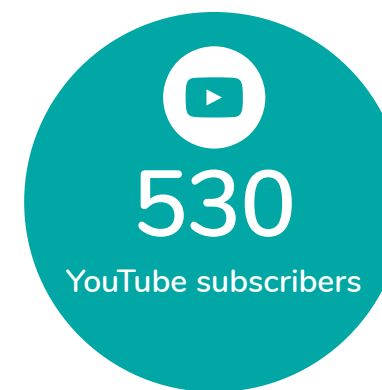
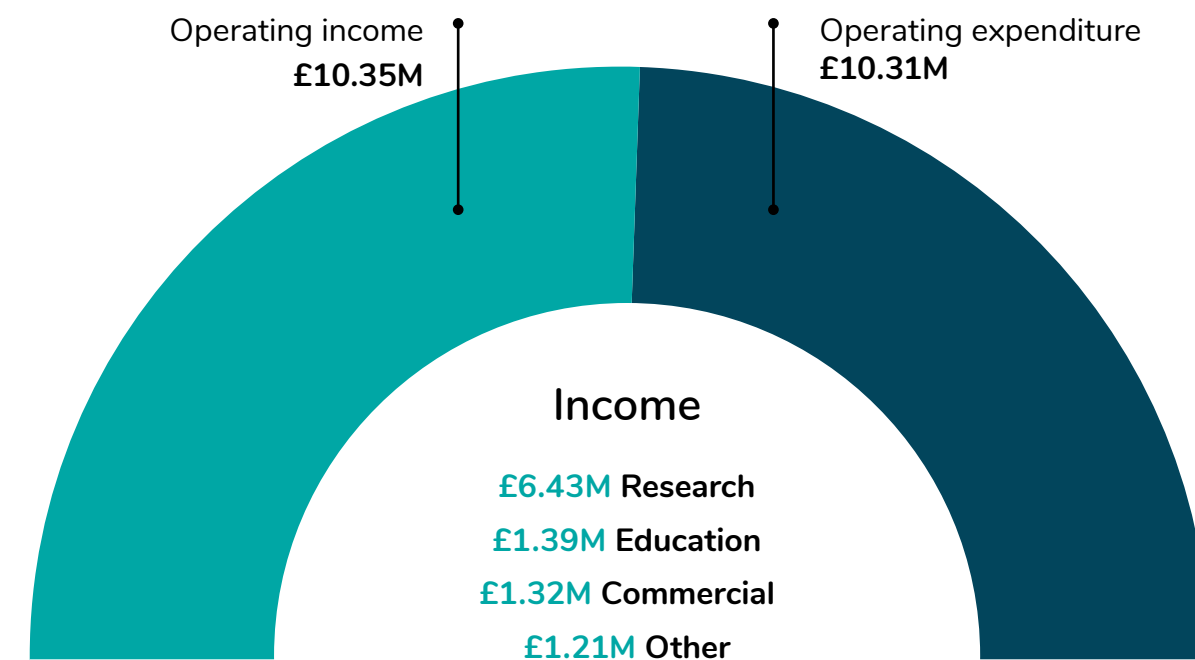
- 3** TAUGHT PROGRAMMES
- 30** COMMERCIAL contracts
- 151** PEER-REVIEWED publications
- 154** FUNDED research projects
- 1140** CULTUERS sold

www.sams.ac.uk

213,796
Page views



Finance



*Education, Enterprise, Professional Services, Management

Research overview




Our researchers study many aspects of the marine environment to develop a deeper understanding of the ocean system. We have experts in physical oceanography, marine geology, chemical oceanography, marine biology, biotechnology, marine resource management and social science and study the ocean from the air above the sea surface to the deepest ocean trenches all around our planet. This diversity is a characteristic strength of SAMS and has skilled us to work and communicate across disciplines and with different stakeholders.

Our multidisciplinary research team focuses on three complex societal challenges: to increase our understanding of ocean systems; to provide tools and knowledge to

manage the health and uses of our dynamically changing coasts; and to support the development of a sustainable blue economy.

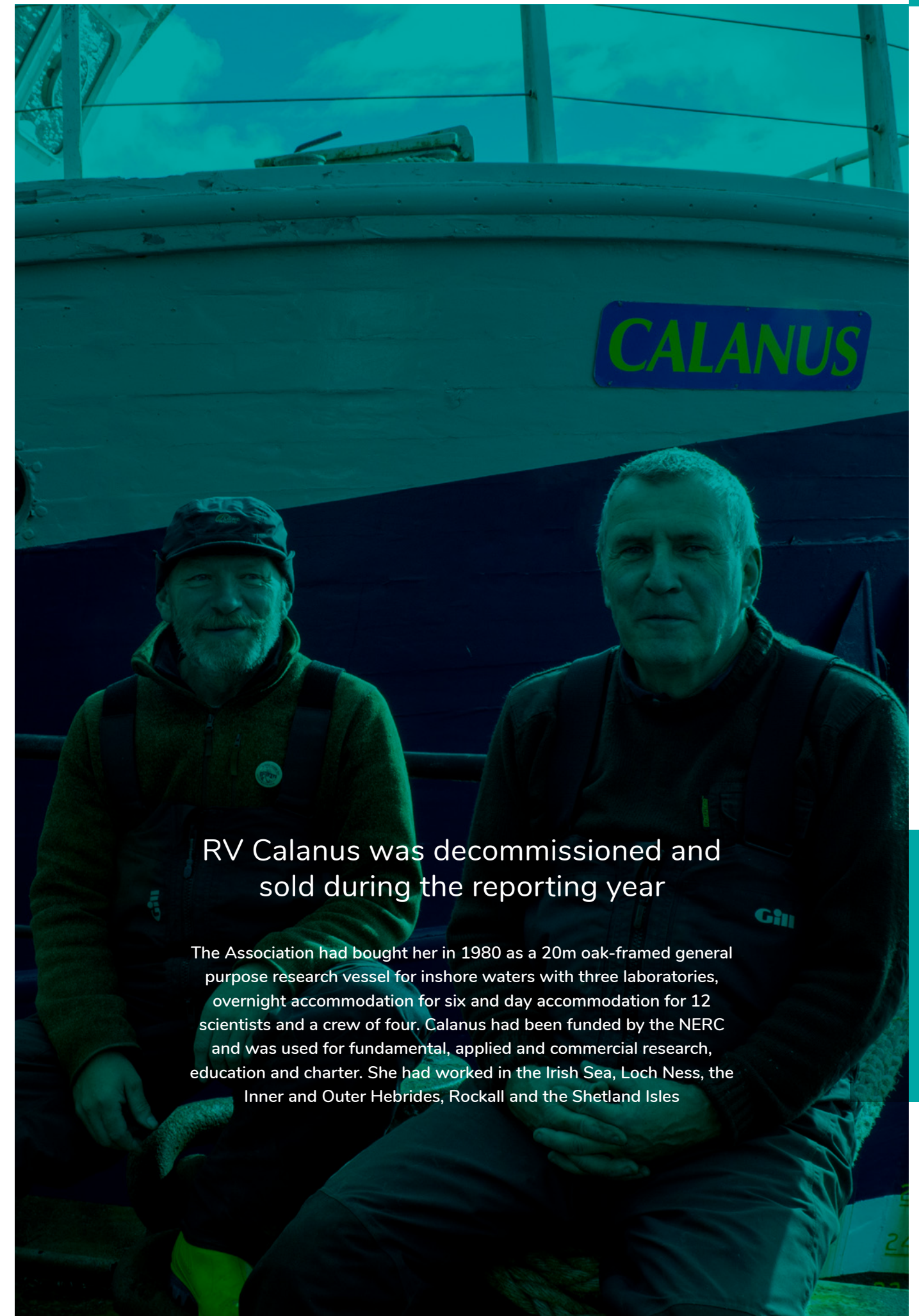
We therefore organise our research into three broad research areas rather than traditional disciplinary departments. Projects are usually affiliated with one research area but researchers themselves often contribute to more than one research area.

Three Associate Directors (Profs Keith Davidson, Michele Stanley and Ben Wilson) manage all Principal Investigators and represent the researcher voice on the Executive Group, while two researchers co-lead each Research Area.

Ocean Systems	Dynamic Coasts	Blue Economy
		
FIELDS	FIELDS	FIELDS
<ul style="list-style-type: none"> Arctic science Physical oceanography Ecosystem function Robotics 	<ul style="list-style-type: none"> Climate change impacts Marine conservation Pollution Fisheries Social science 	<ul style="list-style-type: none"> Aquaculture Energy generation Seaweed industry development Biotechnology

Research Area Leaders: Ocean Systems: Prof Finlo Cottier, Dr Robyn Tuerena, Dynamic Coasts: Dr Helena Reinardy, Dr Will Goodall-Copestake, Blue Economy: Dr Adam Hughes, Dr Lucie Novoveska.

During the reporting year the operation of this science management structure became further embedded in the organisation, facilitating a more integrated approach across different areas of the business. This gave rise to the preparation of an internal research and innovation strategy and the identification of key growth areas, which resulted in recruiting several additional skilled scientists to SAMS. The restructuring and subsequent developments have put a strong foundation in place for taking forward significant projects and future plans.



RV Calanus was decommissioned and sold during the reporting year

The Association had bought her in 1980 as a 20m oak-framed general purpose research vessel for inshore waters with three laboratories, overnight accommodation for six and day accommodation for 12 scientists and a crew of four. Calanus had been funded by the NERC and was used for fundamental, applied and commercial research, education and charter. She had worked in the Irish Sea, Loch Ness, the Inner and Outer Hebrides, Rockall and the Shetland Isles

Ocean Systems Research

The Ocean Systems research area addresses fundamental science questions from a global perspective.

We are exploring key processes that comprise the interconnected ocean systems at scales from molecular to planetary, covering all scientific disciplines. Research topics include polar science, large-scale oceanography, climate change, ecosystem function and the deep sea. Much of this exploration depends on the development and operation of flying and diving robots, based at our Scottish Marine Robotics Facility.

Deep ocean will soon feel the heat

The world's deep oceans are currently warming more slowly than the ocean surface, but even creatures in the deep ocean will be significantly affected in the coming decades, according to new research published in Nature Climate Change. Co-authored by Professor **Mike Burrows** the global team used a metric called climate velocity that describes the likely speed and direction of species' range shifts as the ocean warms. They calculated climate velocity throughout the ocean for the past 50 years and for the rest of the century using data from 11 climate models.

The researchers found that climate velocity is currently twice as fast at the surface because of greater surface warming, implying deeper-living species are likely to be less at risk from climate change than those at the surface. However, by 2100, assuming a high-emissions future, there is not only greater surface warming, but this warmth will have penetrated much deeper: Climate velocities at the surface will be seven times faster than they are now. But in water depths between 200 and 1000 metres, climate velocities will accelerate to 11 times their present rate.

Not only is climate velocity moving at different speeds at different depths in the ocean, but also in different directions,

posing great challenges to the ways we design protected areas.

Lead author Isaac Brito-Morales suggests that action must be taken to aggressively manage carbon emissions.

International call to explore mysteries of the deep sea

An international team of scientists from 45 institutions in 17 countries, including Professor **Bhavani Narayanaswamy** from SAMS, has called for a dedicated decade-long programme of research to greatly advance discovery in the deep sea, which is both the largest ecosystem on our planet and one of the least known.

The programme – which scientists have named Challenger 150 – will coincide with the United Nations Decade of Ocean Science for Sustainable Development, which runs from 2021-2030. Challenger 150 aims to create new geological, physical, biogeochemical, and biological data through a global cooperative of science and innovation, including the application of new technology. These data will be used to understand how changes in the deep sea impact the wider ocean and life on the planet.

Among its key areas of focus are to build greater capacity and diversity in the scientific community, acknowledging

the fact that existing deep-sea research is conducted primarily by developed nations with access to resources and infrastructure.

The programme will use this new knowledge of the deep to support regional, national, and international decision-making on deep-sea issues such as mining, hydrocarbon extraction, fishing, climate mitigation, laying of fibre optic cables and conservation.

“The deep sea is by far the largest ecosystem on planet earth with a plethora of species and a variety of different habitats. A truly global programme is required in order to not only learn more about this ecosystem and to put measures in place to manage it in a sustainable fashion, but to also train the next generation of researchers, the future custodians of the deep sea.”

Professor Bhavani Narayanaswamy

For more information please visit <https://challenger150.world>

Photophobia may help zooplankton adapt to climate change

An aversion to light has long been a survival tactic used by tiny marine animals known as zooplankton. Now scientists have discovered that photophobia may

protect Arctic zooplankton against impacts of environmental changes.

Many zooplankton species conduct daily vertical migrations up and down the water column in response to changing light conditions. By staying in deeper, darker depths during the day, they may avoid visual predators, coming to the surface to feed on tiny marine plants known as phytoplankton during the relative safety of the night.

Light in the Arctic Ocean is changing: As sea ice melts due to climate change, more light penetrates the water. Added to an increase in artificial light from infrastructure and shipping, these changes are potentially making zooplankton – a crucial part of the ocean food web – more vulnerable to predators.

New research has been published that describes that zooplankton have an established threshold of light tolerance, regardless of the time of day, season or year, suggesting they are capable of adapting to dramatic changes in light. As the depth at which this light level is found moves up and down the water column between day and night and across seasons, zooplankton are seen to remain below it, avoiding the shallow depths where it is light.

First UK cruise of the pandemic: monitoring the Atlantic Meridional Overturning Circulation

Cruise DY120 on RRS Discovery was the UK's first ocean-going research expedition since the start of the Covid 19 restrictions in March.

Departing on 8 October 2020 the expedition headed into the North Atlantic towards the Rockall Trough and the Iceland Basin to retrieve and redeploy underwater sensors attached to moorings.

The team, consisting of six SAMS researchers, a colleague from the National Oceanography Centre, seven National Marine Facilities technicians and the crew of Discovery, successfully changed over six moorings and added a seventh to the west of the Rockall Plateau to measure a jet of the North Atlantic Current recently discovered by underwater robotic gliders from SAMS. On their return to SAMS on October 24, research cruise leader Professor

Stuart Cunningham described the data retrieval as 'exceptional', as all but one of 125 instruments made continuous measurements over a the 27-month deployment.

The expedition was part of the UK-OSNAP project that is gathering continuous records of full-depth, trans-basin heat, mass and freshwater fluxes in the Subpolar Gyre. It is part of an international collaboration to establish a transoceanic observing system in the subpolar North Atlantic: the OSNAP array. Understanding the transport of heat and freshwater in this ocean region is essential for predicting the climate of the North Atlantic and Europe.



The findings were published in Biology Letters: Hobbs, Banas, Cohen, Cottier, Berge and Varpe (2021) <https://doi.org/10.1098/rsbl.2020.0810>.

How a changing Arctic affects UK climate

Professor **Finlo Cottier** has co-authored a discussion paper on how the changing Arctic is linked to the UK's climate. The main findings from the paper include:

- The Arctic has warmed by around 2°C since 1850, approximately double the global average. Even if the Paris Agreement successfully limits global warming to a further 0.5°C, the Arctic is expected to warm by at least another 1°C.
- UK weather is linked to conditions in the European Arctic.

• Scientists need to take observations and improve their understanding of climatic processes in the Nordic Seas and the Arctic Ocean to fill gaps in knowledge about the links between the Arctic climate and the UK's weather; a risk identified by the Intergovernmental Panel on Climate Change (IPCC).

- The UK has significant research expertise and experience to understand how global warming will change the Arctic's environment and affect the UK.
- This strength, allied with the capabilities of the UK's new polar research ship the RRS Sir David Attenborough, warrants

an integrated programme of research, including advanced numerical modelling, to improve predictions of future extreme weather events.

- Such a programme must acknowledge that the Arctic is politically an increasingly congested and contested space. It should be designed in collaboration with key Arctic and near-Arctic nations to increase the UK's influence and ability to prepare, respond and plan for future extreme weather events.

Tropic seamounts retain Atlantic deep-ocean water

Ocean circulation models had predicted that seamounts can obstruct the flow of deep-ocean water. In a new study, co-authored by Professor Mikhail Zubkov, planktonic bacteria were used to assess how long deep-ocean water may be retained by an isolated tropic seamount in the North-Eastern Atlantic. The researchers measured 2.4 times higher bacterial concentrations in the seamount-associated water than surrounding deep ocean water. Based on analysis of genomics and proteomic of the bacteria the researchers calculate that the seamount retains the deep-ocean water for an additional 1.8 years.

Giljan et al (2020) <https://doi.org/10.1038/s41598-020-61417-0>

Dynamic Coasts Research

The Dynamic Coasts research area develops new knowledge in natural and social science that underpins the management of coastal and shelf seas ecosystems.

It includes research into impacts of human activities on the marine environment, changes in natural communities and the interaction of human society with the coast.

Blue whales back from near extinction

An international research team has revealed the return of critically endangered Antarctic blue whales to the sub-Antarctic island of South Georgia, 50 years after whaling all but wiped them out.

The discovery, based on analysis of 30 years' worth of sightings, photographs and underwater sound recordings, is crucial evidence in learning how the species is recovering following a ban on commercial whaling in the 1960s.

Blue whales were abundant off South Georgia before early 20th century industrial whaling between 1904 and 1971 killed 42,698 of them there. Most of these were killed before the mid-1930s.

The species all but vanished from the region – dedicated whale surveys from ships off South Georgia resulted in only a single blue whale sighting between 1998 and 2018 – but more recent surveys suggest blue whales are making a comeback.

A 2020 survey in February resulted in 58 blue whale sightings, and numerous acoustic detections. In total, 41 blue whales have been photo-identified from South Georgia between 2011 and 2020, although none of these matched the 517

whales in the current Antarctic blue whale photographic catalogue.

Lead author, **Dr Susannah Calderan**, SAMS Research Fellow, said: "We don't quite know why it has taken the blue whales so long to come back. It may be that so many of them were killed at South Georgia that there was a loss of cultural memory in the population that the area was a foraging ground, and that it is only now being rediscovered."

Calderan et al (2020): <https://doi.org/10.3354/esr01077>

World first at SAMS as endangered skate hatches

A critically endangered flapper skate has been successfully cared for and hatched in captivity in what is thought to be a world first for the species.

The skate egg hatched in the Alan Ansell research aquarium at SAMS after being looked after by SAMS and NatureScot staff for 18 months. The total gestation of the egg was 535 days from laying to hatching.

It is thought to be the first time a flapper skate egg has been cared for from laying to hatching, allowing scientists to accurately confirm the gestation of the species. The SAMS team led by Dr Steven Benjamins photographed the egg every week

on a light box to observe the development of the embryo and captured the moment of hatching on video.

The hatchling, a male measuring just 27cm long, was immediately released into the sea from the shore on the Loch Sunart to the Sound of Jura Marine Protected Area.

Despite its name, the common or flapper skate has been listed as critically endangered since 2006 as a result of overfishing. Flapper skate are described as extinct throughout much of their range with the west coast of Scotland one of the last remaining strongholds for the species.

While flapper skate are protected in a dedicated MPA, we still know very little about their lives, for example how often they breed, and where and when they lay eggs.

Steven Benjamins' also secured funding from NatureScot to continue our citizen science project that encourages skate anglers to measure and photograph flapper skate brought up on a catch and release licence. Our common skate photo-identification database for Scotland 'Skatespotter' is entering its fifth phase!



New project COASTFRAG

Seaweed beds are important coastal habitats, a type of blue forest, covering rocky shores around the globe but are under pressure from human activities and climate change.

Project **COASTFRAG** explores 1) how habitat fragmentation impacts seaweed communities under different climate regimes and at different spatial scales; 2) how environmental conditions, local human pressures and habitat

fragmentation interact to impact coastal seaweed communities and the potential for regime shifts; 3) how different predatory and grazing pressures modify the effect of habitat fragmentation on seaweed communities; and 4) what changes we will see in seaweed communities facing climate change.

The project will create models and projections into a changing future, enhancing our knowledge

to better protect these essential ecosystems.

The project, funded by the Research Council of Norway, is led by the Norwegian Institute for Water Research with five additional partners from Norway, and one each from Estonia, Spain, Italy and SAMS, represented by Prof Mike Burrows, who is involved with research questions 1 and 2.

The UN Decade of Ocean Science – safeguarding intraspecific genetic diversity

Ocean health and biodiversity feature highly in global commitments and plans. The UN Decade of Ocean Science for Sustainable Development aims to maximise the benefits of ocean science for managing, conserving, and sustainably developing our marine environment through communication and cooperation at the science-policy interface.

But a discussion paper in 'Evolutionary Applications' penned by SAMS PostDoc **Dr Alex Thomson** with the support of an international team of experts argues that the draft version of the Decade's implementation plan lacks acknowledgement of the importance of monitoring and maintaining genetic biodiversity WITHIN species.

The paper explores the importance of genetic diversity for a species to be resilient and capable to adapt to changes in its environment. It also considers the major threats to genetic diversity in the marine environment from direct human impacts and the effects of global climate change.

Genetic diversity is not only important in ecological terms but also for socioeconomic reasons eg in a range of marine industries.

In the end the team argue that genetic diversity should be integrated into biodiversity management practices, and should play an integral role in the successful realisation of the 2030 vision for the Decade of Ocean Science.

It is well worth reading the entire paper at <https://onlinelibrary.wiley.com/doi/full/10.1111/eva.13224>

Microplastic in the Scottish deep sea

As previously reported PhD student Winnie Courtene-Jones had found microplastic particles in sediment cores collected from 2200 m below the sea surface in the Rockall Trough off the Scottish west coast. On closer investigation, the team was surprised to find plastic particles 10 cm below the seabed in layers of sediment that had been deposited hundreds of years ago, long before the commercial production of plastic began. They hypothesize that deep-sea dwelling worms such as the peanut worm, spoon worm or bamboo worm reworked the sediment creating pores and burrows through which microscopic plastic might move down through the sediment.

Professor **Bhavani Narayanaswamy**, Winnie's director of studies, explained that the microplastic particles started out as larger plastic items used on land but became fragmented over time.

We still know too little about how microplastics move through the marine environment.

Courtene-Jones, Quinn, Ewins, Gary, Narayanaswamy (2020) <https://doi.org/10.1016/j.marpolbul.2020.111092>

Seagrass restoration & eDNA: The Seawilding project

The Edinburgh Declaration on post-2020 global biodiversity outlines Scotland's aspirations for nature, committing to actions that bring about transformative change to halt biodiversity loss. It puts communities at the heart of this process.

Seawilding is a community led marine habitat restoration organisation working to restore both native oysters and seagrass meadows in Loch Craignish. Dr Alex Thomson and PhD student Alasdair O'Dell from SAMS have teamed up with Project Seagrass and Seawilding to collaborate on Scotland's first seagrass restoration initiative, funded as a NatureScot Biodiversity Challenge Fund project, aiming to enhance biodiversity through the restoration of seagrass habitats. SAMS' role is to monitor changes in biodiversity over time through state-of-the-art eDNA approaches and to assess the carbon sequestration potential.

Blue Economy Research

The Blue Economy research area develops new industry solutions and regulatory tools. Channelling SAMS expertise in fundamental and applied marine science this research area supports commercial users of the marine environment to gain wealth from the oceans without degrading the very system we all depend on.

We have particular expertise in aquaculture, marine biotechnology, marine renewable energy, oil and gas, and industrial impacts.

Designer algae for the shellfish industry

Mussel farms use wild larvae, which is a limiting factor in the expansion of the industry in Scotland. **Dr Joe Penhaul Smith** addressed this problem by farming larvae in a hatchery and feeding them with 'designer' algae, selected for optimal growth. By feeding the algae a diet of organic carbon and exposing to them to varying levels of light, he could control their growth, size and composition. This made his system 6-10 times more efficient than the current production systems used in hatcheries for oyster or other mussel larval species.

These algae are not genetically modified but are 'designed' using their natural evolutionary versatility in how they grow. The newly developed feed combines ratios of three algal species: Tetraselmis and the diatoms Phaeodactylum and Cyclotella, which have all previously been used in aquaculture feeds.

The research was published in the journals Bioresource Technology Reports and Aquaculture international. The method could also change how microalgae are produced for the biotechnology industry.

Penhaul Smith, Beveridge, Laudicella, Hughes, McEvoy & Day

(2021) <https://doi.org/10.1007/s10499-020-00629-7>

Investigating 'COVID-shock' on seafood sector

A new project was launched to investigate the impact of COVID-19 on the UK seafood industry.

The seafood sector incorporates significant processing and logistics operations within the supply chain, which begins with farming and fishing and ends with supermarkets, fishmongers and restaurants.

Analysis of the previous economic crash in 2008 showed substantial implications for the seafood sector, which required a longer recovery time than other industries. Additionally there remains considerable uncertainty and concern within the industry over the impacts of Brexit on the sector.

The RiseUp project, led by **Dr Sofia Franco**, explores the extent of the 'COVID-shock' throughout the industry and provides policy recommendations and advice to help government and business improve resilience.

The 18-month investigation, funded by the Economic and Social Research Council as part of the UK Research and Innovation's rapid response to COVID-19, also involves the University of Manchester and is based initially on interviews and surveys with industry. The project is also benefitting from SeaFish information and analytical input.

Joining a UN-led coalition to support seaweed farming

Professor **Elizabeth Cottier-Cook** is part of the steering committee of the Safe Seaweed Coalition, a global movement launched on 17 March 2021 by UN Global Compact and the Lloyd's Register Foundation in partnership with France's Centre National de la Recherche Scientifique.

Focusing on the core objectives of consumer safety, environmental safety and operational safety, the Safe Seaweed Coalition brings together diverse stakeholders from across the industry to unlock the full potential of seaweed to contribute to the UN Sustainable Development Goals.

The Safe Seaweed Coalition builds on the recommendations outlined in the Seaweed Manifesto, a collaborative report developed by the Lloyd's Register Foundation and UN Global Compact in 2020 to establish the critical infrastructure, regulations and technologies required to bring the industry to scale.

Professor Cottier-Cook heads up the UKRI's Global Challenge Research Fund project GlobalSeaweedSTAR that aims to safeguard the future of the global seaweed industry by working with seaweed farmers and scientists in Tanzania, Malaysia and the Philippines.

Developing early warning HAB resources for Asian aquaculture

The SAMS project 'Malaysian HAB reports' has been developing

NEW Algal Research, Innovation & Environmental Science Centre

Algae are integral to a host of government initiatives including green growth, blue economy and net zero carbon. They are potential producers of biofuel and bioplastics, inks and fibres, can clean up environmental pollution and draw down carbon from the atmosphere. But a critical step from concept to exploitation is upscaling, and until now were only able to produce a few tens of litres of algal culture. But now UKRI is supporting the SAMS-based Culture

Collection of Algae and Protozoa to develop the 'Algal Research, Innovation and Environmental Science Centre', ARIES. ARIES will allow our team to grow and harvest hundreds of litres of algal cultures and carry out metabolomics and genomic analyses for the entire CCAP user community in the UK and throughout the world.

For more information visit <https://www.ccap.ac.uk/index.php/aries/>

applications to provide fishfarmers and shellfish farmers in Asia with early warnings of harmful algal bloom (HAB) and biotoxin incidents.

Professor **Keith Davidson's** team already operates a weekly HAB and biotoxin alert and forecast system in the UK, based around the www.HABreports.org website. It contains products that the aquaculture industry can use to better understand the HAB risk in their location and hence take mitigation action to safeguard human health and prevent economic loss.

In Malaysian HAB reports this technology is being transferred and adapted to Malaysia, a country with a sizeable and growing aquaculture industry that suffers substantial losses from HABs through fish kills and fatal shellfish poisoning.

A Malaysian HABreports website and a mobile phone App are being

developed to warn regulators and consumers of potential health risks from contaminated shellfish and allow aquaculture businesses to mitigate, e.g. postpone harvesting until an outbreak has passed, fencing fish cages with perimeter skirting or transferring fish to land facilities.

Can hormones improve the production and conservation of oysters?

Dr Mairi Cowan is investigating hormonal and environmental factors that control the development of bivalves during key life stages, focussing on the native oyster. Her Neuroshell project is funded by a EU Horizon 2020 Marie Curie Fellowship.

Dr Cowan is investigating how temperature and light affect the hormones of native oysters and samples their neural and reproductive tissues during the conditioning and spawning period to identify the hormones that are involved in

mediating environmental effects on reproduction.

Environmental factors are controlling the seasonality of reproduction in oysters through mechanisms of hormone control, but exactly which hormone systems are involved in this transduction is unclear.

Oysters integrate a medley of cues from the natural environment, which can be difficult to recreate in a captive environment such as a hatchery. This can lead to problems in the synchrony of adults spawning and metamorphosis of larvae into spat.

At the fundamental level, if we understand the hormonal control mechanisms of reproduction and how environmental factors are driving these, operators can tailor culture conditions to optimise reproductive success in a hatchery. This information can be used, not only to increase production but supports the conservation of the species.





2020 Prizes

Johanna Fehling Memorial Prize
KAREN BOSWARVA

PRIZE FOR BEST ACES
DISSERTATION
GERALD MISOL

SAMS BOARD AWARD FOR
ACADEMIC EXCELLENCE
MASCHA DIX

SAMS AWARD FOR OVERALL
ACHIEVEMENT
SOPHIA ROSINSKI

TIM BOYD PRIZE FOR POLAR
SCIENCE
LEA RIEHN

SAMS UHI STUDENT OF THE YEAR
NADJA HOHENADL

HISA SPORTS CLUB OF THE YEAR
UHI WIND AND WAVE CLUB

Shi Quan Ooi



Education

Graduation 2020

The class of 2020 could not celebrate its success at a traditional graduation ceremony because of the pandemic.

We hope that at a future date we can invite all those who graduated in the Corona years to a big event when life returns to a new normal. As a placeholder the SAMS team developed a website with congratulatory video messages for the students from SAMS and UHI. This year's invited guest speaker, Magnus Macfarlane-Barrow OBE, delivered an inspirational filmed address. As former fishfarmer and as the founder and CEO of the charity Mary's Meals, he talked about the importance of education. Mary's Meals provides daily meals to 2 million of the world's poorest children in school, thereby promoting education alongside health and wellbeing.

Mary's Meals may be an international NGO with Hollywood stars among its ardent supporters, but it retains its headquarters in Dalmally and employs several former SAMS staff members.

Celebrating UHI's 10th anniversary

1st February marked the tenth anniversary since the Privy Council bestowed the title and status of university to the UHI Millennium Institute, thereby creating the University of the Highlands and Islands. SAMS was a founder member of the UHI project that began in 1991. On the 10th anniversary date the partnership welcomed a new Principal and Vice-Chancellor, Australian clinical cytologist Professor Todd Walker, the third incumbent since the 2011.

"My three years at SAMS UHI prepared me to pursue a career path in marine sciences, with particular focus on deep-sea and climate change research. The course is structured to give extensive knowledge of our seas. It also heavily emphasises student engagement and hand-on practical experience. For some assignments, I was encouraged to propose novel questions and carry out independent research, always with the guidance and support from senior researchers and lecturers. If you ask around the campus, you will often get the opportunities to participate in professors' and PhD students' research projects which will give invaluable experience in real-world scientific research. We also received personal feedback on an individual level for each assessment we submitted.

While studying at SAMS UHI, not only will you meet the experts across all marine professions, but you will also encounter some of the most passionate students from around the world. Whenever you are facing difficulties in your study or personal life, the staff will always be there to help you out.

Finally, life in the small harbour town on the west coast of Scotland may not be as tough as you think. In fact, you will definitely long to head back to Oban again because of the atmosphere, the scenery and natural beauty, but most of all, the lovely people in the town."

Shi Quan Ooi

Education... continued

Marine Science BSc

Course leader: Dr John Howe, Deputy: Dr Arlene Ditchfield

Student numbers

119 undergraduate students were studying the BSc (Hons) Marine Science programme in the 2020-21 academic year. This includes an intake of 31 new students, a reduction on the record 38 intake the previous, pre-pandemic, pre-Brexit year.

New VLE platform

All teaching was delivered online via Webex and Brightspace. Exams were undertaken as open timed assessments. This worked without major problems but was a disappointment for our students. The university amended numerous academic regulations to mitigate the impact of prolonged periods of study at home. All student recruitment activities were conducted online, negating the opportunity to experience the immersion of studying marine science at the 'university on the beach'.

Survey results

Once again our programme has achieved 100% overall satisfaction in the National Student Survey, with 87% of final year undergraduates filling in the questionnaire. A recurring student concern highlighted by the survey relates to feedback to assessments being late, although improvements have been made in this category. Addressing previous student desire for more career and employability support resulted in a SAMS Careers and Employability Programme including careers talks, CV writing and employer sessions.

Student exchanges

Physical Erasmus mobility was severely impacted by the COVID-19 pandemic. Our main Erasmus+ partners suspended mobility for semester 1. The University Centre

in Svalbard was accepting students for Semester 2 but then UHI cancelled all outgoing mobility for semester 2.

Extensions for the 2020 Erasmus+ project was secured, allowing us to utilise 2020 Erasmus funds for exchanges until 2023.

Funding for students to spend one or two semesters abroad will in the future have to be provided by the UK's new Turing Scheme.

ERASMUS exchanges

All current undergraduate students with European Union country nationalities obtained pre-settled status before the application deadline.

Since Brexit EU students will be classed as international students unless they can show UK residency. International students are subject to tuition fees of c £9.5k for the first three years of their BSc studies. The fourth year is free to make fees roughly equivalent to an RUK student. They will also require visas to study in the UK. SAMS is preparing for a substantial reduction in EU students.

Student accommodation

Students have a number of accommodation options. Most stay in private accommodation. The SAMS Margaret Barnes Residence can accommodate up to 11 students on site, while a private landlord operated the Distillery Apartments in the centre of Oban as student accommodation for up to 22 students. The Distillery Apartment arrangement came to an end in the summer of 2020. Student residencies are mostly allocated to first year students and those with additional needs.



Wind and Wave club- won UHI sports club of the year twice in as many years



Taught Masters

ERASMUS Joint Masters in AquaCulture, Environment and Society (ACES+)

This two-year programme, delivered at SAMS in semester 1, in Crete in semester 2, in Nantes in semester 3 before the final research semester, has always two cohorts in each year: there were 18 students in first year and 21 students in second year.

Most students received ERASMUS Mundus scholarships with an additional scholarship sponsored by MOWI.

The international nature of the student body continued with new intakes hailing from Bangladesh, Brazil, Ghana, Greece, India, Kenya, Nepal, Nigeria, Sri Lanka, the UK and the USA. Three students withdrew due to the pandemic. All teaching was delivered online, often spanning all time zones as most students remained in their home countries. Recorded sessions were available to students unable to attend live sessions or whose internet connection was not reliable.

MSc Industrial Biotechnology

15 students registered to study the optional 'Blue Biotechnology' module, that is part of the MSc in Industrial Biotechnology at the University of Strathclyde. For the second year the module had to be delivered online.

Postgraduate research

Head of SAMS Graduate School: Professor Bhavani Narayanaswamy Registry Officer: Anna Kane

The number of Postgraduate Research Students (PGRs) fluctuates throughout the year. On 1st March 2021 a total of 41 PGRs were registered: 34 were undertaking PhD research, 3 were under examination, and 4 MRes students on the new Algal Biotechnology, Biology and Ecology programme. Research topics cover the entire spectrum of SAMS science.

PGRs benefit from a professional development programme with training available in GDPR, Communications, library research and health and safety. They access further opportunities for training through the UHI Graduate School in topics relating to effective writing, delivering seminars and viva preparation.

For the first time we took on an international student for our MRes programme through the Council for At Risk Academics (CARA), who is partly funded through CARA and our Global Seaweed* project.

COVID-19 required that PGR students had to work from home unless they had to complete research in the laboratory or to download large files. Any work at SAMS had to be scheduled to ensure socially distanced working. Many resources were set up to support students cope with the mental challenges arising from the pandemic.

Enterprise & Innovation



We were very impressed and grateful for the speed and efficiency with which SRSL came to our assistance with hatchery water sampling, providing the required equipment and training at very short notice.

Kate MacKichan
Environment Team Leader
Scottish Sea Farms



SAMS Research Services Ltd becomes SAMS Enterprise - Enabling productive oceans

Our wholly-owned trading subsidiary is an integral part of the organisation, the third leg of the 'SAMS stool' alongside research and education. SAMS Research Services Ltd (SRSL) operates at the interface between academia and business, where innovation can stimulate new businesses, wealth generation and employment.

SRSL leverages the expertise and infrastructure of a world-class marine science organisation for the benefit of its customers, helping them to improve their business performance and reduce conflicts between commercial activities and the environment.

SAMS' commercial activities are financially critical to fill a funding gap generated by research grants mostly not paying the full economic cost of the work. Profits generated by SRSL are thus supporting the independence of SAMS' research.

At the end of the reporting year we changed our name from SRSL to SAMS Enterprise to better reflect the evolution and growth of the business. In the early years after its inception in 2002 SRSL offered primarily research services but now provides a broader range of services, expertise and products. Our consultants deliver modelling, environmental impact and marine growth assessments, laboratory analyses, monitoring and surveys, as well as developing new technologies such as the Snow Ice Mass Balance Array, SIMBA.

SRSL delivers a bespoke service with all commercial projects operating under strict ISO accredited quality management frameworks (ISO9001 and ISO17025).

In the reporting year SRSL had a turnover of £1.321M contributing £133k to SAMS and paying £852k towards staff costs for the consultancy staff delivered.

Some highlight activities from 2020-21

The financial year 2020-21 has been an exceedingly challenging period for the business. Maintaining profitable operations in the face of the global COVID-19 pandemic has delayed some projects. But despite the constraints of remote working, vacancies in key roles and furlough, the team continued to deliver and operate profitably, if not reaching the targets we set ourselves before the arrival of Coronavirus. Opportunities for new work remain fewer and of reduced scope than in normal years. Business uncertainty is likely to remain high until we return to normality.

NewDEPOMOD

As the modelling tool of choice for the salmon farming industry and its regulator in Scotland, NewDEPOMOD can deliver both greater environmental protection and business optimisation. It is sold not just in the UK but also in other temperate regions including Chile, Tasmania, Canada, Norway and the USA. The pricing structure for NewDEPOMOD was fully overhauled during the reporting year in response to an in-depth review. We also added a bespoke modelling service to supplement and complement the NewDEPOMOD offering. We are now ready to adapt NewDEPOMOD to new geographical areas: MERAMOD for the Mediterranean and TROPOMOD for the tropics,

It has since been developed into a commercial product that provides reliable and autonomous measurements of snow and ice structures for any industry that needs to know the thickness and conditions of snow and ice. With fewer research expeditions due to the pandemic, fewer SIMBA units were ordered than we expected. On a positive note, we won a Co-Innovate Grant to develop a full multi-terrain deployment system for SIMBA to expand into the avalanche and flood forecasting market in future years.

We are working with new academic and industrial partners to develop this field into a more significant area of income for SAMS.

Seaweed Nursery

While the sale of seeded line for seaweed farming is not a major contributor to our commercial income yet, it is an essential component in the development of a new and potentially sustainable industry for Europe. Highlands and Islands Enterprise therefore provided substantial funding for the refurbishment of the SAMS Seaweed Nursery that is managed by SAMS Enterprise. We have been proactively engaging with new potential entrants to the market, supporting them until they are ready to establish farms, although the pandemic has also stalled some of these initiatives. We have also developed protocols for growing a greater range of seaweed species.

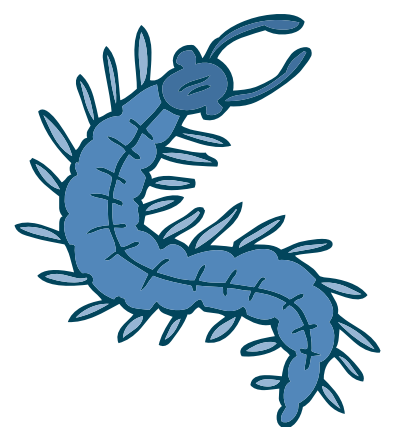
Marine growth assessments

The offshore energy sector struggles with fouling of its underwater structures. We have been delivering marine growth assessment services to them and have grown our team of experts to offer such services to a growing market including the global marine renewables and the oil and gas decommissioning sectors.

SIMBA

The Snow Ice Mass Balance Array was originally developed to study the melting of sea ice in polar regions.

Membership



Membership developments: watch this space

For many years we have been uncertain as to the direction to take with the membership. Subscriptions as well as benefits have remained the same for the past two decades. This is about to change. In the coming year we will introduce a development and fundraising programme that will re-shape and invigorate membership activities. In the past year we contracted the More Partnership to recommend an approach how to develop sustainable philanthropic support for SAMS and will be implementing many of their recommendations.

AGM and Annual Newth Lecture

This was the first time that an AGM of the Association and a Newth lecture had to be organised and delivered online.

To use this medium effectively we decided to alter the format of the Newth event from a traditional lecture to a panel discussion of a relevant topic. The online Newth debate attracted a larger audience than our normal face-to-face events, with 143 participants from 10 countries from five continents.

Brexit and the Coronavirus pandemic may have overshadowed the launch of the United Nations Decade of Ocean Science for Sustainable Development

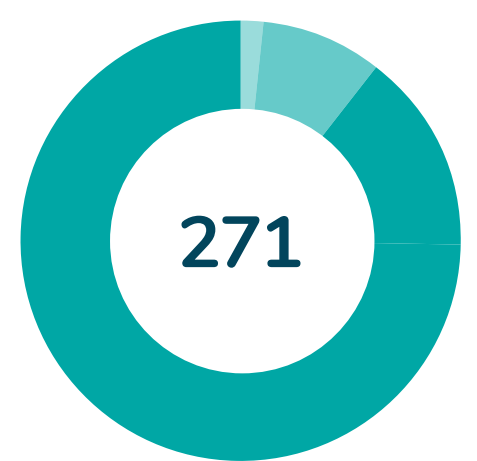
(2021-2030), but the Ocean Decade is here to stay for some time and to bring about a step change in our knowledge of the marine environment. This step change can only be achieved by working internationally and without it, we simply will not have the knowledge and skills to manage a growing blue economy in a sustainable manner that maintains the productivity and biodiversity of the marine realm.

But what does the Decade mean for Scotland? What contributions can we make? How can we maximise our involvement?

SAMS Honorary Fellows

- Dr Robert Batty
- Prof Kenny Black
- Dr Ruth Brennan
- Dr Susannah Calderan
- Christine Campbell
- Dr Clive Craik
- Dr John Gordon
- Prof Angela Hatton
- Dr Ken Jones
- Peter Lamont
- Dr Ray Leakey
- Prof Jane Lewis
- Dr Andy McLeod
- Prof David Meldrum
- Dr Pedro Murúa
- Dr Natalia Serpetti

Current members



- 4 Honorary & Life
- 25 Corporate
- 242 Ordinary

31st Annual Newth Lecture

The UN Decade of Ocean Science for Sustainable Development: Scotland's role in this global initiative
Friday 18 June 2020 15.00-17.00

Science We Want

Programme

Welcome
By Prof Nicholas J.P. Owens - Director, SAMS

What is the UN Decade of Ocean Science for Sustainable Development?
Prof Dr Martin Visbeck - Head of Physical Oceanography, GEOMAR Helmholtz-Centre for Ocean Research Kiel, Germany

The role of citizen science
Dr Hannah Grist - Knowledge Exchange Practitioner, SAMS

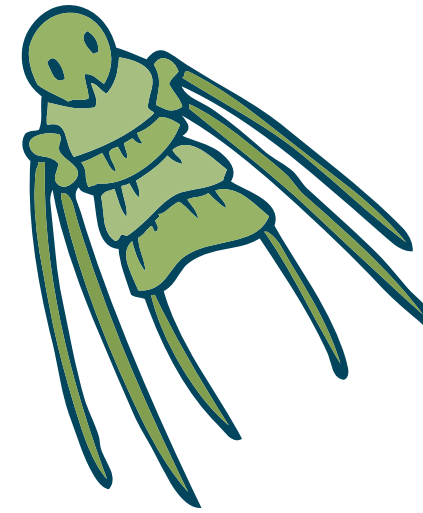
The potential contribution of the community of marine scientists in Scotland to the 'Decade'
Prof David Paterson - Professor of Coastal Ecology University of St Andrews. Executive Director of Marine Alliance for Science and Technology for Scotland (MASTS).

The role of Scotland internationally to the UN Ocean Decade
Mr Michael Russell - President of the Scottish National Party. Former Minister for the Environment, Education and latterly Cabinet Secretary for Constitutional Affairs and Europe.

Prompting behaviour change through science communication
Susan Davies - CEO Scottish Seabird Centre, North Berwick

Panel discussion:
Chair: Susan Watts
Panelists: Susan Davies, Nicholas Owens, David Paterson, Martin Visbeck





Public Engagement

Ocean Explorer Centre: new online shop

The pandemic required the Ocean Explorer Centre including its café and shop to remain closed for the reporting period. All school workshops had to be cancelled and no events could take place. The Centre Manager was furloughed for most of the year, only working part-time on a SAMS history project for a few months. We used the down time to rebrand the café from Café Scientifique into the more widely

accessible Beach Café, updated the display technologies and developed a new Marine Protected Area display.

With our shop in the Ocean Explorer Centre closed we developed an online shop at www.oceanexplorershop.co.uk that provides environmentally friendly and ocean-inspired t-shirts, sweatshirts, hoodies, bags and art prints as well as branded merchandise

for SAMS, UHI and many of its academic partners.

The shop is delivered by TeeMill and uses exclusively eco-clothing brand Rapanui products that are 'Good Organic Textile Standard' certified. The production minimises its climate impact by consuming 100% renewable energy in the final stage of production. All design is done in-house.

Digital publications and events

As our locked-down worlds moved ever more online, we turned our Ocean Explorer magazine, internal Staff Bulletin and marketing materials into interactive, digital documents with embedded videos, animations, photo galleries, sound files and the opportunity for direct feedback. They were developed using online design tool Readymag.

Like the rest of the world all our events, science seminars, public lectures, student open days and SAMS organised project conferences moved online using mostly Microsoft Teams.

Celebrating World Oceans Day

To celebrate International World Oceans Day on 8 June, SAMS staff overcame the limitations of lockdown to help inspire thousands of people to reflect on what the ocean means to them. Sixteen staff members filmed themselves reciting a line from a poem 'Why we love the Ocean' by communications and media officer Euan Paterson. SAMS filmmaker Andy Crabb edited the footage, as well as appearing as a shark to deliver his own line! Within 24 hours, the video, running to 1m 29s, had attracted more than 5,500 views.

SAMS Gallery

To find new ways of encouraging and sharing ocean-inspired creativity we developed an online gallery showcasing our people's talent from composed music to crazy hat creations, amazing illustrations to crochet dolls: www.sams.ac.uk/gallery

Our People

Mike Burrows makes the climate change hot list

Professor Michael Burrows has been included on a list of the world's most influential climate scientists. He ranks 180th on the 'hot list' of 1,000 climate scientists compiled by the Reuters news agency. The list considers the number of publications, how often these are cited and the impact they have in media and social media.

With 154 publications – many in high impact journals like Nature – and 8,355 citations at the time of the announcement, he had already been included last year on the Web of Science's Highly Cited Researchers list.

Prof Mike Burrow's current research looks at how populations of marine animals and plants are responding to changes in the marine environment over recent decades, and using this information to predict how those species might fare in the face of climate change. Part of an international team of ocean scientists that coined the term 'marine heatwave', Prof Burrows also charts the warming ocean using data collected on the rocky shores around SAMS.

This spring Prof Burrows celebrated his 30th anniversary working at SAMS.

Professorship for deep-sea ecologist

The University of the Highlands and Islands has bestowed the title of Professor on **Bhavani Narayanaswamy**. A deep-sea ecologist, who has been forging her marine science career at SAMS since her doctoral studies with the late John Gage, she has an international reputation for her research on deep-sea and polar ecosystems and more recently the distribution and abundance of microplastics in the ocean. Her research has informed policy makers, governments, the United Nations, businesses as well as academic peers.

Professor Narayanaswamy's other passion is for sharing her knowledge and experience. As head of the SAMS graduate school she supports up to 50 marine science research students each year, as well as leading modules in deep sea ecosystems and dissertation on the BSc Marine

Science programme. She mentors junior female scientists and volunteers as a STEM ambassador, promoting science, technology, engineering and maths subjects to local school children. She has also collaborated with sustainable textile design company Crùbag and inspired their Seamounds Collection.

A mother to two sons, she said: 'I hope this will inspire other parents to feel that, with the help and encouragement of colleagues and their employer, they can achieve their career aspirations.'

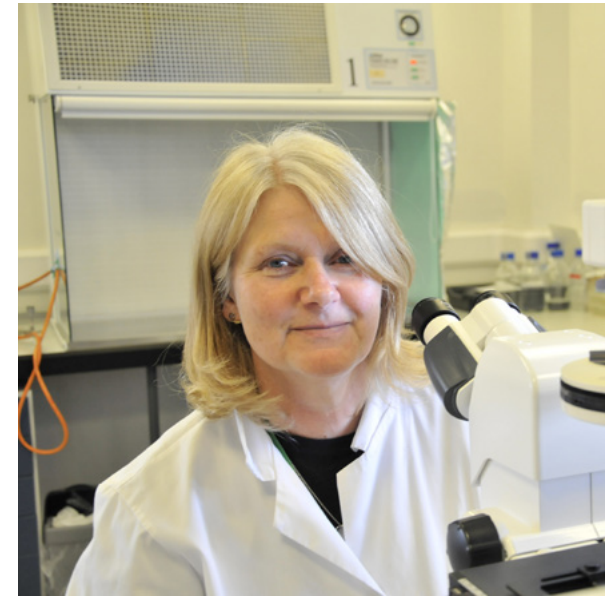
Christine Campbell MBE retires after 35 years at SAMS

The last day covered by this report was the day our longest serving member of staff retired after 35 years at SAMS. Heading up the SAMS-based Culture Collection of Algae and Protozoa, one of the most biodiverse collections of microscopic algae and protozoa in the world, Christine's contribution to all things algae had already been recognised earlier in the year in the Queen's New Years Honours list with the award of an MBE.

Christine oversaw major investment in facilities and staff training, which has helped to grow CCAP's global reputation. The collection is an integral part of the Darwin Tree of Life project, which seeks to sequence the genome of every living creature native to the UK. It also recently secured nearly £700,000 to invest in its services, which include providing pure strains of algae to scientists around the world.

Christine reflected that SAMS is a very different place in 2021 to when she arrived in 1986. She recalls how a typing pool made up for the absence of computers and the Director had a driver to chauffeur him around the country. There were no working mothers on the staff and the canteen had a more formal seating arrangement, including a separate ladies' table. She said: "I have really enjoyed working at SAMS, which as a workplace has a family feel to it. I am extremely privileged to have worked in science."

Throughout her time at SAMS, Christine was also a leading light in the local Prospect union branch.



New sustainability group

Physical oceanographer **Dr Kristin Burmeister** set up and chaired a new sustainability group involving staff and students. Working alongside Safety, Health and Environment Advisor Christopher Clay and SAMS Facilities Manager Iain MacCorquodale the group looks in particular at buildings, waste, and transport. Outputs included the creation of a new wild flower meadow and improved facilities for cyclists.

Obituary: Dr John Gordon OBE



The internationally renowned deep-sea ecologist with expertise in Atlantic deep-water fisheries Dr John Gordon OBE died after a short illness on 3 June 2021.

Born in Edinburgh, Dr Gordon lived in Easdale, Isle of Seil. He had joined the Association after a PhD at Edinburgh University and remained at SAMS for his entire career.

Dr Gordon began his research in the shallow waters of the Firth of Lorn but, with the commissioning of the RRS Challenger in 1974, he moved into deeper waters (500 to 1,500 metres) to the west of Scotland's continental slope, working on the biology of the bottom-living fish, which were later commercially fished.

His work over the next decade contributed to our knowledge of food chains in the deep sea and how commercial trawling affects fish populations in deeper water.

From 1975 to 1985 he comprehensively sampled the deep-sea demersal fish populations of the Rockall Trough and adjacent areas in the NE Atlantic before the onset of any commercial fishing activity. In so doing, John generously offered ship time on RRS Challenger to Nigel Merritt, then of the Institute of Oceanographic Services (IOS). This began an intense series of 11 joint sampling cruises over a six-year period, studying both the Rockall Trough and the adjacent Porcupine Seabight areas with the SMBA Granton trawl to 1,250m depth and the IOS semi-balloon trawl to 4,000m.

Dr Merritt said John's warm and amicable leadership through fair weather and foul - mostly foul - typically knit together the small team involved and ensured the success of this fruitful collaboration well into the future.

This period of sampling led to Dr Gordon's unique description of the distribution, abundance, age, growth, diet and reproduction of 70 species of fishes in their pristine state before human exploitation. In no other fishing ground in the world, shallow or deep, are such pre-fishery baseline data available against which to measure impacts of man and climate change.

Commercial deep-sea fisheries began in the Rockall Trough in 1989 and by 1993, the most valuable fish species, the Orange Roughy, had already been fished close to extinction while other species were being depleted. In 2003 Dr Gordon wrote that "The Rockall Trough is probably one of the best studied deep-water ecosystems ... is now being subjected to Unsustainable Fish Activity".

Since then, Dr Gordon worked tirelessly contributing to reports, working groups, national and international bodies to implement effective regulation of deep-water fisheries. His early data have repeatedly been used in assessments of long-term changes in deep-water fish populations in the North-East Atlantic.

Former colleague Prof Monty Priede said: "John sampled in all seasons of the year including heroic mid-winter trawling when the small ship had to hide from storms behind Hebridean islands and head out to grab fishing opportunities in rough seas between weather fronts. John seemed unperturbed by such working conditions, carefully measuring, counting, and sorting specimens as the ship tossed and turned around him.

"He became a master of the art of scientific deep-water trawling obtaining consistent calibrated samples of numbers of fish per unit area of sea floor, techniques which he later passed on to new generations of fishery scientists.

"John's pre-1989 data set stands as a stark reminder of what we have lost in the uncontrolled rush to exploit the deep-sea. Now we have also lost John Gordon himself, the staunchest advocate for sound science-based fishery management.

"I have known John for 47 years and he was always there as a source of advice on anything to do with deep-sea fishes. As a shipmate, colleague and friend I shall greatly miss him."

In 1995 he was appointed chairman of the International Council for the Exploration of the Sea (ICES) Study Group on the Biology and Assessment of Deep-sea Fishery Resources, a post he held until 2000. He also provided advice and evidence to organisations such as the European Commission, the North East Atlantic Fisheries Commission (NEAFC), the Scottish Government and the House of Lords Select Committee on Science and Technology.

Dr Gordon retired in 2002 as Principal Scientific Officer at SAMS but remained an Honorary Research Fellow. On his retirement, his international reputation kept him busy as a keynote speaker and with several consultancies.

In 2016, his contribution to marine science was recognised with an OBE in the Queen's Birthday Honours.

Dr Gordon spent considerable time outside the UK as visiting scientist and consultant. During visits to Norway he contributed to significant discoveries of early life stages of deep-sea fish. He also spent considerable time in Mallorca, Spain, where he contributed to Mediterranean deep-sea fish studies.

Dr Gordon is survived by his wife, Kathleen and two sons Hamish and Colin.

Finance

2020/21 Financial performance

The SAMS group achieved a surplus of £259k in the reporting year. Excluding a reduction in our Universities Superannuation Scheme liability of £219k, the overall surplus from operations was £40k. The overall income was £10.35M against and expenditure of £10.31M. For details, please consult the statutory accounts on the SAMS website.

Plans for future - our 2020-25 corporate strategy

RESEARCH EXCELLENCE: supporting and training staff; balancing skills with emerging fields; attracting personal fellowship holders

PROVIDING SOLUTIONS: SAMS Enterprise provides solutions for businesses in six target sectors

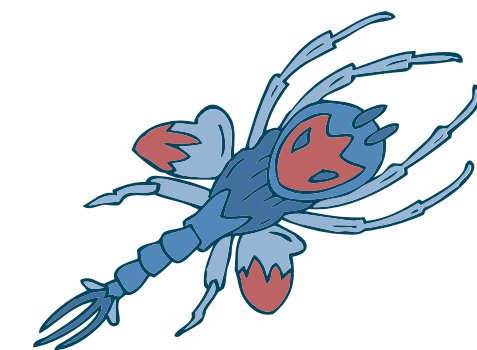
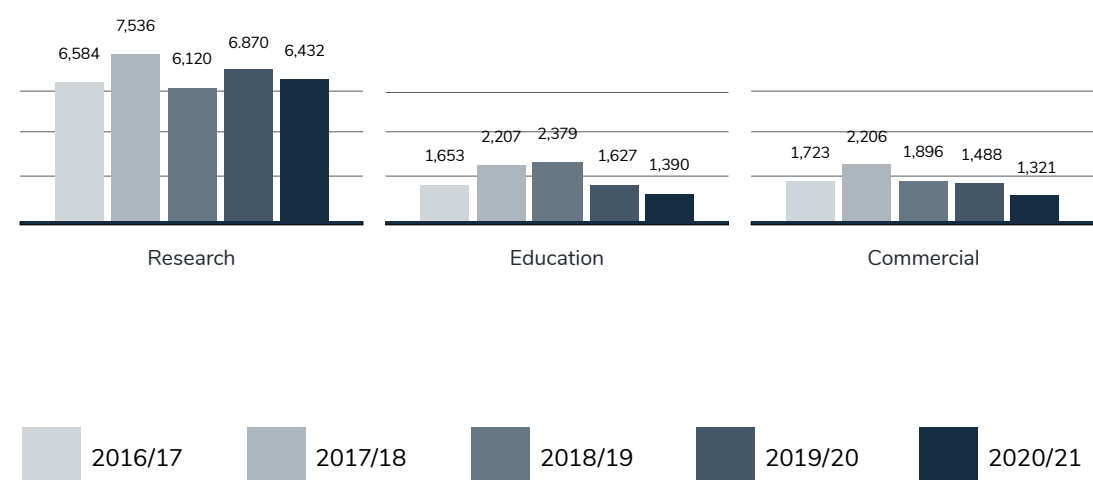
EDUCATION FOR A BETTER FUTURE: developing new Masters level programmes through UHI that support economic regeneration

IMPACT AND INFLUENCE: increasing science communication and public engagement activities

EFFICIENT OPERATIONS: continue working with HIE and Argyll and Bute Council to pursue major infrastructure investments especially around aquaculture and aerial robotics.

INTRODUCTION OF A DEVELOPMENT AND FUNDRAISING FUNCTION: substantially increasing income generation from charitable sources

Income over five years



Financial Summary

	2020/21 £000	2019/20 £000
Operating Income	10,350	10,997
Operating Expenditure excluding grant funded depreciation	(10,310)	(11,470)
Operating Surplus/(Deficit) before exceptional item	40	(484)
Other income		0
Pension Surplus / (Deficit) Obligation	219	(743)
Reconciliation of funds: Total funds brought forward	12,912	12,653
Total funds carried forward	13,171	12,912



Research

Research grants and contracts brought in a total of £6.432M over the reported 12 months period, a 6% decrease against the previous year.

55% of research income (£3.544M) came from UKRI. This included a £500k grant through the COVID-19 Institute support fund, and £282k to sustain UKRI grant funded research affected by COVID-19 to offset the reduction in income caused by postponement of travel and fieldwork

during the pandemic.

SAMS experienced a substantial 32% decrease in EU Horizon 2020 / ERDF income, bringing in only £1.036M. Much of this was a consequence of pandemic related delays but also because Horizon 2020 came to an end while the new Horizon Europe framework programme was delayed. Following Brexit UK institutions can be included as Associate Partners in Horizon funded projects.

The Research Excellence Grant, awarded to fill the gap from funders who do not pay the Full Economic Cost of delivering the research project, attracts a year-on-year reduction of 5% (=£51k) but still contributed £1.015M.

Other funds, including government, agency and innovation centre income, experienced a 26% downturn to only £83k.



Education

As in the previous year, education contributed 17% of SAMS income from undergraduate (£669k), taught and research Masters (ACES = £106k) and doctorate (£612k) programmes. There was no income from field station activity in the reporting year.



Enterprise

SAMS Research Services Ltd / SAMS Enterprise achieved a turnover of £1,321, a reduction of £167k on the previous, pre-pandemic year. SRSL delivered a net profit of £133k and brought in £852k in staff time. SAMS Ltd, our other subsidiary contributed an additional £91k to SAMS income mostly from the sale of CCAP cultures and rental



Peer-reviewed journal articles & reviews

Publications

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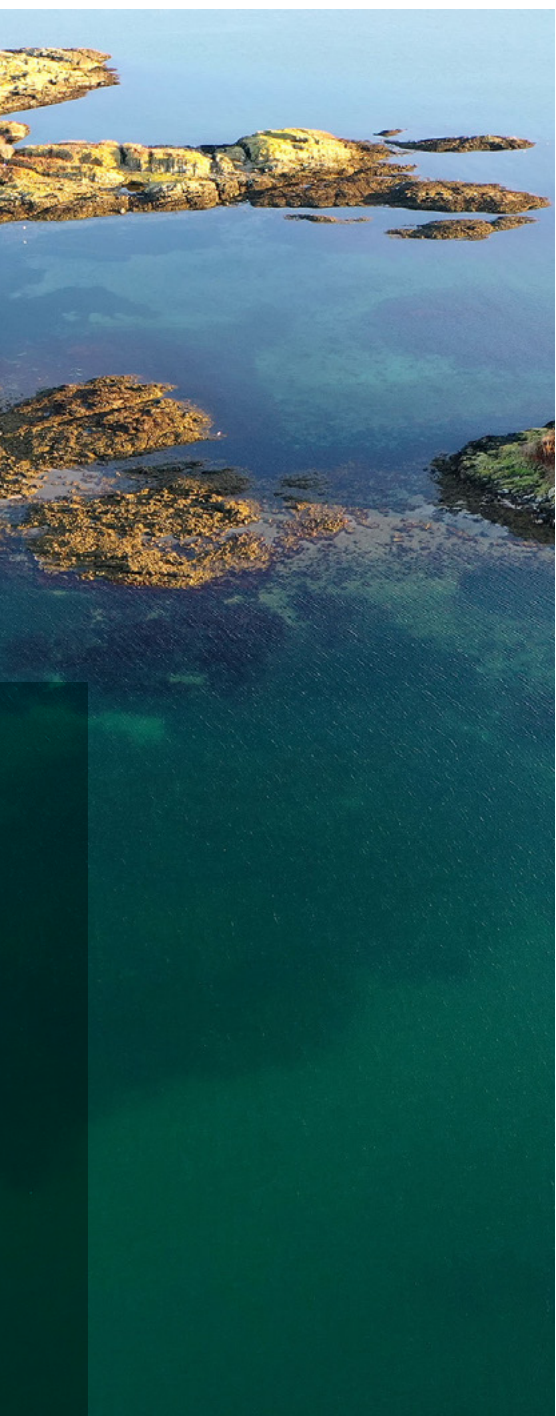
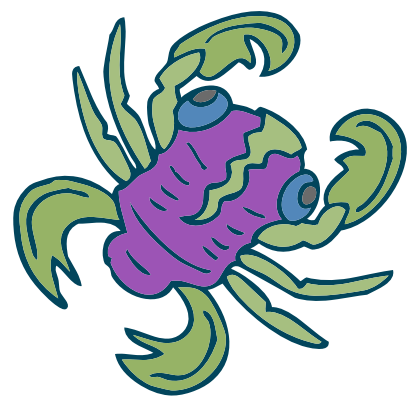
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Electric car

In September, SAMS took delivery of an electric car. The Nissan Leaf replaced a diesel work vehicle and comes with a new electric charging point.



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1st April 2019 to 31st March 2020

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 - Healy, Jessica
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