SCOTTISH
OCEANS
INSTITUTE

The New Gatty:

Safeguarding the Future of our Oceans

University of St Andrews | FOUNDED 1413

Photo credits

Front cover — Dr Thomas Ashton, Xelect Ltd, *Herring shoal with St Andrews Cathedral in background*

Pages 6-7 — Dr Patrick Miller, SOI, *Humpback whales lunge-feeding*

Pages 8-9 — Dr Patrick Miller, SOI, *Humpback whale flipper-slapping*

Page 9

a. Alnitak NGO, *DTAG tagging on an adult pilot whale (*Globicephala macrorhynchus*) from the population of the Alboran Sea*

b. Ari Friedlaender, *Humpback whale*

c. Dr Lars Boehme, SOI, *Female Southern elephant seals and their pups on a beach on South Georgia. The seal in the foreground is equipped with animal-borne sensors to learn more about its behaviour and environment*

d. University of La Laguna (Tenerife, Spain). Photo taken under the permit of the Spanish Ministry of Environment. *Subadult male of Blainville's beaked whale (*Mesoplodon densirostris*) from the population of El Hierro (Canary Islands, Spain)*

Page 10 — Dr Thomas Ashton, Xelect Ltd, *Kelp reef, Kingsbarns, Fife*

Page 11 — Dr Maria Dornelas, SOI, *Corals at Lizard Island, Great Barrier Reef*

Pages 12-13 — Dr Yanni Papastamatiou, SOI, *Blacktip reef shark, photographed on the backreefs of Palmyra atoll, in the central Pacific*

Page 13 — Dr Thomas Ashton, Xelect Ltd, *Ling, Noss Head, Shetland Islands*

Pages 14-15 — Cara Hotchkin*: A North Atlantic Right Whale is tagged in Cape Cod Bay to investigate foraging behaviour relative to vulnerability to collisions with ships. Photo taken under Scientific Research Permit # 775-1875 issued by the US National Marine Fisheries Service*

Page 15 — Dr Thomas Ashton, Xelect Ltd, *Shipwreck, Scapa Flow, Orkney Islands*

CONTENTS

MAJOR INVESTMENT IN MARINE SCIENCE AT ST ANDREWS

Marine science at the University of St Andrews has grown in scale and influence for over a century and today St Andrews is recognised as one of the most dynamic international centres in the field.

Established in 1896, the Gatty Marine Laboratory pioneered the study of the health of our oceans and now - as home to the Scottish Oceans Institute - has 61 principal investigators, 35 engineers and technicians, 80 research fellows and 90 PhD students. The University is a principal partner in the European Marine Biological Resource Centre and also hosts Marine Alliance for Science and Technology Scotland (MASTS).

This exponential growth in scale and influence has brought the Gatty to a critical tipping point in its growth and the current buildings and aquarium are no longer fit for purpose. The aquarium, last upgraded in 1988, is incompatible with digital equipment. Scientists reliant on modern aquaria are borrowing facilities at other institutions. Because of a chronic lack of office space for marine scientists at the Gatty, research groups are located across the University, often miles from laboratory space and colleagues.

The building of a New Gatty, commensurate with the quality and magnitude of marine science now being undertaken at St Andrews, is a priority. The University has commissioned designs for a new 2,256m^2 research building and a 'smart' aquarium that will be the most technologically advanced in the UK.

The University is investing substantially in this £8.8 million project and it is a strategic fundraising priority. At this early stage in the development we are seeking key funders who will partner with us to deliver the infrastructure commensurate with our world class marine science; help us achieve a step change in our research capacity; and safeguard the oceans for future generations.

THE GATTY MARINE RESEARCH COMPLEX – A BRIEF HISTORY

There has been a marine laboratory at St Andrews since 1884. The earliest laboratory was originally established in response to a Royal Commission on the impact of trawling. The work of the Commission led to the establishment of a three-mile limit from which all but scientific trawling was banned in an attempt to conserve stocks. The research vessel, SS Garland, and the aquarium attracted distinguished marine biologists from across Europe to work at the laboratory, including Ernst Haeckel, Anton Dohrn, Ambrosius Hubrecht, Ray Lancaster, Sir John Burdon-Sanderson and many others.

To support the expanding scientific endeavours, a new permanent laboratory was established on the East Sands and opened in 1896. The laboratory was named after its principal benefactor Charles Henry Gatty, a wealthy country gentleman from Sussex and an enthusiastic amateur marine biologist.

The tradition of visiting scholars continued in the post-war years including Sir John Henry Gaddum FRS, a distinguished pharmacologist who, in collaboration with the Gatty staff, developed the first, and highly sensitive, bioassay for the important neurotransmitter 5-hydroxytryptophan (5-HT), using the isolated heart from a marine mollusc. This work attracted the attention of Sir Henry Dale, a member of the advisory committee to the Wellcome Foundation, leading to the construction of a new building which opened in 1960. The building was jointly funded by the Wellcome Foundation, the Carnegie Trust and the University Court of St Andrews. During the 1960s, Adrian Horridge FRS, staff and visitors brilliantly exploited the "new technology" of electron microscopes and electronics to explore the workings of the brain and sensory systems using relatively simple marine invertebrate animals as models.

A new chapter in the story of the Gatty began in 1985 when it became an interdisciplinary research centre between the Departments of Botany, Physiology and Zoology, paving the way for the formation of the current School of Biology. In 1996, the Sea Mammal Research Unit (SMRU) of the Natural Environmental Research Council moved from Cambridge, establishing the Gatty as one of the world's leading centres for research into sea mammals.

The increasingly interdisciplinary nature of marine research was recognised by the formation of the Scottish Oceans Institute (SOI) in 2009. The SOI provides a focus for all marine research in the Schools of Biology, Chemistry, Geography & Geosciences and Mathematics & Statistics with the aquarium and experimental facilities at the Gatty Research Complex at its core. SMRU was recognised with a Queen's Anniversary Prize in 2011 in recognition of its work as "a world-leading research unit which is helping to further understanding and protection of the oceans".

OUR RESEARCH HAS FAR-REACHING IMPACTS

The 2014 Research Excellence Framework (REF) exercise assessed the impact of research carried out across UK universities. The Schools of Geography & Geosciences and Biology were respectively ranked first and second in the UK for research impact. Three of the five "internationally outstanding" "impact case" studies from the SOI are described here. Our recent success in REF reinforces a reputation for excellent science with impact in marine science that now spans more than 130 years.

Animal-borne telemetry tags for conservation and weather forecasting

The Sea Mammal Research Unit (SMRU) Instrumentation Group, of the School of Biology, has designed, built and supplied about 400 telemetry tags per year since 2008, which have generated over £7 million from companies in the UK and abroad. The tags inform decisions on the conservation of species as well as contributing to improved ocean circulation models and weather forecasting.

Tags have enabled national agencies in 15 countries to build their knowledge of endangered or threatened species, such as the Monk Seal and Steller Sea Lion, and allow judgements to be made about the regulation of offshore industrial developments.

Seal-borne unobtrusive instruments can provide information on conductivity and temperature during the animals' dives, particularly in the Polar Regions. The information is then relayed to World Meteorological Organisations to improve weather and ocean forecasting. Hundreds of thousands of conductivity/temperature/depth (CTD) profiles from seals tagged with SMRU instruments have been incorporated into the World Ocean Database, providing over 50 % of all such profiles available for the Southern Ocean. Tags on elephant seals have improved global ocean circulation models significantly, also leading to better forecasting of the weather and consequent economic benefits to shipping, oil and gas companies.

Marine mammal conservation: from policy change to bycatch reduction

The Sea Mammal Research Unit (SMRU) has developed new techniques to support marine mammal conservation, including "sparse data sampling" which gives robust estimates of marine mammal population density and distribution, and telemetry tagging which allows individual animal behaviour and movements to be logged and recovered via satellite or mobile phone.

SMRU's research has been instrumental in the development of policy on marine mammal conservation, placing legal obligations on EU Member States to assess and report on the conservation status of their marine mammal populations. Other EU countries bordering the Atlantic Ocean have also made extensive use of this information.

In the Moray Firth seals had been shot due to the perception that they impacted on salmon stocks and thus the local economy. Targeting individual seals in rivers was shown to be a more effective management option. This led to legislation protecting seals – part of the Marine (Scotland) Act 2010 – and resulted in a 60 % reduction in seal shooting in the Moray Firth area.

The bycatch of marine mammals in fisheries is a major threat to their conservation. SMRU has implemented an observer scheme on UK fishing boats to quantify bycatch and has helped to implement specific acoustic deterrent devices (pingers). As a result, the pair-trawl bass fishery in the English Channel has seen a reduction in cetacean bycatch of over 90 % from more than 400 animals in 2004/05 to just a handful in 2010/12. Pingers have also been shown to reduce porpoise bycatch by over 90 %. Since July 2013, pinger use is required in many areas around the UK coast.

This work and connected public outreach was awarded the Queen's Anniversary Prize in 2011 for excellence in research supporting better governance of the ocean.

Protecting the future of our oceans

Monitoring, managing and protecting international marine assets motivated sonar methodologies research by Dr Richard Bates, of the Department of Earth & Environmental Sciences, and colleagues and led to the establishment of over 107 internationally important sites of Marine Special Areas of Conservation and Marine Special Protection Areas. Since then, the sonar methods have become part of internationally adopted practice, for example on fisheries protection sites.

Similar sonar methods were developed for use in the management of marine cultural heritage, such as wrecks, underwater structures and drowned landscapes. As a result, research on the submerged Neolithic remains around World Heritage sites in Orkney revealed a lost world. Additionally, in Jersey and Norfolk (Happisburgh) research has resulted in widespread interest by the uncovering of new insights into early human expansion in Northern Europe, including the discovery of the earliest known human footprints in Britain. Aspects of the work, La Cotte de St Brelade in Jersey and Happisburgh in Norfolk, featured in a special exhibit, Britain: One Million Years of the Human Story, at the Natural History Museum in London in 2014.

Other applications have been in the study of rapidly retreating glaciers and areas of sea ice melt in Greenland, habitats to some of our most threatened species, such as the polar bear. This research was highlighted in the award-winning 2012 BBC programme, Operation Iceberg. ■

INVESTING IN PEOPLE

The University has made a major investment in people over the last four years. We have been able to recruit outstanding individuals from all over the world. These researchers represent the future of marine science at St Andrews.

Dr Lars Boehme
Physical Oceanography

Lars is a physical oceanographer and MASTS lecturer who graduated from the Leibniz Institute of Marine Sciences at the University of Kiel, Germany. He then moved to St Andrews to pursue a PhD investigating the Antarctic Circumpolar Current by utilising animal-borne technology.

Lars's interests focus on the ocean overturning circulation and the dynamics of frontal systems utilising animal-borne technology. His studies also highlight the benefits to the sensor-carrying animals themselves by showing the usefulness of this approach in examining the sensitivity of top predators to global and regional-scale climate variability. The research has led to a more strategic view of how to combine a range of observation approaches to achieve a cost-effective observation system linking physical observations to the range of trophic levels they drive. He also works closely with the Ocean Observing Systems to make animal-borne data freely available to the wider community in near real-time. He was appointed as a MASTS lecturer in 2012.

Dr Heidi L Burdett
Marine Biogeochemistry

Heidi graduated with a BSc and MSc in Ocean Science from the University of Plymouth, England before completing a PhD and postdoctoral fellowship at the University of Glasgow. She was appointed as an independent MASTS Fellow in the Department of Earth & Environmental Sciences in 2013. Her research investigates the link between ecosystem function and biogeochemical cycling in estuarine, coastal and marine environments, in response to both natural variability and projected changes in climate e.g. ocean acidification and global warming.

Dr Maria Dornelas
Tropical Biodiversity

Maria did her undergraduate degree at the University of Lisbon and a PhD at James Cook University, Australia. She completed postdoctoral positions at the University of St Andrews, the ARC Centre of Excellence for Coral Reef Studies in Australia and the University of Aveiro in Portugal before being appointed to a MASTS lectureship at the University of St Andrews in 2012.

Maria is a marine ecologist and her research focuses on the causes and consequences of biodiversity at multiple scales. She combines synthesis of public data, modelling and the collection of ambitious field data to quantify and explain biodiversity change. She is interested in understanding how biodiversity is changing in the Anthropocene (the age of man), and what drives variation in direction and rate of change. She is currently involved in projects focusing on biodiversity time series, on effects of Marine Protected Areas on coral reef socio-ecosystems and on reef coral species coexistence.

Prof Oscar E Gaggiotti
Molecular Ecology

Oscar carried out his undergraduate studies in Argentina and then obtained a Fulbright Scholarship to complete a MSc in Ecology and PhD in Ecology and Evolution at Rutgers University, USA. He then obtained a US National Research Council fellowship to carry out postdoctoral work at the Southwest Fisheries Science Center (NOAA) in La Jolla, California.

The genetic composition of individuals and populations harbours vast amounts of information that can be used to solve problems in a wide range of areas, including crime, medicine, agriculture, fisheries and management and conservation of natural populations. Professor Gaggiotti's research group develops the statistical tools needed to extract information contained in genetic data and uses them to understand the ecology and demography of species of plants and animals. Current projects include (i) identification of environmental factors that drive individuals to colonise new habitat or emigrate to other populations, (ii) understanding how ocean circulation and environmental factors influence the spatial distribution of biodiversity in marine ecosystems, (iii) understanding how cultural transmission of migratory behaviours influence the genetic composition of whale species, (iv) understanding how species adapt to extreme environmental conditions such as those found in the deep seas. He was appointed MASTS Professor in 2012.

Dr Mark P Johnson
Foraging Behaviour & Sensor Technology

Mark completed his PhD in electronic engineering at the University of Auckland, New Zealand and was then appointed a research position at the Woods Hole Oceanographic Institution in Massachusetts, USA to develop underwater acoustic communication systems. There he teamed up with biologist Peter Tyack, now also at St Andrews, to explore how similar instruments could help in the study of marine life, a collaboration that resulted in the first widely-used sound recording tag for marine mammals. This device combines high-resolution acoustic and movement sensors to provide an integrated picture of how whales use, and respond to, sound underwater. The tags are now used throughout the world and have enabled a wide range of studies in foraging, social communication, locomotion and responses to human disturbance. In June 2011, Mark joined the Sea Mammal Research Unit at the University of St Andrews as a MASTS Senior Research Fellow where he is developing a new generation of miniature sound tags to study the long-term impact of environmental noise on marine animals. Many aquatic animals rely on sound for finding prey or detecting predators, as well as to navigate and maintain contact with their young. The new tags will help to understand how our growing industrialisation of the oceans may be affecting these animals.

Dr Yannis P Papastamatiou
Spatial Ecology & Behaviour of Marine Predators

Yannis did his undergraduate studies at the University of Southampton before moving to the USA to complete a Masters at California State University Long Beach and a PhD at the University of Hawaii. He then did postdoctoral research at the University of Florida before being appointed as a MASTS Research Fellow at the University of St Andrews in 2013. Yannis's research is on the behavioural and physiological ecology of sharks and other fishes and its application to conservation. Many species of shark are top level predators and may help regulate lower levels of the food chain. Unfortunately, overfishing has reduced the populations of several species and it is unclear how this will affect local ecosystems. Novel sensors are being used to understand the role of sharks and predict how ecosystems may change if sharks continue to be removed.

Dr Ildiko M L Somorjai
Regeneration Biology

Ildiko began her scientific career in Canada with an undergraduate degree from the University of Toronto in Zoology and Physical Anthropology and an MSc degree in Zoology with a focus on Quantitative Genetics from the University of Guelph. She completed the Wellcome Trust PhD programme in Developmental Biology at the University of Cambridge in England. This was followed by postdoctoral research in France (Université Pierre et Marie Curie Paris VI), Spain (Universitat de Barcelona) and Germany (Universität Heidelberg). She was appointed to a MASTS lectureship in 2012.

Her current research programme aims to develop a new, ethically acceptable, model system for regeneration and stem cell research that will not only inform regenerative medicine but will also help to explain the diversity in regenerative ability among different organisms. The marine chordate amphioxus is the ideal candidate: although it is a simple marine invertebrate, it nevertheless shares many basic genetic and anatomical similarities with humans. However, unlike humans, it can regenerate major body parts, including the nerve cord, even to an advanced age. Understanding how tissues not only heal upon wounding, but also the cues that induce stem cells to activate a regeneration programme are important biomedical goals that can be facilitated by the study of animals like amphioxus.

Prof Peter L Tyack
Bioacoustics

Peter graduated summa cum laude in Biology from Harvard College and did his PhD in Animal Behaviour at Rockefeller University, USA. He spent most of his career at the Woods Hole Oceanographic Institute, USA before was appointed MASTS Professor at St Andrews in 2012.

His research interests focus on the remarkable abilities of marine mammals to modify their vocalisations based upon the sounds they hear. His early research showed that humpback whales change the songs they sing from month to month and year to year, in a way that cannot be explained unless each whale copies the songs as they change within the population. He also showed that captive dolphins can imitate the individually distinctive signature whistles of other dolphins. Wild dolphins learn to develop individually distinctive signature whistles within the first year of life, and that these whistles are stable throughout their lifetime, except in pairs of males whose whistles converge as they form a strong social bond.

Tyack and his colleagues have developed sophisticated tags to measure sounds and behaviour in free ranging animals. A particular focus has been on the impact of human activities on the ocean soundscape including naval sonars, ship noise, drilling and blasting and the effects this has on the ability of whales to communicate and feed. They designed a new kind of experiment, called a behavioural response study, to monitor the behaviour of animals exposed to an escalating dosage of sound and to compare responses to the baseline behaviour of animals not exposed to the specific stimulus. The resulting research set an important regulatory standard for noise disturbance for several decades. In the late 1990s, Tyack teamed up with Mark Johnson, an engineer at WHOI who developed the Dtag. Since that time, three generations of Dtag have been developed and deployed on more than 1,000 individual marine mammals, from more than 20 species. This tagging approach has opened a new window on the behaviour and bioacoustics of marine mammals, and has been especially important for deep diving species that are seldom observable using other methods.

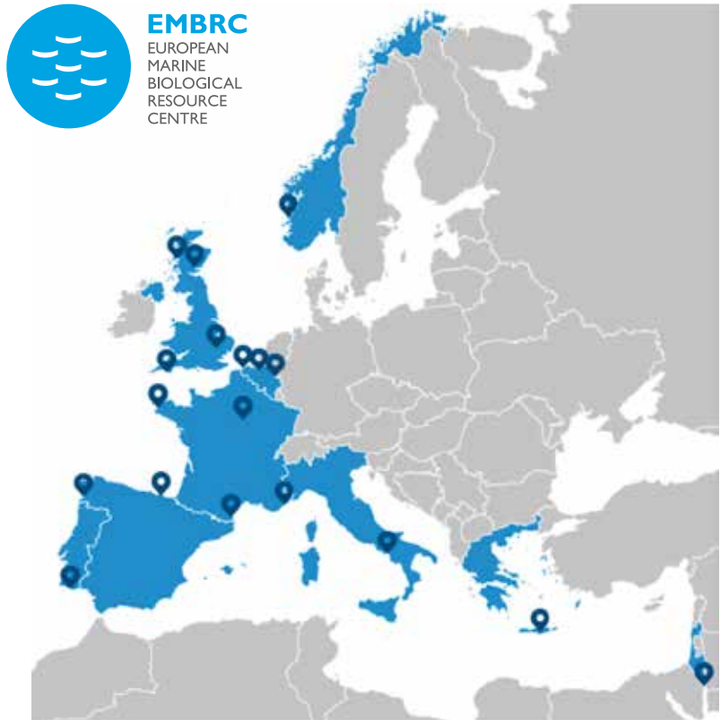
Dr Aubrey L Zerkle
Microbial Biogeochemistry

Aubrey completed a BSc in Geology and an MSc in Geomicrobiology from the University of Illinois at Urbana-Champaign, USA. She obtained her PhD in Biogeochemistry from Pennsylvania State University before carrying out postdoctoral work at the University of Maryland in the USA and at Newcastle University in the UK where she was a NERC Research Fellow. In 2013 she was appointed to a lectureship in the Department of Earth & Environmental Sciences at St Andrews.

Dr Zerkle is primarily interested in understanding the coevolution of life with the Earth's surface environment over short to geologic timescales. Microbes play the dominant role in driving geochemical cycles at and near the Earth's surface today. Most microbial pathways originated billions of years ago and were both causes and effects of environmental changes of the highest order, such as the first accumulation of oxygen in the ocean and atmosphere. Aubrey's research focuses on understanding the biological causes and consequences of these major transitions in Earth history, including the Great Oxidation Event and the end Permian mass extinction. Understanding how microorganisms both respond to and drive major biogeochemical change has additional implications for understanding current and future transitions in the ocean-atmosphere system, such as the expansion of ocean anoxia and the development of ocean acidification.

THE EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE (EMBRC)

The University of St Andrews is a leading partner in The European Marine Biological Resource Centre (EMBRC) – a large-scale European Research Infrastructure in marine biology designed to serve the needs of universities, industry and government. The EMBRC was added to the roadmap of the European Strategy Forum for Research Infrastructures (ESFRI) in 2008. Since then, EMBRC has successfully completed a preparatory phase (2010-14) with €3.9 million funding from the European Commission, resulting in a blueprint for the future infrastructure. The governments of nine countries (UK, France, Italy, Spain, Norway, Belgium, Portugal, Greece and Israel) have now signed a Memorandum of Understanding to proceed to ERIC legal status (European Research Infrastructure Consortium), which is expected to be achieved towards the end of 2016. EMBRC-ERIC is being built to develop marine science in Europe over the longterm and, based on the commitment of European member states, is expected to be operational for a minimum of 25 years.



EMBRC national nodes comprise research infrastructure that is located in leading marine biological stations and laboratories across Europe.

It will be the leading organisation for marine biology research in Europe providing:

- Access to diverse marine ecosystems and organisms.
- Strategic planning for the acquisition and sharing of major capital facilities and equipment.
- High-level research services including culture collections, imaging, genomics and structural biology facilities, and e-infrastructure.
- Standardisation of data management, culture collections and information services.
- Training for postgraduates and professionals.
- A focus for European collaboration with the rest of the world.

EMBRC will support the development of the "blue economy"

Marine biotechnology is the key to unlocking the potential of the unique biodiversity of marine organisms for the benefit of mankind. It is rooted in basic research bringing together marine biology, microbiology, physiology, toxicology, systems biology, bioinformatics, omics technologies and analytical chemistry. The result is new applications in fields such as drug discovery, diagnostics, novel foods and food ingredients, aquaculture and agriculture, bioremediation, biomaterials, cosmetics and bioenergy.

The European Commission has recently provided €9 million for the EMBRC to lead a close collaboration of academic institutions, companies and policy makers to focus on the development of two specific sectors of marine biotechnology, namely (i) discovery and development of marine natural products, and (ii) marker-assisted selection in aquaculture.

EMBRC Partners

BELGIUM
- Ghent University, *Ghent*
- Flanders Marine Institute (VLIZ), *Oostende*
- University of Hasselt, *Hasselt*

FRANCE
- EMBRC Headquarters, *Paris*
- Station Biologique de Roscoff, *Roscoff*
- Observatoire Océanologique de Villefranche-sur-Mer, *Villefranche-sur-Mer*
- Observatoire Océanologique de Banyuls-sur-Mer, *Banyuls-sur-Mer*

GREECE
- Hellenic Centre for Marine Research (HCMR)/ Institute of Marine Biology, Biotechnology and Aquaculture (IMBBC), *Heraklion, Crete*

ISRAEL
- Interuniversity Institute for Marine Sciences (IUI), *Eilat*

ITALY
- Stazione Zoologica Anton Dohrn (SZN), *Naples*

NORWAY
- Sars International Centre for Marine Molecular Biology, *Bergen*

PORTUGAL
- Centre for Marine Sciences (CCMAR), *Faro*

SPAIN
- The Marine Science Station of Toralla (ECIMAT), *Vigo*
- Plentzia Marine Station (PiE), *Plentzia*

UNITED KINGDOM
- Scottish Association for Marine Science (SAMS), *Oban*
- Scottish Oceans Institute (SOI), *St Andrews*
- The Marine Biological Association (MBA), *Plymouth*
- British Antarctic Survey, *Cambridge*

OUR VISION AND PLANS

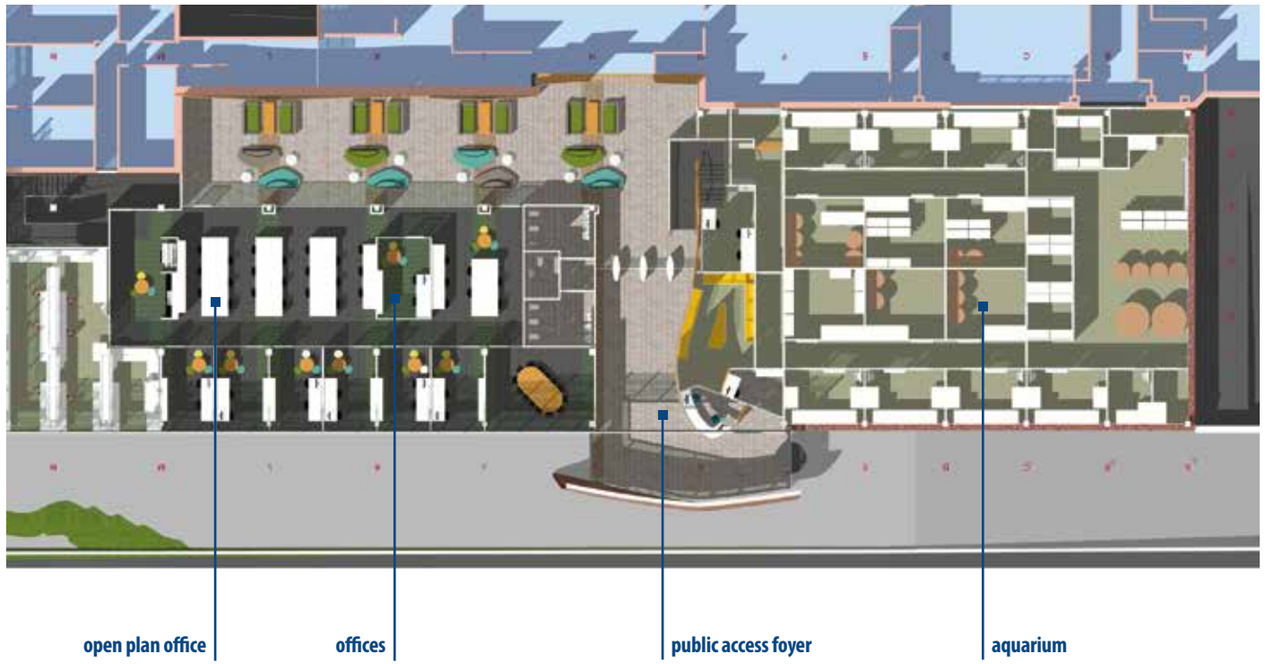
The need to maintain healthy oceans in the face of rapid industrialisation ranks among the grand scientific and societal challenges of the twenty-first century. The University recognises that meeting this challenge will require investment in physical infrastructure, human capital as well as international collaboration. The current buildings at the Gatty Marine Research Complex can no longer accommodate all our marine biologists and several research groups have become scattered across the University, reducing scientific interactions. Furthermore, the aquarium and "wet experimental facilities" which are at the heart of the complex have become outdated and are no longer fit for purpose.

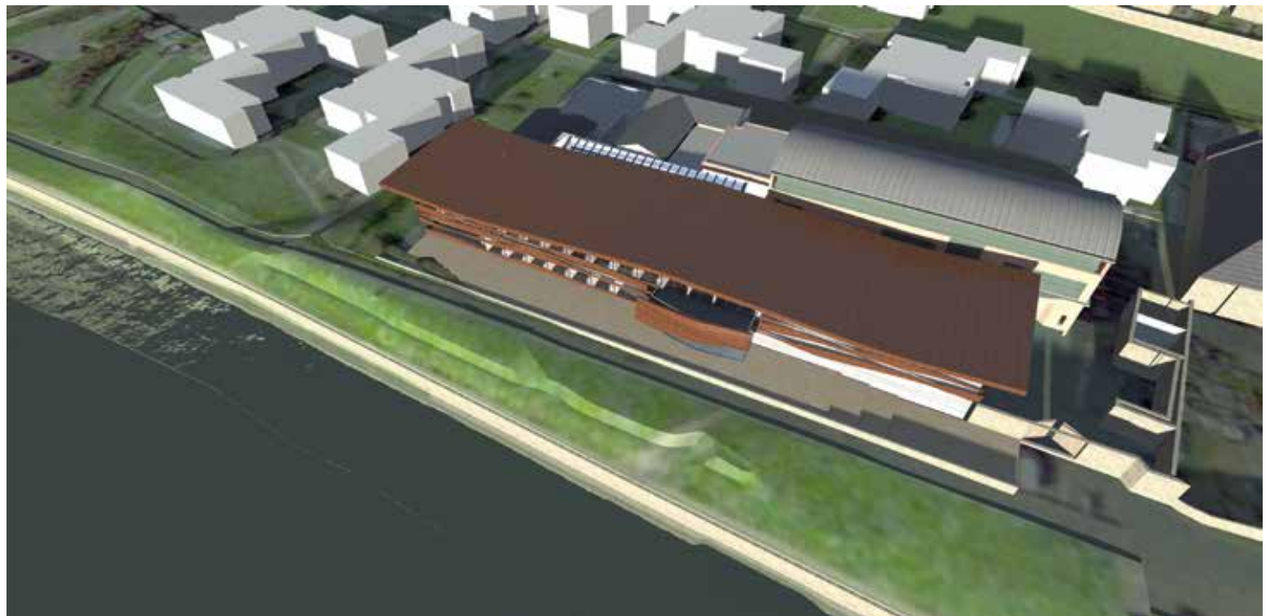
The rebuilding of the Gatty has been recognised as a high priority in the University's 2015 Strategic Plan. The Victorian aquarium will be replaced with a modern research facility. Adjoining this will be a new 2,256m^2 research building with modern office space sufficient to accommodate the existing marine research groups, as well as visiting scientists, and will allow for anticipated further growth. The total estimated cost of the project is £8.8 million. Importantly, the new building will enable all members of the Sea Mammal Research Unit to consolidate on a single site. The new building is also expected to be completed in time for the start of the EMBRC access programme in 2017.

The modern marine biological research being undertaken at St Andrews exploits advances in DNA technology, microscopy and analytical capabilities that rely on a new kind of aquarium. The new aquarium will also cater for extensive environmental monitoring and control of temperature, lighting, pH, oxygen, salinity, ammonia and nitrates. Specialist rooms with air conditioning will allow electronic and optical equipment to co-exist with culture facilities supplied with running seawater. This will support sophisticated long-term experiments on adaptation of organisms to climate change. The new aquarium will cater for a much wider range of organisms than at present.

The New Gatty will take full advantage of the site's prominent position bordering the well-used Fife Coastal Path. A Public Outreach Centre will be incorporated into the foyer of the new building. This will allow the University to enrich its current initiatives involving the local community and visitors with the science at the Gatty. The University recognises this opportunity to take a lead role in promoting public understanding of the world's oceans, including the unique ecosystem of the North Sea.

The design of the new building and aquarium will be energy efficient and sympathetic to its environment. It will be sufficiently flexible to serve the needs of researchers from the Schools of Biology, Medicine, Chemistry and Geography & Geoscience as well visitors from across the world for years to come, and contribute to the wider marine agenda through cooperation with MASTS.





"The new aquarium at the Scottish Oceans Institute will provide a much needed acoustic calibration facility for testing sound tags before they are used on wild animals enabling us to measure more definitively the sound levels they experience. The aquarium will also enable new studies on how sound affects shellfish, crabs and fish".

Dr Mark Johnson, Senior Research Fellow

"The new aquarium will enable my research group to spawn the marine chordate amphioxus in captivity so that we can study early developmental stages, as well as maintain the adults, which is crucial to understanding how nerves and muscles can be regenerated following injury".

Dr Ildiko Somorjai, Lecturer

"The new aquarium will enable the culturing of phototrophic microorganisms under different nutrient and atmosphere scenarios thus providing a unique opportunity to recreate (and test specific hypotheses about) the evolution of the global environment on the early Earth, including how the early Earth transitioned to the O_2-rich atmosphere that was a prerequisite for the evolution of multi-cellular life".

Dr Aubrey Zerkle, Lecturer

CONTACT

For further information please contact:

Professor Ian A Johnston
Director, Scottish Oceans Institute
University of St Andrews
St Andrews · Fife
KY16 8LB · Scotland · UK

E: iaj@st-andrews.ac.uk
W: soi.st-andrews.ac.uk
T: +44 (0) 1334 463440

Development
Robert Fleming, Director
Jo Finnie Jones
Becky Mitchell

E: 600campaign@st-andrews.ac.uk
T: +44 (0)1334 461916

Printed by Print and Design, University of St Andrews, May 2015