

MBA scientists were some of the first to use satellites to study ocean phytoplankton populations.

Marine Biological Association

125 years on

In September last year, some of the top names in the marine world gathered in the Fishmongers' Hall in London to celebrate the Marine Biological Association's 125th anniversary. Guy Baker looks at some of the work that has led to this success.

The unassuming limestone building on the eastern side of Plymouth Hoe is a research laboratory, behind whose walls some of the UK's most eminent marine biologists have wrestled with the pressing science questions of their day for more than a century. The laboratory is home to the Marine Biological Association of the UK (MBA) which was formed by the Royal Society in 1884, primarily to investigate the decline of fish stocks. Newly elected president, TH Huxley, didn't believe the ocean's resources could be dented by the technology of the time. But his view wasn't shared by Ray Lankester, the MBA's first elected secretary, who was very concerned about the effects of the increasing numbers of fish being landed on UK shores.

More than a century on we know that fish stocks are being severely depleted by human activities, and the challenges that now face the oceans and societies across the globe are bigger and more complex than either Huxley or Lankester could have imagined. Large cod, tuna and skate – all abundant in the North Sea in the early part of the 20th century – are now reduced to between 5 and 10 per cent of levels 100 years ago, or are locally extinct. Protection of areas of the seabed and spawning populations of fish is a large part of the solution, and the work of MBA scientists has kept the organisation at the forefront of such challenges.

The MBA's long-term records of fish and zooplankton in the western English Channel have been invaluable for showing environmental change over decades and act as a baseline against which the effects of human activities can be measured. MBA scientists Frederick Russell and Alan Southward were responsible for a key piece of research on marine systems. They looked at zooplankton data and the changes that were observed over roughly 50-year time periods from a predominance of pilchards in the English Channel to one of herrings. This work was supported by records of taxation on fish landings and temperature records going back to the mid-17th century, which showed that pilchards were landed during warm periods and herrings during cold. The 'Russell Cycle' introduced the idea that climate changes follow a roughly ten-year cycle and that these cycles drive periodic changes in marine ecosystems.

Backed by such painstaking long-term studies, MBA scientists have been responsible for some truly groundbreaking scientific achievements. In the early 1950s Alan Hodgkin and Andrew Huxley revealed the chemical mechanism of nerve transmission through their work on the giant nerve fibre found in squid. The scientists' combination of theoretical and experimental work led to Nobel prizes for Hodgkin, Huxley and John Eccles in 1963.

Alan Southward was one of the most influential British marine biologists of his generation. His work with Dennis Crisp was among the first to show the effects of climate on marine ecosystems; it provided a baseline against which recent responses to global warming have been compared and continues to form the foundation for much current MBA research on environmental change. The Marine Biodiversity and Climate Change (MarClim) project has built on Southward's legacy, continuing and expanding the MBA's long-term records of selected rocky-shore species whose abundances were known to be linked to fluctuations in climatic conditions. By studying the distribution of a variety of invertebrates such as limpets and topshells around Britain and Ireland, and using historical data to provide baselines for previous warm and cool periods, MBA researchers found that southern species

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are moving northwards and eastwards at up to 50km per decade – far exceeding the global average of 6.1km per decade on land.

Always at the forefront of marine research, in the 1970s and 1980s MBA scientists were some of the first to use satellites to study ocean phytoplankton populations. They produced the first satellite images of blooms of coccolithophores in the Atlantic Ocean. This



alga is now making headlines for its absorption of carbon dioxide from the oceans, and 40 years on MBA researchers are trying to understand exactly how ocean plankton – and particularly the coccolithophores – absorb CO₂ and produce calcium carbonate. They are developing new tools and techniques to measure the state of plankton in real time in the sea, and to track the changes of past plankton populations.

Another continuing line of research began in the 1980s, when MBA scientists noticed bizarre abnormalities in marine animals living in and around estuaries and at coastal sites where there was lots of boating and shipping activity. In particular, 'imposex' – the imposition of male sexual characteristics on females – was seen in certain types of molluscs. The worst affected was the dog whelk, *Nucella lapillus*, which was rapidly becoming unable to reproduce and in some areas had even become extinct. The scientists identified tin-based antifouling paints as the culprit. The most active ingredient in these paints was tributyl tin – TBT – which the researchers showed to have endocrine-disrupting properties, interfering with the

whelks' hormone production. Populations of other molluscs such as clams, *Scrobicularia plana*, were found to be in decline at TBT-polluted sites too. This and related research led to a ban on the use of TBT-based paints on smaller vessels in the UK in 1987 and to International Maritime Organisation (IMO) recommendations for a similar measure for the global commercial fleet from 2008 onward. This line of work continues to contribute to national and regional perspectives on human impacts on marine environments, and to map pollution hotspots.

The MBA is also looking at how marine animals' environments influence the way they search for food. Since food in the oceans is often sparsely distributed predators must cover huge areas. Electronic tagging and tracking of animals as diverse as penguins, basking sharks and tuna has revealed that the movements of predators correspond to Lévy flight patterns – rather than moving through their environment in a random manner they employ a strategy which maximises their chances of finding their thinly spread prey.

Over 125 years the MBA has established an international reputation for excellent, independent research into all aspects of marine and environmental science. It advises Government and has an innovative education and public outreach programme. The organisation is a founder member of the Plymouth Marine Sciences Partnership (PMSP) which is the largest regional cluster of expertise in marine sciences, education, engineering and technology in Britain and one of the largest in Europe. Climate change, ocean acidification and pollution, the combination of biological, geological and chemical processes and the many other pressures the oceans endure are now exercising the minds of our scientists, and some of the UK's best young researchers will have the formative experiences of their scientific careers in the limestone building on Plymouth Hoe. The next 125 years are likely to be even more demanding than the last but no less rewarding.

MORE INFORMATION

Guy Baker is communications officer at the Marine Biological Association. E-mail: guba@mba.ac.uk

The MBA is a learned society and welcomes new members: visit www.mba.ac.uk/membership.php.

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More information about the MBA's 125-year celebrations can be found at: www.mba.ac.uk/125years.php and for more information on PMSP visit www.pmsp.org.uk



MBA scientists found that antifouling paints were damaging marine life.