

Delivering the evidence for marine policy

**innovative research in the
marine environment 1989 – 2004**



Research in the marine environment: 1989 – 2004

The creation of Defra in 2001 brought together into one government department interests in marine science to support conservation, environmental protection, fishing and coastal management objectives. Research to underpin Defra's objectives since 2001 can be found at www.defra.gov.uk/science and www.defra.gov.uk/environment/marine/research

The aim of the enclosed CD is to summarise the scientific, technical, and policy achievements of Defra's predecessors, MAFF and DETR, from approximately 1990 to 2001, highlighting some of the projects that have advanced our knowledge in clear and important ways.

MAFF and DETR funded extensive programmes of research and monitoring that have helped us to understand how the marine environment works, the risks posed by human activities, and the actions that are needed to secure the health of the seas for future generations. Much of this essential work has been conducted by our Agency CEFAS (the Centre for Environment, Fisheries and Aquaculture Science), but also by other establishments and research organisations. The studies encompass a wide range of environments, from the UK's more industrialised estuaries to the Arctic, and a broad range of subjects, from oil spills to global climate change, all of which have helped to maintain the UK at the cutting edge of marine scientific investigation.

The CD in this pack contains:

Key areas of research activity: simplified accounts of 12 of our most important areas of research funding, with links to supporting scientific information.

Project database: details of marine research and development projects funded by Defra and its predecessor bodies, MAFF and DETR (MLIS), from 1989 to 2001.

Related programmes: details of other programmes of research to which CEFAS and Defra-funded work has made a significant contribution.

CEFAS resources: a bank of captioned images that provide a visual account of the work of CEFAS. All images are downloadable and available for copyright-free use.

Movie: a short video presentation setting out the work of the then Directorate of Fisheries Research (now CEFAS) in the marine environment.

Publications: a list of scientific publications that have emerged from Defra-funded research in the marine environment.

Key contacts: contacts at Defra, CEFAS and associated bodies for all areas of research and development.



Our stewardship of the marine environment must be informed by the best available scientific evidence.

Key areas of research activity

Over the last decade, government's role has changed markedly from the protection of fish and shellfish from the adverse effects of human activities to an indication of the health of the entire marine ecosystem and the processes on which it depends.

Twelve significant areas of marine research and development which government support are outlined here, and are described in detail on the accompanying CD.



Climate change

Oceans absorb, store and transport huge quantities of heat energy from the Sun, and so have a pivotal role in determining climate. For example, the Gulf Stream and its extension into the North Atlantic Current bring warm, salty water across the Atlantic, elevating air temperatures in the UK by 5–10°C above those expected for the latitude, with profound effects on the climate in our country. Intensive monitoring of the oceans is necessary to understand these patterns, how they may have changed in the past, and how they may change in the future. Defra has funded some important observational work in the north Atlantic, making a significant contribution to international science programmes that develop our understanding of ocean–climate links.



Biodiversity

Biodiversity is the term used to describe the richness of life in a given area. It is not a straightforward concept, because this "richness" is measured in terms of the range of habitats, the number of species, and the genetic variety of the animals and plants present in a region. Biodiversity is likely to be affected by any human activity that destroys or disturbs organisms or their habitats. In the marine environment, this may include activities such as fishing, aggregate extraction, depositing dredged material, oil and gas exploration and exploitation, and the discharge of sewage and industrial effluents. Maintaining biodiversity in UK waters is clearly a desirable goal, but one that demands effective regulation backed by coherent programmes of scientific research.



Monitoring the quality of the environment

As part of its role of protecting the marine environment, Defra funds scientists at CEFAS to conduct an extensive monitoring programme which assesses the concentrations of various metal, inorganic and organic contaminants in sediments, water, fish and shellfish. While such monitoring is essential, it presents only part of the picture of environmental contamination. This is because it is only practical to measure concentrations of those chemicals known to, or suspected to, cause problems. Defra, together with a number of other bodies, such as the Environment Agency, is directing the development and implementation of techniques towards a fuller assessment of environmental quality. The National Marine Monitoring Programme (NMMP) provides the vehicle for integrating the environmental quality monitoring activities around the UK, and is a vital element of the UK Government's Marine Stewardship efforts.



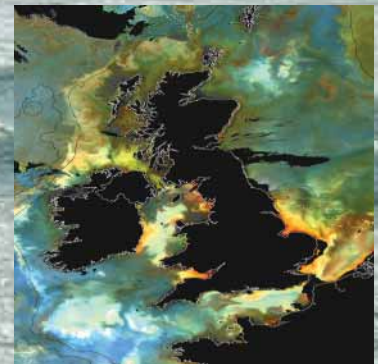
New developments in monitoring equipment

Marine monitoring programmes are constantly evolving both in response to changing needs for information and as scientists refine survey methods and employ novel observational strategies. In order to track environmental change over varying timescales we need to gather increasing amounts of data at ever-higher resolution. This need has driven the development of new instruments that can operate continuously, reliably and autonomously in hostile conditions. Defra has supported the design, testing and introduction of these new techniques which are changing the way in which we understand the marine environment.



Water movement

Water moves constantly in the seas driven by a complex interaction of mechanisms, principally input of heat from the sun, winds, rotation of the earth and the shape of the ocean basins. In the shallower continental shelf waters around the UK, the tides and freshwater input are also important. Taken together, these factors account for the water movement observed at the coastline. This water movement transports the early life stages of marine animals (plankton) and materials introduced by man (sewage, toxic materials etc) as well as providing the physical



Nutrients

All plants, whether terrestrial or aquatic, require a supply of nutrients for growth and development. These nutrients (which include nitrogen, phosphorus and silicon) are naturally supplied by the fixation of atmospheric nitrogen or, in the case of phosphorus and silicon, derived from the weathering of rocks. In the last 50 years, human activity – principally linked to the use of artificial fertilisers and discharges from sewage



Radioactivity

Commercial nuclear power generation has supplied a significant proportion of the electricity required to meet the demands of the population and industry in the UK. As with all industries, the process leads to the production of waste that has to be carefully managed. A component of the waste from the nuclear cycle is discharged to the marine environment but only where this can be done safely and without causing harm to man or the environment. A programme of research and monitoring continues to ensure that not only is there a sound basis for validating the decisions that have been taken, but also that the regulation of this activity can be improved. Research has sought to unravel the complex interplay between the discharged radioactive elements and the water, sediments and biota of the seas.



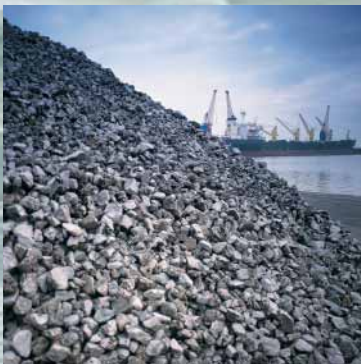
New pollutants and the sexual development of fish

In the early 1990s, anglers began to notice that fish from certain freshwater habitats displayed unusual sexual development: specifically, roach caught in some sewage treatment lagoons were hermaphroditic, showing both male and female characteristics. Preliminary research on other freshwater species indicated that natural and synthetic hormones present in effluents were to blame and raised suspicions that chemical pollutants could affect the development of marine fish and crustaceans in a similar way. Defra research conducted by CEFAS has confirmed these suspicions in a number of marine species, and on-going collaborative work is directed at measuring the scale of the problem and identifying the causes.



TBT control

For decades, tributyltin (TBT) has been used as an anti-fouling agent by shipping fleets and boat owners across the world. Painted onto the hull of a vessel, it prevents encrustation by marine plants and animals, reducing the need for mechanical cleaning of the hull and also cutting the fuel consumption of the ship or boat. Studies have shown that these benefits must be weighed against the adverse effects of TBT on the marine environment and fisheries, particularly the UK oyster industry. The findings have played a key role in highlighting the environmental dangers associated with TBT, and this has ultimately led to its use on vessels being prohibited both in the UK and globally.



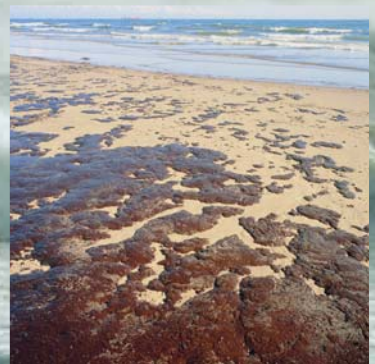
Aggregates

Coarse sand and gravel are found at many locations on the sea bed around England and Wales. These areas support a variety of marine animals, from larger forms including fish, shellfish and crabs to small marine plants and animals living in and on the sea bed, such as worms and anemones (the benthos). Sand and gravel – or aggregates – are also valuable natural resources, used in the construction industry to make concrete. Most aggregates are extracted from quarries on land, but 15 percent of the UK's annual production – about 25 million tonnes – is dredged from the sea bed, which is managed by the Crown Estate. While aggregate extraction is an important industry, it can affect the marine environment, and so needs careful management. Regulation of extraction, backed by sound research, helps make the extraction of the UK's aggregate resource more sustainable and minimises the impacts on the marine environment.



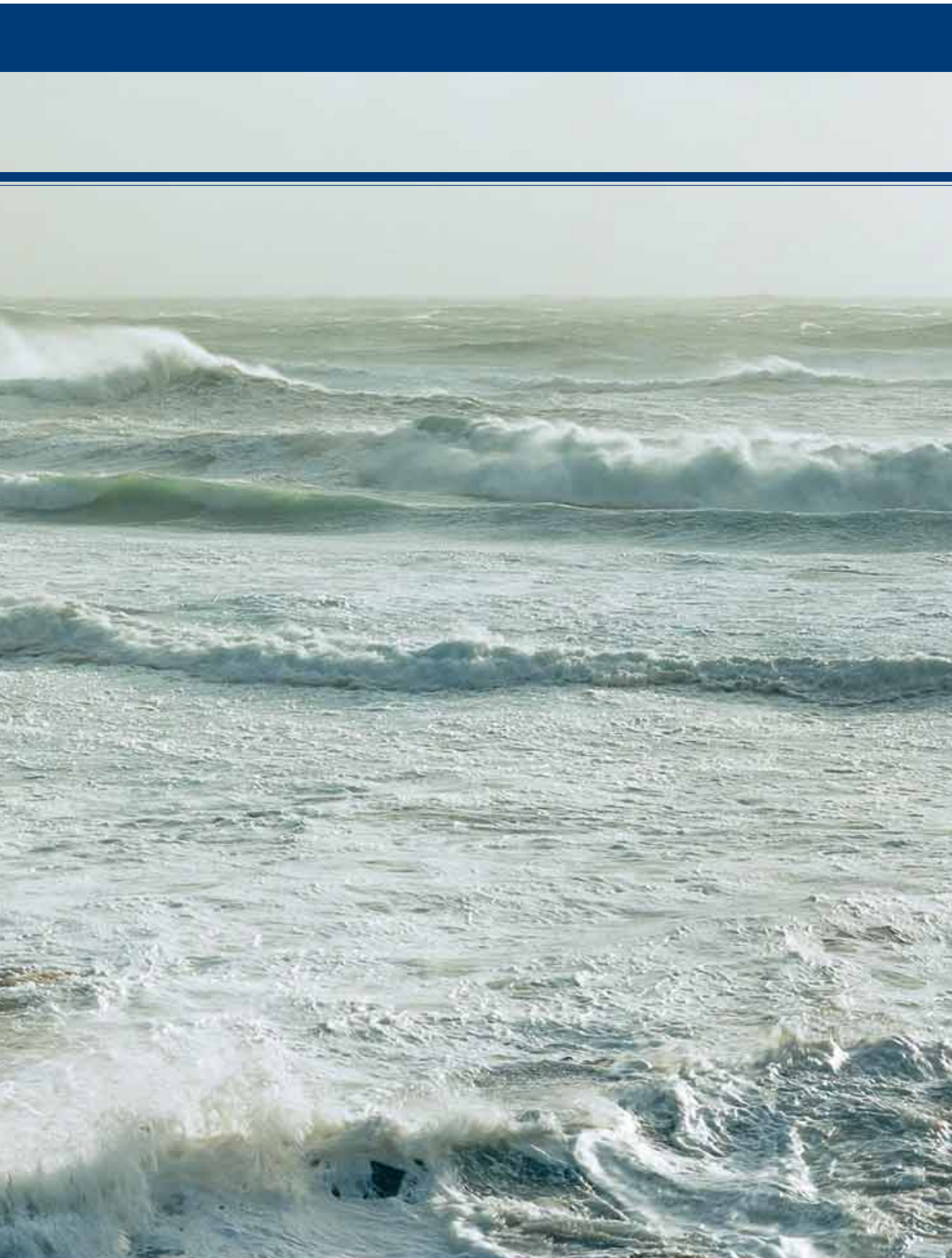
Dredged material deposits

The UK is a maritime nation that relies heavily on its harbours for import and export trade. Ports need constant maintenance because they tend to fill up naturally with silt, which reduces their depth and restricts access by larger cargo vessels. For this reason, harbours are regularly dredged and large quantities of sediment (30-35 million tonnes per year) are removed, much of which is disposed of at sea. When deposited, the dredged silt can affect the marine environment: it can blanket the sea bed, increase the amount of sediment suspended in the water, and it may later be transported to other areas by currents, tides or storms. Defra has commissioned a series of studies that have examined the nature and fate of dredged material and its effects on marine ecosystems. The results of this research have helped develop policy on disposal, and have suggested a number of potentially beneficial ways of using the dredged material.



Oil pollution

The UK's waters and coastlines are at constant risk from accidental oil spillages and losses of cargo at sea. The most dramatic, and widely reported, incidents occur when giant tankers break apart, spilling huge quantities of crude oil, but more widespread environmental contamination can result from far smaller incidents. For example, oil can be spilled when refuelling a vessel at sea, and cargo can be lost during transfer at port. Pollution can also result from leakage of oil or other chemicals from coastal tanks and pipelines, or losses from offshore oil platforms. Whatever the cause of the pollution, it is essential to understand the threats to natural and economic resources, and to act swiftly to minimise overall impacts. Defra has a key role in advising other agencies about the risks to the marine environment. An example is the Defra approval scheme for oil dispersants and the research that underpins the efficacy and toxicity tests that regulate their use.





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