Uncertainty of detecting sea change

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The alarming termination rate of long-term monitoring programmes in Europe is hindering the detection of ecosystem change in the ocean. Existing programmes must be linked and data shared.

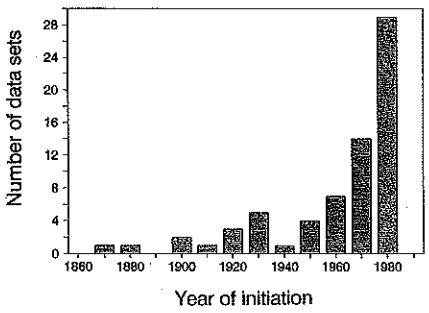
GROWING concern about human influence on marine ecosystems conflicts with our inability to separate man-made from 'natural' change. This limitation results from the lack of adequate baselines and uncertainty as to whether observed changes are local or on a broad scale. Long-term monitoring programmes should be able to solve both these deficiencies, but failure to realize their potential has led to a shocking number of them being prematurely stopped, often permanently.

The initiation of new long-term programmes has been increasing exponentially since 1940 (see figure). Many (55%) of these programmes, however, have been stopped already, most often in the late 1980s when 40% were terminated. Consequently, few records of change in the sea extend beyond two decades, and efforts to monitor marine ecosystems in Europe are not increasing despite growing evidence that human influence is having a significant effect. Thus, long-term monitoring programmes are, paradoxically, among the shortest projects in marine sciences: many are initiated, but few survive a decade.

The growing number of new long-term monitoring programmes parallels a similar bloom in human damage to marine ecosystems. Funding of monitoring programmes triggered by these catastrophes are often withdrawn once 'recovery' has occurred, or once the issue is no longer attractive to communication media. Recent examples include winding down of operations to clean-up the oil spill during the Gulf War, the largest oil spill in history, because countries donating funds to the International Maritime Organization's Persian Gulf Oil Pollution Disaster Fund were no longer willing to contribute, even though clean-up and evaluation of ecological damage is far from complete[1].

The sustained support required by long-term monitoring programmes is jeopardized by unexpected drops in research funding caused by policy changes, such as that experienced recently in France[2]. This appears to be the main cause of the alarming rate at which long-term marine monitoring programmes were stopped in Europe, many of these then cancelled during the 1986–87 funding crisis experienced in France and the United Kingdom[2,3]. Long-term monitoring programmes are easy victims of funding crises because, by their very nature, they are not competitive when evaluated from their short-term scientific yield. The frequent imbalance between the effort invested and the scientific yield, along with the routine nature of long-term monitoring programmes, does little to make them appealing to scientists looking for creative research to develop solid curricula. Consequently, continuation of long-term monitoring programmes is often heavily dependent on the personal effort and dedication of individual scientists.

The question of whether the marine environment should be monitored is no longer at stake, and there is an explicit demand from an increasingly concerned society for answers as to how and how much the marine environment is changing. Scientists must, therefore, improve the mostly meagre scientific yield of their effort. The ability of long-term monitoring programmes to detect and characterize change in the marine environment will be best realized if data sets were examined in concert, as opposed to the isolation of present practices, thereby comparing observations from distant locations. A comparative approach is scientifically more sound because spatial and temporal scales of change in the sea are linked by mixing, such that processes responsible for decade-scale changes in the marine environment operate at spatial scales of thousands of kilometres[4]. Departure of ecosystem properties from long-term average values are therefore likely to be part of changes in water mass distribution and biogeographical patterns at oceanic scales. For instance, we observed anomalously high sea temperatures throughout Europe between 1988 and 1990, and large fluctuations in fish catches can result from changes in the biogeographical distribution, rather than the size, of the populations[5]. Detection of these broad-scale changes, and distinguishing them from local changes, is possible only when data from distant locations are compared.



Rate of initiation of long-term monitoring programmes in European marine stations.

A comparative approach to long-term monitoring should yield valuable knowledge on the nature of changes in the sea and enhance the potential to forecast and detect them. It should encourage the solidarity and cohesion among individual programmes needed to reduce the presently alarming rate at which monitoring programmes are being stopped, because termination of individual programmes would impinge on the overall potential to establish broad-scale patterns of change.

The broad-scale, comparative approach to long-term monitoring of the marine environment proposed here must involve robust international management and funding systems, either already existing (such as EC, ICES or UNESCO) or new, in which individual efforts must be integrated to ensure continuity. Yet an effective approach requires that scientists involved in long-term monitoring programmes be prepared to share data in the relatively short term. Reluctance to share data is a serious threat to large-scale cooperative multinational efforts in other fields where there is a difficult balance between the rapid data dissemination required and the need for a period of confidentiality before the data are available to competing research groups. The balance may be particularly difficult to achieve in the case of marine monitoring programmes because the period of confidentiality of data sets is extremely long (generally more than 5 years). Yet we believe that the profits of a comparative, multinational approach should suffice to overcome any reluctance and improve the prospect for the detection of change in the sea. □

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