

IACMST GOOS ACTION GROUP ANNUAL REPORT 2006

Introduction

The Action Group is currently responsible for co-ordinating those marine observation programmes operated by UK Departments and Agencies that are concerned with marine processes and climate. It was also tasked with improving the co-ordination, development and application of operational models of the shelf seas around the UK. Although much of this has now been picked up by the National Centre for Ocean Forecasting (NCOF), which was established last year, the Action Group continues to maintain a watching brief over developments. At its meeting in January 2006 the IACMST agreed on a series of activities to be undertaken by the Action Group in the course of the year and beyond. That list is reproduced at Annex 1 together with brief notes indicating progress made, together with details of any additional activities undertaken. Further details are given in the following report.

The Action Group normally meets twice a year. During 2006 meetings were held on 9 May in the Baltic Exchange in London and on 10 November at the CCW headquarters in Bangor, North Wales. Attendees at these meetings are listed at Annex 2. The November meeting was held in conjunction with an *Open Meeting on Physical Measurements for Ecosystem Requirements*, which was attended by a wider audience on the day preceding the meeting of the Action Group itself. More details are provided below.

Since 2002 the Action Group has had its own budget, with financial contributions initially coming from Defra, the Met Office, MOD(N), Dstl, Scottish Executive, EA and NERC. Following the retirement of the representative from Dstl, funding from that source ceased and early in the year the Scottish Executive's representative indicated they were ceasing to contribute financially to the GOOS Action Group. That decision unfortunately also applied to any input by their representative from FRS. The decision was brought about at least in part by the establishment of the UK Marine Monitoring and Assessment Strategy (UKMMAS), about which more details are provided later in this report. Given the Scottish position and the way in which the UKMMAS has developed during the year no further efforts were made to secure any financial support from Northern Ireland or the Welsh Office. However, the funds that were available did mean the Action Group was able to organise and support an open meeting and to let contracts to consultants for tasks which would have been beyond the scope of its own membership.

An Action Group co-ordinator (Dr John Portmann) continues to be employed on a part-time basis. His role is to enhance the effectiveness of the Action Group between meetings and to give general support to its Chairman. In that capacity Dr Portmann has during the year: -

- Acted as an adviser to the Action Group's Chairman and the Secretary of IACMST and attended briefing sessions with them in preparation for Action Group meetings and to discuss how best to pursue agreed activities
- Maintained liaison with the MED Action Group by correspondence with its co-ordinator (and her assistants)

- Assisted, early in the year, in finalising the text of the Summary version of the UK GOOS Strategic Plan which was produced via consultants and published in July as a hard copy IACMST publication
- Attended the meeting of the Intergovernmental Oceanographic Commission's Executive Council in June
- Prepared a questionnaire seeking information from member organisations and other organisations involved in monitoring the marine environment on their plans to implement a number of key actions suggested in the UK GOOS Strategic Plan and collated the responses into a report to the Action Group
- Assisted the Action Group's Chairman and the Secretary of IACMST in commenting to the UKMMAS secretariat on the implementation of that Strategy and in particular advising on how the GOOS Action Group's activities might best be incorporated within it and how the Action Group might possibly be subsumed within the UKMMAS structure especially the Marine Assessment and Reporting Group (MARG) and its subsidiary bodies
- Attended meetings of MARG and mini MARG to represent the GOOS Action Group position and establish where the MARG membership felt UKMMAS should develop
- Produced proposals for a 3-5 year work programme of implementation of the UK GOOS Action Plan, providing for the possible transfer of its own activities to UKMMAS (MARG) over the coming twelve months
- Produced explanatory cover sheets for a number of reports produced on behalf of the Action Group prior to their placement on the Action Group's website
- Organised the one day Open Meeting held in Bangor on *Physical Measurements for Ecosystem Requirements* and produced the summary record of proceedings for acceptance by participants prior to its placement on the Action Group's website
- Acted as point of contact and channel for relevant information between members and with external organisations and individuals, either directly or via the Action Group's website.

Actions directly related to GOOS

GOOS and GOOS Commitments

Early in 2002 a return was made to the GOOS Project Office in Paris listing the programmes UK organisations and laboratories were content to regard as contributions to GOOS. Since then returns have been made, on request from the Project Office, with the assistance of the MEDAG co-ordinator using information held at BODC on the status of the previously nominated UK contributions. Towards the end of 2006 a request was received for more information on UK programmes and on the extent of possible increases in financial support for GOOS activities. A response is being developed which relies heavily on provision of a copy of the Strategic Report Summary and the summary of UK intentions as obtained from the questionnaire referred to above and an explanation of the necessary interim nature of UK plans whilst the UKMMAS is developed and implemented.

GOOS Technical Reports

As and when GOOS Technical Reports are published, summaries are prepared by the co-ordinator and issued to members. These summaries are intended to draw members' attention to newly published information on topics directly related to the Action Group's interests. During the year no relevant Technical Reports were published so no summaries were required.

Prior to late 2004 GOOS Newsflashes were sent directly to the Action Group's co-ordinator and were relayed on to its members. This procedure has ceased and the Newsflashes are simply posted on the IOC's GOOS website. The Co-ordinator now scans the website at intervals and if he considers an entry to be of particular interest to members it is drawn to their attention. In the course of the year this has been done on a couple of occasions.

GOOS Strategic Plan

The UK GOOS Strategic Plan was completed by Dr Colin Summerhayes late in 2005 and after some minor editorial work, and the incorporation of amendments suggested by members of the Action Group, was posted on the Action Group's website in the early half of the year. It was felt that the full document was too detailed to be readily accessible to decision makers and accordingly professional editors were commissioned to produce a Summary version which would draw out the key messages, conclusions and recommendations and present them in an attractive illustrated format. This was duly done and the result was published in July with an advance copy being given to Defra Minister, Ben Bradshaw, when he met the Secretary of IACMST in the course of a visit to NOCS in July.

In the course of the May meeting of the Action Group it was agreed that a questionnaire should be distributed to all members of the Action Group and to all the organisations that had initially pledged support to the GOOS programme. The aim of the questionnaire was to elicit information regarding the implementation of a number of the key recommendations for action contained in the Strategic Plan. The questionnaire was designed to be completed mainly by ticking boxes and providing simple few word answers and some 63 copies of the questionnaire were distributed by post with a request for return in the SAE provided. The response rate was disappointing with questionnaires being returned from only 11 recipients; however the replies did indicate that a number of organisations were indeed planning to adjust their programmes of observation to include either extra measurements or new types of observations in their programmes. Most respondents did however point out that doing so would be difficult within their current funding packages and so in many cases full execution of their intentions would be dependent on the outcome of their bids for increased allocations either directly or via the proposed Spending Review bid being collated by Defra.

This reinforces what the Action Group stated in its report to IACMST last year about the need for more investment if the UK GOOS Strategic Plan is to be fully implemented and thus enable the commitments which the UK has pledged it will make to international programmes such as GCOS and GEOSS to be delivered. In this context the Action Group noted at its November meeting that a survey by the ERF of UK monitoring in total had highlighted a major difference between the funds allocated to monitoring the terrestrial UK environment (£500 million) and those allocated to monitoring the marine environment (£36 million).

MPC Action Plan and implementation of the UK GOOS Strategic Plan

The MPC Action Plan was adopted by the Action Group in 2003 and the intention was that this should be updated during 2005. A start was made on this prior to the Action Group's May 2005 meeting, by which time it was apparent that completion should await agreement on the UK GOOS Strategic Plan. By the end of the year Defra had gained interdepartmental agreement to a new UK Marine Monitoring and Assessment Strategy (UKMMAS) and had begun to put in place two senior bodies MAPC (Marine Assessment Policy Committee) and MARG (Marine Assessment and Reporting Group) to oversee and implement the Strategy. The 2003 version of the Action Plan had contained many proposed actions that involved groups other than the GOOS Action Group and most of those that fell within the remit of the GOOS Action Group had been completed. With the agreement of the UKMMAS Secretariat the Action Group therefore ceded the task of overseeing implementation of the remaining tasks and/or any further development of the original Action Plan to MARG.

It remained unclear at the start of 2006 to what extent the UKMMAS would cover all the areas of work previously dealt with by the GOOS Action Group and what if anything MAPC and MARG would do in relation to implementation of the UK GOOS Strategic Plan. During the course of the year there have been numerous discussions between the Chairman and Co-ordinator of the Action Group, the Secretary of IACMST and the UKMMAS Secretariat as to how the GOOS Action Group's activities could be fitted into the UKMMAS structure. These culminated in the production of a set of proposals for a 3-5 year implementation programme for the Strategic Plan. These were discussed by the Action Group when it met in November and after some modifications it was agreed as a satisfactory way forward that would allow the orderly transfer of the Action Group's activities to MARG but preserve the ability of the Action Group to keep things moving until such time as MARG or its sub-groups have assumed full responsibility for all the Action Group's activities.

The revised and agreed version of the proposals is appended to this report in full as Annex 1 and includes a brief summary of the sort of activities the Action Group has pursued in recent years and its achievements, as a background to the suggestions on how to proceed. The logic behind the transfer is that GOOS is intended to cover all aspects of marine environmental observations and assessment. Up to now the GOOS Action Group has focussed mainly on observations related to marine processes and climate and has worked on the expectation that other groups would provide observations related to the quality of the marine environment, including contamination, and for conservation and fisheries issues. These groups have now been subsumed into the UKMMAS structure. The remit of UKMMAS is to produce integrated assessments of the state of the marine environment, which is precisely what GOOS is intended to do for both coastal and open ocean waters. Accordingly rather than have an Action Group focussing on observations of the physical environment separate from UKMMAS with a complex system of data transfer from the Action Group and MARG and vice versa, it is logical that co-ordination of all observation and assessment activities should be handled under UKMMAS and that MARG should take over responsibility for organising the delivery of information etc to GOOS in much the same way that it is expected to do for OSPARCOM and the EU Environment programme.

A review of what the UK GOOS Strategic Plan suggests needs to be added to the programme of coastal observations indicates that much of what is required in terms of biology and chemistry is already underway in order to meet commitments or obligations to OSPARCOM and EU Directives and therefore the principle objectives of coastal GOOS should be attainable. However, the Strategic Plan suggests a number of new physical measurements ought to be introduced as summarised below: -

- Survey (quarterly) more hydrographic lines across the UK margin
- Measure surface and sub-surface currents at more sites
- Create a coastal HF radar network to obtain wave and current data (*Since this was proposed a review of effectiveness has concluded such a network would not be cost-effective*)
- Place sampling instrument (eg FerryBoxes) on more ferries
- Maintain present time series (including the Port Erin ones even after closure of that laboratory)
- Improve bathymetric maps
- Establish a pCO₂ programme in coastal waters to complement the open ocean programme
- Increase the geographical coverage of nutrients, dissolved oxygen, chlorophyll, phyto- and zoo- plankton, dissolved organic matter and total suspended matter
- Increase measurements to understand productivity of the benthos.

Many of these new requirements have already been noted by MARG as matters it needs to organise even if it did not take over GOOS activities and it is therefore suggested that all the additional tasks are accommodated within the UKMMAS with immediate effect.

The organisations already integrated into the UKMMAS structure have not traditionally conducted observations in open ocean waters, whereas the GOOS Action Group has sought to co-ordinate activities in both coastal and distant waters. There will therefore be a need for MARG to broaden its scope to include observations in distant waters. A key factor will be the extent to which MARG implements MAPC's direction that UKMMAS covers **all** UK marine monitoring and recognises that commitments made via the UN system e.g. to GEOSS, GMES, GCOS and JCOMM etc are as important as those made to OSPARCOM and the EU. However, there is in any case a growing realisation that changes well offshore do influence species composition as well as weather and are thus something in which organisations currently concerned primarily with coastal issues should take an interest.

A review of the UK GOOS Strategic Plan suggests that in order to fully implement the GOOS Open Ocean programme the following additional activities are necessary: -

- Increase the number of observations from voluntary observing ships, particularly in the Northeast Atlantic
- Collect pCO₂ data from ships, drifting buoys and transects
- Move one of the Met Office's MAWS network moored buoys to the Porcupine Abyssal Plain mooring site to be co-located with the NOCS's sub-surface reference mooring

- Deploy additional drifting buoys outside the North Atlantic and sea-ice buoys in polar regions
- Provide long-term funding and upgrading of the UK GLOSS so that data are collected and transmitted in real time
- Deploy at least 45 Argo profiling floats per year and preferably more (up to 70) to develop and maintain the network
- Maintain the Atlantic Meridional Transect programme
- Expand the CPR programme to include for example the Antarctic
- Continue to contribute to the funding of European satellite remote sensing of key ocean properties (eg SST, sea ice, wind speed and direction, biomass of phytoplankton, sea level and sea state)
- Increase funds to add new sensors which will aid process understanding and modelling capability (eg salinity)
- Digitise the historical collections of ocean data in the UK National Archive (Kew) to reveal or confirm climate trends
- Continue investment in global scale ocean and coupled model development and assimilation and in basin scale plankton and ecosystem modelling.

Based on the responses to a questionnaire issued during the summer the GOOS AG was able to establish that many of these open ocean related activities are already either underway or at least partial coverage is planned, albeit not as completely as is desirable and with considerable uncertainty as to their funding, particularly in the longer-term. Thus, whilst it is clearly desirable that MARG also takes on co-ordination of the open ocean as soon as practicable, given its fledgling nature there is likely to be some delay before it is in a position to do so fully. Until such time as MARG can assume the responsibility, it is suggested that the GOOS AG should continue its efforts to develop and extend the range of measurements undertaken in the open ocean on the lines suggested above. Meanwhile, and on the assumption that IACMST will agree to the foregoing proposals, as part of the process of handing over to MARG, the GOOS AG is encouraging its members, or representatives of their organisations, to become actively involved with both MARG and its sub-groups in order to ensure that both parties are kept informed of each other's interests and needs for both coastal and open ocean observations.

Protocols for MPC Parameters

Very little progress was made on this task during the year. A set of specifications was drawn up for the measurement of salinity and temperature for a variety of purposes. The intention was to link these requirements to sampling and measurement techniques known to be commonly in use and accepted by the majority of the physical oceanography community. Such a list had been prepared previously by one of the Action Group's members and she had previously volunteered to undertake the matching process. The resultant proposals were to have been distributed around the technical working group established to produce the protocols, with a view to its adoption either unchanged or with additions of any other proven techniques the members may have wished to add. Unfortunately the withdrawal of Scottish Executive support and reorganisation within

FRS meant that no further work was undertaken on behalf of the Action Group by the member concerned.

Given that MARG has established a protocols sub-group it has been agreed with the UKMMAS secretariat that it should assume responsibility for ensuring that protocols and quality assurance procedures are established for measuring S and T, and other physical parameters such as wind, waves, pCO₂, ocean colour, sea ice, etc. To this end the co-ordinator has taken the necessary steps to provide the chair of that sub-group with the data quality requirements that had been prepared for T and S measurements, together with the paper prepared on acceptable methods for S & T measurements.

Links with EuroACT

Links with EuroACT are maintained via Mr Burt. EuroACT is intended to perform a similar function in Europe as US ACT does in the USA. US ACT is well established in the USA and has substantial funding available for US national activities. It exists to test and report on performance of various instruments and sensors used in marine observations. It has taken a keen interest in the development of a European version and proposals for EuroACT were submitted to the EU under the Specific Support Action Component of Framework 6. Unfortunately that submission narrowly failed to gain support and plans for a new submission are being drawn up and will be submitted to the European Commission under Framework 7 proposals. This task was initiated by IFREMER but it was unable to maintain consistent support and the new submission will be submitted via NOCS where it will rest within the Oceans 2025 initiative. The proposal will refer to a proposed European Coastal and Ocean Observing Technologies initiative (ECOOT). The revised name more accurately reflects the European dimension although strong support is expected to be maintained by US ACT. The revised proposal reflects the outcome of various meetings held during the course of the year. The first of these was hosted by Chelsea Technologies Group in conjunction with OI2006 and involved representatives from both Europe and the US. Later in the year a workshop was held in Brussels, aimed at involvement of representatives of the Commission, at which the needs were demonstrated and agreed and where EuroGOOS confirmed the need for ACT/ECOOT products.

At a more practical level, a joint ACT/ECOOT workshop took place at NOCS in October on *Integrated Sensor Systems for Vessels of Opportunity* that essentially aimed to promote systems such as FerryBox. Additional funding was provided by NOCS.

Website

The GOOS Action Group's website shares the Oceannet portal (www.oceannet.org) which gives access to both the GOOS and MED AG's websites. Following the successful revamping of the MEDAG website last year, the GOOS AG website was given a substantial face lift early in 2006 by its hosts at BODC. It is now more user friendly and professional in appearance and has been updated on several occasions during the year with information on upcoming meetings and reports issued etc. This is done at the request of the co-ordinator through the auspices of BODC. If responsibilities for GOOS are taken over by MARG as part of UKMMAS there will be an on-going need to maintain the website with new and updated information on UK activities related to GOOS and a decision will be required on whether this task is to be undertaken by the MARG or IACMST secretariats.

I-GOOS

This body meets every two years. The next meeting, immediately before the IOC Assembly in June 2007, will be important in confirming national contributions to GOOS as it enters its phase of sustained measurements.

EuroGOOS

EuroGOOS newsletters are distributed to members as and when they become available. At present UK membership of GOOS is restricted to three agencies (currently the Met Office, NERC and EA) and doubts have been expressed whether this really provides for all UK interests. The point has been noted by the EuroGOOS Secretariat and it has been suggested that steps be taken to allow national representation for those countries/members that prefer this. If implemented, this would bring UK involvement into line with other GOOS Regional Alliances and will be something MARG needs to consider if it assumes responsibility for all GOOS related activities.

At the meeting of EuroGOOS held late in 2006 there was some discussion on how to respond to the consultation paper issued by the EU on its proposed Maritime Policy and it was agreed that a collective response will be provided through the EuroGOOS Secretariat. A small sub-group has been set up to assist in this, which includes the IACMST Secretariat. This will not preclude national responses but will mean that any UK input to the EuroGOOS submission will have to be consistent with the national response.

JCOMM

This is a Joint Commission of IOC and WMO and meets only once every four years. At its second meeting, held in Halifax, Nova Scotia in September 2005, JCOMM restated its willingness to oversee the implementation of non-physical observations and data products and it was noted that the overall GOOS programme is increasingly moving from a purely open ocean mode to embrace the coastal environment and is at the same time increasingly progressing from a research programme to an operational one. This would be entirely consistent with the approach being adopted for UKMMAS. The international plan for the *in-situ* open ocean observing system aims for full implementation by 2010 and the open ocean observing system continues to grow. However, achieving its design will require substantial additional investment by the international community over the coming years.

During the year several data buoy meetings were held, in which UK agencies participated. These being the DBCP (Data Buoy Cooperation Panel) Technical Workshop (Reading, March 2006) and Annual Meeting (La Jolla, October 2006). A pilot project has been initiated to demonstrate the use and benefits of Iridium satellite communications technology, the project aims to deploy around 50 drifters equipped with Iridium over the next two years; both the Met Office and SAMS are participating.

Actions related to other Action Group Activities

UK Argo

Although not directly involved in the running of the UK Argo programme the Action Group has kept a watching brief on its progress. In this connection the Action Group noted that by the end of 2006 there were some 2,770 fully operational floats and it is expected that the target of 3,000 operational floats will be reached during 2007. The UK Argo contribution has included deployment of 206 floats since 2001 of which around 100 are presently operating. In the last three years reliability of the floats has improved due to better battery pack protection against

single cell failure and the increasing use of lithium batteries. As a result the later floats should operate for around four years rather than three years typically experienced with the earlier floats.

The value of the Argo data to NCOF for operational ocean forecasting has been clearly demonstrated, and its application for seasonal forecasting and climate prediction is becoming increasingly clear. In particular Argo data were used in examining temperature anomalies for the North Atlantic during 2005 and provided observational evidence for the basis of the forecast issued in October 2005 of a two in three chance of a colder-than-average (and drier-than-average) winter for much of Europe. This forecast attracted considerable government and media attention in the UK – and four out of five predicted events actually happened. For climate, the use of Argo data has enabled estimates of global ocean heat content (a key indicator of climate change) to be made with reduced uncertainty. For research, a steadily increasing number of scientists now use the data for a wide variety of purposes, as indicated by the increasing numbers of published papers citing Argo.

IACMST members are reminded that a report was prepared by the UK Argo Expert Group (who report to GOOS AG) describing the work done and achievements made by the UK Argo Project from 2001 to mid-2006, together with expectations for the future. The report (available at www.metoffice.gov.uk/research/ocean/argo/UK_Argo_Project_Report.pdf) also includes short summaries of scientific work and results provided by various colleagues within the UK.

Now that the value of the Argo data is clear and increasing, the Action Group is very concerned that UK funding remains on an *ad hoc* basis and this is neither sustainable nor efficient. The Action Group has pressed successfully to have funding for UK Argo to be included in the proposed Comprehensive Spending Review bid that is intended to cover long-term marine monitoring separately from marine research and to give it greater stability.

Jason-2

The ground station for the new Jason-2 ocean satellite was inaugurated in Germany in September 2006 and its launch is scheduled for June 2008.

Within the UK, the arrangements for funding the Jason-2 programme are still not finalised, although the UK has committed to the programme at the minimum level necessary for it to go ahead (10.65%), significantly below that of our GNI (16.69%) level. There is still considerable uncertainty over the longer-term UK funding for the Jason-2 satellite programme which must be resolved and (as with Argo) the experience of Jason-2 has demonstrated that there is no mechanism to handle the transition from a research mission to operational status.

Long-term funding of marine observations

As mentioned in relation to operational funding for UK Argo a draft submission was prepared for presentation to Treasury requesting more funds for marine observations in order to meet UK commitments to GOOS, GCOS and GEOSS and to provide a more stable funding base for such observations that are required long-term rather than in a research capacity. After considerable discussion the key elements of the bid have been included in a draft resources document prepared by MAPC that is expected to be the basis of a bid submitted via Defra as part of its case for proper funding of UKMMAS. In this context the Action Group noted the outcome of an ERF review of monitoring, which had focussed primarily on the terrestrial zone but had concluded the UKMMAS model should be looked at as a model for terrestrial monitoring co-ordination. It had also highlighted the difference in funding allocated to the two sectors - £500 million for terrestrial and £36 million for marine. The draft submission to Treasury will seek at least a further £22

million for marine monitoring, but this will still represent little more than 10% of the terrestrial allocation.

Modelling

As members of IACMST will recall the National Centre for Ocean Forecasting (NCOF) was established and formally launched in March 2005. In line with the charge placed upon it by IACMST to improve co-ordination and development of operational models the Action Group has been kept informed of the progress of NCOF with reports being provided at both its May and November meetings. It was noted that the partners are moving towards a more formal Consortium agreement, that CEFAS are now involved with NCOF and there are discussions between NCOF, Defra and CEFAS on future collaboration. It was noted that a new high resolution (6 km) global SST and Sea Ice (OSTIA) daily analysis has now been implemented by NCOF on an operational basis. This is based on high resolution satellite data and *in situ* measurements and analyses are available on the web based on the previous 24 hours data.

In the medium term (two-eight years) NCOF modelling capability will be based on the NEMO system (applicable to both shelf seas and deep ocean) which is derived from the French OPA code and freely available under license. In the longer term it is proposed to move towards adoption of the ICOM (Imperial College adaptive grid finite element model) as the future generation ocean model.

A contract was issued to NCOF by the Action Group under which NCOF are undertaking a scoping study to examine how models can be used to optimise monitoring network design, both to establish where measurements can most efficiently be taken and with a view to indicating where there may be redundancy in measurements currently undertaken. This study is currently restricted to physical parameters such as T, S and turbulence rather than chemical or biological parameters but is expected to be suitable for extension to cover such parameters. A preliminary report on some of the findings was presented to the Open Meeting held in conjunction with the November meeting of the Action Group. One of the examples given was the improvement in the accuracy of model predictions that had been achieved by repositioning a number of *in situ* temperature sensors. The full report was due to be available by the end of the 2006.

Indicators Contract

This contract was undertaken during 2005 and the charge on the Action Group was merely to finalise the report by editing and production of an explanatory cover page. The intention was to publish a limited number of hard copies but finances did not permit this, however a copy of the report was posted on the Action Group's website as planned.

Watching brief on changes to member's programmes and definition of ecological zones

The main changes in programmes notified during the year were by the Met Office. These were (i) the impending withdrawal of the K3 moored buoy (which has been replaced by the new Irish M6 buoy) and the implementation of spectral wave capability on the K5 buoy in early 2007 and (ii) the reduction in the UK Voluntary Observing Fleet by deselecting non-performing ships and the introduction of Automatic Weather Systems (AWS) on a small number of Voluntary Observing Ships.

If the proposal that GOOS activities become part of UKMMAS and fall directly mainly under MARG is adopted, it will be much simpler to ensure full consultation of all interested parties in future and for the implications of ecological zones to be incorporated in marine monitoring design.

Open Meeting

As mentioned above an Open Meeting was held in Bangor on 9 November in association with the Action Group's regular November meeting. The theme was *Physical Measurements for Ecosystem Requirements* and the idea was to provide a forum for an exchange between those involved in making physical measurements and those who wish to be able to interpret ecosystem changes. The meeting was possibly the most successful organised thus far by the Action Group. Around 50 persons attended and some active interchanges of views and information took place with the end result that all parties present ended up better informed and aware of what is possible if physical measurements are available and included in the assessment of ecosystem observations. A summary record of the presentations made and the main conclusions has been placed on the Action Group's website following approval of the text by all contributors.

Following a brief introduction by Mr Townend as to the purpose of the meeting, Professor Franciscus Colijn from GKSS in Germany gave a keynote presentation on the FerryBox project and the work within ICES and North Sea GOOS (NOOS). The FerryBox project has been very successful and the concept is being applied ever more widely, enabling continuous measurements along any ferry route of T, S, turbidity, chlorophyll, oxygen, pH, nutrients and basic algal groups. The NOOS project is demonstrating the feasibility and benefit of integrating a wide range of observational data and ICES is now producing quarterly reports on climatic conditions in the North Sea and linking these to fish stock assessments. Professor Colijn's presentation was followed by a talk by David Connor (JNCC) on the use of physical measurements in the development of UK SeaMap and talks by Bill Sanderson and Karen Robinson (CCW) on the use of physical measurements in relation to the monitoring requirements EU Habitats Directive and the development of HabMap respectively. The final talk of the morning was by Andrew Kenny (CEFAS) who described the ICES REGNS project which had collected together some 8.5 million observations of around 100 variables in order to achieve the first truly integrated assessment of the North Sea. The project had demonstrated that biology was most closely correlated with certain distinct physical boundaries which did not fit very well with those currently used for fish stock assessment purposes. It had also shown that the North Sea ecosystem does not change abruptly and tended to support his thesis that there are natural decadal and multi-decadal cycles in ecosystem make up.

A second keynote presentation was given by John Siddorn and Pat Hyder (NCOF) on Physical Measurements for Modelling Ecosystems. One of their main messages was that in designing a model it is extremely important to have a good understanding of the purposes for which it is to be used. They are currently seeking to establish which physical measurements have the most influence on ecosystems and under what circumstances. This presentation was followed by a series of shorter talks on what physical measurements are currently being performed. The first of these by Jon Turton described the Met Office programme and the way it is developing in response to changing requirements and technology. Jon Rees (CEFAS) then spoke about the WaveNet programme and the inshore temperature network around England and Wales – the former uses a number of sophisticated buoys with real time transmission of data whereas the latter relies mainly on sampling buckets and hand held thermometers. Colin Moffat (FRS) complemented that talk by describing their system of coastal sampling and the records of T and S etc they have collected around Scotland for many years mainly using volunteers and along a series of transects off the Scottish coast. The final talk of the day was by Bob Gatliff (BGS) and described the work they are doing using modern multi beam to establish both bathymetry and bottom type. The formal presentations were followed by a session of questions and answers and general discussion by the audience as to the conclusions to be drawn from the meeting. David Pugh drew the meeting to a close with four messages he had derived from the proceedings: -

- Data systems and accessibility need to be improved
- The need for particular observations must be clearly identified and linked to policy requirements
- There need to be common standards for observations and measurements based on what is technically possible and following best practice
- Working towards and within international frameworks can help national coherence.

Review of monitoring

Work on this review was undertaken by Dr Chris Reid assisted by the co-ordinator and was essentially completed in 2005. Action during 2006 was confined to final tidying up of the text and inclusion of some late data submissions. The revised text was placed on the Action Group's website during the first half of the year. It had been hoped that a limited number of printed copies could be produced for display at OI2006 but neither time nor funds allowed this to be achieved. The preface to the review acknowledges that it is still incomplete and that there may be some inaccuracies in the summaries of what is available due to the fact that not all organisations were able to devote the necessary time to checking the details. Nevertheless it is considered to have been a useful undertaking and has been accepted as such by Defra and MARG as a useful starting point for its overall co-ordination activities.

Co-ordination with other Groups

Links with MEDAG

Links between the two Action Groups are maintained by means of reciprocal membership by the two Action Group co-ordinators. Dr Portmann was unable to attend either of the MEDAG meetings but Dr Rickards was represented at both GOOS Action Group meetings. Advice has been sought from MEDAG on how to display data in a more visual way and on the archival requirements for temperature and salinity data in particular. Assistance has been provided by the MEDAG co-ordinator's colleagues.

Development of a comprehensive Marine Monitoring Programme for the UK

When this charge was placed on the Action Group early in 2006 it was unclear how plans would develop under the UKMMAS programme and it seemed possible that the Action Group would need to make progress with its own plans for implementation of the UK GOOS Strategic Plan. In the event, as described earlier, a set of proposals were drawn up for a three - five year implementation programme based in part upon the results of a questionnaire distributed to a large number of organisations involved in marine monitoring seeking information on the actions they were taking to implement a number of key recommendations. The conclusion was that much would depend on funding and how comprehensively the UKMMAS would cover all UK marine monitoring. The Action Group's Chairman, its Co-ordinator and the Secretary of IACMST have been involved during the year in a number of discussions with the UKMMAS secretariat and the membership have been consulted by correspondence as to the best way forward. The outcome of all of these discussions is reported in the early part of this report and approval is sought from IACMST to proceed as proposed.

Future Activities

When the IACMST approved the 2006 programme of work for the Action Group it was recognised that some tasks were on-going or were unlikely to be completed in 2006. This has indeed proved to be the case as the notes in Annex 3 indicate. The overall objective of the Action Group has been to secure a co-ordinated contribution to the open ocean and coastal elements of GOOS and to ensure that the UK benefits accordingly from the overall GOOS programme. If IACMST members approve the proposals to hand over this responsibility to MARG, the Action Group will monitor how well this is implemented by MARG and hand over completely once it is in a position to assure IACMST that there is no further need for it to maintain its own Action Group to encourage and co-ordinate UK GOOS contributions.

In addition to this monitoring task, to avoid loss of momentum, it is recommended that the GOOS AG should seek to further investigate and develop the premise that there is scope for conducting monitoring more cost effectively. This could be done: -

- Firstly, on the assumption that the scoping exercise being conducted by NCOF identifies the potential of further work, to follow this up by seeking further funding from member Departments and organisations to enable the initiative to be more fully developed and brought to fruition
- Secondly by investigating the potential for linking observations and modelling with assessment of the economic benefits of adding, removing or maintaining components of existing programmes. This might initially be done through some form of workshop involving other interested parties such as IMarEST and MIA.

The proposed programme for 2007 is set out in Annex 4.

Annex 1

Summary of past activities and suggested 3 – 5 year Programme of work for the GOOS AG or its successor

To date the GOOS AG has sought to encourage UK organisations to become involved in GOOS activities in a more comprehensive and co-ordinated manner. It has also acted as a conduit for information from its members to the GOOS Project Office in Paris on programmes that could contribute to the overall GOOS Programme and to its members on useful publications issued via the Project Office.

Actions undertaken in recent years, aimed at encouraging greater and more co-ordinated activities include: -

- An assessment of the overall economic benefits of sustained marine observations - which clearly demonstrated the benefits far outweigh the costs
- A report on the use of indicators – which demonstrated the need for these in interpretation and assessments of monitoring results and the need for a limited amount of developmental work to make them a reality
- Two reports on the status and trends in marine processes and climate - which, despite demonstrable gaps in data coverage, did suggest changes are taking place in ocean currents and weather and consequently shorelines and biota. (The second of these reports was one of the main building blocks used in the Charting Progress report published by the Government in 2005.)
- Various efforts to encourage co-ordinated development of marine modelling capacity and the use of models in the design of marine monitoring programmes and the interpretation of results – which led, indirectly at least, to the establishment of NCOF. The latest in these efforts is the placing of a scoping contract with NCOF aimed at demonstrating how models can be used to guide the selection both of sites at which monitoring should be undertaken and the suite of observations required to meet defined goals
- Two reviews of existing monitoring activities – both of which demonstrated varying degrees of duplication and potential redundancy, but also some gaps
- The publication of a UK GOOS Strategic Plan – which explains the comprehensive goals and benefits of GOOS and highlights some of the actions the UK should undertake in order to play a more complete role in the GOOS programme and thus to reap the full benefits.

This last report was intended to guide the GOOS AG and thus IACMST and the UK Government, as to the steps that should be taken over the coming years in order to achieve a comprehensive marine monitoring programme. It clearly points out why the steps are so desirable and necessary if the UK is to meet its commitments to the various global observation programmes.

A key point made in the report is that GOOS is a comprehensive programme embracing both the open ocean and coastal seas, and should address physical, chemical and biological parameters. Thus, whilst recognising that coastal areas are where the marine environment is most likely to impact human interests, it stresses that understanding of open ocean weather and climate etc. is vital if we are to understand what is happening in coastal areas. In short a comprehensive set of observations is required.

The intention of the GOOS AG was to follow up the publication of the UK GOOS Strategic Plan with an action programme aimed at implementing as many as possible of the key recommendations in that Plan. However, during the period of development of the Strategic Plan for UK GOOS, Defra led the way in following up on the Charting Progress report, with the result that Government Departments and the devolved administrations agreed there should be a comprehensive UK Marine Monitoring and Assessment Strategy (UKMMAS). The declared intention of the new UKMMAS is that it should cater for all UK monitoring requirements. It should therefore become the source of all the UK's contributions to GOOS as recommended in the UK GOOS Strategic Plan.

To date the GOOS AG has tended to focus more on those observations related to understanding how the physical environment functions. In so doing it has worked on the premise that investigations related to biology and the direct effects of human activities were being addressed by other groups, most notably the Marine Environment Monitoring Group (MEMG) and the Fisheries and Conservation Agencies. Following the establishment of UKMMAS, the MEMG has disbanded and the monitoring observations for which it was responsible, together with those undertaken by the Fisheries and Conservation Agencies, are now being co-ordinated via MARG and its sub-groups. It has been similarly proposed that the GOOS AG's activities should be merged with those as part of the overall UKMMAS. Exactly how this is to be achieved and via which sub-group or sub-groups of MARG has yet to be finalised.

What is required of a comprehensive UK GOOS programme and why is spelt out in the UK GOOS Strategic Plan (Tables 4 and 5 and reproduced here as Annexes 1A and 1B). For the coastal ocean much of what is required in terms of biology and chemistry is already underway in order to meet the requirements of OSPARCOM and EU Directives and therefore the principal objectives of coastal GOOS should be attainable. However, there are a number of key recommendations for physical measurements and these are summarised as follows: -

- Survey (quarterly) more hydrographic lines across the UK margin
- Measure surface and sub-surface currents at more sites
- Create a coastal HF radar network to obtain wave and current data (*Since this was proposed an review of effectiveness has concluded such a network would not be cost-effective*)
- Place sampling instrument (eg FerryBoxes) on more ferries
- Maintain present time series (including the Port Erin ones even after closure of that laboratory)
- Improve bathymetric maps
- Establish a pCO₂ programme in coastal waters to complement the open ocean programme
- Increase the geographical coverage of nutrients, dissolved oxygen, chlorophyll, phyto- and zoo- plankton, dissolved organic matter and total suspended matter
- Increase measurements to understand productivity of the benthos.

The goals of coastal GOOS are to “have an observing system that provides the data and information required to mitigate and manage the effects of natural hazards, climate change and human activities on coastal systems and their ability to sustain goods and services valued by society”. The new requirements listed above all relate to observations in coastal waters similar to those already being undertaken by those organisations previously involved with MEMG or by the Fisheries and Conservation Agencies. As such they could readily be addressed by MARG and it is therefore suggested that MARG activities should include these additional tasks with immediate effect.

This would still leave the question of co-ordination of observations in more distant waters. However, there is growing realisation that changes well offshore do influence species composition as well as weather and are thus something in which organisations currently concerned primarily with coastal issues do have an interest. A key factor will be the extent to which MAPC directs, and MARG implements, the commitments made via the UN system, e.g. to GEOSS, GMES, GCOS and J-COMM etc., which are as important to honour, albeit not legally binding, as those made to OSPARCOM and the EU. The requirements for open ocean GOOS as set out in the Strategic Plan can be summarised as follows; -

- Increase the number of observations from voluntary observing ships, particularly in the Northeast Atlantic
- Collect pCO₂ data from ships, drifting buoys and transects
- Move one of the Met Office’s MAWS network moored buoys to the Porcupine Abyssal Plain mooring site to be co-located with the NOC’s sub-surface reference mooring
- Deploy additional drifting buoys outside the North Atlantic and sea-ice buoys in polar regions
- Provide long-term funding and upgrading of the UK GLOSS so that data are collected and transmitted in real time
- Deploy at least 45 Argo profiling floats per year and preferably more (up to 70) to develop and maintain the network
- Maintain the Atlantic Meridional Transect programme
- Expand the CPR programme to include for example the Antarctic
- Continue to contribute to the funding of European satellite remote sensing of key ocean properties (e.g. SST, sea ice, wind speed and direction, biomass of phytoplankton, sea level and sea state)
- Increase funds to add new sensors which will aid process understanding and modelling capability (e.g. salinity)
- Digitise the historical collections of ocean data in the UK National Archive (Kew) to reveal or confirm climate trends
- Continue investment in global scale ocean and coupled model development and assimilation and in basin scale plankton and ecosystem modelling.

Based on the responses to a questionnaire issued during the summer the GOOS AG has established that many of these open ocean related activities are already either underway, or at least partial coverage is planned, although not as completely as is desirable and with considerable uncertainty as to their longer-term funding.

In conclusion it would appear that much of what is required for coastal GOOS falls readily within the existing plans of MARG and its sub-groups. Whilst it is clearly desirable that MARG also takes on co-ordination of the open ocean observations as soon as practicable, given its fledgling nature there is likely to be some delay before it is in a position to do so fully. Nevertheless, it is

suggested that its protocols sub-group should assume responsibility for ensuring that protocols and quality assurance procedures are established for measuring such things as S and T, wind, waves, pCO₂, ocean colour, sea ice, etc. (GOOS AG could assist here by making available the data quality requirements it has established for T and S measurements.)

Meanwhile until such time as MARG can assume the responsibility, it is suggested that the GOOS AG should continue its efforts to develop and extend the range of measurements undertaken in the open ocean on the lines suggested above. GOOS AG should also continue to encourage industry involvement in conducting long-term marine observations and the development of better automatic observing systems including the use of remote sensing devices mounted on satellites or aircraft. In this context the present links with the ECOOT initiative (European Coastal and Ocean Observing Technologies – previously known as EuroACT) should be maintained and further developed. It will also be necessary for GOOS AG to maintain the separate links it has with MEDAG and MDIP and to ensure that there continue to be suitable opportunities for briefing delegations to such organisations as IOC and JCOMM.

In addition to these essentially on-going tasks, in order to avoid loss of momentum, the GOOS AG should seek to further investigate and develop the premise that there is scope for conducting monitoring more cost effectively. This could be done: -

- Firstly, on the assumption that the scoping study on the use of models in the design of monitoring programmes being conducted by NCOF will identify the potential for further studies, to follow this up by seeking further funding from member Departments and organisations to enable the initiative to be more fully developed and brought to fruition
- Secondly by investigating the potential for linking observations and modelling with assessment of the economic benefits of adding, removing or maintaining components of existing programmes. This might initially be done through some form of workshop involving other interested parties such as IMarEST and MIA.

As part of the process of handing over to MARG, the GOOS AG has asked its members or representatives of their organisations to become actively involved on both MARG and its sub-groups in order to ensure that both parties are kept informed of each others interests and needs. This is intended to apply to both coastal and open ocean observation requirements.

Annex 1A

Key recommendations for UK contributions to open ocean GOOS

What?	Why?
	<i>in situ</i>
Increase the number of observations from voluntary observing ships, particularly in the Northeast Atlantic	VOS are important because they provide observations of air temperature, sea surface temperature and wind speed and direction and give vital information on surface fluxes, which are essential for validation of climate models. The decline in independent observations from the VOS network is having a significant impact on climate datasets of the North Atlantic. This is an example of where the UK cannot address the decline in isolation but needs to act in collaboration with other countries.
Collect pCO ₂ data from ships, drifting buoys and transects	A global carbon observing system is urgently required. This requires pCO ₂ measurements by a wide variety of instruments. Such measurements are currently made routinely on the Atlantic Meridional Transect (see below).
Move one of the Met Office's Marine Automatic Weather Station network moored buoys to the Porcupine Abyssal Plain mooring site to be collocated with the UK National Oceanographic Centre's sub surface reference mooring	This would make the PAP site fully consistent with requirements in the internationally agreed GCOS Implementation Plan.
Deploy additional drifting buoys outside the North Atlantic, and sea-ice buoys in polar regions	The number of drifting buoys deployed in the North Atlantic through the E-SURFMAR programme should be adequate. However, there is no regular funding for drifters in other ocean areas in support of building the baseline global drifter array required by the GCOS Implementation Plan. UK could play a specific role in building and sustaining the global drifter array by deploying drifters alongside Argo floats. The very small UK contribution to sea ice buoys is surprising in view of the key role of sea ice in modulating ocean-atmosphere exchange and in the climate systems as a whole.
Provide long term funding and upgrading of the UK Global Sea-Level Observing System (GLOSS) so that data are collected and transmitted in real time	The National Tidal and Sea Level Facility was established in 2002 primarily in the context of flood warnings but also in the context of research into long term sea-level rise. With respect to the UK's contribution into the international effort on monitoring sea level for climate change (GLOSS), UK contributes 10 stations, distributed around the world, including three in the UK. The main concerns are to secure long-term funding for all the

	GLOSS stations (currently funded through research routes by NERC) and to make data available in real time.
Deploy at least 45 Argo profiling floats per year, and preferably more (up to 70) to develop and maintain the network	From 2007 the GCOS Implementation Plan calls for the Argo array to be maintained at ~ 3000 floats with the deployment of ~800 floats per year. To maintain the UK's original intention to contribute 6% to the global network, the UK should secure long-term funding for 45 – 50 floats per year.
Maintain the Atlantic Meridional Transect programme using the return passage of ships which would be traversing the Atlantic Ocean anyway e.g. the RRS <i>James Clark Ross</i> between the UK and the Falkland Islands or the RRS <i>Discovery</i> between the UK and Cape Town	The Atlantic Meridional Transect makes a 2500km long transect down the middle of the Atlantic between 50° N and 50° S, across bio-resource rich regions such as shelf seas and coastal upwellings as well as the vast data-poor mid-ocean gyres. The data will uniquely reveal the seasonal and inter-annual variability in plankton functional biodiversity and its impact upon and reaction to climate change. Concurrent remote sensing data is used alongside <i>in situ</i> data to extrapolate to the basin scale. The data are distributed for use in the development of models to describe the interactions between the global climate system, plankton functional biodiversity and ocean/atmosphere biochemistry.
Expand the Continuous Plankton Recorder (CPR) programme, for example to include the Antarctic	As noted by Turton (2005) the GCOS Implementation Plan calls for development of a plan to implement routine measures of ocean plankton. Currently the only instrument routinely making such measurements is the Continuous Plankton Recorder, which is used as a survey tool by several institutions around the world, notably by the UK in the North Atlantic and North Sea, and along a North Pacific line, and by the Australian Antarctic Division and others in the Southern Ocean. The UK should continue to invest in current Continuous Plankton Recorder surveys and in addition should use the UK's regular visits to West Antarctica as an opportunity to use the CPR to obtain plankton data along track through the Atlantic, and in the Southern Ocean.
	Satellite
Continue to co-fund European satellite remote sensing of key ocean properties (e.g. sea surface temperature, sea ice, wind speed and direction, biomass of phytoplankton, sea level, sea state)	For ocean monitoring, satellites provide an essential part of the mix, extending the value of the very sparse <i>in situ</i> network. Continuity of key measurements is being addressed by the global community (eg CEOS, CGMS), and more specifically in Europe through ESA and EUMETSAT. The global reach of satellites provides a clear example of where a collaboration on an international scale has benefits. However, the long lead time to reach international agreements and secure funding means constant vigilance to ensure continuity of vital measurements is not lost. In the European context near-term continuity of

	ocean measurements is planned through MSG (sea surface temperature), METOP (winds, sea surface temperature), Jason 2 (sea level, sea state), GMES Sentinel 1 (sea ice), GMES Sentinel 3 (sea surface temperature, biomass of phytoplankton, sea level, sea state).
Increase funds to add new sensors (e.g. salinity)	Methods to transition new measurement systems (e.g. ESA's SMOS salinity mission) to operational status are needed.
Information Management and Modelling	
Digitise the historical collections of ocean data in the UK National Archive (Kew), to reveal or confirm climate trends	The UK National Archive (Kew) holds around 150,000 logbooks containing about 75 million mainly undigitized observations made by the Royal Navy. The US Climate Data Modernization Program (CDMP) has offered to digitize these records if the UK can provide them with copies of the paper records. The end result would be the digitization of by far the largest undigitized holding in the world. Funds should be made available for this task.
Continue investing in global scale ocean and coupled model development and assimilation, and in basin-scale plankton and ecosystem modelling	The UK continues to be at the forefront of ocean modelling and forecasting. The recent formation of the National Centre for Ocean Forecasting (NCOF) brings together the operational expertise of the Met Office and leading research institutes – a world class resource for understanding and predicting the world's oceans.

Annex 1B

Key recommendations for UK contributions to coastal GOOS

What?	Why?
	In situ
Survey (quarterly) more hydrographic lines across the UK margin	Subsurface temperature and salinity are essential variables to characterise different coastal water masses (i.e. habitats) and key features of their structure (e.g. the thermocline). Subsurface temperature profiles are collected on the following repeat hydrographic lines that help to establish the long-term variability of UK coastal seas. Salinity (conductivity) is usually measured at the same time. The requirements for subsurface coastal measurements are not stated in GOOS planning documents. However, common sense dictates that seasonal changes such as stratification are monitored by at least quarterly surveys, and that such surveys should monitor different water masses and environments. The present pattern of measurements is inadequate to meet those requirements.
Measure surface and subsurface currents at more sites	Currents are determined by satellite from altimetric data on sea-surface height. This is not feasible close to the coast. Currents can be measured <i>in situ</i> by current meter measurements from ships and buoys. But that seems to be an exception; such measurements are derived mostly from research cruises and are not part of any routine monitoring programme. Lack of spatially diverse and good quality long time series of currents makes the definition of long-term circulation and its variability difficult (IACMST, 2004).
Create a coastal HF radar network to obtain wave and current data	Waves are measured by remote sensing using scatterometer data. Waves can also be measured from the coast by HF radar, as in Liverpool Bay, by Proudman Oceanographic Laboratory. The Met Office has evaluated HF radar against buoy measurement waves for Defra. However, the onus is on Defra to decide whether to commission and fund a coastal HR radar network.
Place sampling instruments (e.g. FerryBox) on more ferries	See details below.
Maintain present time series	For example, at Port Erin even after the closure of the laboratory there.
Improve bathymetric maps, especially close to the coast	Because bathymetric data are critically important for modelling and understanding the distributions of organisms and the effects of storms on waves and currents, efforts should be made to ascertain the adequacy of mapping of coastal seabed adjacent to

	the beach and out to 0.5 to 1.0 miles offshore (or out to 5km to 10 km deep) around the entire UK coastline, and to fill the gaps identified.
Establish a pCO ₂ programme in coastal waters to compliment the open ocean programme	As noted for open ocean GOOS there are no routine measurements of this important variable.
Increase the geophysical and vertical coverage of nutrients, dissolved oxygen, chlorophyll, phyto- and zoo-plankton, dissolved organic matter and total suspended matter	<p>Measurements are scattered. Much of the work on dissolved nutrients is being carried out by the partners within the Marine Environmental Change Network (MECN). The present network is inadequate compared both with coastal GOOS requirements, and with assessment needs, especially away from purely coastal sites. In addition, although it is not spelled out in the coastal GOOS documents, there is a common sense requirement for the measurement of nutrient profiles with the seasons through different water masses around the UK. There is a natural linkage between nutrients and inputs from land. To improve assessment and prediction of the state of the marine environment around the UK a substantial increase is required in nutrient measurements; these should meet the basic horizontal resolution (10 – 100km spacing) required by coastal GOOS. Much useful data can be obtained at relatively low cost by instrumenting more ferries (see above). These data should be supplemented by vertical profiles taken quarterly through different water masses around the UK (see above).</p> <p>Dissolved oxygen should be measured along with other dissolved nutrients.</p> <p>To understand and forecast the biochemical behaviour of the coastal seas that governs ecosystem behaviour, vertical profiles of plankton, dissolved organic matter and total suspended matter are needed. While numerous measurement monitoring sites exist, it is not evident that measurements of chlorophyll, phytoplankton and zooplankton <i>in situ</i> are being made everywhere on vertical profiles as well as the surface, nor that the measurements are being made to provide comprehensive regional coverage. CEFAS Smart buoys measure suspended sediment.</p>
Increase measurements to understand productivity of benthos	According to Portmann (2000) the most significant gap in monitoring around the UK is the lack of data on benthic organisms and their changes with time.

Annex 2

Attendees at the 9 May 2006 GOOS Action Group Meeting

Present

Mr I Townend	ABPMer (Chairman)
Dr R Burt	Chelsea Technologies
Dr M Charlesworth	BODC
Dr B Greenaway	Defra
Mr T Guymer	Sec. IACMST
Mr D Palmer	EA
Dr J Portmann	Group Co-ordinator
Dr R Rayner	MIA/IMarEST
Dr C Reid	SAHFOS
Mr J Turton	Met Office
Dr M Waldock	CEFAS

Apologies

Dr G Evans	BODC
Dr J Hawkrigde	JNCC
Ms S Hughes	FRS
Dr A Kenny	CEFAS/Minutes Sec
Mr I Leggett	UKOOA
Dr L Rickards	BODC
Dr M Service	DARD(NI)

Attendees at the 9 November 2006 GOOS Action Group Meeting

Mr I Townend	HR (Chairman)
Dr G Evans	BODC
Dr B Greenaway	Defra
Mr T Guymer	Sec. IACMST
Dr J Hawkrigde	JNCC
Dr A Kenny	CEFAS /Minutes Sec
Dr J Portmann	Group Co-ordinator
Mr J Turton	Met Office
Dr M Waldock	CEFAS

Apologies

Dr R Burt	Chelsea Technologies
Mr I Leggett	UKOOA
Dr R Rayner	MIA/IMarEST
Lt Cdr M Reed	MOD(N)
Dr L Rickards	BODC
Dr M Service	DARD(NI)

Annex 3

Progress with Activities proposed for the GOOS AG in 2006

ACTIONS DIRECTLY RELATED TO GOOS

Action	Output/Milestone	Progress/Comments
Provide briefing and advice to the UK Delegates for the Meeting of the IOC Executive Council	Relevant papers to be circulated in advance of mid-year meeting. Discuss and formulate brief for UK delegation	Completed as intended, although late issue of papers by IOC limited effectiveness
Keep members informed of information issued by the GOOS Office in Paris such as GOOS Newsflashes and prepare appropriate summaries of GOOS Technical Reports and other IOC publications of relevance	Check GOOS website Summaries of GOOS Technical Reports	Carried out at intervals and news relayed as appropriate No relevant documents issued to summarise
Continue to update and extend GOOS Action Group Website	Update dates	Website revamped and updated at intervals as required
Pass a copy of the partially updated MPC Action Plan to Defra with a summary of the progress made in implementing the actions identified as high priority	Material passed over to Defra	Copy passed to Defra early in 2006
Publish the Strategic Plan for the achievement of UK objectives from GOOS and the co-ordination of its contributions to the overall GOOS programme, including its subsidiary programmes such as EuroGOOS and Coastal GOOS.	Printed copy minus Annexes Full text including Annexes on the website	A condensed hard copy version was prepared and published in the first half of 2006 The full text in final form was placed on the website by mid-2006
Develop clear proposals for implementation of a co-ordinated programme of observations by UK organisations which meet both UK and international GOOS needs in the MPC field taking due account of the potential offered by satellites and other remote and automated sensing devices	Completion of work on protocols for T& S observations Decide on next tranche of protocols required and initiate work	Work not completed, task handed over to MARG protocols sub-group This task now rests with the MARG protocols sub-group but suggestions made
Maintain a watching brief on and encourage progress with EuroACT	Reports on progress at each AG meeting	Reports provided to GOOS AG meetings

ACTIONS RELATED TO OTHER AG ACTIVITIES

Action	Output/Milestone	Progress/Comments
Support conversion of Argo project into an operational phase with funding of a UK contribution commensurate with UK interests and responsibilities.	Prepare a strong case for on-going UK involvement and submit to CSA, Treasury, Defra, MOD as appropriate	Case argued and current funding situation eased. Case prepared for on-going operational funding as part of proposed joint Spending Review bid
Seek to ensure allocation of funds for remote sensing is appropriate to the UK's position in the international oceanographic community and that the promise of support for JASON-2 is fulfilled	Case prepared and submitted	Requirement included in proposed joint Spending Review bid

Action	Output/Milestone	Progress/Comments
Maintain close liaison with NCOF with a view to ensuring the widest practicable involvement of user organisations	Reports to AG meetings	Reports provided to GOOS AG meetings
Invite NCOF to develop and use models to assist in the design of a new marine monitoring network suitable for meeting the needs of the new UK Marine Monitoring Strategy with particular reference to GOOS requirements	Contract issued	Contract issued and work expected to be complete by end of 2006
Maintain pressure re the need to submit a case to Treasury for maintaining long-term observations via an assured funding base and place operational marine observations on a secure financial footing	Report to IACMST	Report submitted to IACMST for agreement, detail now included in proposed joint Spending Review bid
Maintain a watching brief on the implications for overall UK MPC type observations of a) any changes AG member organisations may have decided to make to their own programmes and b) the definition of ecological zones	Recommendations to revise overall programme	Details circulated as appropriate and consequent suggested amendments considered
Consider the need to undertake performance evaluation of specific monitoring activities	Define requirement and funding needed`	Preliminary work included in NCOF contract
Publish the completed report on the use of indicators in an MPC context	Report printed and placed on the website	Placed on website but funds did not allow printed version
Consider whether or not it is appropriate to produce a further MPC report, what it should contain, on what time-scale and by what mechanism. Particular consideration to be given to the need for some work on regional synthesis	Decision in principle. to produce a third report	Developments under UKMMAS rendered this activity unnecessary as decision taken to prepare status reports at intervals
Assist in the preparation of an IACMST presentation to OI2006	Presentations on the Review of Monitoring and the Strategic Plan	Exhibit prepared and manned as intended, outcome reasonably successful
Organise an open meeting e.g. on the use of models in the design of a comprehensive marine monitoring programme <u>or</u> on protocols for marine observations	Meeting held and summary of proceedings and PowerPoint presentations placed on website	Meeting organised on Physical measurements for Ecosystem Requirements, summary of proceedings prepared and placed on website with PowerPoint presentations

CO-ORDINATION WITH OTHER GROUPS

Action	Output/Milestone	Progress/Comments
Continue to work with MEDAG ¹ to promote the activities of the two groups		Activity restricted to correspondence due to timing of meetings
Maintain web-site with quarterly updates	Updates recorded	Undertaken as required
Continue to assist Defra in the creation of a coherent and comprehensive Marine Monitoring Programme for the UK	Publication of a comprehensive plan	Close liaison maintained with UKMMAS secretariat

¹ Marine Environmental Data Action Group

Annex 4

Activities Proposed for the GOOS Action Group in 2007

ACTIVITIES DIRECTLY RELATED TO GOOS

Action	Output/Milestone	Timescale
Provide briefing and advice to the UK Delegates for the Meeting of the IOC Assembly	Relevant papers to be circulated in advance of mid-year meeting. Discuss and formulate brief for UK delegation	Prior to May Meeting of Action Group
Pass request to update List of UK contributions to GOOS to MARG for response and prepare submission on financial contributions	Returns as required	First half 2007
Maintain watching brief over actions taken under MARG to implement coastal and open ocean components of UK GOOS Strategic Plan and maintain existing Action Group activities, including website	Advice to Action Group and IACMST	May (and possibly November) meetings of Action Group
Consider scoping report by NCOF on use of models in design of efficient monitoring networks with a view to organising further development of the concept	Proposal to proceed and development of a funding mechanism	First half 2007
Investigate potential for linking observations and modelling with assessment of economic benefits of adding, removing or maintaining components of existing programmes	Possible workshop jointly with MIA/IMarEST	Latter half 2007
Maintain watching brief over the UK Argo programme and Jason-2 developments	Reports to meeting(s)	At Action Group meeting(s)
Maintain a watching brief over members' marine monitoring programmes	Members to report any significant changes	At Action Group meeting(s)
Organise (jointly with UKMMAS/MARG) an Open Meeting in association with the November Action Group meeting (if held)	Holding of Open Meeting	November 2007
Consider the feasibility of funding (partially or in full) secondment of a person familiar with Physical monitoring activities to the UKMMAS secretariat	Job description and possible allocation of funds	First half 2007