



**Proceedings of the  
marine species recording workshop  
29<sup>th</sup> & 30<sup>th</sup> January 1998**

JNCC Report No. 280

Draft for participants to comment on discussions and  
complete questionnaire on recording schemes

edited by  
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## 1. Background

The running of a marine species recording workshop was originally seen as a means of satisfying four main needs:

- 1) The initial idea of a workshop was conceived as a result of the realisation that many marine species recording initiatives, whether already underway or planned, involve electronic storage and display systems, and that there would, therefore, be a need to ensure compatibility of recording methods and data technology if the information is to be shared.
- 2) In addition, JNCC wished to have the opportunity to describe proposals for the development of the well-established 'Recorder' data management package to include marine species and also to obtain assistance from the marine recording community in developing the package.
- 3) Furthermore, the initiation of the National Biodiversity Network (NBN) and the requirement to create a marine 'node' of 'Recorder' highlighted the need to ensure common standards which could best be developed with the input from the marine recording community.
- 4) Most importantly, a workshop was seen as providing an opportunity to encourage collaboration and sharing in the development of new marine species recording initiatives.

The Programme for the workshop (Appendix 1) was developed in the context of the National Biodiversity Network and *UK Marine Biology* with these needs in mind. It included presentations chosen to represent the broad range of existing recording schemes and record collections and also of currently used data management systems. Emphasis was given in many of the presentations to the strengths and weaknesses of the various schemes and systems in relation to sharing species data so that lessons could be learnt for future initiatives and collaborations. The four working group sessions were designed in an attempt to start the decision-making process, to enable tangible progress to be made for developing the mechanisms for the collaborative supply of marine species information.

This report aims to summarise what was said during the workshop, and its layout reflects the pattern of events outlined in the Programme. A list of participants is included for reference.

The workshop was commissioned by the Joint Nature Conservation Committee as a contribution to the National Biodiversity Network and was organised by the Dove Marine Laboratory, part of the Department of Marine Sciences and Coastal Management, Newcastle University.

## 2. Session: Welcome and introduction

### 2.1 Aims of the Workshop

**Dr Keith Hiscock, *Marine Nature Conservation Review, Joint Nature Conservation Committee***

Several exciting initiatives are currently underway which will greatly enhance our ability to assess marine biodiversity and to use the information obtained to improve marine environmental understanding, education, protection and management. The two national ones being especially addressed at this meeting are:

- the National Biodiversity Network, and
- *UK Marine Biology*.

We intend that 'common standards' and 'quality assurance' are going to be two main threads throughout this meeting.

This workshop has three main aims:

- to inform the community of marine biologists undertaking species recording of initiatives (underway or completed) which record species occurrences and add value in terms of dissemination, reporting and usefulness;
- to identify what common standards should be for recording, quality assurance and adding value;
- to encourage participation in national schemes for recording and data enhancement.

Whilst we can adopt-and-adapt from schemes which are much more advanced on land, we need as a minimum to ensure that those schemes are adjusted to suit marine biological requirements. We may also find that, because of our comparative 'backwardness' in marine species recording, we can better take advantage of the opportunities offered by new technology including linking of datasets and disseminating information through the World Wide Web. This meeting is likely to be the one significant opportunity for the wider marine recording community to influence our approach to marine recording within the National Biodiversity Network (NBN) and the information to be added in *UK Marine Biology*.

## **2.2 An introduction to the National Biodiversity Network**

**Lawrence Way, *National Biodiversity Network, Joint Nature Conservation Committee***

The overall goal of the National Biodiversity Network is to provide a means of linking the demand for biodiversity information to its collection. The aim is to maximise the value of individual contributions of information and ensure that the information gathered is fed directly into the decision making process. These goals apply as much to the marine environment as to terrestrial systems.

The NBN has been proposed by a consortium of organisations in response to some well-known problems, many of which are picked out by other presentations. At the moment, although there is a wealth of wildlife information available, it is held in numerous locations and formats. This makes it difficult to pool, in order to get an overall picture of what the situation is. This leads to problems such as difficulty in identifying where the gaps in the data lie, and thus it is difficult for recorders to target their efforts to fill these gaps. In addition, the decision makers are currently weakly linked to the information gatherers, with the result that decisions are often made without reference to the available information and there is no feedback to recorders about what information is really needed. Finally, uncertainty over legal rights, the need for income, and different approaches to assessing sensitivity of information, all present barriers to the efficient exchange of data. These are the problems that the NBN will attempt to resolve.

The NBN can be broken down into four constituent parts:

- A partnership between organisations who use or collect wildlife information within which standards can be agreed and opportunities for co-operation to improve the quality or accessibility of wildlife information can be identified.
- Local and national custodians who are responsible for maintaining the databases and ensuring that the data are used under the appropriate conditions. Any of the organisations represented at the workshop could choose to become 'custodians' once they understand the benefits.
- A framework of standards to allow the exchange of information and controlled access. These standards will be designed to protect against infringements of copyright and unauthorised access to sensitive or confidential data. They will cover different levels of access to meet the needs of different types of user and clarify where charging will not be a barrier to the use of the data.

- An electronic network to link the databases and allow access within the framework of standards. Looking forward to the next millenium, there is little doubt that most information will be shared electronically. It will allow access to the information, regardless of where the user is or where the information is held.

The long-term goal is quite ambitious and the aim is to work slowly towards it through smaller demonstration projects. It is hoped that once a number of working examples are actually underway, people will be able to learn from them, and also copy and tailor to them their own circumstances. One such project that is already underway is the development of the NBN collect/collate software. The idea behind this is not to lock people into using a particular product but to provide an example of how the implementation of standards can assist the process of information storage and exchange. We are now looking for other suitable examples from schemes and societies, local record centres and national organisations and want to ensure that these incorporate marine as well as terrestrial. To this end UK Marine Biology (now known as MarLIN) is investigating how it can make a contribution to the NBN and apply the principals outlined above.

### 2.3 Adding value - *UK Marine Biology*<sup>1</sup>

**Dr Keith Hiscock , *Marine Nature Conservation Review, Joint Nature Conservation Committee***

*UK Marine Biology* is a project being undertaken to provide information which will aid marine environmental management and protection and support marine environmental education projects in the UK. It is being developed by the Marine Biological Association of the United Kingdom at Plymouth in association with organisations having a requirement to use such information.

In the context of this meeting, *UK Marine Biology* is about enhancing the purpose for marine recording by adding value to the information collected.

To answer marine environmental protection and management questions, we need to:

- have access to a comprehensive data set which can be used to describe the distribution of marine species and biotopes around the UK;
- be able to summarise survey data in a structured way - as species distribution and abundance and as biotope distribution as a minimum;
- be able to interpret that information in a way which is relevant to marine environment protection and management and for education;
- access and display the information through a user-friendly medium.

'Adding value' to data to support environmental protection and management and education requires, first of all, a clear understanding of what information is needed, and then a very large effort to find and add that key information in a structured way.

*UK Marine Biology* is being developed to be the marine node of the National Biodiversity Network. The work will be undertaken especially in collaboration with the JNCC Marine Information Project (maintaining and developing the Marine Nature Conservation Review (MNCR) database) and the National Biodiversity Network.

*UK Marine Biology* aims to make full use of available datasets through a co-operative programme of data input and development of facilities to access remote datasets. This will enable the project to :

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<sup>1</sup> At the first Steering Group meeting on 11 March 1998 it was agreed that the name of the project would be changed to MARine Life Information Network (MARLIN) as the Republic of Ireland would now be involved.

- identify and verify or grade data sources;
- add raw data from field surveys and other sources to its database;
- identify biotopes from data;
- add 'key' information on species and biotopes;
- develop software, in collaboration with others, to match field data to biotopes, to identify sensitivity features, to display information etc.

The project will be sensitive throughout to issues of data ownership and confidentiality, and access to information will be at an aggregated level.

Development of *UK Marine Biology* will specifically benefit from:

- The Marine Nature Conservation Review database which includes electronically stored information from a range of sources as well as data on paper and photographic material;
- The BioMar Project (1992-1997), which developed *BioMar Viewer*;
- The National Biodiversity Network, including, in particular, collaborative projects with regional recording centres;
- The facilities of the Marine Biological Association of the UK especially the National Marine Biological Library and the planned Marine Biological Resource Centre.

Success indicators for *UK Marine Biology* will be:

- Support (i.e. collaboration in development and consortium funding) from the wide range of users of marine biological data for marine environment protection, management and education;
- Collaboration of the scientific community (in supplying data and key information and agreeing common standards);
- Obtaining contributions to National Biodiversity Network recording from a wide spectrum of organisations and individuals;
- Requirement by organisations commissioning new work to use *UK Marine Biology* standards and submit or make available data to *UK Marine Biology*;
- Development of a truly UK project by establishment of contributing projects in national or regional locations;
- Use of the information through the World Wide Web, through an enquiry service including intranet of subscribers, and through the sale of specific products;

A Steering Group has been established to give added impetus and direction to the programme.

The project will cost approximately £350,000 for each of three years, with sponsorship being sought by the Marine Biological Association from a wide range of sources. This first three years will be used to develop and prove the concept and to pull together the information required for environmental protection and management. There will be products throughout that period. It is intended that the programme will be viable in the longer term. This will require continued funding and it is expected that this funding would come mainly through commissioned work.

### 3. Session: 'Historical' marine species record collections

#### 3.1 Marine recording in north Wales: an example of fluctuating fashions and fortunes

**Ivor Rees, *School of Ocean Sciences, University of Wales Bangor***

Records of *Thia scutellata* round north Wales provide both an example of a century of changing fashions and some objective lessons. This crab was mentioned in accounts of the first dredging trip by the Liverpool Marine Biological Committee. They operated a field station on Puffin Island for five seasons from 1885 and published a three-volume Fauna of Liverpool Bay. The next record was not until 1952, after Bangor University founded the Menai Bridge Marine Biological Station. It and other records from the 1960s are noted in a card index set up by Wyn Knight Jones and Cyril Burdon Jones. A fauna list for the whole Dee/Dovey region was to be published, but before reaching this stage both instigators moved to chairs elsewhere. The card archive still exists, but little was added to it after the late 1960s. Interests switched to being more experimental, though large numbers of distributional records, including some of *Thia*, continued to be generated. These were mainly incidental to quantitative sampling offshore for pollution monitoring, particularly in Liverpool Bay. Such project-specific data from the 1970s and 80s was not amenable to incorporating in the old style card index and related to much wider sea areas than the local coast fauna list.

Biodiversity recording revived in the 1990s, with a plethora of intertidal and nearshore surveys led by the Countryside Council for Wales (CCW) and the MNCR. Offshore, the most significant initiative has been the National Museum of Wales BIOMÔR (acronym derived from the Welsh 'bioleg' (biology) and 'môr' (sea)) and South West Irish Sea Survey (SWISS) benthos surveys of the whole southern Irish Sea. University collaboration continues, the RV *Prince Madog* being crucial for these surveys. SWISS is part of the European Union (EU) Wales/Ireland INTERREG (inter-regional) programme. These extensive surveys have produced just two more records of *Thia*, but this time from Cardigan Bay. Using DMAP™, *Thia scutellata* records from several sources known to me were plotted as a trial for an Atlas of the Southern Irish Sea in which the BIOMÔR and SWISS data would be supplemented by other recent (post 1960) offshore records. It is instructive that of nearly 30 records, only three were at the time on the MNCR database. This case, of an easily recognised species, where the habitat description also needs refinement, reinforces the need for improving flows of biodiversity information at local, regional and national levels.

#### 3.2 Marine species records revival - the Cullercoats experience

**Dr Judy Foster-Smith, *The Dove Marine Laboratory, Newcastle University***

A large and important resource of marine species information is held at the Dove Marine Laboratory. Some 2,600 species have been documented. Records relate to the area known as the 'Cullercoats District', which stretches approximately 200 km along the extreme north-east coast of England. They extend as far back as the 1750s and include details of species abundances, dates observed, sites and habitats and recorders, and in many cases status and life histories are noted. Rare and protected UK species are recorded for this area, as are several type specimens. Much of the information is anecdotal.

Many of the earlier records were from isolated observations or from organised 'dredging expeditions', made by eminent marine naturalists, such as Alder, Hancock, Johnston and Norman, and published in local naturalists' journals. Subsequent to the establishment of the Dove Marine Laboratory in 1897 many unpublished records were also compiled by staff from the Laboratory, in particular Bull, Meek and Storrow.

It was not until between the 1960s and 1980s that these scattered observations were brought together in taxonomic volumes and produced as 'Reports of the Dove Marine Laboratory'. However, these taxonomic volumes (26 in all) were highly inconsistent in their format, and, with

no easy means of adding new records or revising changing taxonomy, they became increasingly dated and demand for the information steadily declined. This valuable resource of marine species information had effectively become dormant.

The 'revival' process, begun in 1996, involved the transfer of the existing records onto electronic (Word) format using a somewhat laborious scanning and editing process, thus enabling them to be relatively easily updated. The bulk of the revision process was carried out during 1997 (the Dove Marine Laboratory's centenary year) using the *Marine Species Directory*<sup>2</sup> as an invaluable guide to current taxonomy. The species codes from the published (1977) edition of the *Directory* have been used, but - and people need to be aware of this - these apparently do not correspond to the electronic version of the *Directory*, which will change as time goes by.

The revised version is to be published as a double volume and will subsequently be installed on the Internet. A Microsoft Access database is also being developed specifically for the Cullercoats records, taking into account special qualities of the information, such as the numerous synonyms and the valuable anecdotal notes, so that the data can be queried and made best use of.

There are undoubtedly many similar sets of 'historic' records and, although huge investment of time and funds are inevitably involved in making them widely available, we have a responsibility to use such data to their full potential.

### 3.3 Spots in the sea

#### Dale Rostron, *Subsea Survey*

There are many reports and species records covering the inshore seas of the Pembrokeshire region. Subsequent to the Sea Empress spill it became obvious that, in order to be of use, this information must be combined in such a way that it could be accessed by those who needed it. This is the primary reason for the initiation of the Pembrokeshire Marine Species Atlas database.

Data input involves three stages, starting with the report or publication containing the information, of which there are currently over 100, then moving onto the sites or stations and ultimately the species present. Stations are entered as symbols directly onto a map or chart background and the level of accuracy of the site positions placed on the map can be very high. Species input is uncomplicated and uses the revised *Marine Species Directory* and codes. Several types of reports are currently available, and output is as various lists, or in map form if appropriate. Various types of thematic map are available, although not all are appropriate for current data tables. Probably the most important future use for the Species Atlas is as part of a Geographic Information Systems (GIS) management tool for the Pembrokeshire Islands candidate 'Special Area of Conservation' (cSAC).

### 3.4 Discussion of session

*Rapporteur* : Ian Killeen, *The Porcupine Society*

**Bob Earll:** People like visual images, so why deconstruct maps/drawings, which actually mean something to people, into boxed items of data?

**Dale Rostron:** Because there would be difficulties in standardising such imaging.

**Stuart Ball:** What about problems with synonymies during revision of taxonomy?

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<sup>2</sup> Where the term '*Marine Species Directory*' is given in the text, this refers to *The Species Directory of the Marine Fauna and Flora of the British Isles and surrounding Seas* (Howson & Picton, 1997).

**Judy Foster-Smith:** All synonyms can be retained throughout each revision.

**Keith Hiscock:** Are records to generic or family level of any value and worth logging into a database?

**Stuart Ball:** Yes, for 'Phase 1' type surveys.

**Andy Horton:** People may make mistakes identifying to species, therefore genus or family is a safer option.

**Chris Todd:** In addition to recording at levels coarser than species, will databases allow us to go down to subspecies and variety level? These should be included if they are ecologically relevant.

**David Lampard:** Museum catalogue systems are frequently not compatible with other systems, for example Recorder.

**Bernard Picton** : What about records for which there is no voucher material? How are new records going to be vouched for?

**Keith Hiscock:** Can Recorder cope with this?

**Stuart Ball:** Yes.

**David Connor:** There is danger of becoming elitist about identifications being correct.

**Nigel Grist:** Spurious identification is worse than useless.

**Andy Horton:** But some things not identifiable without dissection. (*The implication here is that there is an unwillingness to undertake dissection*).

**Ivor Rees:** There is a problem with allocating historical records for recently segregated species. Also you don't know when people begin to take note of these changes. Recorders might go on using aggregate names for some time after changes have become extant (i.e. if they are using old identification guides).

**Keith Hiscock:** Segregates need some kind of tagged warning.

**Stuart Ball:** There are three possible sorts of flagging: (i) have data been checked? (ii) how certain was the recorder? (iii) do we believe him?

**Lawrence Way:** Some other schemes have considered the option of assessing people's identification ability. Can Societies develop schemes which run in parallel with their members' skill?

**James Perrins:** Often we only have a take it or leave it choice.

**Ivor Rees:** Ecological and distributional information in literature is of equal value to taxonomic descriptions.

**David Connor:** There is a need for data on distributional ecology. The lack of it is one reason why Bill Sanderson (JNCC) had problems compiling the Rare Species Directory.

## **4. Session: Current approaches to marine species recording**

### **4.1 Marine species records in Cornwall and the Isles of Scilly**

**Pamela Tompsett, *Environmental Records Centre for Cornwall and the Isles of Scilly***

*By whom, in what form and where now?*

Cornwall's 350 km of coastline and the adjacent seas with their rich flora and fauna have been studied for well over 150 years. Early collectors and naturalists amassed information on their chosen taxonomic groups and this can be found in a wide variety of publications and collections throughout Britain. The extent and detail of this information was closely linked to

the personal interests, resources and expertise of the people involved. The collection of the significant quantities of specimens which was carried out is of concern, although well-documented items can be of value today!

Casual marine recording by individuals and groups with a range of expertise has continued in Cornwall. To this has been added site related surveys and species studies carried out by professionals and expert amateurs, often as contracts through statutory bodies or within university projects. These surveys include more qualitative and quantitative data which are largely absent from the casual recording. In Cornwall there appear to be more data for the littoral than the sublittoral.

Information in the public domain is usually readily available but the university studies are less easily accessed as many are never published and recorders come and go unnoticed. Records can be on paper, record cards or on databases, which vary from the primitive to the sophisticated.

From 1973 the Cornish Biological Records Unit (CBRU) acted as a focus for the collection and collation of terrestrial and marine records, eventually developing a database to accommodate this information at an early stage. The merging of the CBRU with the data section of the Cornwall Wildlife Trust in 1997, forming the Environmental Record Centre for Cornwall and the Isles of Scilly, means that this work will continue and develop in co-operation with other regions throughout the UK.

## 4.2 Marine mollusc mapping: the Marine Census of the Conchological Society

### Jan Light, *The Conchological Society*

The Conchological Society's Marine Census scheme is co-ordinated by an honorary officer of the Society (the Marine Recorder) supported by a network of Sea Area Representatives whose responsibilities entail collection and collation of records pertaining to the relevant area.

A landmark in the scheme was the publication of the *Sea area atlas of marine molluscs* (Seaward 1982), followed by a revised version: *The marine molluscs of north-west Europe (MMNWE)*, based on 53 Sea Areas within a wider geographical area, eight years later (Seaward 1990).

Current data collection includes:-

- (i) spontaneous and targeted fieldwork by Society members;
- (ii) receiving and soliciting records from amateur and professional biologists, marine laboratories and universities;
- (iii) gathering information from commercial and government organisations and non-government organisations (NGOs) and
- (iv) extracting records from historical and current literature.

Strengths of the scheme include its longevity; in-house expertise and commitment; a system of refereeing and a requirement for voucher specimens in special cases; and the use of a customised computer programme, **Recordit**, linked to DMAP™.

Weaknesses which need to be addressed include the varying levels of commitment by Sea Area Representatives; the dispersed nature of the Society's record cards and archival material relating to each Sea Area; and the non-uniform coverage nationally. Furthermore, distributions which have been published to date are only at the coarse scale of Sea Area, which gives qualitative rather than quantitative information and allows only limited interpretation of distribution patterns. Also, no dedicated funding is allocated to the Marine Census by the Conchological Society nor by external sources.

Currently recording and mapping efforts are directed towards a variety of finer units (6' x 12'; 6' x 6'; 2' x 2' lat./long.). The **Recordit** software is species-based and grid references and lat./long. co-

ordinates are interchangeable. This will provide a much more accurate representation of the marine molluscs of a given area and allow more subtle patterns in distribution to be deduced.

Computerisation of the Society's distributional data is under way for the Channel Project - 'Distribution of Marine Molluscs in the Channel' (DOMMIC), and hand-drawn distribution maps are being produced by Representatives for some other Sea Areas. The future of the Marine Census will best be served by a Society-maintained centralised computer database for the *MMNWE* Area, either using **Recordit** or, if more appropriate, another software package.

### **4.3 The Marine Algal Mapping Scheme**

**Dr Gavin Hardy, *The Phycological Society and Newcastle University***

The British Phycological Society launched its Marine Algal Mapping Scheme in 1970. During the initial stage of the scheme recording was carried out by a team of volunteers using Recording Cards bearing details relating to the distribution of British seaweeds. The validity of the records was checked with the aid of panels of local and taxonomic experts to ensure that no doubtful records were incorporated into the data. Once validated, the records were forwarded to the Biological Records Centre for processing. In 1985 a Provisional Atlas of selected species was published as a progress report and this concluded the first phase of the project.

The scheme has now been re-activated, nomenclature has been updated and further records are being collected, so that a complete Atlas can be published by the end of the century.

### **4.4 Environmental education: a two-way process**

#### **Communities as a valuable resource for marine species record collection**

**Dr Stewart Evans, *The Dove Marine Laboratory, Newcastle University***

The participation of community groups, such as wildlife societies, school natural history societies, angling clubs and SCUBA diving clubs, in scientific (data gathering) exercises is one way of raising environmental awareness and promoting increased public understanding of science. The benefits would be seen by many as being for the community as a whole, not for science. However, this view seriously underestimates the contribution that the public in general has already made, and can make, in some areas of science. Substantial progress has been made in fields such as ornithology, entomology and botany by 'amateur' experts. Community groups have the potential to make an enormous contribution to marine species recording so long as schemes address certain basic problems. These include (i) the levels of expertise in different groups and the training which can be provided; (ii) the need for standardised methods of recording; (iii) the use of appropriate databases for managing information; and (iv) the need to disseminate results in ways which make them generally available and of acceptable quality for scientific use. There are examples of national schemes where these demands have been met successfully, and a programme is currently being developed at the Dove Marine Laboratory to involve community groups in the cataloguing of the local marine biota.

### **4.5 Sublittoral habitat and species information collected from Seasearch surveys**

**Robert Irving, *Sussex Seasearch Project***

*Seasearch* is a project giving a methodology for volunteer divers to record sublittoral habitats and conspicuous characterising species. It was devised in the mid 1980s by Dr Bob Earll (then of the Marine Conservation Society (MCS)) and Dr Roger Mitchell (then of the Nature Conservancy Council), and has been developed into its present form by Dr Bob Foster-Smith of Newcastle University and Robert Irving. The *Sussex Seasearch* Project began in 1992 and is funded by a consortium of organisations headed by English Nature. To date, over 600 dives have been

undertaken by about 200 volunteer divers along the whole 140 km length of the Sussex coastline, from Chichester Harbour in the west to Rye Harbour in the east.

Most of the volunteers have not done this type of survey recording before. With training, they are able to record seabed types reasonably accurately, but many are able to identify only a few of the species they see. However, there can be a feeling of inadequacy if no species are recorded, so lists are made which may include mis-identifications or guesses. These errors have to be filtered out before results can be entered onto a database. Species' abundances are noted, though again these can vary considerably from diver to diver (even amongst the professionals who should be familiar with abundance scales!). However, a note of abundance is considered useful in providing a rough estimate of cover/numbers, though they are treated with caution.

The existing MNCR database has been used for data processing within the Sussex Project. This has saved the effort of designing one specifically for the Project, but it does have a number of drawbacks, chiefly that it is old and not Windows-based. It is hoped that, in the near future, a national database will be designed which would be capable of taking *Seasearch* results from all parts of the country. This could then feed into the National Biodiversity Network. Already, a *Seasearch* group in Dorset is designing a database based on Microsoft Access. Once completed and tested, this may be suitable for other groups to use. Whatever system is used, there may be some problems with data ownership, especially if a number of funding partners have been involved.

It is important not to underestimate the contribution that can be made to marine species recording by 'amateurs'. Many individuals are very knowledgeable about what they are seeing during their dives, and if they can be persuaded to record their field notes on standard recording forms, then so much the better. In return, it is important to provide feedback to the recorders, so that they can see that their efforts are of value and appreciated. In the related field of bird-watching, sightings of rarities have relied on the abilities of keen and knowledgeable 'amateurs' for years. However, in order to have a record authenticated, a photograph, field notes or a specimen is required. This system must be adopted for the less-frequently observed marine species recorded on *Seasearch* dives.

#### **4.6 The proposed 'Porcupine' recording scheme**

**Jon Moore, *CORDAH/OPRU***

The marine natural history society 'Porcupine' is proposing to establish a new marine species recording scheme. The main reasons for doing this come from (i) the interest of Society members in marine biogeography and species ecology, (ii) the recognition that knowledge of marine species distributions is often very poor and (iii) the fact that many important records are lost because most existing recording schemes do not cater for the collation of informal records.

The aims of the scheme are to raise the profile of Porcupine; collect species distribution records; collect other information about species ecology, behaviour etc.; and to disseminate this information. Records would be sent to the co-ordinators of the scheme in one of three possible ways: (i) on pre-addressed pro forma postcards; (ii) by electronic mail using pro formas attached to a World Wide Web page, and (iii) (where members have collated many records from a survey) on spreadsheet or database files.

The type of information to be collected, which would be given on the pro formas, is as follows :

--

Species (& Directory code): _____	
Location: _____	
Grid Ref. or Lat./Long.: _____	Date: _____
Recorded by: _____	Phone: _____
Identified by: _____	Phone: _____
Other material available (ring): Specimen/Photograph/Species List/Habitat Form	
Habitat details (substratum type and features, or biotope): _____	Depth (m): _____
Other information:	

Records would need to be checked by the co-ordinators and, in many cases, by experts in the relevant taxonomic groups. If specimens or photographs had been collected with the record, they would also be used to check records. Records may be categorised into the following:

- A. Records with specimens that have been checked by an expert.
- B. Records without specimens that are considered okay by an expert (i.e. within known geographic range; from expected habitat type etc.).
- C. Records that have not been checked by an expert, but are within known geographic range and from expected habitat type etc.
- D. Records that have not been checked by an expert and are outside known geographic range or in unusual habitat type etc.

Records would be stored on a suitable electronic database and it is hoped that it would be possible to transfer them to a national marine database at intervals. Feedback to recorders and other marine biologists would be by publication of articles in the Society's journal. Experts in particular taxonomic groups would also be encouraged to use the records in atlases and synopses.

#### **4.7 A voluntary approach to rocky shore monitoring**

##### **Jenny Glanville, *Devon Wildlife Trust***

The Wildlife Trusts are professional organisations which rely heavily on the support of volunteers to carry out much of their work. Although Devon Wildlife Trust (DWT) is one of the very few Wildlife Trusts with a full time marine staff, it still relies on volunteers to undertake a great deal of the survey work, in particular, the monitoring project at Wembury Voluntary Marine Conservation Area (VMCA). This survey, begun in 1996, is biotope based, using fixed quadrat photography along five transects at various locations around the VMCA. The photographs are imported into a GIS for interpretation. Given the long term plans for the project, it is not practical for the full time marine staff to carry out the survey. Therefore it has been designed to be carried out by volunteers. With the Marine Biological Association and Plymouth University close by, Wembury has not been short of volunteers with marine biological backgrounds. The surveying takes place at the end of the summer season, when the volunteers are more familiar with the shore and have had training in identification and survey skills. By producing as comprehensive a set of instructions as possible, together with a detailed guide book to the sites, DWT hopes to overcome the problems of replication and continuity of data inherent in a long term study with a high turnover of staff. In the future, a digital camera and image analysis software will help to reduce the margins for error in the

interpretation process. The project is a pilot for other VMCA's and is only in its first year of surveying, but it has already shown a degree of success which bodes well for the future.

#### **4.8 Discussion of session**

*Rapporteur : Dr John Baxter, Scottish Natural Heritage*

The various presentations identified a number of common themes with respect to existing recording schemes and the options for the best way forward to arrive at a core standardised system.

- Sources of records varied from casual observations to records from formal surveys.
- There is an inconsistency in the coverage of recording across taxonomic groups because some are more 'popular' than others.
- Records of 'absence' of a species (rather than just not providing any data) are lacking.
- Records need to carry a quality assessment and possible ranking of validity.
- Systems for validation of records may need to be assessed, possibly through a network of willing acknowledged experts.
- Some sort of national database is needed with elements tailored to meet specific needs.
- Minimum standards for information gathered, e.g. habitat, location etc., need to be agreed.
- For a network of recorders to be successful and motivated there needs to be much greater feedback through a variety of media.
- The limitations of certain data sets need to be acknowledged, without attempts to extract more out of the data than is reasonable.
- The educational benefits of all recording activity must be exploited.
- There is a need to try to identify both the mechanism and the body to co-ordinate all the records being collected - possibly the Porcupine Society.
- There is a need to compile a better record of the distribution of recording effort.

### **5. Session : Managing and viewing species information**

#### **5.1 The New Recorder**

*Dr Steve Wilkinson, Joint Nature Conservation Committee*

The package 'Recorder' was developed in 1992 to meet the need for a computer application that would allow amateur naturalists to store observations electronically. The package was never designed to capture marine data. In addition, it is now quite outdated and in March 1996 plans were made to redevelop it. The scope of the package was considerably increased to fulfil the data collection and collation functions of the National Biodiversity Network. This means that the new version will be capable of capturing almost any kind of environmental data, including marine and possibly earth science.

The project will deliver three products. The first and most important is an agreed set of standards for storing environmental data electronically, including a set of electronic dictionaries. Secondly, the project will produce a piece of software which will allow individuals to access the dictionaries and store records electronically in the agreed format. It will be possible for users to heavily customise the application to meet their specific needs. Finally, the project will deliver another application primarily to meet the needs of local record centres and recording scheme organisers,

such as the collation of records and the management of designated sites. It is anticipated that the project will be completed by the end of 1998 with trial versions of the applications being made available before this time.

## **5.2 The Plymouth Marine Fauna: a new approach for the fourth edition**

**Alison Hood, *The Marine Biological Association of the United Kingdom***

The Plymouth Marine Fauna (PMF) represents nearly a century of species recording (1st ed. 1904) at the Marine Biological Association in Plymouth. The 4th edition of the PMF has seen a very different approach assumed, moving away from the traditional hard copy towards an interactive database, designed for location on the Internet. This is intended to open up the PMF to a larger user-group, representing a broader range of academic levels.

Text from the 3<sup>rd</sup> edition has been digitised and work has commenced on the development of the PMF as an interactive database. The database is being developed using *File Maker Pro (Version 3)*, which is essentially Macintosh software, but is compatible with other makes of personal computer (PC). *File Maker Pro* is a flexible software package facilitating the development of relational databases. It deals well with both fixed and moving images and permits interrogation of all text fields. Most importantly, though, it is user friendly and suitable for use by a non-specialist, both in terms of database development and use of the end product.

As the database is 'relational' (i.e. it has functional links between data tables sharing some common attributes), the task of data entry has been significantly reduced with data shared across files. Images have also been added, increasing the value of the written text. New information was needed to update the previous edition and a wealth of information has been collated for both species and habitats.

The user interface is quite 'friendly', with the database driven by pre-programmed buttons. Data is presented at a number of levels enabling the user to select the level of detail they require. It is possible for the user to either browse the database or ask specific questions regarding species or locations.

The future for the database appears to be one full of change. *File Maker Pro (Version 4)* has now become available, with an integrated HyperText Mark-up Language (HTML) conversion package enabling the relatively easy transfer of information into an Internet format. The current structure of the PMF will undoubtedly change as the software is updated. Issues associated with processing the wealth of new data will also have to be considered, and an electronic link will be formed with the reference facility of the National Marine Biological Library. It is intended to launch a demonstration of the new PMF on the Internet in the near future. However, at this stage, care must be taken to ensure compatibility with other recording systems.

## **5.3 The MNCR Database**

**Eleanor Murray, *Joint Nature Conservation Committee***

In order to facilitate access to, and analysis of, marine information held by the Joint Nature Conservation Committee, the Marine Nature Conservation Review (MNCR) database was developed using *Advanced Revelation DataBase Management Software*. The database was intended to be used as a repository for MNCR data and as a tool to assist MNCR scientific staff in the basic analysis and interpretation of their data. Data held in the database are collated from existing sources of information or derived from field surveys.

The database is split up into an information module (literature references), a field module (survey data), a biotope dictionary and a species dictionary. The species dictionary is cross-referenced to literature sources, habitat records, photographic records and MNCR biotopes (Connor *et al.* 1997a, b). The species contained in the dictionary are named and coded according to the *Marine*

*Species Directory* and contain names and authorities and synonyms for ease of interrogation. The dictionary also has facilities to record species rarity (with sources referenced); associated biotopes and any associated species; distributional information, including any areas of abundance and sensitivity/vulnerability of each species. No information is currently held in these fields.

The database currently holds 29,400 habitat records, all geo-referenced and containing multiple species records. This massive amount of data could help expand the information held in the species dictionary with respect to rarity and trends in distribution. Drawbacks of the *Advanced Revelation* system are that it has no live links with other packages, such as analytical tools, and it has a complex data exchange mechanism. There is no facility for recording individual species without corresponding habitat data, nor any way to add general species information such as descriptions and photographs.

As part of the National Biodiversity Network development, JNCC plans to move the MNCR data out of *Advanced Revelation* into a data repository in a format compatible with the NBN. The data will be interrogated via an intranet connection through a newly designed MNCR database, currently being developed by Steve Wilkinson (JNCC). The MNCR dataset will be made available to the marine node of the NBN.

## **5.4 Microsoft Access as a tool for marine species recording**

### **Dr James Perrins, *exeGIS Spatial Data Management***

Marine species recording is a time intensive (and hence costly) activity, so it is important to make efficient use of the data that are in existence. Many individuals/organisations gather species data with varying aims, at different scales, and with varying accuracy/completeness. Given the varying aims for the data collection, these projects will inevitably record different types of information, but will also contain a certain amount of common information (e.g. who saw what, where and when). The challenge is to bring together and make available the common elements of these datasets (with suitable caveats on the accuracy, completeness etc.).

One enforced system for everybody will not work due to the differing reasons for collecting the data, so people need to be encouraged to collect and structure the core of their information in a standard way to facilitate data sharing. A key element in this would be making available regularly updated species dictionaries to standardise the species coding.

There are a large number of database systems on the market (e.g. Microsoft Access, Advanced Revelation (AREV), Paradox, dBase, Oracle etc.). Most of these will have a large number of features in common, and any one of these could quite adequately be used for marine species recording. For this sort of application a database must be easy to use (including allowing people to perform their own queries), must run on a standard PC, be low cost and, as far as possible, be stable (i.e. widely used, and produced by a big manufacturer). Given that a number of databases could or may be used, the crucial element is that standardised codes and agreed database structures are used, so that the core of the data can easily be moved between databases. Care should be taken not to make the core level of information so complex as to discourage people from contributing. If necessary, there could be more a basic and a more advanced core of data to suit different recording schemes.

Microsoft Access is a good tool to produce relatively simple (and more complex) databases for local recording schemes. It is the most widely used PC database (as Microsoft have been giving it away on many PCs). Clearly this in itself does not necessarily make it a good product, but does mean that there are a large number of people available who are experienced in using it. Microsoft Access is easy for non specialists to pick up and use to perform ad hoc data analysis, one off reports etc. It is well integrated with other Windows packages (e.g. word processors and spreadsheets). Data can be read and written in a range of common formats. Runtime versions can be given away free, including for use on networks. Using programming features such as 'Object Linked Embedding' (OLE), it can be integrated with a range of other software (such as Geographic

Information Systems). Microsoft Access is a good PC/small network database which is widely used and comparatively easy to use whilst still allowing a high degree of functionality.

## 5.5 Unicorn - Marine Biological Database

Nigel Grist, *Unico Marine Ltd.*

Unicorn was developed to enable us (Unicomarine Ltd.) to keep track of the samples and data resulting from marine surveys around the UK. These were undertaken as part of our normal consultancy activities. The system has evolved over time from dBase, Superbase and Paradox and is now in the form of a number of linked Microsoft Access databases. The three main components of the system are: (i) sample logging; (ii) data entry; and (iii) data manipulation and extraction. Each is described briefly below.

### (i) Sample logging

A hierarchical structure exists as follows: 'samples' are taken from 'stations' which are in 'locations' which are in 'sea areas'. A group of samples is termed a 'survey'. When entering details of a batch of samples, all required information for the next level up the hierarchy must already have been entered. For example, a new 'sample' cannot be entered without details of the 'station' from which it was collected being present in the system. Following completion of the sample logging process the user may print out data-sheets for use in the laboratory, and sample labels for the completed vials. Repeat entry of information is avoided and the opportunity for transcription errors reduced.

### (ii) Data entry

The user selects from a drop-down list the 'survey' for which data are to be entered and then chooses the required sample. Species are then entered by typing a three or six letter abbreviation (e.g. MACBAL for *Macoma balthica*). The full taxon name is echoed to the user for confirmation. The user is warned of invalid entries. Taxa other than species may be entered using a three letter abbreviation e.g. NEP for Nephthyidae. If multiple taxa have the same abbreviation the user is required to select the correct taxon from a list. Qualifiers may be appended to the taxon abbreviation to indicate a further division of a taxon; for example MYTEDU#J would record the presence of juvenile *Mytilus edulis*. The number of individuals (and biomass if appropriate) is entered. The user also has an option to import data from existing spreadsheets.

### (iii) Data manipulation and extraction

Users may extract data in the form of a 'spreadsheet' type matrix of species by sample. This may be for a single survey or a combination of several surveys. Other forms and reports may be used to present data in other formats. Microsoft Access queries may be defined to ask almost any possible question of the data, e.g. 'show all samples containing a particular species where a second species was also present with an abundance >10 individuals'.

### Suitability for marine species recording

The system could certainly be of use for marine species recording, although its emphasis is towards the logging and processing of batches of samples resulting from monitoring surveys. Individual records would need to be treated as separate samples. All the system options would be available regardless of the number of species recorded per sample.

### Use as a means of data exchange

The system is already in use as a means of data exchange by the Environment Agency, where it has been used as a mechanism to combine data from approximately 20 laboratories as part of the

National Monitoring Plan. The import routine accepted data as approximately 240 separate spreadsheet files and combined these into a single Unicorn database table with a standardised species list.

## 5.6 BioMar Viewer

**Bernard Picton, *The Ulster Museum***

The BioMar Viewer was conceived as a dissemination tool which could be used to publish the dataset created during the BioMar project. It was never intended as a database for entry of information, but as a container of (and interrogation tool for) a subset of data collected following the MNCR methods and stored in the MNCR Advanced Revelation database. The MNCR database was widely considered to be too complex and too hard to learn to use for individuals involved in coastal zone management and the BioMar Viewer was intended to address their needs.

Originally it was intended that a GIS would be used, with both vector and raster mapping to display points with survey information and provide access to this information from the points displayed on the maps or charts. Some progress towards this was made by the Natural Resources Development Centre (NRDC) staff based in Trinity College, Dublin. Changes in staff at NRDC, new advances in image compression, and a clearer picture of the possibilities for image and data storage on CD-ROM resulted in a change of direction towards a product which would contain images and text describing both species and biotopes, linked to a database containing the main data fields from the survey work. The design of the data structure was based on the MNCR database, but fully normalised so that it could be implemented in Microsoft Access with a front-end written in Microsoft Visual Basic.

CUNAV, a database programming company based in Dublin, implemented the basic design using a dataset exported from the MNCR database and incorporating a re-written version of Stuart Ball's Plot5 mapping routine to provide the mapping and selection of points as originally envisaged. Problems arose over the lack of support for JPEG compressed images in Visual Basic 4.0 and it was decided to take a novel approach to solve this difficulty. The rise of popularity of the World Wide Web and availability of Web browser controls which could be embedded into Visual Basic had suddenly opened up the possibility of creating an interface which used fully formatted text together with many hypertext links and hotspots on images to cross-link species and biotope information in a highly interactive way.

Images and text (largely derived from MCS mini-print guides written by the author) were incorporated to cover 350 of the species, mostly sessile invertebrates and Echinoderms. The text was input into fields in the *Marine Species Directory* database and printed to fully formatted Web pages via a custom output routine. This approach makes it possible to incorporate extra fields of information, headers, tables, standard layouts, standard links at the bottom of the pages and even complete redesign of the pages just by altering the output program, saving tedious editing of hundreds of files of HTML text.

During 1997 the MNCR Biotopes manual was completed by the MNCR team and incorporated into the Viewer by writing an output routine to produce the HTML files and hyperlinks directly from the MNCR database. Many bugs in the original code were removed both by Roger Telford (Informatics, Belfast) and the author. Recently, data linking the habitat records to biotopes has been incorporated, allowing mapping of biotopes and access to the appropriate biotope Web page from a labelled habitat record.

The resulting product has elements of an encyclopaedia and a self-teaching tool covering species, biotopes and their relationships. Data on sites, the habitats present at those sites, the biotope to which the habitat has been assigned, and the species present in those habitats are linked and displayed with details of the physical nature of those sites and habitats. The entire dataset is searchable by physical features, species, biotopes, site names, counties, and also sites selected from a site map. Maps of the resulting selection of sites can be plotted and further refined by selecting

subsets of sites and displaying details of those. Wherever a biotope name or species name is present this is hotlinked to the relevant text and photograph(s) describing these entities.

In the future it is hoped that the species information can be extended so that accounts are available for all species mentioned as characterising biotopes (756 species), species recorded by BioMar/MNCR (4500), and eventually all species in the *Marine Species Directory* (8896). Further fields of information could be added to these species accounts as envisaged in the *UK Marine Biology* proposal. A Great Britain version of the BioMar Viewer is another possibility, plus specialised uses for local areas or different audiences. It is hoped that the species accounts could also be used in any new data capture application such as 'New Recorder' and also in the development of identification software. Images to illustrate the diagnostic features of species could also be added. These could be line drawings, macro photographs, scanning electron microscope or light microscope images, as appropriate. The design itself could be adapted to produce similar software products to cover virtually any geo-referenced structured dataset, with different levels of text for different target audiences.

The BioMar project was part-funded by the EU Life fund and part-funded by JNCC. It was coordinated by Mark Costello at Trinity College, Dublin. Bernard Picton's work on the Viewer since January 1997 was supported by the Ulster Museum, Belfast.

## 5.7 Discussion of session

*Rapporteur: Dr Ian Tittley, The Natural History Museum*

**Unidentified Questioner:** Will New Recorder be tested with different sorts of data?

**Steve Wilkinson:** Yes, certain types of data are to be tested: the MNCR data will be used to test a model programme to make sure all the components match up. A general model will be tested using marine data but core data will have to be tailored to suit specific needs. A test/evaluation model will be created. New Recorder is already being tested on lowland pasture grassland data and if this successful it should also work using marine habitat data.

**Unidentified Questioner:** What will be done with the MNCR references?

**Eleanor Murray:** The spatial component (i.e. literature relating to particular areas) will be moved to the new repository first.

**Keith Hiscock:** Geo-referenced data will remain as a JNCC resource - with Key words. The country agencies hopefully will keep things up to date (through an external source or through the national marine library). The old MNCR database will be kept running until the new version is tested. Completed survey forms are still wanted.

**Jon Moore:** The *Marine Species Directory* is easily and cheaply available - will BioMar Viewer be cheaply available?

**Bernard Picton:** Yes, on CD-ROM and also as HTML Internet version. Hopefully it will be available in the next few months. The price has not been decided, but it may be that it will be cheaper for those who have purchased the printed version.

**Jan Light:** The *MMNWE* dataset is going to be produced on CD-ROM and will be made available to holders of the printed copy.

What about confidentiality of information?

**Nigel Grist:** Unicomarine refer to the commissioning clients for permission to release information and, so far, this has not been a problem.

**Ivor Rees:** Would clients be happy to release specific site information e.g. from under a rig, or would it be available only as a general/nominal reference station?

**Nigel Grist:** This sort of issue has not yet arisen.

**Keith Hiscock:** announced that JNCC are attempting to catalogue marine datasets for the UK. Participants were encouraged to complete the forms requesting details of any marine species record collections known to them.<sup>3</sup>

**Bob Earll:** pointed out that BioMar illustrates the way that things are moving and noted the ‘free-market’ versus the ‘controlled managed’ alternative; he was concerned about the stifling of innovation and also about the repetition of work.

**Bernard Picton:** BioMar Viewer was paid for by the EU and by JNCC, and should be widely available at a reasonable price.

**Robert Irving:** Is there any intention to include data in BioMar Viewer for other sites in the UK?

**Bernard Picton:** The ‘shell’ has now been developed which can accept any set of data, and pages could be prepared for local use containing local data.

**David Connor:** queried how much demand there was likely to be for local data.

**Keith Hiscock:** noted that BioMar Viewer can be applied at different levels and it is a powerful educational tool. It is one of the four ‘legs’ of *UK Marine Biology* and it requires further funding.

**Unidentified Questioner:** observed that BioMar Viewer is quick and easy to use, and that access to updated information was important. Would there be a problem with upgrading CD-ROMs? He felt that BioMar Viewer should be allowed to make as much money as possible.

**Stuart Ball:** suggested that upgrades of CDs could be supplied over the Internet and NBN plans to do this.

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<sup>3</sup> Those provided are given in Appendix 3.

## 6. Session: Working Group discussions

Participants each contributed to one of the four Working Group discussions, the summaries of which are detailed below.

### 6.1 Identifying computing and networking structures appropriate to the development of a national Marine Species Information System

Leader: **Chris Emblow**, *Ecological Consultancy Services Ltd.*

Rapporteur: **Bernard Picton**, *Ulster Museum*

#### Conclusions of the workshop

- There would need to be different levels of access built into any such system to cater for different types of users.
- The group accepted that Recorder would be likely to provide the best structure for such a system but felt that there was a need for input from marine specialists into the redesign of Recorder.
- It was felt that the common data structure would be most important, and the approach taken by the Recorder redesign team so far was correct. (European initiatives such as CDEFD and BIOCISE should be taken into consideration in case these introduced elements not considered.)
- Publicity for the rôle of the MBA and *UK Marine Biology* and a clarification of this would be appreciated by all.
- A common base-level data exchange format should be drawn up.
- There would be a need for an interactive and rapid update facility for notifying and incorporating changes in biotope and species dictionaries and this could best be achieved by a combination of a dedicated listserver group. It was suggested that a listserver, e.g. 'UKMarBiol', could possibly be hosted at Newcastle University's mailbase server and that a dedicated Web site could be created at the Marine Biological Association's Web server.
- There would be a need to build up the detail in these dictionaries, including images. The interactivity possible using the Internet should be used to facilitate this process.
- Literature databases should be combined rather than reconstructed and a need to identify literature databases already under construction was urgent. Databases such as the nudibranch literature database at Scripps and the Porifera database constructed at Endoume, Marseille, were two examples.
- The Taxon dictionary would be best distributed on CD-ROM with yearly updates by replacing the CD and intermediate name-change updates on the Website. Taxonomists should be encouraged to notify changes of nomenclature to the listserver.
- A common format and datum for storage of geo-references should be urgently agreed. The group suggested WGS84 datum and decimal degrees as the format, with algorithms for redisplay in any other format, including grid references.

### 6.2 Identifying the important 'fields' of information for assessing natural heritage

## **importance, sensitivity and functioning**

Leader: **David Connor**, *Joint Nature Conservation Committee*

Rapporteur: **Meriwether Wilson**, *The Scottish Association for Marine Science and Edinburgh University*

### **Purpose/Scope**

The overall task for this group was to discuss what generic ‘fields’ of information would be required, for both species and biotopes, for some form of encyclopaedia and/or dictionary. Such generic sources of information would provide essential background information to help interpret data collected by species recording schemes and be a significant contribution to aid management.

Three likely groups of users of fields of information were identified as:

- (i) marine species and/or biotope ‘recorders’ in the field;
- (ii) information management specialists preparing database applications for accessing the information; and
- (iii) researchers who consult the ‘encyclopaedia’ for information on selected biotopes and/or species.

### **Process**

Members of the group were asked to examine two documents:

- (i) ‘Some existing ideas: key information on marine species’ (Appendix 2a) and
  - (ii) ‘Some existing ideas: key information on marine biotopes’ (Appendix 2b)
- which had been prepared by Keith Hiscock as guidance for developing National Biodiversity Network and *UK Marine Biology* standards for recording species and biotopes.

The group considered the components of each sheet, discussing the relevance of the suggested fields, and the overall flow of information structure, and assessing the level of detail and ease of use.

Many of the comments applied to both species and biotope levels, with some specific comments on each. Therefore, this report presents the conclusions as:

- (i) general comments;
- (ii) species based on comments; and
- (iii) biotope specific comments.

### **General comments**

- In general, the documents produced by Keith Hiscock provide a useful and comprehensive basis for developing fields of information applicable to the user groups noted above. They would also be relevant to a wide range of recording methods, e.g. from casual observations during a seaside walk to highly structured surveys. For this to be possible the list of fields needs to accommodate such a range without being cumbersome.
- In each of the two documents the ‘Other information’ category was thought to contain too many fields for realistic recording, accessing and archiving. There needs to be both prioritisation and clustering of these fields of information. While there was not time in the workshop to rewrite/reorganise the documents, the group suggested that they should be divided into a series of distinct topics, adopting the same headers for both species and biotopes, e.g.
  - (i) Species/biotope (name, authority etc.);
  - (ii) Description/definition;
  - (iii) Illustrations (photographs/line drawings);
  - (iv) Distribution and status (geographical, decline status, non-native species);
  - (v) Ecology (including sensitivity);

- (vi) Protected status (legal, semi-legal);
  - (vii) Human influences (management, exploitation, vulnerability/threat).
- The group noted that the following needed to be incorporated into the ‘fields’ recording process:
    - (i) indications of scale as much as possible; and
    - (ii) confidence levels with respect to recorders, linking to a quality assurance process.
  - There is a need for the ‘species’ and ‘biotope’ documents to be linked by cross-referencing and ‘flagging’ of fields which are relevant to both.
  - There is a need for a glossary explaining terms such as ‘sensitivity’ and ‘vulnerability’.

**Comments on the ‘Species’ document**

- The group recognised that, while there is a lot of information known about relatively few marine species (e.g. up to 200-300 out of 6,000-8,000 approximately), there is very little known about most of the species. It was agreed that indicating a ‘lack of knowledge’ is important in both driving research and identifying gaps, but that ‘no information’ should not be used as a ‘green light’ for development that is contradictory to the ‘precautionary principle’, which is now widely endorsed.
- There needs to be some sort of species prioritisation in terms of themes such as functionality, and the degree to which species have been studied.
- There needs to be a system of indexing and/or scoring of species ‘sensitivity’, e.g. highly sensitive to insensitive, and this needs to be related to specific influences (i.e. a species may be highly sensitive to one influence but not sensitive to another).
- A field is required for the natural status of the species (related to Red Data Book categories to include indications of population stability, size and decline etc.).

**Comments on the ‘Biotopes’ document**

- The ‘biotope’ level of recording is important in terms of providing information on distribution and extent. The MNCR data provide a lot of relevant information on biotope location, but little on status, sensitivity and functioning, and these need to be taken into account.
- There need to be clear links with the ‘species’ fields of information document. One useful idea was to draw upon the species information on longevity to inform the indications of biotope stability, e.g.:

Species	Longevity
A	1-2 years
B	3-5 years
C	5-10 years

**Recording**

- The group discussed recording in general, including position referencing and the need for record ‘confidence’ indexing. It was suggested that recorders provide maximum information on methods used for identifying position, e.g. GPS, DGPS, Decca, Chart, OS map etc. It was felt that it is important to record position at start and end of observations.

- Less precise positioning would need to be accommodated for old records ( e.g. only a 2-figure grid reference) and the output from any database would use information appropriate to the scale being displayed.

### **6.3 Developing successful field recording schemes**

Leader: **Dr Stewart Evans**, *The Dove Marine Laboratory, Newcastle University*

Rapporteur: **Dr Julia Nunn**, *The CEDAR Project, Ulster Museum*

#### **Background note**

The original title in the programme was ‘Developing innovative recording schemes’. This was changed to ‘Developing successful recording schemes’

#### **Aims and objectives of recording schemes**

It was agreed that schemes should be suitable for a multiplicity of users and also be capable of receiving inputs from a range of different contributors. The overall aims and objectives of recording schemes include the following:

- Learning more about the biodiversity, biogeography and ecology of the marine environment.
- Providing a database against which change can be viewed.
- Providing information about anthropogenic (and other) impacts on the environment.
- Contributing to the understanding of marine ecological processes so that the environment can be managed effectively.
- Raising environmental awareness and promoting the public understanding of science.
- Highlighting areas of ignorance about the marine environment.
- Satisfying people’s curiosity and ‘spirit of discovery’ of the environment.

#### **Participants in recording schemes**

There is an enormously diverse range of individuals and groups who are currently involved in marine species recording schemes. They include:

- Professional scientists from universities, museums, research laboratories and institutes, NGOs, industry and environmental consultancy groups.
- Societies such as Porcupine, Conchological Society, Phychological Society, British Marine Life Society, Marine Conservation Society, RSPB, BOU, Marine Biological Association, Linnean Society etc.
- Wildlife Trusts.

#### **Problems with existing recording schemes**

- Lack of targeted financial resources, particularly for long term support.

- Lack of interested and sufficiently motivated individuals prepared to spend their own time recording.
- Lack of facilities (e.g. equipment, buildings, boats, publications) at all levels.
- Lack of experts to assist amateurs.
- Lack of co-ordination between and within schemes.
- Lack of available information about existing schemes.
- Lack of easily available taxonomic information.

A particular problem is the erosion of taxonomic expertise at professional and ‘amateur’ levels. There have been significant changes in the content and approach of school and university curriculum, to the detriment of the development of skills in taxonomy and systematics.

### **Solutions and recommendations**

#### (i) The needs of volunteer groups or individuals

Perhaps the most important need in establishing a group is to find a keen and committed coordinator.

#### (ii) Objectives of the scheme

These should be clearly stated, and not confused with too much information.

#### (iii) Training

In order to develop the potential of volunteers some training is normally necessary. The following should be considered: training days/workshops, using expert tutors. These should be affordable and given wide publicity. They should be pitched at appropriate levels.

#### (iv) Recording

Information packages are required covering the following:

- The *Marine Species Directory* on CD ROM/hard copy.
- Biotopes manual.
- Information on suitable databases and means to analyse data.
- Booklet on recording to include references to literature, ongoing schemes, societies, addresses, recording materials etc.
- Register of experts.

#### (v) Partnerships and recruitment

Partnership between volunteer and expert groups should be encouraged. Recruitment should be proactive. Attempts should be made to encourage the involvement of specialist groups, such as fishermen.

### **What should be recorded in the scheme?**

- Schemes can be focused at different levels on species, habitats, biotopes or geographic areas/regions.
- Careful consideration should be given to recording techniques/procedures at the onset. Attention should be given to, for example, intensity of collecting effort, negative information, methods of assessment of abundance etc.

- Voucher collections should be maintained, as preserved material and/or photographs.
- Collecting locations should be positioned to an appropriate level of precision, using agreed techniques.
- Agreed procedures should be adhered to.
- Quality control should be included in all schemes. There may be a need to validate volunteer records, levels of expertise of recorders etc.

### **Co-ordination**

- Ideally there should be national network of schemes linking them to one another at regional and local levels. This would enable emphasis to be placed on the needs to standardise schemes, avoid unnecessary duplication of effort between them, optimise use of resources and ensure that schemes have realistic and achievable objectives.
- There should be co-ordination between groups for field meetings.

### **Communication**

- There is a need for feedback to encourage and motivate recorders. Affordable forms of feedback include: an annual marine species recording meeting, recording newsletters, field meetings, conferences, individual correspondence, atlases, books, electronic media, internet, messages in bottles, telepathy, morse code, hand signals etc.
- Links should be formed with government and other recording networks, with feedback so that volunteers are aware of their inputs into decision-making processes.

### **Financial resources**

Financial considerations should not be over-emphasised for the fear of destroying the ‘curiosity ethos’ which drives so much voluntary effort. Nevertheless, funds are needed for (probably all) schemes involving the full spectrum from volunteers (especially those organising volunteer groups) to professional scientists.

It is recommended that we:

- Produce a list of potential sponsors/sources of money.
- Encourage grant-giving bodies to give higher priority to recording schemes.
- Encourage partnerships between recording bodies and funding bodies.
- Attract sponsorship for schemes/projects.
- Develop partnerships between groups seeking funding.

## **6.4 Quality Assurance - setting standards for information collection, collation, exchange and ownership**

Leader: **Dr Stuart Ball**, *Joint Nature Conservation Committee*

Rapporteur: **Eleanor Murray**, *Joint Nature Conservation Committee*

### **Terms and conditions - ownership and confidentiality of data**

- Conditions for Intellectual Property Rights and copyright on datasets must be agreed.
- The original source of data should always be acknowledged.
- There should be different levels of access for different users to protect confidential data.
- A standard agreement for the use of data should be made from the outset.
- At a dictionary level, access to sensitive biotope and species records should be protected.

### **Data standards - data structure, content and validation**

- There should be an agreed data standard of fields of entry and minimum content of each record.
- Dictionary items should be flagged to ensure verification of a record with doubtful identification.
- Different users/experts should be given different data entry rights (N.B. beware elitism).
- All records should be accepted initially, and then graded to indicate degree of confidence according to the following:

#### **(i) Identification acceptability codes**

All species in the Species Dictionary should be assigned to the following categories:

- 0 - Identification acceptable from anyone
- 1 - Identification acceptable from a competent recorder (e.g. a scheme recorder)
- 2 - Evidence of identification required (e.g. photograph, field notes etc.)
- 3 - Voucher specimen required to prove identification.

#### **(ii) Validity codes**

Once the record has been validated, it could then be graded as:

- 0 - Not validated - entry level for all records
- 1 - Having been through the validation process and there is no reason to doubt the identification
- 2 - Specimen or other evidence for a species identification has been checked by a relevant specialist.

### **Transfer standards - moving data from one system to another**

- Technical systems can verify the correct transfer procedure and file formats

### **Dictionary standards - constant resources**

- Dictionaries should be of an agreed standard.
- There should be a flexible, controlled system for updating the Dictionaries.

- Species and biotopes should be flagged with respect to, for example, sensitivity, rarity (and non-natives).
- Dictionaries should cover the widest geographic area likely to be required (e.g. north-east Atlantic).

#### **Catalogue standards - records of datasets**

- Dataset owners must maintain their own metadata (combined datasets).
- Catalogues should be of a pre-determined structure with respect to Keywording.

## **7. Final Session: Concluding comments**

by **Dr Bob Earll**, *Coastal Management for Sustainability*

A few words in summary to try and draw some conclusions from what we have discussed. How many of you would like the Biomar Viewer or something like it on your desk now? (Almost all the audience raised its hands). This seems to me the basis of the challenge we face. The organisation which makes such a system available to the marine biological community will have made the single greatest breakthrough in how we organise our knowledge and hence how we develop marine biological science this and the next century.

If we consider the future there are some things we might point to:

- We are on the verge of an electronic publishing explosion which will enable us to have at our finger tips a vast amount of marine biological knowledge, which can be linked together. It will be possible to link species encyclopaedias and distributions with biotope descriptions and a wide range of ecological and habitat information.
- *We will know what we know* and this will enable us to focus our efforts on what we genuinely do **not** know.
- There will be virtually unlimited use of *visual images* which will fundamentally transform the way we organise our knowledge. A species directory with encyclopaedic coverage and images to enable identification and understanding of behaviour and ecology and an image-based guide to coastal sites will all be available within a decade.
- This organisation of information will enable hypothesis-driven survey and recording to be carried out to verify our predictions - what we think we know.
- These changes and systems will involve **ALL** marine biologists in the UK and Europe. (This meeting represents perhaps only 1/20<sup>th</sup> of those who would want to buy and use such systems.)

In our work over the last two days there has been, for a variety of important reasons, an emphasis placed on the development of computer-based systems. We must not forget that the technical dimensions are simply tools for us to achieve our objectives and most of us are routinely concerned with those rather than the technology that makes this possible. Let us draw an analogy with the use of the car. We want to get in our car and drive from A to B – we are not particularly interested in the systems inside the car that enable us to do this. In endless discussion of systems it is easy to lose sight of what we are doing. Systems must be designed to be able to evolve and to effectively interact with the developing demands of users.

We are on the verge of a revolution in the way we are able to access and organise our marine biological knowledge and this will be technology-driven. However, we must also carefully consider the human dimension. The two dimensions, technical and human, must move together hand in hand. There is plenty of evidence of technically orientated projects which have left the

human dimension to chance, to one off ‘consultations’, or just plain ignored it and then ultimately paid a high price for not taking it into account. The human processes of communication and interaction have to be effectively *designed* into programmes. Both dimensions have to be developed to deliver what the marine biological community want and will use routinely.

We started with icons of happiness ☺ from the JNCC. What is it that one needs to do to get happiness from the marine biological community? Bill Gates and Microsoft have succeeded in their field, in contrast to the regulatory bureaucracies, because they have listened to their customers and, using the market, they have delivered innovative solutions that let people do *their* work more effectively.

The great and good and the organisers of grand designs can seek to control and regulate, but, as many have discovered in the modern world, to unleash the full potential of these systems a different set of words and values has come into currency. These include ownership by stakeholders, enabling, facilitating and helping. A lot of hard won evidence shows that if you get the human process right then you not only get massive added value, but also resources, encouragement and even enjoyment!

## 8. Acknowledgements

The editor would like to thank all those who participated in the workshop for their positive contributions, especially those who gave presentations and hence summaries for this report, and also those who chaired sessions and acted as rapporteurs. Particular thanks are given to Dr Keith Hiscock who masterminded the workshop, to Susan Davies for organising the funding and to Dr Stewart Evans and Dr Helen Fletcher whose support during the organising stages was greatly appreciated. The staff at Close House helped to make the workshop a congenial occasion. Dr Steve Wilkinson helped to produce the report as one of the JNCC report series.

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## Appendix 1. Workshop Programme



UNIVERSITY OF  
NEWCASTLE



Dove Marine Laboratory

### *Marine Species Recording Workshop*

*29<sup>th</sup> and 30<sup>th</sup> January 1998*

*Close House Mansion*

### PROGRAMME

#### Thursday 29<sup>th</sup> January

12.00-12.30 *Arrive at Close House*

12.30-1.30 *Buffet lunch*

1.30-2.40 **Welcome and Introductory Session**

Chair: *Dr Stewart Evans* - The Dove Marine Laboratory

1.40-1.50 **Aims of the Workshop**

*Dr Keith Hiscock* - Joint Nature Conservation Committee

1.50-2.20 **An Introduction to the National Biodiversity Network**

*Lawrence Way* - Joint Nature Conservation Committee

2.20-2.40 **Adding Value - UK Marine Biology**

*Dr Keith Hiscock* - Joint Nature Conservation Committee

- 2.40-3.40**      **'Historical' Marine Species Record Collections**  
 Chair : *Jon Moore* - CORDAH/OPRU  
 Rapporteur: *Ian Killeen* -The Porcupine Society
- 2.40- 2.55      **Marine Recording in North Wales:  
 An Example of Fluctuating Fashions and Fortunes**  
*Ivor Rees* - University of Wales Bangor
- 2.55- 3.10      **Marine Species Records Revival - The Cullercoats Experience**  
*Dr Judy Foster-Smith* - The Dove Marine Laboratory
- 3.10- 3.25      **Spots in the Sea**  
*Dale Rostron* - Independent Consultant
- 3.25-3.40      **Discussion**
- 3.40-4.00**      ***Refreshments***
- 4.00-5.30**      **Current Approaches to Marine Species Recording**  
 Chair : *Ivor Rees* - University of Wales Bangor  
 Rapporteur: *Dr John Baxter* - Scottish Natural Heritage
- 4.00-4.10      **Marine Species Records in Cornwall and the Isles of Scilly**  
*Pamela Tompsett* - Environmental Records Centre for Cornwall and the Isles of Scilly
- 4.10-4.20      **Marine Mollusc Recording: The Marine Census of the Conchological Society**  
*Jan Light* - The Conchological Society
- 4.20-4.30      **The Marine Algal Mapping Scheme**  
*Dr Gavin Hardy* - The Phycological Society
- 4.30-4.40      **Environmental Education: A Two-way Process  
 Communities as a valuable Resource for Marine Species Record Collection**  
*Dr Stewart Evans* - The Dove Marine Laboratory
- 4.40-4.50      **Sublittoral Habitat and Species Information collected from Seasearch Surveys**  
*Robert Irving* - Independent Consultant
- 4.50-5.00      **Porcupine: A Society of Marine Natural History and Recording**  
*Jon Moore* - CORDAH/OPRU
- 5.00-5.10      **A Voluntary Approach to Rocky Shore Monitoring**  
*Jenny Glanville* - Devon Wildlife Trust
- 5.10-5.30      **Discussion**

**5.30- 6.00      Introduction to Working Group Sessions**

Chair : *Dr Keith Hiscock* - Joint Nature Conservation Committee

**1. Identifying computing and networking structures most appropriate to the development of a national marine species information exchange system**

Leader : *Chris Emblow* - Ecological Consultancy Services Ltd.

Rapporteur : *Bernard Picton* - Ulster Museum

**2. Identifying the important 'fields' of information for assessing natural heritage importance, sensitivity and functioning**

Leader : *David Connor* - Joint Nature Conservation Committee

Rapporteur : *Meriwether Wilson* - Edinburgh University

**3. Developing innovative field recording schemes**

Leader : *Dr Stewart Evans* - The Dove Marine Laboratory

Rapporteur : *Dr Julia Nunn* - Ulster Museum

**4. Quality Assurance - setting standards for information collection, collation, exchange and ownership**

Leader : *Dr Stuart Ball* - Joint Nature Conservation Committee

Rapporteur : *Eleanor Murray* - Joint Nature Conservation Committee

**6.00-7.00      Opportunity for Working Groups to gather and discuss objectives**

**7.00pm      *Evening meal at Close House***

*(This will not be covered by the Workshop costs and will need to be paid for by individual participants and claimed back as appropriate.)*

**9.00pm      *Bus leaves Close House for the Hospitality Inn***

*(Arrive Hospitality Inn approximately 9.30pm where the bar will be open for continued discussion)*

**Friday 30<sup>th</sup> January**

- 8.30am        ***Bus leaves Hospitality Inn for Close House***
- 9.00-9.15     ***Assemble***
- 9.15-11.10   **Managing and Viewing Species Information**  
Chair : *Dr Stuart Ball* - Joint Nature Conservation Committee  
Rapporteur : *Dr Ian Tittley* - The Natural History Museum
- 9.15-9.30     **Recorder**  
*Dr Steve Wilkinson* - Joint Nature Conservation Committee
- 9.30-9.45     **The Plymouth Marine Fauna**  
*Alison Hood* - Marine Biological Association
- 9.45-10.00   **The MNCR Database**  
*Eleanor Murray* - Joint Nature Conservation Committee
- 10.00-10.15 **The Pros and Cons of Microsoft Access as a tool for Marine Species Recording**  
*Dr James Perrins* - ExeGesIS (Spatial Data Management Consultants)
- 10.15-10.30 **The Unicorn Database - An End to Mythical Beasts?**  
*Nigel Grist* - Unico Marine Ltd.
- 10.30-10.45 **BioMar Viewer**  
*Bernard Picton* - The Ulster Museum
- 10.45-11.10 **Discussion**
- 11.10-11.30 ***Refreshments***

11.30-1.30      **Working Group Discussions**

1. Identifying computing and networking structures most appropriate to the development of a national marine species information exchange system
2. Identifying the important 'fields' of information for assessing natural heritage importance, sensitivity and functioning
3. Developing innovative field recording schemes
4. Quality Assurance - setting standards for information collection, collation, exchange and ownership

1.30-2.30      ***Buffet lunch***

2.30-4.00      **Reporting back from Working Group Discussions  
and Final Discussion**

Chair : *Dr Keith Hiscock* - Joint Nature Conservation Committee

Rapporteur : *Dr Bob Earll* - Coastal Management Training and Sustainability

4.00 pm      ***Tea and Close***

*This Workshop has been commissioned by the Joint Nature Conservation Committee as a contribution to the National Biodiversity Network and has been organised by the Dove Marine Laboratory, part of the Department of Marine Sciences and Coastal Management, Newcastle University.*

## Appendix 2a. Paper on 'Key information on marine species'

### MARINE SPECIES RECORDING WORKSHOP

29-30 January 1998

### WORKING GROUP SESSION 2: *Identifying important 'fields' of information for assessing natural heritage importance, sensitivity and functioning*

#### Some existing ideas: 'Key information on marine species'

This list was prepared in March 1997. Since then, the National Biodiversity Network has started to develop standards for biological recording for marine species and the list below should influence that but eventually, the NBN format will be standard.

#### Key information on marine species would include:

##### 1. Information from the Species Directory (with added common names) compiled once:

<b>Phylum:</b> <b>Class:</b> <b>Family:</b> <b>Genus:</b> <b>Species &amp; authority:</b> <b>Subspecies / variety / form:</b> <b>Recent synonyms:</b> <b>Common name:</b>
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##### 2. Key identification features (prepared from keys & guides to consistent format):

<b>Key identification features:</b>
-------------------------------------

##### 3. Information to be entered for each distributional record:

<b>Location of record (OS grid reference or lat. long.) to best accuracy</b> - [distribution mapping will only accept at two levels: minimum 4-figure grid reference/0.1 minute lat. long. OR 2-figure grid reference / 1 minute lat.long.] <b>Date of record (when observed / collected)</b> <b>Source of record (name of recorder and/or name of survey):</b> <b>Habitat found in:</b> <b>Specimens:</b> [location and reference number]
--

##### 4. Other information (complete from initial review then opportunistically):

<b>Photographs:</b> [source and reference number] <b>Distribution of species worldwide:</b> <b>Habitat found in (general statement):</b> <table> <tr> <td>Physiographic</td> <td>Substratum</td> </tr> <tr> <td></td> <td>Wave exposure</td> </tr> <tr> <td></td> <td>Tidal stream strength</td> </tr> <tr> <td></td> <td>Height/Depth (as zone)</td> </tr> <tr> <td></td> <td>Salinity</td> </tr> <tr> <td></td> <td>Other</td> </tr> </table> <b>Description of habitat preferences:</b> <b>Origin (non-native species):</b> <b>Date of arrival in UK (non-native species):</b> <b>Sensitivity to:</b> <table> <tr> <td>physical disturbance</td> <td>[score 1-5 according to scale]</td> </tr> <tr> <td>oil pollution</td> <td></td> </tr> <tr> <td>chemical contaminants</td> <td></td> </tr> </table>	Physiographic	Substratum		Wave exposure		Tidal stream strength		Height/Depth (as zone)		Salinity		Other	physical disturbance	[score 1-5 according to scale]	oil pollution		chemical contaminants	
Physiographic	Substratum																	
	Wave exposure																	
	Tidal stream strength																	
	Height/Depth (as zone)																	
	Salinity																	
	Other																	
physical disturbance	[score 1-5 according to scale]																	
oil pollution																		
chemical contaminants																		

	<b>eutrophication</b>
	<b>other</b>
<b>Feeding type:</b>	
<b>Life-span:</b>	
<b>Reproduction:</b>	<b>Asexual (budding, splitting)</b>
	<b>Planktonic larva - long</b>
	<b>- short</b>
	<b>Benthic larva</b>
	<b>live-bearer - parental care</b>
	<b>- no parental care</b>
	<b>egg-layer-parental care</b>
	<b>- no parental care</b>
<b>Time of year reproduction occurs:</b>	
<b>Frequency of reproduction:</b>	
<b>Age at which sexual maturity reached:</b>	
<b>Growth rate:</b>	
<b>Fragility [Score 1-5]</b>	
<b>Key references:</b>	<b>taxonomy</b>
	<b>biology</b>
	<b>effects of human activities</b>
	<b>fluctuations</b>
	<b>cooking</b>
<b>Historical information (eg past losses/gains, changes in distribution)</b>	
<b>Parasite on/in:</b>	
<b>Symbiont on/in:</b>	
<b>Inquilinist on/in:</b>	
<b>Host for:</b>	
<b>Characteristic of which biotopes:</b>	
<b>Keystone species in which biotopes:</b>	
<b>Why keystone?:</b>	<b>- feeds on others (population control)</b>
	<b>- fed on by others (food chain link)</b>
	<b>- habitat for community</b>
<b>Applications / use - trade</b>	
	<b>- aquaculture</b>
	<b>- harvest</b>
	<b>- curiosity / charisma (tourism)</b>
<b>Protected status:</b>	<b>Berne</b>
	<b>CITES</b>
	<b>EC Habitats Directive</b>
	<b>GB Wildlife &amp; Countryside Act</b>
	<b>NI ? Act</b>
	<b>UK Biodiversity Action Plans</b>

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12 March 1997

## Appendix 2b. Paper on 'Key information on marine biotopes'

### MARINE SPECIES RECORDING WORKSHOP

29-30 January 1998

### WORKING GROUP SESSION 2: *Identifying important 'fields' of information for assessing natural heritage importance, sensitivity and functioning*

Some existing ideas: Key information on marine biotopes would include:

#### 1. Information from the MNCR Biotopes classification compiled once:

Code:
Name:
Habitat classification:
Description:
Regional variation:
Similar biotopes:
UK distribution:
Characterising species and typical abundance:

#### 2. Other information (complete from initial review then opportunistically):

Species richness (examples from different areas):	
Ecological requirements: (Excluding substratum)	Light Depth range/zone Inclination (rock) Tidal stream velocity Wave exposure Temperature (max. min.) Salinity Siltation Turbidity
Ecological relationships (eg as nursery):	
Keystone (structuring) species in biotope (including for monitoring)	
Surrogate species (indicators of change in the whole biotope) for monitoring - improvement decline	
Sensitivity to: (name species on which based)	physical disturbance (name event or activity) oil pollution (smothering or chemical?) chemical contaminants (name contaminants) eutrophication siltation other
Degree of known temporal change:	
Historical information (eg past losses/gains, changes in distribution):	
Management measures required to maintain the biotope:	
Time to reach stable community and age of community:	
Key references:	biology effects of human activities fluctuations
Species only or mainly found in this biotope:	
Applications / use	- trade - aquaculture - harvest - curiosity / charisma (tourism)
Gaps in knowledge:	
Protected status:	EC Habitats Directive
UK Biodiversity Action Plans?:	
Photographs: [source and reference number]	
Other illustrations: [reference to publication]	

Keith Hiscock. 12 June 1997

