EMODnet Biology

Species attributes workshop – Oostende, Thursday 13 December 2012

1. Participants

1	Ward Appeltans	(UNESCO-IODE)
2	Nicolas Bailly	(Worldfish Center, through Webex)
3	Geoff Boxshall	(Natural History Museum)
4	Simon Claus	(Flanders Marine Institute)
5	Mark Costello	(University of Auckland)
6	Wim Decock	(Flanders Marine Institute)
7	Stefanie Dekeyzer	(Flanders Marine Institute)
8	Sarah Faulwetter	(Hellenic Centre for Marine Research)
9	Janine Felden	(University of Bremen)
10	Dennis Gordon	(National Institute of Water and Atmospheric Research)
11	Adrian Glover	(Natural History Museum, through Webex)
12	Tjess Hernandez	(Flanders Marine Institute)
13	Tammy Horton	(University of Southampton)
14	Mary Kennedy	(Bedford Institute of Oceanografy)
15	Andreas Kroh	(Naturhistorisches Museum Wien)
16	Abigail McQuatters-Gollop	(SAHFOS, through Webex)
17	Sabine Stöhr	(Swedish Museum of Natural History)
18	Ana Trias Verbeeck	(Flanders Marine Institute)
19	Harvey Tyler-Walters	(Marine Biological Association)
20	Leen Vandepitte	(Flanders Marine Institute)

2. Background

The importance to describe species patterns and the underlying processes explaining these patterns is essential to indicate the status and future evolution of marine ecosystems. However, this requires biological information on functional and structural species attributes (feeding ecology, reproduction, behaviour, life history, etc.). That information is currently very difficult to obtain, is often scattered, and is limited to a particular region or taxon group. The lack of an integrated, standardized system serving this biological information hampers therefore large-scale functional analysis of the status of marine ecosystems. This observation has been made within the framework of the EMODnet biological data products workshop, and therefore EMODnet Biology starts up a process to collect and integrate this biological trait information for European marine species. As this information is typically assigned at the species level, it was proposed to use the ERMS/WoRMS marine species register as the taxonomic backbone to store the attribute information. Other critical attribute information identified during the EMODnet data product workshop, is the protection status species have in several legal frameworks, if they are invasive,

harmful (HAB), or if a species is a specific indicator species for OSPAR, the bird and/or the habitat EU-directives.

3. Presentations

a. Introduction: EMODnet Biology (Simon Claus, VLIZ)

http://bio.emodnet.eu/documents/Workshops/Attributes-workshop/Introduction-EMODnet-and-EMODnet-workshops-%28S.-Claus%29/

Currently, three EMODnet Biological Data workshops have been organized:

- the EMODnet Data Products workshop (Oostende, February 2010),
- the EMODnet Data Analysis workshop (Crete, October 2011),
- the EMODnet Attributes workshop (Oostende, December 2012; this report).

The objectives of the **EMODnet Data Products workshop** (February 2010) were (1) to define a set of derived data products relevant for private bodies, public authorities and researchers, (2) to discuss the marine biological (monitoring) data availability in Europe and to identify gaps, and (3) to present a prototype portal to the wide(r) community of European biological experts and capture feedback. During the workshop several topics and questions were discussed: the indices that indicate the status and the future evolution (further degradation/improvement) of marine ecosystems in Europe; how to assist in managing the future of the sea; the use of current databases, monitoring programs and scientific knowledge. It was concluded that the following data is needed to address these questions:

- Species trait information: functional (e.g. trophic role), structural (e.g. reef-forming), tolerance (e.g. temp. range), body size, diet, feeding method, reproduction timing, fecundity, dispersal, longevity
- Special attention for biological structural elements (e.g. Reefs, biogenic habitats)
- Species presence, abundance, biomass data *at different scales*
- Environmental data *at different (matching) scales*: physical, biogeochemical

Furthermore, it was noted that special attention should be given to those species and communities (habitats) that are protected by EU Directives and international conventions, and those that are used as indicators or have specific 'legal' status. The final outcome of the workshop was that species should be categorized using specific attributes, i.e. their trophic level, the habitat in which they occur, their life history, if they are invasive, if they are a HAB species, if they are specific indicator species for OSPAR, the bird or habitat directive. Furthermore, the European/World marine species register (ERMS/WoRMS) should be used as the taxonomic backbone for the attributes.

During the **EMODnet Data Analysis workshop** (October 2011), four scientific working groups (Presence data, Biogeographic areas, Invasive species, and Species distributions) were established to discuss the uniqueness of an integrated database, the production of useful products for science and policy, and the options to improve and enlarge the currently existing database.

The objectives of the **EMODnet Attributes workshop** (December 2012) are:

1. To give an overview of the existing attribute information systems and assess the feasibility of a **standardized vocabulary** and how to implement.
2. To present existing information in WoRMS and identify **gaps.**
3. To make a **priority list** of most appropriate attributes and traits, based on importance, feasibility and resources (sources of information, time and experts).
4. To work out a **data grant system** and identify projects for funding.

b. Extensive gaps and biases in our knowledge of a well-known fauna: implications for integrating biological traits into macroecology (Tom Webb, University of Sheffield – via podcast)
http://bio.emodnet.eu/documents/Workshops/Attributes-workshop/webb-emodnet-traits2---Broadband/

The paper presented by Tom Webb reflects the (lack of) knowledge we actually have about the basic biology of marine fauna. The gaps can be filled by studying the species (basic natural history), by statistical interpolation and/or by fully exploiting the existing knowledge (stored in libraries etc.). This case study explored the possibilities of the third strategy. Despite the limitations of the study, it is clear that there is little basic research in natural history (mostly because funding is limited), and that statistical approaches to detect and fill the information gaps are possible but not always satisfying.

During the presentation it was noted that much of the actual information we "have" is also assumed, extrapolated and reproduced from sometimes doubtful sources, without actual studies or evidence of it. E.g.: how does the sea mouse feed? We should be careful in assuming that the more we know on distributions and biogeography, the more we know in biology. Populations may differ from one location to another.

c. The Biological Traits Information Catalogue (BIOTIC): objectives, the data content and the classification system to store trait information (dr. Harvey Tyler-Walters, MBA)
http://bio.emodnet.eu/documents/Workshops/Attributes-workshop/BIOTIC-%28Harvey-Tyler-Walters%29/

The use of information on biological traits is increasing as ecosystems are more and more studied based on functional groups rather than individual species. Unfortunately this information is spread through the literature (including old and grey literature). During this presentation the importance of fully referenced traits was emphasized. Furthermore it was discussed that both coded and non-coded data is needed, and that peer review of the content is preferable but difficult to organize.

d. Distinguishing marine habitat classification concepts for ecological data: different classifications to describe biological attribute information (Mark Costello, University of Auckland)
http://bio.emodnet.eu/documents/Workshops/Attributes-workshop/Classifying-nature-beyond-taxonomy-%28M-Costello%29/

Currently several ways of classifying nature are in use: taxonomic and phylogenetic, spatial and temporal, biological, and ecological. The biological classification is based on: longevity (maximum, average), body size (length, weight), diet, feeding method, habit - growth form, mobility, dispersal, reproduction (method, age maturity, fecundity, recruitment) and life stages. Candidate standards in biological classification are FishBase , MarLIN's BIOTIC, etc. During this presentation it was shown that different users have different needs and wishes for classification systems, different concepts of habitat exist, and classification systems are dependent on different perspectives, sampling methods and concepts. It was concluded that (1) Existing habitat classifications can be used for data exchange and management, (2) Some can be presented as maps overlaid on point data, others are linked to individual data records, (3) Different concepts need to be dealt with separately, and (4) There is no need to force hierarchies! Let user select 'layers'.

The following outlook was proposed:

- Review marine species traits in use
- Define traits by expanding WoRMS glossary (publish online)
- Design framework for matching attributes (traits) to species in WoRMS ----- publish?
- Have drop-down menu of traits
- Match to higher taxa and correct for exceptions
- Track source of information (e.g. textbook, expert name)
- Conduct analysis of patterns found ----- publish?

e. What do deep-sea animals do? A new functional trait classification for deep-sea fauna (Adrian Glover, Natural History Museum)
http://bio.emodnet.eu/documents/Workshops/Attributes-workshop/What-do-deep-sea-animals-do--A-new-functional-trait-classification-for-deep-sea-fauna-%28A.-Glover%29/

While trying to establish a standardized trait classification for deep-sea fauna, several problems were encountered. Problem 1: Different types of traits are measured in different taxa, with different methods, and called different names. Solution 1: Workshops: Agreement on which traits are equivalent, agreement on a standardized trait vocabulary. Problem 2: Taxonomic level: Traits are more accurate in lower taxonomic levels, but lower levels are less useful in meta-analyses. Solution 2: Variable taxonomic level: Traits are consistent at different taxonomic levels in different groups, so flexibility is key. Currently, the trait vocabulary for deep-sea fauna consists of 10 trait groups, 25 trait categories and 64 traits (an overview was shown during the presentation). As of 3 December 2012, 1877 taxa are coded: Nematoda and Polychaeta (genus level), Mollusca and Echinodermata (family level) and Foraminifera (species level). The coding of the Crustacea and other phyla is still in progress.

f. Traits database for Polychaeta (Sarah Faulwetter, HCMR)

The traits database for Polychaeta is based on a coding system and color system. Problems still exist with misidentifications and species complexes (not able to discern which type of the complex the information is related to). The importance to have ALL traits referenced (with citation if possible) was stressed again. A web based system is available at http://traits.marbigen.org/

g. **Overview attribute information stored in WoRMS (Leen Vandepitte, VLIZ)** http://bio.emodnet.eu/documents/Workshops/Attributes-workshop/Overview-attributes-information-%28L.-Vandepitte%29/

The species attributes currently available in WoRMS consist of:

- Environment (marine – brackish – fresh – terrestrial) (combinations are possible)
- Fossil range (recent only – fossil only – fossil and recent) (planned: addition of actual fossil range)
- Feeding types (pick list with 24 options)
- Host – parasite relationships (note: why parasite only as a feeding type –may not feed on host-?)
- Functional groups (benthos/plankton) (in progress, 30 left to determine)
- Legal status (provided through PESI)
- Alien species (information through different sources)
- Special collections in WoRMS (attributes as WoRMS context) (e.g.: DeepSea)
- Type notes (It is estimated that >30000 notes contain potential information on attributes.)

4. Discussion

During the discussion section of the workshop, it was aimed to address five main topics/questions:

1. Which existing information is available in WoRMS and what are the **gaps**
2. Make **priority list** of most appropriate attributes and traits, based on importance, feasibility and resources (sources of information, time and experts).
3. Towards a proposed **standardized vocabulary/classification** and how to implement – technical implementation?
4. How to link info from WoRMS and existing trait information sources (BIOTIC/FishBase)
5. Work out a **data grant system** and identify projects for funding

However, this outline was not strictly followed. Below, an overview of the different discussion topics can be found.

- During the presentations, several trait classification systems were shown/discussed: Tyler *et al.* classification, BIOTIC classification, Costello *et al.* classifications, proposal VLIZ classification, deep sea traits, Polychaeta traits and FishBase traits. Although all classification systems show some commonalities, each system focuses on a specific taxonomic group/area/etc., has its own coding system, and faces its own problems and gaps of missing information. Especially the issue of **coding** has been a recurrent topic during the discussion.

- During the discussion it was agreed we need to establish **a common trait vocabulary/classification system** by defining the different traits and their importance, and by setting the rules of how to use

them. But, how to do so? Do we adopt one of the existing classifications? Or do we create a new one, specific for WoRMS? Therefore we need to compare these existing classification systems and try to integrate them. To come to one standardized trait classification it was suggested we should construct one big framework which allows, theoretically, all of the available information on traits and attributes to be integrated/added.

- To fill the gaps in trait information in WoRMS we should analyze why users want/need certain attributes, and we need to define priorities. The following traits are believed to be the most important/common ones: **environment/habitat, habit/body form and body size**. Instead of focusing on one or a few traits, we could also focus on certain taxonomic groups (since certain traits may not be relevant for all groups).

- It was suggested that we need traits that help us define other traits that are needed. One strategy could be to **start with some basic traits (the defined priority traits) applying to all groups**. This could lead to more accurate divisions, depending on each taxonomic group and its characteristics. In this way we can work in a hierarchical fashion. For instance, if we start by entering the information on the species being benthos or plankton, this can lead to more detailed trait information, e.g. is the species macro/meio/etc. Another example is **the life stage trait**. To overcome the problem of species with both planktonic and benthic life stages, we could enter the information for the adult stage as default and then the taxonomic editors can provide us with a list of valid substages for a specific taxonomic group.

- It was further noted that the **trait information is often stored at different taxonomic levels**. Therefore it should be possible to group at different taxonomic levels. When traits are entered in WoRMS for higher taxa, by default the child taxa are assigned the same trait information. Off course exceptions are editable within the child taxa.

- It was mentioned that the environmental information in WoRMS needs to be cleaned up. Most of this information is unchecked. By default, it is assumed that a taxon is marine, unless the editor indicates otherwise. We need to check with the taxonomic editors to complete the missing information.

- Another trait that was discussed in detail was habitat. It was suggested to base the **habitat vocabulary on EUNIS**, a classification which is generally excepted. Several elements from EUNIS could be adapted as possible attributes. Or do we also need additional information, and do we need to include endangered environments, e.g. reefs? As EUNIS combines different characteristics (bathymetry, substrate…) to describe one specific habitat, it might be more appropriate to **assign the different habitat characteristics individually at species level**. For example depth (numerical values) and depth zone (description) should become attributes.

- Another recurrent topic during both the presentations and the discussion is that it is imperative that every **trait/attribute has a source**. However, original sources often are hard to find. Therefore, expert opinion is also highly valued.

- During the discussion the question was asked how we can involve the taxonomic editors into the process of constructing one standardized trait vocabulary/classification. Do we need to assign

specific attribute editors (i.e. a whole new category of editors, i.e. ecological editors)? It was agreed that at least a botanist is needed.

Other suggestions during the discussion:

- Another attribute could be to indicate which species are calcareous. This is highly interesting for ocean acidification research and pH studies.
- Invasive terms should go into GE-BICH
- We should let geographical registers know what we are doing, so they can import information for their region.
- Could there be an attribute for cold-temperate-warm water species? This information could be derived from SCAR-MarBIN.
- The WoRMS website should get a separate attributes webpage
- OBIS could be checked for relevant information

5. Conslusion

A set of priorities was identified to work on in the near future:

We should distinguish between important traits, from a data management point of view, and other trait information. In order to have a common framework for adding trait information, we need to have an overall classification system that can be used within WoRMS. But before reaching this point, we can already start working on adding trait information, important from a data management point of view.

1. **Important traits, from a data management point of view, which we can start completing within WoRMS** are:
    - Benthos-plankton-size (life stage dependent)
    - Marine-fresh
    - Depth

2. We will make **an overall classification of life history traits** to be implemented in WoRMS
    - High level classification provisional trait list, based on identified sources (February 2013) → that will be input for a common standard first-match existing system, that should be published as a synthesis paper (also proposed for EMODnet 2 biology project).
        - o Life stage vocabulary (different taxonomic editors)
        - o Body size (feasible…)
        - o Habitat parameters

3. EMODnet can find a **few demonstration projects** by taxonomic editors.
    - These projects should be based on broad category classification. The WoRMS steering committee/WoRMS editors can propose possible demonstration projects. The total funding available for these projects is around 80,000 Euros

4. Legal attributes, management attributes, as required by EMODnet can be added by the WoRMS data management team, by consulting the available legal sources. the existing database on invasive species can be uploaded into WoRMS.

Rapporteurs: Simon Claus, Stefanie Dekeyzer, Ana Trias Verbeeck