Trendylyzer: a Long-Term Trend Analysis on Biogeographic Data

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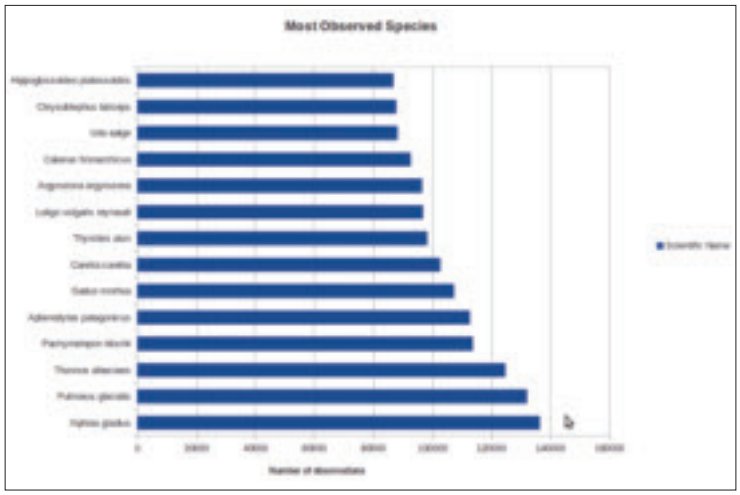

Fig. 1 - Number of records for the 15 most observed species in OBIS.

The United Nations General Assembly (A/RES/63/111)[1] expressed its serious concern over the current and projected adverse effects of climate change, pollution, overfishing and habitat destruction on the marine environment and marine biodiversity. As a result, the UN established a Regular Process for Global Reporting and Assessment of the State of the Marine Environment Including Socioeconomic Aspects, and will publish its 1st World Ocean Assessment in 2014[2]. An entire section will be devoted to the status of marine biodiversity. A basic metric of biodiversity is species composition. High species diversity is essential for maintaining ecosystem functioning and could be regarded as one of the most important indicators on ocean's health. Unfortunately, assessing the global status of marine species is difficult because historical data and accurate long-term time series on species occurences are scarce. One third to two thirds of marine species are yet undiscovered[3], and those species that are described are often known from a single observation or are so rare that a scientific basis to make a meaningful assessment of their status is lacking.

The Ocean Biogeographic Information System[4] (OBIS) is an important source of information on marine species diversity. OBIS is world's largest global online open-access database on the diversity, distribution and abundance of all marine life and can provide an important baseline, against which future change can be measured. OBIS is one of the most used resources in marine science and has been involved also in ecological modelling[5] as well as in marine monitoring systems[6]. OBIS is the data legacy of the decade-long Census of Marine Life, a US$ 650 million foundation-led project that gathered data from 2,700 scientists and 540 expeditions,

and now operates under UNESCO's Intergovernmental Oceanographic Commision as part of its International Oceanographic Data and Informatoin Exchange (IODE) programme. OBIS has continued to grow and has established a network of hundreds of data providers around the globe. In total, it now integrates 1,130 datasets and holds 35 million observations of 120,000 marine species.

In this paper we present Trendylyzer, a new marine species trend analysis tool using data from OBIS. The aim of Trendylyzer is to provide indicators for use in marine biodiversity assessments. Trendylyzer is a tool developed within the D4Science e-Infrastructure[7] (currently co-funded by the EU iMarine project[8]).

This is a Hybrid Data Infrastructure that aims at supporting large-scale resource sharing (both hardware and software) and allows data to be processed with distributed computing. Data can also be enriched with data coming from multiple sources, which are accessible through the e-Infrastructure. Furthermore, the e-Infrastructure allows for the creation of Virtual Research Environments (VREs), which are fully equipped web-based cooperation environments. Trendylyzer will allow users to access the data through the e-Infrastructure, specify filters and groupings, select a statistical analysis model, adjust the algorithm parameters (if any), and monitor the progress. The results will be represented in a variety of formats and the selection of data, algorithms and results will be summarised in a report.

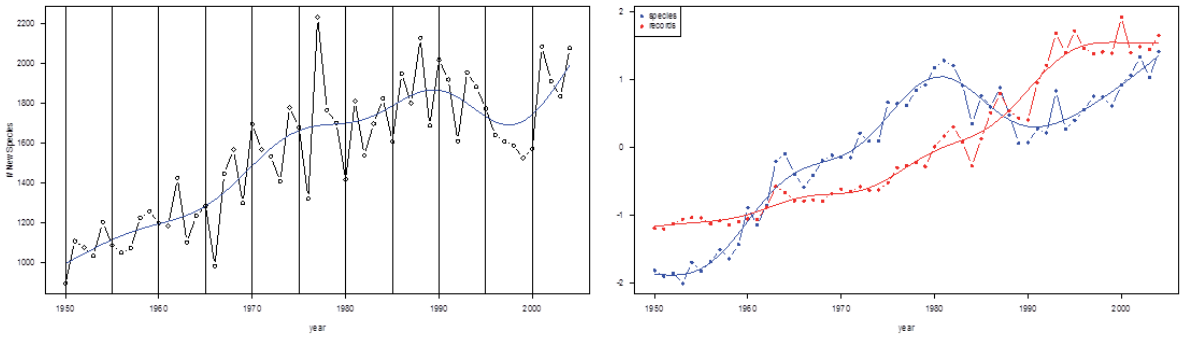

Fig. 2 - Number of new species reported in OBIS per year (left)
and number of globally reported species (blue line) and occurrence records (red line) per year (right).

Trendylyzer will aim to answer questions such as:

1. Which are the most common marine species globally or by region and has this been changing through time?

2. What are the current species gaps and how fast is this gap been filled with records of new species in OBIS?

3. Do threatened or endangered species (based on the IUCN red list) occur in one or more Marine Protected Areas (MPAs) and do the MPAs occur in the center or in the outer limits of the species population range?

One of the challenges will be to define « common species » and to take into account sampling effort. Fig. 1 ranks the most observed species in OBIS. The list was produced by counting the observations for each species. We merged the records that reported the same values for longitude,

latitude, depth, collector and recording time to filter out potential duplicates. Fig. 2 shows the number of new species recorded in OBIS per year (left) and the global trend of the number of species (blue line) and observations (red line) per year (right). Interestingly, the number of records increases steadily, until it begins to level off around 1990 and the number of species declines through the 1980s, but then increases subsequently.

A trend graph like the global number of species observed in each year is obviously biased by the occurrence of rare species, but also by new species recorded in the database. Hence, a better approach to discover shifts in biodiversity is to look at the pool of most common species. The presented charts constitute preliminary analysis and future work will concentrate on more complex analysis involving (i) a study of the trends per year for the most observed species, (ii) interactive visualization facilities to fit data with proper representation metaphors, (iii) representations of new species reports per geographical area and taxonomic group, and (iv) species status investigation based on IUCN indications for MPAs. Trendylyzer is going to be released as an interactive web application on the i-Marine project portal in a specific VRE, which will allow users to produce charts and automatic reports and to share them with the i-Marine community of practice.

References

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