



GBIF

www.gbif.org

...free and open access to biodiversity data

Using GBIF to forecast climate change impacts on marine resources

Case studies

The three case studies, using data derived from the GBIF and OBIS networks, rely on AquaMaps¹ (www.aquamaps.org), a model-based system for generating large-scale distribution maps based on the known occurrences of organisms in relation to key environmental variables such as temperature, depth and salinity. In addition to present day distribution maps derived from known occurrence data, predicted distributions for 2050 have also been generated using climate forecasts. A general shift towards the Poles is apparent. This finding is supported by a recent study², also based on AquaMaps sources, which investigated the probable distribution of 1066 exploited marine fish and invertebrate species in response to climate change and concluded that there are likely to be local extinctions in the tropics, sub-polar regions and partially-enclosed seas with a concomitant invasion of Arctic seas. In general, a shift polewards of 45-59 km per decade is predicted.

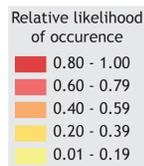
While the Internet provides access to ever increasing volumes of biodiversity-related information, access to species-occurrence data is often lacking or data are made available in formats that hamper database interoperability in support of analyses such as species' response to climate change. To overcome such barriers, the Global Biodiversity Information Facility (GBIF) has developed an informatics infrastructure to enable discovery and access to biodiversity data. Scientists, while retaining ownership and custodianship, can publish their specimen and observation databases online through the GBIF network, thereby joining a growing, distributed, global network of shared biodiversity data. Currently, more than 276 million species-occurrence records are accessible online from over 336 publishers, demonstrating the feasibility of linking data-holding institutions and individuals at national, regional and thematic level. However, much more is needed to create the capacity to observe, monitor and model global environmental and social change.

Global Warming

Global warming is projected to have significant impacts on marine resources through rising sea temperatures and ocean acidification. If change is gradual, some biota may be able to adapt. Rapid climate change, however, will diminish marine productivity in many countries, with significant socio-economic impacts where dependency on marine resources exist. Using species distribution analyses and ecological niche modelling, we present three case studies demonstrating potential changes in marine biota, based, particularly, on temperature changes. These studies can help inform policy on conservation and fisheries management, e.g., the selection of sites for marine reserves, and illustrate the urgent need to contribute to global initiatives such as GBIF that enable the sharing of information about biodiversity resources thereby facilitating such analyses and informing climate-adaptation policies.

¹ Kaschner, K., J. S. Ready, E. Agbayani, J. Rius, K. Kesner-Reyes, P. D. Eastwood, A. B. South, S. O. Kullander, T. Rees, C. H. Close, R. Watson, D. Pauly, and R. Froese. 2008 AquaMaps: Predicted range maps for aquatic species. World wide web electronic publication, www.aquamaps.org, Version 10/2008.

² William W.L. Cheung, Vicky W.Y. Lam, Jorge L. Sarmiento, Kelly Kearney, Reg Watson, Daniel Pauly. Projecting global marine biodiversity impacts under climate change scenarios. Fish and Fisheries, Feb 2009, pp 1467-2960. <http://dx.doi.org/10.1111/j.1467-2979.2008.00315.x>



Example 1: Atlantic cod, *Gadus morhua*, a commercially important species

The Atlantic cod, *Gadus morhua*, is a highly commercial and highly vulnerable species. As sea temperatures warm, cod will be driven northwards towards the Pole, disappearing from much of the North Atlantic.



Gadus morhua

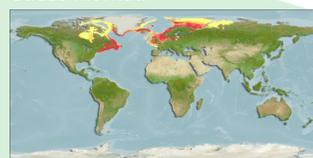


Fig. 1. Present day distribution

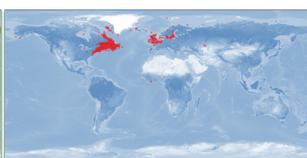


Fig. 2. Point occurrence data (sources: GBIF and OBIS)

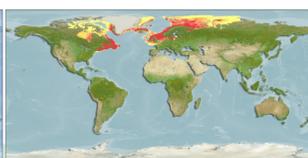


Fig. 3. Predicted distribution in 2050

Example 2: Narrow-barred Spanish mackerel, *Scomberomorus commerson*, an invasive species

S. commerson, an Indo-Pacific species, is already colonising the eastern Mediterranean by way of the Suez canal. By 2050, it is predicted to spread further westwards in the Mediterranean.



Scomberomorus commerson



Fig. 1. Present day distribution



Fig. 2. Point occurrence data (sources: GBIF and OBIS)



Fig. 3. Predicted distribution in 2050

Example 3: Whale shark, *Rhincodon typus*, a widely distributed commercial species vulnerable to overfishing

The Whale shark, *Rhincodon typus*, is a pelagic-oceanic, migratory shark species. The prediction for 2050 indicates a contraction of much of its range.



Rhincodon typus

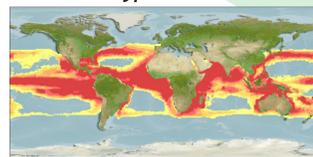


Fig. 1. Present day distribution



Fig. 2. Point occurrence data (sources: GBIF and OBIS)

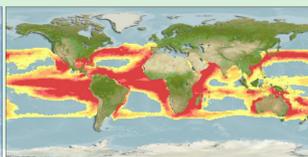


Fig. 3. Predicted distribution in 2050

(Disclaimer: certain of these maps have yet to be fully verified by experts.)

About GBIF

GBIF makes digital biodiversity data openly and freely available on the Internet for everyone, and endorses both open source software and open data access.

<http://www.gbif.org>

GBIF provides scientific biodiversity data for decision-making, research endeavours and public use.

<http://data.gbif.org>

GBIF is a network of data publishers who retain ownership and control of the data they share. Linked datasets provide a more robust representation of biodiversity than any single dataset.

GBIF provides access to primary biodiversity data held in institutions in developed and developing countries. Data shared through GBIF are repatriated data.

GBIF is a dynamic, growing partnership of countries, organisations, institutions and individuals working together to mobilise scientific biodiversity data.

GBIF invites you to download species occurrence data freely and openly from <http://data.gbif.org>

GBIF invites you to join the GBIF network and share your biodiversity data, as well as participate in developing new tools and services.

GBIF is supporting the formation of the Group on Earth Observations Biodiversity Observation Network (GEO BON)³ to monitor the status and trends of the world's biological resources by enabling multidisciplinary investigations such as the climate change impact results reported here.

³ <http://www.earthobservations.org/geobon.shtml>

