

Scientists uncover global distribution of marine biodiversity

New study suggests primary role of ocean temperature in the distribution of marine biodiversity, documents significant overlap between areas of high human impact and diversity hotspots.

In an unprecedented effort that will be published online on the 28th of July by the international journal *Nature*, a team of scientists mapped and analyzed global biodiversity patterns for over 11,000 marine species ranging from tiny zooplankton to sharks and whales. The researchers found striking similarities among the distribution patterns, with temperature strongly linked to biodiversity for all thirteen groups studied. These results imply that future changes in ocean temperature, such as those due to climate change, may greatly affect the distribution of life in the sea. The scientists also found a high overlap between areas of high human impact and hotspots of marine diversity.

Much research has been conducted on diversity patterns on land, but our knowledge of the distribution of marine life has been more limited. This has changed through the decade-long efforts of the Census of Marine Life, upon which the current paper builds. The authors synthesized global diversity patterns for major species groups including corals, fishes, whales, seals, sharks, mangroves, seagrasses, and zooplankton. In the process, the global diversity of all coastal fish species has been mapped for the first time.

The researchers were interested in whether there are consistent "biodiversity hotspots" - areas of especially high numbers of species for many different types of marine organisms simultaneously. They found that the distribution of marine life showed two fundamental patterns: coastal species such as corals and coastal fishes tended to peak in diversity around Southeast Asia, whereas open-ocean creatures such as tunas and

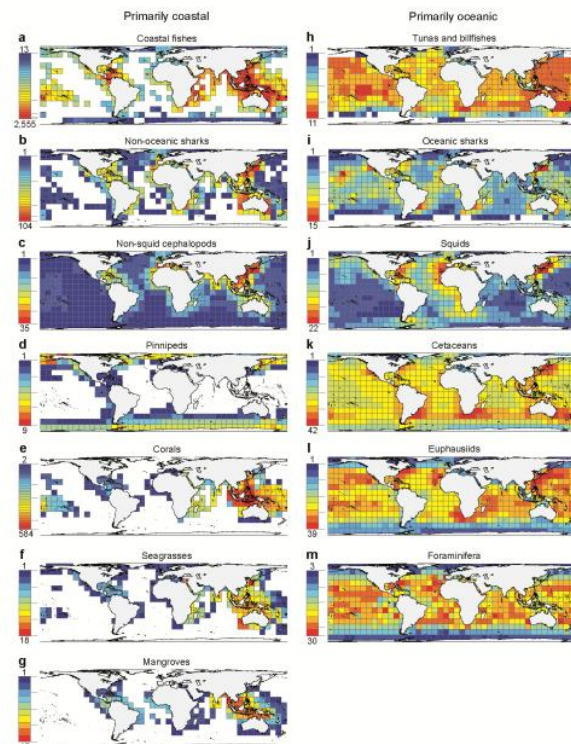


Figure 1: Global patterns of diversity for thirteen taxa, divided into primarily oceanic and primarily coastal species. Red indicates areas of high richness.

whales showed much broader hotspots across the mid-latitude oceans.

The scientists also tested whether these global patterns could be consistently explained by one or more environmental factors. Temperature was the only factor found to be linked with the distribution of all species groups, with the availability of habitat also playing a role.

Says lead author Derek Tittensor of Dalhousie University, “it was striking how consistently temperature was linked with marine diversity. This relationship suggests that ocean warming, such as that due to climate change, may rearrange the distribution of oceanic life.” Co-author Walter Jetz of Yale University notes “while we are increasingly aware of global gradients in diversity and their associated environmental factors, our knowledge of patterns in the ocean has lagged behind that of patterns on land. Our study attempts to help overcome this disparity.”

The study also assessed the overlap between hotspots of marine diversity and human impacts, i.e. the combined effects of fishing, habitat alteration, climate change and pollution. Human impacts were found to be particularly concentrated in areas of high diversity, suggesting the potential for severe species losses in these regions. Says co-author Camilo Mora of Dalhousie University, “the combined effects of exploitation, habitat alteration, pollution and climate change are threatening the diversity of life in the global ocean. Our research provides further evidence that limiting ocean warming and other human impacts will be particularly important in securing these hotspots of marine biodiversity into the future.”

Co-author Boris Worm of Dalhousie University also highlights the need to maintain biodiversity in the face of these impacts: “biodiversity and the functioning of ecosystems are often tightly coupled, with highly diverse ecosystems providing more goods and services that benefit human beings, as well as being more resilient in the face of disturbance, than less diverse ecosystems. The observed concentration of human impacts in our richest marine areas is a worrying indication of our growing footprint in the oceans.”

Many of the data used for this study come from the Ocean Biogeographic Information System (OBIS, <http://www.iobis.org>), a public database created by the Census of Marine Life. Says Edward Vanden Berghe of Rutgers University, co-author of the paper and executive director of OBIS: “with OBIS we’ve created a framework for sharing and re-using data, which makes this type of global, all-encompassing science possible.”

Please contact Charles Crosby at charles.crosby@dal.ca or +1 902-494-1269 for additional information (photos, maps, and external contacts) or visit www.fmap.ca/pressmaterial.php after embargo has lifted.

Contact info for authors:

Derek Tittensor (Lead author, English language)

Biology Department, Dalhousie University
Halifax, Nova Scotia, **Canada**, B3H 4J1
Office: +1 902 494 7720
Fax: +1 902 494 3736
Email: derekt@mathstat.dal.ca

Camilo Mora (English and Spanish)

Biology Department, Dalhousie University
Halifax, Nova Scotia, **Canada**, B3H 4J1
Office: +1 902 494 7720
Fax: + 1 902 494 3736
Email: cmora@dal.ca

Walter Jetz (English and German)

Department of Ecology and Evolutionary Biology, Yale University
New Haven, CT, **USA**, 06520-8106
Office: +1 203 432 7540
Fax: +1 203 432 5176
Email: walter.jetz@yale.edu

Heike Lotze (English and German)

Biology Department, Dalhousie University
PRESENTLY AT: Potsdam Institute for Climate Research, Potsdam, **Germany**
Office: +49 331 288 2699
Fax: +49 331 288 2620
Email: hlotze@dal.ca

Daniel Ricard (English and French)

Biology Department, Dalhousie University
Halifax, Nova Scotia, **Canada**, B3H 4J1
Office: 1 902 494 2146
Fax: 1 902 494 3736
Email: ricardd@mathstat.dal.ca

Edward Vanden Berghe (English, Dutch and French)

Ocean Biogeographic Information System
Rutgers University Institute of Marine and Coastal Sciences
71 Dudley Road, New Brunswick, NJ, **USA** 08901
Office: +1 732 932 6555 ext 565
Email: evberghe@iobis.org

Boris Worm (English and German)

Biology Department, Dalhousie University
PRESENTLY AT: Potsdam Institute for Climate Research, Potsdam, **Germany**
Office: +49 331 288 2521
Fax: +49 331 288 2620
Email: bworm@dal.ca