Q-MARE working group

Konstantina Agiadi[1], B.A. Caswell[2], M. Bas[3], P. Holm[4] and
J.A. Lueders-Dumont[5]

Climate and human activities altered marine ecosystems for thousands of years before industrialization, changing the structure and dynamics of marine communities, and the distribution, ecology, and physiology of marine organisms (e.g. Jackson 2001; Engelhard et al. 2016). However, disentangling these impacts from those of natural climate variability (Kowalewski et al. 2015; Agiadi et al. 2018), remains a challenge. Pre-industrial baselines are, therefore, necessary to understand the true magnitude and rate of change induced by modern anthropogenic activities, including climate change.

Q-MARE (pastglobalchanges.org/q-mare) brings together scientists from vastly different disciplines, including historians, archaeologists, paleontologists, and ecologists, to explore the impacts of climate and human activities on the environment during the pre-industrial era. Time series from scientific monitoring postdate the industrial revolution. Therefore, our working group relies on a variety of tools for reconstructing patterns of biodiversity loss and ecosystem resilience. Moreover, we aim to provide guidelines for the integration of multidisciplinary observation data and proxy-based reconstructions with dynamic ecosystem models.

Scientific goals and objectives

How did climate and human activities affect marine ecosystems in the pre-industrial Holocene and the Pleistocene? Fossil and death assemblages provide data on both exploited and unexploited species. However, these archives have been a largely untapped resource for disentangling the relative contributions of climate and human activities on biota. Disproportionate changes in abundance and/or disappearances of exploited species reflect human impacts (Dillon et al. 2021), whereas climatic changes show effects across species (Albano et al. 2021). Such selective changes are visible in the stratigraphic record and can be interpreted along with paleoclimatic, archaeological, and historical records.

When did humans start having a significant impact on the marine environment? Historical, archaeological, and sedimentary records will be combined to construct a database that will then be used to identify some of the first human impacts and their causes. In addition, pivotal studies on the importance of quantifying ecological baselines will be revisited, considering new knowledge on the timing of the first human settlements and medium-to-large-scale marine resource exploitation in different regions, and their possible impacts on the natural environment (Engelhard et al. 2016; Holm et al. 2022).

How can data from different sources be combined to inform environmental conservation targets and model marine ecosystems? We aim to provide clear solutions to the methodological issues and guidelines for accessing, processing, and analyzing data derived from different sources (paleontological, archaeological, and historical) and integrating them into dynamic ecosystem models, such as dynamic food-web models, for disentangling human and climate impacts.

Visit the Q-MARE website at pastglobalchanges.org/q-mare and sign up to our mailing list to receive news and updates on our activities.

Upcoming activities

The first Q-MARE meeting was held 17–19 January 2022 online (pastglobalchanges.org/calendar/128791). Our next events will be a workshop on "Quaternary marine ecosystems" (December 2022) and a group meeting in early 2023 (both online), an in-person stakeholder engagement meeting in late 2023, and a training workshop in 2024.

AFFILIATIONS
[1]Department of Palaeontology, University of Vienna, Austria
[2]Department of Geography, Geology, and Environment, University of Hull, UK
[3]Forestal Catalana, Generalitat de Catalunya, Spain
[4]Trinity Centre for Environmental Humanities, Trinity College Dublin, Ireland
[5]Department of Geosciences, Princeton University, USA and Smithsonian Tropical Research Institute, Panama

CONTACT
Konstantina Agiadi: q.mare.wg@gmail.com

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Figure 1: Raking for Holocene shells in the Bahamas (photo credit: Tobias Grun, University of Florida).