

2023 Annual SCOR Working Group Report

1. Name of group

SCOR WG157 MetaZooGene: Toward a new global view of marine zooplankton biodiversity based on DNA metabarcoding and reference DNA sequence databases

2. Activities since previous report to SCOR (e.g., virtual or in-person meetings, email discussions, special sessions). Limit 1000 words

Virtual Meetings for Creation of MetaZooGene Barcode Atlas & Database:

Planning and cooperation among WG157 members was carried out through email, virtual meetings, and an online collaboration space, with topic-related folders for sharing files and preparing documents and manuscripts.

MetaZooGene Symposium @ ICES 2022 Annual Science Conference

SCOR WG157 sponsored a symposium, *New insights into biodiversity, biogeography, ecology, and evolution of marine zooplankton based on molecular approaches*, in association with the ICES Annual Science Conference (Hybrid; Dublin, Ireland; September 23, 2022). Convenors were Ann Bucklin (USA), Katja Peijnenburg (NL), Leocadio Blanco-Bercial (BM), and Silke Laakmann (DE). The program included 26 presentations, of which 14 were by Early Career Scientists (ECS) and 16 included WG157 members as co-authors (see: <https://metazoogene.org/symposium2022>).

SCOR 2022 SCOR Exceptional Scholar

SCOR WG157 member, Mary Mar N. Payne (University of the Philippines) was hosted by SCOR WG157 member, Junya Hirai (University of Tokyo, Japan) for a collaborative research visit during March 24 – April 15, 2023. Support was provided by the SCOR 2022 SCOR Exceptional Scholar Program. Results from the project, *Preliminary assessment of zooplankton biodiversity in Batan and Tangalan Bays (Aklan, Philippines) using DNA metabarcoding*, are being prepared for publication.

Zooplankton Metabarcoding Initiatives in South Africa and Western Indian Ocean Region

SCOR WG157 member Jenny Huggett convened and participated in meetings (both in-person and virtual) during 2023 to discuss implementation of DNA metabarcoding as a routine method for monitoring the marine environment in South Africa (see Huggett et al. 2022). At the *Western Indian Ocean Marine Science Symposium* (Gqeberha, South Africa; October 2022), collaborative meetings with UN Ocean Decade representatives sought to develop metabarcoding capacity throughout the Western Indian Ocean region.

UN Ocean Decade Action Collaborative Meetings

SCOR WG157 members and colleagues serve as representatives for the MetaZooGene UNOD Action (No. 102.2) and have attended numerous meetings with UNOD partner programs and projects, including regularly-scheduled, special-topic, and strategic meetings. Meetings during the previous year included:

1) Marine Life 2030 (ML2030)

- July 29, 2022: Affiliated Project Meetings (virtual); MZG Rep: Ann Bucklin
- September 6, 2022: Affiliated Project Meetings (virtual); MZG Rep: Ann Bucklin
- October 13, 2022: Affiliated Project Meeting (virtual); MZG Rep: Leocadio Blanco-Bercial
- June 7, 2023: Quarterly Meeting (virtual); MZG Rep: Ann Bucklin

2) *Ocean Biomolecular Observing Network (OBON)*

- September 27-29, 2022: Face-to-Face (Plymouth, UK); MZG Rep: Pennie Lindeque

3) *World Register of Marine Species (WoRMS)*

- October 18, 2022: Collaborative opportunities; MZG Reps: Leocadio Blanco-Bercial, Todd O'Brien

4) *Ocean Decade Collaborative Center for the Northeast Pacific (DCC-NEP)*

- November 3, 2022: Collaboration with Smithsonian National Museum of Natural History (virtual); MZG Reps: Jennifer Questel, Todd O'Brien

- April 11, 2023: DNA barcode databases for North Pacific Zooplankton (virtual); MZG Rep: Jennifer Questel (UAF)

3. Documents published since previous report to SCOR (e.g., peer-reviewed journal articles, reports, Web pages) and should be limited to publications that resulted directly from WG activities and which acknowledge SCOR support

Huggett, J.A., Groeneveld, J.C., Singh, S.P., Willows-Munro, S., Govender, A., Cedras, R., et al. (2022) Metabarcoding of zooplankton to derive indicators of pelagic ecosystem status. *South African J Science* 118: 12977. <https://doi.org/10.17159/sajs.2022/12977>

O'Brien, T.D., L. Blanco-Bercial, P.G. Batta-Lona, J.M. Questel, A. Bucklin (Accepted for publication, March 30, 2023) DNA barcode reference databases: MetaZooGene Atlas and Database. *Protocols for DNA Barcoding, Methods in Molecular Biology* (Springer Nature)

MetaZooGene Atlas and Database Web page: <https://metazoogene.org/mzgdb/>. The MZGdb web portal provides access to both a reference database and a barcode atlas, and now includes zooplankton, benthic invertebrates, fish, marine mammals, and phytoplankton (aka microbes and protists). The molecular content now includes mitochondrial COI, 12S, 16S; and nuclear 18S and 28S. The web portal is designed to fulfill deliverables WG157 ToR 1 (see below).

4. Progress toward achieving group's terms of reference. List each term of reference separately and describe progress on each one. Limit 1000 words

ToR 1) Create an open-access web portal for DNA barcodes for marine zooplankton

The MetaZooGene Atlas and Database (MZGdb; <https://metazoogene.org/mzgdb/>) includes DNA sequences for cytochrome oxidase I (COI) for 19,350 (31%) of the total 62,393 recognized marine invertebrate species. The MZGdb creator, WG157 member Todd O'Brien (NOAA Fisheries) designed the database, which also includes multiple gene regions used as barcodes for marine organisms across the Tree of Life: planktonic and benthic animals; fish, sharks and rays; protists and microbes (phytoplankton, bacteria, protozoa); mammals (whales, dolphins, seals, walruses, otters, polar bears); birds (penguins, petrels, shore birds); and reptiles (sea turtles and sea snakes). Observation records from the OBIS and COPEPOD databases, barcoding coverage, and summary statistics are generated for taxonomic groups and ocean regions. The MZGdb is a unique and valuable resource for biodiversity researchers and fisheries managers, allowing targeted searches and providing coverage statistics that guide priorities for efforts toward a complete reference database for marine organisms.

ToR 2) Design an optimal DNA barcoding pipeline for marine zooplankton

Deliverables for this ToR (2) have focused on a key aspect of the DNA barcoding pipeline: improving reliability and accuracy of taxonomic classification and species identification, with the specific goal of

encouraging use of the MetaZooGene Atlas and Database (MZGdb). Several WG157 members, including Todd O'Brien, Leocadio Blanco Bercial and Ann Bucklin served as co-authors for an invited chapter (accepted for publication on March 30, 2023) in a forthcoming book, *Protocols for DNA Barcoding*, in the series, *Methods in Molecular Biology* (Springer Nature). The target audience for the book chapter includes researchers, managers, museum curators, and students focused on diverse topics requiring accurate identification of marine species based on DNA barcodes.

ToR 3) Develop best practices for DNA metabarcoding of marine zooplankton biodiversity

WG157 members are carrying out a global-scale inter-calibration experiment for testing impacts of using different molecular and analytical protocols for DNA metabarcoding of zooplankton diversity. A set of reference samples was generated by and distributed among 10 research groups led by participating WG157 members. Statistical analysis and bioinformatics of the resulting DNA sequence data are underway. The study is designed to evaluate the consequences of using different molecular, bioinformatics, and statistics protocols and parameters for metabarcoding analysis and evaluate the impacts and significance for the results and conclusions about the biodiversity of marine zooplankton.

5. WG activities planned for the coming year. Limit 500 words

Inter-calibration Experiment for Metabarcoding Zooplankton Diversity

This effort will fulfill goals and deliverables associated with ToR 3 (see above). Bioinformatics and statistical analysis of DNA sequence data are in progress. Preparation of a manuscript for publication in the scientific peer-reviewed literature is planned for Fall 2023, with submission for publication by early 2024.

International Conference Workshop (March, 2024)

SCOR WG157 members led a successful proposal for a workshop at the ICES-PICES 7th Zooplankton Production Symposium, to be held in Hobart (Tasmania) during March 17-24, 2024. The workshop titled, *Reference sequence databases for global zooplankton biodiversity: Optimization, applications and user guidelines*, will be convened by WG157 members Silke Laakman, Todd O'Brien, and Jenny Huggett, and a MetaZooGene collaborator, Leonie Suter.

Support for Early Career Scientists

Early Career participants will continue to be invited and actively encouraged to participate in all WG157 activities, including meetings, special sessions at conferences, and publications. These efforts have been very successful in ensuring significant numbers of ECS colleagues at conferences, special sessions, and symposia. Special attention to active participation of ECS will be expanded whenever and however possible.

Continued Progress on Deliverables

Progress on Terms of Reference and Deliverables will continue online and via web resources, including project-specific virtual "Work-Areas" for WG157 members.

6. Is the group having difficulties expected in achieving terms of reference or meeting original time schedule? If so, why, and what is being done to address the difficulties Limit 200 words

Work toward SCOR WG157 goals, as defined by terms of reference and deliverables, is continuing successfully as WG157 begins a fifth year. Activities requiring international travel and in-person collaboration were cancelled in Spring 2020 and the primary focus shifted to online and virtual activities. In-person gatherings resumed in 2022, with an international MetaZooGene Symposium focused on Early Career Scientists. Many WG157 activities continue to be carried out virtually due to funding limitations. A special online Work-Area with project-specific folders for MetaZooGene documents and data has ensured that all WG157 members have access to shared files.

7. Any special comments or requests to SCOR. Limit 100 words.

N/A

Additional information can be submitted and will be included in the background book for the SCOR meeting at the discretion of the SCOR Executive Committee Reporter for the WG and the SCOR Secretariat.