



SCOR WG157

MetaZooGene



2024 Annual Meeting SCOR WG157

Institute for Marine and Antarctic Studies (IMAS)
 University of Tasmania (Hobart, Tasmania, AUS)
 March 20, 2024



UNIVERSITY of
TASMANIA



17-22 March, 2024
 Hobart, Tasmania
 AUSTRALIA | #ZPS7

7th International Zooplankton Production Symposium
 ICES - PICES #ZPS7 (17-22 March 2024; Hobart, AUS)



SCOR WG157

MetaZooGene



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



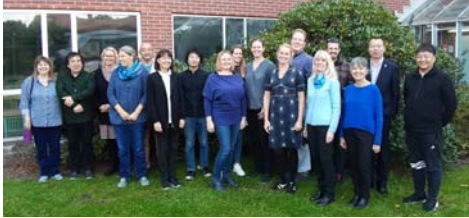
Hauling in the MOGNES (P.H. Wiebe, WHOI)

metazoogene.org/ and scor-int.org/group/157



SCOR WG157

MetaZooGene



2019 – WG157 Meeting @ Global Biodiversity Centre
(Gothenburg, Sweden)



2020 - WG157 Meeting @ Ocean Sciences, San Diego (USA)

WG157 Members:

- 23 members from 19 countries
- Welcome to Leonie Suter (AUS) & Iole DiCapua (IT)

Primary focus:

~8,000 species of holozooplankton (15 phyla, 32 classes) of animals that drift with ocean currents

Primary goal:

Integrative molecular – morphological taxonomic analysis of marine zooplankton biodiversity throughout global ocean



SCOR WG157

MetaZooGene



Terms of Reference

- 1) Create open-access web portal for DNA barcodes
- 2) Design an optimal DNA barcoding pipeline
- 3) Develop best practices for DNA metabarcoding of biodiversity

Deliverables

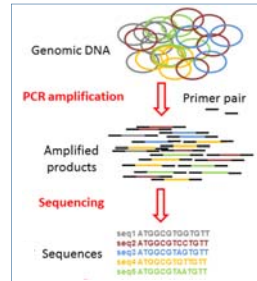
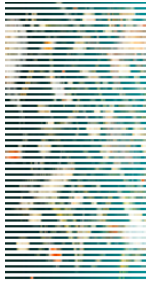
- Project website, web portal, and database
- Best practices for DNA barcoding and metabarcoding
- Publications in peer-reviewed journals
- Review papers

Capacity Building

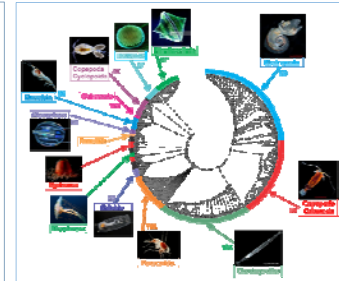
- Early career colleagues invited to WG157 activities & meetings
- Workshops addressing key themes of WG157 mission



DNA Metabarcoding Marine Zooplankton: Multi-gene Analysis of Biodiversity



Corell and Rodríguez-Ezpeleta (2014)



Bucklin et al. (2019)

- Extraction of genomic DNA from environmental samples
- High-throughput DNA sequencing
- PCR of short gene regions (mtCOI, mt16S, nuclear 18S rRNA, others)
- Bioinformatics pipelines for sequence QC and analysis
- Statistical analysis of biodiversity

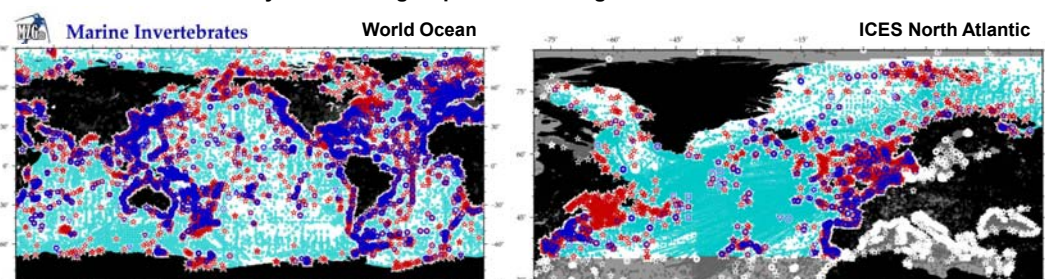


MetaZooGene Atlas & Database (MZGdb)

Todd O'Brien, NOAA Fisheries (USA)



- COI sequences: >20,400 marine invertebrate species
 - ~30% of 66,800 species recognized by COPEPOD/OBIS
- Additional coverage:
 - Multi-gene regions used for metabarcoding: mt12S, mt16S, 18S & 28S rRNA
 - Microbes to mammals: zooplankton, phytoplankton, fish & more
- Data from NCBI GenBank & BOLD checked for errors
- Searchable by taxonomic group and ocean region



Observation locations in OBIS/Copepod (light blue dots), barcode-sampling-locations for COI (red stars), 12S (blue triangles), 16S (blue inverted triangles), 18S (blue circles), 28S (blue squares). See <http://metazooGene.org/atlas> and <https://wgimt.net/molecular/atlas>

SCOR WGI
MetaZooGene



ICES Working Group on Integrated
Morphological & Molecular Taxonomy
wgimt.net



Toward a Global Reference Database of COI Barcodes for Marine Zooplankton

Marine Biology (2021) <https://doi.org/10.1007/s00227-021-03887-y>



Ann Bucklin, Todd D. O'Brien & MetaZooGene (SCOR WG157) members



- Introduces *MetaZooGene Barcode Atlas and Database*
 - MZGdb, <https://metazoogene.org/MZGdb>
- Acknowledges: MetaZooGene (SCOR WG157) and ICES WGIMT

Photos by R.R. Hopcroft and C. Clarke (UAF) and L.P. Madin (WHOI); see <http://www.cmarz.org/galleries.html>



MZGdb Instructions & Guidance for Users
Springer Protocols (2024)

Todd O'Brien, Leocadio Blanco-Bercial, Jennifer Questel, Paola Batta-Lona, Ann Bucklin
(2024) *Protocols for DNA Barcoding, Methods in Molecular Biology* (Springer Nature)



MZGdb Atlas & Summaries by Group

MZGdb Taxa Summary Tables

MZGdb Data Downloads



See: <https://metazoogene.org/mzqdb/>



SCOR WG157

MetaZooGene



ICES Journal of
Marine Science



Patterns of Biodiversity of Marine Zooplankton Based on Molecular Analysis
Special issue on biodiversity of marine zooplankton based on novel molecular approaches.

Manuscript deadline: **October 30, 2020**

- Howard I. Browman, ICES JMS Editor-in-Chief

- Ann Bucklin*, Katja Peijnenburg*, Ksenia Kosobokova*, Ryuji Machida*, Themed Set motivators

MetaZooGene Publications from 2020



Silke Laakmann*, Leocadio Blanco-Bercial*, Astrid Cornils* (2020) *The crossover from microscopy to genes in marine diversity – from species to assemblages in marine pelagic copepods*. Philos. Trans. Roy. Soc. B. Doi:10.1098/rstb.2019.0446.



Katja Peijnenburg*, Arie Janssen, Deborah Wall-Palmer, Erica Goetze*, Amy Maas, Jonathan Todd, Ferdinand Marlétaz (2020) *The origin and diversification of pteropods precede past perturbations in the Earth's carbon cycle*. Proc. Natl. Acad. Sci. Doi: 10.1073/pnas.1920918117.



Junya Hirai*, Aiko Tachibana, Atsushi Tsuda (2020) *Large-scale metabarcoding analysis of epipelagic and mesopelagic copepods in the Pacific*. PLoS ONE



2023 Publications by WG157 Members

*SCOR Acknowledged (Total=13); ++ECS authors (Total=37)



Partial List from Annual Report to SCOR (June, 2023)

- ++Choo, L.Q., Spagliardi, G., Malinsky, M., Choquet, M., Goetze, E., Hoarau, G., Peijnenburg, K.T.C.A. (2023) *Genome-wide phylogeography reveals cryptic speciation in the circumglobal planktonic calcifier *Limacina bulimoides**. Molec. Ecol. 32: 3200–3219. <https://doi.org/10.1111/mec.16931>
- ++Hirai, J., Katakura, S., Nagai, S. (2023) *Comparisons of genetic population structures of copepods *Pseudocalanus* spp. in the Okhotsk Sea: the first record of *P. acuspes* in coastal waters off Japan*. Mar. Biodivers. 53: 12. <https://doi.org/10.1007/s12526-022-01323-y>
- ++Watanabe T, Hirai J, et al. (2023) *Improving taxonomic classification of marine zooplankton by molecular approach: registration of taxonomically verified 18S and 28S rRNA gene sequences*. PeerJ 11:e15427. <https://doi.org/10.7717/peerj.15427>
- Huys, R., Savchenko, A.S., Kosobokova K.N. (2023) *Discovery of a new species and host record of *Holophryxus* Richardson, 1905 (Isopoda: Dajidae) from the central Arctic: a model of enhanced descriptive standards for epicaridean isopods*. Zool. J. Linnean Soc. 198: 592–649. <https://doi.org/10.1093/zoolinnean/zlac105>
- ++*Bucklin, A., Questel, J.M., Batta-Lona, P.G. et al. (2023) *Population genetic diversity and structure of the euphausiids *Thysanoessa inermis* and *T. raschii* in the Arctic Ocean: inferences from COI barcodes*. Mar. Biodivers. 53: 70. <https://doi.org/10.1007/s12526-023-01371-y>
- ++Beckmann, L.M., Soto-Angel, J.J., Hosia, A., Martell, L. (2023) *Odd family reunion: DNA barcoding reveals unexpected relationship between three hydrozoan species*. PeerJ 11:e15118 <https://doi.org/10.7717/peerj.15118>
- ++Di Capua, I., Piredda, R., D'Angiolo, R., Minucci, C., Montalbano, A., Boero, F., Carotenuto, Y., Uttieri, M. (2023) *Is integrated taxonomy useful to study diversity and ecology? An example from crustacean zooplankton at the Long-Term ecological research site MareChiara (LTER-MC)*. Mar. Ecol. 44: e12752. <https://doi.org/10.1111/maec.12752>



SCOR WG157

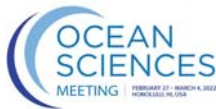
MetaZooGene



Conference Sessions Led by WG157 Members

ASLO 2021 AQUATIC SCIENCES MEETING ASLO ASM (Virtual, 22-27 June 2021)

Name that species: Toward a New Global View of Marine Zooplankton Biodiversity
Co-Chairs: Silke Laakmann, Ann Bucklin, Katja Peijnenburg, Leocadio Blanco-Bercial



OSM (Hybrid & Virtual, 27 Feb - 4 Mar 2022, Hawaii, USA)

Zooplankton diversity through space and time (ME20)
Co-Chairs: Katja Peijnenburg, Erica Goetze, Galice Hoarau, Matthew Miller



ICES ASC (September 10, 2022, Dublin, Ireland)

MetaZooGene Early Career Symposium
Following 2021 WG157 meeting (in-person?)



MetaZooGene ECS Symposium

New Insights into Biodiversity, Biogeography, Ecology and Evolution of Marine Zooplankton Based on Molecular Approaches

Convenors: Ann Bucklin (University of Connecticut, USA); Katja Peijnenburg (Naturalis Biodiversity Center, NL); Leocadio Blanco-Bercial (Bermuda Institute of Ocean Sciences, BM); Silke Laakmann (University of Oldenburg, DE)



Symposium in-person participants, including 11 Early Career Scientists. Presenters & participants also joined virtually.

Sponsor: Scientific Committee for Ocean Research (SCOR); MetaZooGene Working Group (SCOR WG157)
MetaZooGene Symposium associated with ICES 2022 Annual Science Conference
Aviva Stadium, Dublin, Ireland - September 23, 2022
<https://metazoogene.org/symposium2022>

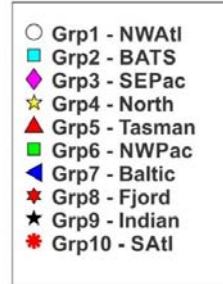
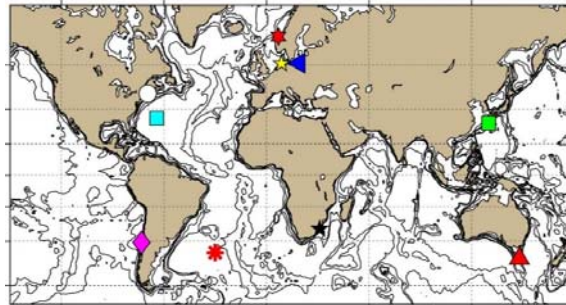




MetaZooGene Intercalibration Experiment (MZG-ICE)
 Global Exchange of Zooplankton Samples
 Leo Blanco-Bercial & Rocio Rodriguez Perez (BATS, ASU)
 Bioinformatics & Statistics Leads



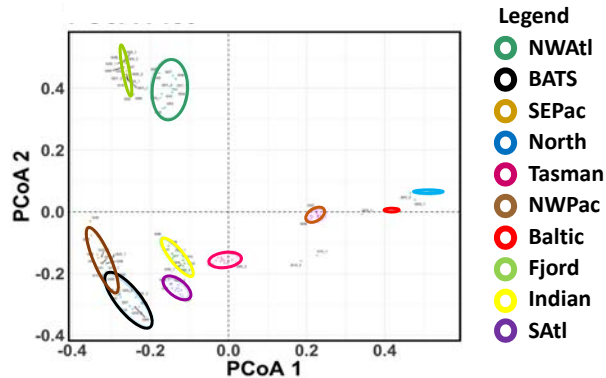
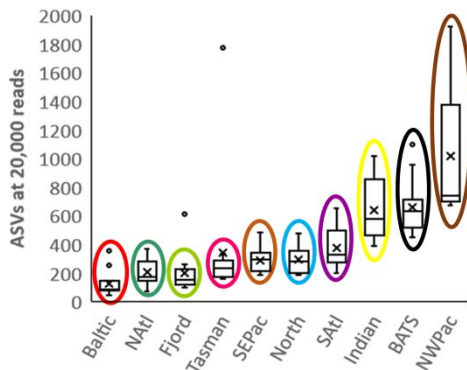
- 10 WG157 teams extracted & shared DNA
- Metabarcoding 4 genes: mtCOI, V1-V2, V4, V9 18S rRNA
- Central analysis: QA/QC, bioinformatics, statistics
- Evaluate reliability & accuracy of DNA metabarcoding for analysis of zooplankton diversity of global ocean
- Presentation @ ZPS7 & peer-reviewed publication



MetaZooGene Intercalibration Experiment (MZG-ICE)
 Global Exchange of Zooplankton Samples
 Leo Blanco-Bercial & Rocio Rodriguez Perez (BATS, ASU)
 Bioinformatics & Statistics Leads



- Diversity & taxonomic composition of samples based on V9 differed among MZG-ICE regions
- Lower diversity usually resulted in higher replicability of samples among groups





MetaZooGene

Metabarcoding Zooplankton Diversity
Ocean Decade Action No. 102.2



United Nations Ocean Decade of Ocean Science for Sustainable Development: Program & Project Partnerships



Marine Life 2030 (ML2030) See: <https://marinelife2030.org/>
MZG Coordination by Leocadio Blanco-Bercial (BIOS, ASU)



Ocean Decade
Collaborative Center
Northeast Pacific

Decade Collaborative Center – Northeast Pacific (DCC-NEP)
See: <https://oceandecadenortheastpacific.org/about>
MZG Coordination by Jennifer Questel (UAF)



Ocean Biomolecular Observing Network (OBON)
See: <https://www.obon-ocean.org/>
MZG Coordination by Ann Bucklin (UConn) & Pennie Lindeque (PML)

<https://www.unesco.org/en/decades/ocean-decade>
<https://forum.oceandecade.org/ventures/89135>



Appreciation to Patricia Miloslavich SCOR Executive Director (ret.)

Patricia was SCOR Executive Director between January 2020 and July 2023. She is a Venezuelan/Australian marine biologist and a retired senior professor / ad honorem researcher from Simon Bolivar University in Venezuela.

From 2015-2019 she was the International Project Officer of the Biology and Ecosystems Panel from the Global Ocean Observing System (GOOS), based at Australian Institute of Marine Science and later University of Tasmania.

Patricia played key roles with the Census of Marine Life program (2000-2010), chairing of Caribbean Committee and leading Natural Geography in Shore Areas (NaGISA) project in South America.

Patricia is now Program Lead for the East Antarctic Monitoring Program at the Australian Antarctic Division





Thank you to our IMAS hosts
Kerrie Swadling & Luke Brokensha



UNIVERSITY of
TASMANIA

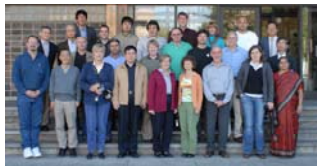
**Sincere appreciation for hosting & joining
MetaZooGene WG157 Annual 2024 Meeting**



SCOR WG157 - Gothenburg, Sweden (2019)



ICES WGIMT - Boulogne-sur-Mer, France (2017)



CMarZ Steering Group - Tokyo, Japan (2006)

Acknowledgements

**MetaZooGene SCOR WG157
Scientific Committee for Oceanic
Research (SCOR)**



**Working Group for Integrative
Morphological and Molecular Taxonomy
(WGIMT)
International Council for the Exploration
of the Sea (ICES)**



**Census of Marine Zooplankton (CMarZ)
Steering Group
Census of Marine Life (CoML)
Alfred P. Sloan Foundation**



Appreciation: University of Connecticut: Institute for Systems
Genomics (ISG), Computational Biology Core (CBC), Center for
Genomic Innovation (CGI)



Photo credits: R.R. Hopcroft, UAF; L.P. Madin, WHOI (USA)



SCOR WG157

MetaZooGene

SCOR WG157 Annual Meeting Agenda



- 5:30 pm** **Doors open @ IMAS**
- 6:00 pm** **Dinner buffet available**
- 7:00 pm** **Introductions & MetaZooGene Overview**
- 7:20 pm** **Presentation updates from WG157 members**
- 8:30 pm** **Looking ahead: WG157 activities & goals for 2024**
- 9:00 pm** **Adjourn**



SCOR WG157

MetaZooGene

Annual Meeting Agenda



Institute for Marine and Antarctic Studies, University of Tasmania
 March 20, 2024, Hobart, Tasmania (AUS)

Presentation updates from WG157 members:

- **Katja Peijnenburg**
- **Ksenia Kosobokova / Dimitry Kulagin**
- **Agata Weydmann-Zwolicka**
- **Aino Hosia**
- **Tone Falkenhaus / Elizaveta Ershova**
- **Jenny Huggett**
- **Junya Hirai**
- **Leonie Suter**
- **Mary Mar N. Payne**
- **Pennie Lindeque**
- **Silke Laakmann**
- **Todd O'Brien**
- **Ann Bucklin**

