

## Theme session M

Molecules and morphology: integrative taxonomic analysis of marine planktonic assemblages

Conveners: Pennie Lindeque (United Kingdom), Lidia Yebra (Spain), Ann Bucklin (USA)

This theme session focused on advances in the emergent science of integrative taxonomy, which uses morphological, molecular, biochemical, ecological, and geographic data. Applied to marine planktonic assemblages, the overarching goal of this emergent science is to yield new understanding of the taxonomy, systematics, and biodiversity of marine life. The theme session sought to encourage discussion from multiple and complementary perspectives: phylogeography, morphology, population genetics, ecology, development, and behaviour, among others. One novel approach is the assessment of planktonic diversity via high-throughput sequencing of environmental samples or metabarcoding (i.e., large-scale analysis of taxon richness via DNA sequencing of a barcode gene region from environmental samples), which is proving to be increasingly accurate, reliable and cost-effective. However, comparison and combination with classical morphological taxonomic analysis of plankton samples will continue to be necessary and important.

Remaining challenges for integrative taxonomy include consistent discrimination of species – even closely related, cryptic, and rare species – based on high-throughput sequencing and accurate identification of taxa by comparison with reference sequence databases. This session examined a broad range of methodologies, provided overviews of recent results using diverse types of data, and encouraged discussion on opportunities and challenges of integrative taxonomy of marine planktonic assemblages.

The session was organized into several topical areas, based on the abstracts accepted for oral presentations (7) and poster flash talks (8). Several presentations were focused on novel approaches and new technologies: Heidi Sosik reported new findings from DNA sequencing, cytometry, and imaging of plankton communities. A presentation by Annette Govindarajan showcased the importance of new underwater vehicles for sampling eDNA (environmental DNA) in the deep sea. Janna Peters' poster flash talk described advances in proteomic fingerprinting.

Several presentations focused on analysis of regional biodiversity: Anna Schroeder described metabarcoding of zooplankton from the Venice lagoon; Judith Bakker focused on biodiversity of Caribbean shelf assemblages; and Iole Di Capua reported on using eDNA to document planktonic diversity of the Gulf of Naples. Poster flash talks on this subject area included an examination of the diet of Alboran Sea sardine larvae by Lidia Yebra; comparative metabarcoding and morphological analysis of zooplankton diversity of the NW Atlantic shelf by Ann Bucklin; and an Arctic reference barcode database by Hayley DeHart.

Another focus of the session was integrative taxonomy of particularly challenging taxonomic groups of organisms. Glafirra Kolbasova described the power of DNA-based analysis to discriminate pelagic polychaetes in the Arctic Ocean; Marvin Choquet explained how DNA has transformed our understanding of distributions of copepod species of *Calanus* in the North Atlantic and Arctic. Poster flash talks on this topic were by Juan Ramón Beltrán Castro, who reported on DNA barcodes for epipelagic copepods; Véronique Merten, who focused on cephalopod biodiversity using eDNA; Rade Garić, who examined appendicularian taxonomy; and Kayla B. Erikson, who used qPCR to discriminate cryptic copepods.

The discussion period focused on several questions, including opportunities and challenges of integrative taxonomy of marine planktonic assemblages, the challenge of rapid and accurate detection of species-level diversity in the pelagic zone, and the role of integrative taxonomy in ecosystem assessment and management.

An additional discussion session was arranged during the lunch hour following the session to allow more interaction among session participants, including authors and co-authors. This proved to be a very useful forum for introductions and further exploration on topics of shared interest.