

SCOR Working Group Proposal

Title: Advancing Tools in Zooplankton Trait-based Research

Acronym: AtoZTraits

Summary/Abstract (245/250 words)

Zooplankton are integral to food webs, biogeochemical cycles, and carbon flux. Despite their ecological significance, quantifying their importance in ecosystem functioning is challenging, and the functional diversity of zooplankton remains poorly resolved in ecosystem models or well-integrated in biodiversity monitoring. Trait-based approaches offer a promising framework for simplifying the complexity of ecosystems through a common currency of traits, thereby mechanistically linking species to ecosystem functioning. As demonstrated in other domains of life, community-driven expert networks centered in a global trait database are necessary for standardizing methods and promoting trait-based research.

The AtoZTraits working group brings together a global network of zooplankton experts to consolidate efforts in expanding, applying, and promoting the Global Zooplankton Trait Database (GZTD). The overall objective of the AtoZTraits working group is to advance the tools in zooplankton trait-based research that will stimulate discovery and innovation in ocean sciences through highlighting the traits that bridge species and ecosystem functioning. The working group will (1) update the GZTD to synthesize a global functional zooplankton biogeography, (2) compare traditional and modern methods in measuring traits, (3) review the representation of traits in ecological models, (4) facilitate the integration of traits into biodiversity monitoring, and (5) promote trait data harmonization and ecological applications. These working group outputs will be instrumental for ecologists, biological oceanographers, fisheries scientists, and biogeoscientists. We will leverage existing resources in trait-based research and education and our collaborations with database infrastructures and related working groups to maximize our impact and capacity-building activities.

Scientific Background and Rationale (1208/1250 words)

Zooplankton comprise a taxonomically and functionally diverse group of organisms, ranging from unicellular microzooplankton to large gelatinous animals, and including the early life stages of most aquatic animals. Zooplankton connect primary producers (phytoplankton) with higher trophic levels (e.g., planktivorous fish and whales) and thus plays a central role in the flow of energy and nutrients in food webs. Through the sinking of organic matter and the extensive vertical migrations of many species, zooplankton significantly influence biogeochemical cycles and carbon sequestration (Kiko et al. 2020), shape microbial communities (Tinta et al. 2021), and connect pelagic and benthic communities (Bandara et al. 2021).

The species composition of zooplankton communities is known to affect their ecological roles, but these processes are mechanistically influenced by their traits. “Traits” are defined as the morphological, phenological, physiological, and behavioral characteristics of individual organisms that directly influence their Darwinian fitness through processes of growth, reproduction, and survival (Violle et al. 2007). In zooplankton, for example, traits on body size and feeding strategies influence food web interactions; traits on biochemical composition translate to nutritional quality of prey; and traits on vertical migration, fecal pellet production, and metabolic rates influence vertical carbon flux. The need to better understand how trait diversity, both between and within species, influences ecosystem processes is all the more important since dynamic changes in traits, shaped by genetic plasticity and intraspecific variability, are key mechanisms that enable species to adapt to climate change.

Similar to how open-access taxonomic (e.g., WoRMS) and DNA barcode databases (e.g., SCOR MetaZooGene) have been invaluable in standardizing global research and promoting innovation, trait databases are vital in advancing functional ecology. The rapid progress in applying traits to terrestrial plant ecology and marine fishes (Green et al. 2022) was facilitated by global trait databases such as the TRY database for plants and FishBase for fishes. Acquiring trait information for a wide range of traits from experiments and laboratory measurements is a time-consuming process, thus, trait databases are critical for capacity-building. Multiple international expert networks manage and promote dedicated trait databases for various taxonomic groups. However, no formalized and funded expert network yet exists for marine zooplankton traits with similar functionalities to those available for the other domains of life.

The global importance of supporting the effective application of zooplankton traits in ocean monitoring, biogeography, and modelling is immense. Traits are a common currency shared among the rich diversity of species which allows for the comparative analysis of taxonomically distinct regions and the simplification of ecosystem complexity, linking processes across trophic levels (Litchman et al. 2021, Martini et al. 2021). Species traits are Essential Biodiversity Variables (EBVs) and hold strong potential for transforming how biodiversity is monitored and understood. Current frameworks, including the Group on Earth Observations Biodiversity Observation Network (GEO BON), have identified key trait EBVs yet applications are still largely terrestrial, with marine and planktonic systems underrepresented. Expanding trait-based EBVs focused on zooplankton is therefore essential to improve the detection and interpretation of ecological changes.

Ecosystem models are also dependent on trait information, but how well models represent traits matter. Zooplankton traits in biogeochemical models have been identified as one of the biggest sources of uncertainty in projected climate impacts on the carbon cycle (Clerc et al. 2023, Rohr et al. 2023). Additionally, a new generation of ecological models is explicitly using zooplankton traits to redefine organismal interactions and energy flow, yielding improved model sensitivity to climate-driven impacts on food web production (Heneghan et al. 2023).

In the past 20 years, since the popularization of the field of Functional Ecology (McGill et al. 2006), various milestones that influence zooplankton trait-based research have been achieved

on functional traits theory, trait databases, tools, data frameworks, and ecological applications in biogeography and modelling (**Figure 1**). Many of the achievements related to zooplankton traits arose independently and were taxon-specific, region-specific, or method-specific. The establishment of findable, accessible, interoperable, and reusable (FAIR) data principles and community standards in trait nomenclature through the LifeWatch Traits Thesaurus (Titocci et al. 2025) and the recent compilation of marine zooplankton trait literature into the Global Zooplankton Trait Database (GZTDv1, Pata & Hunt, 2023) lay the foundation for the global synthesis and integration of the tools needed to advance zooplankton trait-based research.

A workshop on zooplankton traits, attended by over 50 zooplankton experts during the 7th Zooplankton Production Symposium in March 2024, reviewed the status of zooplankton trait-based research and discussed the future directions required to advance the field as documented by Titocci et al. (2025). The need for establishing a working group to coordinate efforts in trait data harmonization and ecological synthesis was identified as a top priority to realise the full potential of trait-based approaches and the utilization of zooplankton trait information in ecosystem and fisheries modelling. Cooperation within the zooplankton scientific community is even more urgent as technological progress in high-throughput molecular and imaging techniques is expanding the possibilities for comprehensive and near-real-time observations of plankton and their traits (Orenstein et al. 2021). Furthermore, the trait data produced by these innovations and by traditional laboratory measurements need to be systematically compared, standardized, and harmonized. As new approaches in applying trait information in models continue to emerge, active dialogues and collaborations between modelers and zooplankton ecologists are much needed to align our shared interest in better understanding the functioning of our oceans.

The proposed AtoZTraits working group answers the call for global cooperation on marine zooplankton traits. A focus on traits is an essential next step to complement the outputs of the past zooplankton working groups which were pivotal for ocean science, including the SCOR working groups WG3, WG13, WG23, WG125, and WG157 and other groups such as the ICES WGZE, WGIMT, and PICES WG37 (Figure 1). Building on these fundamental collaborations that were centered on species taxonomy, ecology, and observations, AtoZTraits will highlight the traits that bridge species and ecosystem functioning.

AtoZTraits brings together an international group of scientists working on various facets of zooplankton trait-based approaches including trait measurement, data management, ocean observation, functional ecology, biogeography, and ecosystem modelling. The overall objective of the AtoZTraits working group is to advance the tools in zooplankton trait-based research that will promote discovery and innovation in ocean sciences. We aim to resolve these questions:

- What is the global zooplankton trait distribution?
- What are the globally consistent patterns in zooplankton functional biogeography?
- How can traditional and modern methods in trait measurements expand FAIR trait data?
- How can ocean models better represent zooplankton traits and functional diversity?
- How can advances in trait-based approaches enhance ocean and biodiversity observation?

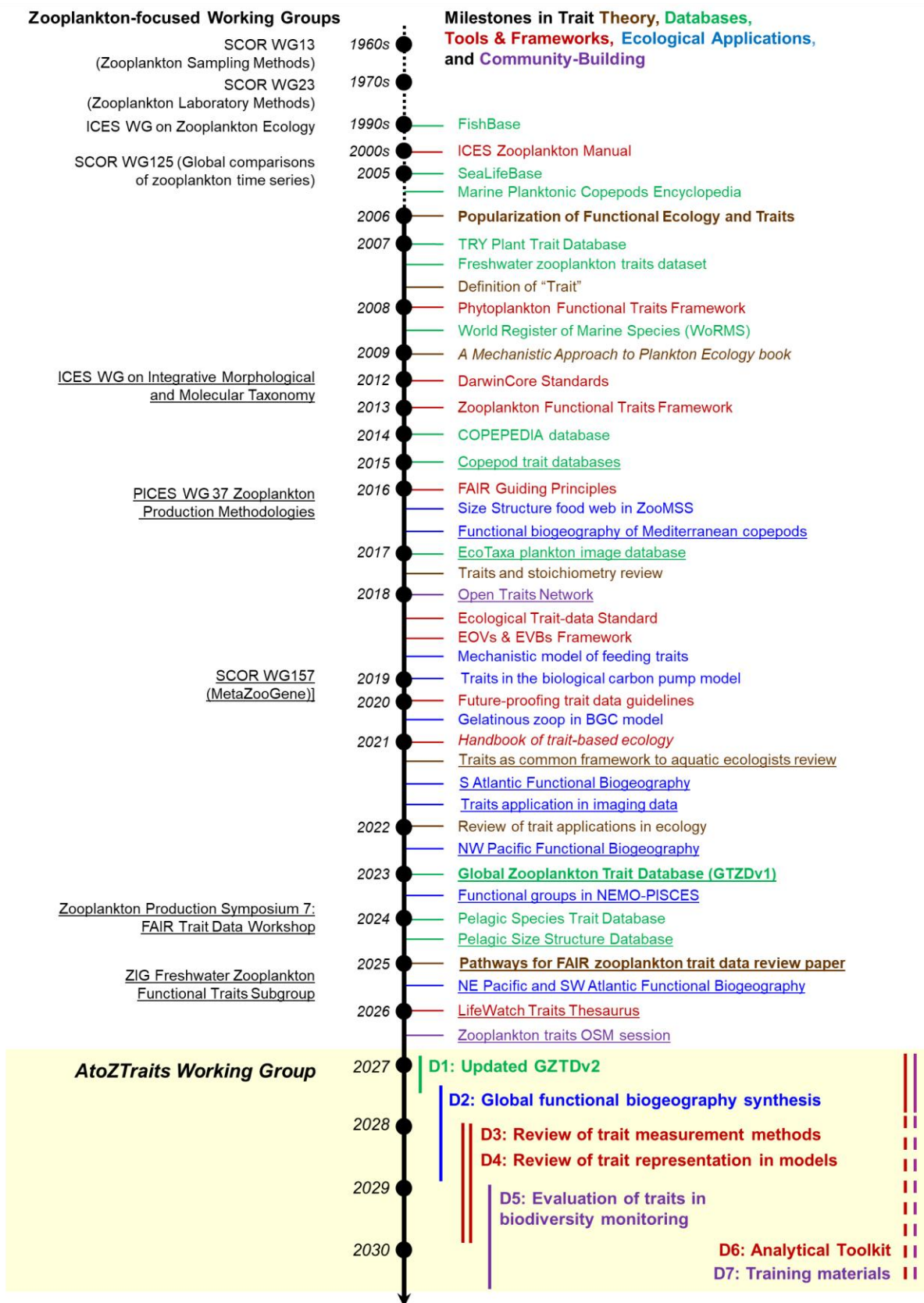


Figure 1. Milestones in the development of zooplankton trait-based approaches. Underlined milestones indicate the involvement of AtoZTraits members. The advancements proposed by AtoZTraits are highlighted with the general timeline for achieving the deliverables. Dashed lines for D6 and D7 indicate applications in capacity-building activities.

The AtoZTraits members will utilize our existing connections with database infrastructures and related working groups to advance trait-based tools for the global zooplankton research community. Thus, we will address the need for FAIR zooplankton trait data and provide expert reviews and syntheses on global functional zooplankton biogeography, trait measurement methods, modelling traits, and zooplankton observations. We will promote trait-based approaches and reinforce the application of the working group outputs through various online and in-person capacity-building activities.

Terms of Reference (249/250 words)

ToR1: Synthesize the global zooplankton trait distribution and functional biogeography.

We will combine the GZTD, regional functional ecology studies, and historical species data to enable a global comparison of zooplankton trait distribution and functional biogeography. We aim to provide a global baseline characterization for future monitoring and modelling.

ToR2: Catalogue and compare the methods for measuring zooplankton traits. The ICES Zooplankton Methodology Manual (Harris et al. 2000) was instrumental in standardizing the laboratory methods for measuring traits. Since its publication, many new methods for measuring traits have emerged, including biochemical analyses, molecular approaches, acoustics, and imaging devices. Updating the catalogue of methodologies is vital to guide future trait measurements.

ToR3: Review the representation of zooplankton traits in models. To improve the representation of zooplankton in models, the working group aims to understand the spatiotemporal and biological scales of how traits are measured, analyzed, and utilized in food web and biogeochemical models for mechanistically simulating ecological processes.

ToR4: Facilitate the integration of traits into biodiversity monitoring. Zooplankton biomass is an Essential Ocean Variable, while species traits are EBVs. The working group will examine and advise how zooplankton traits could be integrated operationally into biodiversity observation initiatives and routine monitoring programs.

ToR5: Promote trait data harmonization and tools for sustained observations and ecological applications. The members are actively involved in developing databases, computational tools, and educational materials on zooplankton functional ecology. We will organize and share our resources through trainings, webinars, and hosting community-building events during conferences to broaden our impact.

Deliverables (246/ 250 words)

D1: An updated Global Zooplankton Trait Database (GZTDv2). It appends additional literature data for underrepresented traits, taxa, and regions. **(ToR1, ToR5)**

D2: A synthesis paper on global zooplankton functional biogeography. It will apply the GZTDv2 to species distribution datasets accessible to the members and from zooplankton databases, guided by a data-sharing plan. **(ToR1, ToR4)**

D3: A review paper on the classical and modern methodologies in trait measurement. The paper will evaluate which methods are essential to fill in the data gaps identified in **D1** for future trait measurements. **(ToR2, ToR4)**

D4: A review paper on the representation of traits in ecological models. The paper will determine the scope of available trait data in **D1** required for model parameterization and recommend which trait variables are needed to support modelling. **(ToR3, ToR4)**

D5: A perspective paper evaluating the integration of traits into biodiversity monitoring. Guided by the insights from ToR1-3 and leveraging the existing networks and collaborators of the members, this paper will summarize the discussions with experts on biodiversity observation initiatives, regulations, and monitoring. **(ToR4)**

D6: A working group website and analytical toolbox library stored in a GitHub repository. The toolbox will gather existing scripts for trait data harmonization, terminology standardization, taxonomy validation, and trait-based statistical analysis. **(ToR5)**

D7: Training materials on zooplankton trait ecology. We will compile and supplement our existing lectures and practical tutorials which will be applied in webinars and training workshops. All materials will be available under CC-BY license on our website. **(ToR5)**

Working plan (989/1000 words)

The timeline for achieving the AtoZTraits milestones within 4 years is presented in **Figure 1** and detailed below. Internal communication will be primarily managed via email and Microsoft Teams to coordinate schedules, track progress, and share files. The progress of the working group will be publicized through the website starting Year 1 (**D6**). All papers (**D2-5**) will be submitted to open-access journals and all tools (**D1,6,7**) will have CC-BY licenses.

Meetings will be convened twice a year and mostly online for general discussions and logistical planning. The online kick-off meeting in 2027 will include confirmation of the WG code of conduct, authorship and collaboration agreements, and a data management plan. Three of the scheduled meetings will be in-person, ideally around international scientific conferences, with possible remote attendance to limit GHG emissions. The first in-person meeting is planned for the Ocean Sciences Meeting (OSM) in Feb-Mar 2028 in Vancouver, Canada. The second in-person meeting will be in early 2029 and planned for South America. The third in-person meeting will be in early 2030 and targeted for the 8th Zooplankton Production Symposium or alternatively in Asia or Europe.

Year 1 (2027) will focus on compiling data and resources (ToR1 and ToR5) and planning capacity-building activities. Since the first version of the trait database (with over 57,000 trait records from 183 references), more than 50 trait datasets and papers have already been identified for harmonization. The data coverage will be assessed, and gaps will be statistically estimated following Pata & Hunt (2023). The updated version of the database (**D1**) will be completed by midyear 2027 and will be archived first in Zenodo and eventually integrated into SeaLifeBase.

In undertaking the global functional biogeography synthesis (**D2**) from the second half of Year 1 to the end of Year 2, the working group will compile the zooplankton species distribution data from members as open datasets (e.g., OBIS) (**Figure 2**), including what we analyzed for regional biogeography (**Figure 1**). After matching the species with the traits data, the global zooplankton trait distribution and functional diversity will be characterized following standardized statistical procedures in Pata et al. (2025) and reported in a synthesis paper (**D2**).

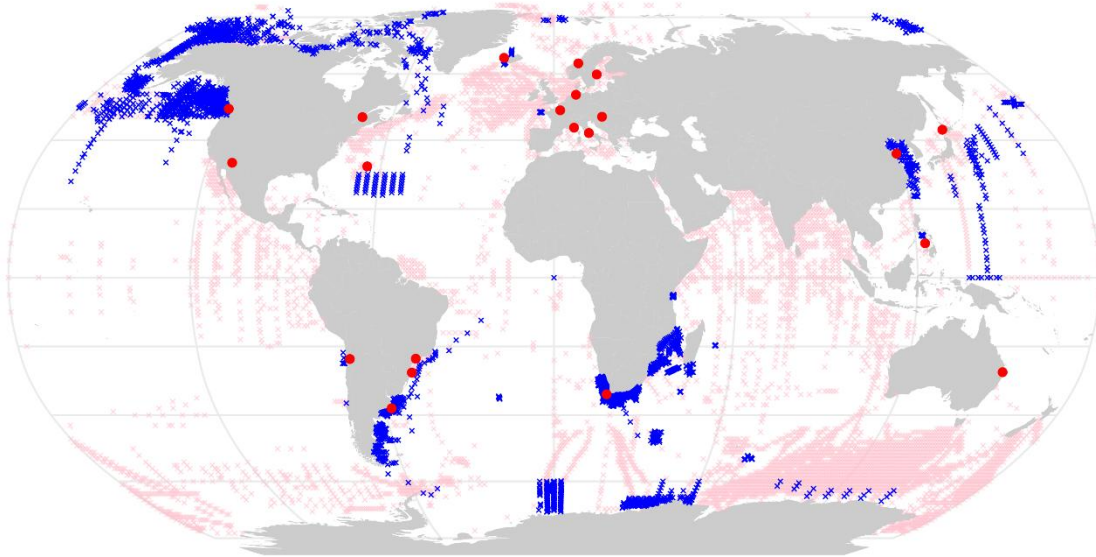


Figure 2. Location of member institutions (red circles) and zooplankton community data previously analyzed by the members (blue crosses) and from open-source databases (pink crosses) for the ToR1 functional biogeography synthesis.

During Year 1, we will compile our existing materials on zooplankton functional ecology for the analytical toolkit (**D6**) and educational resources (**D7**). After matching the training workshop outlines with the available resources during the WG meetings, we will strategically develop materials for missing topics. The **D6** and **D7** compilations will be used for the webinars training workshops (**ToR5**) in Years 2-4.

Year 2 (2028) will focus on the global synthesis (ToR1) and begin the review papers (ToR2 and ToR3). The outputs from **ToR1** will be presented in OSM for feedback and will be completed by the end of Year 2. The first in-person meeting around OSM will include two public half-day expert workshops on trait measurement methods (**ToR2**) and the representation of traits in models (**ToR3**). These workshops will gather the WG members and other experts to fuel collaborative discussions supporting review papers (**D3, D4**).

The work for **ToR2/D3** will review the literature on zooplankton trait measurement methods, specifically focusing on biochemical, molecular, genetic, acoustic, and imaging approaches that emerged since 2000. This **D3** paper will compare the units, precision, taxonomic scope, and quality of the trait data measured or estimated by each method. Upon comparison with the updated trait data availability (**D1**), we will evaluate which methods would be instrumental in filling in the data gaps.

The work for **ToR3/D4** will survey how zooplankton traits are represented in the parameters and processes in food web and biogeochemical models. The **D4** paper will investigate if the definitions and units of the traits used in models match the Traits Thesaurus. We will also compare model trait values with those in the trait database (**D1**) to evaluate how well models represent observed zooplankton trait variability, and to recommend new measurement to support modelling.

Year 3 (2029) will focus on traits and monitoring (ToR4) guided by ToRs1-3. The **D3** and **D4** manuscripts are targeted for completion by the end of Year 3. Throughout the process of achieving **D1**, **D3**, and **D4**, we expect to produce a list of trait definitions and units. These will be contributed to the EcoTaxoGuide taxonomic sheets and the LifeWatch Traits Thesaurus, thus linking the outputs of **ToRS1-3** to **ToR5**.

We will evaluate the integration of traits as EBVs in zooplankton biodiversity monitoring (**D5**) in Year 3. Around the second in-person meeting, two half-day expert workshops on novel trait measurement methods and on biodiversity monitoring will seed the discussions for **ToR4**. We will connect with international initiatives and data portals (e.g., GEO BON, IODE, WoRMS, GBIF) and gather colleagues who are experts in plankton monitoring programs at local (e.g., for specific MPAs), regional (e.g., OSPAR in the North Atlantic), and global scales (e.g., GOOS).

The **D5** perspective paper will summarize the lessons learned in the past decade since the introduction of traits as EBVs. Guided by the functional biogeography synthesis and reviews of the data, methods, and models, we will identify key steps to facilitate the practical application of traits in global observation initiatives. This includes assessing which traits (beyond size and biomass) and trait-based biodiversity indices will be most ecologically meaningful and operationally feasible for sustained zooplankton monitoring programs.

Year 4 (2030) will wrap up deliverables from ToR1-5 and set the foundation for future collaborations. During the third in-person meeting, we will organize a public consultation workshop to specifically discuss the learnings on traits as EBVs (**ToR4**) and identify future research directions. The **D5** paper is targeted for submission by the end of Year 4. We plan to organize a special issue on zooplankton trait-based approaches, for instance in the Journal of Plankton Research.

Capacity Building (1366/1500 words)

a. Promoting Open Science and FAIR data principles

The AtoZTraits working group will build a long-lasting capacity in biological oceanography by promoting the application of trait-based approaches in zooplankton research, applying and demonstrating the use of FAIR principles for zooplankton trait data, and inspiring innovation in the statistical and modelling methods for studying zooplankton ecology (**ToR5**). The updated database (**D1**) and related publications (**D2-D5**) serve as key capacity-building resources.

The application and promotion of FAIR principles will include concrete actions to improve data management practices, which will be disseminated among participants of the working group and beyond, with the aim of enhancing the findability, accessibility, interoperability, and

reusability of zooplankton trait data. Particular attention will be given to semantic interoperability, focusing on actions and practices such as the use of controlled vocabularies and data and metadata standards that are still less well known and used within the zooplankton community. Specifically for zooplankton traits, we will adopt the LifeWatch Traits Thesaurus, a project led by J. Titocci.

Semantic interoperability is key in bridging trait data **(D1)**, trait measurements **(D3)**, parameterization of traits in models **(D4)**, and the operational utilization of traits in monitoring **(D5)**. In our outputs, workshops, and collaborations within and beyond the working group, traits are the common ecological currency, and controlled vocabularies are the common language. We will promote the use of existing trait-based standards for data annotation among participants and collaborators, as well as explore the need for the development of new standards particularly to ensure the proper definition of zooplankton traits in modern measurement methods, models, and instrumentations **(ToR5)**.

Moreover, raising awareness of the importance of sound and FAIR data management practices will contribute to more efficient workflows, reducing the time and effort required for data harmonisation, and thereby strengthening individual and community capacity in data handling, standardisation, and applications. This, in turn, will enhance the reusability of both existing and newly generated trait-based data **(ToR5)**.

b. Creating and promoting tools for the global science community

Through providing a global synthesis on zooplankton trait distribution and functional biogeography **(D2)**, we aim to provide a baseline for zooplankton monitoring utilizing traits, especially for underrepresented regions. The reviews on trait measurements **(D3)** and modelling **(D4)** are expected to be important resources to guide the prioritization of which traits could be investigated further. The evaluation on integrating traits as EBVs in zooplankton observations **(D5)** will contextualize the costs and challenges in advancing trait-based aquatic research.

The deliverables **D6** and **D7** are tangible capacity-building resources to promote trait-based approaches globally. The training workshops will include active learning modules on FAIR data management, functional ecology theory, and ecological perspectives **(D7)** and practical tutorial modules in using the GZTDv2 **(D1)** and R templates in the analytical toolbox **(D6)**. We will organize and strategize the framework of training modules in Year 1 and share the syllabus through the WG website so that it is publicly accessible for distance learning. The training workshops will use the same syllabus and training modules but will be adapted to the specific needs of the regions. We plan to connect with the International Oceanographic Data and Information Exchange (IODE) OceanTeacher Global Academy (<https://classroom.oceanteacher.org/>) to disseminate the resources we develop, with the aim of making all training modules broadly accessible **(ToR5)**.

The training workshops will prioritize 15-30 graduate students and early career researchers (ECRs) in biological oceanography and marine biology from developing countries to ensure equity in capacity development. Three training workshops are scheduled: 2028 at the University of the Philippines, Philippines (led by C. Acabado); 2029 at either Argentina or Chile (led by G.

Cepeda); and 2030 at the Middle East Technical University, Turkey (led by S. Hasnain). These trainings target trainees in Asia, South America, and the Middle East. We will apply for additional funding to support the travel from national programs connected to the host institutions and from international sources such as the SCOR Travel Support grant and the Partnership for Observation of the Global Ocean (POGO).

Around the end of each year, the working group will organize webinars featuring the emerging research related to the themes for each of the **ToRs 1-4** (4 webinars in total). These webinars are intended to promote the resources prepared by the working group and broaden the horizons in trait-based research (**ToR5**). The schedules of the webinars will be shifted regularly to accommodate different time zones, and the leadership will rotate among the members. The presenters will be requested to allow recording so presentations may be available online.

c. Supporting Early-Career Researchers (ECRs)

AtoZTraits is composed of 9 ECR members with positions ranging from postdocs to assistant professors. The working group provides a global network of collaborators, mentorship from senior members, publications, computational tools, and teaching resources that will stimulate the research directions and support career development of the ECR members. Senior career members will also promote the participation of their labs in AtoZTraits activities. This will strengthen the skills of a next generation of researchers, from all over the globe, dedicated to zooplankton traits studies. We commit to applying for supplementary funding to support the travel of the ECR members to participate in the working group meetings, workshops, and conferences.

The training modules and webinars will be designed for ECRs as the primary audience. The training workshops will put equal emphasis on big-picture perspectives on trait-based approaches and practical computational skills to equip trainees in completing their research objectives. The yearly webinars will include an hour of “Ask the Experts” panel discussion, wherein participants can ask for guidance and solutions to the challenges they are experiencing in relation to trait-based approaches.

d. Building a global network of collaboration centered on traits

Throughout the duration of the working group, the members will convene dedicated sessions on zooplankton trait-based approaches during international conferences (**ToR5**). Convening sessions requires minimal additional effort from the members already attending the conferences and will maximize the exposure of the working group and promote its objectives. More importantly, these sessions will provide a space for the global zooplankton functional ecology research community to share their work, redirecting and focusing attention to this field from the typical general marine ecology and biological oceanography sessions. The sessions will help to promote new collaborations and stimulate novel ideas to advance the field. Such global networking will open new opportunities for international collaborations, scientists’ mobility, and proposal writing.

As described in the work plan, each in-person meeting of the working group will include public consultation and discussion workshops targeting the ToR topics. Scheduling workshops around international conferences will increase the participation of students, ECRs, and senior researchers. These workshops will provide space for the working group members to strengthen their existing network of collaborators and bridge global expertise, especially to underrepresented regions in zooplankton trait-based research.

The FishBase consortium has previously expressed much interest in the development of the zooplankton trait database. In parallel to the AtoZTraits working group, B. Hunt and P. Pata are leading a collaborative project with SeaLifeBase in the integration of the GZTD with SeaLifeBase. This ongoing integration project contributes to **ToR4** and **ToR5**. The working group will support this effort by continuously identifying funding opportunities and institutional collaborations and by providing expert advice in the development of the zooplankton traits component of SeaLifeBase. Expediting the integration will expand the impact of the working group's deliverables by connecting with the FishBase consortium and the users of SeaLifeBase and FishBase. Zooplankton trait information is important for food web and fisheries researchers and ecosystem managers, as the trait composition of zooplankton communities determines the abundance and health of higher trophic levels.

We will keep track of the impact of the capacity-building efforts by monitoring the number of participants in the webinars and training workshops, the number of downloads of the database, analytical tools, and educational resources, and the number of studies citing and utilizing the deliverables of the working group. The capacity building activities will culminate with a special issue on zooplankton trait-based approaches to emphasize the scientific advancements in zooplankton trait-based approaches in the 25 years since the popularization of Functional Ecology (**ToR5**). We will submit the perspective paper (**D5**) in this special issue to set the stage for sustained progress in this field.

Working Group composition (as table). Divide by Full Members (10 people) and Associate Members (max. 10 people), taking note of scientific discipline spread, geographical spread, gender balance, and participation by early-career scientists. Proponents may also include a short rationale for the composition and balance. (max. 500 words)

The AtoZTraits working group is composed of 10 full members and 10 associate members who are experts in various facets of zooplankton ecology. We have independently contributed to recent milestones in zooplankton trait-based research (**Figure 1**) and we come together as a global expert network on zooplankton traits.

The composition of the working group was established to provide balance in the representation of the ToRs, expected work to accomplish the deliverables, and taxonomic and regional expertise. The geographic representation spans tropical to polar ecosystems and affiliations with over 20 institutions and 18 countries and territories (**Figure 2**). The leadership is composed of one ECR and two female senior researchers. There is gender balance in both the full and associate members (55% female) and an overall participation of 9 ECRs.

Full Members (no more than 10, please identify chair(s))

Name	Gender	Years since degree*	Country and institution of affiliation(s)	Expertise relevant to proposal
1 Patrick Pata (chair)	M	3	Canada , <i>Université Laval</i>	Trait database, functional ecology, imaging, ecosystem modelling
2 Astrid Cornils (vice-chair)	F		Germany , <i>Alfred-Wegener-Institut Helmholtz-Zentrum für Polar-und Meeresforschung</i>	Ecology and biogeography, copepod taxonomy
3 Sakina-Dorothee Ayata (vice-chair)	F		France , <i>Institut Universitaire de France; Sorbonne Université</i>	Biogeography, trait-based approaches, ecosystem modelling
4 Cristy Acabado	F	4	Philippines , <i>University of the Philippines</i>	Community ecology, traits, ichthyoplankton, tropical zooplankton
5 Leocadio Blanco Bercial	M	15	Bermuda/USA , <i>Bermuda Institute of Ocean Sciences - Arizona State University</i>	Community ecology, microzooplankton, phylogenetics, evolution
6 Georgina Cepeda	F	13	Argentina , <i>Consejo Nacional de Investigaciones Cientificas y Técnicas; Instituto Nacional de Investigación y Desarrollo Pesquero</i>	Community ecology, temperate zooplankton taxonomy, molecular methods
7 Hongju Chen	M		China , <i>Ocean University of China</i>	Biological oceanography, ecology, taxonomy, functional biogeography
8 Jenny Huggett	F		South Africa , <i>Department of Forestry, Fisheries & the Environment; University of Cape Town</i>	Biological oceanography, ecology, imaging and metabarcoding approaches, traits
9 Kohei Matsuno	M		Japan , <i>Hokkaido University</i>	Arctic ecology, zooplankton taxonomy, traits
10 Kieran Murphy	M	5	Australia , <i>University of Tasmania</i>	ZooMSS size-spectra modelling, ecosystem modelling, cephalopod traits

* Field only required for members identified as early career: 10 years or less post-degree, not counting time off for family leave.

Associate Member (no more than 10)

Name	Gender	Years since degree*	Country and institution of affiliation(s)	Expertise relevant to proposal
1 Érica Becker	F	4	Brazil , <i>University of São Paulo</i>	Taxonomy, imaging, trait-based approaches
2 Corentin Clerc	M	4	France , <i>LOCEAN - Sorbonne Université</i>	NEMO-PISCES model, biogeochemical and habitat modelling
3 Carolina Gonzalez	F	6	Chile , <i>University of Antofagasta</i>	Community ecology, phylogenetics, evolution
4 Sarah Hasnain	F	7	Hungary , <i>Center for Ecological Research</i>	Theoretical ecology, freshwater zooplankton ecology, big data management
5 Brian Hunt	M	21	Canada , <i>University of British Columbia</i>	Biological oceanography, zooplankton traits, food web ecology
6 Jean-Olivier Irisson	M		France , <i>Laboratoire d'Océanographie de Villefranche (LOV)</i>	EcoTaxa, ecology and biogeography, imaging, machine learning
7 Florian Luskow	M	4	Sweden , <i>Uppsala University</i>	Biological oceanography, gelatinous zooplankton taxonomy, traits
8 Sanna Majaneva	F	12	Norway , <i>Akvaplan-niva Trondheim</i>	Integrated plankton taxonomy, biogeography, molecular ecology
9 Karyn Suchy	F	11	Iceland , <i>Marine and Freshwater Research Institute</i>	Biological oceanography, ecology, secondary productivity
10 Jessica Titocci	F	3	Italy , <i>National Research Council of Italy CNR-IRET</i>	Ecology, freshwater zooplankton traits, data management, semantic interoperability

* Field only required for members identified as early career: 10 years or less post-degree, not counting time off for family leave.

Working Group contributions (737/750 words)

Patrick Pata is a postdoc with expertise in trait data compilation, Subarctic and Arctic zooplankton functional ecology, and combining net and imaging monitoring data. He will lead the update of the GZTD and will contribute to the biogeography synthesis, model comparisons, integrating traits in observations, and organizing the theoretical functional ecology components of the training workshops.

Astrid Cornils is a senior researcher with experience in morphological, molecular, and imaging techniques to investigate the interaction of polar zooplankton with their environments and is a member of the ICES WGIMT. She combines novel techniques with traditional microscopic

observations to provide a comprehensive view of zooplankton biodiversity, biogeography, and life history with integrative approaches.

Sakina-Dorothee Ayata is an associate professor working on molecular and imaging tools, biogeochemical models, and individual-based models. She co-led the review papers on the trait-based approaches in aquatic ecology and on using machine learning to quantify plankton traits from images which contributes to advancing the evaluation of traits in models and monitoring methods, and in developing the educational resources for capacity building.

Cristy S. Acabado is an assistant professor specializing in plankton biodiversity and community ecology, integrating biological data with physical environmental parameters in marine food webs and ecosystem health. She will lead the training in the Philippines and will contribute new species observations and trait measurements of tropical zooplankton.

Leocadio Blanco-Bercial is an associate professor focused on plankton diversity, ecology, and evolution, and how those influence their role in biogeochemical cycles. He contributes expertise in microzooplankton and in understanding the links between taxonomy, traits, and phylogenetics in the oceans.

Georgina D. Cepeda is an associate researcher with expertise in ecology and diversity of temperate marine zooplankton using morphological and molecular techniques in the Southwest Atlantic. She will lead the training in South America and contribute to linking traits with species composition and ecological functions.

Hongju Chen is a professor with expertise in biological oceanography and marine ecology of zooplankton in China coastal seas and the adjacent Northwest Pacific. He contributes to the functional biogeography synthesis and in linking biodiversity, community structures, and the marine environment.

Jenny Huggett is a senior researcher with expertise in biological oceanography and copepod ecology in the southern Benguela, Agulhas Current and Southern Ocean large marine ecosystems. Her current focus is on combining image-based analysis, DNA metabarcoding and species which contributes to deriving zooplankton EOVs and EBVs for monitoring ecosystem health and biodiversity.

Kohei Matsuno is an associate professor studying plankton from micro- to macro-size with trait-based approaches in polar and subpolar oceans. Through using microscopy, imaging instruments, and models, he contributes to investigating the relationship between plankton and environmental conditions for climate change assessment.

Kieran Murphy is a research associate focusing on improving the representation of zooplankton in models, addressing the critical gap in our understanding of ocean carbon cycling and fisheries production. He works primarily on the development of the Zooplankton Model of Size Spectra and contributes to strengthening the connection between trait-based observations and model applications.

The associate members support the working group by providing expertise in specific taxonomic groups and methods, connections to global initiatives, access to regional datasets, and resources for capacity building. Canada and France are represented again in the associate members to connect with international professional networks in plankton observations and for the importance of representing EcoTaxa and the NEMO-PISCES model in global zooplankton traits research.

Érica Becker contributes to imaging traits, functional biogeography, and will support capacity building in South America. **Corentin Clerc** contributes to evaluating traits in models and in incorporating traits in the NEMO-PISCES model. **Carolina Gonzalez** contributes to zooplankton phylogeny, evolution, and molecular methods, and will support capacity building in South America. **Sarah Hasnain** will lead the training in Turkey, and she contributes expertise in theoretical ecology and freshwater zooplankton through the ZIG functional traits subgroup. **Brian Hunt** contributes to food web ecology, biochemical methods, and connects the group with PICES and SeaLifeBase. **Jean-Olivier Irisson** contributes expertise in imaging and machine learning and connects the group with EcoTaxa. **Florian Luskow** specializes in gelatinous zooplankton, stoichiometry, and integrated ocean observation through the EU BioEcoOcean project. **Sanna Majaneva** contributes to integrated taxonomy particularly on gelatinous zooplankton, DNA-based approaches, biodiversity assessment, and is a member of ICES WGIMT. **Karyn Suchy** contributes to expertise in secondary productivity measurements and phytoplankton-zooplankton modelling. **Jessica Titocci** contributes to guiding the FAIR and open data practices in achieving the ToRs, semantic interoperability, and connects the group with LifeWatch.

Relationship to other international programs and SCOR Working Groups (460/500 words)

The objectives of the AtoZTraits working group build on the foundational works from previous SCOR working groups on zooplankton ecology (**Figure 1**). AtoZTraits benefits from our member's experience in past and current international collaborations.

Our ToRs intersect with ICES WGZE (Working Group on Zooplankton Ecology) (<https://wgze.net/>) regarding zooplankton traits and modelling. We will collaborate with WGZE to apply our trait database to the ecological analysis of long-term zooplankton observations. The ICES WGZE and WGIPEM (Working Group on Integrative, Physical-biological and Ecosystem Modelling) both target advancing ecosystem modelling, and our group's **ToR3** supplements this endeavor by highlighting the trait-based approaches in modelling zooplankton. We will encourage active collaboration with the zooplankton experts from these working groups in enriching the discussions in the workshops and papers for **D3**, **D4**, and **D5**.

Our focus on zooplankton trait data (**ToR1**) and measurement methods (**ToR2**) complements the taxonomy-based morphological and molecular tools of the ICES WGIMT (Working group on Integrated Morphological and Molecular Taxonomy) (<https://wgimt.net/>) and SCOR MetaZooGene. The GZTD (**D1**) will enhance molecular species identification of zooplankton communities by providing the functional and ecological context. A. Cornils and S. Majaneva represent AtoZTraits in WGIMT.

We will continue existing collaborations to promote zooplankton traits to the broader ecological community. The GZTD is already linked to the Open Traits Network (<https://opentraits.org/>) and this will be updated after **D1** to promote discoverability. The related project of integrating the GZTD with SeaLifeBase connects us with the members of the FishBase Consortium to better link zooplankton trait data with the rest of the marine realm. The development of the GZTD benefits from the digital tools and web services provided by LifeWatch ERIC and LifeWatch Italy (<https://www.lifewatch.eu>), and we are linked through J. Titocci. LifeWatch's repository of semantic assets and the Traits Thesaurus will strengthen the adherence to FAIR principles in achieving our **D1**. Similarly, we will connect the trait database with the GEO BON Species Traits working group (<https://geobon.org/ebvs/working-groups/species-traits/>) to contribute our expertise on marine zooplankton.

Our ToRs intersect with the broader objectives of the GEO BON Species Traits working group and we will join the network to collaborate on our shared objectives of identifying species traits suitable for EBVs towards accomplishing our **ToR4**. We are connected to the GOOS BioEco panel through J. Huggett and the BioEcoOcean EU project through F. Lüsrow which strengthens our collaborations on ocean observation initiatives.

The freshwater counterpart of AtoZTraits is the Zooplankton as Indicators Group (ZIG) (<https://sfigary.github.io/website/ZIG.html>) subgroup on freshwater zooplankton functional traits. The ZIG subgroup recently started compiling freshwater zooplankton trait data. P. Pata and S. Hasnain connects us to this group and we will continue to communicate with the ZIG subgroup in standardizing the frameworks in data compilation and to envision future collaborations between freshwater and marine zooplankton functional ecology.

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Appendix

For each Full Member, indicate 5 key publications related to the proposal.

Patrick Pata

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