

**Title of the doctoral thesis:** Life at both ends of the globe – bipolarity concept tested on pelagic ostracods

**Name and surname of the doctoral candidate:** M.Sc. Emily Yi-Shyuan Chen

**Scientific unit where the thesis was created:** Institute of Oceanology Polish Academy of Science

**Introduction:** I congratulate Ms Chen, and her mentors on this achievement. All research is based on an enormous amount of data, which is often a sign of a good study. It is not different with this thesis. I was impressed with the number of specimens Ms Chen had to go through, and having had a chance in life to do so, I understand the diligence and dedication behind it. If it is only for that, the PhD would be good, but the results of data analyses are impressive and provide a deep insight into a secret life of halocyprid ostracods. I must admit that I have very little experience with the group just because I always had a feeling that the taxonomy and their biology is complicated. Nevertheless, I learned a lot by reading the PhD and I am glad the ostracodology is getting such a good scientist as Ms Chen is.

**Formal analysis of the dissertation:** The thesis covers two polar regions and studies halocypris ostracods, a pelagic crustacean group that is, like all animals group, under the threats of climate change. It approaches the group from the life history standpoint and shows regularities and irregularities in the spatio temporal distribution of sexes and sexual abnormalities, and for the first time shows phenomenon of intersexuality in four species. Finally, it provides valuable annotations of the mitochondrial genome of five species and briefly provides insights into population genetics (through haplotype networks) of the same five species. The thesis is based on the impressive data sets, which only adds to its value.

**Assessment of the topic and aim of the thesis Is the topic current and relevant to the field?** The topic deals with hot issues related to global changes in climate and its influences on the life history and spatio temporal distribution of an animal group that is an important contributor to the plankton communitas, i.e. halocyprid ostracods. The study is therefore relevant to the filed.

**Are the aims of the thesis clearly defined and achievable?** The aims of all four topics covered in this thesis are clearly defined, and through good methodology and study design, have been achieved.

**Assessment of the methodology:** All four contributions use adequate methodology which is also well described or referred to. The amount of data covered is impressive and the methods used for its analysis is adequate.

**Are the research methods applied adequate?** Yes

**Is the way the research is conducted rigorous and compliant with scientific principles?** Yes

**Content analysis:** The first part of the thesis is historical review of the study of marine organisms bipolar and antitropical distribution patterns. It only briefly touches ostracods, but it also shows that bipolarity has not been adequately studied, pointing out some possible solutions.

The second part studies sex ratios of polar pelagic ostracods. Here it was particularly important to have a substantial data covering 10 years. This study shows that *halocypris* ostracods could be a useful model group for such studies.

The third part is also based on the large data of the same time scale. Since the environmental changes are known drivers of sex determination in many animal lineages, potentially causing reproductive instability and threatening population health, studying such phenomena in a marine ostracod taxon for the first time, was extremely important. Although the correlation of intersexuality and time was only slightly significant, it shows that it is a species character and therefore be very useful in conservation efforts.

The fourth part studies mitochondrial genome make up of 5 *halocypris* species and compares it with currently available ostracod genomes on GenBank. The results show some exceptions and regularities with other ostracods, but more importantly paves a path to further comparative studies of mitogenomes for the purpose of better understanding evolutionary pressure exerted on these organelles in different species, but also evolutionary pathways of the group. Although long time studied, mitochondrial genomes have a potential insight into evolution and phylogeny.

**Logical coherence of the thesis:** All parts soundly follow principles of scientific writing, and coherence is one of them.

**Quality of arguments and interpretation of results:** All arguments are logical and supported with extensive and updated literature data.

**Degree of innovation and the author's own contribution:** Each part is scientifically original. It uses poorly studied, but important components of the plankton communities in polar regions, which seem to be most vulnerable to changes climate. Since the author did most crucial parts for each of the four contributions, her presence in this research is clearly demonstrated.

**Linguistic and stylistic correctness Structure of the thesis (introduction, chapters, conclusion).** The thesis is well written, follows all principles of the scientific paper format and style. I have nothing else to add to this.

**Quality of sources and bibliography.** The reference lists for each chapter are substantial and importantly are relative to the content.

**Reviewer's conclusions:** This is a high-quality PhD thesis, composed of four independent, but logically and structurally connected, contributions. It touches critical topics of the changing oceans and consequences on living world. It is particularly well done because it has an impressive data set, uses several analytical methods for their proper interpretation, but it also presents a poorly studied ostracod group showing how important model organisms they can become in future research.

**Strengths and weaknesses of the thesis.** The strength lies in the amount of data analyzed, in providing new data on this understudied group, and in dealing with environmentally challenging polar regions of our planet. I was unable to formulate any real weaknesses. Potentially it would be good to have more details on the biodiversity of halocyprid ostracods on one place. I know there are several publications that describe the group's diversity here, but it would be good addition if you included the list of described species. However, this is all minor.

**Does the thesis meet the requirements set for a doctoral dissertation?** Yes

#### **Questions for the PhD student about thesis**

1. Bipolarity and Antitropicality in Marine Taxa: Understanding the Complexities of Libidinal Distribution.

I would expect that more accent was placed on Halocyprididae and what is known about their biodiversity and antitropicality.

2. It's a female world: Sex ration of polar ostracods tested across multiple spatiotemporal scales.

a) Figure 2 would be better if in the captions it was explained that males are grey and females blue.

b) Figure 3: I see that in Svalbard *Boroecias p.* has localities with all males. Is this a mistake in color codes. I also didn't see much attention paid to this in the text.

3. A decade of reproductive abnormalities in pelagic ostracods observed at the entrance to a changing Arctic.

a) From the abstract it was not clear if only A-1 individuals expressed abnormality or also adults?

b) on the page 3 there is an unusual expression: you call segments “antennule”?

c) Is it may be possible that the abnormality is happening as a way of population to regulate the number of males during the reproductive season and regulate the population growth?

4. Mitogenomic organization and diversity of deep-sea pelagic ostracods from both polar research.

a) The title is a little misleading because of the word “biodiversity”, everyone would expect this to deal with some kind of microbiological diversity (species, genus, etc.)

b) In introduction some information on cryptic diversity of ostracods. A lot has been done there as well.

Recommendation: admission to defense or not to scientific council (based on the law):  
Highly recommended.

Application for the distinction of the dissertation if you find it appropriate: This PhD merits to be decorated with merits of distinction.

Final conclusions: This PhD clearly mirrors commitment and hard work, and it is not strange that it produced expectational results.

Signature and date



22 August 2025

Name and surname of the reviewer

Prof. Ivana Karanovic

Scientific institution

Hanyang University, Department of Life Sciences

Date of the review preparation

22 August 2025

