10th European Ostracodologists' Meeting

Ostracoda (Crustacea) as indicators of anthropogenic impacts – a review

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Introduction:

Human activities increasingly impact aquatic ecosystems, necessitating reliable bioindicators for monitoring. Ostracods, small crustaceans are sensitive to pollutants and have proven being effective in this role. This review summarizes Ostracoda responses to anthropogenic stresses across global water bodies, highlighting their value as indicators for water quality, human impacts, and paleo-research. It covers ostracod-related research on organic pollution, effects of heavy metals, hydrocarbons and persistant organic pollutants, salinization, habitat degradation, thermal and nuclear pollution.

Publication patterns and overviews

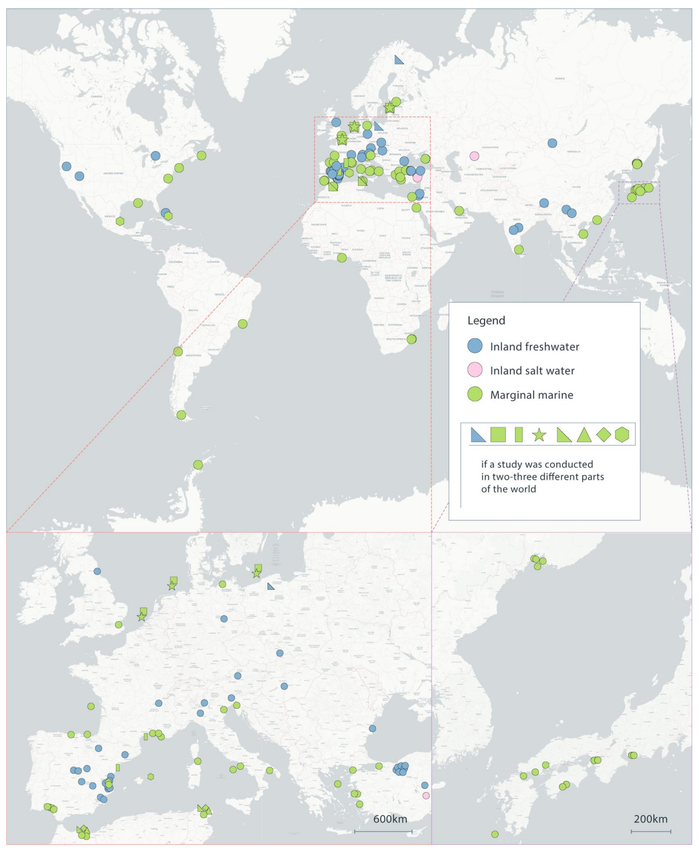


Figure 1: Geographical overview of studies on ostracods as bioindicators of anthropogenic impacts around the world. Laboratory studies with microcosms and Ostracodtoxkit are not included.

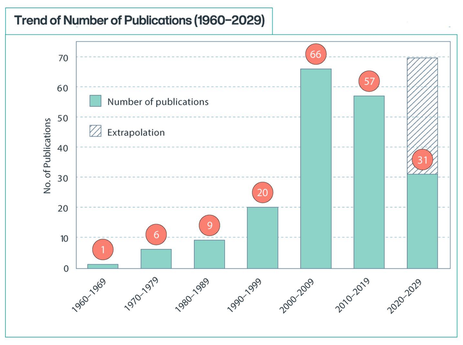


Figure 2: Overview of studies on ostracods as tracers of anthropogenic impacts over the past decades. Circles show exact number of publications; dashed extrapolation illustrates expected number of publications according to the current trend.

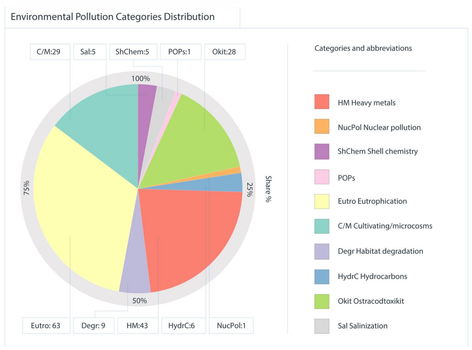


Figure 3: Papers with different applications of ostracods as bioindicators or tracers of anthropogenic impacts. POPs refer to persistent organic pollutants.

Organic pollution

Ostracods have been valuable in detecting nutrient input, heavy metals, fertilizers, oil spills, and even nuclear pollution, with growing research since 1969. While eutrophication is the main focus, studies on metalloids, pesticides, and hydrocarbons show promise.

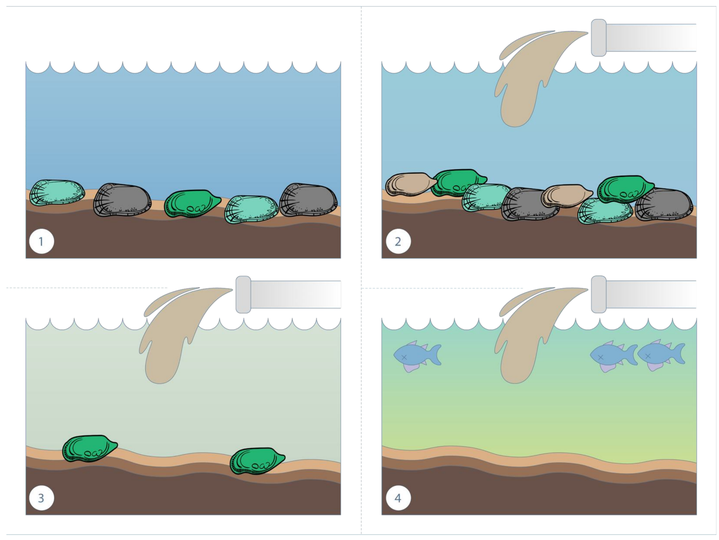
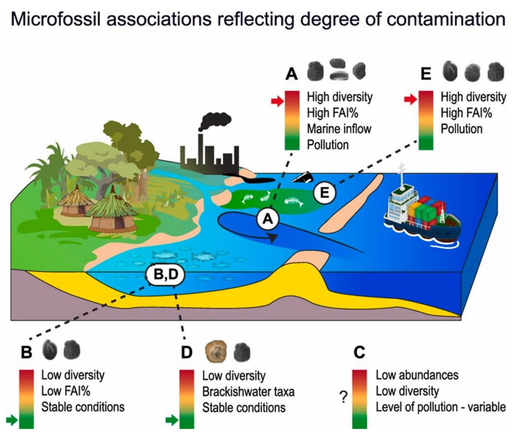


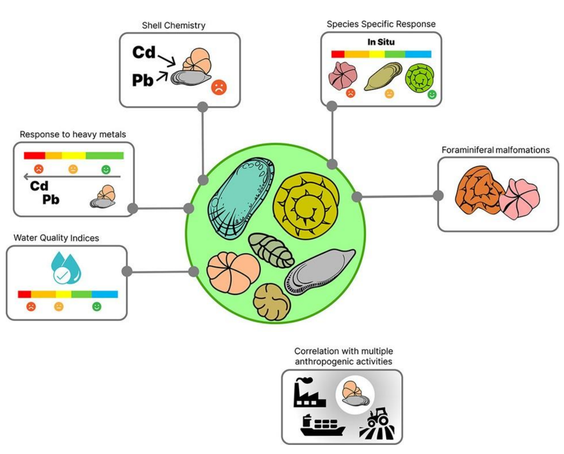
Figure 4: Stages of pollution levels affecting ostracod associations. 1. Non-affected oligotrophic water body with high diversity and many low tolerance species. 2. Diversity and abundance of ostracods tend to increase with moderate organic input. 3. As eutrophication sets in, there is a subsequent decrease in species richness and only tolerant, opportunistic species survive. 4. Eventually anoxic conditions lead to total mortality and no ostracods or only empty shells can be found (created with BioRender).

But what about an example of case studies?

Recent brackish water Foraminifera and Ostracoda from two estuaries in Ghana, and their potential as (palaeo)environmental indicators
Gildeeva et al., 2021



Find out more about our research on Ostracoda as sentinels of anthropogenic impacts in case studies in Ghana and South Africa:



Ostracoda and Foraminifera as bioindicators of (aquatic) pollution in the protected area of uMlalazi estuary, South Africa
Schmitz et al., 2024

Combined effect of organic pollution and heavy metal contamination

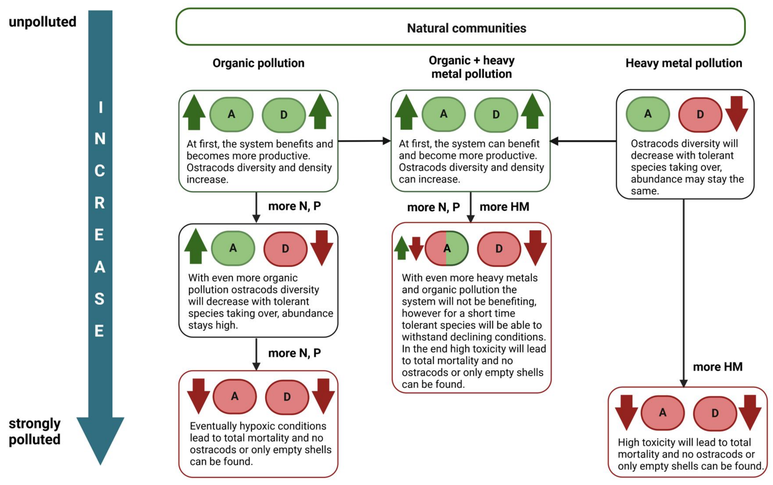


Figure 5: Schematic response of ostracod associations from marine, brackish and freshwater to organic pollution, heavy metal contamination and their combined effects. Green symbols stand for high, red ones for low values of abundance (A) and diversity (D). Arrows show trends. HM – heavy metals, N – nitrogen, P – phosphorus. Created with BioRender.

Conclusions

- Reviewed 122 publications to identify key ostracod species for tracing anthropogenic impacts.
- Compiled tables of sensitive and resistant ostracod species.
- Proposed genus-level classification for better applicability in poorly studied regions and historical contexts.
  - Example: *Loxoconcha* (ecologically tolerant) and *Callistocythere* (sensitive).
- Live-dead comparisons of ostracod communities offer a valuable tool for:
  - Assessing environmental status.
  - Identifying local species losses.
  - Unraveling recovery dynamics.
- Emphasized the need to explore ostracod ecological dynamics due to regional variability in species responses.
- Highlighted challenges in establishing universal environmental assessment standards using ostracods.

However:

- Lack of comprehensive taxonomic atlases due to biogeographical differences among taxa.
- Controversy in the identification of index species.
- Advocate for consistent water quality monitoring with ostracods, requiring years of sampling and verification.
- Stressed the need for further research on:
  - Ecological implications of invasive ostracod species.
  - Their transport and role in freshwater ecosystems under changing climates.

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Main Focus:
Micropalentology (Ostracoda, Foraminifera), Paleoecology, Paleoclimate, Recent, Water Quality, Africa, Central Asia, Tibet

This poster shows a part of the results of a paper currently under review in Earth-Science Reviews