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Original article

Insights gained from a web-based atlas of halocyprid ostracods of the Southern Ocean

Perceptions des ostracodes halocyprides de l'océan Austral obtenues à partir d'un atlas Internet

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Abstract

Planktonic ostracods are an important, but poorly studied component of open ocean plankton communities, which inhabit all depths and play a significant role in detrital cycles. A web-based atlas (http://ocean.iopan.gda.pl/ostracoda) of the distribution of Southern Ocean planktonic ostracods has been developed compiling all extractable published data together with a considerable amount of unpublished data from samples collected during Discovery investigations (1929–1952). The northern boundary of the Southern Ocean was taken pragmatically as 52°S. The website includes information that includes distributional maps, taxonomic drawings (mostly original), size data and systematic notes on 47 species. All the data are freely downloadable as PDF files and are thus available to anyone, anywhere, with access to the web.

Published data are subject to a number of errors generated by faulty identifications and changes in the taxonomy. Most, but not all, published data could be included in drawing up the maps. Not all publications have included detailed positional data and from those that included distributional maps, it was not always possible to relate the plotted distributions to the published station listings. A lack of archived data and specimens for some of the records meant dubious records could not be validated. Data are now generally archived by national oceanographic data centres, but unless supported by voucher specimens further confusion may arise for those current species which are found to include cryptic species after classical morphological studies or molecular studies.

One species (*Boroecia antipoda*) had an apparently anomalous distribution; specimens archived in the Copenhagen Museum were reexamined and the anomalies were shown to result from the fact that some of the specimens belong to a novel species. Generally, the limits to the distributional ranges of the species showed little coherence with major oceanographic features, such as the Antarctic convergence and hence, biogeographical provinces; possible reasons are discussed. Despite these possible inherent errors, the website not only provides a resource for species identification, but is also proving to be a powerful tool for generation of hypotheses and highlighting taxonomic problems.

Résumé

Les ostracodes planctoniques sont une composante importante, mais peu étudiée des communautés planctoniques de l'océan ouvert, qui vivent à toutes les profondeurs et jouent un rôle substantiel dans les cycles détritiques. Un atlas Internet (http://ocean.iopan.gda.pl/ostracoda) de la distribution des ostracodes planctoniques de l'océan Austral a été développé, compilant toutes les données publiées pouvant être extraites, ainsi qu'une quantité considérable de données non publiées à partir d'échantillons collectés pendant les *Discovery investigations* (1929–1952). La limite nord de l'océan Austral a été pragmatiquement prise à 52°S. Le site Internet comprend des informations incluant des cartes de distribution, des dessins taxonomiques (pour la plupart originaux), des données sur la taille des animaux et des notes méthodiques sur 47 espèces. Toutes les données sont téléchargeables librement en fichiers PDF et sont donc disponibles à tous ceux ayant accès à Internet.

Les données publiées sont sujettes à un certain nombre d'erreurs générées par des identifications erronées et des changements dans la taxonomie. La plupart des données publiées, mais pas toutes, ont été utilisées pour l'élaboration des cartes. Toutes les publications n'incluaient pas de données de position et pour celles comprenant des cartes de distribution, il n'était pas toujours possible de connecter les distributions tracées aux listes de stations publiées. Les données sont maintenant généralement archivées par des centres nationaux de données océanographiques, mais à moins

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qu'elles ne soient soutenues par des exemplaires de spécimens, une confusion supplémentaire peut survenir pour les espèces actuelles incluant des espèces cryptiques après les études morphologiques ou moléculaires classiques.

Une espèce (*Boroecia antipoda*) avait une distribution anormale apparente. Les spécimens archivés au musée de Copenhague ont été réexaminés et il a été démontré que les anomalies résultaient du fait que certains des spécimens appartenaient à une nouvelle espèce. Généralement, les limites des aires de distribution des espèces ont montré peu de cohérence avec des processus océanographiques majeurs, comme la convergence Antarctique et donc, avec les provinces biogéographiques. Les raisons possibles sont discutées. Malgré ces erreurs sous-jacentes possibles, le site Internet fourni non seulement une ressource pour l'identification d'espèces, mais aussi un outil puissant pour la génération d'hypothèses et pour souligner des problèmes taxonomiques.

Keywords: Planktonic ostracods; Halocyprids; Southern Ocean; Zoogeography; Systematics

Mots clés : Ostracodes planctoniques ; Halocyprides ; Océan Austral ; Zoogéographie ; Systématique

1. Introduction

Halocyprid ostracods are important constituents of open ocean plankton communities. Numerically, they are often the second or third most abundant group in mesoplankton samples and they occur at all depths apart from the upper 100–200 m in polar oceans. The majority of species are detritivores and play a significant role in the recycling of marine snow and faecal pellets within subthermocline waters. Even so, they are seldom included in general plankton studies, even in those few sampling programmes that purport to analyze the full species composition of the pelagic communities. This is, in spite of the current intense interest in biodiversity and species richness, stimulated by major research initiatives, such as the census of marine life. This lack of attention to the ostracods results partially from a lack of expertise in the group, but also because of the inaccessibility of much of the relevant taxonomic literature and a general lack of identification resources. Therefore, it has remained difficult to establish their bathymetric and zoogeographical ranges and also to relate their distributions to emerging paradigms such as Longhurst's biogeochemical provinces (Longhurst, 1995, 1998). In turn, this makes it almost impossible to use the ostracod data to detect changes in plankton communities resulting from the impacts of climate fluctuations, as for example have emerged from continuous plankton recorder surveys in the North Atlantic in response to North Atlantic oscillations (Reid et al., 2001; Beaugrand, 2004a). Nor is it currently possible to identify potential plankton indicators of such changes (Beaugrand, 2004b). Pierrot-Bults (1998) emphasised the enormous potential of the vast amount of published data on plankton distributions that have not been collated. So we identified the following needs:

- a compilation of global and regional lists of the known halocyprid species;
- a comprehensive compilation of published and unpublished geopositional data for all species;
- the development of taxonomic resources that are readily and freely available to facilitate accurate determinations of species. The value of such resources will be greatly enhanced if they can be readily updated to include new species and taxonomic revisions;
- a comprehensive bibliography of the group;
- a database of size data for adult and juvenile instars from different regions; size being a useful indicator of species' identities.

The senior author had accumulated extensive quantities of unpublished data, and had access to a large numbers of samples collected in the 1930s by Discovery investigations, which had not previously been worked up systematically. The award of exchange fellowships to the two authors by the Royal Society and the Polish Academy of Sciences in order for them to collaborate on studies of the planktonic ostracods gave further impetus to this study.

Ultimately, we aim to develop a global web-based atlas, but as an initial step, we chose to focus on the fauna of the Southern Ocean, as a demonstration project. The option to publish on the worldwide web was adopted to circumvent publication difficulties, despite the lack of formal peer review. Publication in a journal would have had the added disadvantages of cost to users, particularly those working in under-resourced laboratories in developing countries, where there is still an emphasis on traditional approaches to plankton sampling, identification and enumeration. Hard copy versions of taxonomic studies and keys can rapidly become out-of-date and so, lead to the confusions in the literature that remain stubbornly difficult to resolve. We concluded that publishing a web-based atlas offered the optimum solution to making the atlas widely available.

2. Methods

2.1. Compilation of the data bases

A reasonably comprehensive bibliography of publications reporting on planktonic ostracods had already been compiled by the senior author. Using this, a database of all published records for all species was compiled. However, not all published records could be converted into acceptable geopositional data. In the past, many authors were either unable or unwilling to publish their distributional records and prior to 1970s, there were few, if any, formal archives existed for biological oceanographic data. Even when national oceanographic data centres were established, they have been understandably slow in developing inventories of biological data. Some papers have only recorded the latitudinal and longitudinal ranges of species'