



TAXONOMIC STANDARDIZATION WORKSHOP

Deep Sea Macrofauna of the Clarion-Clipperton Zone

The second workshop in the series of taxonomic standardization workshops was convened at the East Sea Research Institute of the Korea Institute of Ocean Science & Technology (KIOST) in Ulsan-gun, Republic of Korea, 23-30 November 2014. It focused on the evaluation and difficulties in assigning macrofaunal diversity (classified to species level) to the deep sea of the Clarion-Clipperton Zone (CCZ). The main taxonomic groups analyzed during the workshop were tanaidacea, amphipoda, isopoda, ostracoda, mollusca, bryozoa and polychaeta.

INTRODUCTION

Following informal consultations in January 2012 on the standardization of the biological component of environmental baseline data in exploration areas, the ISA planned a series of taxonomic standardization workshops to focus on megafauna, macrofauna, and meiofauna in contract areas. It was envisaged that all contractors for polymetallic nodules in the Clarion-Clipperton Zone (CCZ) would share their taxon list at the highest possible taxonomic resolution (taxa level) to establish a sound and defined protocol for reporting biodiversity to the Authority. It is expected that the standardization work will also assist in the Authority's work on the Environmental Management Plan for the CCZ.

The first workshop in the series was convened in Wilhelmshaven, Germany, from 10-15 June, 2013, and focused on the evaluation of samples and difficulties encountered in assessing megafaunal biodiversity in the deep sea, specifically associated with polymetallic nodule deposits in the CCZ. The main taxonomic groups analyzed in this workshop were: fish, holothurians, asteroids, crinoids, ophiurids, cnidaria and protistas together with images of crustaceans, cephalopod molluscs and sponges. The third and final workshop in the series will be held in Belgium in December 2015 and will focus on meiofauna.

The objective of the Korea workshop was to bring together international deep sea macrofauna experts with representatives of ISA contractors for the exploration for polymetallic nodules in the Area to

establish a standardized taxonomy for the baseline studies of macrofauna associated with these resources by:

- creating a standardized nomenclature with associated descriptions and keys, to be made available on the web for use by contractors;
- recommending to contractors a standardized taxonomic identification protocol including sampling and storing methods;
- creating a database of the locations where different species have been observed (including biogeographic variables), as was done for the megafauna workshop, to ultimately create a faunal distribution atlas for the CCZ;
- providing guidelines and procedures to be utilized by contractors, prospectors and the marine scientific research community in applying the standardized nomenclature;
- collecting representative images for each identified species;
- creating an atlas of the locations where different species have been observed; and
- creating a programme of work to address any gaps in knowledge or understanding.

The workshop was attended by 12 taxonomic experts and 13 contractor representatives. It comprised a series of presentations on tanaidaceans, amphipoda, isopoda, ostracoda, mollusca, bryozoa and polychaeta by the experts together with hands-on sessions, where

representatives of contractors and experts exchanged and discussed the collected specimens. The contractors presented papers on their current status of reporting macrofaunal diversity. The workshop included three practical sessions where samples collected by various contractors were examined by the taxonomists.

The results highlighted some of the challenges and issues facing macrofaunal taxonomy in the CCZ. In all cases, the number of species recorded in terms of the individuals examined was high and in some cases 1:1. The proportion of new taxa identified from the small number of individuals provided by the contractors was also high, including the discovery of genera and species new to science. It became obvious that to be able to assess the biodiversity in a timely and accurate way, greater taxonomic resources will be needed. The sample identifications were all based on morphological analyses which also reflected the general absence of molecular approaches in the baseline surveys.

It was noted that there were several taxonomic challenges facing contractors in macrofauna classification in the CCZ, including the fact that after more than 200 cruises, the output of information on diversity had been very slow using traditional taxonomy procedures, and that the sampling in this mineral province had neither been pragmatic nor systematic. It was suggested that the main taxonomic challenge is to devise new and appropriate sampling efforts as well as DNA sampling of individual tissues. Participants were informed that among the advantages of DNA taxonomy was the storage of an organism's DNA sequence after its identification for further reference to assign similar individuals the same code (species), and storage information for future analyses (phylogene, gene flow, connectivity, species range, and population structure). It was also pointed out that DNA techniques could also be used to assess bulk sample identification (eDNA) very quickly using a DNA library as well as for a single sample from a single specimen (reverse taxonomy).

The absence of a molecular approach would be a constraint to producing rigorous, verifiable and robust taxonomy in the future.

Considering the low number of samples, it was noted that caution should be taken in interpreting the observations, which nevertheless, pointed to a highly diverse fauna. The small number of samples also hint at low densities that might cause problems in the identification and classification of new species. To carry out molecular work it was necessary to have more than one individual. If the numerical abundance on the abyss is low, the probability of encountering several specimens of the same species in a sample would be small. The deployment of additional samplers such as the epibenthic sledge would supplement the box core samples by providing greater numbers of individuals to understand the diversity of the CCZ.

Several problems were encountered with the preservation of samples and treatment of material which included poor fixation or insufficient care in processing of samples once on board the ship. Some of the material was in poor condition (dehydrated or decalcified) with parts and appendages missing and therefore could not be identified to a species level. There was some mis-sorting of crustacean specimens by more than one of the contractors (e.g. mixing of isopods, tanidaceans, amphipods and copepods). Furthermore, many other phyla were found in some mollusca samples, including brachiopods and ostracods suggesting that there were important issues around the taxonomic resolution and competencies. Samples were often fragmented or compressed which indicated that the sieving process was too vigorous. Given the cost of sampling in the abyss, more care with sample handling is needed.





WORKSHOP RECOMMENDATIONS

The following recommendations are the outcome of discussions among taxonomic experts and contractor representatives and are grouped under four subheadings: (a) sampling and preservation; (b) taxonomic resolution; (c) technical co-operation; and, (d) data access and availability.

Sampling and Preservation

- (a) The workshop recommended that contractors undertake biologically focused sampling cruises and that mixed discipline cruises allocate sufficient ship berth space for biological teams and sufficient wire time to be able to extract enough samples for biology by defining an area of research - both the scientific aims and spatial extent; take samples randomly in the research area as a preliminary survey; and, analyse the samples and assess the species cumulative curve. This facilitates an efficient estimation of the number of samples required for the assessment of the number of species in the area. Repeated sampling to overcome any shortfall would also need to be done.
- (b) The workshop strongly recommended that ISA organize and convene a workshop on Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) process and its application in the CCZ to bring together the appropriate experts as soon as was practical.
- (c) The workshop noted that box core samples for biology should not be divided into subsamples for other disciplines.
- (d) Contractors were urged to use the LTC guidelines in the processing of box core samples and that any additional sample subdivision or processing step should be reported in their annual reports to the ISA.
- (e) Contractors were urged to take samples for molecular taxonomic analyses to support greater accuracy in biodiversity and ecological assessments.
- (f) Contractors were urged to follow the most appropriate 'cold-chain' protocol to support molecular samples.
- (g) Contractors were urged to deposit all identified material (including molecular samples) in an internationally-recognized museum or collections facility. The material should be freely accessible for

study and be available for loan to researchers. The need for material to be archived in an appropriate collections facility should be specified in the contractor's plan of work and the contractor should identify the facility in which their material would be deposited. How the transfer of taxonomic material to the collections facility will be financed should also be in the plan of work.

- (h) The workshop noted that the epibenthic sledge device should be included as part of the sampling for the baseline study.

Taxonomic Resolution

Specimens must be identified to species level and follow the World Registry of Marine Species (www.marinespecies.org).

Technical Cooperation

The participants recommended that a technical cooperation framework be established to support the following areas:

- (a) Training;
- (b) Visiting-scientist programmes;
- (c) Joint industry/academic partnerships;
- (d) Taxonomic consistency and quality control;
- (e) The participants strongly urged the ISA to develop a technical co-operation framework to enable the building of support which will be essential to advance understanding of the risk and impacts of mining in the CCZ;
- (f) The participants urged the ISA to establish a mechanism which would support contractors seeking taxonomic expertise – a form of taxonomic clearing house mechanism;
- (g) The participants recommended that the ISA develop a series of inter-calibration workshops to bring together contractors with groups of taxonomists to review and assess collections made in different contract areas;
- (h) The ISA should use the provided list of deep-sea taxonomists to create an expert panel to assist them in the assessment and validation of species level evaluation as part of the annual data returns; and,

- (i) Contractors were encouraged to collaborate among themselves and with relevant academic partners, to address gaps and provide consistency, particularly in taxonomic identification.

Data Access and Availability

- (a) The workshop fully supported the ISA's plans to develop the existing database. Researchers and contractors were also encouraged to work with the ISA to provide expertise in developing the taxonomic modules.
- (b) Taxonomists working on material from the CCZ were urged to publish their data in recognized scientific journals as soon as practical.
- (c) Participants were encouraged to facilitate the publication of Special volumes in appropriate scientific journals, such as ZooKeys (<http://www.pensoft.net/journals/zookeys/>) and Zootaxa (<http://www.mapress.com/zootaxa/>), to enable taxonomists to describe the fauna of the CCZ as soon as sufficient material is available.

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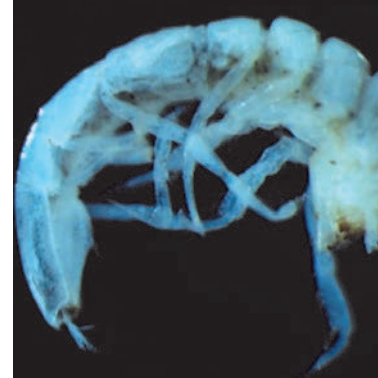
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For complete copies of the workshop presentations, visit <http://bit.ly/1HuiAmD>



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