Report on the Abyssal Polychaete Inter-calibration Project (APIP) Workshop held at The Natural History Museum (London) January 8-11 2007

Report by Dr Adrian Glover, e-mail a.glover@nhm.ac.uk

APIP workshop participants[1]

Left to right in image above: Gordon Paterson, Dieter Fiege, Lenaick Menot, Kirsty Kemp, Adrian Glover, Alex Muir, Emma Sherlock, Sarah Mincks, Markus Böggemann, Andy Mackie, Craig Smith, Stacy Doner, Kristian Fauchald, Brigitte Ebbe, Jim Blake, Nataliya Budaeva, Iris Altamira, Susan Chambers.

Organising committee: Adrian Glover, Gordon Paterson, Brigitte Ebbe, Craig Smith

APIP workshop funding

Census of the Diversity of Abyssal Marine Life CeDAMar

J.M. KAPLAN FUND

NATURAL HISTORY MUSEUM

INTERNATIONAL SEABED AUTHORITY

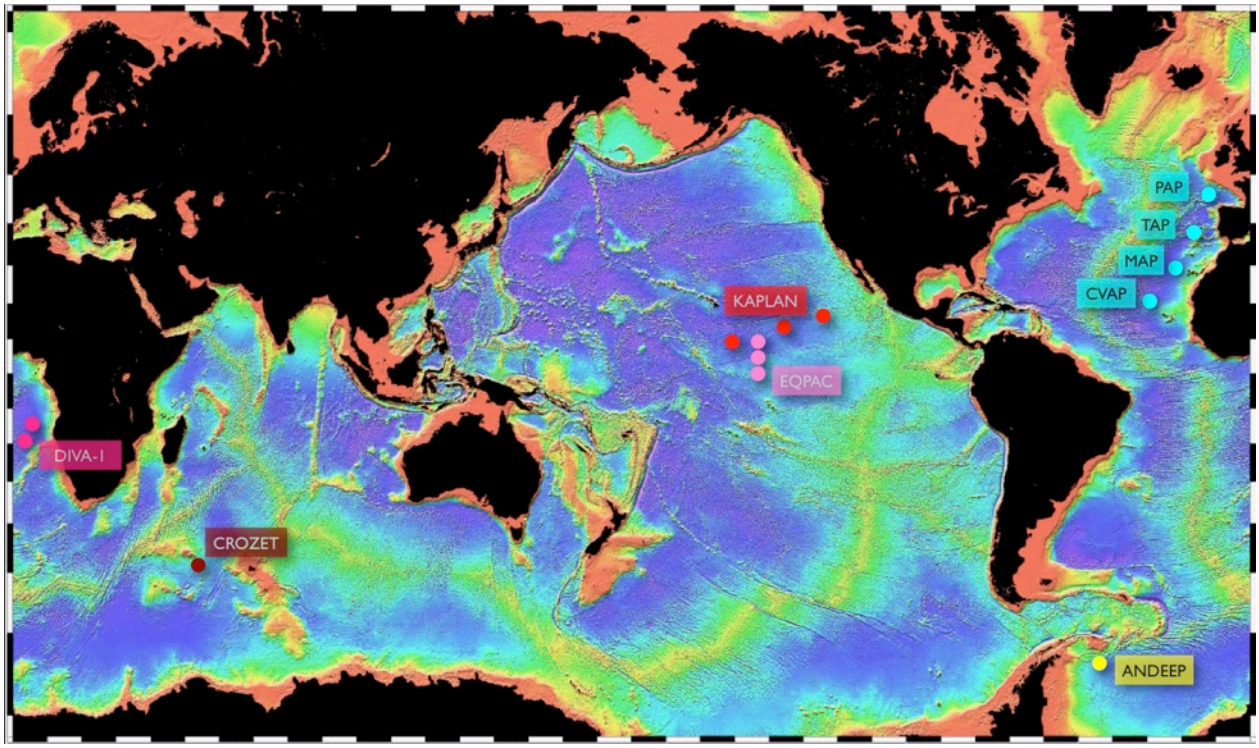
marbef

[1] Contact details for the APIP participants are provided in Appendix 3

Introduction

The APIP workshop was conceived when the organisers were asked by the Census of the Diversity of Abyssal Marine Life (CeDAMar), a field program of the the Census of Marine Life (CoML), to arrange a meeting to discuss problems in abyssal polychaete taxonomy. With the financial support of CeDAMar, we were able to propose a workshop to be held at the Natural History Museum (NHM) in London with two specific objectives:

- To discuss **a strategy to overcome the 'taxonomic impediment'** in studies of abyssal polychaetes
- To undertake **trial taxonomic synthesis studies** by bringing taxonomists and abyssal samples together from multiple geographic regions in order to produce guidelines for a future, larger study



Location of abyssal polychaete samples samples examined during the APIP workshop

The workshop convened on January 8, with 18 participants from countries including the UK, USA, Germany, France and Russia.

Methods

The workshop was held in the Darwin Centre of the Natural History Museum, a recently built facility used by the Zoology Department to house both the national spirit collection (specimens preserved in fluid, usually ethanol) and research teams, administrators and curators of the collection. An extensive collection of deep-sea material is present, including historical collections from early expeditions and the more recent samples collected by Gordon Paterson and Adrian Glover, polychaete researchers in the department.

The workshop comprised 3.5 days and including discussion sessions and microscope-based break-out sessions. Discussion sessions were held in the first floor meeting room (formerly a public gallery) and microscope sessions in a large wet lab facility one floor below with 12 microscopes (6 dissection scopes and 6 high-power scopes).

The original agenda proposed for the APIP workshop is provided in Appendix 2. External visitors were housed in a hotel 5 minutes walk from the Museum, and a programme of social events ensured discussions continued into the evenings.

Results

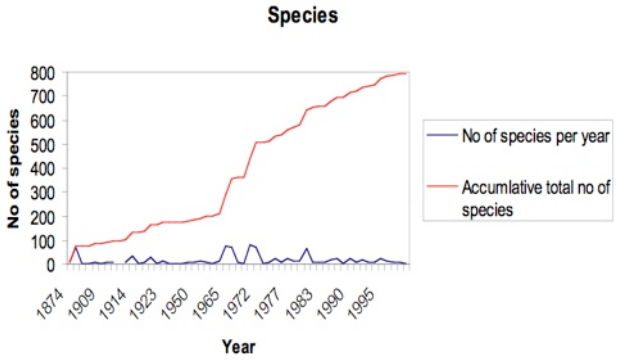
Discussion session 1 - status report and purpose of workshop

After the meeting was opened with a welcome from the Keeper of Zoology (Prof Phil Rainbow), the workshop began with Adrian Glover outlining the proposed purpose of the workshop:

- To discuss **a strategy to overcome the 'taxonomic impediment'** in studies of abyssal polychaetes
- To undertake **trial taxonomic synthesis studies** by bringing taxonomists and abyssal samples together from multiple geographic regions in order to produce guidelines for a future, larger study

Brigitte Hilbig then outlined the role of CoML and CeDAMar including the field programmes within (ANDEEP, SYSTCO, CROZEX, DIVA, BIOZAIRE, KAPLAN, NODINAUT, LEVAR). A unifying theme was the requirement for high-quality taxonomy on specimens collected during these expeditions, with limited personnel time to achieve these goals. In addition, it was apparent that large numbers of new species are being recovered from these abyssal sites.

Gordon Paterson then highlighted some preliminary results from another CeDAMar funded project that is databasing records of abyssal polychaetes. Although there are some 3389 records of polychaete species below 3000m, and 790 species in total known, large areas of the worlds oceans remain unsampled (or at least the material has not been described taxonomically). Historical data show a slow rate of increase of species descriptions from 1900-1960, then the most rapid rate of alpha taxonomy between 1960-1980, and a gradual slowing down of descriptions from the mid 1980's onwards.



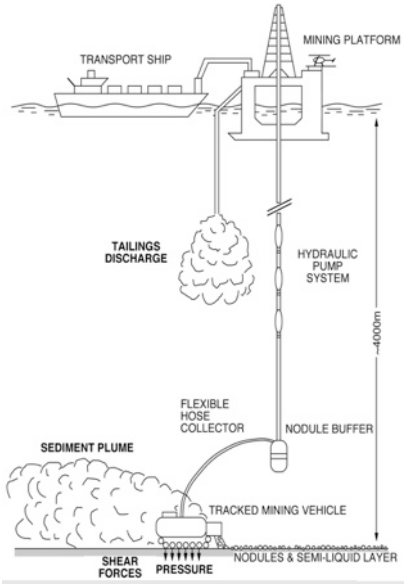
Numbers of new abyssal polychaete species described per year 1874-2005 (Paterson et al. unpubl. data)

Craig Smith then presented a talk on 'what do we want to know?', outlining the needs of ecologists, biologists and policymakers of the taxonomic community. There is increasing interest in large-scale patterns of biodiversity in the deep-sea, driven both by basic interest and applied interest related to potential impacts from mining, oil exploration, waste disposal (inc. CO2). He outlined how it is essential to know:

- The number of species residing within areas potentially exposed to impacts
- The typical geographic ranges (and rates of gene flow) for species living within a region exposed to impacts (e.g an ocean basin with manganese nodule deposits)

Craig Smith also outlined reasons why our knowledge of abyssal biodiversity and our ability to evaluate extinction risk is extremely limited for several reasons:

- Abyssal areas are undersampled
- The abyssal fauna is very poorly described
- Different studies have used different taxonomists who have used their own databases of 'working species' (e.g *Prionospio* sp. A, sp. B etc.) precluding faunal comparisons over large scales.



Manganese nodule mining (adapted from Glover & Smith, 2003)

The final part of Session 1 was a discussion chaired by Adrian Glover outlining the need to split into microscope-based break out groups to focus on particular taxa (e.g polychaete families) relevant to the expertise of the participants. The final break-out groups were agreed as follows:

- **Spionidae:** Andy Mackie, Iris Altamira, Jim Blake

- **Cirratulidae:** Gordon Paterson, Stacy Doner, Susan Chambers, Jim Blake
- **Paraonidae:** Lenaick Menot, Adrian Glover, Craig Smith, Jim Blake
- **Syllidae:** Markus Böggemann, Lenaick Menot, Jim Blake, Brigitte Ebbe
- **Glyceridae, Goniadidae:** Markus Böggemann
- **Polynoidae:** Kristian Fauchald, Alex Muir, Dieter Fiege, Sarah Mincks
- **Onuphidae:** Nataliya Budaeva
- **Ampharetidae, Dorvilleidae:** Briggite Ebbe, Andy Mackie

The original goals of the break-out groups were as follows:

1. Summary taxonomic problems & characters informative for the identification of particular families
2. Timetable to publication
3. Conference poster
4. Resources required for a taxonomic synthesis of these groups
5. Strategy for a synthesis on a variety of spatial scales. Regional, Basin, Global.
6. Other taxonomists to incorporate into future family-based workshops
7. What should happen next? Where/how to hold future workshops?
8. Knowledge transfer and training

Abyssal polychaeteologists at work

Microscope session 1

The first microscope session got underway in the afternoon with participants working in groups as above.

Discussion session 2

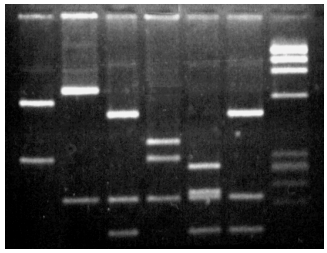
The second discussion session began with Brigitte Hilbig providing an overview of the ANDEEP programme. This project has been running since 2002, with a series of three cruises to the Southern Ocean and Antarctic Peninsula region. First results from the polychaetes suggest a high percentage of widespread/cosmopolitan species, with a true deep-sea fauna from depths greater than 2500m and a distinct abyssal fauna.

Lenaick Menot then provided an update on the NODINAUT project, the context of which is an environmental baseline survey within a manganese nodule mining claim area. The goals of the project are to 1) describe the abundance and diversity of benthic fauna at a regional scale, 2) to study the effects of nodules on benthic communities and 3) to assess the resilience of abyssal communities by studying a past mining track. Identifications are still underway but preliminary data suggests that nodule density and form is highly heterogeneous at multiple scales and may significantly structure benthic communities.

Jim Blake provided an update on his studies of polychaetes from a whole series of projects looking at the north American continental slope and rise. 750-800 new species of polychaete have been recorded from these extensive studies, and taxonomic work is ongoing.

Craig Smith and Adrian Glover updated the participants on the KAPLAN project. This project involved a series of three cruises to three sites across the central equatorial Pacific, with close collaboration with NODINAUT scientists. One of the main goals was to use a molecular approach to characterise species distributions and rates of gene-flow across the manganese nodule mining area, with these data to be used for the design of potential marine protected areas. Preliminary data suggest high rates of species turnover (and hence low levels of gene-flow) at a molecular level, with both nematode and polychaete studies showing quite high heterogeneity for the 18S gene. However, morphologies are in general quite conserved across the region, with conspecific morphotypes present in multiple sites. One of the discussion points was whether taxonomic work should extend to descriptions of these cryptic species.

Dieter Fiege outlined results from the DIVA project, which has been working on latitudinal gradients of diversity in the South Atlantic, in particular examining rates of species turnover and biodiversity at a range of scales. Taxonomic identifications are in progress and further expeditions are planned in 2008.



Discussions continued with three futher presentations on methods in abyssal systematic studies. Kristian Fauchald presented a demonstration of the DELTA system for coding morphological characters, Andy Mackie outlined a range of web-based taxonomic systems and Sarah Mincks outlined some of the problems and solutions for obtaining molecular sequence data from abyssal polychaetes.

Microscope session 2

A second microscope session took place in the afternoon, with participants working on research collections brought with them, and using the national type collection.

Discussion session 3

The third day opened with a talk by Geoff Boxshall on copepod parasites on polychaete hosts. This was followed by a presentation by Jim Blake on the 9th International Polychaete conference:

http://www.dmc.maine.edu/wormsinfo12-06.html

Craig Smith then presented a talk on a recent project he has been involved in to model endemism in the deep-sea. The goals of this project are to predict the numbers of endemics one might expect given a certain level of sampling and known population distribution patterns, and to use these data to further strengthen our sampling effort.

The final discussion session of the day, chaired by Gordon Paterson, focussed on data sharing within the polychaete community. It was agreed that one way to overcome the taxonomic impediment would be to share data using an informal web-based taxonomic system, with a collaborative authoring approach.

Break-out group presentations

Break-out groups reported back on their microscope sessions. Most participants were in agreement that while major monographs were unlikely given the lack of funding for this type of work, these family-based groups could be pushed into further collaboration using a web-based information exchange system. The cirratulid group proposed developing a poster for the forthcoming IPC and submission of a paper on abyssal cirratulids.

- **Spionidae:** Andy Mackie, Iris Altamira, Jim Blake
- **Cirratulidae:** Gordon Paterson, Stacy Doner, Susan Chambers, Jim Blake
- **Paraonidae:** Lenaick Menot, Adrian Glover, Craig Smith, Jim Blake
- **Syllidae:** Markus Böggemann, Lenaick Menot, Jim Blake, Brigitte Ebbe
- **Glyceridae, Goniadidae:** Markus Böggemann
- **Polynoidae:** Kristian Fauchald, Alex Muir, Dieter Fiege, Sarah Mincks
- **Onuphidae:** Nataliya Budaeva
- **Ampharetidae, Dorvilleidae:** Briggite Ebbe, Andy Mackie

Final discussion

The workshop rounded up with a final discussion on the results of APIP and recommendations to be made.

Discussion and Recommendations

The participants were in broad agreement with regards the future direction of abyssal taxonomy and recommendations were made as follows:

1. We recommend that abyssal polychaete researchers collaborate using web-based information exchange systems that allow uploading of morphological data (e.g descriptions, images). An example system to use would be the European Distributed Institutue of Taxonomy http://www.editwebrevisions.info/
2. Researchers should be encouraged to collaborate within taxonomic groups (e.g polychaete families), rather than within sampling programs, furthering our ability to understand macro-ecological patterns on regional scales in the abyss
3. Further CeDAMar sponsored workshops should take the model developed by the APIP group and use it in more detailed studies of individual families, e.g funds that would allow 2-3 researchers to work together for 1-2 weeks on a particular taxonomic problem/paper would greatly assist in developing an integrated taxonomy for abyssal polychaetes.
4. Standard worksheets and character sets should be developed for the recording and sharing of morphological information using a system of ‘informal’ taxonomic exchange. These data-sharing exercises would lead to both a greater taxonomic output and better quality ecological data.
5. Abyssal polychaete workers should meet informally at the forthcoming IPC in Maine to implement these recommendations
6. A poster should be produced at the IPC highlighting the results from the APIP workshop.
7. A working group should be set-up to manage and integrate data and voucher specimens from past projects that have since ‘stalled’ following initial publication of ecological data (i.e projects where ‘morphotyping’ of species has been undertaken to sp. A, B level and biodiversity papers published, but taxonomic integration with published names and/or other informal datasets has stalled due to lack of ongoing funding).
8. Sampling methods for DNA studies currently in use should be evaluated. Bulk-fixation of sediments or sieved sediments in ethanol should be avoided if time allows for the live-picking of animals on ship, and fixation in RNALater (or similar buffer) and freezing at at least -30C.

Apppendix 1 - Papers in preparation

The following abyssal papers are in preparation and acknowledgement should be given to CeDAMar if appropriate:

1. ANDEEP cirratulids (J Blake, S Doner)
2. Orbiniid review (J Blake)
3. Polynoid review (K Fauchald)
4. Phyllodocid review (M Böggemann)
5. DIVA biodiversity paper (D Fiege)
6. *Aurospio* review (S Mincks, A Glover)
7. KAPLAN biogeography (G Paterson, A Glover, C Smith)

Appendix 2 - Future sampling programs planned

1. SYSTCO - Antarctica - Nov 07 - Feb 08 (B Hilbig)
2. DIVA-3 - S Atlantic - 2008 (D Fiege)
3. EqPac Size - central Pacific - proposal only - (C Smith)
4. PAP - NOC?
5. NODINAUT 2 - 2009 proposal (L Menot)
6. German cruise to CCFZ - proposal only
7. BIOPEARL II 2008 - Antarctica - (A Glover - polychaetes, PI - Katrin Linse, BAS)

Appendix 3 - List of participants

Altamira, Iris
University of Hawaii
USA
irisis@hawaii.edu

Blake, Jim
University of Massachusetts
USA
JBlake@ensr.aecom.com

Budaeva, Nataliya
Institute of Oceanology
Russia
BUDAEVAN@si.edu

Böggemann, Markus
Germany
mboeggem@aol.com

Chambers, Susan
National Museums Scotland
UK
s.chambers@nms.ac.uk

Doner, Stacy
University of Massachusetts
USA
sdoner@ensr.aecom.com

Ebbe, Brigitte
German Center for Marine Biodiversity Research (DZMB)
Germany
bhilbig@senckenberg.de

Fauchald, Kristian
Smithsonian Institution
USA
FauchaldK@si.edu, FAUCHALD@si.edu

Fiege, Dieter
Senckenberg Museum
Germany
Dieter.fiege@senkenberg.de

Glover, Adrian
Natural History Museum
UK
a.glover@nhm.ac.uk

Kemp, Kirsty
Natural History Museum
UK
k.kemp@nhm.ac.uk

Mackie, Andy
National Museum of Wales
UK
Andy.Mackie@museumwales.ac.uk

Menot, Lenaick
IFREMER
France
Lenaick.Menot@ifremer.fr

Mincks, Sarah
Natural History Museum
UK
s.mincks@nhm.ac.uk

Muir, Alex
Natural History Museum
UK
aim@nhm.ac.uk

Paterson, Gordon
Natural History Museum
UK
g.paterson@nhm.ac.uk

Sherlock, Emma
Natural History Museum
UK
e.sherlock@nhm.ac.uk

Smith, Craig
University of Hawaii
USA
craigsmi@hawaii.edu