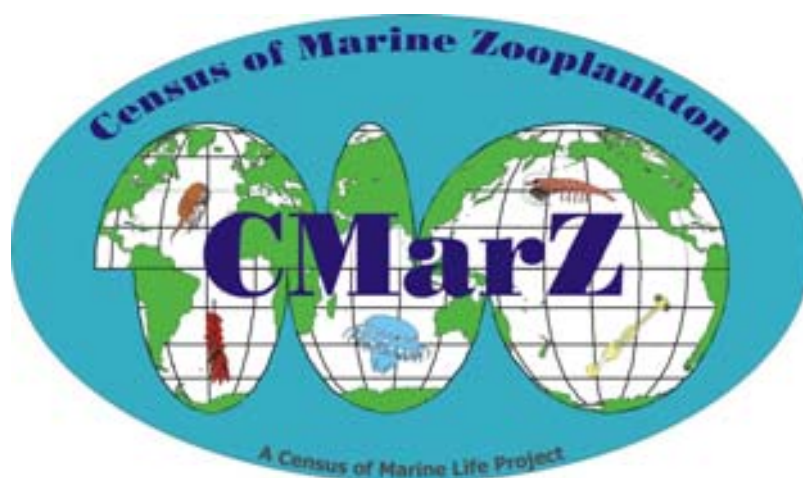


Report of the
2nd Steering Group Meeting
Census of Marine Zooplankton (CMarZ)



Ocean Research Institute
University of Tokyo
Tokyo, Japan

November 6 – 8, 2006

Report distributed January 8, 2007

I. Summary of the CMarZ Public Symposium (Day 1)

The goals of the second CMarZ Steering Group meeting included:

1. Public presentations on CMarZ research activities;
2. Review of the goals of CMarZ, identifying and overcoming the major challenges; and
3. Planning for CoML benchmarks of 2007 and 2010.

The workshop began with introductions by Prof. Shuhei Nishida and a welcome from Prof. Makoto Terazaki, Director of the Ocean Research Institute (ORI). Prof. Terazaki mentioned CMarZ and NaGISA, among the CoML programs with offices in Japan. He said that ORI seeks to coordinate regional oceanography in Southeast Asia, and emphasizes studies in marine biodiversity. He noted that Shuhei Nishida is a leader in Asia for zooplankton.

Shuhei Nishida welcomed the meeting guests who are zooplankton experts from Japan. He reviewed the agenda and the sessions planned for the day. Ann Bucklin made a presentation with a general introduction to CMarZ. The scheduled talks followed:

- Exploring the deep sea: 2006 CMarZ cruise in the Sargasso Sea (Peter Wiebe)
- Black and Caspian Sea zooplankton (Ahmet Kideys)
- Antarctic and Indonesia (Sigi Schiel and Astrid Cornils)
- Zooplankton monitoring along the southern African coast (Hans Verheye)
- Time-series monitoring in Japan (Hiroya Sugisaki)
- Inner-Space Speciation Project (Larry Madin)
- North Atlantic Ridge (Webjørn Melle)
- Diversity and phylogeny of gelatinous zooplankton in the deep eastern Pacific (Erik Thuesen and Steven Haddock)
- Jostling for jellies: muddling molecular & morphological methodology (Francesc Pages and Dhugal Lindsay)
- Coastal waters of China and the Antarctic (Sun Song)

The Workshop Agenda can be viewed in Appendix I; Workshop Participants are listed in Appendix II. The presentation PowerPoint files are available on the CMarZ website.

The late afternoon session, “How Does CMarZ Work”, focused on practical matters associated with coordination of the program. The talks included:

- Virtual taxonomic network (Annelies Pierrot-Bults)
- Training para-taxonomists (Shuhei Nishida and Erik Thuesen)
- DNA barcoding of specimens (Rob Jennings)
- CMarZ database and species pages (Peter Wiebe and Nancy Copley)

Discussion during this period was active, and resulted in several recommendations and action items, described below. No summary discussion period was held due to limited time availability.

II. Summary of Working Group Activities and Recommendations (Day 2)

The second day of the workshop included three Working Group sessions, with introductory plenary presentations from the chairpersons and individual reports from group members. In the afternoon of Day 2, there were also presentations by Japanese colleagues on their CMarZ activities: collection database (Shozo Sawamoto and Naonobu Shiga), species diversity and vertical patterns in the oncaeid copepods (Yuichiro Nishibe), outreach activities with gelatinous plankton (Juro Hiromi). On Day 3 the working groups then separated. The groups then separated for more detailed discussions recorded by a rapporteur, with preparation of reports by each group. The groups were asked to 1) re-visit CMarZ goals in each area; 2) review our progress to date; and 3) identify challenges and make plans to overcome them. The Working Groups were:

- I. Global Synoptic Survey and Protocols (Peter Wiebe, Chair; Rob Jennings, Rapporteur)
- II. Analytical approaches (Sigi Schiel, Chair; Larry Madin, Rapporteur)
- III. Infrastructure needs (Shuheh Nishida, Chair; Nancy Copley, Rapporteur)

The Working Group reports are included here.

Working Group I: Global Synoptic Survey

The group compiled a complete summary of cruises completed during 2004 – 2006. The information available in the CMarZ Science Plan, CMarZ Renewal Proposal, and CMarZ website were reviewed for accuracy and updated as needed. Updated information on planned and proposed cruises was discussed and included. See Appendix III.

Specific discussion by the group members included:

- Turkish coast and Black Sea cruises during 2004 (Ahmet Kideys)
- MAR-ECO cruise (Annelies Pierrot-Bults)
- Transect from Shanghai to Antarctica (Sun Song)
- Indian Ocean cruise delayed (Vijayalakshmi Nair, E5)
- NW and NE Australia cruises set for 2008 (Dhugal Lyndsay)
- SE Pacific time-series cruises (Ruben Escribano)

The group discussed regions that need more sampling coverage, since most cruises in renewal proposal still focus on the surface ocean. Very little known work proposed for the deep ocean. Concerted effort is needed to secure major funding for a deep-ocean sampling effort.

- Shuheh Nishida summarized approved Pacific cruises (D3, D5, E1, E4) and mentioned additional proposed cruises: to the NW Pacific off Japan by JAMSTEC in 2007; Yellow Sea and S. and E. China Seas (Sun Song); Celebes Sea and Sulu Sea (Larry Madin). There are gaps in the NW Pacific, most of South Pacific.
- Erik Thuesen mentioned a proposal for synoptic surveying off California which was declined by NSF. Ann commented on difficulties for CoML and CMarZ with NSF and suggested that there may be a need to explain to NSF that CoML funding is for

programmatic and organizational needs – not science. Benefits from CoML are globalization of scientific results, enlarging areas of expertise, education/outreach/expanded communications. Larry suggested that the ASLO meeting offered an opportunity for an evening meeting (Santa Fe, NM in February 2007).

- Webjørn summarized NE Atlantic cruises, including the annual Faroese/Norwegian/Icelandic cruises. A likely Atlantic / Antarctic survey by the GO Sars is planned for late 2007 to study krill as part of IPY. There may be opportunities for CMarZ members.
- Sigi summarized CMarZ cruises to in the Weddell Sea and Lazarev Sea, as well as a cruise to the Amundsen Sea and Scotia/Weddell confluence in 2006.
- Vjyalakshmi summarized Indian Ocean activities including surveys around Indian EEZ, Andaman Sea, JGOFS India, Bay of Bengal process studies and the planned cruises of NIO, India. Samples were taken during 2004 tsunami in Bay of Bengal.
- Hans described work in the SW Indian Ocean, for which there is an increasing number of EtOH samples for CMarZ. Monitoring programs have been implemented by several SE African nations.
- Francesc described Mediterranean Sea activities, citing poor knowledge of deep-water zooplankton and difficulty in getting funds for deep water research.
- Ahmet mentioned that there are ~1400 archived samples from the Black and Caspian Sea that need to be incorporated in the CMarZ database.

Recommendations from Working Group I:

- 1) Prepare XLS file with accomplished and proposed cruises broken down by ocean and then by basin (N vs. S)
- 2) People to recruit for Mediterranean Sea work (Gaby Gorsky, Adam Benovic, one other mentioned in Naples)
- 3) Modifications of zooplankton sampling protocol: need first-pass edit, add notion of different levels of detail for CMarZ vs. non-CMarZ (i.e., ships of opportunity) cruises
- 4) Need to include other types of collections: e.g., blue water divers, ROV
- 5) Increase use of double-MOC (similar to bongo nets) to avoid splitting samples (avoid damage, avoid splitting rare organisms into separate useless pieces).

Working Group II. Analytical Approaches

The Working Group discussed and agreed on the following recommendations.

A. Taxonomic and Molecular Analyses

Taxonomic resources

1. Establish contact with MARBEF (Marine Biodiversity and Ecosystem Function), which includes all institutions (>100) in Europe involved in research on marine systems. They

have a molecular group currently with focus on benthic organisms, but not limited to that. Jean Pierre Feral (Marseilles) is the head of MARBEF and sits on the Steering Committee of CoML in Europe. CMarZ could seek to make a connection with this group to expand our network of taxonomic experts and interests.

2. Additional expertise available in eastern Europe could be investigated, including Poland (Zooplankton Sorting Center), Ukraine, and Russia.
3. Make an effort to expand network in geographic areas currently under-represented including Africa, South America, Australia, Southeast Asia, South Pacific.
4. Current SG and Network members could solicit their colleagues not currently in the network to join it. Network membership involves providing information about an individual's expertise and interests (taxonomic, ecological, geographic etc.) as well as contact. Membership implies some degree of willingness to contribute expertise to CMarZ related projects.
5. In order to attract interest of other taxonomists, put on the web page an easily accessed list or map of locations from which samples are available. This could include a list by taxonomic group and a map showing locations of collections. Clicking on items in the list or spots on the map would bring up information about the collection.
6. Present species pages on the website in a format that can be browsed and searched, even if many of the pages are minimally populated (i.e. name and synonymy only). Provide a tree format to facilitate entry into the species pages (similar to Tree of Life).
7. Locate and make links to existing relevant species page information on other sites to minimize duplication of effort (e.g. Tree of Life, ITIS, etc.)
8. Provide PDF files of relevant taxonomic literature for each group, linked to species pages and also with a searchable (author, title, keyword) index available on the web site.

Molecular Protocols

1. Reorganize web page menu (left side) to be more easily navigated by users with different interests (e.g., contributing specimens, looking for specimens, participating in meetings etc.)
2. Sampling protocol should specify the preferred combination of samples: morphological voucher specimens in formalin, specimens in 95% ethanol for DNA extraction, and high-resolution digital photographs. Also indicate where necessary what parts of an organism are most important for morphological identification so that these are not removed for DNA extraction.
3. Modify current protocol on web page to include information about cold storage of ethanol samples and to encourage some pre-sorting of categories before preservation in ethanol.
4. Encourage rapid turnaround of barcoding results so that if repeat extractions are needed they can be done before samples get too old. Ideally replicate physical and DNA vouchers would be kept in two or more locations (i.e., Barcoding Center and originating investigator).
5. Additional Barcoding Centers primarily need to be responsible for tracking and safeguarding submitted samples and maintaining good records and communication with investigators. Where necessary, the actual molecular lab work could be outsourced to academic or commercial labs that provide rapid turnaround at relatively low cost.

Continuing Challenges

1. It continues to be difficult to obtain sufficient funding to cover the post-cruise sorting and analysis of samples, so that they often sit for years. What action could CMarZ take to improve this situation?
2. It is difficult to ship ethanol-preserved samples from many countries, either because of the hazardous nature of the alcohol or concerns about biopiracy, or both. This is especially true in some developing countries. One solution would be to establish more Barcoding Centers in these countries so that specimens do not have to be exported. Alternatively CMarZ could encourage development of other preserving methods that eliminate alcohol hazard.

B. Ecological Analysis

1. Ecological studies of zooplankton must rely on relevant and accurate taxonomic information. The contribution of CMarZ to ecological analysis is principally in promoting improved taxonomic knowledge of zooplankton. It is beyond the scope or capabilities of CMarZ to directly undertake or organize ecological research programs.
2. CMarZ should highlight the importance of taxonomic data to ecological analysis by preparing a new home page that clearly explains and emphasizes the importance of taxonomic and biodiversity information for all ecological and oceanographic studies, including points like these:
 - a. Community structure and energy flow are not defined by biomass alone
 - b. Species function differently and have different effects on how ecosystems work
 - c. Species are the units of adaptation – the intersection of genome and environment
 - d. Changes in species diversity signal changes in environment
 - e. Baseline biodiversity data is needed to assess effects of anthropogenic and global climate change.

Examples of research topics that rely on a foundation of accurate taxonomic information include:

- Marine bioinvasions
 - Global elemental cycles – biological pump
 - Food web efficiency and stability
 - Pelagic speciation models
 - Phylogenetic relationships
 - Patterns of endemism
 - Management of marine ecosystems
 - Indicators of ecosystem health
 - Fisheries oceanography
3. Translate the home page into the languages of the participating countries so that it can be used more easily to explain CMarZ related research in those countries. Remainder of the CMarZ website could be in English.
 4. Write and publish a paper in a high-profile journal that describes and explains the goals and significance of CMarZ for oceanographic research.
 5. Give presentations at scientific meetings and with agency officials that explain the nature and importance of zooplankton taxonomy and CMarZ affiliated research.

Working Group III: Infrastructure Needs

A. Zooplankton Collections

1. Databases on zooplankton collections have been or being compiled as e-files as originally planned/proposed for some major collections (e.g. ORI, IIOE, China, CSK, Hokkaido Univ., Turkey). See Appendix IV.
2. While the Science Plan proposed to make efficient use of existing zooplankton collections, a specific site for zooplankton-collection database has not yet been established in the CMarZ website, and our global coverage for these collections is still very incomplete.
3. We discussed this matter and agreed that compiling information on all available collections worldwide is outside the ability of CMarZ, and that it will be more practical to provide with the following information/actions to the website:
 - 1) Full datasets from CMarZ cruises and co-operating projects.
 - 2) Full collection-databases from institutions/universities/museums/projects that have no original websites and are recommended through contact by the SG members.
 - 3) Establish links for collections that have their original websites.
 - 4) Indicate only general information and contact persons for collections of e.g. museums, universities, and institutes that do not have their database in e-files.

The following SG members have been tentatively assigned as persons to request plankton-collection datasets from various areas: Chris Reid for Europe; Ruben Escribano for South America (Chile, Argentina, Brazil) (Rubens Lopez and Demetrio Boltovskoy are candidates but might be too busy to organize); Marina Sabatini for INIDEP collections; Janet Bradford-Grieve for New Zealand; Shuhei Nishida and Song Sun for Asia. Ann Bucklin will write to Network members to offer to serve data sets on CMarZ. Nancy Copley and Data Management Office will establish zooplankton-collection database page in the CMarZ web site. The SG members are expected to encourage submission of collection information as indicated in 1 – 4 above. The form for collection information created by Mark Ohman for the CMarZ Science Plan can be used for these requests. Cruise information must comply with CoML requirements and be consistent with the format (i.e., text paragraphs) on the CoML website, www.coml.org/medres/medres-cruise.htm.

B. Taxonomic Training

1. Many training courses/workshops has been done in good order and more planned for 2006-2009; a revised list of the previous- and planned training courses has been presented (cf. Appx 2) to be refined with additions from SG members.
2. CMarZ-related training courses/workshops span over wide ranges in terms of trainees' expertise and topics covered different taxonomic groups, geographic area coverage, purely taxonomic to more ecological, etc., and there has been little coordination/cooperation among these activities. CMarZ' stance in this respect should be flexible in order to provide with as many opportunities as possible to people with diverse expertise and situations. There was also a question about whether the trained para-taxonomists should be used to identify CMarZ samples. Ann Bucklin replied that

training of para-taxonomists is a useful goal for CMarZ, regardless of whether they work directly on CMarZ samples or not.

In developing countries trainees may have little chance to take advantage of their expertise as jobs are limited. In such cases it would be to the student's advantage to incorporate molecular techniques into the scope of the taxonomic training, to add to the possibilities of future employment. . The establishment of sorting centers as commercial ventures might enhance employment opportunities, hence could be considered a legacy of CoML. Limited funding (travel expenses etc.), in some developing countries, may be augmented by PIs and through communication with SG members.

3. The following actions are needed with relevant time limits:

- 1) List SG members who are willing to join as lecturers. Send out to Network a query of who would be willing to teach. Current volunteers include: Janet Bradford-Grieve (copepods) and Vijayalakshmi Nair (chaetognaths).
- 2) Submit proposals for taxonomic workshops from 2007 to 2010 (e.g. SAHFOS, WHOI, JSPS, MARBEF, what else?). Chris Reid is willing to give advice on how to run workshops.
- 3) Put information on previous (activity reports, photos, etc) and future training courses on the Web. Indicate information on funding availability; SG members to contact (Sigi Schiel and Chris Reid for Europe; Ahmet Kideys for Middle East; Shuhei Nishida and Song Sun for Asia; Vijayalakshmi Nair for India; Ann Bucklin for US; Demetrio Boltovskoy/Ruben Escribano for South America, etc.)
- 4) Need regional planning and draft goals for workshops (e.g., analyzing CMarZ samples of SG members).

C. CMarZ Network

1. CMarZ website has been established to call for the Network members. In Japan, Shuhei Nishida sent e-mails to ca. 60 experts, asking for their cooperation. After having received no single response for one month, he contacted these people individually, asked again for their help, and now ca. 10 people have joined the Network.

2. The Network is growing much more slowly than initially expected, due partly to insufficient effort to advertise the website and network activity, and the fact that many experts on zooplankton taxonomy are busy with their own research. Nishida reported that mysid taxonomists in Japan already have more than 100 undescribed species that are waiting for description; more-or-less similar situation, but with much fewer species, for copepodologists. There have also been a couple of overloading personal requests asking for identification of all copepods from one site in one bottle, without making attempts to identify specimens themselves. Overall, the Network appears to be easy to propose, but difficult to realize, a true challenge for CMarZ.

3. The following actions are suggested:

- 1) SG members are expected to encourage their colleagues in different areas and taxonomic groups, etc. to join the Network. The members will identify people who will be the Species-Pages Contributors (SPC). Perhaps people involved in workshops could do it

as an exercise, creating Species Pages with supervision of teachers, particularly for their local species.

- 2) Some of these experts are willing to check identifications of a small number of specimens. They will need evidence that the requesters have attempted to identify the animal themselves, e.g. a provisional name, drawings or text describing their findings.

D. Website, Database & Species pages

1. The submission on species distribution databases is in progress. Annelies Pierrot-Bults' pages are a work in process using Filemaker database.

2. The originality of the CMarZ species pages was questioned. Claude Razouls' website contains a regional species list and literature on copepods but with no morphological information. CMarZ species pages will be unique in that each will accommodate morphological, molecular, and ecological information as well. There are still many other websites containing species information on zooplankton, including ecological/morphological aspects. Care must be taken not to duplicate tasks in our preparation of CMarZ species pages.

3. The following actions and future activities are suggested:

- 1) Contact with WG of CoML species pages (Sara Hickox, Darlene True Crist, etc) to clarify their general requirements.
- 2) Action for Data Management Office to figure out how to link to established pages.
- 3) Establish editorial board for CMarZ species pages, which is responsible in verifying submitted species information and ecological datasets; the latter requires very careful examination but will be important for CMarZ to provide with truly unique/useful species pages.
- 4) SG members are expected to encourage network membership and contributions.
- 5) Add links to information on existing pages, so that the contributors don't have to re-enter information already available on the web.
- 6) Submission of good quality images by SG members and collaborators is expected. Add image-credit information to database (provider and year) so it can be put into a caption. Right now, this information is part of filename and must be viewed in non-intuitive ways. All SAFHOS images are freely available (mostly specimen photos).
- 7) Publications: Papers tend to address only part of the existing data. The rest is accessible only from the author but is very valuable. In this connection, Shuheï Nishida introduced a new project in Japan which aims to standardize and synthesize all available database on global environment including those on zooplankton biodiversity. It would be nice to get this data from global researchers. CMarZ could advertise Shuheï Nishida's project and suggest people to send data to him. SG members should check quality of the data. Shuheï will send Nancy Copley a 'blurb' advertising and she'll put this under ****News**** on website and also list it as a "Cooperating Project". Shuheï Nishida will send PPT for posting a link to CoML to update for next newsletter.
- 8) Listing all species names at first in CMarZ species pages may enhance submission of each species' information.

Additional suggestions arising from the plenary discussion include:

- 1) CMarZ SG members to be charged with signing on 10 members to Network by Dec 2006
- 2) Get information on Network members who are willing to validate small numbers of informally or inexpertly identified material
- 3) Include species page creation as part of taxonomic workshops
- 4) Submission and posting of good quality images to species pages; modify image credits to be more intuitive and accessible.

CoML benchmark goals for 2007 and 2010 (Day 3)

Please see the handouts for this session included as Appendix V.

CoML Milestones

Milestones are requested by CoML for all projects. Metrics include: project and workshop participation, funding, partnerships, program commitments, observations, scientific results, societal outcomes, legacies, and other outputs (publications, DNA barcodes, workshops, media attention, data submissions, website hits, species pages). Information is needed from all SG members for all CMarZ activities pertaining to CoML milestones. Please send Ann or Nancy this information at any time.

Recommendations:

1. Education and outreach efforts for CMarZ should be expanded. E.g., how to get youngsters interested in plankton. SAFHOS works on this and Chris Reid can help with 'societal outcomes'. Games, educational activities with use of good pictures, etc.
2. CMarZ should suggest to CoML that an E&O Network to consider holding a meeting at SAFHO

CoML Framework Committee activities

At the request of CoML, CMarZ has identified five big questions to work toward synthesis. Comments and suggestions are welcome regarding the choice of questions.

Synthesis

Global synthesis will involve integrating with other CoML projects to understand global patterns of marine biodiversity. CMarZ can work toward this by targeted small meetings among groups or individuals, e.g., meetings of researchers interested in copepods or gelatinous zooplankton; or researchers in Asia working on zooplankton, etc. In order to integrate across realms, CMarZ will need to fill holes in our sampling and analysis, as e.g., the South Pacific.

Global synthesis will also require models to help us strategize and prioritize our sampling needs and model our results. These can be statistical models of populations, etc. Assistance is needed to identify modelers who may be interested in working with CMarZ. Chris Reid may know someone at SAFHOS; Janet Bradford-Grieve may know someone at NIWA.

CoML Legacies

Recommendations for new technologies for studying marine life:

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- 1) Shuhei Nishida will contact people working on holographic analysis of zooplankton for morphological studies.
 - 2) Sun Song is working with image analysis software and database, and is on the SCOR working group on New Technologies.
 - 3) Larry Madin can update CMarZ on video capabilities.
 - 4) Hans Verheye is working with a group on automated analysis of zooplankton samples
 - 5) Dhugal Lyndsay suggested web-based image analysis work, so users can identify animals and submit a picture, software will compare to images available in the database.
 - 6) CMarZ should organize web-based galleries of photos. These images can also be used for species pages. CMarZ could have a “mystery image of the day” to keep interest up.
 - 7) Photo credits should be integrated into the picture.

Recommendations for Centers of Excellence in DNA barcoding and taxonomy in developing countries:

- 1) China (Sun Song) and India (Vijaya) are engaged in discussions and planning for developing barcoding and taxonomic centers in their countries;
- 2) Need to keep track of graduate students associated with CMarZ;
- 3) Barcode centers should carry out both molecular work and bookkeeping of samples. Can molecular work be outsourced? Best to keep samples and barcoding in same country. Need a tracking number to follow samples through barcoding process.

Plans for the Year Ahead

CMarZ – USA Office (Ann)

- Program management – milestones, applications, synthesis, meetings,
- Cruises and sampling – hotspots, cooperating projects
- Sample analysis – need funding and coordination for taxonomy and barcoding
- O&E – taxonomic workshops, international exchanges (Chaolun, Annelies)
- Communications – info. for CoML, reporting requirements, website maintenance and updates
- Database – increase submission rate, more species pages
- Updated lists of meetings and cruises (dates & locations)
- Update methodologies

CMarZ – Europe Office (Sigi)

- Taxonomic experts
- Zooplankton Collections
- CMarZ Network
- Database

- Polarstern Atlantic Meridian Transect: scheduled for Oct. 26th to Nov. 26th, 2007; Bremerhaven to Capetown. Plan for 3-5 days sampling, but not sure of the number of stations. Plan to use Multinet, RMT, maybe MOCNESS (from Horst ???). On board expenses will be paid by AWI and can accommodate more than 20 scientists. Need to pay own travel and shipping of gear/samples (can ship to AWI rather than to Capetown) Interested people should contact Sigi (include Hans, Shuhei, Ann, Peter, Janet, Sigi, Ruben, Astrid, Rob).

CMarZ – Asia Office (Shuhei)

- Training courses – 5 countries to run through 2010. Currently in first year of second phase, with advanced courses in genetics, photography, etc.
- Special volume in DSR-II on biochemistry and biodiversity of Sulu and S. China Seas will be published next year. Results are from 2000 and 2002 cruises.
- 20 new species descriptions to be published in next 2 years; Shuhei has 6 new species; expects 40 new species in next 2 years.

CMarZ – India (Vijayalakshmi)

- Digitized inventory by specialists is ongoing and includes morphology, distribution, and bibliographies for Species Pages. Cruises – some data near Indonesia; deep water from central Indian. Community structure of Andaman water, Arabian sea, Bay of Bengal.
- Network – more people will be encouraged to join; will prepare list of taxonomists form Indian Ocean.
- Cruises – planning field sampling from western side of Indonesia and deep water collections from central and southern Indian Ocean; these are under-sampled sectors of Indian Ocean.
- Training – at NIO; chaetognaths; new generation of taxonomists being trained.
- Articles and press coverage will continue.
- Barcoding – will start sequencing mtCOI soon.

CMarZ – China (Sun Song)

- Cooperation with CBOL – barcoding group.
- Cruise planning for Antarctic cruise from Shanghai to New Zealand, sampling around the Antarctic Peninsula, circumnavigating Antarctica. High speed sampler and Apstein (?) net.
- Sun Song has excellent collection of samples, available for examination.

Additional News from the NE Atlantic (Steve Hay)

This report was sent prior to the meeting. Please see Steve's entire report on the CMarZ website.

- Taxonomy – The Zooplankton Ecology Group in FRS is now involved in a UK NERC funded Knowledge Transfer project to create a practical manual for zooplankton taxonomic identification, for completion by the beginning of 2008.
- FRS will also be working with SAHFOS over the coming months to collate species length, dry weight and CN relationships and such data for as many of our species list as we can, to make our data meaningful for biophysical modelling.

- Time Series Collections: FRS runs two Time Series Collections, similar to Roger Harris' L4 station at Plymouth, one station is on the Scottish west coast (since 2002) and one is near Aberdeen on the east coast (started 1997). Summarised data is incorporated in the ICES CRR -Plankton Status Report and reported on our FRS web site. We collect weekly plankton and environmental samples and measurements.
- Collections from Scottish coastal areas: FRS cruises have collected samples around Scotland. Bongo net samples are in ethanol, with a partner sample in formalin. We also have a regular annual survey in December to the Faroe – Shetland region where we collect plankton and could collect for others. One sample set is available from 2004 offshore surveys for Mackerel eggs along the eastern Atlantic shelf edge; another set will be collected during 2007. These are Gulf III 250µm samples to <200m, and many of these from 2004 have an ethanol preserved partner sample. The surveys and many archived samples date back some 25 years.
- Identified Specimens: We have a potentially useful collection of identified specimens, many in ethanol too and to which we add to as and when times permit. I keep promising that I will send some on to Ann for barcoding.
- Graduate Students: PhD student Maria Pan is working hard on the seasonal production, settlement and recruitment of decapods at our inshore sampling sites. Part of her PhD has been to develop RT-PCR to try to identify particularly brachyuran crab larvae in plankton samples. She has also been compiling a pictorial and textual taxonomic guide, which we hope she will complete in collaboration with decapod taxonomy specialist colleagues in Europe.

Next meeting:

Suggestion to hold the next Steering Group meeting in association with a conference meeting where there can be a CMarZ special session. Consider:

- Hiroshima meeting, but this is too soon.
- ASLO, Feb 2007 Santa Fe, NM
- 2008 WAC
- Deep sea biology symposium – Goa 2009
- ASLO/AGU/TOS Ocean Sciences – Orlando, Florida 2008

Appendix I. CMarZ Workshop Agenda



CMarZ Steering Group Meeting

November 6 – 8, 2006

Ocean Research Institute, University of Tokyo
Tokyo, Japan

MEETING AGENDA

Goals for the Meeting:

- 1. Public presentations on CMarZ research activities**
- 2. Goals of CMarZ: identifying and overcoming the major challenges**
- 3. Planning for CoML benchmarks of 2007 and 2010**

November 5th Arrival

6:00 pm Welcoming dinner for those who have arrived

November 6th CMarZ Open Workshop

8:30 am COFFEE

9:00 am Welcome to the ORI (Prof. Makoto Terazaki, Director)

9:10 am Opening Address (Shuheï Nishida)

9:20 am CMarZ – General Introduction (Ann Bucklin)

Session 1: Highlights from Hotspots

9:40 am Exploring the deep sea: 2006 CMarZ cruise in the Sargasso Sea (Peter Wiebe)

10:10 am Black and Caspian Sea zooplankton (Ahmet Kideys)

10:40 am Antarctic and Indonesia (Sigi Schiel, Astrid Cornils)

11:10 am Zooplankton monitoring along the southern African coast (Hans Verheye)

11:40 am Time-series monitoring in Japan (Hiroya Sugisaki, Sanae Chiba)

12:00 pm LUNCH

Session 1 (continued)

1:00 pm Inner-Space Speciation Project (Larry Madin)

1:30 pm North Atlantic Ridge (Webjørn Melle)

2:00 pm Undiscovered treasures in the backyard: Diversity and phylogeny of gelatinous zooplankton in the deep eastern Pacific
(Erik Thuesen, Steven Haddock)

2:30 pm Jostling for jellies: muddling molecular & morphological methodology
(Francesc Pages, Dhugal Lindsay)

3:00 pm The coastal waters of China and the Antarctic (Sun Song)

3:20 pm COFFEE

Session 2: How does CMarZ Work?

3:40 pm Virtual Taxonomic Network (Annelies Pierrot-Bults, Steve Hay)
4:00 pm Training para-taxonomists (Shuhe Nishida, Erik Thuesen)
4:20 pm DNA barcoding of specimens (Rob Jennings, Ann Bucklin, Ryuji Machida)
4:40 pm CMarZ database / OBIS / Species page (Peter Wiebe, Nancy Copley)
5:00 pm General discussion (Chair: Shuhe Nishida)

5:30 pm Adjourn

6:00 pm Reception at ORI

November 7th CMarZ Steering Group

Making CMarZ Work

The second day of the workshop will include three sets of Working Group sessions, with an introductory plenary presentation from the chairperson, followed by reports from the moderators of each topic. The moderators will be asked to:

- 1) re-visit CMarZ goals in each area
- 2) review our progress to date
- 3) identify challenges and make plans to overcome them

8:30 am COFFEE

9:00 am Working Group I. Global Synoptic Survey and Protocol (20 min each)
- Introduction (Peter Wiebe: chair)
- Atlantic Ocean (Moderators: Peter Wiebe, Webjørn Melle)
- Pacific (Mod: Shuhe Nishida, Erik Thuesen)
- Indian Ocean (Mod: Vijayalakshmi Nair, Hans Verheye)
- Polar Seas (Mod: Sigi Schiel, Russ Hopcroft)
- Mediterranean and Black Sea (Francesc Pages, Ahmet Kideys)

10:40 am COFFEE

11:00 am Working Group II. Analytical approaches (20 min each)
- Introduction (Sigi Schiel: chair)
- Taxonomic analysis/network (Mod: Annelies Pierrot-Bults, Steve Hay)
- Ecological analysis (Mod: Larry Madin, Ahmet Kideys)
- Molecular analysis and barcoding (Mod: Ryuji Machida, Rob Jennings)

12:20 am LUNCH

- 1:30 pm Working Group III. Infrastructure needs (20 min each)
- Introduction (Shuheh Nishida: chair)
 - Zooplankton collections (Mod: Shuheh Nishida, Mark Ohman)
 - Taxonomic training (Mod: Shuheh Nishida, Janet Bradford-Grieve)
 - CMarZ Database and Species Pages (Mod: Peter Wiebe; Nancy Copley)

3:00 pm COFFEE

3:20 pm Activity reports from Japan (Hiroshi Ueda, Shozo Sawamoto, Naonobu Shiga, Susumu Ohtsuka, Yuichiro Nishibe, Juro Hiromi)

4:20 pm Working Groups (continued plenary discussion, or group discussion on demand)

6:00 pm Adjourn
DINNER (on own)

November 8th CMarZ Steering Group (planning and general discussion)

8:30 am COFFEE

9:00 am Group discussion (preparation of reports)

10:40 am COFFEE

11:00 am Working Group reports

- Session I (Peter Wiebe)
- Session II (Sigi Schiel)
- Session III (Shuheh Nishida)

12:00 am LUNCH

1:00 pm CoML benchmark goals for 2007 and 2010 (Ann Bucklin)

- CoML Milestones
- CoML Framework Committee
- CoML Legacies
- CoML Synthesis
- Collaboration with other CoML field projects

2:40 pm COFFEE

3:00 pm Plans for the year ahead

- CMarZ - USA (Ann Bucklin)
- CMarZ - Europe (Sigi Schiel)
- CMarZ - Asia (Shuheh Nishida)
- CMarZ in China (Sun Song)
- CMarZ in Indian Ocean (Vijayalakshmi Nair)

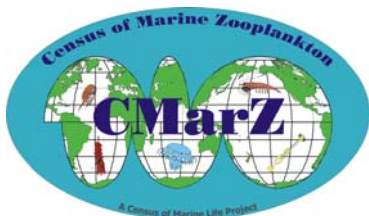
5:00 pm Upcoming CoML and CMarZ meetings

5:30 pm Adjourn

7:00 pm FAREWELL DINNER

November 9nd Excursion/Departure

Appendix II. List of Participants



CMarZ Steering Group Meeting
November 6 – 8, 2006
Ocean Research Institute, University of Tokyo
Tokyo, Japan

Steering Group Members

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Dhugal Lindsay (Gelatinous plankton, deep-sea, image analysis)

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Yuichiro Nishibe (Oncaeid copepods, species diversity)

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Susumu Ohtsuka (Copepods, evolutionary patterns, parasitism)

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Naonobu Shiga (Appendiculata, Hokkaido Univ. Database)

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Hiroya Sugisaki (Odate Series)

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Hiroshi Ueda (Copepods, *Acartia*, molecular-genetic analysis)

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Appendix III. CMarZ Cruises

I. CMarZ cruises completed 2004-2006

Described in the CMarZ Science Plan

A3. SW Pacific Ocean: Coastal ecosystems of Indonesia, including Spermonde Archipelago, Strait of Makassar, SW Sulawesi, with sampling from small boats during Spring and Fall, 2005. [CMarZ contact: Sigrid Schiel]
A4. Arctic Ocean: Sampling done in association with ARCoML. [CMarZ contact: Russ Hopcroft]
A5. Antarctic / Southern Ocean: Cruise to sample in the western Weddell Sea from the RV Polarstern during November 2004 - January 2005. [CMarZ contact: Sigrid Schiel]
A7. Nordic Seas: Icelandic and Norwegian Seas were sampled during a herring survey by the Marine Research Institute on the R/V Árni Fridriksson during 17 – 30 May 2005. Icelandic and Irminger Seas were sampled during the MRI Spring Survey during 18-28 May 2005. See http://www.hafro.is/ . [CMarZ contact: Astthor Gislason, Institute of Marine Research, Iceland]
A8. SE Atlantic: Three ‘proof-of-concept’ CPR (Continuous Plankton Recorder) tows were made in the Benguela Current Large Marine Ecosystem (BCLME) during October/November 2005 using the MV Tugela. Tows stretched 1,422 nm from Cape Frio, Namibia (18°S, 11°E) to near East London, South Africa (33°S, 27°E). CPR samples were collected in the Angola-Benguela Frontal Zone, Benguela Current (Atlantic Ocean), and Agulhas Current (Indian Ocean). For the 35 samples analysed, 75 phytoplankton and 104 zooplankton taxa (including 54 copepod taxa) were recorded. This extension of the proposed Atlantic Eastern Margin Transect (AEMT) and will serve as a precursor for a new CPR survey in the region. [CMarZ contacts: Hans Verheye and Chris Reid]
A9. NW Atlantic / NE Pacific: Ecosystem monitoring over USA continental shelf regions is carried out by the US National Marine Fisheries Service from survey vessels on the northeast US continental shelf, in the Gulf of Mexico, on the California continental shelf, and off coastal Alaska. Surveys by R/V Albatross have yielded samples for CMarZ from the Gulf of Maine, NW Atlantic Ocean, at 3 month intervals during 2004 - 2006. [CMarZ contact: Ann Bucklin]
A10a. Mid-Pacific Oceans: During 2005, SEA sailing vessel SSV Robert C. Seamans sailed extensively in the central Pacific Ocean, collecting surface zooplankton samples in regions rarely sampled by oceanographic research vessels. [CMarZ contact: Peter Wiebe]
A10b. NW Atlantic Ocean: The SEA (Sea Education Association, Woods Hole, MA) vessel SSV Corwith Cramer collected samples in right whale feeding grounds in the Slope Water and in the Gulf of Maine and in the Sargasso Sea. [CMarZ contact: Peter Wiebe]

A11. SE. Atlantic Ocean: Seasonal Oceanography and Fisheries in the Benguela Current Region as part of the ongoing BENEFIT monitoring program, with monthly zooplankton sampling off southern Angola, central Namibia and the west coast of South Africa. A standard protocol for the collection and preservation of CMarZ samples has been devised for these research or monitoring cruises. [CMarZ contact: Hans Verheye]
A12. SW Indian Ocean: African Coelocanth Ecology Programme (ACEP) off the east coast of Southern Africa, including Tanzania, Mozambique and South Africa, during August 2004 and April-May 2005. [CMarZ contact: Hans Verheye]
A13. SW Indian Ocean: 'Madex' cruise on RRS Discovery south of Madagascar during February 2005 [CMarZ contact: Hans Verheye]
B4. N Pacific Ocean: Regular cruises for sampling in coastal regions of the Gulf of Alaska along the US GLOBEC "Seward Line". Cruises were carried out during May 2005, October 2005, and May 2006 [CMarZ contact: Russ Hopcroft]
B5. Mediterranean region: The R/V Bilim sampled extensively in the Mediterranean / Aegean Seas and the Sea of Marmara during March 2005. [CMarZ contact: Ahmet Kideys]
B7. SE. Atlantic Ocean: Pelagic fisheries recruitment survey during May - June 2005; and spawning biomass survey during November 2005, off west and south coasts of South Africa. [CMarZ contact: Hans Verheye]
B8. SE. Atlantic Ocean: Alexander von Humboldt – Angola-Benguela (AHAB) Research and Training Expedition off SW Africa, with sampling of the Angola-Benguela Front during January-February 2004, and off central Namibia during April 2004. [CMarZ contact: Hans Verheye]
<i>Not described in CMarZ Science Plan</i>
C1. Mid-Pacific Ocean: Cruise of the Hakuho-Maru (KH-04-5) during November 2004 to March 2005 from the Antarctic to tropical North Pacific along 170°W longitude. [CMarZ contact: Shuhei Nishida]
C2. N Pacific Ocean: HOT (Hawaii Ocean Time Series) cruise #169 during May 16 – 20, 2005. Several net tows were conducted to collect coccolithophores. See http://hahana.soest.hawaii.edu/hot/cruises.html ; HOT-cruise #169. [CMarZ contact: Colomban de Vargas]
C3. Eastern Atlantic Ocean: Atlantic Meridian Transect cruise #16 sampled from Cape Town, South Africa to Falmouth, UK during May and June, 2005. See http://www.pml.ac.uk/amt . [CMarZ contact: Colomban de Vargas]
C4. Antarctic/Southern Ocean: Zooplankton sampling was carried out during four cruise legs of the R/V Polarstern: Lazarev Sea (November 2005 - January 2006 and June – August 2006); Bellingshausen Sea (February – April 2006); and western Weddell Sea (August – October 2006) [CMarZ contact: Sigrid Schiel]

C5. Antarctic / Arctic: Zooplankton sampling during 2006 included a transect across the South Atlantic from Punta Arenas to Cape Town on the RV Polarstern and a transect across the Greenland Sea from Longyearbyen, Svalbard to Reykjavik, Iceland on the RV Merian. The study, funded by German Science Foundation (DFG), evaluated speciation processes and ecological niches of deep-sea copepods in polar seas. [CMarZ contacts: Sigi Schiel and Holger Auel, University of Bremen, Germany]
C6. Indian Ocean: The French program OISO provided opportunities for CMarZ sampling of zooplankton in the Indian Ocean. The lead for this program is Nicolas Metzl. (see http://www.ipsl.jussieu.fr/services/Observations/fr/OISO.htm) [CMarZ contact: Colomban de Vargas]
C7. NW Atlantic Ocean: Comprehensive biodiversity survey of deep waters of the western Atlantic (Sargasso Sea). Collections were made using nets from meso- and bathypelagic waters. Funded by the NOAA Ocean Exploration Program, the cruise took place during April 10 – 30, 2006. [CMarZ contacts: Peter Wiebe, Larry Madin, and Ann Bucklin]
C8. Antarctic/Southern Ocean: The Chinese Antarctic Expedition during February/March 2006 yielded zooplankton samples for taxonomic analysis through CMarZ. Identified specimens are being DNA barcoded. [CMarZ contact: Sun Song]
C9. NW Pacific Ocean: Zooplankton sampling was done with a conical opening/closing net during April 10-29 2006 on the R/V Beidou. [CMarZ contact: Sun Song]
C10. NW Pacific Ocean: A research cruise in Sagami Bay, coastal waters of Japan, sampled zooplankton for taxonomic analysis during November/December 2005. [CMarZ contact: Shuhei Nishida]
C11. NW Pacific Ocean: Species variability and depth adaptation of zooplankton was studied during a cruise of the Tansei Maru during June 2006. [CMarZ contacts: Ryuji Machida, Colomban de Vargas]
<i>Ongoing time series cruises that can provide samples to CMarZ</i>
D1. SE Atlantic and SW Indian Oceans: Continued sampling during annual fisheries stock assessment cruises and monthly environmental monitoring cruises, as well as dedicated research and training cruises, during 2006-2009. Specimens will be identified and sent to the University of Connecticut for DNA barcoding. [CMarZ contact: Hans Verheye]
D2. NW Atlantic / NE Pacific: Ecosystem monitoring over USA continental shelf regions is carried out by the US National Marine Fisheries Service from survey vessels on the northeast US continental shelf, in the Gulf of Mexico, on the California continental shelf, and off coastal Alaska. [CMarZ contact: Ann Bucklin]

D3. N Pacific Ocean: Regular cruises for sampling in coastal regions of the Gulf of Alaska along the US GLOBEC “Seward Line”. Cruises are planned for September and May of 2006, 2007, and 2008 [CMarZ contact: Russ Hopcroft]

D4. NW Atlantic / Baltic Sea: A time-series collection begun in 1957 at a shallow station in the Gulf of Riga will be continued by Henn Ojaveer (Estonian Marine Institute, University of Tartu, Estonia), who will oversee an effort to analyze the data for species diversity and abundance/biomass dynamics. New collections will be made to evaluate sampling methods. [CMarZ contact: Ann Bucklin]

D5. N. Pacific / N. Atlantic Oceans: During 2006 – 2009, vessels of the SEA (Sea Education Association, Woods Hole, MA USA) will sail extensively through the N. Pacific and N. Atlantic Oceans, collecting surface zooplankton samples in regions rarely sampled by oceanographic research vessels. The sailing vessels SSV Robert C. Seamans and SSV Corwith Cramer carry students and teachers on educational cruises. Lessons include material from CMarZ. [CMarZ contact: Peter Wiebe]

Cooperating project cruises that can provide samples to CMarZ

E1. SE Asia: Samples will be collected using nets and ROV during an expedition to Malaysian waters during 2007. Funded by NOAA Ocean Exploration, the National Geographic Society and Conservation International, the project is titled “Inner-space Speciation Project”. [CMarZ contact: Larry Madin]

E2. NW Pacific Ocean: An educational cruise for Japanese high school students, Let's study the sea with research vessel will take place during July 31 – August 5, 2006. The cruise is sponsored by the Japan Science Society, Oceanographic Society of Japan, and Tokai University (Japan). [CMarZ contact: Ryuji Machida]

E3. Antarctic/Southern Ocean: Lazarev and N. Weddell Seas will be sampled during June/August and August/October 2006 on the R/V Polarstern. Zooplankton will be captured by Multinet down to 2000. [CMarZ contact: Sigi Schiel]

E4. Equatorial W. Pacific Ocean: Cruise led by James Murray (Univ. Washington, USA) will transect from Hawaii to Papua New Guinea (140oW to 148oE) on the R/V Kilo Moana to sample water column and organisms for heavy metals, with ancillary sampling for CMarZ at 5 – 10 stations. Cruise dates are August 15 – October 1, 2006. [CMarZ contact: Ann Bucklin]

E5. Indian Ocean: DNA barcoding of the copepod fauna of estuaries and coastal waters along the central west coast of India. Taxonomic analysis of calanoid copepods will be done by S.C.

Goswami [retired from National Institute of Oceanography (NIO), Goa, India], with DNA barcoding of selected calanoid species, focusing on the family Acartiidae, by Usha Goswami (NIO, Goa, India). [CMarZ contact: Ann Bucklin]

E6. N. Atlantic Ocean: Sampling from the subtropical NE Atlantic in the NW African upwelling region, during July to August 2006 from the R/V Meteor. Sampling will be done by WP2 net from 0 - 100 m. [CMarZ contact: Sigi Schiel]

E7. N and S Atlantic Ocean: A north-to-south latitudinal transect throughout the Atlantic Ocean is planned for October/November 2007 or March/April 2008. Sampling from the R/V Polarstern will be done with a Multinet, including deep samples below 2000m. [CMarZ contact: Sigi Schiel]

E8. S Atlantic Ocean: A west-to-east transect will be sampled along 51°S during April-June 2006 from the R/V Polarstern. In a project led by Holger Auel (University of Bremen, Germany), zooplankton will be collected using a Multinet from 0 - 2000 m, with samples preserved in formaldehyde and ethanol. [CMarZ contact: Sigi Schiel]

Proposed/pending cruises

E9. S Atlantic Ocean: Sampling in the Benguela Upwelling Region during March/April 2008 from the R/V Meteor will be done using a Multinet to sample down to 2000 m. Project leader is Holger Auel from the University of Bremen, Germany. [CMarZ contact: Sigi Schiel]

F1. SE Asia and NE Pacific: Comprehensive survey of zooplankton biodiversity during 2007/2008. Collections will be made using nets, ROVs, and submersibles, as part of a field effort to be proposed to the Japan Agency for Marine-Earth Science and Technology. [CMarZ contact: Shuhei Nishida]

Appendix IV. Zooplankton Collection Databases

(List for CMarZ SG Meeting, 6-8 Nov. 2006)

Contact	Title	Area	Year	No. samples	Gear	Mesh size	Sampling depths	Institution
A. Kideys	SINOP Plankton Collection	Southern Black Sea along Turkish coasts	1999-2006	ca. 370	METU net	112 µm	0-70/180	Ondokuz Mayıs Univ.
	IFRO Mazandaran Plankton Collection	Southern Caspian Sea along Iranian coasts	2001-2006	ca. 700	METU net	112 µm		Iranian Fish. Res. Org.
C. Reid	CPR North Atlantic Database	North Atlantic	1958-	ca. 380,000	CPR	270 µm	6-10	SAHFOS
	CPR North Pacific Database	North Pacific	2000-		CPR	270 µm	6-10	SAHFOS
J. Bradford-Grieve	NIWA Stations Database							NIWA
	Specify Database: NIWA Invertebrate Collection	NZ Region, SW Pacific, Ross Sea						NIWA
	Te Papa (Meusium of New Zealand) Collection	NZ Reagion,		> 1000				Te Papa
	New Zealand Species Inventory							Te Papa
V. Nair	IIOE Zooplankton Collection	Entire Indian Ocean	1960-1965	1548	Indian Ocean Standard Net (IOSN)		0-200/bottom	NIO

S. Sun	Yellow Sea and East China Sea Database	Yellow Sea and East China Sea	2000-2006	9535	Zoopl. Net/water sampler	500/350/160 μ m		IOCAS
	South China Sea Database	South China Sea	2004, 2006	200	Zoopl. Net	500/160 μ m		IOCAS
	Arctic Area	Arctic area	1999, 2003, 2006	197	Zoopl. Net	350/500 μ m		IOCAS
	Antarctic Ocean	Antarctic Ocean	2001-2006	787	Zoopl. Net/HS sampler/IKMT	350/227 μ m/5 mm		IOCAS
	Jiaozhou Bay	Jiaozhou Bay	2002-2006	2980	Zoopl. Net/water sampler	260/500 μ m		IOCAS
P. Wiebe	GLOBEC-Gulf of Maine	NW Atlantic - Gulf of Maine	1997-1999	320	MOCNESS			WHOI
	ZooGene Time Series: NW Atlantic	Gulf of Maine, Georges Bank, Mid-Atlantic Bight	2001-2006 +	500	Bongo nets			WHOI
	SOGLOBEC Broadscale	western Antarctic Peninsula	2001-2001	80	MOCNESS			WHOI
	SEA Collection	N. Atl. & N./trop. Pac.	2006-2006	20	meter net, Tucker trawl			WHOI
	GLOBEC-Broadscale	NW Atlantic - Georges Bank	1993-1999	many	MOCNESS, Bongos			WHOI
S. Nishida	ORI Norpac-net Collection	Pacific, Indian, Antarctic Oceans	1968-2004	ca. 1400	Norpac-twin net	100, 330 μ m	0-150	ORIUT

	ORI Zooplankton Collection	Pacific, Indian, Antarctic Oceans	1967-2006	ca. 15,000	Norpac/ ORI net/IKMT/MOCN ESS			ORIUT
	ORI-CMarZ Collection	South Pacific along 170W	2005	ca. 20	Norpac/ORI net	330/690 μm	0-150/1000	ORIUT
S. Sawamoto	CSK Zooplankton Collection	SE Asia, Kuroshio Region	1965-1974	3302	Norpac net	330 μm	0-150	Tokai Univ.
	Tokai University Macrozooplankton Collection	Suruga Bay, Nansei Is., Izu-Ogasawara Region	1979-	ca. 400	160-cm net		0-1000, 5 layers	Tokai Univ.
N. Shiga	Hokkaido University Zooplankton Collection	N Pacific, Bering Sea	1954-	ca. 6200	Norpac net	330/100 μm	0-150/500	Hokkaido Univ.

Appendix V. Handouts for CoML benchmark goals for 2007 and 2010

Census of Marine Zooplankton (CMarZ)

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The CMarZ goal is to produce accurate information on species diversity, biomass, biogeographic distribution, and genetic diversity of the ~6,800 described species of animals that drift with ocean currents throughout their lives (i.e., the holozooplankton). CMarZ seeks to characterize global patterns of zooplankton biodiversity, sampling from pole to pole, from surface to bottom, and in unexplored regions and biodiversity hotspots. From our 2004 starting date, CMarZ has made significant progress toward this lofty goal through the concerted effort of our 20-member Steering Group, who together span the globe and range across most of the 15 animal phyla represented in the zooplankton assemblage.

What are the big messages from your project?

CMarZ taxonomic experts estimate that there are two-times as many zooplankton species as are described today. The project activities to date are confirming that **many zooplankton species remain to be discovered**, and suggesting that our original estimate of actual numbers of species may be low. CMarZ is discovering new species in under-sampled regions of the world ocean (e.g., mesopelagic depths of the N. Atlantic and Arctic Oceans; biodiversity hotspots in Southeast Asia) or as cryptic forms within cosmopolitan species.

Biodiversity studies should proceed through **integrated morphological and molecular systematic analysis** to characterize known species and describe new species. Expert taxonomists are essential to identify known and recognize unknown species; their expertise can be codified using a DNA sequence – or barcode – that can then serve as an additional taxonomic character for species identification and recognition. A cost-effective approach to accelerating such integrated analysis is through dedicated cruises, with both expert taxonomists and DNA sequencing capacity on board ship.

Global-scale biodiversity surveys are possible within the CoML time frame and funding approach. **Global coverage can be achieved through cooperative efforts** of a diverse leadership group, each member of which is responsible for one or more geographic regions and/or taxonomic groups.

What specific accomplishments/highlights do you anticipate by 2010?

CMarZ scientists will have sampled many regions of the world oceans – consistent with our goal of global coverage. Dedicated CMarZ cruises will have provided opportunities for comprehensive biodiversity surveys by CMarZ Steering Group members, allied scientists, staff, and students. CMarZ efforts will have resulted in discovery of numerous new species, with largest gains in gelatinous groups and from deep sea environments.

CMarZ taxonomic workshops will have helped address the need for taxonomic expertise for the 15 phyla of animals occurring in the plankton. CMarZ will have trained graduate students and staff in morphological and molecular approaches species identification.

The CMarZ database will be a comprehensive resource for researchers and students to locate zooplankton specimens and collections, access ancillary environmental data, view species pages, and find DNA sequences. The database will also provide links to other CoML projects, respond to OBIS queries, and link to other plankton databases.

Are there examples of how your data/output/analysis has been applied? Is there a reasonable chance that they may be used by 2010?

Accurate assessment of zooplankton diversity will contribute to improved management of living marine resources (fisheries recruitment models, ecosystem health, and ecosystem-based fisheries management). Zooplankton are short-lived and are excellent indicator organisms of climate and environmental change (detection of ocean food web perturbation, changes in species or biomass distribution and range).

The CMarZ effort to determine DNA barcodes for holozooplankton species is yielding the data and information needed to produce DNA microarrays (“chips”), which can be used for automated and/or remote identification and quantification of zooplankton. It is entirely realistic to expect that DNA sequences will be used routinely for taxonomic analysis of zooplankton samples in the laboratory. On a longer time-frame (15 to 20 years?), ocean observing stations may include moored instruments with DNA-based detection systems for *in situ* identification of species. The sensors would provide near-real-time monitoring of changes in plankton communities over any temporal and spatial scales.

In what year do you anticipate your major manuscript outputs or other kinds of tangible outputs (major conferences, movies, etc.) to be released?

Publications, presentations, media coverage, and data submission (including species pages) from CMarZ will be continuously from the present through 2010 and beyond. Major cruises and field activities stimulate media coverage, so this attention may be more intermittent with the anticipated once- or twice-yearly opportunities for dedicated CMarZ cruises from 2006 – 2010. CMarZ has finalized a species page concept and approach, and will produce at least 500 species pages from 2007 – 2010. CMarZ will use Steering Group meetings in 2006 (Tokyo, Japan), 2008 (linked to an international scientific conference), and 2010 (with other CoML projects) to showcase our activities with special symposia.

PROJECT MILESTONES: CMarZ

Category 1: Participation

2006

In 2005, the original CMarZ Steering Group of 16 people was increased to 22 members from 15 countries, in order to ensure broader taxonomic breadth and geographic distribution. Led by Steering Group members, 19 cooperating projects were underway during 2006, including taxonomic and training workshops, data and sample analysis, creation of databases and websites, and oceanographic cruises for zooplankton sampling throughout the world oceans.\

In order to respond to requests from researchers and to increase the CMarZ reach without added costs, the CMarZ Network was established in 2005. About 20 scientists are members of the network (see www.CMarZ.org).

2007-2010

No changes anticipated. The CMarZ Network is expected to continue to grow.

Category 2: Funding Commitments

2006-2010

All CMarZ Steering Group members are expected to submit proposals for CMarZ-related activities, including cooperating projects, as opportunities arise in their home countries and regions. Securing funding to meet CMarZ project goals requires sustained effort by all Steering Group members, most of whom have been extremely active in this regard. As of August 2005, CMarZ was supported by >15 awards with multi-year totals exceeding \$7.5M. Funding information for 2006 will be collected for the annual report. Our yearly target funding levels are:

Year	Funding Target
2006	\$3M
2007	\$3M
2008	\$3M
2009	\$2M
2010	\$2M

CMarZ can make significant progress through ancillary use of ship-time, but dedicated cruises allowing more CMarZ participation greatly accelerate our progress. The goal is at least one dedicated CMarZ cruise to a region of interest each year for 2006 – 2010 (see Category 5, below).

Category 3: Partnerships

2006-2010

Of primary importance for CMarZ are other CoML field projects, especially MAR-ECO, ArcOD, ICOMM, and CeDAMAR, and soon CAML. In partnership with FMAP, CMarZ will contribute to a relational database of the gelatinous species sighted during open-ocean SCUBA dives made by Larry Madin (WHOI) and others from 1971-2006. Additional partnerships have been formed with

federal fisheries agencies in the USA, Japan, Norway, Iceland, and South Africa, with additional such partnerships expected. CMarZ is engaged in international intergovernmental activities, including ICES (International Council for the Exploration of the Sea), which can offer visibility and networking but little funding. CMarZ will succeed in meeting our goal for a comprehensive global-scale biodiversity survey through the coordinated activities of the P.I.s and Steering Group members. It is not possible for any five individuals to complete the job.

The anticipated role of N/RICs in helping the field projects build partnerships in the different countries and regions has not had tangible impact on CMarZ. This is not a problem, since there are no particular unmet expectations, but should serve as an encouragement for the future.

Category 4: Program Management

2006-2010

The CMarZ leadership approach is working effectively and is deemed sufficient to meet project goals and affordable given project budgets. CMarZ relies on the three lead investigators to coordinate activities, build partnerships, and secure funding in their country and region. The CMarZ Steering Group members also add to this capacity – usually to a lesser degree. CMarZ has three project offices: CMarZ-USA led by Ann Bucklin at the University of Connecticut; CMarZ-Asia led by Shuhei Nishida at the Ocean Research Institute, University of Tokyo, Japan; and CMarZ-Europe led by Sigrid Schiel at the Alfred Wegener Institute for Polar and Marine Sciences, Bremerhaven, Germany. In addition, Peter Wiebe leads the CMarZ Database Management team and supervises the CMarZ Communications Office at Woods Hole Oceanographic Institution. No changes in the CMarZ leadership approach or team are anticipated for the foreseeable future.

The distributed effort that makes CMarZ successful in meeting project goals also creates genuine challenges in keeping track of our activities, including cruises, workshops, meetings, proposals, presentations, and publications. This function is carried out by the CMarZ Communications Coordinator, Nancy Copley, and is a significant portion of her time and effort for CMarZ. All activities are reported on the project website, www.CMarZ.org, which is maintained and updated by Nancy Copley. The project website serves an essential function in information exchange and coordination among the Steering Group members, CMarZ Network members, and interested researchers and students.

Category 5: Observations made or otherwise obtained

2006-2010

CMarZ has made significant progress through ancillary use of ship-time. From 2004 - 2006, sampling for CMarZ has been carried out during more than 25 cruises, with collections from every ocean basin. Plans for sampling from 10 additional cruises are in place for 2007.

Dedicated CMarZ cruises allow greater control over sampling and more participation by Steering Group members and students, and greatly accelerate progress toward project goals. CMarZ plans for at least one dedicated cruise to a region of interest each year for 2006 – 2009. We are very likely to meet this goal, with CMarZ/NOAA Ocean Exploration cruises in the N. Atlantic (P.H.

Wiebe, April 2006) and Southeast Asia (L.P. Madin, 2007); an Atlantic meridian transect by the Polarstern (S. Schiel, 2007); and others.

Category 6: Scientific Results; Societal Outcomes; Legacies

2006-2010

CMarZ will likely have cumulative impacts throughout the project's remaining lifespan up to 2010. A CMarZ legacy may be new capacity in zooplankton taxonomic analysis, including integrated morphological/molecular approaches to species identification and recognition. At the same time, CMarZ will almost increase the public's knowledge of and appreciation for zooplankton and other small marine organisms, and more particularly the importance of maintaining and building taxonomic expertise for identifying species in these groups.

Accurate assessment of zooplankton diversity will contribute to improved management of living marine resources (fisheries recruitment models, ecosystem health, and ecosystem-based fisheries management). Zooplankton are short-lived and are excellent indicator organisms of climate and environmental change (detection of ocean food web perturbation, changes in species or biomass distribution and range).

The CMarZ effort to determine DNA barcodes for holozooplankton species is yielding the data and information needed to produce DNA microarrays ("chips"), which can be used for automated and/or remote identification and quantification of zooplankton. It is entirely realistic to expect that DNA sequences will be used routinely for taxonomic analysis of zooplankton samples in the laboratory. On a longer time-frame (15 to 20 years), ocean observing stations may include moored instruments with DNA-based detection systems for *in situ* identification of species. The sensors would provide near-real-time monitoring of changes in plankton communities over any temporal and spatial scales.

Category 7: Tangible Outputs

2006

CMarZ milestones from October 2005 have proven to be over-ambitious in some respects. Earlier plans called for most CMarZ field work during 2005-2006. We now anticipate major field work continuing throughout 2006-2010, with many more cruises than originally anticipated, yielding steady progress in sample analysis, DNA barcoding, species descriptions, and publications. We have met our earlier target for publications (25), but not for barcodes (currently 500 species are barcoded, rather than 1,500 as predicted). Our educational efforts are proceeding well, with 7 training workshops held with >100 total participants.

Cumulative CMarZ targets for each category are indicated in parentheses:

2007

Publications (50); DNA barcodes (1,000); 10 workshops held with 150 total participants.

2008

Publications (75); DNA barcodes (3,000); 13 workshops held with 200 total participants.

2009

Publications (100); DNA barcodes (5,000); 16 workshops held with 250 total participants.

2010

Publications (120); DNA barcodes (7,000); 20 workshops held with 300 total participants.

Category 8: Outreach and Education; Recognition

2006

Media coverage of the 2006 CMarZ/NOAA Ocean Exploration cruise led by P.H. Wiebe wildly exceeded our expectations, with more than 100 articles placed throughout the world in newspapers, magazines, and ‘news’ sections of scientific journals. Although we can’t expect such attention for every CMarZ cruise, it is evident that species discovery during oceanographic research cruises has the greatest and broadest appeal for the media. With one dedicated CMarZ cruise anticipated for 2007-2010, we can expect some media attention each year.

A recent CMarZ cruise included an ARMADA Teacher-at-Sea, Joe Catron, who we hope will help us tailor the CMarZ messages to secondary school students. German High School students were introduced to zooplankton and sampling methods during a CMarZ cruise on the traditional sailing ship, *Roald Amundsen*, to Atlantic seamounts. Several Steering Group members are engaged with teachers and/or host teachers’ workshops relevant to their research activities. CMarZ will seek to expand our interactions with teachers and students at all levels.

Products of CMarZ O&E activities may include a diverse menu of communications materials, including gift items (screensavers, mouse pads, calendars, and postcards). Our legacy will be a web-based library of Species Pages. We may build recognition for the large project by profiling a “species of the month” and/or preparing a written series about why we should care about zooplankton, explaining their importance for the health of the global ocean.

2007

Cumulative target for media coverage: 125 articles.

2008

Cumulative target for media coverage: 150 articles.

2009

Cumulative target for media coverage: 175 articles.

2010

Cumulative target for media coverage: 200 articles.

Category 9: Data Management

2006

With the start of the project, the CMarZ Data and Information Management Office was established by P.H. Wiebe (Woods Hole Oceanographic Institution, USA). Robert Groman (WHOI) is the data manager and liaison to OBIS. Work is ongoing to ensure full interoperability with the OBIS portal. The CMarZ data management system will serve all data and information from CMarZ cooperating projects and activities. Specimen records will include DNA barcodes, with links to GenBank via the entry Accession Numbers. The JGOFS/GLOBEC will link to the CMarZ database and will ensure that CMarZ can provide open access to all ancillary environmental data, cruise reports, images and video clips, etc that are not currently available through OBIS.

The CMarZ database will also serve species pages for zooplankton taxa. The creation of species pages are based on contributions from CMarZ Steering Group members, allied taxonomists, and other specialists, some of whom serve as editors for the submitted material and page presentations. A dual web-based data entry approach is being implemented. The first involves a web-supervised approach using web-pages where authorized data contributors can input and modify the species information. The second involves a community-based approach using the WIKIPEDIA philosophy. The zooplankton species to be featured are selected by the taxonomists, with an overall goal of 500 species pages by 2010.

Data submission to the CMarZ database is slower than anticipated due to a slower than anticipated contributions from specialists. Database development has focused on the direct web based input by contributors and on building the linkages to OBIS. Primary metrics of CMarZ database completeness are the numbers of records (specimen records and DNA sequences) and species pages. Anticipated cumulative milestones for the CMarZ database are:

2007

1,000 specimen records and DNA barcodes; 100 species pages.

2008

3,000 specimen records and DNA barcodes; 200 species pages.

2009

5,000 specimen records and DNA barcodes; 400 species pages.

2010

7,000 specimen records and DNA barcodes; 500 species pages.

Category 10: Synthesis

2006

Planning for synthesis will be a topic of discussion during the CMarZ Steering Group meeting (November 2006 in Tokyo). An essential goal for CMarZ will be integration and synthesis of data and information toward a global view of zooplankton biodiversity, including a prospective view of the completeness of the information and the remaining holes (unknown or unknowable) by 2010.

Coordination with ArcOD, CAML, MAR-ECO, ICOMM, CeDAMAR, and FMAP will be explicitly discussed; the Reporting Framework will be used as a guide for our planning.

2007

Data management and synthesis workshop for CMarZ Steering Group members who are major data contributors (Woods Hole, MA USA; May 2007)

2008

CMarZ Steering Group meeting (TBA)

2009

Synthesis planning workshop with other some CMarZ Steering Group members and selected CoML field project representatives (TBA)

2010

CMarZ Steering Group meeting and CoML meetings.

CoML All-Program meetings are useful events to build a sense of identity and common purpose, and should be a primary vehicle to move projects toward and through synthesis activities. Annual All-Program meetings would be useful, but CoML would need provide funding to projects for participant travel.