

The 4th International Zooplankton Production Symposium: A review

by Michael Dagg, Roger Harris, Shin-ichi Uye and Luis Valdés

Zooplankton play a key role in the pelagic food web by controlling phytoplankton production and shaping pelagic ecosystems. In addition, because of their critical role as a food source for larval and juvenile fish, the dynamics of zooplankton populations have a significant influence on recruitment to fish stocks.

In 1961, ICES convened the 1st Zooplankton Production Symposium in Charlottenlund, Denmark. ICES also had a lead role in the 2nd Zooplankton Production Symposium on “*Zooplankton Production: Measurement and role in global ecosystem dynamics and biogeochemical cycles*”, held in Plymouth, UK, in 1994. The increasing importance of international programmes such as GLOBEC and the general concerns about global change and the changing role of zooplankton in ocean ecosystems were reflected in the development of this Symposium.



Organizers of the 2nd Zooplankton Production Symposium, Plymouth (UK), 1994. From left: Hein-Rune Skjoldal (Norway), Thomas Kiørboe (Denmark), Roger Harris (UK), David Griffiths (President, ICES) and Michael Reeve (U.S.A.).

This trend was further enhanced in the 3rd Zooplankton Production Symposium on “*The role of zooplankton in global ecosystem dynamics: Comparative studies from the world oceans*”, which was held in Gijón, Spain, in 2003. It was here that the Symposium was co-sponsored by ICES, PICES and GLOBEC for the first time. The Gijón Symposium attracted 333 participants from 38 countries from around the world.

The 4th International Zooplankton Production Symposium was held in Hiroshima, Japan, from May 28–June 1, 2007. This Symposium was the first of the series to be held outside Europe, and its focus was on “*Human and climate forcing of zooplankton populations*”.

At the 1st Zooplankton Symposium only four themes were represented: “*Methods at sea, Methods in the laboratory, Food and trophic relations, and Distribution*”. By the Plymouth meeting the number and variety of topics had increased to “*Biomass and production measurements (New sampling and analysis techniques, Production and grazing methodology), Regional interactions of physics and population dynamics (Quantitative aspects of life history patterns, Population dynamics models and production), Food chain control (Grazing, flux and microzooplankton, Predation and gelatinous zooplankton), Spatial/temporal variability and prediction (Time-series and their significance, Large-scale physical/biological coupled models), and GLOBEC International*”. This trend was further developed in Gijón with sessions on “*Physical variability and zooplankton population dynamics, Role of zooplankton in biogeochemical cycles, Climate influences: What are long-term zooplankton data sets telling us? New approaches to zooplankton modelling, Progress in molecular biology, and Application of new technologies*”. The 3rd Symposium also saw a number of associated workshops on “*Comparative life histories and life cycles of zooplankton populations within and between North Pacific and North Atlantic, Microzooplankton in the marine pelagial: Recent advances from molecules to ecosystems, Gelatinous zooplankton and fish: Predators, prey or nuisance, Meso- and bathy-pelagic zooplankton: Current status and future aspects, and Climate variability, zooplankton abundance and distribution: Comparative opportunities from the world’s oceans*”.

The trend of the previous three Zooplankton Symposia was also towards an increasing number of participants and an ever expanding number of countries represented. The Hiroshima Symposium was certainly a notable landmark in this progression. Similarly, as noted above, new scientific themes have developed over the years, indicating the evolution of the field of zooplankton research. It has already been mentioned that the 1961 Symposium had only four session themes. In the subsequent Symposia, new emphasis on physical–biological interactions, climate change effects, time-series, molecular biology and modeling, as well as greater emphasis on zooplankton groups, such as microzooplankton and gelatinous zooplankton, are obvious evidence that our field continues to develop and innovate.



Dr. Toshimasa Asahara, President of Hiroshima University, welcomes participants to Hiroshima and the Symposium.



Dr. Victoria Fabry giving one of the three keynote lectures on the first official day of the Symposium.



A full attendance at the plenary sessions.



A very attentive and enthusiastic audience (here represented by Dr. Mike Landry) active in a session discussion period.

International co-sponsors of the Hiroshima Symposium included: the North Pacific Marine Science Organization (PICES), the International Council for the Exploration of the Sea (ICES) and the Global Ocean Ecosystem Dynamics Program (GLOBEC). Local sponsors were the Japanese Society of Fisheries Oceanography, the Plankton Society of Japan and Hiroshima University. Dr. Shin-ichi Uye, the Chairman of the Local Organizing Committee, was very active in raising financial support for the meeting from many generous Japanese sources. In addition, SCOR (Scientific Committee on Oceanic Research) provided travel support to scientists from countries with “economies in transition”.

PICES member countries recognize the importance of bringing marine scientists together to provide better understanding and predictive capability for the world’s oceanic ecosystems. International meetings such as this symposium contribute greatly to these broad goals. This symposium not only provided a better knowledge of zooplankton production processes but also contributed to a deeper understanding of all marine ecosystems. Zooplanktologists from all PICES member countries and countries around the world met to address issues important to marine science and to society in this time of rapid and serious climate change. For this week-long symposium, 334 participants from 46 countries contributed 141 oral and 250 poster presentations. These demographics clearly indicate the international nature of zooplankton research.

On Monday (May 28), the day prior to the meeting, there were three full-day workshops:

- W1 – “*Temporal and regional responses of zooplankton to global warming: Phenology and poleward displacement*”, convener: Anthony J. Richardson (Australia) representing Wulf Greve (Germany) who was unable to attend;
- W2 – “*Zooplankton research in Asian countries: Current status and future prospects*”, convenors: Sun Song (P.R. China), Sanae Chiba (Japan) and Young-Shil Kang (Republic of Korea);
- W3 – “*Krill research: current status and its future*”, convenors: So Kawaguchi (Australia) and William T. Peterson (U.S.A.).

On Tuesday (May 29), the Symposium was officially opened with welcome addresses from the President of Hiroshima University, Dr. Toshimasa Asahara, and the Chairman of the Local Organizing Committee, Shin-ichi Uye. This was followed by brief presentations from symposium convenors representing ICES (Luis Valdés), PICES (Michael Dagg) and GLOBEC (Roger Harris).

The morning plenary session provided three excellent presentations on different aspects of the symposium theme:

- *Impacts of ocean acidification on marine zooplankton: Knowns and unknowns* by Victoria J. Fabry;

- *In hot water: Zooplankton communities now and in the future* by Anthony J. Richardson; and
- *The role of microzooplankton in a changing ocean* by Albert Calbet.

Parallel oral sessions followed in the afternoon and throughout the duration of the meeting. These were:

- S1 – “*Global comparisons of zooplankton time series*”, convenors: David L. Mackas (Canada) and Luis Valdés (Spain);
- S2 – “*Importance of zooplankton in biogeochemical cycles*”, convenors: Hiroaki Saito (Japan) and Deborah K. Steinberg (U.S.A.);
- S3 – “*The role of zooplankton in foodwebs: Changes related to impacts of climate variability and human perturbation*”, convenors: Hans G. Dam (U.S.A.) and Mike A. St. John (Germany);
- S4 – “*Mortality impacts on the ontogeny and productivity of zooplankton*”, convenors: Mark Ohman (U.S.A.), Serge Poulet (France) and Anthony Verschoor (The Netherlands);
- S5 – “*Zooplankton functional groups in ecosystems*”, convenors: Sanae Chiba (Japan) and Sun Song (P.R. China);
- S6 – “*Microbial loop vs classical short food chains: Implications for appraisal of foodweb efficiency and productivity*”, convenor: Ulf Bamstedt (Sweden);
- S7 – “*Environmental and other constraints on zooplankton behaviour, life histories and demography*”, convenors: Charles B. Miller (U.S.A.) and Atsushi Tsuda (Japan);
- S8 – “*Zooplankton biochemistry and physiology: Practical and potential biotechnology applications*”, convenors: Ann Bucklin (U.S.A.), Adrianna Ianora (Italy) and Kurt Tande (Norway);
- S9 – “*Advances in image technologies and the application of image analysis to count and identify plankton*”, convenors: Cabell Davis (U.S.A.) and Xabier Irigoien (Spain);
- S10 – “*Analysis and synthesis: Modelling zooplankton in aquatic ecosystems*”, convenors: Daniel Grunbaum (U.S.A.) and Michio Kishi (Japan).

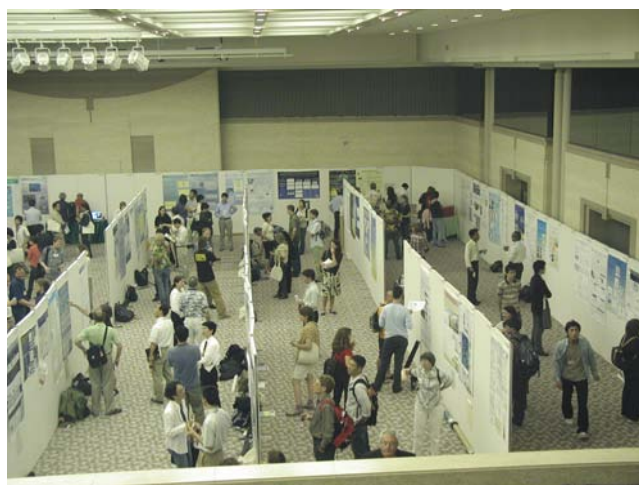
The large number of symposium participants required extensive time for poster viewing, so on both Tuesday (May 29) and Wednesday (May 30) there were official poster sessions of 2 hours each. Refreshments and snacks, combined with the many interesting posters, made these sessions a forum for terrific scientific discussions.

With such a range of topics and such a large number of contributions, it is difficult to single out highlights of the Symposium. The standard throughout was very high and the level of interest and participation was great. Perhaps, looking to the future, the focus on topics, such as the characterization of zooplankton with novel approaches like bar-coding and image analysis, the increased emphasis on time-series analysis and large data sets, the range and

activity of modeling approaches, emerging functional group concepts and concerted international efforts on particular groups or species (such as krill and *Calanus*), will come to be recognized as particular achievements of the Hiroshima Symposium.



Numerous posters await to be displayed at the Poster Session.



A labyrinth of colourful and informative posters and interested viewers.



Participants hanging around the Registration Area during a coffee break.

Remarks by Teruaki Yoshida

I would like to thank Prof. Uye and the Symposium organizers for giving me the opportunity to speak in front of so many distinguished zooplanktologists.

I am currently a Ph.D. student at University Kebangsaan Malaysia. Today, I am happy to have the opportunity to stand here in the presence of my mentor, Prof. Othman Haji Ross. Going back a few years, I met Prof. Othman for the first time at Soka University in Tokyo, where I was doing my Master degree under the guidance of Prof. Toda, my other mentor. Both of them have a record of active collaborative research projects between Japan and Malaysia. Their collaborative efforts have borne fruit to 12 publications over the years, and there are more on the way. At that time, I had always wanted to go abroad to do a Ph.D., and I was happy when Prof. Othman kindly offered to take me under his wing. I have been working on zooplankton in Malaysia ever since.

As a participant from Malaysia, I had many fruitful discussions with scientists from all around the world, but I am especially happy to be able to meet participants from Asian countries as we exchanged opinions and formed mutual friendships as zooplanktologists from the same region. I found out that many of these countries faced similar challenges such as a lack of funding, expertise and facilities. Thus, I believe that it is important to form close networks with scientists for open exchanges and collaborative partnerships for major advances in the understanding of zooplankton.

40 years ago in Japan, nobody thought of studying plankton. Today, Japan has become a leading country in

zooplankton research. Malaysia would like to aim for that. Although zooplankton studies are still at an early stage in Malaysia, I am taking this experience back and sharing it with fellow researchers and the next generation of students. I hope more Asian researchers will be able to participate in the next zooplankton symposium. Until we meet again.

Thank you very much.



One emphasis of the Symposium was the encouragement and recognition of young scientists. To highlight the importance of this issue, travel support for more than 40 early career scientists was provided from the Symposium budget or directly by PICES and ICES. Many young scientists from Asian countries were also able to participate thanks to the special support arranged by Shin-ichi Uye. Recognition for the two best posters by young scientists was provided by the Symposium during the closing ceremony. The two best posters were:

- Yuichiro Nishibe (Japan) and T. Ikeda, “*Metabolism and elemental composition of four oncaeid copepods in the western subarctic Pacific*”;
- Jörn O. Schmidt (Germany), J. Renz and J. Dutz, “*Vertical distribution and diel vertical migration of main copepod species in the Bornholm Basin (Baltic Sea)*”.

On Thursday (May 31) afternoon, everyone took a break from the formal sessions and participated in a Symposium excursion to Miyajima Island, the location of the majestic Itsukushima Shrine, first built in 593, then rebuilt in 1168

on the same scale as seen today. The shrine was designated as a UNESCO World Heritage site in 1996. The evening’s banquet dinner of fine Japanese foods brought the day to a close.

The closing ceremony was held after the sessions on Friday (June 1). Ceremonies began with a short speech by Teruaki Yoshida, a Japanese student presently pursuing his Ph.D. in Malaysia (see the insert on this page). If he is representative of the future, then we will have no worries about zooplankton research in the coming years. Poster awards, described above, were presented by Luis Valdés. Recipients received some nice prizes including encouragement, in the form of a waived registration fee, to attend the meeting on “*Effects of climate change on the world’s oceans*” to be held in Gijón, in May 2008.

Closing scientific remarks were provided by Roger Harris, who gave a brief summary of the history of zooplankton research as represented by the three previous Symposia, and then pointed to the future, reflecting on some of the key themes of the Hiroshima Symposium. He concluded



Dr. Luis Valdés presenting the Best Poster Award to the winners, Yuichiro Nishibe (left) and Jörn O. Schmidt (right), at the Closing Ceremony.

by projecting ahead to the next Zooplankton Symposium and anticipating significant advances in topics, such as automated/semi-automated characterization of zooplankton spatial and temporal distribution on a global scale, coupling food-web models from phytoplankton to fish, coupling between physical and biological models, and assessments and prediction of climate change on marine resources and marine ecosystems. He observed that society was starting to demand a predictive capability regarding marine ecosystems, and that this would be a major challenge for the community. With developing new technologies, carefully posed new questions and hypotheses, and with new people entering the field, future progress will be assured. The quality of presentations and the enthusiastic participation by early career stage scientists had been outstanding and he concluded that their contribution to the Hiroshima Symposium provided real confidence for the future. Shin-ichi Uye then officially closed the Symposium.

Two special publications will result from this Symposium. Manuscripts based on papers and posters presented at the symposium will be considered for publication in a special issue of the *ICES Journal of Marine Science*. Publication is planned for the late summer of 2008, and approximately 35 to 40 papers are anticipated. All registered participants of the Symposium will receive a copy of the special issue following publication. There will also be a special issue of *Deep Sea Research II* on krill biology and ecology. This volume will be derived from papers and posters presented in the krill workshop (W3) and relevant papers and posters presented in the other sessions of the Symposium.



Participants are given a chance to explore the culture of Japan during an excursion to the famous Itsukushima Shrine on nearby Miyajima Island.



Participants are treated to an exquisite banquet after the pleasant outdoor excursion.

The PICES staff (Alexander Bychkov, Skip McKinnell, Christina Chiu and Julia Yazvenko) contributed greatly to the smooth running of the Symposium by their activity before and during the meeting. Additional assistance was provided by Dawn Ashby and Lotty Ireland from the GLOBEC office. Many Japanese students were of excellent assistance in running the registration desk and the audio-visual equipment used in all the sessions and workshops.

In summary, PICES, GLOBEC and ICES were privileged and pleased to have served as co-sponsors of the highly successful 4th International Zooplankton Production Symposium.



History in the making... Alexander Bychkov and Shin-ichi Uye asking Rubén Escribano, "Will the 5th Zooplankton Production Symposium be in Chile ...???"



The symposium convenors, Drs. Roger Harris, Michael Dagg, Shin-ichi Uye and Luis Valdés, express their feelings for the outcome of the Symposium by body language.

Dr. Roger Harris (r.harris@pml.ac.uk) is a Senior Scientist at the Plymouth Marine Laboratory (UK). His main research interests are: the control of biological production by physical processes, the role of water column biology in global oceanic carbon flux and the ecology and physiology of calanoid copepods. Roger has considerable experience in international and interdisciplinary project management. He is the past Chairman of the IGBP/SCOR/IOC GLOBEC Scientific Steering Committee (SSC) and continues to serve on the GLOBEC SSC and leads the Focus 2 Process Studies Working Group. He is also the past Chairman of the ICES Working Group on Zooplankton Ecology and remains active in the Working Group. He is currently a member of the EUR-OCEANS Network of Excellence Executive Committee. He is involved in a number of editorial roles, principally as Strategic Editor of the Journal of Plankton Research.

Dr. Michael Dagg (mdagg@lumcon.edu) is a Professor at the Louisiana Universities Marine Consortium (U.S.A.). He divides his research efforts between studies of river plume–ocean interaction in the northern Gulf of Mexico and zooplankton feeding processes in the North Pacific Ocean. He has worked extensively with North Pacific copepods over the past 25 years. Mike received his undergraduate and graduate degrees in Canada and his Ph.D. from the University of Washington (U.S.A.). He is currently serving as the Chairman of the Biological Oceanography Committee of PICES, and is a member of the Science Advisory Panel of the North Pacific Research Board, U.S.A.

*Dr. Shin-ichi Uye (suye@hiroshima-u.ac.jp) is the Executive Vice-president of Hiroshima University (Japan), as well as a Professor of Biological Oceanography of the Graduate School of Biosphere Science at the same university. He was motivated to study zooplankton production ecology during a year's (1974–75) stay as a visiting student at the Scripps Institution of Oceanography. He had determined the specific growth rates (somata and eggs) of major copepod species, and has used them to estimate the production rates of the natural copepod populations in various Japanese coastal waters. His scientific interest has now shifted to megazooplankton, including the giant jellyfish (*Nemopilema nomurai*), which has been continuously blooming in the East Asian Marginal Seas since 2002. He is currently wearing two hats, one as a researcher investigating the causes for the recent jellyfish population explosions and their impact and another as a university administrator. He is also the President of the World Association of Copepodologists.*

Dr. Luis Valdés (luis.valdes@gi.ieo.es) is the Director of the Centro Oceanográfico de Gijón - Instituto Español de Oceanografía (CO Gijón-IEO), Spain. He has more than 25 years' experience in marine research and field studies related to zooplankton time series and climate change. In 1988, he started the Radiales project which has grown from one standard transect off Coruña to the present network of 20 fixed stations along the north and northwest coast of Spain. In 1998–2001, Luis was the coordinator of the IEO programme on Time Series and Ocean Observing Systems. He maintains an intense activity in the international arena serving as the Spanish Delegate to IOC-UNESCO and to ICES, where he is the current Chairman of the Oceanographic Committee. He has convened several international symposia and was also the local organizer of the 3rd International Zooplankton Production Symposium held in Gijón in 2003.