

Report of Working Group 37 on Zooplankton Production Methodologies, Applications and Measurements in PICES Regions

The first meeting of the Working Group on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions* (WG 37) was held on September 24, 2017 from 9:00 to 12:30 h in Vladivostok, Russia, under the chairmanship of Dr. Toru Kobari (Japan) and Dr. Akash Sastri (Canada). Three members and two observers attended the meeting (**WG 37 Endnote 1**). Several members who could not attend the meeting reported progress on their inter-sessional activities (see **WG 37 Endnote 2**) and/or provided comments through the E-mail communication.

AGENDA ITEM 1

Background and recent activities of the Working Group

Dr. Kobari provided a brief rationale and background for the formation of the Working Group, problems in measuring zooplankton rates, and recent activities and progress made by the Group.

AGENDA ITEMS 2 AND 3

Terms of reference and future plans

Dr. Kobari reviewed the WG terms of reference (**WG 37 Endnote 3**) and provided details to address them.

1. Review papers on traditional and biochemical methodologies (ToR1).
 - Review paper for biochemical approaches was already published in *Advances in Marine Biology* (<http://dx.doi.org/10.1016/bs.amb.2016.09.001>);
 - Guideline describing advantages, disadvantages and limitations was not deemed novel since such information is already described in the ICES manual and Kimmerer *et al.* (2007). In the proposed review paper, quantitative evaluation like error and variance should be compared among the estimates for available traditional methodologies;
 - Average and variance of growth rates estimated with the traditional methods can be compared with the estimates with the Ikeda-Motoda and Banse-Mosher models which are applicable to wide taxonomic groups with the least variables (*i.e.*, temperature and individual body weight). Such comparison standards estimated with these models enable evaluation of the applicability of traditional methodologies to taxonomic groups, locations and situations.
 - *In situ* or laboratory experiments for comparing the traditional methodologies should be encouraged and promoted. WG37 will seek and call for collaborative opportunities without funding like sample exchange, small field or laboratory projects (traveling on individual funding) and application to zooplankton data sets;
 - Colleagues who confirmed their interest in participating in the review paper on traditional methodologies are:
 - Toru Kobari, Akash Sastri (Co-Chairs),
 - Hui Liu (U.S. member: artificial cohort),
 - Andrew Hirst (UK colleague: empirical models).

2. Guidelines and recommendations of traditional and biochemical methodologies (ToR2).
 - Recommendations and procedures for the biochemical methodologies are completed and included in the review paper (Yebrá *et al.*, 2017) as supplements. The Co-Chairs and Dr. Lidia Yebrá (WG 37 *ex*

- officio* member, representing ICES) will draft recommendations and guidelines for the biochemical methodologies. A final version will be posted on the PICES website;
- Similar guidelines for the traditional methodologies can be produced by the authors of that review paper. WG 37 asks for an outline of the following methods: molting rate by T. Kobari; natural cohort by Koichi Ara; artificial cohort by Hui Liu, egg production by H.K. Kang and M.C. Jang; and empirical models by Andrew Hirst. Dr. Kobari will draft an outline of this guideline by the next Ocean Science Meeting (February 2018);
3. Develop practical models for estimating zooplankton production to time-series (ToR3).
 - Ikeda-Motoda and Banse-Mosher models are recommended as the best methods for application to zooplankton time-series because of applicability to wide taxonomic groups, locations and situations, minimum requirements of variables only for temperature and animal body weight, and high temporal and spatial resolutions. Dr. Kobari is applying the Ikeda-Motoda model to the different time-series and comparing the estimates. He will demonstrate the results in the workshop during the PICES 2018 Annual Meeting in Japan, collaborating with T. Tadokoro (Japan) and D. Steinberg (USA);
 - Dr. Tadokoro will demonstrate the application of the Ikeda-Motoda model to zooplankton data sets in the Inland Sea of Japan in the proposed workshop (see **WG 37 Endnote 4**) during the PICES-2018.
 4. Build a platform of information exchange on zooplankton production measurements through an interactive website for regional and/or global mapping (ToR4).
 - WG 37 asks Dr. Yebra to apply the Ikeda-Motoda and Banse-Mosher models to the zooplankton data base in collaboration with its organizer, Mr. Todd O'Brien (USA).
 5. Build a network of scientists and laboratories measuring zooplankton production among PICES and ICES member countries as well as developing countries (ToR5).
 - WG members continue to seek scientists and laboratories measuring zooplankton production. They will report on and update this information at the WG meeting at PICES-2018. In particular, WG 37 needs information from China and Russia because we have none from those countries at the moment;
 - Each WG member is to update a list of the information (*e.g.*, name, institute, email, methodology used, some publications). The Co-Chairs will contact the Secretariat about placing the information on the PICES website.
 6. Promote international collaborations among zooplankton production researchers through international organizations such as PICES, ICES and IMBER (ToR6).
 - WG members should continue to seek and report on potential funding opportunities for international collaboration on zooplankton production estimates. They will report any updates at the WG meetings in 2018. Opportunities and ideas for collaborative research or experiments for zooplankton production estimate comparisons with small funding or without funding are also welcome to report (see above);
 - ToR6 will be simultaneously promoted with ToR2, ToR3 and ToR4.
 7. Publish a final report summarizing results (ToR7).
 - The Co-Chairs will draft an outline for the final report referring to the previous reports for the past working groups as examples;
 - WG members will discuss an outline (sections) of the report at PICES-2018. All of the members are associated with each section;
 - A bibliography of zooplankton growth and production in the North Pacific will be included in the report. WG members will assemble the literature for zooplankton growth and production studies for each country and report them at the next WG meeting. In particular, WG 37 strongly encourages

China and Russia to submit this information because we have nothing from these countries at the moment.

Additional plans for WG 37 include a workshop proposed for PICES-2018 (*WG 37 Endnote 4*). This workshop is intended to provide a venue for both Working Group members and others to present either syntheses of secondary production work in their region and/or recent focused methodological studies on secondary production.

AGENDA ITEM 4

Other items

- *Bibliography for zooplankton production methodology and measurements in the PICES region*

Published papers in Korean and Japanese waters have been listed in a bibliography. Members were asked to continue collecting published papers, in particular for Canada, China, Russia and the U.S.

- *Review of BIO Workshop (W6) on “Advantages and limitations of traditional and biochemical methods of measuring zooplankton production” at PICES-2017*

Drs. Kobari and Sastri convened the ½-day W6 workshop on September 23. Eleven participants attended and 4 talks and 2 posters were presented (see PICES-2017 [Session Summaries](#) for a summary of the workshop).

- *Upcoming Ocean Sciences Meeting 2018 in Oregon*

Drs. Kobari, Sastri and Yebra will convene a topic session on “*Zooplankton productivity as a function of trophodynamics in marine ecosystems*” at the 2018 Ocean Sciences Meeting in Portland, Oregon (February 11–16, 2018). Nineteen abstracts have been submitted to the Science Steering Committee and will be reviewed by the conveners. The schedule will be determined in late September to early October 2017.

- *School or workshop for early career scientists*

Members discussed holding a fall school or workshop for early career scientists to practice zooplankton production procedures, sample analysis and types of traditional methodologies after the PICES 2018 Annual Meeting in Japan or in 2019 in Canada. The final decision was to hold a practical workshop prior to the Annual Meeting at the Manazuru Marine Center for Environmental Research and Education of Yokohama National University (*WG 37 Endnote 5*).

- *Membership*

Dr. Lidia Yebra (representing ICES) was approved as an *ex officio* member of WG 37 by Governing Council.

WG 37 Endnote 1

WG 37 participation list

Members

Toru Kobari (Co-Chair, Japan)
Akash Sastri (Co-Chair, Canada)
Kazuaki Tadokoro (Japan)

Observers

Ian Perry (Canada)
Ryan Rykaczewski (USA)

Members unable to attend

China: Qing Yang
Korea: Se-Jong Ju, Jung-Hoon Kang
Russia: Vladimir Napazakov
USA: Hui Liu, Todd O'Brien

WG 37 Endnote 2

WG 37 meeting agenda

1. Background of the Working Group on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions* and recent activities
2. Terms of reference
3. Future plans
4. Other items

WG 37 Endnote 3

WG 37 Terms of reference

1. Summarize assumptions, recent advances and limitations of both traditional and biochemical methodologies for measuring zooplankton production of natural populations and communities;
2. Produce recommendations and procedures for both traditional and biochemical zooplankton production rate measurement methodologies and make them available for worldwide users on a website;
3. Develop practical models for estimating zooplankton production to time-series;
4. Build a platform of information exchange on zooplankton production measurements through an interactive website for regional and/or global mapping;
5. Build a network of scientists and laboratories measuring zooplankton production among PICES and ICES nations as well as developing countries;
6. Promote international collaborations among zooplankton production researchers through international organizations such as PICES, ICES and IMBER;
7. Publish a final report summarizing results.

WG 37 Endnote 4

**Proposal for a Workshop on
 “Regional evaluation of secondary production observations and application of methodology in
 the North Pacific” at PICES-2018**

Duration: ½ day

Convenors: Akash Sastri (Canada) and Toru Kobari (Japan)

Suggested Invited Speakers: Shin-ichi Uye (Japan), Chih-hao Hsieh (Chinese Taipei)

Zooplankton production represents a quantitative proxy for the functional response of marine ecosystems to regional and global climate change, because material and energy scattering in the lower food web is integrated by zooplankton communities. Although a variety of methodologies for measuring zooplankton production have been developed and applied over the last half century, our knowledge of which approaches are applicable to a diverse range of organisms and habitats remains limited. Recent advances in biochemical methods for measuring zooplankton production have been reviewed, however, such information is still lacking for the traditional methodologies. This workshop will share the current status on zooplankton production methodologies and measurements, to be reported by the working group members representative of each PICES nation. In addition, we also encourage presentations and discussion on advantages, applications and limitations of traditional methodologies on zooplankton production applicable to natural zooplankton populations and communities.

WG 37 Endnote 5

**Proposal for a Practical Workshop on
 “Production methodologies and measurements for in situ zooplankton: Phase I”**

PICES Working Group 37 and Yokohama National University are conducting a 3-day practical workshop (22–24 October, 2018) at Yokohama National University to introduce students and early career scientists to information about several approaches for estimating zooplankton production. Included in the course is both shipboard coastal sampling of zooplankton and instruction in the laboratory on methods of estimating production. This practical workshop is limited to 10 participants due to vessel capacity and classroom facility limitations. The workshop is aimed at early arrivals to the PICES Annual Meeting and is envisioned as the first of two workshops (Phase 2 in 2019, date TBD) on the topic of estimation of zooplankton production.

Scope

Zooplankton production represents a quantitative proxy for the functional response of marine ecosystems to regional and global climate change because material and energy scattering in the lower food web is integrated by zooplankton communities. In the last half century, many methodologies for measuring zooplankton production have been developed as described in the ICES Zooplankton Methodology Manual. Unfortunately, the applications to zooplankton population and community in nature remain limited due to the specific knowledge and handlings for these methodologies. In this workshop, participants will estimate zooplankton growth or production with several methodologies using zooplankton samples and share the practical tricks. We also encourage international network and collaborations on zooplankton production

measurements among early career scientists and students from PICES member countries through this workshop.

Sponsors

PICES BIO/Working Group on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions* (WG 37)

Yokohama National University

Japan Science and Promotion Society

Organizers

Toru Kobari (WG 37)

Akash Sastri (WG 37)

Local Organizing Committee (LOC)

Toru Kobari (Chair: Kagoshima University)

Shinji Shimode (Yokohama National University)

Koichi Ara (Nihon University)

Date

22–24 October, 2018 (Monday to Wednesday, just before the PICES 2018 Annual Meeting)

Venue

Manazuru Marine Center for Environmental Research and Education, Yokohama National University

(<http://www.mmcer.ynu.ac.jp/mmcer/top.html>)

Maximum number of participants

10 early career scientists or students

Registration

- ✓ All applicants must email a curriculum vita including their name, institutional information, nationality, gender and email address to the Chair of the LOC (kobari@fish.kagoshima-u.ac.jp). Deadline for registration is 15 June 2018. Considering international balance among the PICES member countries, participants will be decided by the LOC on a first-come-first-served basis. All applicants will receive the decision by email from the LOC by 30 June.
- ✓ Note: PICES is not providing financial support for participants to attend the workshop.
- ✓ There is no registration fee, but participants will be required to pay their own meals and transportation costs to the Manazuru Marine Center during the workshop. Accommodation and facility are provided for the participants by grants-in-aid for scientific research from the Japan Science and Promotion Society (17K00522).

Practical Workshop Schedule

October 22 (Monday)

19:00–21:00 Opening ceremony and ice breaker

October 23 (Tuesday)

07:30–08:30 Breakfast (bring own meal)

08:30–09:30 Loading sampling gears and lecture for on-board sampling

09:30–12:00 On-board sampling

12:00–13:00 Lunch (pre-ordered lunch box)

13:00–15:00 Laboratory work

Sorting for egg production method (Dr. Shimode)

15:00–15:30 Coffee break

15:30–17:30 Laboratory work

Imaging for live zooplankton (TBA)

18:00–19:00 Dinner (make own meals)

19:00–21:00 Night session

October 24 (Wednesday)

07:30–08:30 Breakfast (bring own meals before coming)

08:30–12:00 Laboratory work

Counting eggs and estimating egg production (Dr. Shimode)

12:00–13:00 Lunch (pre-ordered lunch box)

13:00–15:00 Laboratory work

Application of empirical models to in situ zooplankton (Dr. Ara)

15:00–15:30 Closing ceremony

15:30 Break up

Note

- ✓ Participants should bring the following items:
 - Laptop PC (MS Excel pre-installed)
 - Rain suits, boots and work clothes for onboard sampling (if necessary)
 - Medicine for motion sickness (if necessary)
 - Bath amenity and towel
- ✓ The Chair of the LOC will send an “email” to all participants if this practical workshop is cancelled by severe storms on the day before this workshop (i.e., 21 October, 2018).
- ✓ Participants should bring their own meals for breakfast on Tuesday and Wednesday. The LOC will support all participants on transportation to local shops.
- ✓ All participants will make their own dinner on Tuesday. All participants and the others will pool funds to purchase food, which is cooked in a kitchen.