

GC Appendix A**2016 Governing Council Decisions**

(The following decisions were taken at the Governing Council Meeting at PICES-2016 in San Diego, USA November 12 and 13/, 2016. Decisions 2016/A/1 to 2016/A/5 and 2016/S/1 to 2016/S/4 were rendered at the Intersessional Governing Council Meeting in Hangzhou, China, June 1 and 2, 2016.)

2016/A/6: 2015 Auditor's Report

Council accepted the audited accounts for FY 2015.

2016/A/7: Annual contributions

- i. Council re-iterated the importance for all Contracting Parties to pay the Annual Fee by the January 1 deadline and confirmed that for planning of their funding requests for annual contributions, Contracting Parties should continue to use the guideline generally accepted at PICES-1999 (Decision 1999/A/2(ii)), which states that the annual contributions will increase at the rate of inflation in Canada.
- ii. Council instructed the F&A Chairman and Executive Secretary to continue to report metrics to characterize the increase in science activities of the Organization.

2016/A/8: Budgetary considerations

- i. Council accepted the estimated accounts for FY2016.
- ii. Council approved the FY 2017 budget of \$908,100. The amount of \$131,100 will be transferred from the Working Capital Fund to balance the budget, setting the total annual contributions at \$777,000, and the 2017 annual contribution at \$129,500 per Contracting Party.
- iii. Council approved a transfer of \$260,000 from the Working Capital Fund to the Relocation and Home Leave Fund in order to provide for severance and excess vacation leave expenditures expected in FY 2017.
- iv. Council approved a transfer from the Working Capital Fund to the Trust Fund to recover the 2016 expenses and restore the Trust Fund to the level of \$110,000.
- v. Council approved:
 - a. a lump sum employer contribution of \$20,000 from the FY 2017 budget to the International Fisheries Commission (IFC) Pension Plan to pay down unfunded liabilities;
 - b. an additional lump sum payment in FY 2017 (up to \$25,000) to the IFC Pension Plan, if there is a FY 2016 surplus in the General Fund, as determined by the Auditor's Report for 2016; and
 - c. this practice be continued until PICES receives the next actuarial valuation, which is currently expected in 2017.

2016/A/9: Future PICES Annual Meetings and 2017 Inter-sessional Science Board meeting

- i. Council approved the proposal from the Russia to hold the 2017 PICES Annual Meeting from September 20 – October 1, 2017, in Vladivostok.
- ii. Council approved the expenditure of up to \$40,000 from the General Fund to defray the costs of the 2017 Meeting, as requested by Russia.
- iii. Council accepted the offer from Japan to host the 2018 PICES Annual Meeting in Yokohama, with the dates and specific venue to be confirmed in spring 2017. Japan requests up to \$40,000 from PICES to defray the costs of the 2017 Meeting.
- iv. Council requested Canada to confirm by March 31, 2017 their intention to host the 2019 PICES Annual Meeting in Canada.

- v. Council agreed to keep the same registration fee structure for PICES-2017 as for PICES-2010 through PICES-2016:

Type of registration fee	CDN \$
Regular	275
Early	200
Student	50
Spousal/guest	50

- vi. Council approved an Inter-sessional Science Board meeting to be hosted by USA in May or June, 2017.
- vii. Council requests that the Secretariat continue to work individually with Contracting Parties to implement approaches for funding annual meetings that are consistent with PICES Financial Regulations.

2016/A/10: PICES Intern Program

- i. Considering funding currently available for the Intern Program and stated intentions for contributions by Contracting Parties, Council agreed to initiate the process to obtain an intern for the 2017/2018 term. To ensure continuity of the program, an earlier starting date, such as early May was suggested. Following the existing rotation cycle, Russia was requested to nominate an intern by February 28, 2017.
- ii. Council instructed the Executive Secretary to invite Contracting Parties to provide voluntary contributions to the Trust Fund to support the Intern Program in 2017 and beyond.

2016/A/11: Changes to PICES Staff Rules

Council adopted the following revised Staff Rules:

- i. Staff. Rule 47 (new)
In the event of a dispute over a decision of the Executive Secretary, a staff member may apply in writing to either the Chairman or Vice-Chairman for a review of the decision by the Executive Secretary. Such application must be made within 14 days of receipt of written notice of such a decision.
- ii. Staff. Rule 31 (revised)
The Organization shall pay expenses at two year intervals, for internationally recruited staff and their dependents, to the staff member's home country for two weeks of home leave, provided that;
- (a) dependents who benefit from this grant have resided at the location of the Secretariat for at least six months prior to the travel;
 - (b) Permanent Resident status (or equivalent) has not been established at the location of the Secretariat;
 - (c) the staff member has agreed to return to the Secretariat to continue rendering services for a minimum additional period of six months; and
 - (d) travel claims should be in accordance with the provisions of Staff Rule 36.

2016/A/12: Changes to PICES Financial Regulations

Council approved the following additions to the Financial Regulations:

- i. Regulation 10 –Internal Control
v. The Executive Secretary may make an award of a value not to exceed \$500 in recognition of exceptional contributions to the organization.
- ii. Regulation 12 – Salaries and Expenses
vii. US citizens working at the PICES Secretariat shall be reimbursed for mandatory taxes paid to the US Internal Revenue Service, upon receipt of proof that these payments have been made

2016/A/13: Policy regarding funding support for Open Access Publication

Council approved the following process for evaluating requests for financial support for Open Access publication in peer-reviewed journals:

1. Is the paper/volume of very broad interest in the scientific community? Science Board to make this determination.
2. Does the paper/volume represent time-sensitive information that is sought after by a broad scientific community? Science Board to make this determination.
3. Is the paper/volume a key output product of an Expert Group or PICES sponsored activity? Science Board to make this determination.
4. Is the paper/volume a key output product of an activity carried out in collaboration with one of our strategic partners? .Governing Council to make this determination, with input from Science Board.
5. Is this a high priority for funding? Science Board shall assign a numeric priority to any requests.
6. Is this affordable? Finance and Administration Committee to make this determination, in consultation with the Executive Secretary.

2016/A/14: Policy regarding process for development and approval of Special Projects

Council approved a tiered process for the development and approval of Special Projects. Short term projects valued at under \$50,000 can be approved by the Executive Secretary. For higher value and/or longer term projects, the Chair and Executive Secretary will determine an appropriate process for review and approval. A full review is mandatory for projects valued at over \$500,000 according to the following process:

1. Initial triage/assessment to be conducted by Chair, Science Board Chair and Executive Secretary to establish scientific relevance to PICES and financial/administrative requirements. The appropriate Expert Groups for next steps will be identified.
2. Assessment and/or proposal development by Expert Group(s), with assistance from Secretariat (as required), by correspondence if necessary.
3. Support/endorsement by Science Board (by correspondence if necessary). Science Board to identify lead Expert Groups.
4. Decision by Governing Council, with inputs described above in 2) and 3), by correspondence if necessary.
5. Regular reporting on Special Projects will take place at meetings of the Finance and Administration Committee and appropriate Expert Group meetings.
6. Approval of any PICES-branded publications arising from these Special Projects will take place at Science Board and Governing Council, following the existing process for approval of publications.

2016/A/15: Data Management Policy

Council directed the Executive Secretary and the Chair of the Finance and Administration Committee to develop a simple Data Management Policy for PICES. Council further directed the Executive Secretary, working closely with the Technical Committee on Data Exchange and Science Board to develop an inventory of data or data products that PICES has the responsibility to manage. The draft policy will be circulated to Council by the end of March 2017 for high level input prior to the review of the policy and the inventory by Science Board at the Intersessional Meeting in 2017. Following Science Board input the policy will be submitted to Council for approval in 2017.

2016/A/16: PICES/ICES Strategic Planning Group

Council approved a proposal from the ICES President to establish a planning group at the leadership level to consider longer- term strategic planning across the two organizations. Initial Terms of Reference will be developed and presented for approval by ICES at their Bureau meeting in February 2017 and to Council by correspondence, with an initial meeting of this group to be held in conjunction with the ICES/PICES Small Pelagic Fish Resources Symposium in Victoria in March 2017.

2016/A/17: Standard Template for proposals for new Working Groups

Council directed the Executive Secretary to prepare a standard template for new Working Group proposals

2016/S/5: PICES Participation in Arctic-based activities

Council accepted the recommendation that PICES collaborate with ICES on development of an Integrated Ecosystem Assessment for the Central Arctic Ocean and agreed to co-chair this expert group, at the request of ICES. Council instructed the Executive Secretary to contact ICES and determine the process for integrating PICES into the existing Working Group.

2016/S/6: PICES /Mexico scientific collaboration

Council approved the Mexican proposal to host a North Pacific transitional areas symposium no later than 2018. This symposium will update accomplishments since the previous symposium in Mexico in 2002. . Council instructed the Executive Secretary to work with Mexico and Science Board on the planning for this symposium.

2016/S/7: PICES Collaboration with NPAFC on the International Year of the Salmon (IYS) Program

Council agreed to continue collaborations with NPAFC on the IYS Program, with a focus on providing the expertise from within the PICES community that is complementary to that within the NPAFC community. Specific commitments include:

- i. A senior manager to serve of the IYS North Pacific Steering Committee. This member to be named by Japan.
- ii. A scientist to serve on IYS Symposium Steering Committee. This member to be named by the USA.
- iii. A representative of the PICES Secretariat to serve on IYS Symposium Steering Committee. Dr. Hal Batchelder will serve in this capacity.

2016/S/8: 2017 PICES Annual Meeting

- i. The following scientific sessions are to be convened at PICES-2017:
- ¾-day Science Board (SB) Symposium on *Environmental Changes in the North Pacific and Impacts on Biological Resources and Ecosystem Services*;
 - ½ - day Topic Session on *Microplastics in Marine Environments: Fate and Effects* to be co-sponsored by GESAMP and NOWPAP;
 - ½ - day Topic Session on *Below and Beyond Maximum Sustainable Yield: Ecosystem Reference Points* to be potentially co-sponsored by ICES;
 - ¾ - day Topic Session on *Adverse impacts on coastal ocean ecosystems: How do we best measure, monitor, understand and predict?*;
 - ½ - day Topic Session on *Coastal ecosystem conservation and challenges*;
 - 1 - day Topic Session on *Interannual variability, forecasts and climate projections in marine ecosystems*;
 - ¾ - day Topic Session on *Indicators for assessing and monitoring biodiversity of biogenic habitats*;
 - ¾ - day Topic Session on *Marine ecosystem health and human well-being: a social-ecological systems approach*. to be potentially co-sponsored by ICES and IMBER;
 - ¾ - day Topic Session on *Meso and submesoscale processes and their role in marine ecosystems*;
 - ½- day Topic Session on *Emerging issues in understanding, forecasting and communicating climate impacts on North Pacific Marine Ecosystems*;
 - ¾ - day Topic Session on *Environmental variability in Arctic and Subarctic ecosystems and impacts on fishery management strategies*;
 - ½ - day Topic Session on *Seasonal and climatic influences on prey consumption by marine birds, mammals, and predatory fishes*;
 - ½-day BIO Contributed Paper Session;
 - ½-day FIS Contributed Paper Session;
 - ½-day MEQ Contributed Paper Session;
 - ½-day POC Contributed Paper Session;
 - ½-day HD Contributed Paper Session.
- ii. The following workshops are to be convened at PICES-2017:
- 1 – day PICES/NPRB Workshop on *The role of the northern Bering Sea in modulating the Arctic II: international interdisciplinary collaboration*;
 - 1 – day Workshop on *Coastal ecosystem services in the North Pacific and analytical tools/methodologies for the assessment*;
 - 1 – day Workshop on *Linking oceanographic conditions to the distribution and productivity of highly migratory species and incorporation into fishery stock assessment models*;
 - 1.5 – day Workshop on *Long-term changes in HAB occurrences in PICES nations; the Eastern vs. Western Pacific* to be potentially co-sponsored by GlobalHAB and NOWPAP;
 - 1 – day Workshop on *A guide to communicating PICES science to scientists, governments, stakeholders and the public*;
 - 1 – day Workshop on *Advantages and limitations of traditional and biochemical methods of measuring zooplankton production* to be potentially co-sponsored by ICES.
- iii. The following business meetings are to be held at PICES-2017:
- 3-hour overture meeting, ½-day meeting and a 1-day meeting of Science Board;
 - 1-day FUTURE SSC meeting and ½ day Mini-Symposium;
 - 2-hour overture meetings and ½-day meetings of Standing Committees;
 - 1-day meeting of the Section on *Marine Birds and Mammals (S-MBM)*;
 - 1-day meeting of the Section on *Ecology of Harmful Algal Blooms in the North Pacific (S-HAB)*;
 - 1-day meeting of the Section on *Carbon and Climate (S-CC)*;
 - ½ -day meeting of the joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems (S-CCME)*;

- 1.5 -day meeting of the Working Group 30 on *Assessment of Marine Environmental Quality of Radiation around the North Pacific*;
- 1-day meeting of the Working Group 32 on *Working Group on Biodiversity of Biogenic Habitats*;
- 1-day meeting of the Working Group 35 on the *Third North Pacific Ecosystem Status Report*;
- 1-day meeting of the Working Group 36 on *Common Ecosystem Reference Points across PICES Member Countries*;
- ½-day meeting of the Working Group 37 on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions*;
- 1 -day meeting of the Working Group 38 on *Mesoscale and Submesoscale Processes*;
- ½-day meeting of the *Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas (AP-CREAMS)*;
- 1-day meeting of the *Advisory Panel on North Pacific Coastal Ocean Observing System (AP-NPCOOS)*;
- ½-day meeting of the *Advisory Panel on Non-Indigenous Species (AP-NIS)*;
- 1-day meeting of the *Study Group on Marine Ecosystem Services (SG-MES)*;

2016/S/9: Inter-sessional symposia/session/workshops and meetings

Council approved the following activities:

Activity	Dates	Location	PICES role	Support to be provided
NPFC Pacific Saury Stock Assessment Workshop	Dec. 13-15, 2016	Busan, Korea	PICES representative	1 local FIS member (Dr. Sukgeun Jung, Korea); low cost
Workshop on Oceanography of the Yellow and East China Seas	Jan. 2017	Xiamen, China		AP-CREAMS; no cost to PICES
S-CCME Workshop- Phase 2 Planning (in conjunction with P/ICES Symp. on Small Pelagic Fish)	Mar, 2017	Victoria, Canada	Co-chair with ICES	Incremental costs for S-CCME to hold 1-day WS at Symposium
PICES- ICES Strategic Planning group meeting ((in conjunction with P/ICES Symp. on Small Pelagic Fish)	Mar, 2017	Victoria, Canada	Co-chair with ICES	Chair, Executive Secretary, Past Chair, SB Chair
SG- MES Workshop - Taking Stock of Marine Ecosystem Services in the North Pacific— exploring examples and examining methods	April 2017	Qingdao, China	coordinate	Incremental costs for SG-MES to hold 1-day WS with UNESCO/IOC/WESTPAC Conference
Lowell Wakefield Symposium on Impacts of a Changing Environment on the dynamics of High-Latitude Fish and Fisheries	May 9–12, 2017	Anchorage , USA	Capacity building	1 PICES ECS
HAB Best Practices Manual mini-workshop	May 2017	Paris, France	Contributor	1 S-HAB member (Dr. Mark Wells) up to \$5K
ESSAS Open Science Meeting	June 11-15, 2017	Tromso, Norway	Co-sponsor	Up to \$12.5K for ECS from PICES member countries
ICES/PAME WG on Integrated Ecosystem Assessment for the Central Arctic Ocean	Spring 2017	Seattle, USA	Co-Chair with ICES	Co-Chair plus 1 local FIS member (Dr. Libby Logerwell); no cost

Activity	Dates	Location	PICES role	Support to be provided
WG 35 (NPESR3) progress meeting (subject to submission of detailed plan)	Spring 2017	Sidney, Canada or Honolulu, USA	coordinate	NPESR WG members
Intersessional Science Board meeting -2017	Spring 2017	TBD, USA	coordinate	SB members/ Secretariat
Inter-sessional FUTURE SSC meeting	Spring 2017	TBD	coordinate	FUTURE SSC members
International Year of the Salmon Symposium Planning Meeting	January, 2017		SSC members	Limited. Meeting to be held/correspondence and/or conference calls
SCOR Rio5 Workshop on Radionuclide Applications and Methods	August 2017	Paris, France	Contributor	WG 30 member (Dr. Kathryn Higley) up to \$3K
ICES 2017 Annual Science Conference	Sep 2017	Fort Lauderdale ,USA	Co-sponsor or Convener	Shin-ichi Ito (S7); T. Therriault (S4) (convenors),
WG 26 (CERP) Workshop on Identifying ecosystem indicators for reference point selection methods (subject to submission of detailed plan)	2017	TBD	WG 36 (CERP)	May be linked to FUTURE SSC Meeting
ICES/PICES MSEAS II (approved in principle)	2019 or 2020	Yokohama, Japan	Co-sponsor	Up to \$15K for convenors (Keith Criddle, Mitsutaku Makino), invited speakers and/or ECS (budget request deferred)
PICES AP-NPCOOS Summer School on “Coastal Ocean Observing Systems and Ecosystem Monitoring”	5 days, July or Aug 2018	Vancouver Island, Canada	Capacity building;	Up to \$10K for student travel + \$5K for on-site support
North Pacific Transition Zones Symposium (approved in principle)	TBD, 2018	Mexico	Co-sponsor	Executive Secretary and SB Cahir to work with Mexico.

2016/S/10: Publications

- i. The following publications are to be produced in or submitted to primary journals in 2017–2018:
 - a. A WG 31 Special Issue on “Oil Spills” in Archives of Environmental Contamination and Toxicology to be published in March 2017
 - b. A WG 31 Special Issue on “Pollution Indicators” in Archives of Environmental Contamination and Toxicology
 - c. A WG 31 Special issue on “Hydrocarbons in Marine Environments” in Archives of Environmental Contamination and Toxicology
- ii. The following publications are to be produced in the PICES Scientific Report series in 2017–2018:
 - a. A S-HAB PICES Scientific Report on “East-West comparison of Pseudo-nitzschia”
 - b. An AP-CREAMS PICES Scientific Report on “Oceanography of the Yellow and East China Sea”
 - c. A S-CC PICES Scientific Report on “Basin-wide Assessment of Ocean Acidification”
- iii. The following brochures are to be produced in 2017:
 - a. A brochure summarizing the accomplishments of WG 30 on *Assessment of Marine Environmental Quality of Radiation around the North Pacific*

2016/S/11: Future of Current Expert Groups

Council approved the following changes to existing Expert Groups:

- i. The Section on *Human Dimensions of Marine Systems* was disbanded;
- ii. The Study Group on *Common Ecosystem Reference Points across PICES Member Countries* shall be disbanded on submission of their final report;
- iii. The Study Group on *North Pacific Ecosystem Status Report* shall be disbanded on submission of their final report;
- iv. The duration of WG 30 on *Assessment of Marine Environmental Quality of Radiation* around the *North Pacific* is extended to 2017 to allow the completion of their work, including collaboration with SCOR WG 146 *Radioactivity in the Ocean, 5 Decades Later (RiO5)*;
- v. The duration of WG 31 on *Emerging Topics in Marine Pollution* is extended to 2017 to complete their work, including Special Issues in Archives of Environmental Contamination and Toxicology;
- vi. A minor change to the Terms of Reference for the Section on *Marine Birds and Mammals* was approved.
- vii. The biogeographic convention of numbered areas for submission of Environmental Time Series Observations for the Third North Pacific Ecosystem Status Report proposed by the Study Group on *North Pacific Ecosystem Status Report* and endorsed by Science Board was approved by Governing Council.

2016/S/12: New Expert Groups

The following expert groups, with terms of reference as described in GC Appendix B, were established:

- i. A new Scientific Committee on Human Dimensions (HD);
- ii. Study Group on *Marine Ecosystem Services* (SG-MES)
- iii. Working Group 36 on *Common Ecosystem Reference Points across PICES Member Countries*
- iv. Working Group 37 on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions*
- v. Working Group 38 on *Mesoscale and Submesoscale Processes*
- vi. The proposal for a new Working Group on *Climate and Ecosystem Predictability* received some support, but required additional clarification. It is anticipated that that a revised proposal will be received, reviewed and submitted to Council for approval intersessionally.

2016/S/13: Chairmanship and membership for Science Board, Standing Committees and expert groups

- i. Dr. Sukyung Kang (Korea) was elected Co-Chair of FUTURE SSC, replacing Hiroaki Saito (Japan);
- ii. Dr. Se-Jong Ju (Korea) was elected Chair of the Biological Oceanography Committee, replacing Dr. Angelica Peña (Canada);
- iii. Dr. Debora Iglesias-Rodriguez (USA) was elected Vice-Chair of the Biological Oceanography Committee, replacing Dr. Se-Jong Ju;
- iv. Dr. Patrick O'Hara (Canada) was elected Co-Chair of Section on Marine Birds and Mammals, replacing Dr. Rolf Ream (USA);
- v. Dr. Emanuele Di Lorenzo (USA) was elected Chair of POC, replacing Dr. Kyung-Il Chang (Korea);
- vi. Dr. Yury Zuenko (Russia) was elected Vice-Chair of POC, replacing Dr. Michael Foreman (Canada);
- vii. Dr. Jennifer Boldt (Canada) was re-elected Chair of MONITOR for a second term;
- viii. Dr. Sanae Chiba (Japan) was re-elected Vice-Chair of MONITOR for a second term;
- ix. Dr. Joon-Soo Lee (Korea) was elected Chair of the Technical Committee on Data Exchange, replacing Dr. Toru Suzuki (Japan);
- x. Mr. Peter Chandler (Canada) elected Vice-Chair of the Technical Committee on Data Exchange, replacing Dr. Hernan Garcia (USA).

*GC Appendix B***Human Dimension Committee (HD)**

Parent Committee: Science Board

Key Tasks:

The Human Dimensions (HD) committee's area of responsibility is to promote and coordinate interdisciplinary research that leads to increased understanding of the relationship between North Pacific marine ecosystems and the people, communities, and economies that are part of those systems and rely on the resources and services they provide. Particular emphasis will be given to fostering research on: (a) methodological and empirical challenges involved in integrating human dimensions into ecosystem analyses; and (b) exploration of development pathways that are sustainable from social, economic, and ecological perspectives. The HD committee will support the work of other PICES expert groups, including any integrated science program. Where other PICES expert groups often consider the impact of human activities on ecosystems, the HD committee will promote both the consideration of these impacts and how biophysical changes impact the well-being of people, communities, and economies taking into account their characteristics and values. In addition, the committee will engage with kindred 'human dimension' initiatives of other organizations (e.g., ICES and IMBER).

Study Group on Marine Ecosystem Services (SG-MES)

Parent Committee: Science Board

Duration: 1 year

1. Background

Marine ecosystem services (MES) are benefits people obtain from marine ecosystems. Marine ecosystems provide ecological products and environmental services (e.g., seafood production, climate regulation, recreation and leisure, biodiversity maintenance, etc.). The value of MES is an emerging and challenging subject for the scientific community, and an increasingly important social issue. MES has become a priority for many international and regional organizations and programs. The United Nation's (UN) Millennium Ecosystem Assessment focuses on the change of global ecosystem status and services. The First World Ocean Assessment required knowledge on MES. In 2012, the United Nations Environmental Programme (UNEP) formed the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) which aims to develop and use knowledge about ecosystem services and biodiversity to improve national, regional, and global ecosystem management. Also, PICES and IMBER co-sponsored a topic session on marine ecosystem services at PICES-2013 following a successful intersessional workshop in Honolulu in June 2013 in support of the First World Ocean Assessment. Although PICES has already contributed to these efforts and more, additional work is required on MES.

2. Description and Statement of Purpose

This proposed SG aims to exchange and share studies on MES in North Pacific ecosystems, to promote ecosystem service sciences, and to suggest how consideration of MES could improve marine ecosystem (integrated) management.

While the focus of SG-MES lies within the general TOR of S-HD (but see 1 above), the work plan for S-HD is already very full. Formation of SG-MES will allow PICES to attract researchers with specific interest in MES while leaving S-HD members free to dedicate their effort to completing the current work-plan.

The SG-MES will help meet the FUTURE program's Objective 1 (Understanding Critical Processes in the North Pacific) and Objective 2 (Status Reports, Outlooks, Forecasts, and Engagement). The third key scientific question under Objective 1 (How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?) are related to MES as studies on supply and consumption of ecosystem services provide a better understanding of North Pacific ecosystem status and change. In addition, the SG will contribute to Objective 2 as the next North Pacific Ecosystem Status Report is expected to include a preliminary assessment of MES.

3. Terms of Reference

1. Review MES studies from the North Pacific region.
2. Convene two workshops: (1) an intersessional workshop during the UNESCO/IOC/WESTPAC Conference (see funding request below) and, (2) a workshop at the 2017 PICES Annual Meeting. These workshops will examine the provision of MES in North Pacific waters and the scientific tools/methodologies for analyzing them.
3. Develop a typology of marine ecosystem services and tools/methodologies that can be used to analyze them.
4. Develop the terms of reference for a potential Working Group on MES and identify potential members of that WG who would reflect wider interests of scientists in PICES member nations, including relevance to the FUTURE mandate.

4. Suggested members of Study Group

Each member country is asked to identify 1 - 2 scientists with backgrounds in marine ecology, marine economics, or marine management to be SG members.

5. Possible Financial Support

State Oceanic Administration of China would like to provide support for this study group together with PICES, such a fund would be used to cover meeting facilities and invited speakers' travel expenses, etc.

6. Tentative Timeline/ Process/ Products

January 2017: Following SG approval by GC, nominating/finalizing membership and chairmanship

February 2017: Initiating work by correspondence

April 2017: Organizing a workshop in Qingdao during UNESCO/IOC/WESTPAC Conference (see funding request below)

October 2017: Convene a workshop during 2017 PICES Annual Meeting

April 2018: Submit final report and recommendation to Science Board.

Working Group 36 on *Common Ecosystem Reference Points across PICES Member Countries*

Parent Committee/Program: FUTURE

Duration: 3 years

Background

Reference points for fisheries management are generally determined under a single set of environmental conditions with a single species focus. All forms of fisheries management rely on reference points in order to manage a species (e.g. BMSY, Potential Biological Removal, Yield per Recruit) or ecosystem (e.g. Maximum Ecosystem Yield in Gulf of Alaska and Bering Sea, 1/3rd forage fish for the birds). However, more attention is needed on setting reference points in relation to ecosystem functioning such as climatic forcing and predator-prey relationships. Maximum ecosystem yield (MEY) is one example of an ecosystem reference point, and provides an umbrella on total catch but still does not account for intraspecific dynamics or climate forcing.

North Pacific marine ecosystems are influenced by dynamic atmospheric and oceanographic drivers, and most marine species have shown both cyclical and unidirectional trends over time. Broad scale environmental forcing and fine-scale ecological interactions together drive ecosystem responses. An open question is whether biological responses within the ecosystems are linear or nonlinear in relation to the magnitude and direction of climatic forcing variables or the abundance of other species (especially in the context of predator-prey relationships). Recent research indicates that the relationships between ecosystem states and biophysical drivers are often strongly nonlinear (Large et al. 2013, Fay et al. 2013, Large et al. 2015, Hunsicker et al. 2016). Strong nonlinearities suggest the existence of thresholds beyond which small changes in a climatic variable or species abundance cause large responses in another ecosystem component (Samhuri et al. 2011).

Crossing ecological thresholds can alter or redistribute ecosystem benefits to humans, with potentially negative outcomes for livelihoods, economic well-being and public health (Golden et al. 2016). In many decision-making contexts, such as fisheries and water quality, thresholds are used as target or limit reference points to prevent ecosystem components from tipping into undesirable states. Identifying such ecosystem reference points in relation to climatic variables or key ecological species is a primary goal, but a critical gap, at this time in many PICES member countries. To move forward on this front, we need 1) methodologies for determining how ecological (e.g. trophic) interactions and societal needs can be directly included in establishing reference points, 2) an examination of how climate variability and change can be incorporated into the determination of biological reference points, and 3) a methodological framework for identifying non-linearities in common ecosystem indicators (Table 1).

Table 1. Methodologies for assessing non-linear driver-pressure relationships that will be evaluated as part of this proposed WG.

Methodology	Purpose	Citation
Specified functional forms	Identify nonlinearities in stressor-response relationships, sign and form of those relationships, and threshold values	Samhouri et al. 2011
Random gradient analysis	Detect threshold responses in stressor-response relationships	Large et al. 2015, Samhouri et al. <i>in prep</i>
Generalized Additive Models (incl. mixed effects GAMs and threshold GAMs)	Identify nonlinearities in stressor-response relationships, determine sign and form of those relationships	Large et al. 2013, Karr et al. 2015, Hunsicker et al. 2016, Samhouri et al. <i>in prep</i>
Nonlinear time series analysis	Test for nonlinear time series behavior	Deyle et al. 2013, Glaser et al. 2014, Liu et al. 2014, Hao et al. 2015
Second derivative analysis	Inflection point / threshold detection in stressor-response relationships	Large et al. 2013, Burthe et al. 2016, Samhouri et al. <i>in prep</i>
Changepoint analysis	Threshold detection in stressor-response relationships	Cury et al. 2011
Breakpoint analysis	Threshold detection in stressor-response relationships	Bestelmeyer et al. 2011
Sequential t-test analysis of regime shifts	Threshold detection in time series data	Rodinov et al. 2004 Vert-pre 2013
Structural equation modeling	Evaluation of heuristic model	Byrnes et al. 2011

The proposed WG would contribute to Objective 1.1 of the FUTURE Science Plan to understand what determines “an ecosystem’s intrinsic resilience and vulnerability to natural and anthropogenic forcing.” Managing ecosystems under a changing climate requires flexibility in order to facilitate resilient ecosystems for ecological and societal goals. For example, high fishing rates under poor climatic conditions and high predation pressures are less likely to produce favorable management outcomes than the same fishing rates under good climatic conditions. This kind of observation motivates the need for dynamic reference points that reflect a dynamic marine environment and a coupled social-ecological system. This WG would build on the findings of PICES Working Group 28 on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* and WG-NPESR3 on identifying indicators, and will seek to work closely on reference points under future climate scenarios developed by WG-CEP (proposed, see below) and S-CCME (Figure 1). A timeline of planned activities are outlined below (Figure 2).

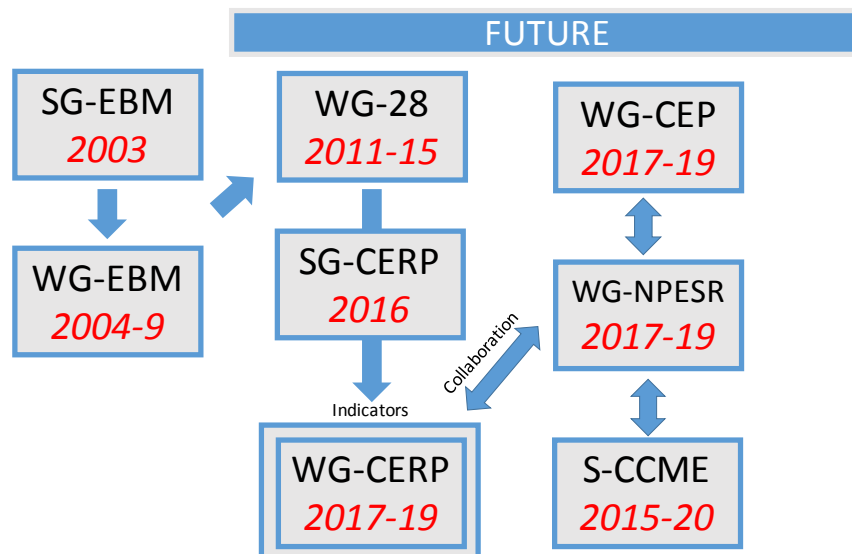


Figure 1. Alignment of WG-CERP within past, current and proposed PICES Expert Groups.

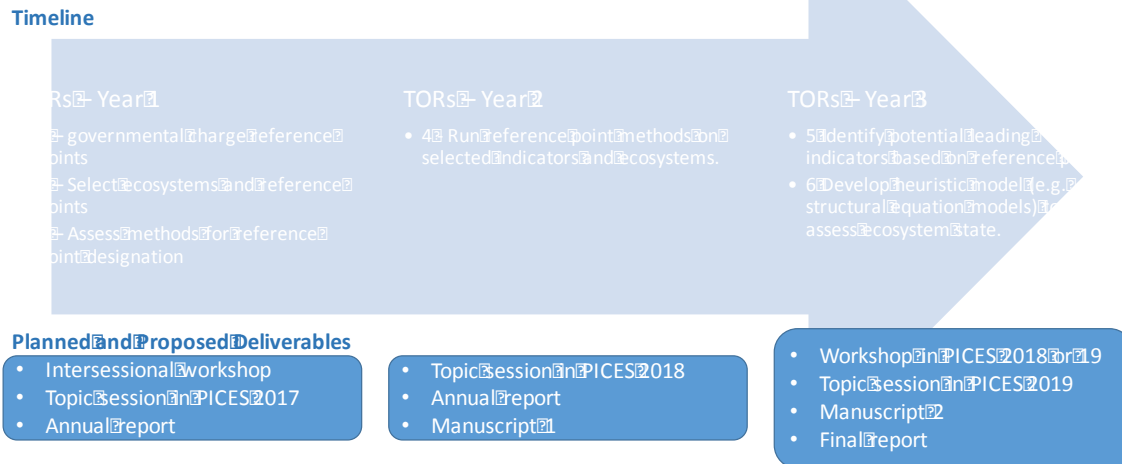


Figure 2. Proposed timeline for terms of reference and deliverables for WG-CERP.

Terms of Reference

- 1) Outline each country's mission, goals, and governmental science plans that point to the establishment of reference points across PICES member nations, and identify those that are comparable. (Intersessional / Yr1)
- 2) Summarize previous efforts identifying data availability for geographic areas and time periods of particularly strong climate influence and dependence on marine systems within specific North Pacific ecosystems, fish stocks, and fishing communities. This will build upon indicators identified via WG-19, WG-28, S-HD, and NPESR-3. Determine a subset (or not) of ecosystems and indicators that will be the focus of WG activities (Appendix 1). (Intersessional / Yr 1)
- 3) Summarize and select previous methods for determining thresholds (both non-linear and societal limits) in ecosystem indicators. This would include statistical and objective-based approaches (Table 1). (Intersessional / Yr 1)
- 4) Determine shapes or functional forms of driver - response relationships from available datasets, and quantify thresholds to identify potential ecosystem reference points. (Yr 2)
- 5) Identify ecosystem components that respond earliest to changes in biophysical drivers and could potentially serve as leading indicators of loss of resilience and ecosystem change. (Yr 3)
- 6) Develop a "heuristic model" to examine drivers (climate forcing, fishing) and ecosystem response using selected ecosystem reference points for member nations. (Yr 3)
- 7) Publish final report.

Expected Deliverables/Activities

- 1) Intersessional workshop in 2017 on "Identifying Ecosystem Indicators for Reference Point Selection methods" (Hunsicker, Blasiak, Boldt, Hazen)
- 2) Topic Sessions in 2017-19 on Ecosystem Reference Point relevant topics.
E.g.: PICES-2017: "Above and beyond Maximum Sustainable Yield: Ecosystem reference points" (Hunsicker, Blasiak, Boldt, Hazen)
- 3) Workshop in 2018 on methodological testing of reference point identification.
- 4) Annual reports on WG progress.
- 5) Two manuscripts on ecosystem reference points.
- 6) Submit a final report summarizing WG results and next steps with special attention to FUTURE needs and goals.

**Working Group37 on Zooplankton Production Methodologies, Applications and Measurements in
PICES Regions**

Parent Committee: BIO

Duration: 3 years

Background

Knowledge of marine zooplankton productivity is key to understanding how ecosystem-scale resource production (i.e. harvested fisheries) and biogeochemical processes will respond to broad-scale physical forcing such as climate change. The limited number and poor spatial-temporal resolution of traditional zooplankton production rate measurements does not currently permit characterization of the variability of this rate relative to current and predicted physical, chemical and biological conditions. A fundamental barrier to improving our understanding of the processes driving variation in zooplankton production rates (population and community-level) is the lack of consensus on the most practical and relevant methods for measuring rates across a wide range of phyla and trophic levels. Thus, development and application of practical approaches for estimating zooplankton productivity are urgently needed.

The proposed Working Group (WG) will focus on assessing the applicability of current methodologies (i.e., traditional and newer biochemical methodologies) for measuring rates of zooplankton production for natural mesozooplankton populations and communities (including non-crustaceans); and for applying the most practical methods to existing zooplankton time-series. It is particularly timely to focus on zooplankton production because assumptions and limitations underlying the most commonly applied methods have now been reconsidered and biochemical methods have been developed since the publication of the ICES Zooplankton Methodology Manual in 2000. Recent advances in biochemical methods for measuring zooplankton growth and production, such as quantification of RNA/DNA ratios, chitobiase, or aminoacyl-tRNA synthetases, have been developed, applied to a diverse range of organisms and habitats, and are able to characterize growth rates at small spatial and temporal scales. A consequence of these recent developments has been general confusion about how these methods should be applied for natural zooplankton populations and communities, and how the various estimates can be compared. The latest IPCC report (IPCC 2013) reaffirmed that global warming exerts widespread impacts on natural systems; a quantitative evaluation of secondary productivity is therefore both timely and critical for understanding how marine ecosystems adapt to continued global climate change. However, there is still little information on zooplankton production as a proxy for the integrated biological response of lower trophic levels in marine food webs. Although, the generation of global maps of primary productivity is becoming routine, the ability to make similar spatial comparisons is lacking for zooplankton productivity. At this stage, a comprehensive review of zooplankton production methodologies (in the context of recent advances) would allow us to:

- 1) Elaborate on recommendations for the standardized application of traditional and biochemical zooplankton production measurement methodologies for worldwide users;
- 2) Develop and apply practical methods for estimating zooplankton production to existing time-series.

This WG could promote information exchange and collaborations between PICES and ICES via the ICES Working Group on Zooplankton Ecology (WGZE) and among previous (e.g., SCOR WG125) and ongoing projects (e.g., IGMETS and IMBER). Further, the WG would provide a basis for sharing technological approaches for estimating zooplankton production in countries bordering the North Pacific Ocean.

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 on a website for worldwide access.

3. Develop practical models for estimating zooplankton production from time-series observations.
4. Develop an interactive website for exchange of information on zooplankton production measurements for regional and/or global mapping.
5. Build a network of scientists and laboratories measuring zooplankton production among PICES member nations.
6. Promote international collaborations among zooplankton production researchers with other international organizations or programs (e.g., ICES and IMBER).
7. Publish a final report summarizing results.

Work plan

Year 1 (2017)

1. WG meeting (by correspondences and during PICES-2017 annual meeting: Russia)
 - ✓ Discuss schedules, plans and contributors for terms of reference and deliverables.
 - ✓ Discuss schedules and plans for a topic session during the next PICES annual meeting in Japan.
2. PICES workshop (during PICES annual meeting: Russia)
 - ✓ Summarize practical disadvantages and limitations of both traditional and biochemical methodologies for measuring natural zooplankton production.
 - ✓ Develop the recommendations and standardized protocols for the traditional and biochemical methodologies.
 - ✓ Develop the methodologies or approaches for estimating zooplankton production which are applicable to zooplankton time-series
3. Contact information
 - ✓ Make a list of contact information on scientists and laboratories measuring zooplankton production.
4. Review articles
 - ✓ Prepare manuscript drafts to review the assumptions, advantages and limitations of traditional and biochemical methodologies for measuring production of natural zooplankton populations or communities.

Year 2 (2018)

1. WG meeting (during PICES annual meeting: Japan)
 - ✓ Revise schedules and discuss plans for terms of reference and deliverables.
 - ✓ Apply practical models for estimating zooplankton production to select zooplankton time-series and compare the estimates and sensitivity of the model results.
 - ✓ Share recommendations and standardized protocols for both traditional and biochemical zooplankton production rate measurement methodologies on a website.
2. PICES topic session (during PICES annual meeting: Japan)
 - ✓ Overview of plankton ecosystem status in PICES and ICES regions (Invited talks).
 - ✓ Introduce IGMETS project and the achievements (Invited talk).
 - ✓ Integrate latest information on zooplankton production methodologies, applications and measurements in PICES and the other regions.
3. Contact information
 - ✓ Develop a mailing list and share on a website the contact information on scientists and

laboratories measuring zooplankton production.

4. Review articles
 - ✓ Submit, revise and publish review articles on both traditional and biochemical methodologies for measuring zooplankton production.
5. PICES scientific report
 - ✓ Make a draft of PICES scientific report, including the following information on traditional and biochemical methodologies for measuring zooplankton production
 - Review of the assumptions, advantages and limitations applying natural zooplankton community.
 - Recommendations and standardized protocols.
 - Application of practical model to some zooplankton time-series and comparison of the production estimates.
 - Regional and global mapping of zooplankton production estimated with the practical models.

Year 3 (2019)

1. WG meeting (during PICES annual meeting: Canada)
 - ✓ Discuss and revise PICES scientific report.
 - ✓ Make a regional and global map of zooplankton production estimated with the practical models applied to regional and global zooplankton time-series.
2. Topic Session (during PICES annual meeting)
 - ✓ Zooplankton production in marine systems (Invited talk).
 - ✓ Biochemical or physiological approach for estimating zooplankton production (Invited talk).
 - ✓ Introduction of latest zooplankton production measurements by both traditional and biochemical approaches.
3. PICES scientific report
 - ✓ Submit a final scientific report to PICES.

Deliverables

1. Reports or peer-reviewed articles summarizing the assumptions, recent advances and limitations of both traditional and biochemical methods to estimate zooplankton production of natural populations and communities.
2. Guidelines on recommendations and procedures for both traditional and biochemical methods posted on PICES website.
3. Lists of contact information on scientists and laboratories measuring zooplankton production among PICES and ICES nations.
4. An interactive website for regional to global scale mapping of zooplankton production estimates incorporated to zooplankton time-series on a website.
5. A final report summarizing the results of the WG as a Scientific Report in PICES.

Working Group 38 on *Mesoscale and Submesoscale Processes*

Parent Committee: POC

Duration: 3 years

Background

Oceanic mesoscale flow fields like eddies, upwelling, and fronts at spatial scales of 10 – 100 km have been extensively studied for their dynamics and various contributions to marine ecosystems. Motions on the submesoscale (~1 km) and their impacts on the marine ecosystem, however, are less well known. Submesoscale features are often found along the periphery of mesoscale eddies and involve larger vertical fluxes than those associated with mesoscale eddies which then have substantial effects on the biological production. Submesoscale processes also interact with mesoscale processes. Understanding the structure and physics of these processes, their effects on distribution and production of marine organisms, and how they influence the functioning of the marine ecosystem and its services is necessary in order to assess likely system changes and shifts under a changing climate. Faced with these important issues, however, observational skills, theoretical understandings, and modeling techniques are still immature. This working group would elucidate meso-/submeso-scales processes, their spacio-temporal variations, and impacts on heat/material transport and marine ecosystem.

Terms of Reference

1. Review and document the current understanding of meso-/submeso-scale processes and their impact in the North Pacific.
2. Summarize the detection, observation and modeling methods of meso-/submeso-scale processes.
3. Classify meso-/submeso-scale features, and identify their spatio-temporal variations.
4. Compare the impacts of meso-/submeso-scale processes on heat/material transport and marine ecosystems between areas in the PICES region.
5. Convene a session or workshop on meso-/submeso-scale processes at PICES Annual Meetings.
6. Publish a final report summarizing results.