FIS Committee Meeting
PICES Annual Meeting, San Diego, USA

Sunday, November 6, 2015, 18:00 – 20:00 (Set clocks back 1 hour at 02:00 am Sunday). 4th Floor, Salon E

Wednesday, November 9, 2014, 14:00 – 18:00. 4th Floor, Gaslamp 4

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FIS Meeting Agenda

Chairman: Libby Logerwell (U.S.A.)

Vice-Chairman: Xianshi Jin (China)

Sunday November 6 18:00 – 20:00

1. Introductions, and nomination of a rapporteur
2. Adoption of agenda
3. Volunteers for Award Committees for 2016
   a) FIS Best Presentation Award
   b) FIS Best Poster
4. FIS Chairman's Report
5. Update on FUTURE Activities
   a) FIS Chair report on FUTURE mini-symposium
   b) FUTURE SSC liaison update on FUTURE. Sukyung Kang
6. Review of standing committees
   a) What are three or four highest priority scientific activities that FIS is undertaking?
   b) What are FIS's current or planned collaborations?
   c) What are some ideas for new Expert Groups?
   d) What are some gaps, challenges in terms of products and deliverables? (*see Attachment 1*)

   Action Item: Review Appendix 1 "FIS achievements and challenges" and add items or edit as needed.

   Action Item: Prepare responses to questions a) through c)

Wednesday November 9 14:00 – 18:00

7. Status Reports of FIS-sponsored Expert Groups
   a) S-CCME: Joint PICES/ICES Section on "Climate Change Effects of Marine Ecosystems". Anne Hollowed. Excerpts from Dr. Hollowed's report (*see Attachment 2*) include:
      i) "SICCME co-chairs discussed the need for another side workshop to be held in conjunction with the ICES meeting in 2017. By 2017, modeling teams from Japan, CERES, COCA and ACLIM will have outputs available as will several other teams. With this in mind, we **request a workshop** that would focus on techniques for comparing results, within region structural uncertainty (multi-model inter-comparison), between region responses of marine species, and across region assessment of community impacts. SICCME co-chairs felt that this workshop will be critical since SICCME projections are expected to be delivered in time for the 4th Effects of Climate on the Worlds Ocean symposium in 2018."
      Action Item: Does FIS recommend that PICES support this workshop?
      ii) S-CCME also requests PICES **support of ICES ASC Theme Session**…

Action Item: Does FIS recommend that PICES support this Theme Session?

b) WG 34: Joint PICES/ICS Working Group on Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish. Siqing Chen

8. Relations with other programs and organizations

a) ICES ASC 2017 list of theme sessions for PICES co-sponsoring (TBD)

Action Item: Which theme sessions do FIS recommend PICES supports?

b) SCOR Working Group Proposals (TBD).

Action Item: Assign "must fund", "may fund" or "do not fund" rating for each proposal

c) North Pacific Anadromous Fish Commission, International Year of the Salmon (IYS) update. Vladimir Radchenko

i) The proposal and reports of the two scoping meetings are available at the NPAFC IYS webpage http://www.npafc.org/new/science_IYS.html

ii) Note that there will be a meeting of the IYS Pacific Steering Committee in late 2016 or early 2017 in Vancouver to meet with key partners to discuss the outreach strategy and research priorities for the North Pacific and input regarding the Symposium

Action Item: Review proposal and reports and provide feedback to NPAFC

Action Item: Should PICES send a representative to the meeting of the IYS Pacific Steering Committee?

d) Observers

i) International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). Chi-lu Sun and Gerard DiNardo. Oral presentation.

ii) North Pacific Anadromous Fish Commission (NPAFC). Vladimir Radchenko

iii) North Pacific Fishery Management Council (NPFMC). Gordon Kruse. Oral presentation

iv) Inter-American Tropical Tuna Commission (IATTC). Dan Margulies. Oral presentation on "IATTC's pre-recruit research on tunas in the eastern Pacific, with an emphasis on hatchery-based research with yellowfin tuna in Panama"

v) Ecosystem Studies of Sub-Arctic Seas (ESSAS). Franz Mueter. Oral presentation.

Action Item: Does FIS endorse the Observers' requests for PICES financial support or other involvement?

9. PICES 2017

a) Vladivostok, Russia, dates TBD. The theme is "Environmental Changes in the North Pacific and Impacts on Biological Resources and Ecosystem Services."

b) FIS committee rankings of Topic Sessions and Workshops.

i) Please review proposals online before our meeting. The online system no longer allows us to rank proposals, so please email me your ranking and I will compile the results. This will not be our final ranking, but will serve as a starting point for our discussion of which proposals FIS will support.

- http://www.pices.int/meetings/annual/PICES-2017/2017-theme.aspx
- Click "Submit topic session/workshop proposal here"
- Login, Update, then scroll to bottom of page and click on "View Session submissions" and "View Workshop submissions"
- Proposers are encouraged to submit proposals online before October 1. The online system closes at midnight November 9. We will review any later submissions during the FIS meeting.

Action Item: Which proposals does FIS support? Suggest revisions to proposals, if necessary

c) FUTURE at Annual Meetings

Action Item: Provide suggestions for how to increase the profile of FUTURE at Annual Meetings

10. Proposals for new FIS Working Groups, Study Groups and Special Projects

a) No proposals have been received yet. This is a placeholder for proposals received after publication of the Agenda.

Action Item: Does FIS support the new Expert Group(s)? Suggest revisions to proposal, if necessary

11. Proposals for new meetings/workshops/conferences with PICES as co-sponsor (with funding implications)

a) PICES International Summer School on Advanced Survey Approaches for Broad-Scale Fishery Independent Surveys of Fish and their Habitats. Libby Logerwell (*see Attachment 3)*
Action Item: Does FIS support this Summer School? Suggest revisions to proposal, if necessary.

b) This is a placeholder for proposals received after publication of the Agenda.

Action Item: Should PICES support meetings/workshops/conferences?

12. High priority projects and activities with financial/policy implications

a) North Pacific Fishery Commission (NPFC) Pacific Saury Stock Assessment Workshop, Busan, 13-15 December 2016. Aleksandr Zavolokin (Science Officer at NPFC) . PICES has been invited to send a representative to this workshop. The PICES Secretariat will support travel costs.

Action Item: Nominate one or two PICES scientists to attend the Pacific Saury Stock Assessment Workshop

b) North Pacific Ecosystem Status Report (NPESR)

i) Report on NPESR3-SG workshop, Institute of Ocean Sciences, Sydney BC, June 2016. Jackie King

ii) Report on NPESR next steps. Phil Mundy (*see Attachment 4*)

Action Item: Does FIS recommend the biogeographical classification as described in the Status Report?

13. Proposed publications (PICES Scientific Report series and primary journals)

    a) PICES Scientific Report Series. It costs about $5,000 to publish each report and takes a fair amount of the Secretariat's time. The demand for hard copies is decreasing and storage is limited. PICES could use the money for Open Access or other items instead.

    Action Item: Should PICES continue to publish hard copies of the Report Series?

14. Intersessional activities and meetings, travel support requests

15. Other business

Attachment 1: FIS achievements and challenges

2012-2016

PICES and other meetings

- FIS sponsers Topic Sessions and Workshops at each PICES Annual Meeting, and the general FIS-Paper session. On average 3.75 each year. Co-chairing committees include BIO, FUTURE, MEQ, MONITOR, POC, and TCODE. Co-chairing organizations include: ICES, ISC, NPAFC
- FIS members served as co-convenors and/or participants in 4 joint international meetings

GLOBEC/PICES/ICES International Workshop on "Forecasting Ecosystem Indicators with Climate-driven Process Models" Friday Harbor Labs, Washington, USA, 8-10 September, 2012. Jackie King (Canada) was an organizer.

PICES/ICES Workshop, Global assessment of the implications of climate change on the spatial distribution of fish and fisheries, St. Petersburg, Russia, 22-24 May 2013.

Responses of Arctic Marine Ecosystems to Climate Change, Anchorage, Alaska. 26-29 March 2013. Libby Logerwell (Steering Committee)

Libby Logerwell represented PICES at the *3rd meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean*, April 14-16, 2015, Seattle (USA).

FUTURE

- FIS members served on two FUTURE Advisory Panels – AICE-AP (Anya Dunham) and COVE-AP (Jackie King)
- Jackie King also servied on the initial FUTURE Science Plan Writing Team and the subsequent FUTURE Evaluation Panel

S-CCME: Joint PICES/ICES Section on "Climate Change Effects of Marine Ecosystems"

- S-CCME co-chairs Topic Sessions and Workshops at PICES meetings. The Section also typically participates in several sessions at the ICES Annual Science Meetings.
- S-CCME was highly involved in the 2nd and 3rd Effects of Climate Change on the World's Oceans Symposia
- S-CCME convened 2 international workshops on climate, ecosystems and fisheries. Both workshops advanced international modeling efforts and resulted in publications in the peer-reviewed literature.

ICES PICES IOC 2nd Effects of Climate Change on the World's Oceans Symposium, Yeosu, Korea. Suam Kim (SICCME co-chair) served on the symposium scientific steering committee.

PICES/ICES GLOBEC Workshop. PICES and ICES co-sponsored a workshop on "Forecasting Ecosystem Indicators with Climate-driven Process Models" held on September 8-10, 2012, Friday Harbor Labs, WA 98250 USA. Anne Hollowed attended as a SICCME representative.

S-CCME Chairs convened the *PICES/ICES Workshop on Global Assessment of the Implications of Climate Change on the Spatial distribution of fish and fisheries* St. Petersburg, Russia, May 22-24, 2013. Articles from the workshop were published in Journal of Marine Science.

The Section was quite active over at the FUTURE Open Science Meeting April 13-18, 2014, Kohala Coast, Big Island, HI, U.S.A., where several members were co-conveners

S-CCME was very active in the 3rd International Symposium on the Effects of Climate Change on the World's Oceans, Santos, Brazil 2015. Jackie King from PICES (FIS), and Manuel Barange from ICES were on the Symposium Steering Committee; and S-CCME members co-convened several Theme Sessions. A special journal issue will result from this symposium

Intersessional activities in 2015 include an S-CCME organized workshop in August in Seattle, USA "WKSICCME Effects of Climate Change on Fish and Fisheries", which will result in regional modeling nodes throughout the North Pacific and Atlantic. 4 publications will result from this workshop. Three other international meetings. 5 publications

Several workshops in 2016, one on "Economic Modelling of the Effects of Climate Change on Fish and Fisheries" (WKSICCME_Econ), Brest, France; two on SICCME modeling updates (for ICES and PICES scientists separately)

<u>SG-SC-NP: Joint NPAFC-PICES Study Group on Scientific Cooperation in the North Pacific Ocean</u>

- Libby Logerwell co-chaired this SG with Jim Irvine (NPAFC) from Jun. 2013 - Oct. 2014.
- The SG developed a Framework of enhanced collaboration between the two organizations
- The co-chairs convened a Workshop at PICES 2014 that resulted in a new analysis, publication (Shoshiro Minobe et al.) and invited presentation (to NPAFC).

The objective of the SG was to develop a framework of enhanced collaboration between the two organizations to achieve better and/or more rapid understanding of natural and anthropogenic variability in marine ecosystems. The two major topics of joint interest to NPAFC and PICES in the framework are: effects of climate change on the dynamics and production of Pacific salmon populations; and oceanographic properties and the growth and survival of Pacific salmon. Focused research questions pertaining to each of these two topics are described in the framework.

The co-chairs of the study group, Logerwell and James Irvine (Canada) co-convened a W2 "Linkages between the winter distribution of Pacific salmon and their marine ecosystems and how this might be altered with climate change" at PICES 2014 the result of which was the formation of a group from Canada, Russia, Japan and USA that will explore new data and hypotheses on Pacific salmon distribution changes at sea in a changing climate and oceanographic conditions.

PICES supported the participation of Shoshiro Minobe at the "NPAFC International Symposium on Pacific Salmon and Steelhead Production in a Changing Climate: Past, Present, and Future" in Session 2—Climate change impacts on salmonid production and their marine ecosystems. Dr. Minobe presented the results of new research on climate effects on salmon ocean habitat initiated during the FIS/NPAFC Workshop 2 of PICES 2014, Yeosu.

The International Year of the Salmon (a multi-year, internationally coordinated, interdisciplinary program) is going ahead. PICES contributed to its planning and PICES scientists are encouraged to play a greater role as it moves forward (http://www.npafc.org/new/publications/Newsletter/NL38/newsletter38%2819-20%29.pdf).

SG-SCISC: Study Group for Scientific Cooperation of ISC and PICES

- Jackie King and Gerard DiNardo (ISC) chaired this study group from Apr. 2015 - Apr. 2016.
- The SG developed a Framework of enhanced collaboration between the two organizations

Libby Logerwell and Jackie King attended a meeting of the SG-SCISC (Dr. King is co-chair), July 13-14, in Kona to develop the framework for cooperation between ISC and PICES.

PICES-ISC Framework. Groups that would benefit from the results of collaborative research include tuna RFMOs in both the Pacific and Atlantic Oceans, ICES. If specific tools are developed, they could become part of the NMFS Stock Assessment Toolbox.

WG-34: Joint PICES/ISC Working Group on Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish

- FIS-sponsored WG to last from Oct. 2015 – 2018
- The WG will collaborate on deriving habitat models relating albacore tuna distributions to oceanographic conditions
- The WG is organizing a Workshop at PICES 2016 "W4 (Nov. 3) Methods relating oceanographic conditions to the distribution of highly migratory species"
- ***Challenges***: it took a long time to identify PICES co-chairs

SG-NPESR on the "North Pacific Ecosystem Status Report (NPESR) Draft Implementation Plan"

- Jackie King represented FIS at the workshop "Evaluation and Synthesis North Pacific Time Series Observations, Study Group NPESR-3". June 28 – 30, 2016, Sidney, B.C., Canada.
- FIS committee members nominated Ecosystem Time Series Observations for consideration during the workshop.

WG-24 "Environmental Interactions of Marine Aquaculture"

- WG 24 held its final meeting on October 15, 2011, in Khabarovsk, Russia.
- ***Challenges:*** Although 2010/2011 was to be the last year of the WG, members were not able to complete the Final Report, so an extension was requested and granted until PICES 2012. After the PICES 2011, the activity of WG-24 was low. The WG did not receive a report from USA for TOR-1 (country reports on environmental interactions of aquaculture) or reports from China for all TORs.

Publications

- In addition to the S-CCME publications described above, a FIS-sponsored activity (Topic Session) led to a special issue publication.

Special Issue on Ecosystem-based Approaches for the Assessment of Fisheries under Data-limited Situations, Fisheries Research 112, December 2011. Product of PICES 2009 Topic Session S2. Editors are Pat Livingston (USA), Gordon Kruse (USA), and Laura Richards (Canada).

Attachment 2: Progress Report ICES - PICES Strategic Initiative on Climate Change effects on Marine Ecosystems

Co-Chairs: Myron Peck (Germany), John Pinnegar (U.K.),
Anne Hollowed (U.S.A.), and Shin-ichi Ito (Japan),

Membership

The membership will be updated based on a transition in the group's needs and activities as well as due to the fact that some members are now retired. Dr. Helen Joseph retired. Drs. Nancy Shackell and Denis Gilbert, both from the Department of Fisheries and Oceans Canada, were nominated and have agreed to serve on SICCME in her place. Dr. Michael Foreman retired and Angelica Pena has been nominated to serve in his place. Confirmation of Michael's replacement will be considered at the upcoming PICES meeting in November. Drs. Keith Brander, Jurgen Alheit and Harald Loeng have all retired and it is not clear whether they will continue to participate in SICCME meetings.

Three new members were added to SICCME: Dr. Sara Gainluca (UNIP), Valerio Bartolino (Sweden) and Mikael van Deurs (DK).

Requests have been made to the US delegation of PICES to add Dr. Kirstin Holsman (USA) to SICCME. It is envisioned that Dr. Alan Haynie will petition the US delegate for membership in SICCME (PICES). SICCME Chairs nominate the following individuals to be added to SICCME: Jose Fernandes (UK, PML), Trond Krisitiansen (NO, IMR) and Hamon Katell (NL, DLO-LEI).

The SICCME Co-Chairs discussed ways to increase the engagement of the climate/ocean science community in ICES. They noted that PICES has a standing committee focused on physical oceanography. This standing committee provides an opportunity for professional development at PICES meetings. ICES typically does not have physics focused theme sessions. Therefore, the physical oceanographic community (particularly scientists creating and/or downscaling Global Climate Models) seldom has a critical mass assembled an annual science conferences. SICCME co-chairs recommended that membership included a core suite of leading climate/oceanography leaders who might be a draw for others to ICES meetings. Potential candidates would include Jonathan Tinker (Met Office, UK), Daniela Matei (MPI, DE), and Charles Stock (GFDL, NOAA, USA). Coordination in the development of theme sessions for the ICES ASC with WGS2D, WGIPEM, WGOOFE and other groups with physical, biogeochemical modelers is also recommended.

Activities 2015/16

A. October 2015: Convened a one day SICCME meeting in Qingdao, China (see Appendix 1).
B. October 2015: PICES Topic Session S3: Eastern-western approaches to fisheries: resource utilization and ecosystem impacts. (Jacquelynne King co-chair)

C. October 2015: Past, present, and future climate in the North Pacific Ocean: Updates of our understanding since IPCC AR5. (Anne Hollowed, Shin-ichi Ito and Sukgeun Jung co-chairs among other).

D. June 2016: ICES/PICES intersessional workshop on "Economic Modelling of the Effects of Climate Change on Fish and Fisheries" (WKSICCME_Econ), Brest, France (See Appendix 1)

E. September 2016: ICES workshop on SICCME modeling update (Appendix 2) A full-day open workshop to review regional models and preliminary results on the ICES side.

F. Fall 2016 PICES workshop on SICCME modeling updates (Appendix 3). A full-day open workshop to review regional models and preliminary results on the PICES side. Next year the designated SICCME business meeting will be split into a half-day discussion on new proposals and a full-day open workshop to review regional models and preliminary results; if the workshop proposal is not accepted SICCME would extend it's meeting to be 1.5 days to allow for member reporting on preliminary results.

G. Fall 2016 ICES-PICES Theme Session: Seasonal to decadal prediction of marine systems: opportunities, approaches and applications. Co-convened by Mark Payne (Denmark), Desiree Tommasi (U.S.A.), Alistair Hobday (Australia). http://ices.dk/news-and-events/asc/ASC2016/Pages/Theme-session-I.aspx\\

Publications

Papers from 3rd Effects of Climate Change on the World's Oceans meeting, Santos, Brazil (SICCME members underlined and bold):

1. Payne, M., **M. Barange**, H. Bachelder, W. Cheung, T. Eddy, J. Fernandes, **A. Hollowed**, M. Jones, **J. Link**, **B. MacKenzie**, P. Neubauer, I. Ortiz, A. Queiros, J. Paula, 2016. Uncertainties in projecting climate change impacts in marine ecosystems. ICES J. Mar. Sci. 73 (5): 1272-1282, doi: 10.1093/icesjms/fsv231.
2. Suzwalski, C. and **A. Hollowed**, 2016. Setting biological reference points under climate change. ICES J. Mar. Sci. ICES J. Mar. Sci. 73(5):1297-1305, doi: 10.1093/icesjms/fsv229
3. Spencer, P. D. N. A. Bond, **A. B. Hollowed**, S. Zador, K. Holsman, and **F. J. Mueter**, 2016. Modeling of spatially-dependent predation mortality upon eastern Bering Sea walleye pollock, and its implications for stock dynamics under future climate scenarios. ICES J. Mar. Sci. 73 (5): 1330-1342.
4. Fernandes, J. A. S. Kay, M. R. Hossain, M. Ahmed, W.W. L. Cheung, A. N. Lazar,and **M. Barange**. In Press. Projecting marine fish production and catch potential in Bangladesh in the 21st century under long-term environmental change and management scenarios

Papers from the WKSICCME Modeling workshop, Seattle, WA, USA (WKSICCME members underlined and bold):

1. **Holsman, K.**, Hazen, E., **Hollowed, A.**, Aydin, K. In Review. Aligning scales of climate change, research and fisheries management. TBD.

2. **Stock, C.**, Alexander, M., Bograd, S., Bond, N., Butenschon, M., Cheng, W., Di Lorenzo, E., Hermann, A., Jacox, M., Jang, C. J., Lein, V., Kearney, K., Wang, M. In Prep. Challenges and evolving roles for global models and downscaling in assessing climate impacts on marine resources. TBD.

PICES Special Issue and selected other papers (SICCME or WKSICCME members underlined and bold):

1. **Ito, S.**, K. A. Rose, B. A. Megrey, J. Schweigert, D. Hay, **F. E. Werner**, M. N. Aita. 2015. Geographic variation in Pacific herring growth in response to regime shifts in the North Pacific Ocean. Prog. Oceanogr. 138, Part B, 331-347. (PICES special issue)
2. Boermsa, M., N. Grüner, N. T. Signorelli, P. E. Montoro González, **M. A. Peck**, K. H. Wiltshire. 2015. Projecting effects of climate change on marine systems: Is the mean all that matters? Royal Soc. Proc. B. 283: 20152274 doi: 10.1098/rspb.2015.2274
3. Mullon, C., F.Steinmetz, G. Merino, J.A. Fernandez, **W. W. L. Cheung, M. Butenschon**, 2016. Quantitative pathways for Northeast Atlantic fisheries based on climate, ecological-economic and governance modelling scenarios. Ecological Modelling 320:273-291.
4. Sassa, C., **M. Takahashi**, Y. Konishi, and Y. Tsukamoto. 2016. Interannual variations in distribution and abundance of Japanese jack mackerel *Trachurus japonicus* larvae in the East China Sea. ICES Journal of Marine Science: Journal du Conseil, 73 (4): 1170-1185.
5. Saba, V.S., S. M. Griffies, W. G. Anderson, M. Winton, M. A. Alexander, T. L. Delworth, **J. A. Hare**, M. J. Harrison, A. Rosati, G. A. Vecchi, R. Zhang. J. Geophysical Research 121(1):118-132.Modeling Updates
6. **Hare, J.,** W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis, M. A. Alexander, J. D. Scott, L. Alade, R. J. Belle, A. S. Chute, K. L. Curit, T. H. Curtis, and others. 2016. A vulnerability assessment of fish and invertebrates to climate change on the northeast U. S. continental shelf. PLOS one. DOI: 10.1371/journal.pone.0146756
7. Illing, B., M. Moyano, M. Hufnagl, **M. A. Peck**. 2016. Projected habitat loss for Atlantic herring in the Baltic Sea. Marine Environmental Research 113:164-173.
8. Woodworth-Jefcoats, P. A., **J. J. Polovina** and J. C. Drazen. In Press. Climate change is projected to reduce carrying capacity and redistribute species richness in North Pacific pelagic marine ecosystems, DOI: 10.1111/gcb.13471View
9. Petrik, C. M. J. T. Duffy-Anderson, F. Castruccio,E. N. Curchitser, S. L. Danielson, K. Hedstrom, **F. Mueter** 2016. Modelled connectivity between Walleye Pollock (*Gadus chalcogrammus*) spawning and age-0 nursery areas in warm and cold years with implications for juvenile survival

Pinnegar, J. K. , G. H. Engelhard, M. C. Jones, W. W.L. Cheung, **M. A. Peck**, **K. M. Brander**. 2016. Socio-economic Impacts—Fisheries. Chapter In: North Sea Region Climate Change Assessment Part of the series Regional Climate Studies pp 375-395.

Groeneveld, R., Bosello, F., Butenschon, M., Elliott, M., **Peck, M. A**., **Pinnegar, J. K.** (2016) Defining scenarios of future vectors of change in marine life and associated economic sectors. Estuarine, Coastal and Shelf Science DOI: 10.1016/j.ecss.2015.10.020

New Funded Research Programs:

A. Climate change and European aquatic RESources (CERES): This is one of the first Horizon 2020 Blue Growth 2projects. It is a 4 year (2016-2020) project involving scientists and industry partners from 17 countries. CERES will contribute to SICCME by involving and closely cooperating with industry and policy stakeholders to:

- Provide regionally and industry relevant, short-, medium- and long-term future projections of key environmental variables for European marine and freshwater ecosystems;
- Integrate the resulting knowledge on changes in productivity, biology and ecology of wild and cultured animals (including key indirect/food web interactions), and 'scale up' to consequences for shellfish, fish populations and assemblages as well as their ecosystems and economic sectors;
- Anticipate responses and assist in the adaptation of aquatic food production industries to underlying biophysical changes, including the development of early warning methods, new operating procedures, infrastructures, location choice and commercial markets;
- Assess relative exposure, sensitivity, vulnerability and adaptive capacity within the European fisheries and aquaculture sectors;
- Consider market-level responses to changes (both positive and negative) in commodity availability as a result of climate change;
- Apply innovative risk-assessment methodologies that encompass drivers of change, threats to fishery and aquaculture resources, barriers to adaptation and likely consequences if mitigation measures are not put in place;
- Formulate viable autonomous adaptation strategies (solutions) within the industries to circumvent/prevent perceived risks or to access future opportunities;
- Formulate policy guidelines (solutions) and highlight management challenges where established governance structures may hinder successful adaptation to long-term climate change.
- Effectively communicate findings and tools to potential end-users and relevant stakeholders.

B. NOAA funded a new comprehensive Bering Sea climate change project: the Alaska CLimate Integrated Modeling, ACLIM, http://www.afsc.noaa.gov/News/BS_climate-change-study.htm). This 3 year project (2015-2017) will utilize a multi-model climate projection framework that will allow scientists to the implications of different sources of uncertainty (e.g., scenario uncertainty, parameter uncertainty, process uncertainty, and structural uncertainty) in projections of climate change impacts on fish and fisheries in the Bering Sea.

C. NOAA Fisheries Office of Science and Technology is working closely with the NOAA Research Climate Program Office to study the impacts of a changing climate on the fish and fisheries of the Northeast Shelf Large Marine Ecosystem (COCA): https://www.st.nmfs.noaa.gov/ecosystems/climate/northeast-shelf-climate-impact. The program supports 7 projects of 2-3 year duration.

Other business

A. PICES formed a new study group on Climate and Ecosystem Predictability SG-CEP (chair Nick Bond), co-chaired by Emanuele Di Lorenzo. Anne Hollowed is a member and will seek to find ways to ensure the products are complimentary to the overarching activity of SICCME (especially with respect to Terms of Reference 2-4m http://www.pices.int/members/study_groups/SG-CEP.aspx). SICCME supported the travel of Mark Payne (DK) to this group's first meeting.

B. PICES and ISC approved a Joint Working Group on "Oceanographic Conditions on Distribution and Productivity of Highly Migratory Species". The WG will produce a habitat model for North Pacific albacore, which will have a finer-scale resolution than the ecosystem models that currently exist for the central north Pacific region of S-CCME modeling efforts. The Working Group would also identify the underlying mechanisms for this, and other commercially important species. The habitat model developed could be coupled to climate change model outputs for forecasting. As such the proposed Joint Working Group products would be beneficial for S-CCME efforts and the proposal is supported by S-CCME.

C. SICCME co-chairs noted that the CERES group does not have an active single species or multi-species climate enhanced projection modeling team. The SICCME co-chairs plan to submit a TOR for ACOM to explore how they might be able to use our downscaled climate/ocean/lower trophic time series in their models. Specifically we will ask ACOM to identify which stock assessment models may include environmental sensitivity in their models (or how environmental sensitivity has / can be incorporated). SICCME co-chairs felt that the encouraging developments in short-term forecasting discussed at this ICES ASC indicated this new capability was potentially useful. If short-term forecasting was operationalized, SICCME would use projection skill assessments to evaluate uncertainty in our parameterization of ecosystem process and accelerate identification of when or if course corrections are needed.

D. Mark Dickey Collas asked SICCME to consider holding an intersessional meeting focused on an effort to develop rapid vulnerability assessments (see Hare 2016 PLoS one). Rapid vulnerability assessments differ from the multi-model projection approaches currently underway in SICCME regions. The method relies on expert opinion of the sensitivity of species to climate variability and the exposure of species to climate change. The rapid climate assessment approach is complimentary to the SICCME regional projection modeling teams. It has the distinct advantage of covering minor species that may not be the primary focus of regional projection modeling. The rapid climate assessment modeling teams would use the physical and lower trophic level regional climate projections under development for the multi-model projections to assess exposure of core species. A key input will be maps of essential fish habitat.

E. M. Dickey Collas also requested that SICCME writes short summaries of current and projected climate conditions in the key ICES regions: the Baltic; the Bay of Biscay; the NE Atlantic; the Norwegian Sea; and the Barents Sea. These regional summaries will be used by the ICES Advisory Committee to inform decision makers of pending change in their regions. This activity would raise the visibility of SICCME within ICES.

F. SICCME co-chairs discussed the need for another side workshop to be held in conjunction with the ICES meeting in 2017. By 2017, modeling teams from Japan, CERES, COCA and ACLIM will have outputs available as will several other teams. With this in mind, we request a workshop that would focus on techniques for comparing results, within region structural uncertainty (multi-model inter-comparison), between region responses of marine species, and across region assessment of community impacts. SICCME co-chairs felt that this workshop will be critical since SICCME projections are expected to be delivered in time for the 4th Effects of Climate on the Worlds Ocean symposium in 2018.

G. SICCME leaders discussed membership for the Scientific Steering Committee for the upcoming 4th Effects of Climate Change on the World's Oceans meeting. Apparently PICES has already developed their list but ICES has not. We recommend that ICES considers: John Pinnegar, Myron Peck, and Cassandra DeYoung.

Appendix 1.

Agenda

DRAFT PICES Annual Meeting, Qingdao, China
S-CCME Meeting Agenda
Saturday, October 17, 2015, 8:55 -18:00

Chairman: Anne Hollowed (U.S.A.) and Shin-ichi Ito (Japan)

October 17

1. Welcome of new members, introductions, and nomination of a rapporteur
2. Adoption of agenda
3. Review of 2015 activities
   a) 3rd Climate Change Effects on the World's Oceans symposium, Santos Brazil
   b) Our common future under climate change symposium, Paris, France
   c) Topic session G ICES Annual Science Conference, Copenhagen, Denmark
   d) 2nd International Ocean Research Conference "One Planet One Ocean", Barcelona, Spain
4. Outcome of WKSICCME
   a) IPCC scenarios
   b) Model selection
   c) Candidate regions
   d) Core contacts for regional modeling teams
   e) Core species
   f) Core modeling approaches
5. Proposals for workshops and topic sessions for 2016
   a) ICES/PICES intersessional workshop on socio-economic pathways, Brest, France May 2016
   b) ICES workshop on SICCME modeling update
   c) PICES workshop on SICCME modeling updates
6. Collaboration with other groups
   a) Decadal forecasting
   b) Scientific collaboration between PICES and ISC
7. Proposals for new meetings/workshops/conferences with PICES as co-sponsor
   a) 2018 4th Climate Change Effects on the World's Oceans meeting
   b) "Species on the Move International Conference", Hobart Tasmania. Conference sponsers: University of Tasmania and Institute for Marine and Antarctic Studies (http://www.speciesonthemove.com/). See Appendix II "Species on the move letter.doc"
8. Adjourn

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Appendix 2: PICES/ICES S-CCME intersessional workshop

The ICES/PICES Workshop on Economic Modelling of the Effects of Climate Change on Fish and Fisheries (WKSICCME_Econ), chaired by Alan Haynie (USA), John Pinnegar (UK), Lisa Pfeiffer (USA), Mitsutaku Makino (JPN), Jörn Schmidt (DE), and Sophie Gourget (France) will be established and will meet for 2 days in Brest, France, in association with the existing 'Understanding marine socio-ecological systems' symposium, in June, 2016 to:

a) Identify the socioeconomic data and features of the suite of representative future fishing and ecosystem scenarios identified in the August 2015 inter-sessional that could be employed for use in evaluating climate change effects on fish and fisheries.
b) Identify how fisheries management policies will interact with climate change and identify how researchers can best evaluate what management tools are most likely to be resilient to climate change effects on fisheries.
c) Identify suites of bioeconomic and spatially explicit models of fishery behaviour that can be used to project the implications different climate models on commercially important marine fish stocks in the northern hemisphere.

WKSICCME_Project will report by September 4, 2016 for the attention of the Strategic Initiative on Climate Change Effects on Marine Ecosystems.

Supporting information

Priority	The group will identify socio-economic scenarios for future use of marine ecosystems, especially commercial fishing, and therefore the projections will contribute the most to the the ICES second thematic area Understanding Interactions of Human Activities. This activity will also contribute towards the first ICES thematic area: Understanding Ecosystem Functioning under climate change processes and projections of associated. with Ecosystems. Consequently, the activities of WKSICCME_Econ are considered to have a very high priority.

Scientific justification	Climate change is a global issue affecting marine ecosystems and species that span international boundaries, and is one of the most universal challenges facing fisheries scientists, economists, and managers around the world. The projected changes in climate are expected to alter marine ecosystems through shifts in trophic demand, predator and prey distributions, overall system productivity, and human access to resources. It is unclear how these changes will impact the future of commercial fisheries in the northern hemisphere. To address this challenge scientists have developed models to project future impacts. These models are being tested regionally and discussed globally in an effort to initiate an international collaboration to provide quantitative estimates of the status and trends of commercial fish and fisheries worldwide by 2019 (for consideration by IPCC AR6 working groups). Understanding the vulnerability of commercially important species, and their predators and prey to changing climate conditions is critical if ICES and PICES plans to provide climate-literate options for mitigation of, and management under a changing climate. The spatial distribution of global climate models and earth system models varies and institutions are rapidly improving the performance of the models. While regional ocean modellers and fisheries scientists are working to balance the trade-offs of models of different scale and complexity, greater effor is required to tie ocean and fisheires models of different complexity to the most realistic economic models of fisheries and communities. Integration of different types of bio-physical models with economic models will not occur overnight, but necessitates further efforts to match the appropropriate economic models, given the data available in different countries. In some cases, the complexity of social and bioeconomic models may be similar to that of the most complex ocean models, while in other cases, qualitative inferences will be made from available information. This process will be directed at both informing other modeling efforts and providing insights to policy makers on additional research that wi help develop more climate resilienct management institutions. WKSICCME-Econ will provide a forum for economists, other social scientists, and natural scientists to meet and discuss options for selecting reasonable economic and fishing scenarios that could be generated for several large marine ecosystems in the northern hemisphere and can be integrated with other aspects of WKSICCME. Combining the output from this process with population dynamics models of different complexity will allow analysts to provide more realistic understanding of the social and economic impacts of climate change on the marine environment.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resources required to undertake additional activities in the framework of this group is negligible. By holding this workshop in conjunction with the existing ICES/PICES 'Understanding marine socio-ecological systems' symposium in Brest (30th May – 3rd June), i is hoped that many marine economists and social scientists will be attending anyway, thus saving on travel expenses and expanding participation. The workshop requests ICES endorsement, participation by ICES scientists, some secretarial assistance (e. g., email communication, workshop publicity on website, etc.).
Participants	The workshop will be attended by some 30-40 members and guests from both ICES and PICES.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to advisory committees	There are no obvious direct linkages with the advisory committee.
Linkages to other committees or groups	The workshop contributes directly to SICCME objectives and activities, and to the activities of SSG UEF and SSG UIHA.
Linkages to other organizations	The workshop is a joint activity with PICES.

Appendix 3: ICES S-CCME Workshop proposal

Expert Group Meeting Resolution (Category 2) WKSICCME

The ICES/PICES Workshop on Phase 1: Modelling Effects of Climate Change on Fish and Fisheries (WKSICCME_Phase1), chaired by Anne Hollowed(USA), John Pinnegar (UK), Myron Peck (DE), and Mark Payne (DK) in September, 2016 to:

a) Meet with other SICCME investigators in ICES member contries to review progress on projected impacts of climate change on fish and fisheries.
b) Identify new analytical approaches that could be used in other regional nodes.
c) Review challenges in comparing suites of single species climate enhanced projection models, multispecies climate enhanced projection models, full food web (e.g., EcoSIM), and dynamic spatially explicit ecosystem models that would be used to project the implications of a and b on commercially important marine fish stocks in the northern hemisphere.

WKSICCME_Phase1 will report by November 2016 for the attention of the Strategic Initiative on Climate Change Effects on Marine Ecosystems (SICCME).

Supporting information

Priority	This activity will contribute towards the first ICES thematic area: Understanding Ecosystem Processes and Dynamics (SSGEPD) and their response to change. Our focus will be on responses c fish and fisheries to climate change. To assess this, the group will identify scenarios for future use of marine ecosystems, especially commercial fishing, and therefore the projections will contribute also to the the second ICES thematic area onUnderstanding Interactions of Human Activities with Ecosystems (SSGHIE). Consequently, the activities of WKSICCME_Projection are considered to hav a very high priority to ICES.
Scientific justification	In August 2015 SICCME convened a workshop to discuss the details needed to establish an international effort to project the implications of climate change on fish and fisheries. The group identified 15 regions that could be part of the SICCME research effort. The group also agreed to work closely with the FISH-MIP research group to ensure that the efforts are complimentary. The central focus of the SICCME effort is to understand the vulnerability of commercially important species, and their predators and prey to changing climate conditions. This is critical to ICES and PICES plans to provide climate-informed options for mitigation of, and management of harvested resources under a changing climate. This proposal calls for a one day workshop to be held prior to or immediately after the ICES annua meeting in Riga, Latvia in 2016 (WKSICCME-I). This ICES regional workshop will allow researche a chance to compare results, evaluate harvest control rules and discuss challenges encountered in developing multi-model ensembles of impacts on fish and fisheries for the SICCME project. The format will allow for breakout groups for intradisciplinary discussions and plenary interdisciplinary research. Projected outcomes of these scenarios using population dynamics models of different approaches and complexity will allow analysts to compared and report on the relationship between model complexity, efficiency, and the computational costs of increased ecological realism in models[1].
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible. The workshop requests ICES endorsement, participation by ICES scientists, and some secretarial assistance (e. g., email communication, workshop publicity on website, etc.).
Participants	The workshop will be attended by ca. 20–25 members and guests from both ICES and PICES.
Secretariat facilities	None.

Financial	No financial implications.
Linkages to advisory committee	There are no obvious direct linkages with the advisory committees.
Linkages to other committees or groups	The workshop contributes directly to SICCME objectives and activities, and to the activities of SSGEPD and SSGHIE.
Linkages to other organizations	The workshop is a joint activity with PICES.

Appendix 4: 2016 PICES Workshop

Title: Phase 1: Modeling Effects of Climate Change on Fish and Fisheries

Co-Convenors: Anne B. Hollowed, Anne.Hollowed@noaa.gov, Shin-ichi Ito,goito@aori.u-tokyo.ac.jp

Invited Speaker: John Pinnegar

Workshop Description:
In August 2015 S-CCME convened a workshop to discuss the details needed to establish an international effort to project the response of fish and fisheries to different climate change scenarios and fisheries management strategies. Several regional modeling teams were identified that would form the core of the S-CCME projection modeling research effort. S-CCME members were tasked with working with modelers within each of the modeling nodes to initiate projections in 2016.

The proposed workshop will provide an opportunity for S-CCME investigators and collaborating modelers in each of the regional nodes to meet to discuss the current status of their regional integrated modeling teams. Specific goals of this workshop are to:

a) Identify analytical approaches that are being used in each of the regional nodes.
b) Review methods for comparing projections derived from different suites of single species climate enhanced projection models, multispecies climate enhanced projection models, full food web (e.g., EcoSIM), and dynamic spatially explicit ecosystem models.
c) Preliminary inspection of the implications of future climate change on commercially important marine fish stocks in the northern hemisphere. Results will provide a critical opportunity for S-CCME scientists to coordinate their regional modeling efforts.
S-CCME members plan to use the scenarios derived from the regional modeling teams to provide climate-informed options for mitigation of, and management of harvested resources under a changing climate. This proposal calls for a one day workshop to be held prior to or immediately after the PICES annual meeting in La Jolla, California in 2016. The format will allow for breakout groups for intradisciplinary discussions and plenary interdisciplinary research. Projected outcomes of these scenarios using population dynamics models of different approaches and complexity will allow analysts to compare and report on the relationship between model complexity, efficiency, and the computational costs of increased ecological realism in models.

Expected products include a meeting report.

Appendix 5: ICES Theme Session Proposal (seeking PICES co-sponsorship)

Seasonal to Decadal Prediction of Marine Systems:
Opportunities, Approaches and Applications

Proposer

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Description

Tremendous advances in oceanographic observing and modelling systems over the last decade have led to unprecedented developments in the nature of information available to marine science. While improvements in observational technologies and networks have garnered much attention, remarkable developments in forecasting the ocean have received much less focus. Exploiting this new predictive skill to improve scientific understanding, generate advice and aid in the management of marine resources, is emerging as one of the new challenges of marine science.

The potential for predicting the ocean far exceeds that of the atmosphere. The slow-dynamics (and therefore "long-memory") of the ocean mean that anomalies can persist for months or longer, and can thus be used as the basis for simple persistence forecasts. State of the art global climate prediction systems can increase forecast skill above persistence, adding further value and allowing for higher forecast skill at longer lead times. Moreover, in some areas, most notably in the NE Atlantic (but also potentially in the North Pacific and Southern Ocean), statistically meaningful predictive skill of variables such as sea-surface temperature has been demonstrated out to five years or more.

Translating these predictions of the physical environment into biological outcomes, on the other hand, is not straightforward. Fisheries scientists, for example, have been trying to

understand the links between physics and biology, and generate predictions of variables such as recruitment, for close to a century, with limited success. Nevertheless, spatial distributions and the timing of key events, which have received less focus, are often tightly linked to the physical environment and may have management-relevant applications.

This session aims to provide an overview of marine forecasting at seasonal-to-decadal scales, a scientific field that is still in its infancy, and allow researchers to share their experiences of developing prediction systems for marine resource management. It is also an opportunity for those involved in advice and management of these systems to get an overview of a rapidly emerging field, and to consider how this new knowledge can be used to benefit human societies.

We welcome contributions that address all aspects of prediction in marine ecosystems, including, but not limited to:

- What aspects of the marine physical (and chemical) environment can be predicted? For what variables and over what time and space scales does predictability exist? How does the predictability arise?
- What aspects of the marine biological environment can be predicted? What biological responses are the most predictable and why?
- Do we need to have mechanistic understanding or can useful predictions be predicated on the basis of correlative relationships?
- How do we assess the quality (skill) of a prediction?
- What can be learned from biological predictions already being made on the climatic (centennial) time-scales? Where are there similarities and where are there differences?
- How do we use predictions of biological outcomes in pre-existing advice and management structures? What structures are required to take advantage of this new knowledge? How can these estimates be incorporated into management strategy evaluations?
- How do we make predictions with a frequency and timeliness that is appropriate for end-users?
- Does predictive knowledge have a value in the management of marine systems? How can we quantify the value of such knowledge?
- Case studies of existing and proposed predictive systems
- Needs for future research, advisory and management structures

Suggested theme session format

We propose a workshop format, based primarily on invited speakers and submitted presentations to set the scene and provoke discussion. A discussion session (1-2hrs) will follow centered on small groups facilitated by the conveners that address specific questions: the outcomes of these discussions will be collated into a synthesis paper.

Furthermore, if accepted, we will propose the contents of this theme session to “Frontiers in Marine Science” as a “Research Topic”. Papers presented during the ICES theme session will be encouraged to submit to this issue, with a deadline for submission three months after the conference. Upon completion of the review process, the accepted papers will be

published by Frontiers as an "e-book" that surveys the current state-of-the-art of this emerging field.

Expected participation

Given the wide scope of this theme session, the scientific challenges involved and the direct relevance to advice generation, we expect it to be of interest to members of both the scientific and advisory communities within ICES. Furthermore, the international spread of the conveners and the proposed linkages to PISCES are intended to attract participants from both within and outside the ICES community. The conveners also intend to promote the session widely within existing networks focusing on seasonal-to-decadal prediction and within their own scientific communities, to ensure the broadest international participation possible.

Linkages to ICES Strategic Plan

The theme session address the following goals of the strategic plan:

Goal 1 (Science Plan), by integrating existing knowledge and providing an interdisciplinary forum for researchers to share their experiences with seasonal-to-decadal prediction.

Goal 3 (Advisory Plan), by developing seasonal-to-decadal scale forecasts of marine-ecosystems and showing how they can be incorporated into evaluating and advising on the use and protection of marine ecosystems.

Goals 4 and 5 (Data and Information Plan), by demonstrating how forecast products can be operationalized for use by the ICES community.

Linkages to ICES Steering Groups and/or Advisory Committee (if relevant)

The theme session has clear linkages to the broad goals of both ACOM and SCICOM. Furthermore, the SCICOM Steering Group on Ecosystem Processes and Dynamics (SSGEPD), and the SCICOM/ACOM Steering Group on Integrated Ecosystem Assessments (SSGIEA) both have forecasting and prediction as a key aspect of their work and therefore closely link to the content of the theme session.

Linkages to ICES Strategic Initiatives and/or ICES action areas on Aquaculture and the Arctic:

Given the similarities in the approaches employed and the questions asked, linkages to the climate-change community via SICCME (The ICES-PICES Strategic Initiative on Climate Change Impacts on Marine Ecosystems) are natural. The proposal has been discussed with the current chairs of this initiative, who have expressed interest in such a theme session.

Appendix 5

Stewart Frusher, Gretta Pecl and Alistair Hobday, on behalf of the Species on the Move Organizing Committee (http://www.speciesonthemove.com/), asked S-CCME and FIS to think about support of the conference.

The request includes

- keynote or invited speakers on "Implications of species range change for health, food security and ecosystem services'' and "Cultural, social and economic dimensions of range shifts and changing ecosystems".
- support the next generation of scientists to be working in this space and have a range of opportunities available including a Mentor Matching program, an Early

Career Networking Function where ECRs will have the opportunity to meet and discuss their research with the plenary and invited speakers.

Attachment 3: PICES International Summer School on Advanced Survey Approaches for Broad-Scale Fishery Independent Surveys of Fish and their Habitats.

PROPOSAL TO NMFS' OFFICE OF SCIENCE AND TECHNOLOGY INTERNATIONAL RFP

PROJECT TITLE:
PICES International Summer School on Advanced Survey Approaches for Broad-Scale Fishery Independent Surveys of Fish and their Habitats

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Progress Report was submitted for earlier funded work

Funding (in kind and cash) is also being solicited from PICES

Project Objectives and Background:
The North Pacific Marine Science Organization (PICES) participates in organizing summer schools that focus on bringing together young investigators from PICES member countries (Canada, Japan, People's Republic of China, Republic of Korea, the Russian Federation, and the United States of America) to receive training and information in a variety of fields of marine science. PICES has approved a summer school for 2017 focusing on advanced technology tools that are being used for conducting fishery independent surveys. We propose to organize and support the participation by international and domestic students and lecturers. The participation by NOAA Fisheries in an international summer school will allow the results from Advanced Sampling Technology Working Group (ASTWG) and Strategic Initiative groups to be widely disseminated and will allow lecturers and students to exchange up-to-date information on advanced technologies being used internationally to conduct fishery independent surveys. The project will address NMFS' international objectives by initiating new collaborations with PICES countries:

1) to build capacity to survey using advanced technologies
2) to monitor data-poor species using advanced technologies

Project Rationale:
Traditional survey tools continue to limit the amount and kinds of fishery independent information that can be collected. There are many areas where important fishery surveys cannot be conducted because these areas are inaccessible to traditional extractive methods. Many habitats are topographically complex (e.g. rocky reefs, deep coral reefs, seamounts) making them impossible to sample with traditional survey methods (e.g. trawling). Furthermore, many stocks inhabit protected areas where extractive sampling is restricted. In many cases new technologies are available that can provide a cost-effective solution to expanding surveys into areas that were previously unsurveyed and improving information about data poor species. But deciding what tools are most appropriate for a particular habitat, species complex and budget can be daunting and mistakes can be costly. Most of the knowledge needed to implement large-scale surveys using advanced technologies is held by a limited number of specialists. We propose to engage those who are at the beginning stages of implementing new technologies in their surveys and provide them expertise and advice not available in other fora. The summer school will serve several purposes: 1) to expand the dissemination of research results from NMFS including ASTWG and SI working group activities 2) to improve the transfer of technological information between US researchers and international researchers, especially those from PICES member countries 3) to increase the knowledge base to conduct large scale fishery independent surveys with new technologies in the US and other PICES member countries 4) to disseminate information on technologies that can improve information on data poor species and ecosystems. This information exchange can improve US efforts as well as those in partner countries to use new technologies to conduct fishery independent surveys. Fishery stock assessments will be improved by wider exchange of information about survey technologies between international entities undertaking similar work.

This 7-day course will review advanced underwater sampling technologies appropriate for surveying fish and their habitats from the initial consideration of which tool to use through methods and techniques for conducting surveys and, finally, discussions of sampling strategies and reporting. Students will be provided the background needed to determine the suitability of a

variety of technologies based on species to be surveyed, habitats of interest, costs of tools (including acquisition, maintenance, operations), ease of implementation, and the availability of local expertise. Topics to be covered include: strengths and weaknesses of a variety of tools, methods of operations, survey design, calibration of tools, risk assessment, and innovative data analysis tools and methods (e.g. automated image analysis). During the final three days of the class there will be demonstrations and hands-on operations of technologies including, terrain-following autonomous underwater vehicles (AUVs), water column AUVs, Remotely Operated Underwater Vehicles (ROVs) and stationary underwater platforms; all with a variety of optical and acoustic sensors. We propose a course that could accommodate at least 8 students (or more as funding allows) and would take place over seven days in late summer or fall of 2017. The proposed location would be a marine laboratory (such as the Friday Harbor Labs, University of Washington or the Wrigley Institute, University of Southern California) with easy access to housing, lecture rooms, laboratory spaces, and platforms for launching a variety of advanced technologies. PICES is a forum from which instructors from US, Canada, Japan, Korea, China and Russia will be solicited to demonstrate advanced survey technologies developed and used in those countries. We have already contacted colleagues in Japan and Korea to gauge their interest in participating in the course. We are requesting funds to support the travel for both some lecturers and students.

Budget Scalability: The budget could be scaled by reducing the number of students and lecturers or by having students pay a portion of their air travel.

Budget Justification: $23,896 for foreign travel for 2 participants each from Russia, Korea, Japan, and People's Republic of China will be sent to PICES via an international purchase order. A request for $2,390 is included to fund the AGO surcharge on acquisitions. $8,086.00 will be used by the NWFSC to fund domestic travel and shipping of advanced technologies that will be used for demonstrations to the summer school site.

Budget Template

		Funding from Science Center		PICES	
LINE-ITEM EXPENSES	ST International Science RFP Request	In-Kind	Cash	In-Kind	Cash
Field/Experimental Supplies (Please specify)					
Field/Experimental Supply 1					
Field/Experimental Supply 2					
Field/Experimental Supply 3, etc					
Vessel Coordination/Course Travel Logistics					
Personnel expenses (Number, days, rate)				5,000	
Boat Use (Number, days, rate)					
Travel Expenses					
Flight cost 2x Japan, 2 x Korea, 2 x Russia, 2 x China to LAX, and 3 domestic tickets for instructors and students 12,000 to PICES, 3,000 to NWFSC	15,000				
On site transport (days, rate) taxi trips to from airport 11 x 50 (400 to PICES, 150 to NWFSC)	550				
Lodging (Number of rooms, days, rate) 100 x 8 days x 8 students and 3 instructors (6,400 to PICES, 2,400 to NWFSC)	8,800				
Additional Travel Expenses (Please specify)					
Per diem/incidentals (days, rate) 64.00 x 8 days x 8 students and 3 instructors (4,096 to PICES, 1,536 to NWC)	5,632				
Data Analysis Costs (Please specify below)					
Analysis Cost 1					
Analysis Cost 2, etc					
Other Non-Equipment Expenses (Please specify below)					
Non-Equipment Expense 1 shipping (to NWFSC)	1,000				
Non-Equipment Expense 2, facility fees for lecture rooms at Wrigley Center (to PICES)	1,000				
3% AGO surcharge on International PO to PICES 23,896	2,390				
SUBTOTALS					
Field/Experimental Supplies	0	0	0	0	0
Vessel Coordination	0	0	0	5,000	0
Travel Expenses	29,982	0	0	0	0
Data Analysis Costs	0	0	0	0	0
Other Non-Equipment Expenses	4,390	0	0	0	0
PROJECT TOTAL	**34,372**	**0**	**0**	**5,000**	**0**

/Logistics

Attachment 4: PICES Study Group on the Third North Pacific Ecosystem Status Report, SG-NPESR-3

October 24, 2016

Report to SB-2016 on options for biogeographical classification of data submitted to NPESR-3, including a recommendation on a preferred approach.

Introduction

The terms of reference of SGNPESR called for a report to ISB 2016 on options for biogeographical classification of data submitted to NPESR-3, including a recommendation on a preferred approach. For reasons discussed below it was not possible to reach a consensus on a preferred approach in time for ISB 2016. The matter was referred to the inter-sessional NPESR workshop in June 2016 where a consensus recommendation was developed.

Options for Biogeographical Classification of Data Submitted to NPESR-3

The options considered for biogeographical classification are summarized as follows;

1. Marine Ecosystems of the North Pacific Ocean, 2003-2008, NPESR-2 (McKinnell and Dagg 2010)
2. Large Marine Ecosystems of the World, LME (Sherman 1987)
3. Marine Ecoregions of the World, MEOW (Spalding et al., 2007)
4. Longhurst Biogeographical Provinces, LBR (A. R. Longhurst 2006)

Other schemes were briefly reviewed, but not selected for discussion because they appeared to be variations on the approaches of options 2 – 4.

Discussions prior to the intersessional workshop revolved around retaining the biogeographical model of the most recent report NPESR-2 (#1). Although the model served the essential purpose of geographical organization, the selection of the areas was not organized around an identifiable body of consistent biological and physical criteria. In examining the other three models the intention was to find a peer reviewed, published biogeographical classification system that could be applied, or adapted, to the PICES treaty area.

The difficulty in selecting an alternative to the approach of NPESR-2 was that the other three systems, although more or less similar in approach, each fell short of providing a clearly superior approach for the biogeographical classification purposes of NPESR-3. Both LME and MEOW (2007) are inherently coastal and shelf oriented, providing limited rationales for classifying oceanic areas. The LBR approach does address coastal, shelf and oceanic areas with a consistent rationale, however the resulting provinces and subdivisions for the PICES treaty area were overly broad, combining national boundaries and providing limited guidance on geographic boundaries between shelf and oceanic environments.

Intersessional workshop participants considered the question of biogeographical organization in view of the 280 environmental time series observations (ETSOs) submitted for consideration at the workshop. A consensus was reached at the workshop on how best to geographically organize ETSOs for reporting and

syntheses. Consensus was reached that the Large Marine Ecosystems used in concert with three additional oceanic areas would best serve to categorize and organize locations of the ETSOs (Figure 1). The Large Marine Ecosystems of the PICES area were drawn from the currently recognized Large Marine Ecosystems of the World (Figure 2).

Large Marine Ecosystems of PICES

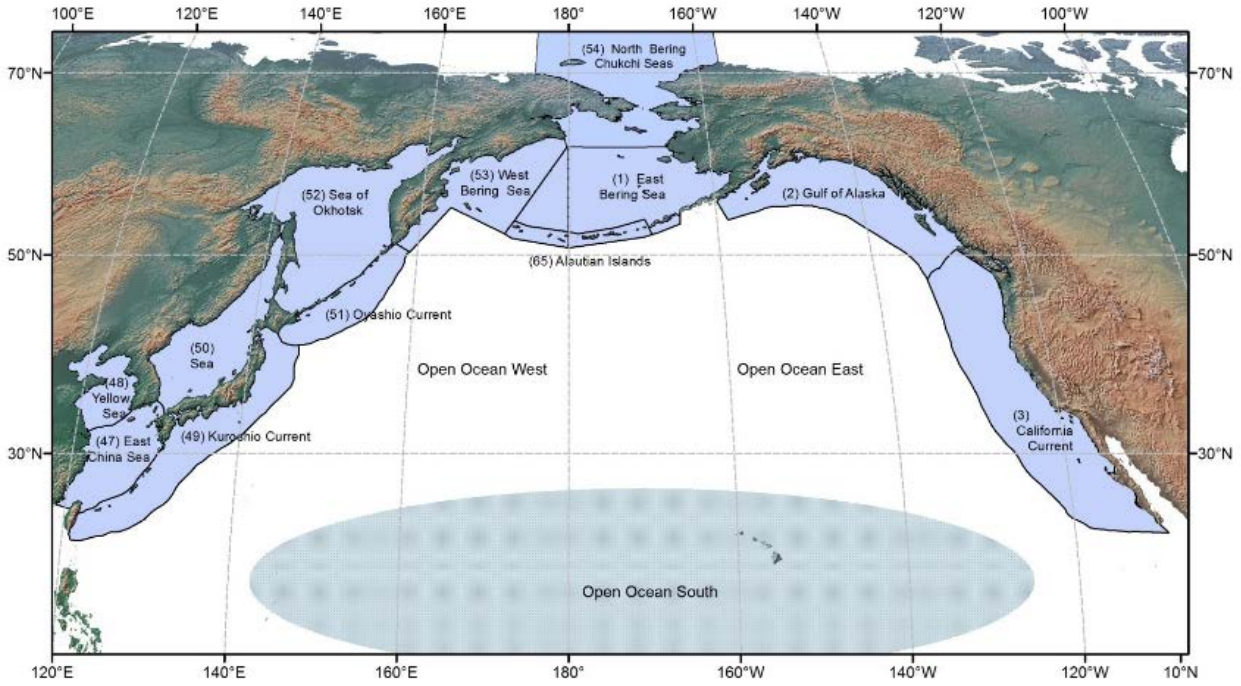

Figure 1. Large Marine Ecosystems of the PICES area, adapted from Large Marine Ecosystems of the World by Peter Chandler. Note that references for original LME and the figure above are hyperlinked to text.