2020 Intersessional Science Board Meeting
SCIENCE BOARD
BACKGROUND BRIEFING BOOK

Call Schedule

To be held via Zoom* video conference calls, as follows. Call invitations will be sent to attendees prior to meeting.

Location	Start Time for all Days (Local Time)	First Day of ISB meeting (local date)	Third Day of ISB meeting (local date)
Atlanta (US East Coast); [UTC-4]	9:00 PM	29 April (local Wed)	1 May (local Fri)
Sidney, BC (US West Coast); [UTC-7]	6:00 PM	29 April (local Wed)	1 May (local Fri)
Vladivostok (Eastern Russia); [UTC+10]	11:00 AM	30 April (local Thu)	2 May (local Sat)
Seoul (South Korea); [UTC+9]	10:00 AM	30 April (local Thu)	2 May (local Sat)
Yokohama (Japan); [UTC+9]	10:00 AM	30 April (local Thu)	2 May (local Sat)
Qingdao (China); [UTC+8]	9:00 AM	30 April (local Thu)	2 May (local Sat)

** Note: GoToMeeting is PICES backup plan in case of any technical issues with Zoom.*

Prepared by Science Board Chair, Dr. Vera Trainer, and the PICES Secretariat

Call Protocol

To help us have successful Zoom meetings, please observe the following videoconferencing practices:

1. Test your microphone and video settings beforehand at https://zoom.us/test to ensure all technical aspects are working properly;
2. If you can, connect to the internet via an ethernet cable, to ensure the best quality connection;
3. Because we are compressing a normal 3 day Science Board meeting into 9 hours of video conferencing, it is critical that participants have become familiar with the agenda and briefing materials. If we cannot address the issues in the allotted time, we may have to defer some agenda items to a subsequent (additional) web conference session;
4. Please connect to the meeting 10 to 15 minutes in advance of the start time, This will provide an opportunity to work out any "bugs" in the connection;
5. Set up in a quiet location and silence personal devices before you join each video call;
6. Remove distractions, and, if possible, avoid multitasking during call, such as eating, checking email/phone/web;
7. The Chair will guide a round of individual introductions;
8. Mute your microphone when you're not speaking;
9. Please be aware that PICES intends to record this meeting;
10. Please open each of these Zoom feature windows during the call, in order to access the additional functionality described below:
    - "**Participants"** - allows you to: see who is in the meeting; who is sharing their desktop; who has "raised their hand". At the bottom of this feature, you will see that you can raise and lower your hand to ask a question. You can also change how your name appears in the meeting by clicking on the "more ..." by your video, and selecting "rename." Please use your full name for the purposes of these meetings;
    - "**Chat"** - allows chatting with individual or all participants, file and URL sharing as described below. This can be very useful if you are experiencing technical problems.
    - Primary video window - allows you to see other participants, as well as presentations and files being shared to the meeting.
11. Please familiarize yourself with the use of the following Zoom functions:
    - "Raise your hand": if you wish to ask a question - this function will be used for the Chair to organize the sequence of speaking;
    - "Chat": if you wish to chat with individual members or with everyone in the meeting;
    - Sharing URL's: URL's can be shared with the group by pasting them into chat messages;
    - "Share file" - send files during the meeting using the share file function within the chat window;
    - Share screen: allows you to share your screen with everyone in the meeting when requested to do so by the meeting host.
12. If you/we start to experience bandwidth problems, it may be necessary to disable/shut down your video.
13. This is an experiment for PICES. Please keep track of what works and what doesn't work. We plan to conclude each session with a short discussion on this, with the objective of making improvements as we go along.

Instructions/Invitation for joining the virtual meeting will be sent to you by email prior to each meeting. Please be on the lookout for these instructions. If you need to use an email address that differs from the one listed for you on the Science Board webpage (https://meetings.pices.int/members/committees/SB) please let us know.

Table of Contents: SCIENCE BOARD – INTER-SESSIONAL MEETING 2020

Conference Call #1 – See table on cover to determine local call time

AGENDA ITEM 1 – Welcome and adoption of agenda (Trainer; 15 min)

➔Action: SB review agenda, note revisions, additions

Science Board Chair, Dr. Vera Trainer, will review video meeting etiquette and protocol, will call the meeting to order, welcome participants, and make introductions. The agenda will be reviewed and any adjustments/amendments will be made before the meeting commences.

Science Board	
Vera Trainer	Science Board Chair
Igor Shevchenko, rep. Russia	Science Board Vice-Chair
Steven Bograd	FUTURE SSC Co-Chair
Sukyung Kang	FUTURE SSC Co-Chair
Akash Sastri	BIO Chair
Xianshi Jin	FIS Chair
Mitsutaku Makino	HD Chair
Guangshui Na	MEQ Chair
Emanuele Di Lorenzo	POC Chair
Sung Yong Kim	MONITOR Chair
Jeanette Gann	TCODE Chair
Governing Council	
Chul Park	PICES Chair (TBC)
Note 1:	
PICES Secretariat	
Sonia Batten	Executive Secretary
Robin Brown	Executive Secretary (retiring)
Harold (Hal) Batchelder	Deputy Executive Secretary
Lori Waters	Science Board Support
Invited Guests	
William Karp	ICES
Erin Satterthwaite	FUTURE Earth

Note1 : In accordance with regular practice, GC members are invited to participate in the Intersessional Science Board Meeting

AGENDA ITEM 1 (cont'd) – Welcome and adoption of agenda (Trainer; 15 min)

180 Minute Conference call #1 - times as noted on cover.

#	Item	Presenter, # mins	Item time (mins)	Total Time	Details / Action, etc.
*	Conduct of call				
1	- Welcome - Call mtg to order - Call etiquette - Introductions - adopt agenda	Trainer	15	15	**SB Action:** SB review agenda, note revisions, additions
2	Mid-year report: FUTURE SSC	Kang, Bograd	Update: 20 WG 35: 5 WG 36: 5 Discussion: 10	35 40 45 55	- FUTURE update; highlight items requiring SB attention or decisions (20 mins) - Provide WG updates: 35, 36 (5 mins ea.) - SB Discussion (10 mins)
3	Next integrative science program	Bograd, Kang, Trainer: present SB discussion /decision	20 40	75 115	**Focus:** UN Ocean Decade in the North Pacific. Presentation: Bograd, Kang, Trainer (20 mins) **SB Decision Required:** support for one or more science themes (40 mins)
4	Special Projects: Inter-sessional reports:	**FishGIS** final: Makino **SEAturtle** update: Sastri **Ciguatera** intro: Makino	10 mins or less 10 mins or less 10 mins or less	125 135 145	- **FishGIS -** (ended March 2020) wrap -up presenter: Makino, 10 mins or less - **SEAturtle**: update, - From Taewon Kim, presenter: Akash Sastri, 10 mins or less - **Ciguatera** - Project intro report , presenter: Makino, 10 mins or less
5	Awards	**Wooster:** Trainer **POMA**: Kim, Gann **Zhu-Peterson:** Trainer	15 10 10	160 170 180	- **Action:** SB to decide on Wooster awardee. **Action:** TCODE and MONITOR Chairs to make recommendation to SB for POMA. - **Action:** SB to decide on POMA awardee. - **Action:** SB to review nominations - decide on Zhu-Peterson awardee.
*	Review Conduct of Call	**Call Review:** Trainer			- Review conduct of call - note any required changes, suggestions, technical aspects for following meeting.

/End First Call.

AGENDA ITEM 1 (cont'd) – Welcome and adoption of agenda (Trainer; 15 min)

180 Minute Conference call #2 - times as noted on cover.

#	Item	Presenter, # mins	Item time (mins)	Total Time (mins)	Details / Action, etc.
*	Conduct of Call				
6	Scientific / Technical Committee Mid-year reports	**BIO**: Sastri, 5 **S-MBM**: Sastri, 5 **WG32:** Sastri, 5 **WG37:** Sastri, 5 **FIS:** Jin, 5 **S-CCME**: Di Lorenzo, 5 **WG34**: Jin, 5 **WG43**: Jin, 5 **HD:** Makino, 5 **WG41:** Makino, 5 **MEQ:** Na, 5 **S-HAB:** Na, 5 **AP-NIS:** Na, 5 **WG42:** Na, 5 **POC:** DiLorenzo, 5 **S-CC**: Di Lorenzo, 5 **AP-CREAMS:** Di Lorenzo, 5 **WG38:** Di Lorenzo, 5 **WG40:** Di Lorenzo, 5 **MONITOR**: Kim, 5 . **AP-NPCOOS:** Kim, 5 **TCODE:** Gann, 5 +/- SB Discussion	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 30	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 140	**Sci/Tech Committee mid-year reports.** **SB Chair direction:** • Presenters to focus on highlights • Max: 2-3 slides • <5 mins, unless critical issues requiring SB attention. • Committee chairs - please stay within total time allocation, but shorten or allot time to individual reports as required. **Presenters, please use provided PowerPoint template.** **Please note reporting arrangements as follows, especially for Expert Groups that have more than one parent:** **Committee reports for EG's:** • **BIO** to report on **S-MBM, WG 32, WG 37** • **FIS** to report on **S-CCME, WG 34, WG 43** • **HD** to report **on WG 41** • **MEQ** to report on **S-HAB, AP-NIS, WG 42** • **POC** to report on **S-CC, AP-CREAMS, WG 38, WG 40** • **MONITOR** to report on **AP-NPCOOS** **110 mins presentations** **+ 30 mins SB disc. = 140 mins.**

AGENDA ITEM 1 (cont'd) – Welcome and adoption of agenda (Trainer; 15 min)

7	Expert Group updates **- total 30 minutes**	Trainer/Batten • **WG 39:** 5 mins • **WG ONCE:** 5 mins • **WG GRAFY:** 5 mins • **WG 44:** 5 mins • **WG CHANGE:** 5 mins • **SG-IMCE Study Group: :** 5 mins	 5 5 5 5 0 5	 145 150 155 160 160 165	**EG Updates:** • **WG 39: -** EXTENDED in 2018 to OCT 2021 • **WG ONCE -** ICES/PICES Ocean Negative Carbon Emissions (ONCE) • **WG GRAFY:** Joint ICES/PICES Working Group on Impacts of Warming on Growth Rates and Fisheries Yields . • **WG 44 Northern Bering Sea - Chukchi Sea–** Approved and awaiting nominations from GC. • **WG CHANGE** Correlating Habitats using Artificial Intelligence, Numerical models and Gathered Empirical data" (CHANGE) Defer to PICES2020. • **SG-IMCE Study Group**: Impacts of Mariculture on Coastal Ecosystems
8	Cmte Action Plans – do we need them?	Trainer	10	175	Intro /overview in preparation for completing Action Plans at PICES 2020
*	Review Conduct of Call	**Call Review:** Trainer			- Review conduct of call - note any required changes, suggestions, technical aspects for following meeting.

/End Second Call.

AGENDA ITEM 1 (cont'd) – Welcome and adoption of agenda (Trainer; 15 min)

180 Minute Conference call #3 - times as noted on cover.

#	Item	Presenter, # mins	Item time (mins)	Total Time (mins)	Details / Action, etc.
*	Conduct of Call				-
9	WG-NPESR3	Batten - present SB - discuss	10 15	10 25	- Batten update NPESR3 Status - SB discuss
10	Greener PICES meetings	Trainer, Batten, SB - discuss	10 20	35 55	- Intro to greener meeting discussions
11	PICES 2020 Update	Batchelder	20	75	- Update on Qingdao meeting
12	UN Ocean Decade	Satterthwaite Bograd / Trainer	5 30	80 110	
13	FUTURE OSM	Kang / Bograd	30	130	- Open Science Meeting Plans update
14	PICES sponsored conferences symposia	Brown / Batchelder	5 5 5 5	135 140 145 150	- ECCW05 Norway - PICES → IYS - ICES/PICES ZPS - MSEAS - Small Pelagic Fish (SPF)
15	Capacity Building	Batchelder	5 5	155 160	- ICES PICES ECS 2022 - ClimEco7 Summer School
16	PICES-2022	Brown/Trainer	10	170	- What compromises are we willing to make to have a joint PICES/ICES Science Conference on 202? This would require Expert Groups to give up much face-to face meeting time to be replaced with meetings by correspondence/conference call in the summer.
17	Publications	Batchelder	5	175	-
18	ISB-2021	Trainer / Secretariat	5	180	- ISB2021 – venue / date / format - overview - For further consideration at PICES2020
19	Virtual ISB meetiings	Trainer	10	190	- Initial thoughts on effectiveness - Suggestions for improvements
20	Code of Ethics for PICES operations	Brown	5	195	- Brief Introduction
21	SB / GC Decisions	Secretariat	0	0	- Report only - Appendix P
22	PICES Partner Organizations - See Appendix P	Science Board	0	0	- SB members to review Appendix Q and provide suggestions for changes/updates by correspondence to Lori.Waters@pices.int. - To be revisited at PICES-2020
*	Review Conduct of call				

/End Third Call.

AGENDA ITEM 2 – Mid-year report from FUTURE SSC (Kang/Bograd; 40 minutes total)

➔Action: Kang / Bograd to highlight items requiring SB attention or decisions

Progress reports focusing on highlights since PICES-2019 for both FUTURE SSC and its expert group(s):

Suggested Time Allocation:

- Mid-year report from FUTURE SSC: 20 minutes
- Mid-year report from WG 35: 5 minutes
- Mid-year report from WG 36: 5 minutes
- Discussion: 10 minutes

FUTURE SSC (Co-Chairs: Steven Bograd, USA, Sukyung Kang, Korea
Established: Oct. 2014

Reports for working groups reporting to FUTURE SSC: (5 minutes each)

- **WG 35: Working Group on the Third North Pacific Ecosystem Status Report (WG-NPESR3)**
  *Term:*extended at PICES-2019 until PICES-2020
  Parents: MONITOR, FUTURE SSC
  Co-Chairs: **Peter Chandler (Canada), SinjaeYoo (Korea)**

  ➔ Please see **Agenda Item 9: DRAFT *NPESR Synthesis Report***, Appendix G - being sent as separate document due to large size.

- **WG 36: Working Group on Ecosystem Reference Points as Common Currency across PICES Member Countries**
  *Term:*extended at PICES-2019 until PICES-2020
  Parent: FUTURE SSC
  Co-Chairs: Mary Hunsicker (USA) and Xiujuan Shan (China)

AGENDA ITEM 3 – Next integrative science program (Bograd/Kang/Trainer; 20 minutes)

Focus: UN Ocean Decade in the North Pacific

- Presentation (20 mins)
- Discussion SB (40 mins)

➔**SB Action: DECISION REQUIRED** : Support for one or more science themes.

➔**NOTE: SCIENCE BOARD members may wish to:**

- **review the draft Implementation plan: https://on.unesco.org/3a2tO86**
- **submit their comments *prior to closing date of April 17 2020*, via the following Survey monkey response: https://www.surveymonkey.com/r/decade-ip-review**

Please see Appendix B for the following relevant materials:

- Joint letter to ICES and PICES governing councils
- International Marine Science Networks to Advance Ocean Science for Sustainable Development
  - PICES & ICES DOCUMENT ON PLANNED AND EXISTING AREAS OF COOPERATION AND AN INVITATION TO OTHER GROUPS AND ORGANIZATIONS TO JOIN OUR EFFORTS IN SUPPORT OF THE UNITED NATIONS DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT

➔**Does Science Board have suggested additional potential Science THEMES for ICES / PICES?**

Additional UN Ocean Decade background material is also available as follows:

- The *REVISED* UN Ocean Decade Roadmap is available in full, here: https://unesdoc.unesco.org/ark:/48223/pf0000265141
- United Nations Decade of Ocean Science for Sustainable Development (2021-2030) Website: https://en.unesco.org/ocean-decade
- PUBLICATION: The Science we need for the ocean we want: the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) https://unesdoc.unesco.org/ark:/48223/pf0000265198

Please also see Appendix J – UN Ocean Decade for additional materials related to the UN Ocean Decade (for discussion under Agenda Item 12).

AGENDA ITEM 4 – Special Projects – Inter-sessional reports (Sastri, Makino; 30 minutes)

FishGIS – Special Project: Final Report - (Makino, 10 mins)

https://meetings.pices.int/projects/FishGIS
Building capacity for coastal monitoring by local small-scale fishers: (November 2017 – March 2020).

- Current status of the FishGIS project;
- Status and timing of a FishGIS final report;
- Any publications (and anticipated timing of publications) expected as a result of the FishGIS project;
- FishGIS project items requiring Science Board approval, e.g. FishGIS publications.

Please see Appendix C for additional information on PICES/MAFF FishGIS

AGENDA ITEM 4 – Special Projects:Inter-sessional reports (Sastri, Makino; 30 minutes)

SEAturtle – Special Project Report - (Sastri, 10 mins)

https://meetings.pices.int/projects/SEAturtle
Sea turtle ecology in relation to environmental stressors in the North Pacific region: (December 2018 - November 2022).

Recent activities

1. **Publication** of an article in the PICES newsletter Vo. 28, No. 1
   - Title: PICES Special Project: Sea Turtle Ecology in Relation to Environmental Stressors in the North Pacific Regions
   - By Taewon Kim, Soojin Jang, Mi Yeon Kim, and Jibin Im

2. **Abstract submission** to ISTS (International Sea Turtle Symposium)
   - TITLE: PICES special project on "sea turtle ecology in relation to environmental Stressors in the North pacific regions"
   - Authors: Taewon Kim[1], Byung-Yeob Kim[2], George Shillinger[3], Soojin Jang[4], Miyeon Kim[5], Jibin Im[1], and Jeongjoo Ha[4]
   - Scheduled to be held in Cartagena, Columbia, on Mar 14-20, 2020 but canceled due to COVID 19 (New dates are 13-19 Feb, 2021)

3. **Abstract submission** to AOGS(Asia Oceania Geosciences Society)
   - Title: Thermal Migration and Overwintering of Green Sea Turtles, ***Chelonia mydas*,** Observed by Using SeaTrkr GPS/Iridium Marine Systems
   - Authors: Jibin Im1, Seo jeong Park1, Soojin Jang2, Mi Yeon Kim3, Byung-Yeob Kim4 and Taewon Kim1*
   - Scheduled to be held in Hongcheon, Korea, on Jun 28 to July 4, 2020 but canceled due to COVID 19.

4. **Membership changes**: New member - **George Shillinger** ,Executive Director, Upwell, 99 Pacific Street, Suite 375-E, Monterey, CA, 93940,E-mail: george@upwell.org

→Please see Appendix C for additional background information on SEAturtle

→Science Board Decision required:

- Travel fund request for invited speaker for PICES 2020:
  W8 Sea turtles and environmental stressors in the North Pacific
  Potential Invited speaker: George Shillinger (USA)
  Note: travel funded by Special Project does not require SB recommendation

AGENDA ITEM 4 (cont'd) – Special Projects:Inter-sessional reports

Ciguatera – Special Project: Introductory Report - (Makino, 10 mins)

- https://meetings.pices.int/projects/Ciguatera
- **Term:** April 2020 – March 2023
- **Project Science Team Co-Chairs:**
  Mitsutaku Makino (Atmosphere and Ocean Research Institute, The University of Tokyo, Japan)
  Mark Wells (University of Maine, USA)
- **Project Coordinator:** Alexander Bychkov (PICES)
- **Funding Agency:**
  Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan (JFA)
- **Parent PICES Committee:** Human Dimensions Committee (HD)

→Please see Appendix C for additional background information on Special Projects

AGENDA ITEM 5 – Awards: Wooster

https://meetings.pices.int/awards/Wooster-Award

Introduction

In 2000, PICES Governing Council approved the establishment of a new award, the Wooster Award. The award is named in honour of Professor Warren S. Wooster, a principal founder and the first Chairman of PICES, and a world-renowned researcher and statesman in the area of climate variability and fisheries production. The award is given annually to an individual who has made significant scientific contributions to North Pacific marine science, such as understanding and predicting the role of human and climate interactions on marine ecosystem production.

The award consists of a plaque with the recipient's name engraved on it. A large plaque is maintained at the PICES Secretariat with the names of all the award winners over the years. The recipient will also receive financial support to attend the PICES Annual Meeting at which the award is given.

Nominations

The main criteria for selection are sustained excellence in research, teaching, administration or a combination of the three in the area of North Pacific marine science. Special consideration is given to individuals who have worked in integrating the disciplines of marine science. Individuals who were or are currently actively involved in PICES activities are preferred but the award may be given to any suitable candidate, including those from outside PICES member countries.

Nominations are accepted annually from the PICES community although the award may not be given every year if a suitable candidate is not found. The Selection Committee consists of the PICES Science Board and the PICES Chairman, and the Award Presentation Ceremony takes place at an Opening Session during the PICES Annual Meeting. Individuals who are not chosen for the Wooster Award when nominated are eligible to be re-nominated, providing that the nomination documents are updated.

Please see Appendix D - Wooster Award Nominee:

- **Hiroaki SAITO**

→Science Board Decision required: To award / not award Wooster Award.

AGENDA ITEM 5 – Awards: POMA

https://meetings.pices.int/awards/POMA_award

This award is given for significant contributions to the progress of marine science in the North Pacific through long-term monitoring operations, management of data associated with ocean conditions and marine bio-resources in the region, development of advanced and innovative technologies for ocean monitoring or all categories. Recipients may include, for example, research vessels, research or administrative institutes or portions thereof, or technical groups involved in monitoring, data management and dissemination, or the development of tools or technologies that have been shown to enhance ocean monitoring, or a combination of these activities. Outstanding individual efforts may also be recognized.

Nominations from individuals or groups from PICES member countries should be sent with supporting documentation to the Executive Secretary (Robin.Brown@pices.int) by the deadline specified in the Call for Nominations. The Technical Committee on Monitoring (MONITOR) and the Technical Committee on Data Exchange (TCODE) will evaluate independently the documents submitted with each nomination, and recommend some or all of the nominations for consideration by Science Board. Evaluations will include the relevance, duration and balance of activities (ocean observation, resource monitoring, data management, etc.). If more than one nomination is considered worthy of recognition by MONITOR or TCODE, rank preferences will be provided to Science Board by each Technical Committee. A maximum of one award will be given each year. To keep a large pool of potential candidates, Science Board will reserve any surplus of recommendations for review in two consecutive years and will be reactivated if nominator gives approval.

2020 POMA Award Nominations:

1. LaPerouse Montoring Program
2. M2 Bering Sea Mooring
3. AFSC Bering Sea Surveys

Please see POMA Nominations available in Appendix D2

→TCODE and MONITOR will present re: POMA recommendation

→Science Board Decision required: Accept / Do not accept TCODE/ MONITOR recommendation

AGENDA ITEM 5 – Awards: Zhu Peterson Early Career Scientist

https://meetings.pices.int/awards/Zhu-Peterson-Award

In 2019, the Governing Council approved the establishment of a new PICES award, the Zhu-Peterson Early Career Scientist Award. The award is named in honor of Professor Zhu and Dr. Peterson, two marine scientists who strongly encouraged early career scientists to become engaged in PICES. Professor Mingyuan Zhu of the First Institute of Oceanography, State Oceanic Administration, China, trained many graduate students and young scientists, who carry on his rich legacy of honest enthusiasm for cooperative approaches to marine science research. He led many national and international projects, including studies of environmental carrying capacity, eutrophication and shellfish toxins, and sustainable mariculture. Dr. William (Bill) Peterson of the Northwest Fisheries Science Center of NOAA, USA, was cherished by his students, technicians, and PICES early career scientists who regarded him as "a great teacher, and a fun, humble and inspiring mentor". For many, the greatest benefit of working with Bill was expanding their research vision and expertise into areas such as zooplankton ecology, fisheries oceanography, and climate change. Both Zhu and Peterson passed away far too early during their careers in ocean science. PICES honours the memories of their contributions with this Award. The Zhu-Peterson ECS Award may be given annually to an individual who has performed innovative research at the frontier of science relevant to the PICES mission as set out in the Convention:

Article III: Purpose of the Organization:

to promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources, including but not necessarily limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and impacts upon it from human activities;
to promote the collection and exchange of information and data related to marine scientific research in the area concerned.

Nominations:
Nominations are accepted annually from the PICES community although the award may not be given every year if a suitable candidate is not found. The nominee must be in the beginning of his or her independent research career which is defined as: (1) less than 5 years since finishing graduate school or postdoctoral training, whichever comes later, and (2) less than or equal to 38 years of age on the date of nomination. The main criterion for selection is innovative research at the frontiers of ocean science relevant to the mission of the North Pacific Marine Science Organization and society. The individual must be performing research in the PICES region. Special consideration will be given to nominees who have worked in integrating the disciplines of marine science. Individuals who were or are currently actively involved in PICES activities are preferred. The PICES Science Board will serve as the Selection Committee. The Award Presentation Ceremony takes place at an Opening Session during the PICES Annual Meeting and travel support will be provided to the successful nominee. Individuals nominated but not chosen for the Zhu-Peterson Award are eligible to be re-nominated, providing that the nomination documents are updated.

Nominees : Zhu Peterson Early Career Scientist Award

1. SAKAMOTO, Tatsuya
2. SATTERTHWAITE, Erin
3. SHI, Yongiang
4. SONG, Wei
5. WANG, Pengbin
6. XU, Qinzeng
7. ZHANG, Hui

→Please see Appendix D3 – Zhu-Peterson Early Career Scientist Nominations

→Science Board Decision required: Choose Zhu-Peterson Award Recipient

Conference Call #2 – See table on cover to determine local call time

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports

Presenters as noted, 145 minutes total

➔Action: Presenters to please:

- report highlights
- use provided template
- 2 - 3 content slides
- <5 mins, unless critical issue needs SB attention

Powerpoint template has been sent to Science Board, and is also available for download here: https://drive.google.com/file/d/1ImnA1Y7-BCzw4IFAxRjNruATRTggpLgw/view?usp=sharing

Scientific and Technical Committee Mid-yearProgress Reports

➔ **Action: Presenters to present for <15 minutes each, maximum 2-3 slides**;Since PICES-2019: recent activities, membership changes;highlight items requiring SB attention, i.e.: any proposals or requests for funding (e.g.: travel, workshop, schools, publications, etc.).;

➔**Action:** SB to consider / make decisions regarding requests, as appropriate.

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports (cont'd)

BIO & EGs - Mid-year reports 2020

BIO - Biological Oceanography Committee – Presenter: Sastri, 5 mins

1. Dr. Akash Sastri (Canada) has been elected as a new BIO Committee Chair replacing Dr. Se-Jong Ju (Korea). Prof. Wongyu Park (Korea) will replace Dr. Akash Sastri as a BIO Committee Vice-Chair.
2. Dr. David G Kimmel (USA) was appointed as anew member of BIO Committee October 7, 2019.

S-MBM: No mid-year update

WG 32: Working Group on Biodiversity of Biogenic Habitats – Presenter: Sastri, 5 mins

1. WG32 final report has been submitted to BIO for review. See Appendix
   For additional review by Science Board at PICES2020.

2. WG32 would like to propose a new WG to focus on the biodiversity of seamounts. The proposed WG will follow on WG32 and will be reviewed by BIO prior to the PICES 2020 annual meeting for review by SB at that meeting.

WG 37: Zooplankton Production Methodologies, Applications and Measurements in PICES Regions – Presenter: Sastri, 5 mins

1. Members of WG37 have recently published a paper in the Progress in Oceanography, Bill Peterson special issue: Evaluation of trade-offs in traditional methodologies for measuring metazooplankton growth rates: Assumptions, advantages and disadvantages for field applications. T. Kobari, A.R. Sastri, L. Yebra, H. Liu, R.R. Hopcroft Progress in Oceanography (2019) 178: https://doi.org/10.1016/j.pocean.2019.102137

2. Members of WG37 and AP-NPCOOS (Prof. Toru Kobari and Dr. Naoki Yoshie) organized the "PICES-2020 Spring School on Coastal Ocean Observatory Science" which was planned for March 4-8, 2020 at Kagoshima University, Kagoshima, Japan. Unfortunately, the spring school was cancelled due to COVID-19 concerns.

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports (cont'd)

FIS & EGs - Mid-year reports 2020

FIS - Fishery Science Committee – Presenter: Jin, 5 mins

- Chair: Xianshi Jin, (China)
- Vice-Chair: Jacquelynne King(Canada)

S-CCME - PICES/ICES Section on Climate Change Effects on Marine Ecosystems – Presenter: Di Lorenzo, 5 mins

- Term:Established in Oct. 2011,Renewed at PICES-2019: Oct. 2017 - Oct. 2020
- Duration: lifetime of FUTURE (Jan. 2012 – Dec. 2020)
- ICES Co-Chairs: Myron Peck (ICES/Germany) /John Pinnegar (ICES/UK)
- Co-Chairs: Jackie R. King (Canada) /Xiujuan Shan (China)
  Parent Committees: BIO, FIS and POC

WG 34: PICES / ISC Working Group on Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish – Presenter: Jin, 5 mins

- Term: Oct. 2015 – Oct. 2019, Extended: at PICES-2019 until PICES-2020
- ISC Co-Chair: TBA
- ISC Co-Chair: Chi-Lu Sun
- Co-Chair: Prof. Siqing Chen
- Co-Chair: Dr. Barbara Muhling
- Parent Committee: FIS
- Please see Appendix

WG 43: PICES/ICES Working Group on Small Pelagic Fish – Presenter: Jin, 5 mins

- Term: Dec. 2019 – Dec. 2022
- Co-Chairs: Ryan R. Rykaczewski (USA) and AkinoriTakasuka (Japan)
- ICES Co-Chairs: Myron Peck (ICES/Germany) Ignacio Catalán (ICES/Spain)

HD & EGs - Mid-year reports 2020

2020 Mid-year report for HD & EGs

HD – Human Dimensions Committee – Presenter: Makino, 5 mins

Chair: Mitsutaku Makino (Japan), Vice-Chair: Karen Hunter (Canada)

WG 41: Working Group on Marine Ecosystem Services – Presenter: Makino, 5 mins

- Term: Sept. 2017 - Sept. 2020
- Co-Chairs: Shang Sunny Chen, Dan Lew
- Parent Committee: HD

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports (cont'd)

MEQ & EGs - Mid-year reports 2020

MEQ - Marine Environmental Quality Committee – Presenter: Na, 5 mins

- Chair: Dr. Guangshui Na
- Vice-Chair: Dr. Andrew RS Ross
- Parent Committee: SB

S-HAB – Section on Ecology of Harmful Algal Blooms in the North Pacific – Presenter: Na, 5 mins

- *Term:* Established 2003, most recently renewed at PICES-2018 until Oct. 2021
- *Parent Committee:* MEQ
- *Co-Chairs:*Pengbin Wang(China) and Mark L. Wells (USA)

AP-NIS – Advisory Panel on Marine Non-indigenous Species – Presenter: Na, 5 mins

- *Term:Established:* June 2016
- *Duration:* Indeterminate
- *Parent Committee:* MEQ
- *Chairs:*Thomas W. Therriault(Canada)

WG 42: Indicators of Marine Plastic Pollution – Presenter: Na, 5 mins

- *Term:* Nov. 2018 - Nov. 2021

*Co-Chairs:*Jennifer M Lynch (USA) and Chengjun Sun (China)

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports (cont'd)

POC & EGs - Mid-year reports 2020

POC – Physical Oceanography and Climate Committee – Presenter: Di Lorenzo, 5 mins

- Chair: Emanuele Di Lorenzo(USA)
- Vice-Chair: Yury Zuenko (Russia)

S-CC Section on *Carbon and Climate* – Presenter: Di Lorenzo, 5 mins

- Term: Established in 2005. Renewed at PICES-2019: Oct. 2018 - Oct. 2021
- Co-Chairs: Alexander Kozyr (USA) and Tsuneo Ono (Japan)
- Parent Committees: BIO and POC.

AP-CREAMS Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas – Presenter: Di Lorenzo, 5 mins

- Term: Oct. 2015 - Oct. 2024 (renewed at PICES-2019 until Oct 2024)
- Co-Chairs:Joji Ishizaka (Japan), Jae-Hak Lee (Korea), Vyacheslav Lobanov (Russia), Fei Yu (China)

- **AP-CREAMS Training - request for funding**
  PICES has co-sponsored two capacity building training courses as a joint activity with NOWPAP, one in 2011 and one in 2013 (see table on Training courses, above). A third in a series NOWPAP/PICES training courses on remote sensing. UNEP/NOWPAP/PICES Training Course "Remote sensing data analysis", last half of 2020, TBD Japan, funding for one lecturer and travel for students and early career scientists, $9,000 (See Appendix E for supporting documentation).

➔**Action:** Science Board to approve/not approve funding for Training Course on "Remote sensing data analysis"

WG 38: Mesoscale and Submesoscale Processes – Presenter: Di Lorenzo, 5 mins

- Term: Nov. 2016 – Oct. 2019 (Extended: at PICES-2019 until PICES-2020)
- Co-Chairs: Annalisa Bracco, Hiromichi Ueno
- Parent Committee: POC

WG 40: Climate and Ecosystem Predictability – Presenter: Di Lorenzo, 5 mins

- Term: Jul. 2017- Oct. 2020
- Co-Chairs: Michael Jacox, Masami Nonaka
- CLIVAR Co-Chairs: Antonietta Capotondi, Shoshiro Minobe, Ryan Rykaczewski
- Parent Committee: POC

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports (cont'd)

MONITOR & EGs - Mid-year reports 2020

MONITOR Technical Committee on Monitoring -- Presenter: Kim, 5 mins

- Chair: Sung Yong Kim (Korea)
- Vice-Chair: Lisa B. Eisner (USA)

Active Groups:

- **AP-CREAMS**: Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas (Oct. 2005 - 2019) (also reports to POC)
- **AP-NPCOOS**: Advisory Panel on North Pacific Coastal Ocean Observing Systems (Oct. 2015 -) (also reports to TCODE)
- **WG 35**: Working Group on Third North Pacific Ecosystem Status Report (WG-NPESR3) (May 2016 – 2020 PICES) (also reports to FUTURE-SSC)

Membership/Leadership changes

- **MONITOR**
  - **Chair:** Prof. Sung Yong Kim (Korea) Past Chair: Dr. Jennifer L. Boldt (Canada)
  - **Vice Chair:** Dr. Lisa B. Eisner (USA) Past Vice Chair: Dr. Sanae Chiba (Japan)
  - **Japan:** Dr. Hiroto Abe (Past: Prof. Sei-Ichi Saitoh)
    Dr. Minoru Kitamura (Past: Dr. Sanae Chiba)
  - **USA:** Dr. Kym Jacobson (Past: Dr. Jeff Napp.)

- **AP-NPCOOS**
  - **Next co-chairs suggestions**: Prof. Kim Juniper(Canada) and Prof. Naoki Yoshie (Japan)
    Past Co-chairs: Dr. Jack Barth (USA) and Prof. Sung Yong Kim (Korea)
- **WG-35**
  - **Japan: Dr. Tsuneo Ono (Past: Dr. Masahito Hirota);**
  - Dr. Sanae Chiba and Dr. Shinji Uehara are stepping down
- **CPR**
  - Clare Ostle (UK) Past: Dr. Sonia Batten (Canada)
  - MONITOR requests to add Clare Ostle as ex-officio member of MONITOR representing MBA, to replace Sonia Batten. Please see Appendix E

➔**Action:** Science Board to recommend / not recommend addition of Clare Ostle as ex-officio member of the MONITOR committee, representing the North Pacific CPR Survey, and replacing Sonia Batten in this role.

Activities

- **AP-NPCOOS**
  - 2020 PICES Spring School was cancelled due to COVID-19, and any plans to have 2021 will be discussed when COVID-19 risk is reduced.
  - The OceanObs group officially recognized our AP-NCOOS efforts to "Map spatial and temporal coverage by EOV/EBV of long-term sustained **coastal** ocean observations" which focused on the North Pacific initially in the *OceanObs Research Coordination Network* meeting on Feb 16, 2020, in San Diego, CA

- **AP-CREAMS**

2020 Ocean Turbulence PICES Summer School

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports (cont'd)

MONITOR & EG's (cont'd)

- **CPR**
  - The 2020 field season starts in April (no changes to the normal operations). Waiting on a funding decision for the additional Arctic sampling for 2020.
  - CPR workshop was featured in January 2020 PICES Press

Proposals/requests for funding (incl. publications)

- **AP-NPCOOS (no funding requested)**
  - Barth, J. A. et al, 2019: Better Regional Ocean Observing Through Cross-National Cooperation: A Case Study From the Northeast Pacific, Frontiers in Marine Science, 6, doi:10.3389/fmars.2019.00093
  - Lee, E. A., S. Y. Kim, and H. S. Min, 2019: Climatological descriptions on regional circulation around the Korean Peninsula, Tellus A: Dynamic Meteorology & Oceanography, 71:1, 1 - 22 doi:10.1080/16000870.2019.1604058
- **AP-CREAMS**
  - Expect to finish two chapters of EAST-II before ISB [by Joji Ishizaka]
- **WG-35 -(see Agenda Item 9 re: NPESR 3 Synthesis Report)**
- **CPR**
  - IGMETS (International Group for Marine Ecological Time Series) outputs include ~30 peer-reviewed papers (using both data and samples); these are freely available data, accessible through PICES website.(https://pices.int/projects/tcprsotnp/main.aspx)
- **WOA-II**
  - WOA II focuses on the "changes" of ocean environments, human activities and its management from WOA I using best available data.
  - 31 chapters are in place toward the publication in 2020
  - Final version will be confirmed by Group of Experts, the secretariat (DOALOS) and the Bureau (government officers group represented around 20 States), followed by the approval by UN Ad Hoc Working Group as a Whole in Autumn.
  - Discussion of strategy for WOA III (2021-2025) has already begun including on "lessons learned" during the WOA II process. Considering the fact that WOA is not fully visible or used for policy compared to other international assessment reports, e.g. IPCC report and IPBES assessment, we put emphasis on and make it clear its relevance and contribution to SDGs and The Decade of Ocean Science in the summary (Chapter 1) of WOA II.
- **SCOR Working Group-154** "P-Obs" : No updates
- **GOOS Biology and Ecosystems Panel**: No updates

AP-NPCOOS Advisory Panel on North Pacific Coastal Ocean Observing Systems – Presenter: Kim, 5 mins

- Co-Chairs: Jack A. Barth (USA) and Sung Yong Kim (Korea)

AGENDA ITEM 6 – Scientific and Technical Committee Mid-Year Reports (cont'd)

TCODE & EGs - Mid-year reports 2020

TCODE Technical Committee on Data Exchange – Presenter: Gann, 5 mins

- Chair: Jeanette C. Gann (USA)
- Vice-Chair: Peter Chandler (Canada)

AGENDA ITEM 7 – Expert Group Updates – Presenters: Trainer, Batten, 30 mins

WG 39: Joint PICES/ICES/PAME Working Group on an Integrated Ecosystem Assessment for the Central Arctic Ocean

- EXTENDED in 2018 to OCT 2021

➔Please see Appendix F

WG 43: Joint PICES/ICES Working Group on Small Pelagic Fish (ICES WGSPF)

- Approved at PICES-2019.
- Membership is confirmed, although some changes are possible
- A "kick-off" meeting of the joint Working Group was held in Copenhagen in January 2020
-
- ICES-PICES Working Group on Small Pelagic Fish
- Brief Summary of kick-off meeting, next steps and timeline
- The kick-off meeting of the ICES-PICES WGSPF took place in Copenhagen, Denmark from Monday March 9th to Wednesday March 11th. It was attended by 31 scientists (11 via WebEx) from 17 nations.
- Engraulid and Clupeid fishes are targeted (anchovies, sardines, sprats, herrings). Three Task Forces (TF), were identified, with TF1, TF2 and TF3 having 5, 3, and 3 activities, respectively. The full list needs to be built after the membership from PICES and ICES are confirmed. Ideally, each activity will have co-leaders, one from western and one from eastern hemisphere. We requested that participants identify their interested activities, and many did. Attendees to the Copenhagen meeting were asked to show preferences for specific activities (see Appendix XX). Individuals can participate in multiple activities as desired. Tangible products such as research papers, primary literature publications, and proposals for topic sessions at PICES or ICES are expected. Members not participating in any activity (or topic) will be removed from working group. New members will be added as necessary based on interest/expertise.
- Brief WebEx meetings were held on Tuesday March 24th 08:00 (CET Europe), Tuesday 24th 16:00 JST, which is 23:00 Monday 23rd PTZ and two weeks later on April 7th.
- WG-SPF (Joint ICES and PICES activity) is chaired by: Akinori Takasuka (atakasuka@mail.ecc.u-tokyo.ac.jp), Ignacio Catalan (ignacio@imedea.uib-csic.es), Myron Peck (myron.peck@uni-hamburg.de), and Ryan Rykaczewski (ryan.rykaczewski@noaa.gov)
- Task Force 1: Ecological Process Knowledge (EPK)
- Activity 1: Critical review, evaluation and testing of hypotheses (1 topic) Activity 2: Life cycle closures (IBMs for ELHS) – bottlenecks and gaps in knowledge (various topics) Activity 3: Drivers of spatial distribution and phenology (habitats; multiple topics) Activity 4: Food-web dynamics (links to prey, predators and competitors) (multiple topics) Activity 5: Internal and external drivers of growth, reproduction and survival (climate, fishing...)

- Task Force 2: Translating process knowledge (TPK)
- Inputs and outputs to management structures and policy advice (AKM)
- Activity 6: Survey design / monitoring (knowledge from fishers), citizen scienceActivity 7: Improving short-term forecasts and/or long-term projections
- Activity 8: Improvements to management (knowledge to fishers, indicators, stock assessments, Management Strategy Evaluation) – need leaders and more ideas for ecosystems that are non-target.
-
- Task Force 3: Social ecological approaches (SEA)
- Activity 9: Networks, vulnerability and opportunities of dependent human communities. Activity 10: Quantifying trade-offs in goods and services (end-to-end models) Activity 11: Bioeconomic modelling (including stakeholder engagement; need confirmed participants) Timeline for WGSPF group activities

24th March 2020 – confirm members; Early April – have leaders identified; co-chairs develop the SSC for the symposium considering region, disciplinary and gender; April – leaders of activities that might benefit from other ICES WG should reach out to groups prior to spring workshops; mid-May 2020 – leaders and group members propose theme sessions for the symposium; mid-late May 2020 – co-chairs will work to confirm location, venue and dates of symposium (Mediterranean region preferred; tentatively Dec 2021 symposium; possible delay to Spring 2022)

WG ONCE - ICES/PICES Ocean Negative Carbon Emissions (ONCE)

➔**Action:** SB Please see Appendix F. Please review proposal for WG ONCE.

➔**Action:** SB decision to recommend or not recommend new working group.

GRAFY Joint ICES/PICES Working Group on Impacts of Warming on Growth Rates and Fisheries Yields

➔**Action:** SB Please see Appendix F. Please review proposal for WG GRAFY.

➔**Action:** SB decision to recommend or not recommend new working group.

WG 44 Joint PICES/ICES Working Group on Integrated Ecosystem Assessment for the Northern Bering Sea - Chukchi Sea (NBS-CS)

➔**Action:** SB Please see Appendix F for WG 44 Status report.

WG CHANGE

- For information only at this time.
- At PICES-2019, a proposal for a Study Group on "Correlating Habitats using Artificial Intelligence, Numerical models and Gathered Empirical data" (CHANGE) was proposed by ECS Dr. Amber Holdsworth, based on the outcome of the Workshop on the "Application of machine learning to ecosystem change issues in the North Pacific" October 17, 2019.
- Science Board agreed it was not necessary to begin with a study group and recommended that it proceed straight to a working group pending a change in terms of reference.
- PICES-2019 Action: Dr. Di Lorenzo to work with Dr. Holdsworth to develop terms of reference for a working group.
- Defer to PICES2020.

SG-IMCE Study Group: Impacts of Mariculture on Coastal Ecosystems

➔Action: Robin to provide update at meeting.

AGENDA ITEM 8 – Committee Action Plans - Do we need them? Presenter: Trainer, 10 mins SB, 10 mins

- Intended to provide a framework guidance for activities within each committee
- Intended to be communicated in advance to expert groups
- See sample Action Plan on next page for discussion
- Discussion questions:
    - Will goals be the same for every Committee?
    - Is the vision that Action Plans be renewed every 3 years?
    - Will there be a report out to SB on Committee progress every 3 years or is this done only for each project, WG and Section within each Committee?
- Is a synthesis for each Committee useful, or is having a Committee Action Plan more work for already-burdened Committee chairs?

➔**Action:** SB to discuss role of Action Plans for Committees
➔**Action:** SB to work on Action Plan framework over the summer with the goal of bringing recommendations and plan to PICES-2020 for discussion and possible implementation.

Sample Action Plan – for discussion

POC – 2019 - POC Action Plan

POC Mission Statement

- To promote and coordinate research and facilitates exchange of information and data on the impacts of
- ocean climate variability and change on living marine resources and human societies, on scales ranging
- from sub-seasonal to millenial and sub-mesocale to basin-scale.

Goal 1: Foster collaboration among scientists within PICES and with other multinational organizations

- Coordinate research and communication among international organizations and programs focusing on climate-ecosystem interactions, including CLIVAR, PACON, WESTPAC, and IOC through implementation of the UN Decade of Ocean Science.
- Facilitate partnerships with organizations and programs, within and outside of PICES, with interests in understanding North Pacific climate processes and impacts.
- Participate in and contribute to organization of scientific fora to promote North Pacific climate research.

Goal 2: Understand the status and trends, vulnerability and resilience, of marine ecosystems

- Promote coordinated activities dedicated to understanding physical and chemical processes in the North Pacific, their impacts on ecosystems, and their current status and trends.
- Facilitate the development of modeling frameworks to improve climate and ecosystem predictability, and guide research and communication about the drivers and impacts of extreme events.
- Communicate the status and trends of North Pacific climate conditions to the PICES and broader scientific communities.

Goal 3: Understand and quantify how marine ecosystems respond to natural forcing and human activities

- Lead PICES efforts for improving understanding and advancing predictability of North Pacific climate variability and change, through guidance of collaborative research projects, parenting of Expert Groups, and organizing sessions and workshops.
- In the near term, a research focus is on understanding the drivers, impacts and predictability of extreme events, and diagnosing the links between coastal ecosystems and large-scale climate with a focus on multiscale processes.

Goal 4: Advance methods and tools

- Advance the development of regional to basin-scale models of North Pacific physics and biogeochemistry, including seasonal forecasts and multi-decadal projections.
- Develop modeling toolkit to facilitate research and operational forecasts throughout the North Pacific.
- Contribute to the training of early career scientists on the development and use of models.
- Promote advanced observational technologies and the rapid dissemination of data to the PICES community and other stakeholders.

Goal 5: Provide relevant scientific information pertinent to North Pacific ecosystems that is timely and broadly accessible

- Provide data, products and information on North Pacific oceanographic conditions and climate variability and change to the PICES and broader scientific community through peer-reviewed publications and other PICES communication outlets.
- Contribute to a publication of a special journal issue on North Pacific climate and ecosystem predictability, the North Pacific Ecosystem Status Reports, and contribute to other special issues on emerging issues of interest to PICES.

Goal 6: Engage with early career scientists to sustain a vibrant and cutting edge PICES scientific community

- Promote the engagement of early career scientists in the work and leadership of POC and PICES, including the organization of Summer Schools on ocean processes, climate variability and change, methods of ocean modeling and observing, data analysis and management, and impacts of extreme events.
- Work through NEAR-GOOS, SOLAS and other PICES partners to support the participation and involvement of young scientists in PICES meetings and projects.
- Support and participate in the creation of a professional development program for early career scientists within PICES.

Conference Call #3 – See table on cover to determine local call time

AGENDA ITEM 9 – NPESR3 – Presenter: Batten, 10 mins

Third North Pacific Ecosystem Status Report

Please see Appendix G for Third North Pacific Ecosystem Status Report

➔Action: SB to review Draft NPESR3:

- **DRAFT NPESR3 sent by separate cover, as noted in APPENDIX G**
- 2020-ISB_APPENDIX_G_Draft_NPESR3_SynthesisReport_Apr2020

➔Action: SB to recommend / not recommend publication of NPESR3

AGENDA ITEM 10 – Greener PICES Meetings – Presenter:Batten, Trainer, SB 30 mins

Please see Appendix H for supporting information on greener meetings

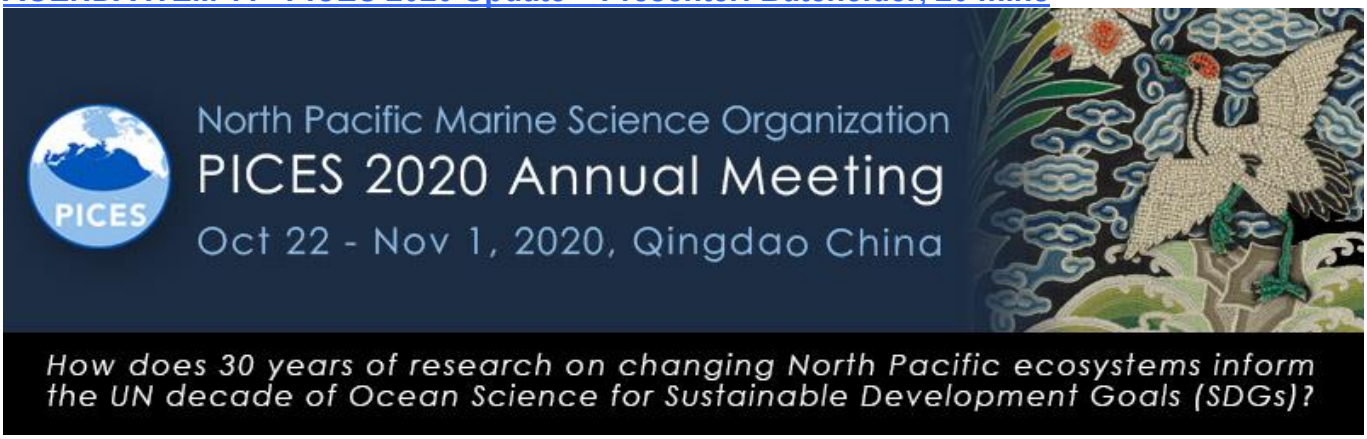
- *A year without conferences? How the coronavirus pandemic could change research,* Nature, 16 March 2020 https://www.nature.com/articles/d41586-020-00786-y

- *Information on American Meteorological Society carbon offsets for meetings: https://www.ametsoc.org/index.cfm/ams/meetings-events/attendees/carbon-offsets/*

- In Appendix H:
  Subject: Thinking about carbon: A preliminary carbon footprint for MSEAS air travel
  Date: Thu, 27 Feb 2020 15:27:12 -0800
  From: "Robin Brown" <Robin.Brown@pices.int>

➔**Action:** SB to brainstorm how to make future PICES meetings greener:
- Remote meetings
- Satellite meetings
- Carbon offsets as part of conference fees

AGENDA ITEM 11 –PICES 2020 Update – Presenter: Batchelder, 20 mins



See https://meetings.pices.int/meetings/annual/2020/PICES/schedule for current draft schedule of Topic Session and Workshop descriptions.

Please see Appendix I for Draft Schedule of PICES 2020.

SCOPE

For 29 years, PICES has conducted investigations of North Pacific ecosystems. There has been a significant focus on multidecadal ecological processes and a more recent emphasis on the impacts of changes in the ocean on the human societies that rely on the North Pacific. The FUTURE Science Plan has identified several important science questions about the status and future of North Pacific marine ecosystems. As a result, PICES scientists are well-positioned to contribute to the United Nations Decade of Ocean Science for Sustainable Development. It is now urgent for PICES scientists to identify the most important science questions which must be answered to achieve the objectives of the Sustainable Development Goals and to suggest effective ways to answer these questions, mobilizing the coordination within PICES and collaborations with other partners.

We welcome submissions for topic sessions and workshops that address these issues, including : 1) What are the greatest issues of concern regarding the status and health of the North Pacific Ocean, 2) Are there critical science issues for ocean Sustainable Development Goals that PICES is not addressing? and 3) What kind of blueprint is necessary to facilitate the coordinated ocean observation, prediction and ecosystem and social service systems for the North Pacific, so that the diverse interests of PICES significantly contribute to the goals and objectives of the UN Ocean Decade.

Please see Appendix I for Draft Schedule of PICES 2020.
→SB – short discussion on alternatives if PICES-2020 is postponed

AGENDA ITEM 12 – UN Ocean Decade – Presenter: Bograd/Trainer, 10 mins

Erin Satterthwaite Presentation - Early Career Scientist Input into UN Ocean Decade: 5 mins

Materials relevant to this agenda item:

Please see Appendix B for PICES/ICES UN Ocean Decade cooperation documentation

Please see Appendix J for UN Ocean Decade documentation

AGENDA ITEM 13 – FUTURE OPEN SCIENCE MEETING (OSM) – Presenter: Bograd, 10 mins

- S. Bograd to present information on planning for FUTURE Open Science Meeting.

Please see Appendix K for scope of previous FUTURE OSM,

- **See Appendix K** for scope of previous FUTURE OSM, April 15 - 18 2014, Kohala Coast, Big Island, Hawaii, USA. https://www.pices.int/meetings/international_symposia/2014/2014-FUTURE-OSM/schedule.aspx

AGENDA ITEM 14 – PICES-sponsored conferences / Symposia – Presenter: Brown, Batchelder, 10 mins

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ECCW05 Norway

- Local Host: Institute of Marine Research, Norway
- Venue: Bergen, Norway
- Proposed dates: 8-12 May 2023
- Principal local host contact: Geir Huse (Geir.Huse@hi.no)

➔Action: SB to identify PICES leadership team:

- **One** Symposium Convenor
- **Two** Symposium Coordinators (recommend Sonia Batten and Hal Batchelder)
- **3 – 5** scientists from PICES for the Scientific Steering Committee. At least one of these should be drawn from S-CCME
- (E.g. see https://meetings.pices.int/meetings/international/2018/climate-change/organizers).

PICES International Year of the Salmon (IYS)

➔Please see Appendix L for additional information on this agenda item

- Local Host: NPAFC IYS North Pacific Steering Committee Meeting
- Venue: Blue Horizon Hotel, Vancouver, BC
- Proposed dates: February 26-27, 2020
- Principal local host contact: Mark Saunders (NPAFC/IYS)

ICES / PICES ZPS7 (7th Zooplankton Production Symposium)

- Local Host: CSIRO
- Venue: Grand Chancellor Hotel, Hobart, Tasmania
- Proposed dates: March 13 - 18, 2022
- Principal local host contact: Dr. Anthony Richardson (CSIRO)

➔Action: SB to identify PICES members to serve on ZPS7 Scientific Steering Committee:

PICES to identify 1-2 members to serve on the Scientific Steering Committee for the ZPS7. To include:

1. A zooplankton ecologist from the BIO committee; and,
2. If a second member is needed, they might be from any reasonable discipline. The convenors also wish to have an SSC member from China, which may be a good second choice for PICES.

International Symposium on Small Pelagic Fish:

- "Small Pelagic Fish: New Frontiers in Science for Sustainable Management"
- Co-conveners: Marta Coll (Spain, ICES), Myron Peck (Germany, ICES), Ryan Rykaczewski (USA, PICES), Ignacio Catalán (Spain, ICES), Akinori Takasuka (Japan, PICES) and Miguel Bernal (FAO-GFCM).
- Venue: Barcelona, Spain
- Proposed dates: Early December 2021
- Note: Location, venue, and dates of the symposium are expected to be confirmed by WGSPF Co-Chairs by mid-May 2020. Though Barcelona is a primary option, the Mediterranean region in general is the target. The tentative time period is still early December 2021, but the symposium may be delayed until spring 2022.

➔Please see Appendix L for additional information on this agenda item.

AGENDA ITEM 15 – Capacity Building – Presenter: Batchelder, 10 mins

Summer Schools/Conferences co-sponsored by PICES			
Year	**Event**	**PICES funding for ECS from PICES member countries**	**Location**
2022	ICES/PICES ECS 2022	TBD	TED
17-21 August 2020	IMBeR ClimEco7 Summer School on "Interdisciplinary ocean science for sustainable development" *- note: postponed until August.* • Original request for the Cabo Verde venue was not approved by SB. • Does SB wish to approve the likely less expensive opportunity to partially support ca. 3-5 students to Vancouver IMBeR ClimEco7 summer school →Action: SB to determine the extent of support to recommend for ECS for this summer school.	PICES would like to provide some financial support to students/ECS to attend (3-5 partial supports?) TBC - $7500 CAD?	Originally in Cabo Verde, now moved to Vancouver, Canada.
2020	AP-CREAMS led Summer School on Ocean Turbulence →Action: SB to determine the extent of support to recommend for this summer school. • To be determined by SB at ISB and by GC $9000USD to support instructors; support not requested for students travel/ participation in the Summer School, which is highly unusual.	Financial Request: $9000USD to support instructors; support not requested for students travel or participation.	Qingdao, China
Held Feb 21 - 23, 2020	Pacific Ecology and Evolution Conference (PEEC 2020) https://peec2020.wordpress.com/	$1500 CAD toward capacity building activities approved by SB and GC at PICES-2019	Bamfield, Canada
Jun17–21, 2019	IMBeR Open Science Conference	4 ECS: 2 from Canada, 1 from Japan, 1 from China	Brest, France
April 21, 2019	Early Career Scientists Day (during SOLAS Open Science Conference	3 ECS: 2 from Japan, 1 from Canada	Sapporo, Japan
Apr 21–29, 2019	SOLAS Open Science Conference	2 ECS from China	Sapporo, Japan
Feb 22–24, 2019	Pacific Ecology and Evolution Conference (PEEC 2019)	$1,500 towards capacity building activities	Bamfield, Canada

Please see Appendix M for additional information on past Summer Schools and Conferences co-sponsored by PICES.

AGENDA ITEM 16 – PICES 2022 – Presenter: Brown, Trainer, 10 mins

- What compromises are we willing to make to have a joint PICES/ICES Science Conference in 2022?
- This would require Expert Groups to give up much face-to face meeting time to be replaced with meetings by correspondence/conference call in the summer.

"Council instructed the Executive Secretary to continue to explore the option for a joint ICES/PICES Annual Meeting and to provide an evaluation of the benefits and additional costs for the Organization and Contracting Parties for consideration by the Finance and Administration Committee at PICES-2019."

I think the general rules would be:

1. The science meeting part (think ASC) cannot be longer than 5 days.
2. It would have to be hosted in North America. I don't think PICES can live with decamping to Europe and ICES can't live with an Asian location. The USA is interested in exploring this option when they are slated to host PICES-2022.
3. Numbers would have to be less than 1000 to be sensible, I think. ICES had 762 this year and our registration is looking like 550 to 600, possibly more.
4. PICES is probably unwilling to have a second big meeting elsewhere/at another time of year to deal with the "business" of the organization. For better or worse, that means that our expert groups would meet PRIOR to the Science Conference. I imagine that our executive groups (SB, F&A and GC for us; SCICOM and Council for you?) would meet separately and together on the weekend AFTER the Science Conference. I expect that these executive groups would have to agree to simplify their usual agenda in order to allocate enough time to the JOINT discussion. I think PICES could manage to do this.
5. Most PICES expert groups would need to meet by correspondence/video conference (possibly multiple times) prior to this Annual Meeting
6. In a more schedule-like format, what I have in mind is:

Days	**Activity**	**PICES comments**
Friday Saturday Sunday	Expert groups meet	PICES "Business" meetings (SB; F&A)
Monday - Friday	Joint ICES/PICES science Conference	
Saturday Sunday	Most participants go home SB and SCICOM meet together and separately Councils meet together and separately	PICES needs to formally adopt a budget and Science Board recommendations. (SB and GC)
Monday	Clean up	

AGENDA ITEM 17 – PICES Publications – Presenter: Batchelder, 5 mins

Publication and Editors	Approved	Expected publ. date/comment
1. *Deep-Sea Research II*—special issue resulting from the 2018 Pacific Transition Symposium (April 24-26, 2018, La Paz, Mexico); **Managing Editor:** Salvador Lluch-Cota, **Guest Editors:** Sachihiko Itoh, François Colas, Shingo Kimura, Angelica Peña, Phoebe Woodworth-Jefcoats	PICES-2017	2019 Vol. 169-170 Open Access, includes Editorial, 19 original articles
2. *Deep-Sea Research II*—special issue resulting from the 2017 Small Pelagic Fish Symposium (Victoria, BC, March 2017); (**Guest Editors**: Jürgen Alheit, Ryan Rykaczewski, Svein Sundby, Manuele Di Lorenzo	PICES-2017	2019 Vol. 159 Open Access, includes Editorial, 15 original articles
3. *Marine Ecology Progress Series*—special issue resulting from the 2017 Small Pelagic Fish Symposium (March 6-11, 2017, Victoria BC); **Editors**: Jürgen Alheit *et al*.	PICES-2017	2019 Vol. 617-618 Open Access, includes Introduction, 22 original articles
4. *ICES Journal of Marine Science*—special issue resulting from the 4th International Symposium on "The effects of climate change on the world's oceans" (June 4–8, 2018, Washington, DC) **Overview article**: Anne B. Hollowed, Manuel Barange, Véronique Garçon, Shin-ichi Ito, Jason S. Link, Salvatore Aricò, Harold Batchelder, Robin Brown, Roger Griffis, Wojciech Wawryzynski	PICES-2018	2019 Vol 76, Issue 5 12 articles (including 2 open access)

5. *Progress in Oceanography*—special issue dedicated to the memory of Dr. Bill Peterson; **Managing Editor:** Hal Batchelder; **Review Editors:** Skip McKinnell, Hans Dam, Eric Bjorkstedt, So Kawaguchi; **5 papers currently published and online** **Overview article**: Schwing, F. B., M. J. Sissenwine, H. Batchelder, H. G. Dam, J. Gomez-Gutierrez, J. E. Keister, H. Liu, J. O. Peterson. 2019. William (Bill) Peterson's contributions to ocean science, management, and policy. https://doi.org/10.1016/j.pocean.2019.102241 Kobari, T., A. R. Sastri, L. Yebra, H. Liu, and R. R. Hopcroft. 2019. Evaluation of trade-offs in traditional methodologies for measuring metazooplankton growth rates: assumptions, advantages and disadvantages for field applications. https://doi.org/10.1016/j.pocean.2019.102137 Cabrol, J., Nadalini, J-B., Tremblay, R., Galbraith, P. S., Nozais, C., Starr, M., Plourde, S. and Winkley G. 2019. Seasonal and large -scale spatial variability of the energy reserves and the feeding selectivity of Meganyctiphanes norvegica and Thysanoess inermis in a Subarctc environment. https://doi.org/10.1016/j.pocean.2019.102203 Satterthwaite, E. V., S. G. Morgan, J. P. Ryan, J. B. J. Harvey and R. C. Vrijenhoek. 2020. Seasonal and synoptic oceanographic changes influence the larval biodiversity of a retentive upwelling shadow. https://doi.org/10.1016/j.pocean.2019.102261 Benkort, D., D. Lavoie, S. Plourde, C. Dufresne and F. Maps. 2020. Arctic and Nordic krill circuits of production revealed by the interactions between their physiology, swimming behavior and circulation. https://doi.org/10.1016/j.pocean.2020.102270	PICES-2017	2020 ~40 ms submitted ~5 rejected, ~5 accepted, ~30 in review and are in various stages
6. *Progress in Oceanography*—Synthesis paper by WG 38 members	PICES-2019	To be submitted in early 2020 – status: stalled
7. *Environmental Pollution*—special issue of 3–4 review papers by WG 42 based on the mini review in SG-MMP final report. **Editors**: TBD	To be approved at ISB-2020	
8. Barth, J. A. et al, 2019: Better Regional Ocean Observing Through Cross-National Cooperation: A Case Study from the Northeast Pacific, *Frontiers in Marine Science,* 6, doi:10.3389/fmars.2019.00093		2019
9. Lee, E. A., S. Y. Kim, and H. S. Min, 2019: Climatological descriptions on regional circulation around the Korean Peninsula, *Tellus A: Dynamic Meteorology & Oceanography,* 71:1, 1 - 22 doi:10.1080/16000870.2019.1604058		2019
10. *Frontiers in Marine Science* special issue on North Pacific Climate and Ecosystem Predictability on Seasonal to Decadal Timescales resulting from the 2019 Qingdao workshop and papers from the PICES-2019 Annual Meeting in Victoria. **Editors:** S. Minobe, A. Capotondo, F. Chai,M. Jacox, M Nonaka,and R. Rykaczewski.	To be approved at ISB-2020	Papers expected to be submitted by end of April 2020; expect ~15-20 manuscripts to be submitted.

PICES Scientific Reports		
1. Final Report of the Working Group 27 on *North Pacific Climate Variability and Change.* **Editors:** E. Di Lorenzo, M. Foreman and S. Minobe	PICES-2014	Tracked changes sent to Dr. Di Lorenzo May 2019. Dr. Di Lorenzo to update on progress.
2. Final Report of the Working Group 28 on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors*. **Editors:** I. Perry and M. Takahashi	PICES-2014	Tech. editing in progress, TB published before PICES-2020
3. Report on "*Oceanography of the Yellow and East China Seas (EAST-II region)"* **Editors**: J. Ishizaka, T. Matsuno, J. Zhang, J-H. Lee, S. Kim, D. Xu, Y. Fei, S.-M. Liu and V. Lobanov	PICES-2013	Waiting for replies from 2 subchapter authors to finalize revision (email as of Mar. 13, 2020)
4. Final Report of Working Group 30 on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* **Editors:** Yusheng Zhang and Kathryn Higley	PICES-2017	MEQ to report status
5. Final Report of Working Group 31 on *Emerging Topics in Marine Pollution* **Editors:** Peter Ross, Won Joon Shim, Olga Lukyanova	PICES-2017	In the queue for tech. editing, TB published before PICES-2020
6. Final Report of Working Group 32 on *Biodiversity of Biogenic Habitats* Editors: Janelle M. R. Curtis and Masashi Kiyota	PICES-2018	WG 32 report submitted to BIO April 8 2020
7. Final Report of Joint PICES/ISC Working Group 34 on *Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish*	PICES-2019	Draft final submitted to FIS Oct. 2019. Dr. Jin to provide update.
8. Final Report of Working Group 36 on *Common Ecosystem Reference Points across PICES Member Countries*	PICES-2019	TB submitted by PICES-2020
9. Final Report of Working Group 38 on *Mesoscale and Submesoscale Processes*	PICES-2019	TB submitted by PICES-2020
10. Inniss, Lorna, Alan Simcock, Amanuel Yoanes Ajawin, Angel C. Alcala, Patricio Bernal, Hilconida P. Calumpong, Peyman Eghtesadi Araghi et al. "The first global integrated marine assessment." *United Nations. Accessed on 5th February* (2016). Chapter 36C Therriault, T., Park, C., & Rice, J. (2016). C. North Pacific Ocean.		No action needed?
Other		
PICES Special Publication 5 — "Ocean Acidification and Deoxygenation in the North Pacific Ocean", **Editors:** James R. Christian and Tsuneo Ono, 115 pp.	PICES-2017	Special Publication 5 2019
PICES Special Publication 6 — ADRIFT Project Special Publication report titled "The Effects of Marine Debris Caused by the 2011 Tsunami", **Editors:** Cathryn Clarke Murray, Thomas W. Therriault, Hideaki Maki, and Nancy Wallace. 490 pp.	PICES-2017	Special Publication 6 2019

PICES Special Publication 7 – NPESR synthesis report	TBD	Needs a recommendation from SB to publish when complete
Outreach brochure based on the PICES Scientific Report No. 47 (2014) on "*Economic and social impacts of HABs on aquaculture and fisheries*"	PICES-2014	Pending from Secretariat; needs minor actions—mostly harmonizing monetary effects across nations/years; Still worth publishing—Q for SB?
Supplementary chapter on Marine Ecosystems of the North Pacific Ocean 2003-2008: Japan/East Sea (K. Kim, V. Lobanov, T. Gamo, S. Jung, Y. Zuenko and J. Ishizaka)	PICES-2011	Tech. edited in 2016. In review by the two contracting parties since then.
WG 30 Radioactivity in North Pacific; outreach brochure for policy makers and stake holders	PICES-2017	First draft is available; Hal recommended reducing the length of the document by deleting a few less essential items in the brochure; Secretariat to work with WG-30 after completion of WG report pending approval.

AGENDA ITEM 18 – ISB PICES 2021 – Presenter: Brown/Trainer, 5 mins

➔**Action:** For SB to consider for further discussion at PICES2020

Holding inter-sessional meetings of Science Board has become an integral part of PICES management, providing an essential opportunity for mid-term reviews of scientific activities and in-depth discussions on administrative issues of the Organization. The Finance and Administration Committee and Governing Council have reiterated their support for the concept of inter-sessional meetings, but stressed that that, given meeting costs (including time commitment of the members), an inter-sessional meeting should be held only if the agenda is substantive. Inter-sessional Science Board meetings have been held without break since 2003, thus indicating the need for Science Board to discuss science issues on a more frequent time scale.At PICES-2015 Science Board agreed that an inter-sessional Science Board meeting should be held annually unless Science Board indicates otherwise.

Rotating the venue for these meetings is highly desirable, especially if overall costs of the inter-sessional meeting for the Organization are kept to a minimum. This approach has been implemented by obtaining financial support from the country hosting the inter-sessional meeting and by having the meeting in conjunction with other PICES events (see Table below).

At PICES-2018, several inter-sessional meetings were proposed in conjunction with ISB-2019: a FUTURE SSC meeting; a NPESR3 synthesis workshop, and a WG 36 (*Common Ecosystem Reference Points across PICES Member Countries*)workshop to identify the existence of thresholds in marine ecosystem-driver response relationships (later cancelled).

Date	Venue	Other events held in conjunction with ISB in the past decade
2020	~~Vladivostok, Russia~~ Conference calls	FUTURE SSC
2019	Yokohama, Japan	FUTURE SSC (3 days); WG 35 (NPESR3; 4 days – 1 jointly with SB)
2018	Sidney, Canada	(3 days)
April 2017	Honolulu, USA	FUTURE SSC (3 days); WG 35 (NPESR3; 2.5 days)
May-June 2016	Hangzhou, China	Inter-sessional GC Meeting
May 2015	Busan, Korea	–
April 2014	Big Island, USA	FUTURE Open Science Meeting
May 2013	St. Petersburg, Russia	Joint PICES/ICES workshop on "*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*"
May 2012	Busan, Korea	FUTURE roadmap workshop
April 2011	Honolulu, USA	FUTURE workshop on "*Indicators of status and change within the North Pacific marine ecosystems*"
April 2010	Sendai, Japan	PICES/ICES/FAO international symposium on "*Climate change effects on fish and fisheries*"

AGENDA ITEM 19 – Virtual Science Board Meetings – Presenter: Trainer, 10 mins

- Thoughts on effectiveness,
- Suggestions for improvements
- Review conduct of calls

AGENDA ITEM 20 – Code of Ethics for the Operations of PICES – Presenter: Brown, 5 mins

At PICES-2019, the Governing Council directed:

2019/A/13: A Code of Ethics for the operations of PICES (members and Secretariat staff) to promote the fair, transparent and equitable treatment of all participants. Council directs that the Executive Secretary work with Science Board Chair and F&A to:

i. Review best practices, policies and experience of similar organizations
ii. Draft new policies and practices for discussion by expert groups at the Intersessional Science Board meeting in Spring 2020 and by correspondence between ISB and PICES-2020.
iii. These policies and practices to be reviewed by Science Board and F&A at PICES-2020 for potential adoption at PICES-2020 by Council.

The ICES Code of Conduct (Appendix O) is provided as a possible model for such a Code. Science Board members should review and be prepared to comment on this. In the (likely) event that we have insufficient time for discussion, this issue will be conducted by correspondence and an additional video conference call.

➔**Please see Appendix O for additional information**

AGENDA ITEM 21 – Science Board / Governing Council Decisions - Report in Appendix P

Presenter: Brown 5 mins

The Executive secretary will provide an overview of the status of implementation of SB / GC decisions from PICES-2019. The detailed list (Appendix P) will be provided by email following distribution of the briefing book.

AGENDA ITEM 22 – PICES Partners List – For Science Board Review

➔**Please see Appendix Q for additional information**
➔Science Board Members - Please review Appendix Q: Organizations / Programs relevant to PICES
➔Science Board Members - Please send any required revisions to: Lori.Waters@pices.int

APPENDICES – Contents

Appendix A – Mid Year Report from FUTURE-SSC

Mid-year report from FUTURE SSC to be provided by Kang / Bograd - materials to be sent via email.

Appendix B –PICES Next Integrative Science Program

Joint letter to ICES and PICES governing councils - UN Ocean Decade

Dear Governing Council members,
As you are aware, PICES and ICES individually have indicated their strong support for the Ocean Decade and have participated in various global and regional planning workshops, including those with a specific focus on the North Atlantic, and the North Pacific hemisphere.

We have also been in active communications with our research partners, key Intergovernmental Oceanographic Commission (IOC) staff and members of the Executive Planning Group for the Ocean Decade. Perhaps more importantly, ICES and PICES have been in regular bilateral discussions on joint ICES and PICES activities for the Ocean Decade. The strategic plans and objectives of both organizations are well-aligned with the Ocean Decade objectives and we have experience in successfully conducting joint research across our organizations and associated networks. Frankly, we believe that ICES, PICES and our associated networks have a great deal of expertise and experience to "bring to the table" for the Ocean Decade priorities and societal outcomes.

We have identified multiple potential project areas, but the leading candidate is an expansion of the current joint ICES/PICES activity on Climate Change and Marine Ecosystems, with an enhanced focus on credible projections of the state of future marine ecosystems, including fish, fisheries and dependent communities. We think this is an activity that ICES and PICES are ideally positioned to lead and is central to the science objectives for our organizations and the Ocean Decade.

It is clear that a substantive contribution to the Ocean Decade will require activities and investments that go beyond the "business as usual" activities of our organizations. In particular, Ocean Decade activities will likely require:

1. An expansion of our activities to other geographic areas, beyond the North Pacific and the North Atlantic. We don't plan to change the constitutions of our organizations. Rather we plan to seek new partner organizations to achieve this for the Ocean Decade period;
2. A larger commitment to capacity building/ capacity development in non-member countries, particularly Small Island Developing States (SIDS) and Least Developed Countries (LDC). We have some limited experience with this;
3. A new commitment to engage/work with indigenous communities and other under-represented groups. We plan to seek new partner organizations to achieve this for the Ocean Decade period;
4. A larger investment in outreach/ocean literacy activities;
5. An increased emphasis on supporting Early Career Scientists/Early Career Ocean Professional and providing roles for them in joint Ocean Decade activities. This will include a gender equality focus. Our organizations have already taken some steps in this direction, including planning for the 5th ICES/PICES Early Career Scientist Conference in 2022 with an Ocean Decade theme. Canada has agreed to be the local host for this event.

IOC is also consulting directly with their member states and IOC representatives in your countries will have received documents for comment. We have attached the e-mail that was sent out by IOC asking for comments on the Zero Draft of the Ocean Decade Implementation Plan, for your further reference.

We encourage you to:

- connect with these representatives and discuss the potential role of joint ICES/PICES activities (not restricted to the project discussed above).
- Review the draft Implementation Plan for the Ocean Decade keeping in mind the possibility of joint ICES/PICES projects.
- Consider providing support for joint ICES/PICES activities as part of any national strategy to contribute to the Ocean Decade. As you can see from the information above credible Ocean Decade projects imply a scaling-up of current science activities and investments in non-traditional areas for our organizations for the Ocean Decade period.

We would be happy to discuss these ideas with you or your representatives.

Appendix B – RE: PICES Next Integrative Science Program

International Marine Science Networks for the Ocean Decade

DRAFT PICES & ICES DOCUMENT ON PLANNED AND EXISTING AREAS OF COOPERATION AND AN INVITATION TO OTHER GROUPS AND ORGANIZATIONS TO JOIN OUR EFFORTS

IN SUPPORT OF THE **UNITED NATIONS DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT**

The UN Decade of Ocean Science for Sustainable Development provides an unprecedented opportunity to strengthen and expand the collaborative science between ICES and PICES and with other partner organizations. ICES and PICES are the principal Intergovernmental Marine Science Organizations in the Northern Hemisphere. These organizations play leading roles in advancing and communicating scientific understanding of marine ecosystems for societal outcomes. ICES and PICES are comprised of an array of different sectors, from academia, policy, civil society, industry, and foundations throughout the Northern Hemisphere. Our partnership brings together diverse networks to increase the overall capacity to conduct ocean science in support of sustainable development and to foster the range of skills necessary to support broad and overarching marine science goals. Our vision is to bring about transformational science by building our strong record of success and establishing a global network of groups and organizations to facilitate progress in ocean science and sustainable development during the UN Decade of Ocean Science (2021-2030).

Our approach is to support and leverage ICES, PICES, and partner member countries' priorities and initiatives related to the Ocean Decade, by emphasizing areas of mutual research interest and policy needs, including climate change, fisheries and ecosystem-based management, social, ecological and environmental dynamics of marine systems, and coastal communities and human dimensions. New and innovative activities will be leveraged through modest investments that build upon existing structures and processes. We find the Ocean Decade cross-cutting inclusivity themes relating to gender, early career scientists, indigenous communities and developing countries especially compelling and will bring strong and effective leadership in these areas.
Financial and other resources made available by member countries will be used for specific and well-defined activities such as workshops and conferences or directed to address national priorities that support Ocean Decade societal outcomes.

PICES and ICES foster international and diverse scientific networks. Through these networks we maintain and expand our collective capacity for producing science that supports the sustainable development of marine ecosystems

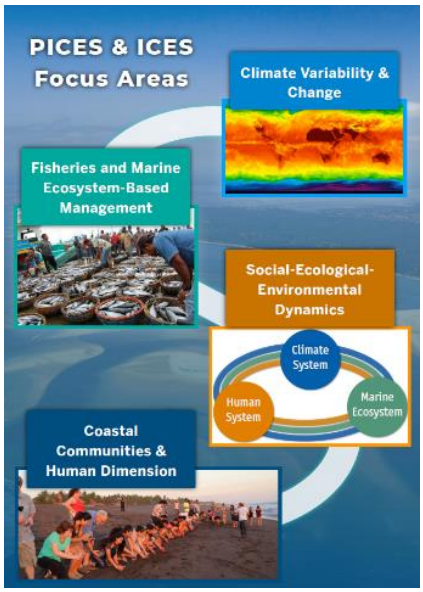
About PICES and ICES

The International Council for the Exploration of the Sea (ICES; www.ices.dk) and the North Pacific Marine Science Organization (PICES; www.pices.int) are intergovernmental organizations that promote and coordinate marine science in the North Atlantic and North Pacific. We have a strong history of effective collaboration and are united in our willingness and capacity to contribute to developing and implementing the science plan for the Ocean Decade, the UN Agenda 2030, and the Sustainable Development Goals.
Together, the ICES and PICES networks include 7000 ocean experts, 900 institutions, 23 countries members in the Northern Hemisphere, and collaborators from Southern Hemisphere countries.

Member Countries: *Belgium, Canada, China, Denmark, Estonia, Finland, France, Germany, Iceland, Ireland, Japan, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, Russian Federation, Republic of South Korea, Spain, Sweden, United Kingdom, and the United States of America.*

ICES and PICES were established through legally binding conventions and commitments from member countries, recognizing the importance of scientific research and coordination of effort, the importance of relating scientific work to national, regional, and global societal objectives, and reconciling resource management and biodiversity conservation objectives. This is evident through the unique and collaborative work of our two organizations, which is strengthened through cooperation with other partners (*see Ocean Decadecross-cutting theme: Partnerships*).

This joint network explicitly covers the North Atlantic, North Pacific, and Arctic, yet engages scientists from throughout the world. Our thematic scope is broad. Working together, and with others, we support science in areas such as climate change effects on marine ecosystems (*understand, estimate, and predict*), fisheries and ecosystem-based management, social-ecological-environmental dynamics, as well as capacity-building and early career ocean professional engagement and development.



Joint Focus Areas:

1. Climate Variability & Change
2. Fisheries and Marine Ecosystem-Based Management
3. Social-Ecological-Environmental Dynamics
4. Coastal Communities & Human Dimension
5. International Capacity Building & Enhancement
6. Early Career Ocean Professional Development

In addition, our organizations have a focus on Clean Ocean Societal Priorities such as monitoring and management of pollutants and harmful algal blooms.

Ongoing and planned activities by ICES and PICES directly address priority focus areas that will support the societal objectives of the Ocean Decade (**Figure 2**)

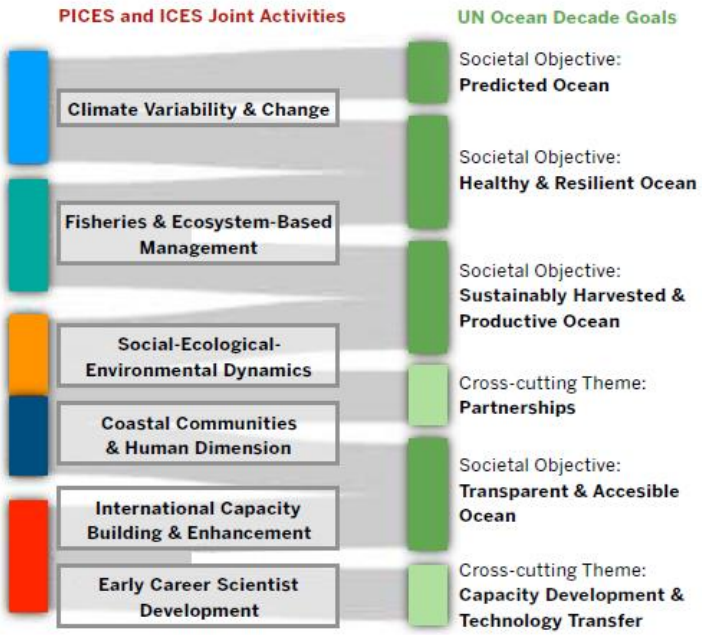


Figure 2: How the PICES and ICES core activities & focus areas map into the societal objectives and crosscutting themes of the Ocean Decade.

1. Climate Variability and Change

The effects of climate variability and change are contributing to destabilization of social and economic activities and communities, affecting governance of marine resources, and threatening geo-political security. ICES and PICES coordinate Northern Hemisphere efforts to understand, estimate, and predict the impacts of climate change on marine ecosystems (Joint ICES-PICES Section on Climate Change Effects on Marine Ecosystems). This work is substantive and diverse and includes themes such as:

- Global assessment of the implications of climate change on the spatial distribution of fish and fisheries
- Seasonal to decadal prediction of climate impacts on marine ecosystems
- Development and evaluation of socio-economic management scenarios
- Development and dissemination of scientific information to support decision-making

Link to Ocean Decade societal objective: A predicted ocean; A healthy and resilient ocean; Sustainably harvested and productive ocean.

2. Fisheries and Ecosystem-Based Management

A healthy and resilient ocean requires strong science to support ecosystem-based decision-making for the management of human activities in our seas and oceans. This ecosystem-based approach seeks to maintain the health of marine ecosystems, including appropriate human use, for the benefit of current and future generations. Our activities in this area include:

- Ongoing development of science and provision of evidence to decision-makers to support resource management and optimize benefits among diverse societal goals
- Development and implementation of tools and assessments to support decision-making:
    - Evaluation of cumulative effects of pressures on marine ecosystems
    - Analyses of trade-offs amongst stakeholders

- Development of regional ecosystem, fisheries, and aquaculture overviews in new areas that provide concise and informative introductions to ecosystem components, , identify the main human pressures, and provide users the opportunity to understand the implications of management decisions in an ecosystem context.
- Inclusion of local, traditional, and stakeholder knowledge

Link to Ocean Decade societal objectives: A sustainably harvested and productive ocean; A healthy and resilient ocean.

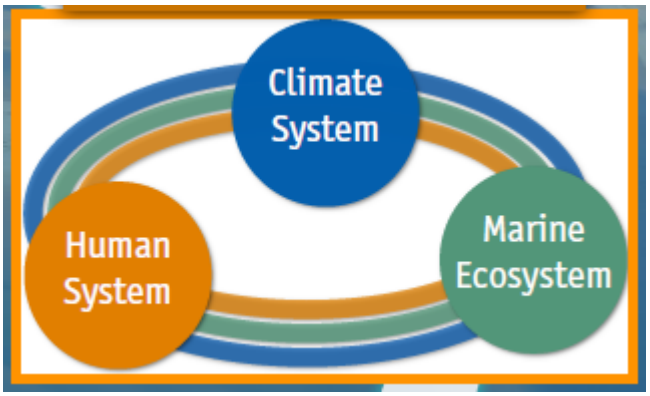
3. Social-Ecological-Environmental Dynamics of Marine Systems

The challenge in enhancing diverse uses of the marine domain is to enable current and future growth in the sustainable blue economy, and the associated development of coastal livelihoods, while also supporting sustainable social, economic, and environmental outcomes. This challenge requires the thoughtful management of human activities to avoid negative impacts on marine and coastal systems. and management of the feedback of these impacts on humans. To fully address this topic, an evaluation of marine socio-environmental-ecological systems (SEES) is warranted (**Figure 3**) and should include:.

- Full inclusion of social and economic data and information within integrated ecosystem assessments
- Exploration of tools to evaluate socio-ecological systems
- Engaging Indigenous communities and other partners (e.g. industry, municipalities, community-based organizations, etc.) in ocean science and management of resources.

Link to cross-cutting theme: Partnerships
Link to Ocean Decade societal objective: A sustainably harvested and productive ocean; A transparent and accessible ocean
Link to example of ongoing effort: https://meetings.pices.int/meetings/international/2020/MSEAS/Background

Figure 3: The PICES and ICES integrated trans-disciplinary approach allows expert groups to co-design and co-develop strategies to understand and predict the social-ecological-environmental dynamics of marine systems.



4. Coastal Communities & Human Dimension

The health and welfare of humans and oceans are inextricably linked. Comprehensive understanding of marine social-ecological systems will require development of methodologies which integrate across these disciplines. Work on integrated ecosystem assessments currently is an area of focus for both organizations and provides the groundwork for moving forward with new partners.

PICES has expanded its influence with under-represented Nations through collaborative projects on seafood safety, marine ecosystem health and well-being, and environmental monitoring using mobile phone technologies, highlighting the connection between sustainable human communities and productive marine ecosystems. We envision that through the Ocean Decade, collaborations with other under-represented countries could be initiated using the tools and technologies developed through PICES partnerships with the Republic of the Philippines, Guatemala, and Indonesia.

Cross-cutting themes for the UN Ocean Decade

5. International Capacity Building & Enhancement

It is important to continue to develop capacity within the global science network in order to respond to the challenges in the ocean with the required science and infrastructure. Specific focus on training, engagement of early career professionals, gender aware planning, inclusion of under-represented voices, and effective communication of science results are critical to meeting the objectives of the UN Ocean Decade and beyond.

- Training early/mid-career professionals
    - Training courses & summer schools
    - Early career scientist symposium (2022)
- Working with partners and offering our infrastructures for capacity development
    - Joint working groups on emerging themes (ICES-PICES and representation from least-developed countries)
    - Improved data management, dissemination and governance
    - Publication series
- Investigating potential to expand education/capacity building to address needs for developing countries and under-represented communities in developed countries
- Developing new approaches to expand our influence while reducing our global carbon footprint

Link to Ocean Decade societal objective: Transparent and accessible ocean.
Link to crosscutting theme: Capacity development and technology transfer.

6. Early Career Ocean Professional Engagement

A key component of the Ocean Decade has been identified as engaging and providing opportunities for Early Career Ocean Professionals (ECOPs) in the context of national and international science and policy fora, since ECOPs will drive transformative change in the conduct and application of science for sustainable development and will ensure the legacy and continuity of the Decade. ICES and PICES have a long history of supporting ECOP participation through travel grants to attend annual meetings and other high-level events and providing professional development opportunities through joint Symposia and Summer Schools (links). These efforts will be strengthened and expanded by linking ICES and PICES ECOP networks to other global ECOP networks to provide additional opportunities for engagement of ECOPs from least developed countries. Key needs and initiatives identified by global ECOPs are to provide professional development and mentoring opportunities, and facilitation of improved communication, such as through a network of networks. As such, ICES and PICES are working with the Ocean Decade ECOP Informal Working Group to develop an Early Career Ocean Professional Development short-course at the start of the Ocean Decade, along with a PICES ECOP network that could be linked to the emerging global Ocean Decade ECOP Network of Networks.

Background info

ICES and PICES collaboration for the UN Decade of Ocean Science for Sustainable Development

ICES and PICES are platforms for science cooperation. Both ICES and PICES have existing capacity and well-developed institutional infrastructures supporting marine science research. This is made possible through legally binding conventions and commitments from member countries, recognizing the importance of scientific research and coordination of effort. This is evident through the individual and joint work of our two organizations, as well as in their cooperation with other partners working in areas such as climate change, ecosystem-based management, the human dimension, as well as the Arctic. The text below provides detailed information about the structure and work of ICES and PICES.

Opportunities:

- Provide input based on ICES/PICES Science Plans, and already agreed science priorities
- Consider a joint "commitment" to one of the upcoming conferences – UN Ocean Conference (2-6 June Lisbon), Our Ocean (17-18 August, Palau),
- The kick-off event of the United Nations Decade of Ocean Science for Sustainable Development will take place in Berlin, Germany, from the 31 May - 2 June 2021. Hosted by the Federal Ministry of Education and Research of Germany.
- Encourage bottom-up contributions from the science network to provide concrete examples of ongoing work – mapping them to the UNDOS societal outcomes (Science highlights – ICES in process of developing a specific series for the North Atlantic Regional Workshop. Example from our science highlights series: http://www.ices.dk/news-and-events/news-archive/news/Pages/Science-highlights-series-long-term-data.aspx)
- Based on existing priorities and joint work, identify areas that ICES and PICES find are in need of further work, stressing the benefits and linkages to regional and global legal frameworks
- Use upcoming ICES and PICES events to further the above, such as:
    - Future ICES-PICES joint conference (TBC)
    - ICES-PICES Early Career science conference 2022
    - ICES and PICES representatives participated in the North Atlantic Regional workshop (7-10 January 2020).
    - ICES representatives are engaged in the planning of the Arctic regional workshop, Copenhagen (29 April – 1 May)
    - 2nd Global Planning Meeting "Building Partnerships for the Ocean we Need", 18-20 March 2020, UNESCO, Paris, France [Cancelled]
    - Synergies in data management/governance/technological innovation in collection/observation and monitoring
    - ICES/PICES/NOAA pilot study in the Arctic - data sharing/protocol standardization

Existing ICES - PICES cooperation

- Climate change effects on the marine ecosystem, including global assessment of the implications of climate change on the spatial distribution of fish and fisheries, and forecasting
- Ecosystem based management of marine resources, including creation of tools, and covering issues such as forage fish interaction, phytoplankton production, bio invasions, environmental interactions of mariculture
- Arctic, both Central Arctic Ocean (CAO) and waters adjacent to the CAO
- Marine social ecological systems, and the upcoming joint conference MSEAS
- Areas of potential cooperation, based on existing cooperation (Biological Diversity in Areas Beyond National Jurisdiction/BBNJ)

See list of past, present and future collaborations in PICES 2019 GC briefing book
Decade of Ocean Science societal objectives:

- A clean ocean
- A healthy and resilient ocean
- A predicted ocean
- A safe ocean
- A sustainably harvested and productive ocean
- A transparent and accessible ocean

Based on previous UN Decade discussions and meetings, the IOC has identified the following four crosscutting themes:

1. Capacity building and technology transfer;
2. Partnerships and financing;
3. Access to information, data, and knowledge; and
4. Communication and awareness raising.

In the current guidance for WGs developed by the IOC for Regional and Global Planning Workshops, there are specific questions that aim to capture the crosscutting themes within the context of each WG. Led by the WG conveners, discussions should provide tangible, concrete actions and ideas, with examples where available, for each of the crosscutting themes.
Embedded within the crosscutting themes mentioned above, there are particular areas of interest for the North Atlantic such as:

- Advancing gender equality;
- Engaging early career scientists;
- Promoting ocean literacy; and
- Engaging Indigenous communities and other partners (e.g. industry, municipalities, community-based organizations, etc.) in ocean science.

Appendix B – RE: PICES Next Integrative Science Program

Links to UN Ocean Decade document and survey for Science Board Review and comment if desired:

→Review the draft UN Ocean Decade Implementation plan: https://on.unesco.org/3a2tO86

→Submit comments prior to closing date of April 17 2020,
via the following Survey monkey response: https://www.surveymonkey.com/r/decade-ip-review

Appendix C – Special Projects – details

PICES / MAFF FishGIS

"*Building capacity for coastal monitoring by local small-scale fishers*"

Term: November 2017 – March 31, 2020

Project Science Team Co-Chairs: Mitsutaku Makino (Fisheries Research and Education Agency, Japan), Mark Wells (University of Maine, USA)

The overall goal of the project is to enhance the capacity of local small-scale fishers to monitor coastal ecosystems and coastal fisheries in Pacific Rim developing countries. Indonesia was chosen as a country to implement the project.

The project key questions are:

1) How do global changes in climate and economy affect coastal ecosystems? and
2) How may enhanced capacity for monitoring activities by local fishers help to improve fisheries management in coastal areas?

The focus of the project is on developing smartphone capabilities for using citizen science for monitoring environmental conditions and fisheries in coastal waters to assist the Indonesian government in enhancing their capacity for collecting data needed to improve management practices.

The project major initiatives include:

1. Coastal ecosystem monitoring activities by local small-scale fishers to detect ecosystems changes (e.g., deviations in water quality and the changes in plankton community composition);
2. Coastal fisheries monitoring activities by local small-scale fishers to improve coastal fisheries management (e.g., information about fishing operation or species composition on the market);
3. Coastal and estuarine water monitoring activities by local small-scale aquaculture fishers to measure the effects of government clean water initiatives on water quality for aquaculture operations.

These initiatives will be supported by a series of training/capacity building workshops, led by scientists from PICES member countries.

Appendix C – Special Projects – details (cont'd)

SEAturtle – PICES / Korea project

"*Sea turtle ecology in relation to environmental stressors in the north pacific regions*" (SEAturtle)

Background

Most sea turtles are endangered species designated by IUCN. They are now receiving threats from multiple stressors induced by anthropogenic activities such as climate change, pollution and plastic garbage. Based on the PI group's research (Jang et al. 2018) on the movement of green sea turtles bycaught in the Sea of Jeju Island of Korea, they have different movement patterns (1. Staying around Jeju Island 2, Moving toward Japan, and 3. Moving toward China) depending on individuals. It is necessary to reveal the connectivity of populations in the North Pacific regions and to identify the major environmental stressors to them to conserve the sea turtles in the North Pacific areas.

Project Goal and Key Questions

The overall project goal is to research the sea turtle population found in the North Pacific regions centering on Jeju Island of Korea to enhance the understanding of their habitat use and ecology related to anthropogenic activities. The project key questions are: (a) How the sea turtles found in Jeju Island, Korea, Kyusu Island, Japan, and Hongkong, China are connected to the other identified populations in the North Pacific areas and (b) What are the major environmental stressors to the sea turtles in the North Pacific regions.

Connection to PICES

The project is expected to interact with and support relevant activities of PICES Scientific Committees on Human Dimension (HD), PICES Technical Committee on Monitoring (MONITOR), and PICES FUTURE (***F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems*) Program (specifically, Research Theme 1 on "*What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?*").

Major Initiatives

The project is proposed to focus on the following two major initiatives:

1. Identifying the ecological information of the sea turtle population through the use of advanced tagging technologies, DNA analysis, and stable isotope analysis (*e.g.*, identify habitat use and movement and collect environmental factors through satellite tagging, and identify the sea turtle population through DNA analysis, identifying the tropic ecology using stable isotope analysis).
2. Identifying the ecological threats (collect environmental information on the habitat and bycatch/stranding monitoring in Jeju Island) and conducting behavioral experiments (*e.g.*, testing the behavioral response to marine plastic debris) using individuals in the aquarium.

Products and Publications

- A report to be published in the PICES Scientific Report Series that presents the project, its findings and lessons learned;
- A summary of the report to be published as a brochure, possibly in PICES member languages;
- Several newsletter (PICES Press) articles will be contributed during the project period.
- A workshop will be held at the PICES Annual Meeting, or at the International Sea Turtle Symposium for the project collaborators and party who are interested in the project.

Appendix C – Special Projects – details (cont'd)

SEAturtle PICES / Korea project(cont'd)

Outreaches

- An outreach/promotional Material: create brochures (both physical and online) that emphasize project purpose and research results in PICES member languages and distribute it both locally and globally;
- Public education on sea turtle ecology and marine ecosystem towards local fishermen, all levels of students and the general public;
- Domestic and international seminar and workshops to promote and share the research results;
- Building capacity for coastal sea turtle monitoring by local small-scale fishermen and local NGOs.

Tentative budgets (CAD/yr)

Budget managed by PICES : 39,750
Overhead to PICES (13%): 5,200
GPS tags and supplies: 10,000
GPS service fee: 5,000
International travel of researchers: 20,000

Budget managed by Inha University: 35,250
Overhead to Inha University (20%): 7,050
Stipend to students: 20,000 (1.5 persons/yr)
Domestic travel of researchers: 8,200

Reference

Jang, S., Balazs, G. H., Parker, D., Kim, B.-Y., Kim, M.Y., Ka Yan NG, C., Kim, T. W. (2018) Movements of green turtles (*Chelonia mydas*) rescued from pound nets near Jeju Island, the Republic of Korea. *Chelonian Conservation and Biology. In Press.*

Appendix C – Special Projects – details (cont'd)

SEAturtle PICES / Korea project(cont'd)

Participants

Principal Investigator
-Tae Won Kim, Assistant Professor, Department of Ocean Sciences, Inha University, Republic of Korea marlover7@gmail.com

Coinvestigators
-George H. Balazs, Golden Honu Services of Oceania, 992 Awaawaanoa Place, Honolulu, Hawaii, USA itsahonuworldinhawaii@hotmail.com
-Byung-Yeob Kim, Professor, College of Ocean Sciences, Jeju National University, Republic of Korea kimby@jejunu.ac.kr
-Hideaki Nishizawa, Professor, Biosphere Informatics Laboratory, Graduate School of Informatics, Kyoto University, Japan nishizawa0311@gmail.com
-Connie Ka Yan NG, Department of Biology and Chemistry and State Key Laboratory in Marine Pollution, City University of Hong Kong / Kowloon Tong, Hong Kong Special Administrative Region, People's Republic of China kayan.ng.connie@gmail.com
-Soojin Jang, Ph.D. Candidate Interdisciplinary Program, EcoCreative, the Graduate School, EwhaWomans University, Republic of Korea kesha00@gmail.com
-Mi Yeon Kim, Ph.D. Candidate, Leading Graduate Program in Primatology and Wildlife Science, Kyoto University and Wildlife Research Center of Kyoto University, Japan miyeonkim88@gmail.com

Students
-Jeongjoo Ha, Integrated PhD program Interdisciplinary Program of EcoCreative, the Graduate School, EwhaWomans University, Republic of Korea wjdwn0525@naver.com
-JibinIm, Undergrad student, Department of Ocean Sciences, Inha University, Republic of Korea

Collaboration Partner
WWF Korea
Lotte World Aquarium, Republic of Korea

Membership to date (March 2019):
Co-Chair: Taewon Kim (Inha Univ.)

First meeting took place at PICES-2019: Saturday, October 19, 2019.

Appendix C – Special Projects – details (cont'd)

Ciguatera Special Project

- **Term:** April 2020 – March 2023
- **Project Science Team Co-Chairs:**
  Mitsutaku Makino (Atmosphere and Ocean Research Institute, The University of Tokyo, Japan)
  Mark Wells (University of Maine, USA)
- **Project Coordinator:** Alexander Bychkov (PICES)
- **Funding Agency:**
  Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan (JFA)
- **Parent PICES Committee:** Human Dimensions Committee (HD)

Background

Indonesia has one of the most extensive coral reef systems in the world on which many of its coastal communities depend upon for its biodiversity and ecological products. However, presently only about 7% of these coral reefs are in excellent condition whilst more than 35% are in poor condition, mainly due to anthropogenic stressors. This expanse of poor coral health in Indonesia is a relatively new phenomenon, and the human populations living adjacent to the deteriorating corals are not yet fully aware of the consequences of this change. Increasing areal extents of dead coral and expanding eel-grass habitats are known to lead to incursions and establishment of exotic populations of toxin-producing benthic algae. Fish that ingest these toxic benthic cells bioaccumlate and concentrate the toxin in their tissues, so that humans consuming fish in the region suffer a debilitating illness referred to as Ciguatera Fish Poisoning (CFP). In some tropical nations, CFP has resulted in people shunning the consumption of all fish from their local waters, negatively affecting the cultural, economic, and human health foundations for their communities.

CFP is endemic in many tropical coastal waters, and there is evidence that the abundance of the ciguatoxin-producing dinoflagellates may be increasing and their range may be expanding to higher latitudes with climate change. Reports of CFP in Indonesia presently are few, but this almost certainly is due to the difficulty in diagnosis in communities that lack proper training and experience. The methods to measure the presence and abundance of these harmful species are not well developed, and details of the toxin transfer to communities are a challenge to understand both as a biological event and as a social event. The Indonesian Institute of Sciences (LIPI) recognizes the importance of CFP in Indonesian coastal waters and has targeted it as an area for developing capacity. This was the rationale for a PICES project entitled “The Detection and Human Dimension of Ciguatera Fish Poisoning in Indonesia” (acronym “Ciguatera”) and funded by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan (JFA), from the Official Development Assistance (ODA) Fund. It is anticipated that this project will equip communities with the tools for technology-assisted knowledge generation that will enable them to make decisions to avoid any emerging health risk associated with fisheries and declining corals.

Project organization and funding

The request to undertake the project was accepted by PICES Governing Council in February 2020.

The project is expected to have strong connections and interactions with, and support relevant activities of, the PICES Scientific Committees on Human Dimensions – HD, Marine Environmental Quality – MEQ (through the Section on Ecology of Harmful Algal Blooms in the North Pacific – S-HAB) and Fishery Science – FIS, PICES Technical Committees on Data Exchange – TCODE and on Monitoring – MONITOR, and the PICES FUTURE Science Program (specifically, Research Theme 3 on “How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?”). The HD Committee serves as the parent committee for the project.

To direct the project, a Project Science Team (PST) is established based on principles and procedures

Appendix C – Special Projects – details (cont'd)

Ciguatera Special Project

detailed in the PICES Policy for approval and management of special projects (Decision 2017/A/7). All PICES member countries and all the above-mentioned Committees are represented on the PST (see the membership below), co-chaired by Drs. Mitsutaku Makino and Mark Wells. The PST Co-Chairmen are responsible for the detailed planning and execution of the project and annual reporting to MAFF/JFA and to PICES Science Board through the HD Committee.

The Project Coordinator, Dr. Alexander Bychkov, is responsible for the management of the fund and annual reporting on its disposition to MAFF/JFA and to PICES Finance and Administration Committee.

Annual reports to MAFF/JFA are to be submitted within 90 days after the close of each project year ending March 31. Within PICES, Science Board takes the responsibility for reporting to Governing Council on the progress and achievements of the project, and the Finance and Administration Committee takes the responsibility for reporting to Governing Council on the financial and management aspects of the project.

Funding for Year 1 (FY 2020, ending March 31, 2021) was set at $96,385 CAD.

Project goal, key question and initiatives
The overall goal of the project is to build the capacity of local small-scale fishers and community members to monitor their coastal ecosystems and coastal fisheries to benefit human health in Pacific Rim developing countries (Indonesia). The project is focused on Ciguatera Fish Poisoning (CFP) in tropical reef fisheries, which globally has the greatest human health and economic impacts of any algal-based poisoning syndromes.

The key question of the project: How to best foster the use of smartphone-based observation tools, developed during the 2017–2020 PICES/MAFF project on “Building Capacity for Coastal Monitoring by Local Small-scale Fishers” (FishGIS), to empower coastal communities to assess, detect, and minimize their exposure to CFP in community-scale fisheries?

The project major initiatives include:
Coastal ecosystem monitoring activities by local small-scale fishers and other community members to detect ecosystem changes (e.g., changes in water quality, and the presence and changes in the spatial distributions of dead coral and eel-grass benthic environments);
Detection of CFP toxin-containing dinoflagellates in the reef environment using smartphone observation tools developed during the FishGIS project as well as new international standardized sampling protocols for toxic benthic algae;
Training of community members to utilize these tools for generating citizen-science data streams to be used in local decision-making on coastal fisheries regions to avoid a health risk associated with fishing until the presence of CFP toxin-containing dinoflagellates is minimized.
These three initiatives are to be supported by a series of annual capacity building workshops led by scientists from PICES member countries. At the workshops, the community will be encouraged to develop an “ASSESS. DETECT. AVOID!” convention in order to protect community members against this emerging health concern:

To ASSESS the state of the local corals, community members will be taught to monitor some aspects water quality (turbidity and water color) of the reef and to document the outbreaks of eel-grass or the expansion of the dead coral using the smartphone-based technology and approach developed during the FishGIS project;
To DETECT the presence of the toxin-containing dinoflagellates in the reef environment and to help develop predictive indices for reef regions susceptible to CFP, community members will be trained in two **Appendix**

Ciguatera Special Project (cont'd)

methodologies: one that is developed within the project and is based on specialized smartphone-driven microscopes and community-appropriate protocols, and the other that employs a detection kit recently created by an international CFP working group (Monaco, 2018) to determine the presence of Gambierdiscus in the water column and measure its abundance.

To AVOID the transfer of contaminated fish from the damaged environment to the tables of families, community members will be encouraged to reduce risk – avoid eating fish from regions where Gambierdiscus numbers are high.

It is expected that the combination of training and citizen-science contributions in the project will: (1) generate the needed capacity for monitoring CFP hotspots in Indonesian waters, (2) provide valuable datasets for the study of Gambierdiscus and the factors controlling its abundance in reef systems, and (3) increase human wellness by identifying fishing regions where the health of community members is at risk.

In addition to the primary initiatives, initial steps will be taken to explore two secondary initiatives: modifying the smartphone FishGIS application to incorporate (1) artificial intelligence-based assessment of fish stocks from the collective catch data reported by community members, and (2) a tsunami early warning notification for remote fishing communities, with the goal of laying the foundation for future full development of these capabilities.
Meetings and Events
First Project Science Team meeting (in conjunction with the MSEAS-2020 Symposium, to be held from May 25–29, 2020, in Yokohama, Japan)
Objectives: (1) to discuss the overall project strategy and develop timelines for project activities and products and (2) to review and refine the Year 1 workplan.

For additional information:
HABs and Ciguatera Poisoning: emerging methodological perspectives
Presentation by Charles Trick & Danielle Beausoleil
https://meetings.pices.int/publications/presentations/PICES-2012/2012-S2/S2-1015-Trick.pdf

Appendix D1 –Wooster Nomination

Wooster Award Nomination: Hiroaki Saito

2020 March 27

Dear PICES Executive Secretary

Please find our proposal for 2020 Wooster Award nomination.

Emanuele Di Lorenzo, Motomitsu Takahashi, Shin-ichi Ito

Proposal for 2020 Wooster Award nomination

It is with great enthusiasm that we nominate Dr. Hiroaki Saito for the 2020 Wooster Award of PICES based on his extensive service to PICES, his scholarship, and his scientific leadership.

Dr. Hiroaki Saito graduated Tohoku University in 1986 and started his scientific career at Hokkaido National Fisheries Research Institute, Japan Fisheries Agency. He was assigned to the Fisheries Resources Division preparing the stock assessment for squids in the western North Pacific. Since 1990, he moved to Biological Oceanography Section and started biological and ecological studies on copepod. He first worked on *Eurytemora herdmani* and *Pseudocalanus* spp. and focused on daily ration of the zooplanktons. However, he rapidly extended his research to cover a variety of marine organisms from virus to whales and focused on their functions in marine ecosystem dynamics and biogeochemical cycles. An essential aim of Saito's research is to understand the processes and mechanisms of marine ecosystem response to natural and anthropogenic perturbations. In 2001, he moved to Tohoku National Fisheries Research Institute and later in 2014 joined the Atmosphere and Ocean Research Institute, at The University of Tokyo in the role of Associate Professor. In 2016, he promoted to Professor. During his scientific career, he elucidated 1) the role of zooplankton on biological pump, 2) the role of iron on marine food-web dynamics and biogeochemical cycles, 3) the role of twilight zone, 4) the role of Kuroshio on the structure and dynamics of the marine ecosystem including fisheries production, 5) the sustainable use of marine ecosystem services, and
6) the geographical distribution of biogenic elements and biogeography. Such a wide range of scientific investigations points to the breath of Dr. Saito intellect and his ability to integrate knowledge, techniques and innovative analyses.

Dr. Saito is not only an outstanding scientist, but has shown strong leadership in several

national and international scientific programs. He was assigned to the BIOCOSMOS project (1990-1998) and contributed to elucidate bottom up process of Japanese sardine fluctuation. He was one of the founders of A-line Monitoring in the Oyashio Region since 1990 and the data contributed to JGOFS. He also contributed to SAGE (Subarctic Gyre Experiment: 1997-2002) as a core member and elucidated functioning of *Neocalanus* spp. on biogeochemical cycles. He was assigned to VENFISH (Comprehensive study of the Variation of the oceanic ENvironment and FISH populations in the northwestern Pacific: 1998-2002) and contributed to clarify the fluctuation mechanism of Pacific saury and walleye pollock. He was also a core member of SEEDS (Subarctic ocean iron Enrichment and Ecosystem Dynamics Study: 2001-2004) and conducted iron fertilization experiments. He was the project leader of DEEP (Deep-Sea Ecosystem and Exploitation Project: 2002-2006) and elucidated marine ecosystems in the twilight zone. He was also project leader of POMAL (Population outbreak of Marine Life: 2007-2012) and contributed to clarify the mechanism of sardine outbreaks. He also led SKED (The Study of Kuroshio Ecosystem Dynamics for Sustainable Fisheries: 2011- 2021) in the beginning period and contributed to elucidate the Kuroshio Paradox: why many fish species form spawning grounds in oligotrophic region Kuroshio. In addition, he contributed NEOPS (New Ocean Paradigm on its Biogeochemistry, Ecosystem and Sustainable Use: 2011-2016) as a core member to develop new ocean provinces respect to the distribution of biogenic elements and biogeography.

Throughout his leadership, Dr. Saito has always shown a strong commitment to advance and educate early career scientists and students. Most recently, as Chairmen of the PICES Science Board he led the establishment of a new early career scientist award. Dr. Saito was also recognized as an outstanding early career scientists in 1998 when awarded the Okada Prize (young scientist award) of Oceanographic Society of Japan through the comprehensive study on the productivity of lower trophic levels and diel feeding rythm of copepods in the Oyasio region. He also was awarded the Best Paper Award of Japanese Society of Fisheries Oceanography in 1999, the Best Paper Award of Plankton Society of Japan in 2003 and the Hidaka Prize (the best paper award) of the Oceangraphic Society of Japan in 2007 as co-author. These recognitions speak to the impressive impacts of Dr. Saito's scientific contributions with over 115 peer-reviewed publications as author or co-author.

Dr. Saito has worked tirelessly for several professional organizations, most notably IGBP/SCOR, IMBER, CLIVAR, Science Council of Japan and PICES. He served terms as a member of Science Steering Committee of IGBP/SCRO IMBER. He was on the editorial board of the Progress in Oceanography (2003-2010), Plankton and Benthos Research (2005-2011), Fisheries Oceanography (2007-2013) and Journal of Oceanography (2011-2019) and he is working as the editorial board of Frontiers in Marine Science from 2014.

Within PICES, he served as a member of MODEL Task Team (2001-2004), IFEB Advisory Panel (2004-2007), Study Group on Future Integrative Scientific Programs (2005-2009), WG22 (Iron supply and its impact on biogeochemistry and ecosystems in the North Pacific Ocean: 2007-2011), FISP Writing Team (2007-2008), and ICES/PICES Joint Study Group on "Developing a Framework for Scientific Cooperation in Northern Hemisphere Marine Science" (2010-2012). He served as the Co-

Chairman of FUTURE Implementation Plan Writing Team (2008-2010), Co-Chairman of FUTURE Advisory Panel on Climate, Oceanographic Variability of Ecosystems (2009-2016), Co-Chairman of PICES FUTURE SSC (2015-2016) and Vice Chairman of PICES Scientific Board (2013-2016). He also served as the Chairman of PICES Science Board (2016-2019).

Dr. Hiroaki Saito's outstanding achievements cover the broad spectrum of a scientist's career (scientific output, teaching, and service), and his contributions to PICES has been sustained over many years. Through his careful leadership of FUTURE and of PICES Science Board later, Hiroaki not only made significant scientific contributions to North Pacific marine science but also enabled many others to participate and feel ownership in the process. His ability to be inclusive and deliver a vision to PICES is a trait that characterizes great leaders. Under his leadership PICES has made major advances in understanding the processes and mechanisms of the marine ecosystem response to natural and anthropogenic perturbations through a social-ecological- environmental approach. This places PICES on the leading-edge of marine science.

Therefore, we are pleased to recommend Dr. Hiroaki Saito for the 2020 Wooster Award of PICES.

Motomitsu Takahashi
Group Leader, Seikai National Fisheries Research Institute
Japan Fisheries Research and Education Agency, Japan

Emanuele Di Lorenzo
Professor, School of Earth and Atmospheric Dynamics
Director, Program in Ocean Science and Engineering
Chairmen, Ocean Visions Board of Directors
Georgia Institute of Technology, USA

Shin-ichi Ito
Professor, Atmosphere and Ocean Research Institute The University of Tokyo, Japan

CURRICULUM VITAE

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e-mail: hsaito@aori.u-tokyo.ac.jp
Web site: https://www.aori-saitolaboratory.com/home-1

Education:

1986	B.S. Agriculture, Tohoku University
1996	Ph.D. (Agriculture), Tohoku University

Research and professional experience:

2019-	Advisor to the Director, AORI, the University of Tokyo
2016-	Professor, AORI, the Universtiy of Tokyo
2014-2016	Associate Professor, Section of Marine Planktology, AORI, the
	University of Tokyo
2011-2014	Head, Ecosystem Dynamics Group, Tohoku National Fisheries
	Research Institute, Fisheries Research Agency
2010-2011	Lecturer, Nagasaki University
2007-2008	Guest associate Professor, The University of Tokyo
2001-2011	Chief of Biological Oceanography Section, Tohoku National
	Fisheries Research Institute, Fisheries Research Agency
2004	Lecturer, Shizuoka University
1997 - 2001	Senior Scientist of Biological Oceanography Section, Hokkaido

	National Fisheries Research Institute
1998 - 1999	Guest Scientist, Danish Institute for Fisheries Research

1994 - 2000 Cooperated Scientist of Sea Ice Research Laboratory, The Institute of Low Temperature Science, Hokkaido University

1992 -2001 Cooperated Scientist of National Institute of Polar Research

1990 - 1997 Researcher, Biological Oceanography Section, Fisheries Oceanography Division, Hokkaido National Fisheries Research Institute

1987 - 1990 Researcher, Fisheries Resources Division, Hokkaido National Fisheries -Research Institute, Fisheries Agency

Awards:

1998 The Okada Prize of the Oceanographic Society of Japan

1999 The Best Paper Award of the Japanese Society of Fisheries Oceanography (co-author)

2003 The Best Paper Award from the Plankton Society of Japan (co-author)

2007 The Hidaka Prize of the Oceanographic Society of Japan (co-author)

Research Interest:

My scientific interests is on the role of organisms in marine ecosystem dynamics and biogeochemical cycles. I have been studied biology and ecology of copepod, beautiful creature in marine ecosystem, but also working on variety of marine organisms from virus to whales. The essential aime of my studies is to understand the processes and mechanisms of marine ecosystem response to natural and anthropogenic perturbations. Recemt research topics are:

The role of zooplankton on biological pump

The role of iron on marine food-web dynamics and biogeochemical cycles

Developing new ocean provices respect to the distribution of biogenic elements and biogeography

The role of Kuroshio on the structure and dyamics of the marine ecosystem including fisheries production

Sustainable use of marine ecosystem services

Committees:

2018- Associate member, The Science Council of Japan

2018- Chair, IMBeR-Japan Nartional Committee, The Science Council of Japan

2017- Member, NPOCE SSC, CLIVAR Pacific Panel

2016-2019 Chairman, PICES Scienece Board

2015-2016 Cochairman, PICES FUTURE SSC

2013-2016 Vice Chairman, PICES Science Board

2013- Fellow of the board of Oceanographic Society of Japan

2011-2013, 2014-2017, 2019-2021 Member of the Paper Awards Selection Committee of the Oceanographic Society of Japan

2010-2012	Member, ICES/PICES Joint Study Group on "Developing a Framework for Scientific Cooperation in Northern Hemisphere Marine Science"
2009-2019	PICES Sceience Board member
2009-2016	Chair of FUTURE Advisory Panel on Climate, Oceanographic Variability and Ecosystems, PICES
2008 - 2010	Co-chair, Future Implementation Plan Writing Team, PICES
2007 - 2008	Member, FISP Writing Team, PICES
2007 - 2011	Member, WG22 (Iron supply and its impact on biogeochemistry and ecosystems in the North Pacific Ocean), PICES
2007 - 2013	Member, International Journal Committee, The Japanese Society of Fisheries Oceanography
2007 - 2008	Associate member, The Science Council of Japan
2005 - 2009	Member, Study Group on Future Integrative Scientific Programs, PICES
2004 - 2007	Member, IFEP Advisory Panel, PICES
2004 - 2008	Chair, IMBER-Japan Nartional Committee, The Science Council of Japan
2004 - 2005	Member, Japan-GLOBEC National Committee, The Science Council of Japan
2004 - 2008	Science Steering Committee, IGBP/SCOR IMBER

2003 - 2005 Member, Committee of Global Environmental Research, The Science Council of Japan

2002—2004 Member, IGBP/SCOR Ocean Biogeochemistry and Ecosystems Transition Team

2001 - 2004 Member of MODEL Task Team, PICES

Editorial boards of academic journals:

2019 Editor, Kuroshio Current: Physical, Biogeochemical, and Ecosystem Dynamics (Geophysical Monograph Series, AGU)

2019 Guest Editor, Philippine Journal of Natural Sciences

2014 - Editorial board, Frontiers in Marine Science

2011 -2019 Editorial board, Journal of Oceanography

2007- 2013 Editorial board, Fisheries Oceanography

2005- 2011 Editor, Plankton and Benthos Research (Plankton Biology and Ecology until 2005)

2003- 2010 Associate editor, Progress in Oceanography.

Membership of academic societies:

The Oceanographic Society of Japan
Plankton Society of Japan
Japanese Society of Fisheries Oceanography
Japan Geoscience Union
The American Society of Limnology and Oceanography
The American Geosphysical Union

Project

2020-2023 CREPSUM (Collaborative Research and Education Project in Southeast Asia for Sustainable Use of Marine Ecosystems), Project Coordinator (PI), funded by JSPS Core-to-core program.

2017-2019 RENSEA (Research and education network on coastal ecosystems in Southeast Asia. Project Coordinator (PI), funded by JSPS Core-to-core program.

2011-2016 New Ocean Paradigme on its Biogeochemistry, Ecosystem and Sustainable Use (funded by MEXT).
http://ocean.fs.a.u-tokyo.ac.jp/

2011-2021 SKED Project leader (2011-2014), member (2014-2021). The Study of Kuroshio Ecosystem Dynamics for Sustainable Fisheries (funded by MEXT) http://tnfri.fra.affrc.go.jp/kaiyo/sked/english/index.html

2007-2012 POMAL Project leader, Population outbreak of Marine Life (funded by the Ministry of Agriculture, Forestry and Fisheries) http://tnfri.fra.affrc.go.jp/kaiyo/POMALweb/e-pomal.html

2007 BLOSSOM Project leader, Blooming Plankton Succession Study in the Oyashio Marine Ecosystem

2005-2008 PI. The role of heterotrophic dinoflagellates on the vertical ransport of biogenic elements, funded by JSPS.

2003 SPINUP: Project leader, Study for Plankton and Iron Dynamics in the western Subarctic Pacific.

2002-2006 DEEP: Project leader, Deep-Sea Ecosystem and Exploitation Project, funded from Ministry of Agriculture, Forests and Fisheries of Japan.

2001-2004 SEEDS: Member. Japan-SOLAS related project Subarctic ocean iron Enrichment and Ecosystem Dynamics Study, funded from Ministry of Enviroments of Japan.

1998-2000 PROVES: Member, EU funded project under the MUST III programme, Processes of Vertical Exchange in Shelf Sea.

1998-2002 VENFISH: Member, Japan-GLOBEC related project, Comprehensive study of the Variation of the oceanic ENvironment and FISH populations in the North-western Pacific

1997-2002 SAGE: Member. Japan-JGOFS related project. Subarctic Gyre Experiment, funded from Science and Technology Agency of Japan

1990-2010 *A-line* Monitoring: Japan-JGOFS related progect. Monitoring program of biological processes in the Oyashio region, western subarctic Pacific.

1992-1993 SARES: Member. A joint Canada-Japan project conducted on the first-year ice of Saroma-ko Lagoon and Resolute Passage, Ministy of Education, Culture and Sprots of Japan

1990-1998 Global Environmental Research Fund project, Effects of Enhanced UV-B radiation on terrestrial and marine ecosystem, funded from Ministry of Environment.

1990-1998 BIOCOSMOS: Member, Comprehensive Program of Research for Agro-Ecological System and Optimum Control. Ministry of Agriculture, Forests and Fisheries of Japan.

Refereed Publications:

1. Arifin, Z., and Saito, H. (2019). Bridging coastal research program between Indonesia and Japan. Marine Research in Indonesia, 44, 34-41. doi.org/10.14203/mri.v44i1.551

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Appendix D2 –POMA Award Nominations
La Perouse Program of Fisheries and Oceans Canada.

Canada

Fisheries and Oceans | Pêches et Océans

R. Ian Perry
Ocean Sciences Division
Pacific Biological Station,
Nanaimo, B.C. V9T 6N7,
Canada

16 March 2020

Mr. Robin Brown, Executive Secretary,
North Pacific Marine Science Organisation
(PICES), c/o Institute of Ocean Sciences
P.O. Box 6000
Sidney, British Columbia Canada
V8L 4B2

Dear Mr. Brown,

Re: Nomination for 2020 PICES POMA Award

We are pleased to submit this nomination for the 2020 PICES Ocean Monitoring Service Award (POMA). Our nomination is for the **La Perouse Program of Fisheries and Oceans Canada**.

This program has made many significant contributions to the progress of marine science in the Northeast Pacific. It was begun in 1979 by Dr. David Mackas of Fisheries and Oceans Canada's Institute of Ocean Sciences, in Sidney, B.C. Since then the program has consisted of two to four surveys each year, with over 10 to 30 plankton samples collected from each of four regions during each survey. Initially, the program sampled only the southern continental shelf west of Vancouver Island, but since 1998 it has sampled the entire west coast of Vancouver Island, from near the coast to the deep ocean west of the continental shelf, and northwards into southern Queen Charlotte Sound (see Figure 1 in Supporting Materials). Over the past 20 years the survey has also been extended to include sampling in the Strait of Georgia to the east of Vancouver Island, making a full circumnavigation of Vancouver Island.

The program has always been a full physical and biological oceanographic survey. Properties sampled include temperature, salinity, oxygen, light attenuation, fluorescence, nutrients, chlorophyll, carbon system parameters, phytoplankton taxonomic composition, zooplankton taxonomic composition,

acoustic data for currents and backscatter measurements, and frequently systematic marine mammal and seabird observations. To date, since 1979 there have been over 5000 zooplankton samples collected during this program. All physical data are archived in the Fisheries and Oceans Canada water properties data base, and are searchable through the web (see Waterproperties.ca). Zooplankton data are also archived by the Ocean Ecology group at the Institute of Ocean Sciences; these data are also freely available through the Canadian data Geoportal at https://open.canada.ca.

Key personnel associated with the program since 1979 include Dr. David Mackas, Mr. Rod Forbes, Mr. Douglas Moore, Mr. Douglas Yelland, Ms. Moira Galbraith, Ms. Kelly Young, Ms. Nina Nemcek, Ms. Marie Robert, Dr. Ian Perry¸ Dr. Angelica Peña, and Dr. Ken Denman. Dr. Akash Sastri is currently responsible for leading these surveys. In addition, each survey is supported by several technical experts from Fisheries and Oceans Canada who provide expertise in ocean and water chemistry sampling methods.

These surveys, which sample several marine ecosystems of significant importance to Canada, also provide excellent platforms for the training and experiences of students and early career researchers (such as Post-Doctoral Fellows). Many of these students are from local universities such as the University of Victoria and the University of British Columbia, but also include students from universities across Canada and the United States. They conduct their own experiments but also stand scientific watches and contribute to the general data collection activities of the program. Since 1979, over 60 students and early career researchers have participated in the surveys of the La Perouse Program; for most of these students this sea-going program was essential to the completion of their thesis. Some of these students have returned as staff researchers with DFO and various academic institutions, and are on-going active participants in the La Perouse program.

The contributions of the La Perouse program to marine science within Canada and internationally have been numerous (for example, see the Supporting Materials for a partial list of over 120 publications resulting from the La Perouse Program, including 18 contributions to PICES publications). This Program is recognised as one of the key, and among the longest, plankton time series featured on the U.S. NOAA Coastal and Oceanic Plankton Ecology, Production and Observation Database (COPEPOD) (https://www.st.nmfs.noaa.gov/copepod/about/databases.html). It is also a core contributor to the IOC-UNESCO International Group for Marine Ecological Time Series (IGMETS) project (http://igmets.net/).

Results of papers published from the La Perouse program have also been significant. One of the key findings from the La Perouse program, which has had important influences on the understanding and management of Canada's important salmon stocks, has been that the type of copepods that occur along the west coast of Vancouver Island changes with episodes of cold or warm water (which are usually forced by El Niño – Southern Oscillation events). In particular, cold water periods are dominated by large and lipid-rich copepods which are excellent food for fish such as juvenile salmonids, whereas warm periods bring increases in southern-origin small and lipid-poor copepods which are poor food for fish (e.g. Mackas et al. 2004). The consequence is that EL Niño and other warm water events that reach the coast of British Columbia are poor feeding environments for juvenile salmon and cause reductions in the amount and size of salmon returning to their natal rivers a few years later. In addition, the La Perouse program was the basis for the development of methods to compare plankton time series from differernt plankton programs around the world. This method led to an international Scientific Committee on Oceanic Research (SCOR) Working Group (WG 125: https://scor-int.org/group/125/) to conduct these comparisons; papers from that Working Group have been highly cited (e.g. Mackas et al. 2012).

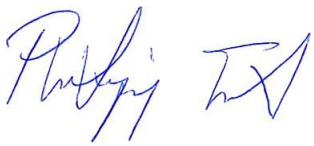
A selection of other important issues addressed by research conducted as part of the La Perouse Program include: changes in the carbonate chemistry of the NE Pacific and coastal British Columbia, ocean acidification, dimethylsulfide (e.g. Tortell et al. 2012), methane and nitrous oxide (Capelle and Tortell, 2016); the development of novel underway methods to measure net community production (e.g. Izett et al. 2018); the impacts of changes in zooplankton composition to the survival of seabirds along the B.C. coast (e.g. Hipfner et al. 2020); and early studies of the presence of microplastics in the marine food web of the NE Pacific (e.g. Desforges et al. 2015). Findings from the La Perouse Program have also been related to the dynamics of fish populations (e.g. Mackas et al. 2007). In addition, the physical and biological oceanographic conditions along the continental shelf and deep ocean regions of the west coast of Vancouver Island for the most recent year have been reported annually since 1999 in the Fisheries and Oceans Canada State of the Pacific Ocean reports (e.g. see the list of reports at the bottom of the web page https://dfo-mpo.gc.ca/oceans/publications/index-eng.html).

In summary, the La Perouse Program of Fisheries and Oceans Canada would be a worthy recipient of the PICES POMA Award. It exhibits all of the qualities this award represents: significant contributions to the progress of marine science in the North Pacific; long- term monitoring operations; management of data associated with ocean conditions and marine bio-resources in the region; and the training of students and early career scientists.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Ian Perry, Ph.D.
Research Scientist, Fisheries and Oceans Canada,
Pacific Biological Station, Nanaimo, B.C. and Institute of Ocean Sciences, Sidney, B.C. Ian.Perry@dfo-mpo.gc.ca



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John Dower,
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Papers cited above (note: numbers in square brackets are the number of citations to date) :

Capelle, D., Tortell, P. 2016. Factors controlling methane and nitrous-oxide variability in the southern British Columbia coastal upwelling system. Marine Chemistry. doi:10.1016/j.marchem.2016.01.011 [8]

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Materials Supporting the Nomination of the La Perouse Program of Fisheries and Oceans Canada for the PICES Ocean Monitoring Award (POMA)

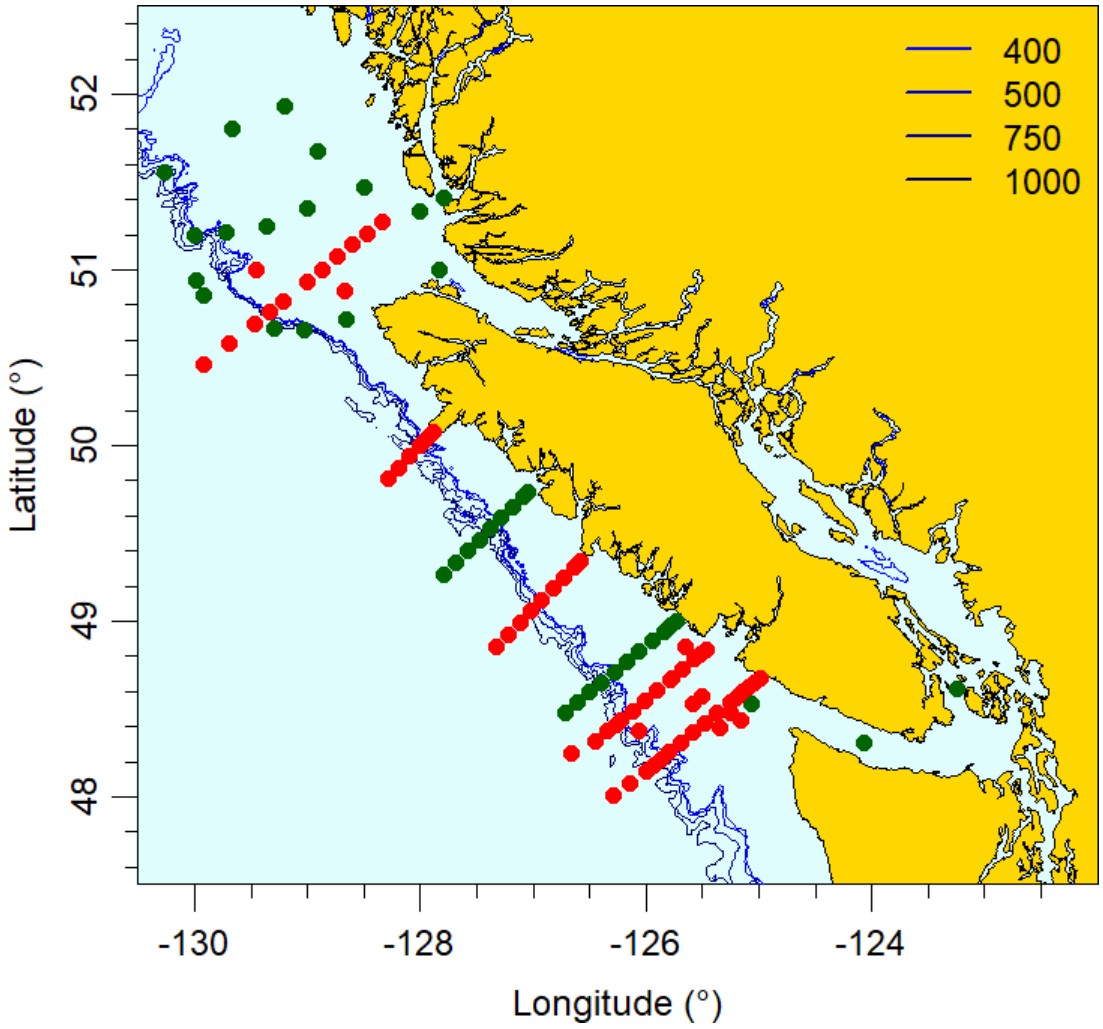

Figure 1. Station locations along the west coast of Vancouver Island for the La Perouse Program of Fisheries and Oceans Canada. Red stations are high priority locations, which are sampled on every survey; green stations are sampled as time and weather permits.

Partial List of Publications Resulting from the La Perouse Program

1. Nielsen. J., Rogers, L., Brodeur, R., Thompson, A., Auth, T., Deary, A., Duffy-Anderson, J., Galbraith, M., Koslow, J.A., Perry, R.I. Submitted. Responses of ichthyoplankton communities to the recent marine heatwave and previous climate fluctuations in Northeast Pacific marine ecosystems. Global Change Biology.

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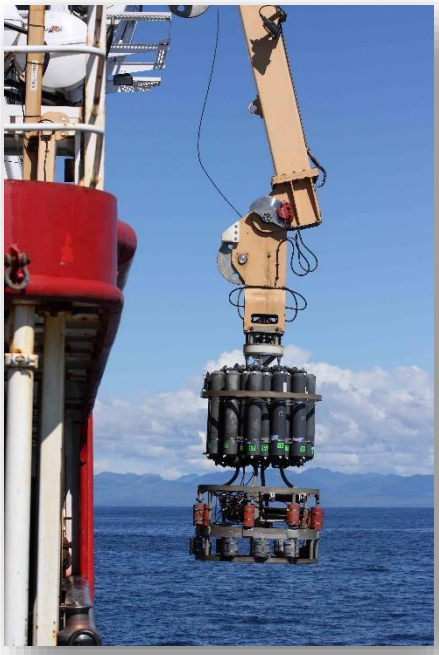
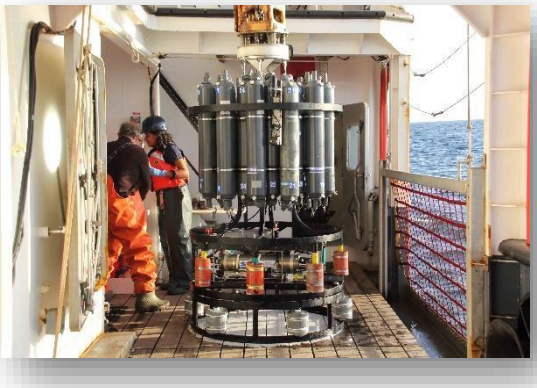
120. Mackas, D., Galbraith, M., Romaine, S. 2001. Zooplankton, p. 16-18. DFO, 2001. 2000 Pacific Region State of the Ocean. DFO Science. Ocean Status Report 2001/01.

121. Mackas, D., Galbraith. 2000.1. Zooplankton, p. 17-18. DFO, 2000. 1999 Pacific Region State of the Ocean. DFO Science. Ocean Status Report 2000/01.

La Perouse Program - Selected Photos from Surveys





Appendix D2 –POMA Award Nominations

AFSC / PMEL - Bering Sea Monitoring.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration National Marine Fisheries Service
Alaska Fisheries Science Center 7600 Sand Point Way N.E. Seattle, Washington 98115-6349

March 31, 2020

Dr. Robin Brown, Executive Secretary
North Pacific Marine Science Organization (PICES)
PICES Secretariat
c/o Institute of Ocean Sciences
9860 West Saanich Road
Sidney, British Columbia
Canada V8L 4B2

Dear Dr. Brown:

As the Director of Science and Research of the NOAA's Alaska Fisheries Science Center (AFSC) I nominate both my Center the AFSC and Pacific Marine Environmental Laboratory (PMEL) for the 2020 PICES Ocean Monitoring Award (POMA). For over forty years, multiple monitoring programs and world-class monitoring systems have been maintained by these two institutions in the eastern Bering Sea. During this time, AFSC programs such as the Groundfish Assessment Program (GAP), Midwater Assessment & Conservation Engineering (MACE) Program, and the Recruitment Processes Alliance (RPA; Recruitment Processes and Ecosystem Monitoring and Analysis Programs) have provided a comprehensive view of ecosystem status and trends in the eastern Bering Sea Large Marine Ecosystem (LME). Similarly, the coordinated investigations of the RPA's with the PMEL Ecosystems & Fisheries Oceanography Coordinated Investigations Program (eFOCI) have provided monitoring data (Figure 1; Table 1) that is unequaled in any other ocean basin.

Table 1. Programs and the data resources resulting from the AFSC and PMEL eastern Bering Sea monitoring network.

Program	Area	Start	Frequency	Sampling
GAP	Eastern Bering Sea	1982	Annual	Demersal Community (fish, crab, other invertebrates) and ecosystem variables
GAP	Northern Bering Sea	2010, 2017-2019	Intermittent	Demersal Community (fish, crab, other invertebrates)
MACE	Eastern Bering Sea	1979	Triennial (1979 1984; Biennial (1984 – present)	Pelagic fishes & ecosystem variables
RPA	Eastern Bering Sea	1995	Biennial - spring	Lower trophic levels, larval fishes, ecosystem variables
RPA	Eastern Bering Sea	1995	Biennial -fall	Lower trophic levels, age-0 fishes, ecosystem variables

RPA	Northern Bering Sea		Annual	Lower trophic levels, age-0 and juvenile fishes, salmon and ecosystem variables

eFOCI RPA	Eastern Bering Sea	1995	Annual	Spring and fall latitudinal variation in physical & chemical oceanography, lower trophic levels. sentinel moorings
eFOCI	Eastern Bering Sea	1995	Annual	(4) sentinel moorings – from Bristol Bay to St. Lawrence Is., Alaska

Data from these monitoring programs provides data ranging from atmospheric and physical oceanographic data, to data about the lower trophic levels and information about the populations of commercially and ecologically important fish and invertebrates. These data have informed resource managers, coastal communities, and PICES member countries of how weather and changing climate impact the ecosystem on which many countries depend for their cultural, spiritual, and nutritional sustenance.

Ecosystem data collected by the AFSC and PMEL are the source of many environmental indices that have provided the foundation to detect the current status and long-term changes in populations of ecologically and commercially important species in the Bering Sea. The data from these observational networks were fundamental to the following PICES Special Publications: "Marine Life in the North Pacific: The Known, Unknown, and Unknowable," "Marine Ecosystems of the North Pacific;" and the periodical, PICES Press, "Bering Sea – Current Status and Recent Trends." Perhaps most importantly, this observational network also provides data for
U.S. Dept of Commerce publications such as those used to manage individual exploited populations (Status and trends document) whose transboundary populations (e.g. walleye pollock Pacific cod, many cetaceans) are important to other PICES member countries and that provide an ecosystem approach to fisheries management -- U.S. Dept. of Commerce Ecosystem Status and Trends, new efforts to provide near term forecasts (Kerim/Bond).

Additionally, the observational network has provided an early warning system and increased understanding into the mechanisms underlying climate change and the loss of seasonal sea ice in the Bering Sea. Without this monitoring effort, we would not have captured how the ecosystem responds to frequent shifts between cold and warm states. Our knowledge of how populations respond to periods of sustained warm or cold conditions (stanzas) would be limited or non- existent if not for the observational network. Today with long periods of ice-free conditions in the Bering Sea, this monitoring network is showing us what the ecosystem may become in response to climate change. For example, they are observing how the distribution of invertebrate and fish populations respond to the loss of the Bering Sea cold pool and other oceanographic features that have kept the biogeographic boundary between the arctic and subarctic provinces relatively stationary during recent history (as evidenced by both the traditional knowledge of our First Nations and Native Peoples, as well as the written histories of European and Western explorers, naturalists, and scientists).

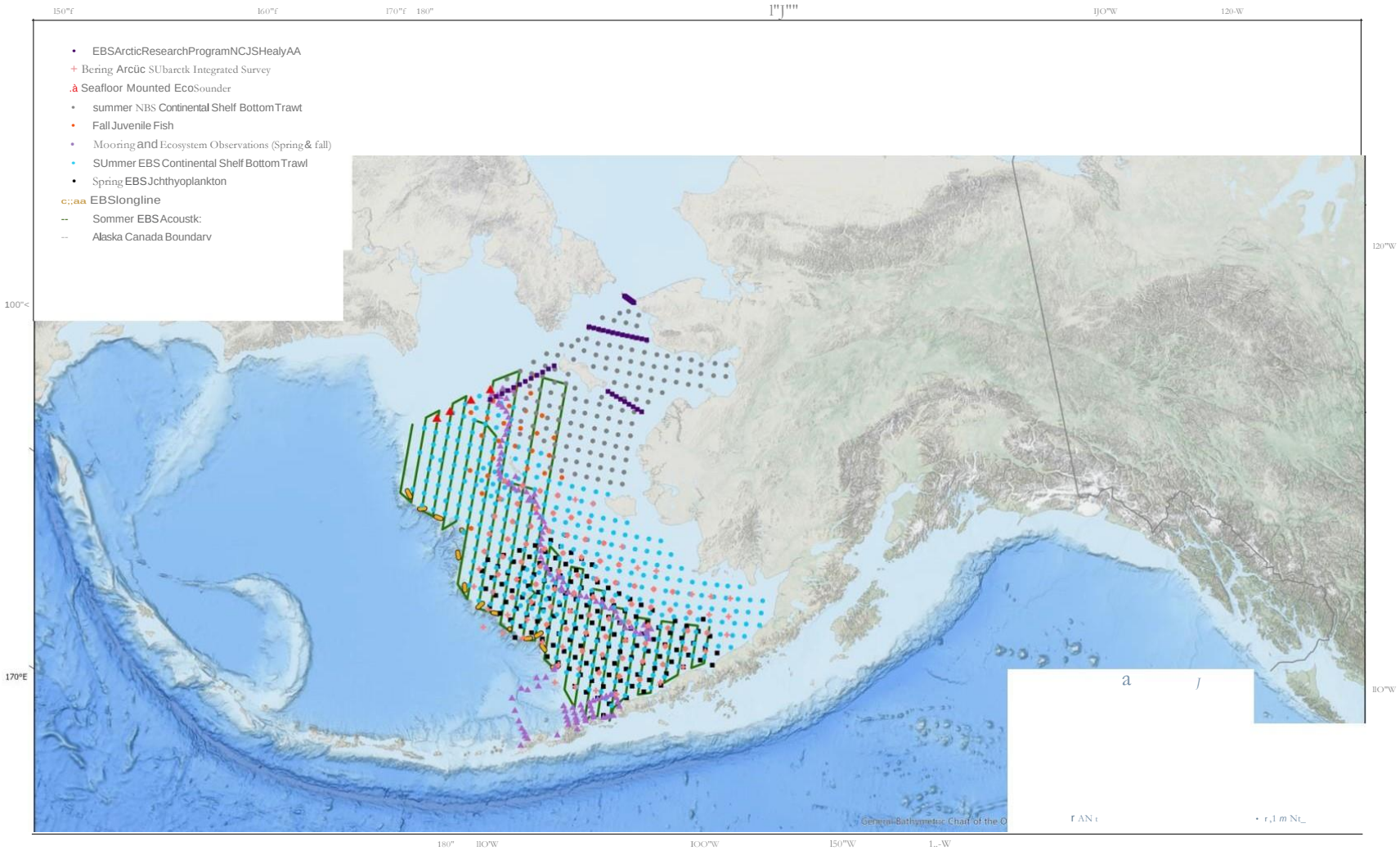
Maintenance of these observational systems is difficult. They require large investments of money, time, and people. They also require a small army of scientists to go to sea, often sacrificing significant time with their families and friends. Although many of the scientists who initially established these time series have retired, NOAA's AFSC and PMEL are committed to continuing these programs and deserve recognition for this effort. While the cost of these systems is often defended by the value of the U.S. jobs and food provided by the marine resources of the Bering Sea, the true value of is much higher when including the global impact of both the resources and the ecosystem.

Please recognize the value of AFSC and PMEL's monitoring effort, as well as the hard work and effort expended by the staff by selecting them to be the recipient of the PICES 2020 Ocean Monitoring Award.

Robert J Foy 3/30/2020

__ Dated:_____ Dr. Robert J. Foy,
Science and Research Director
Alaska Fisheries Science Center

Attachment: Map showcasing the geographic extent of all the monitoring programs of NOAA's AFSC and PMEL.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Appendix D – AWARDS POMA Award Nominations

M2 Mooring Time Series Observations.

Ecosystems and Fisheries-Oceanography Coordinated Investigations (EcoFOCI)
M2 Mooring Time Series Observations

During the fall of 2019, National Oceanic and Atmospheric Administration's (NOAA) Pacific Marine Environmental Laboratory (PMEL) program, Ecosystems and Fisheries-Oceanography Coordinated Investigations (EcoFOCI) recovered a surface mooring "Peggy" at the biophysical mooring site 2 (M2) adding a prestigious marker to this time series by providing near- continuous, year-round measurements of the southeastern Bering Sea since 1995. Moorings, like M2, give researchers an expanded view of the remote corners of the world's oceans, in this case, measuring temperature, salinity, nitrate, chlorophyll, and currents in this highly productive area. Data used from M2 have been instrumental in studying the loss of sea ice in the Bering Sea, understanding and developing the Oscillating Control Hypothesis.

M2 Mooring, Peggy, situated over the southeast Bering Sea shelf.

The Bering Sea supports large marine mammal and bird populations and some of the most profitable and sustainable commercial fisheries in the United States. Continuous monitoring of oceanographic conditions from this region provides critical data to support sustainable management of these living marine resources in the Bering Sea.

On March 13, 1995, the M2 surface mooring, nicknamed 'Peggy', was deployed from the NOAA Ship *Miller Freeman*. The surface buoy pays homage to Peggy Dyson, who for 25 years, from her home in Kodiak, Alaska, reported the weather, family messages, and sometimes even paid bills for the mariners of the North Pacific Ocean. She began the radio calls on WBH-29 in 1974 for her husband, late commercial fishing pioneer Oscar Dyson (namesake of the NOAA Ship *Oscar Dyson*), to give him weather reports. Peggy became the 'voice of the north' and even worked with the NOAA weather service to provide real-time ship-to-shore information to aid forecasters in refining their data, which she did until 1999.

This is a true testament to the regionally focused fisheries- oceanography research program, EcoFOCI, in forecasting the need for long-term monitoring of the Bering Sea as well as providing strong science, information fisheries recruitment and implications to regional fisheries management councils. With the enhancement of Arctic-driven technologies at NOAA's Pacific Marine Environmental Laboratory, it is now possible to enhance the M2 site while continuing to meet the goals and responsibility of NOAA and provide solid science for the management of Alaska's marine ecosystems.

The EcoFOCI website is available for more information about research done in the Bering Sea, Gulf of Alaska, and Arctic waters.

H. M. Tabisola, P. J. Stabeno and C. W. Mordy, "Using a biophysical mooring as a sentinel for ecosystem change: The story of M2," *OCEANS 2017 - Anchorage*, Anchorage, AK, 2017, pp. 1- 6.

EcoFOCI M2 Products include the following:

1. Ecosystem Status Reports are produced annually to compile and summarize information about the status of the Alaska marine ecosystems for the North Pacific Fishery Management Council, the scientific community and the public. As of 2016, there are separate reports for the Eastern Bering Sea (updated 2019), Aleutian Islands (updated 2018), the Gulf of Alaska (updated 2019), and Arctic (forthcoming) ecosystems. These reports include ecosystem report cards, ecosystem assessments, and ecosystem and ecosystem-based management indicators that together provide context for ecosystem-based fisheries management in Alaska."
    - Ecosystem Status Report 2019 Eastern Bering Sea | Eastern Bering Sea Climate - FOCI | includes M2 & M8 Temperature Data and Sea Ice Extent.
    - Ecosystem Status Report 2019 Eastern Bering Sea | Phenology and Magnitude of Primary Production in the Eastern Bering Sea | Includes new index from Prawler, 2019-annually
    - Ecosystem Status Report 2019 Eastern Bering Sea | Phytoplankton Biomass and Size Structure During Late Summer to Early Fall in the Eastern Bering Sea | Data is from BASIS cruises, annually
    - Ecosystem Status Report 2019 Eastern Bering Sea | Coccolithophores in the Bering Sea
2. EcoFOCI mooring and shipboard data products to Alaska Ocean Observing System (https://aoos.org/), annually,
3. EcoFOCI mooring and shipboard data products to NOAA Arctic Report Card (SST section (since 2017-annually) and Recent Warming in the Bering Sea and Its Impact on the Ecosystem (2019-annually))
4. Observing systems (you should have these from the NRDD-- GOA, BS, and Arctic)
5. EcoFOCI mooring and shipboard data products to the Distributed Biological Observatory (annually)

Additionally, EcoFOCI mooring and shipboard data products are used in the decision making process to directly influence quota setting. For example,PMEL/ EcoFOCI's North Pacific Climate Regimes and Ecosystem Productivity provided key scientific information that enabled effective management and sustainable use of Alaska marine resources. Ecosystem science done with the help of the M2 mooring in 2016 and 2017 directly influenced decision-making by the North Pacific Fishery Management Council in determining the Alaska walleye pollock total allowable catch (TAC) and contributed to the Alaska Marine Ecosystems Considerations Report, used by the Council and other stakeholders, to evaluate current ecosystem status and project near- future conditions.

EcoFOCI mooring and shipboard data products:
In 2019, the Recruitment Processes Alliance provided key scientific information that enabled effective management and sustainable use of Alaska marine resources. Mooring data products retrieved from the M2 mooring ("Peggy"), contributed once again to ecosystem science in 2018 and 2019 that directly influenced decision-making by the North Pacific Fishery Management Council in determining the Alaska pacific cod total allowable catch (TAC) and contributed to the Alaska Marine Ecosystems Considerations Report, used by the Council and other stakeholders, to evaluate current ecosystem status and project near-future conditions. To provide the necessary data to make informed management decisions, NOAA Research and Fisheries scientists worked together to produce on-board sampling (Rapid Larval Assessment via shipboard sampling at mooring sites), expedited data work up, careful synthesis, and swift communication of results.

Appendix D3 –Zhu Peterson Early Career Scientist Award Nominations

Zhu Peterson Early Career Scientist Award Nominees 2020:

1. SAKAMOTO, Tatsuya
2. SATTERTHWAITE, Erin
3. SHI, Yongiang
4. SONG, Wei
5. WANG, Pengbin
6. XU, Qinzeng
7. ZHANG, Hui

Please see file sent separately

Appendix E – Scientific and Technical Committee Mid Year Reports - Supporting Documentation

Working Group 32: Biodiversity of Biogenic Habitats

See separate file:
Final Report of Working Group 32 on Biodiversity of Biogenic Habitats
Edited by Janelle M.R. Curtis and Masashi Kiyota
2020-ISB_AGENDA_ITEM_6_WG32_FINAL_REPORT

This report has been submitted to BIO for initial review, and is available on ISB download page.

Appendix E – Scientific and Technical Committee Mid Year Reports - Supporting Documentation

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

Final report

Executive Summary

Working Group 34 was proposed as a joint working group between PICES, and the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). The main purpose of the group was to collaborate on deriving habitat models for albacore tuna, and other Highly Migratory Species (HMS) in the North Pacific. Seven initial Terms of Reference for the working group emphasized collaborative activities across the scientific and management communities, to identify datasets, build models, and communicate results. In the four years since the working group was formed, research by group members has advanced understanding of the drivers of distribution and productivity for some commercially important HMS in the North Pacific. However, this research has largely proceeded within member countries, using fishery-dependent data available from their national fishing fleets. This is partially due to the difficulties associated with sharing confidential fishery-dependent data among countries, at the spatial and temporal resolutions most useful for building distribution models. A lack of intersessional meetings also limited cross-institution collaborations. Despite these challenges, the working group produced several publications, and multiple presentations at PICES annual meetings and other international conferences. The group also hosted or co-hosted two workshops and two topic sessions at PICES annual meetings between 2016 and 2019. Research by working group members particularly improved our knowledge of distribution drivers for albacore and Pacific bluefin tuna, and recruitment predictors for Pacific bluefin tuna. However, many questions remain. To highlight these knowledge gaps, research recommendations have been included under the activity summary of each Term of Reference.

Introduction

Working Group 34 was formed with the aim of leveraging international collaborative relationships to improve understanding of factors driving the distribution and productivity of highly migratory fishes in the North Pacific. The working group was chaired by scientists from both PICES and the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC). The ISC is an intergovernmental body dedicated to advancing fishery science of the North Pacific tuna and tuna-like fishes through cooperation and collaboration. PICES has similar goals (i.e. to promote and coordinate marine research in the northern North Pacific, and to advance scientific knowledge about the ocean environment, global weather and climate change, living resources and their ecosystems), but focuses much less on stock assessment and management activities. The joint working group was therefore proposed as a mechanism to link the science, assessment, and management communities, and thus to enhance understanding of the drivers of HMS distributions in the PICES domain.

The work plan and terms of reference initially focused on albacore tuna (*Thunnus alalunga*) as a case study, due to its distribution covering much of the PICES domain. This species is also not currently considered to be overfished, or undergoing overfishing, and so it was hypothesized that environmental influences on its distribution and recruitment may be more easily discernable than for more heavily exploited species such as Pacific bluefin tuna (*Thunnus orientalis*). However, research by working group members focused on both species, as well as some other pelagic fishes, during the life of the group.

The Terms of Reference for the working group highlighted the need to understand how oceanographic conditions influence the distribution, movement, and recruitment of highly migratory fishes. Many of these species are important top predators in North Pacific ecosystems, and some support economically important

fisheries. However, their extensive migratory movements across broad geographic ranges can complicate understanding of their ecology and population structure, as well as presenting difficulties for effective stock assessment. In addition, recruitment to highly migratory fish populations is often highly variable, and only weakly correlated with spawning stock biomass. The formation of Working Group 34 was designed to address some of these issues through targeted fisheries oceanography studies of key species.

Working Group Administrative Details

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

Current Chairs: Chi-Lu Sun (ISC, Chinese Taipei), Siqing Chen (China), Barbara Muhling (United States)

Past Chairs: Gerard DiNardo (United States)

Duration: October 2015 – October 2019

Meeting Venues and Dates

- FIS Workshop W4: "Methods relating oceanographic conditions to the distribution of highly migratory species". PICES-2016 Annual Meeting, San Diego, United States, November 2nd – 13th, 2016.
- FIS Workshop W3: "*Linking oceanographic conditions to the distribution and productivity of highly migratory species and incorporation into fishery stock assessment models*". PICES-2017 Annual Meeting, Vladivostok, Russia, September 22nd – October 1st, 2017
- FIS Topic Session S12: "*Applying ecosystem considerations in science advice for managing highly migratory species*". PICES-2018 Annual Meeting, Yokohama, Japan, October 25th – November 4th, 2018
- FIS/POC/BIO/HD Topic Session S11: "Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century". Victoria, Canada, October 16th – 27th, 2019.

Achievements with respect to Terms of Reference

1. *Promote research between PICES and ISC communities directed at understanding oceanographic conditions that provide suitable habitat for large, highly migratory pelagic fishes (specifically albacore tuna) in the North Pacific Ocean;*

Highly migratory fish species such as tunas and billfishes are ecologically important top predators in the North Pacific Ocean, as well as in other oceans around the world. They are fished by multiple fishing fleets using a wide variety of gears, with various national and international fisheries targeting newly recruited individuals (Yamada et al. 2006), juvenile animals (Childers et al. 2011), and mature adults (Itoh 2006). The migratory paths of HMS can cover entire ocean basins (Fujioka et al. 2018), and can allow fish to move between spawning and foraging grounds. The more endothermic tuna species, such as albacore and Pacific bluefin tuna, can maintain their internal body temperatures above ambient water temperatures, which has allowed them to exploit productive temperate foraging grounds in the North Pacific, and in Eastern Boundary Upwelling Systems, such as the California Current. However, like most other tuna species, their spawning activity is limited to more oligotrophic regions with warmer waters (greater than approximately 20°C), conditions which are presumed to enhance the survival of larvae (Muhling et al. 2017). Albacore and Pacific bluefin tuna must therefore travel long distances between foraging and spawning areas, and the timing and extent of these movements can be sensitive to environmental conditions. As a result, fisheries targeting these species may have to adapt to shifting phenology, distributions, and abundance of HMS as environmental variability and climate change impact their productivity and movements.

In addition to challenging fishing fleets and fishing communities, environmentally driven shifts in the distributions of managed species can cause problems if stock assessment and management frameworks are not robust to changes in availability among different fleets. Unlike many coastal or benthic fish species, which are the focus of other PICES working groups, HMS are not bound to particular benthic habitats or

bottom types. They often move through the Exclusive Economic Zones of multiple countries, as well as the high seas, throughout their life cycles. Shifts in species distributions therefore have implications for transboundary management and exploitation of shared resources among nations, as well as the future effectiveness of current arrangements between states and countries. These management measures may be increasingly challenged as climate change will continue to result in novel environmental conditions across the North Pacific.

Significant progress has been made in the four years since the working group was initiated on understanding habitat use of highly migratory species in the North Pacific, particularly with respect to albacore and Pacific bluefin tuna. Research results have highlighted the important roles of species-specific thermal limits in determining foraging areas and migratory corridors. There is also some evidence that changes in the distributions of prey fields can have substantial impacts on distribution of HMS, both at seasonal and interannual scales. Decadal-scale oceanographic variability in the North Pacific Transition Zone also appears important for migratory paths in juvenile albacore, potentially due to impacts on foraging conditions. Strong fluctuations in the availability of prey such as Japanese sardine in the western Pacific, and northern anchovy in the eastern Pacific, may also drive large-scale movements of juvenile albacore, impacting their availability to fishing fleets. As well as being important for broad-scale movements of albacore across the North Pacific, prey fields may also drive interannual variability in abundances of Pacific bluefin tuna in the Southern California Bight. Although both of these species are considered to be temperate tunas, albacore fisheries in the eastern north Pacific appear to be adversely impacted by anomalously warm conditions, whereas catches of Pacific bluefin tuna in the California Current region were at record levels during the recent marine heatwave.

However, this research has proceeded largely within PICES member countries, with some limited collaboration between scientists from different institutions. For example, some spatially aggregated data were shared between working group members from the USA and Canada, and some discussions were initiated between the USA and Japan regarding sharing tracks of archivally tagged fish. This lack of coordinated collaboration was partially due to the difficulties associated with sharing confidential fishery-dependent data among countries. This is a long-standing barrier to international collaborations among countries when analyses require set-by-set or un-aggregated fishery-dependent data. The lack of regular meetings among working group members outside of the PICES annual meetings also limited collaborations, as did the lack of coordination between PICES scientists and the ISC. However, two publications addressing Term of Reference #1 have been produced, and are listed in **Appendix 2,** with others in preparation. Relevant presentations at PICES and other international scientific meetings with working group members as co-authors are also shown in **Appendix 3**.

To best advance the research themes commenced under Term of Reference #1, more attention needs to be paid to the physiological mechanisms driving observed patterns of species distributions and movements. This is consistent with a general push by the climate impacts community to make biological models more mechanistic, instead of relying solely on correlative relationships. In the future, we also consider that it would be beneficial to improve communication between the scientific community, including Working Group 34 members, and the population dynamics and stock assessment communities. The two groups should continue to explore potential collaborations, including through the ISC, to determine where distribution modeling results could be useful for assessment and management of HMS. This can be difficult with current restrictions on travel, but could lead to more coordinated efforts including scientists across countries, and improve the applicability of fisheries oceanography research to fisheries management.

2. *Facilitate communication, regular exchange of information and organization of meetings to discuss and publish data, methodologies and results of research outlined above;*

Discussions among working group members from different countries were largely restricted to the workshops and topic sessions held at each PICES annual meeting from 2016 through 2019. In addition, the

results of working group research and related publications were presented to the ISC in 2019, as part of the National Report of the U.S.A, presented by the NOAA National Marine Fisheries Service. (Plenary 9, 19th Meeting of the International Scientific Committee for Tuna and Tuna-Like Species in the North Pacific Ocean. Taiwan, Taiwan, July 11-15, 2019).

As highlighted above, sharing of fishery-dependent data among countries is very difficult. However, analyses on aggregated data, or analyses of confidential data within countries but using common methodologies may be more achievable. This would require improved communication between the PICES and ISC/stock assessment communities. We note that several of the presentations given in the FIS/POC/BIO/HD Topic Session S11: "*Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century*" at the 2019 annual meeting highlighted that environmental information can be incorporated in the assessment and management framework at many stages in the process. These opportunities include at the hypothesis generation stage, as qualitative context, in the index standardization process or in the stock assessment model itself, or at the management advice stage. As the stock assessment models current used for HMS often do not lend themselves to direct incorporation of environmental covariates, future work in these areas should consider where in the assessment and management procedures environmental considerations may be useful. This scoping could then identify target areas for continuing research.

3. *Identify relevant environmental and distribution data sets for derivation of habitat models for albacore tuna, and if available for other key large pelagic fish species. Use these data to develop habitat models (and quantify model uncertainty), that identify oceanographic conditions that drive distribution of albacore tuna and predict fishery CPUE 'hot spots';*

A key requirement for building statistical species distribution models is the availability of both biological and environmental datasets. Biological data for commercially exploited species can be sourced from fishery-dependent observations, which can include self-reported industry logbooks, records from government-employed onboard observers, or electronic monitoring systems, such as VMS. In some cases, observations from fishery-independent surveys are available. Fishery-independent data have several advantages, including that they are often from statistically-designed surveys grids, which cover times, areas, and species of particular interest. They may also include life stages not present in commercial or recreational fishing data, such as larvae or early juveniles (e.g. Ohshimo et al. 2017). However, at-sea surveys are also expensive and time-consuming to run, particularly for species which are found across very large spatial areas. As result, the majority of data available for modeling HMS distributions comes from the fishing industry. In contrast, environmental predictors for use in species distribution models are mostly from remotely-sensed sources, or from ocean models, rather than at-sea observations. This is particularly true in recent decades, as these types of remote observations and ocean models have become more sophisticated, and more widely available. However, *in situ* observations are still highly valuable for verification and ground-truthing, and for assimilation into ocean models.

For the species distribution models developed as part of Working Group 34, environmental data were obtained from satellite observations, global physical and biogeochemical models, and higher resolution regional models (e.g. ROMS, Neveu et al. 2016). These were usually freely available, or obtained through partnerships among academic and/or government institutions. Biological data from fishery-independent surveys were also available in some regions, and were used to build habitat models for some albacore prey species (e.g. Muhling et al. 2019, **Appendix 2**). However, distribution data for albacore and other highly migratory pelagic fishes were mostly available from commercial and recreational fisheries. These data are usually considered to be confidential when in raw, un-aggregated format, and are typically not able to be shared among scientists from different countries. As a result, habitat modeling activities relevant to Working Group 34 mostly focused on the geographic ranges covered by national fishing fleets, rather than attempting to combine data from different countries. Despite these limitations, research by working group members and their colleagues produced new insights into drivers of distribution of juvenile albacore targeted by the U.S.

fleet (Muhling et al. presentations 2017-9, **Appendix 3**), and adult albacore targeted by the Japanese longline fleet (Nakatsugawa et al. presentation 2018, **Appendix 3**).

Future research recommendations relevant to Term of Reference #2 include the need to define habitat and movements of HMS throughout their geographic ranges, and across different life stages. This will be most effectively achieved if fishery dependent and fishery independent datasets from different member countries can be analyzed together, although this is generally difficult to do, as noted above. An improved understanding of the physiological drivers of migration and foraging behaviors from laboratory and/or modeling studies may also help to build more mechanistic distribution models for HMS. These will be particularly valuable as climate change continues to result in novel environmental conditions across the North Pacific.

4. *Identify relevant climate indices, demographic parameters and recruitment indices for investigation of climate driven variability in ocean state and productivity of albacore tuna, and if available for other key large pelagic fish species. Use these data to investigate linkages between large-scale climate indices and fish productivity.*

Many population dynamics and stock assessment models assume that recruitment to fish populations is largely dependent on adult spawning biomass (Hilborn & Walters 1992). However, observed relationships between annual recruitment and spawning biomass are often extremely noisy, and in some species, recruitment appears to vary almost independently (Lowerre-Barbieri et al., 2017). Some of this variability in recruitment can be attributed to environmental factors. There are multiple mechanisms by which environmental conditions can impact recruitment, including through larval growth and feeding, by varying oceanographic connections between spawning grounds and nursery areas, and through impacts on maternal condition. Although there is a long history of fisheries oceanography studies linking environmental conditions to recruitment in exploited fishes (e.g. Rothschild, 2000; Megrey et al., 2005), these relationships often fail when challenged with new data, or different analysis techniques (Myers, 1998). As a result, environmentally-driven indices of recruitment are rarely included in assessment and management processes, or as part of ecosystem-based management frameworks. However, if robust relationships based on mechanistic understanding can be developed, there is potential for both short-term early warnings of falling stock productivity, and enhanced understanding of how productivity may change in the longer term (e.g. Tommasi et al. 2017).

Much of the work on variable recruitment in North Pacific albacore was conducted by Dr. Desiree Tommasi (University of California – Santa Cruz and NOAA), who is leading the current Management Strategy Evaluation (MSE) of this stock. Initial work (Muhling et al. presentation, 2018 Ocean Sciences meeting, **Appendix 3**) showed that albacore recruitment was not strongly predictable by environmental or climate variables. This finding was likely due to both the broad geographic area over which albacore spawn, and our relatively limited understanding of interannual variability in larval distribution and survival. As a result, the work relevant to the MSE (Tommasi presentations 2017-9, **Appendix 3**) has focused on the effects of different recruitment scenarios, rather than modeling environmental influences on recruitment explicitly. In contrast, recruitment to the Pacific bluefin tuna stock was found to be strongly predictable based on environmental conditions near spawning grounds (Muhling et al. 2018, **Appendix 2**). In particular, warmer temperatures on juvenile nursery grounds in the late summer and autumn were associated with higher levels of recruitment in this species. Unlike albacore, Pacific bluefin tuna spawn in well-defined, spatially restricted areas within a short spawning season, their early life history is relatively well understood, and catches of age-0 fish around coastal Japan provide a very reliable index of recruitment. These results may allow the advance prediction of recruitment for this species, if skillful multiannual temperature forecasts are available (Tommasi & Muhling 2019 presentation, **Appendix 3**). The sensitivity of Pacific bluefin tuna early life stages to temperature may also have implications for their phenology as ocean temperatures continue to warm (Kimura et al. 2017-8 presentations, **Appendix 3**).

In order to predict near-term and long-term future changes in recruitment of North Pacific HMS, improved mechanistic understanding of spawning and larval ecology will likely be required. While statistical correlations between environmental time series and annual recruitment can be helpful, without knowledge of the physiological processes underpinning these correlations, confidence in the stationarity of the relationships going in to the future can be limited. In addition, outstanding questions regarding spatial stock structure in species such as albacore will need to be resolved. This species is currently managed and assessed as one stock across the North Pacific. If future research suggests that there is spatial structure in spawning, genetic types, or movement of young juveniles onto nursery grounds, then current hypotheses regarding drivers of recruitment in the species will need to be re-assessed.

5. *Hold three workshops, one each year of the duration of the Working Group: with the first and third workshops held in conjunction with the PICES Annual Meeting (PICES-2016, USA and PICES-2018, Japan), and the second workshop held in conjunction with the ISC Plenary Meeting (July 2017, location TBD). Reports of these workshops will be jointly published by PICES and the ISC;*

Workshops were held as planned at the 2016 and 2017 PICES annual meetings. In addition, a topic session on "*Applying ecosystem considerations in science advice for managing highly migratory species*" was held at the 2018 PICES annual meeting (report in **Appendix 4**), and a broader topic session on "*Incorporating ecosystem variability and climate change into fisheries management"* was co-hosted at the 2019 PICES annual meeting (report in **Appendix 5**). The 2019 topic session was particularly well-attended, including by NOAA laboratory directors and ISC representatives, and presentations given in this session highlighted that North Pacific Ecosystem Based Fishery Management frameworks have advanced substantially in the past several years. Workshops were not held at ISC plenary sessions, but results of the working group were reported to the ISC at the 2019 plenary, as part of the National Report of the U.S.A, presented by the NOAA National Marine Fisheries Service. The topic session at the 2018 PICES annual meeting was also co-sponsored by the ISC, and Dr. Steve Teo co-chaired the session on their behalf.

6. *Produce peer-reviewed publications of scientific results;*

Publications resulting from working group activities are shown in **Appendix 2**. Additional publications are being prepared, with some preliminary results of these presented at the 2018 and 2019 PICES annual meetings. These publications address many of the research questions outlines under the original Terms of Reference, particularly with respect to determining the drivers of distribution shifts and recruitment variability in albacore and Pacific bluefin tuna.

7. *Publish a final report summarizing the results of the WG as a PICES Scientific Report*

Summary of Working Group conclusions and future plans

Working Group 34 was convened to advance understanding of how distribution and productivity of highly migratory pelagic fishes responds to their oceanographic environment. Research by multiple working group members has addressed the aims set out under the initial Terms of Reference, however work has proceeded largely within member countries, with limited collaboration among institutions. This was partly due to the difficulties associated with sharing confidential fishery-dependent data, but also potentially due to a lack of inter-sessional meetings of the group. Despite these limitations, the working group hosted or co-hosted two workshops and two topic sessions at PICES annual meetings between 2016 and 2019. Research from working group members addressing the objectives of the group has been published in peer-reviewed journals, with more manuscripts in the preparatory stages. In addition, a large number of presentations have been given on research relevant to the Terms of Reference, both at PICES annual meetings, and other major international conferences. We recommend that future work include studies focused on determining the biological mechanisms underlying observed shifts in distribution and productivity of HMS in the North Pacific, to enhance our ability to predict future changes. We also recommend that communication be improved between scientists from PICES and the ISC, to explore ways in which PICES

research could be applicable to existing management frameworks. Although no follow-up working group has been proposed, research relevant to Working Group 34 is continuing under some external grants, such as the Future Seas project in the United States (www.future-seas.com), and also within the home scientific institutions of working group members.

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Appendix 1: List of participants

Name	Institution	Country
Chi-Lu Sun	ISC	Chinese Taipei
Siqing Chen	Yellow Sea Fisheries Research Institute	China
Barbara Muhling	UCSC/NOAA	United States
Zane Zhang	Fisheries and Oceans Canada	Canada
Zuozhi Chen	South China Sea Fisheries Research Institute	China
Heng Zhang	East China Sea Fisheries Research Institute	China
Ping Zhuang	East China Sea Fisheries Research Institute	China
Shingo Kimura	Atmosphere and Ocean Research Institute, The University of Tokyo	Japan
Youjung Kwon	National Institute of Fisheries Science	Korea
Sung-Il Lee	National Institute of Fisheries Science	Korea
Carrie Holt (past)	Fisheries and Oceans Canada	Canada
Gerard DiNardo (past)	NOAA NMFS	United States

Appendix 2: Working Group Publications

Term of Reference #1

- **Muhling B., A.,** Brodie, S., Jacox, M., Snodgrass, O., Dewar, H., Tommasi, D., Edwards, C. A., Xu, Y., Snyder, S., & Childers, J. (2019) Dynamic habitat use of albacore and their primary prey species in the California Current System. Calcofi Reports 60
- Runcie, R. M., **Muhling, B. A.**, Hazen, E. L., Bograd, S. J., Garfield, T., & **DiNardo, G.** (2019). Environmental associations of Pacific bluefin tuna (*Thunnus orientalis*) catch in the California Current system. Fisheries Oceanography 28: 372-388.

Term of Reference #4

- **Muhling, B. A.**, Tommasi, D., Ohshimo, S., Alexander, M. A., and **DiNardo, G.** (2018). Regional-scale surface temperature variability allows prediction of Pacific bluefin tuna recruitment. ICES Journal of Marine Science, 75(4), 1341-1352.

Appendix 3: Relevant working Group Presentations

Term of Reference #1

PICES-2019 Annual Meeting, Victoria, BC, Canada

- Shifting distributions of fisheries for juvenile albacore in the eastern North Pacific. **Barbara Muhling**, Desiree Tommasi
- Recent changes to the structure and function of the North Pacific albacore fishery. Timothy Frawley, **Barbara Muhling**, Gwendal Le Fol, Megan Cimino, Steven Bograd, Elliott Hazen and Michael Jacox
- Using machine learning techniques to estimate pelagic species distributions under novel environmental conditions in the California Current system. **Barbara Muhling**, Elliott Hazen, Stephanie Brodie and Michael Jacox

PICES-2018 Annual Meeting, Yokohama, Japan

- Spatio-temporal distribution of albacore *Thunnus alalunga* and its relationship with environmental changes in the Pacific Ocean. Kento Nakatsugawa, Hidetada Kiyofuji and **Shingo Kimura**
- Migration paths and habitat use of albacore in the eastern North Pacific, with implications for surface fisheries. **Barbara Muhling**, Desiree Tommasi, Owyn Snodgrass and Heidi Dewar

2018 Ocean Sciences Meeting, Portland, OR, USA

- Using habitat models to incorporate climate variability and assess the impact on Pacific Bluefin (*Thunnus orientalis*) tuna distributions and availability to commercial and recreational fishing fleets in the Eastern Pacific Ocean. Rosa Runcie, **Barbara Muhling**, Elliott Hazen, Steven Bograd, Toby Garfield and **Gerard DiNardo**

2017 PICES Transition Zones Symposium, La Paz, Mexico

- North Pacific albacore distribution and migrations along transition zones. **Barbara Muhling**, Desiree Tommasi and John Childers

PICES-2016 Annual Meeting, San Diego, CA, USA.

- The impact of climate change on Pacific Bluefin (*Thunnus orientalis*) tuna distribution in the Eastern Pacific Ocean. Rosa Runcie, **Gerard DiNardo**, Toby Garfield, Elliott Hazen, Steven Bograd, Kylie Scales and Jordan DiNardo

Term of Reference #4

PICES-2019 Annual Meeting, Victoria, BC, Canada

- Integration of multiannual climate predictions in the estimation of stock status and rebuilding time frames for highly migratory species. Desiree Tommasi, **Barbara Muhling**

PICES-2018 Annual Meeting, Yokohama, Japan

- A management strategy evaluation framework to assess robustness of harvest guidelines for North Pacific Albacore tuna to variable productivity and distribution. Desiree Tommasi, **Barbara Muhling**, Steve Teo and **Gerard DiNardo**
- Effects of global warming on spawning behavior of the Pacific bluefin tuna based on otolith oxygen stable isotope analysis. **Shingo Kimura**, Yulina Hane, Yusuke Yokoyama, Yosuke Miyairi, Takayuki Ushikubo and Nobuhiro Ogawa

2018 Ocean Sciences Meeting, Portland, OR, USA

- Environmentally-Informed Recruitment Indices for North Pacific Albacore: Assessing Management Performance in a Changing Ocean. **Barbara Muhling** and Desiree Tommasi

PICES-2017 Annual Meeting, Vladivostok, Russia

- Consequences of environmentally driven uncertainty in productivity for management of North Pacific Albacore tuna. Desiree Tommasi, **Barbara Muhling**, Steven Teo and **Gerard Di Nardo**

- Oceanographic influences on the spawning and recruitment of Pacific bluefin tuna. **Barbara Muhling**, Desiree Tommasi and **Gerard DiNardo**
- Development of methodology for analyses of larval ambient water temperature of Pacific bluefin tuna using SIMS. Yulina V. Hane, **Shingo Kimura**, Yusuke Yokoyama, Yosuke Miyairi and Takayuki Ushikubo

Appendix 4: Report of 2018 FIS Topic Session (S12)

Applying ecosystem considerations in science advice for managing highly migratory species

Convenors: Steve Teo (USA, ISC), Carolina Minte-Vera (USA, IATTC), Gerard DiNardo (USA)
Co-sponsor: ISC
Invited Speaker:
Yong Chen (School of Marine Sciences, University of Maine, USA)

Background

Large-scale oceanographic processes and bioenergetic requirements determine the distribution and productivity of many pelagic fish populations in the North Pacific, as well as the fisheries which depend on them. For example, highly migratory pelagic species (HMS), such as albacore tuna (*Thunnus alalungus*) and Pacific sardine (*Sardinops sagax*), have environmental thresholds and preferences, as well as energetic requirements to sustain growth and survival that drive their distribution and productivity. Managing these species has traditionally focused on maintaining the sustainability of targeted stocks and, as such, comprehensive data sets on the catches, biology and ecology of many exploited stocks exists. In many cases, there are limited quantitative data describing ecosystem impacts on HMS, social and economic impacts on HMS fisheries due to ecosystem variability, and limited formal consideration of the roles of external drivers (e.g., oceanographic variability) in the context of sustainability and governance. Beyond these limitations there is also the challenge to identify linkages and important relationships both within ecosystems (including exploited stocks), and across social, economic and governance facets of fisheries management.

This topic session aimed to provide an overview of contemporary research on the topic, including the identification of statistical modeling approaches linking spatially explicit environmental variables to the distributional of fish, determined through both fishery-dependent and fishery-independent data. Presentations included studies on methods to assess the impacts of oceanographic variability on fish productivity and socioeconomic decision making, as well as descriptions of new, cutting-edge technologies which can aid the management of HMS. Challenges to explicitly incorporating environmentally driven dynamics into stock assessments, and challenges facing governance when applying ecosystem considerations, were also discussed.

Summary of Presentations

The invited speaker was Yong Chen (University of Maine, USA), who gave a plenary presentation on "*Challenge and opportunity for fisheries stock assessment in changing environments*". He described how changing environmental conditions can challenge traditional stock assessment methods, but also described some future paths forward, to address some of these issues.

Shingo Kimura described a new method of detecting changes in otolith oxygen stable isotope ratios in Pacific bluefin tuna. The Secondary Ion Mass Spectrometry (SIMS) technique can recreate potential water temperatures experienced by fish at much higher temporal resolution than previously, including estimation of water temperatures at the time of spawning.

Ayako Suda reported on the identification of male-specific DNA markers in Pacific bluefin tuna. A PCR-based method was shown to correctly identify the sex of 131 individual fish, which will contribute to determining optimum sex ratios for aquaculture of this valuable species.

Kento Nakatsugawa presented on some apparent spatial changes in the distribution of North Pacific albacore over the last several decades. A westward shift in the distribution of this species may be related to fluctuations in key prey species in the central-western North Pacific, including Japanese sardine, and Japanese anchovy.

Barbara Muhling also described results from a study on North Pacific albacore, showing how migration paths in this species may be related to both optimum temperature ranges, and primary production, which can be used as a proxy for foraging conditions. These may also drive some of the latitudinal shifts in albacore off the western North American coast.

Gerard DiNardo presented results of a study led by Desiree Tommasi, on a management strategy evaluation of North Pacific albacore. Simulation results showed how the likelihood of meeting a range of

target conditions identified by stakeholders depended on a combination of harvest guidelines, and reference points adopted.

Ning Chen showed estimates of fishing mortality (F), and FMSY for Fang's blenny Haizou Bay, China, using length-based assessment methods implemented by two different R packages. The advantages of each package depended on the amount of survey data available to inform them.

Oxana Mikhaylova presented on the stock assessment of northern shrimp off Kamchatka, Russia. She described how improving information on the age of the shrimp has allowed several methodological improvements in the assessment over time.

Xindong Pan closed the oral session by describing life-history connectivity in Japanese Spanish mackerel from otolith chemistry. Results of his study suggested that immature fish mixed substantially after spawning, and local mackerel assemblages which support fisheries may derive recruitments from multiple geographic locations.

List of papers

Oral presentations

Challenge and opportunity for fisheries stock assessment in changing environments
Yong Chen

Effects of global warming on spawning behavior of the Pacific bluefin tuna based on otolith oxygen stable isotope analysis
Shingo Kimura, Yulina Hane, Yusuke Yokoyama, Yosuke Miyairi, Takayuki Ushikubo and Nobuhiro Ogawa

Development of male-specific DNA markers in the Pacific bluefin tuna (*Thunnus orientalis*): Potential applications for sex ratio control in aquaculture and contribution to tuna resource management
Ayako Suda, Tsubasa Uchino, Issei Nishiki, Yuki Iwasaki, Masashi Sekino, Tetsuya Akita, Nobuaki Suzuki and Atushi Fujiwara

Spatio-temporal distribution of albacore *Thunnus alalunga* and its relationship with environmental changes in the Pacific Ocean
Kento Nakatsugawa, Hidetada Kiyofuji and Shingo Kimura

Migration paths and habitat use of albacore in the eastern North Pacific, with implications for surface fisheries
Barbara Muhling, Desiree Tommasi, Yi Xu, Stephanie Snyder, John Childers, Owyn Snodgrass, Heidi Dewar

A management strategy evaluation framework to assess robustness of harvest guidelines for North Pacific Albacore tuna to variable productivity and distribution
Desiree Tommasi, Barbara Muhling, Steve Teo and Gerard DiNardo

Evaluating the performance of two methods for estimating fishing mortality rate of Fang's blenny (*Pholis fangi*) based on size frequency data
Ning Chen, Chongliang Zhang, Ming Sun, Binduo Xu, Ying Xue, Yiping Ren,, Yong Chen

Commercial stock assessment and forecast of northern shrimp *Pandalus eous* on the south-western Kamchatka
Oxana G. Mikhaylova and Oleg I. Ilyin

Life-history connectivity in a highly migratory fish, Japanese Spanish mackerel (Scomberomorus niphonius), implications from otolith chemistry
Xindong Pan, Chi Zhang, Zhenjiang Ye, Binduo Xu, Yang Liu and Yongjun Tian

Poster presentations

Changes in Pacific cod (*Gadus macrocephalus*) size distribution in the North Pacific Ocean over 6 millennia: Possible impacts of fishing pressure or environmental variability
Catherine F. West, Michael A. Etnier, Megan A. Partlow, Steven Barbeaux, and Alexei Orlov

Variation in the catch rate and distribution of swordtip squid (*Uroteuthis edulis*) associated with factors of the oceanic environment in the southern East China Sea
Jia-Huei Lin, Kuo-Wei Lan1 and Cheng-Hsin Liao

Review of stock status of Japanese domestic fisheries and new harvest control rule in Japanese

domestic fisheries management
Momoko Ichinokawa and Hiroshi Okamura
Role of shallow channel to space-time variation of coastal fisheries resources -Relationship between coastal fisheries resources and oceanographic condition in Hyuga-Nada, Japan
Tsutomu Tokeshi, Kenji Nakanishi and Hirotaka Toyama
Using habitat models to incorporate climate variability and assess the impact on Pacific Bluefin (*Thunnus orientalis*) tuna distributions and availability to commercial and recreational fishing fleets in the Eastern Pacific Ocean
Rosa Runcie, Barbara Muhling, Elliott L. Hazen, Steven J. Bograd, Newell Garfield, Gerard DiNardo.

Appendix 5: Report of 2019 FIS/POC/BIO/HD Topic Session (S11)

Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century

Convenors: Barb Muhling (USA), Carrie Holt (Canada), Kirstin Holsman (USA), Sukyung Kang (Korea), Gerard DiNardo (USA, past)

Invited Speaker: Stephani Zador (NOAA Fisheries, USA)

Background

Physical, biological and social components of marine ecosystems interact in complex ways through space and time, resulting in challenges for natural resource managers. Environmental variability and climate change can drive shifts in the spatial distribution and productivity of target and bycatch species. This can impact the effectiveness of stock assessment and management. Ecosystem-Based Fisheries Management (EBFM) aims to address these issues by including environmental effects, species interactions, and other ecosystem-level processes in the management process for exploited species, in addition to fishing pressure. Ecosystem variables can be considered qualitatively in management advice by providing context about the state of the ecosystem or quantitatively in models that derive management-relevant quantities (e.g., allowable catch). However, despite the theoretical benefits of EBFM, most stock assessments and management measures still use single-species models with no ecosystem information incorporated. In this session, we sought presentations describing how ecosystem variability and climate change have been considered in management advice qualitatively and/or quantitatively, or on how management advice could consider those variables.

Summary of Presentations

The invited speaker was Stephani Zador (NOAA Fisheries, USA), who gave a presentation on "*Merging contextual ecosystem advice with single-species stock assessment to inform fisheries managers in times of extreme environmental changes*". She described how ecosystem advice is incorporated into the assessment and management of several fish stocks in the Bering Sea and Gulf of Alaska, both through inclusion in assessment models and provision of contextual advice later in the process. Recent developments in the region included the development of species-specific risk tables, to alert managers and industry to unusual trends or events which could impact stock status or catch limits.

Anne Hollowed presented on the NOAA Climate Fisheries Initiative, which is working on determining the climate information needs of natural resource scientists and managers in United States Large Marine Ecosystems. She described the current implementation plan, and future developments, including the planned adoption of MOM6 for regional downscaling efforts.

Szymon Surma (Early Career Scientist) described a Management Strategy Evaluation (MSE) for Pacific herring in the northeast Pacific, using an ecosystem modeling framework (Ecopath with Ecosim). His results suggested that protected species which feed on herring, such as marine mammals, could benefit most strongly from low allowable catch rates for herring. However, these management actions are predicted to cause frequent closures to the herring fishery, resulting in large economic impacts. The ideal balance between forage fish protection and sustainable herring fisheries was thus difficult to achieve.

Isaac Kaplan presented research testing the performance of different stock assessments from the California Current and Nordic/Barents Sea under climate change conditions, using Atlantis ecosystem models. Stock assessment performance was evaluated by quantifying the bias and precision of derived quantities related to population size, fishing intensity, and depletion, and by evaluating management performance when fishing rates were set based on reference points estimated in the assessments.

Gloria Duran (Early Career Scientist) showed how the catch per unit effort of swordfish on longline gear was influenced by oceanographic features in the Kuroshio Extension system. Her results highlighted the importance of mesoscale eddies, as well as Kuroshio Current instability, in drive spatial distributions of catch rates.

Phoebe Woodworth-Jefcoats presented a number of different ways by which EBFM could be better incorporated into the deep-set longline fishery targeting bigeye tuna in the central and eastern North Pacific.

Current management measures can cause a "race to fish", leading to instability in prices and profits for fishers. Alternative management strategies could ameliorate these issues, as well as providing ways to address potential future yield decreases in the region under climate change.

James Smith presented the results of a simulation study, looking at the effects of different spatial closures in the west coast US drift gillnet fishery. Dynamic spatial closures can provide more economic opportunity for fishers than static closures, but can also lead to potentially higher rates of turtle interactions. The low number of turtle observations available for building species distribution models was identified as a key uncertainty in the study.

Yan-Lun Wu described how global yellowfin tuna catch rates are correlated with a suite of climate indices, across different ocean basins. Wavelet analysis showed that basin-specific indices (e.g. Pacific Decadal Oscillation, Atlantic Multidecadal Oscillation) were generally most influential in the region over which they are calculated, but they could also be important in neighboring basins.

Johanna Wren (Early Career Scientist) presented a network analysis for the Hawaii-based deep set longline fishery. This work used co-occurrence measures to show associations between target species (bigeye tuna), and various bycatch species. These associations were often stable through time, but varied across the spatial extent of the fishery.

Desiree Tommasi showed results from a study predicting Pacific bluefin tuna recruitment based on surface temperatures around nursery areas in the Western North Pacific. She showed that multiannual forecasts of SST had some potential to predict recruitment in advance, but that more work is required to capture the observed variability in interannual recruitment for this species.

Melissa Karp (Early Career Scientist) presented recommendations from a recent workshop on the impacts of shifting distributions and productivity changes in managed stocks for the United States. She highlighted the importance of continuing survey data collection, appropriate modeling techniques, and communication with management agencies in addressing these issues.

Fan Zhang (Early Career Scientist) examined the presence of hysteresis and alternative stable states in populations of cod and American plaice in the Northwest Atlantic. He showed that hysteresis did exist in time series of abundance for these two species, but that these regime shifts did not appear to be predictable in advance using time series characteristics such as temporal autocorrelation and variance through time.

Kristin Marshall described work from the western United States examining the robustness of Pacific hake management strategies to environmental variability. Her results suggested that status quo management may lead to reduced management performance if hake distributions shift in the future, due to climate change.

Elliott Hazen presented work on behalf of Heather Welch describing how surface temperature metrics in the Southern California Bight can reduce bycatch of loggerhead turtles on fishing gear. This study found that a 6 month mean of surface temperature was the best indicator of turtle presence on the fishing grounds, and that turtles were more likely to be encountered when temperatures were anomalously high.

Briana Abrahms (Early Career Scientist) showed how ship strike risk for blue whales off southern California was predictable based on suitable foraging habitat for whales, and locations of shipping lanes. A dynamic ocean management strategy was shown to have potential advantages over a current voluntary ship speed limit imposed from spring through fall.

Johanna Wren presented work on behalf of Donald Kobayashi describing a climate vulnerability assessment for marine species in the Pacific Islands region. Vulnerability to future climate change varied widely depending on the habitat of each species, with sharks showing potentially high vulnerability out of the more than 80 species considered.

Carrie Holt described the results of a review examining how environmental information is incorporated into stock assessments and management decisions for Canadian fisheries. She showed that the incorporation of environmental metrics is most common at the hypothesis development stage, and as qualitative information during the assessment process, but is less commonly included when giving management advice.

James Thorson described how the decomposition of environmental drivers into large-scale indices, and local effects, can best represent the impacts of environmental regimes on species distribution shifts. He also showed how spatiotemporal aucotcorrelation frameworks can be useful to address gaps in survey sampling

designs through time.
Yumeng Pang (Early Career Scientist) presented work examining the effects of temperature on the reproductive characteristics of two commercially important squid species. These were shown to be potential drivers behind observed changes in stock biomass through time, which have impact fisheries landings in the region.
Xiutang Yuan described the results of laboratory studies on impacts of warming and acidification on a species of sea cucumber. His work showed that this species attained larger sizes at warmer water temperatures, but that acidification negatively impacted growth.
Brian Wells presented results from a life cycle model for eastern Pacific salmon. This work highlighted the importance of predation to juvenile salmon survival during the marine part of their life history, as well as the impacts of juvenile size upon emigration from freshwater environments.
Barbara Muhling described historical changes in the distribution of eastern North Pacific albacore fisheries in the past several decades. Her results suggested that future climate change may have complex effects on albacore distribution, and that drivers of inshore-offshore shifts in the fishery need to be better understood.
Desiree Tommasi presented work on behalf of Kisei Tanaka showing the skill of temperature forecasts for estimating species distribution shifts in the Northwest Atlantic. Forecasts at 1-5 year lead times showed particular promise for future predictions.
Tatiana Kozlova described the dynamics of pink salmon abundance in riverine environments in coastal Russia. Her work suggested that environmental drivers were strongly influential in determining salmon dynamics, and thus availability to fisheries.

List of papers

Oral presentations

Merging contextual ecosystem advice with single-species stock assessment to inform fisheries managers in times of extreme environmental changes
Stephani Zador, Elizabeth Siddon, Martin Dorn

National Oceanic and Atmospheric Administration's Climate Fisheries Initiative: Longterm projections
Anne Hollowed, Charles Stock, Alan Haynie, Albert Hermann, Kirstin Holsman

Towards ecosystem-based management of Northeast Pacific herring fisheries
Szymon Surma

Fragile ecosystems, robust assessments? Performance testing stock assessments for the California Current and Nordic and Barents Seas under climate change
Isaac C. Kaplan, Sarah K. Gaichas, Patrick D. Lynch, Christine C. Stawitz, Cecilie Hansen

Spatiotemporal interannual variabilities of Swordfish Catch in relation to Fronts and Eddies in the Northwestern Pacific
Gloria S. Duran, Takeyoshi Nagai, Kotaro Yokawa

Ideas on how to incorporate EBFM into a pelagic longline tuna fishery
Phoebe A. Woodworth-Jefcoats, Justin Hospital, Johanna L.K. Wren, Sarah Medoff-Wong

An evaluation of dynamic and static spatial management in a swordfish fishery: Balancing economic and bycatch concerns
James A. Smith, Desiree Tommasi, Michael Jacox, Elliot Hazen, Heather Welch, Stephanie Brodie

Application of time series analysis to detect the effect of multi-scale climate indices on global yellowfin tuna population
Yan-Lun Wu, Kuo-Wei Lan, Yong-Jun Tian

Network analysis in the Hawai'i-based longline fishery reveal spatiotemporal changes in network complexity and species association from 1995-2019
Johanna L.K. Wren, Phoebe A. Woodworth-Jefcoats

Integration of multiannual climate predictions in the estimation of stock status and rebuilding time frames for highly migratory species
Desiree Tommasi and Barbara Muhling

Accounting for shifting distributions and changing productivity in U.S. marine fisheries

management: Challenges and recommendations
Melissa Karp, Jay Peterson, Patrick Lynch, Roger Griffis
Regime shift and early warning signals of Atlantic cod and American plaice on Grand Bank off Newfoundland
Fan Zhang, Paul Regular, Eric Pedersen
A multi-model approach to better understanding the robustness of management of Pacific hake to environmental variability
Kristin N. Marshall, Isaac C. Kaplan, Kirstin Holsman, Grant Adams, Nis Jacobsen
Environmental indicators to reduce loggerhead turtle bycatch offshore of Southern California
Heather Welch, Elliott L. Hazen, Dana K. Briscoe, Steven J. Bograd, Michael G. Jacox, Tomoharu Eguchi, Scott R. Benson, Christina C. Fahy, Toby Garfield, Dale Robinson, Jeffrey A. Seminoff, Helen Bailey
The only constant is change: Incorporating socioecological variability into protected species management
Briana Abrahms, Hannah Blondin, Steven J. Bograd, Blake Feist, Mary Fisher, Arjun Hausner, Elliott L. Hazen, Jameal Samhouri
Assessing the vulnerability of marine life to climate change in the Pacific Islands Region
Donald R. Kobayashi, Jonathan Giddens, Mark Nelson, Johanna Wren
Incorporating climate, oceanographic and ecological change considerations into population assessments in Canada: A review and recommendations
Pierre Pepin, Jacquie King, Carrie Holt, Helen Gurney-Smith, Nancy Shackell, Kevin Hedges, Alida Bundy
Measuring the impact of oceanographic indices on species distribution shifts: The spatially varying effect of cold-pool extent in the eastern Bering Sea
James T. Thorson
Environmental effects on reproductive traits in cold/warm-water squids: Implications on catch fluctuation
Yumeng Pang, Chin-Shin Chen, Tomohiko Kawamura, Yoko Iwata
Impact of seawater acidification and warming on the early development of the sea cucumber *Apostichopus japonicus* (Selenka) (Echinodermata: Holothuroidea)
Xiutang Yuan, Mingshan Song, Xiaolong Yang, Anguo Zhang, Lili Wang
Environmental determinants of spatiotemporal variability in salmon forage and its direct and indirect effects on salmon recruitment
Brian K. Wells, Whitney R. Friedman, Megan Sabal
Shifting distributions of fisheries for juvenile albacore in the eastern North Pacific
Barbara Muhling, Desiree Tommasi
Prospects for environmental prediction of annual fishery range expansion and contraction:
A case study in the Northwest Atlantic
Kisei R. Tanaka, Fernando G. Taboada, Charles A. Stock, Desiree Tommasi, Malin L. Pinsky, Vincent S. Saba, Jorge L. Sarmiento1
Dynamics of Pink Salmon (Oncorhynchusgorbuscha) abundance in the Tatar Strait rivers (Sea of Japan)
A.A. Dulenin, Tatiana.V. Kozlova

Poster presentations
Is there a disruption in the food-web pathways in the Strait of Georgia that might be related to the declines in the Pacific salmon and Pacific herring in Canada?
David Costalgo
Traditional Intertidal Species Regression Study

Mikale Milne

Appendix E – Scientific and Technical Committee Mid Year Reports - Supporting Documentation

MONITOR request to add Clare Ostle as ex-officio member of MONITOR representing MBA, to replace Sonia Batten.

Dear Sung Yong,

I hope that life in South Korea is slowly returning to normal - it is not yet like that here, but I am hoping it is not too far away!

We have talked about this briefly already, but now I am formally asking you to consider the addition of Dr Clare Ostle as an ex-officio member of the MONITOR committee, representing the North Pacific CPR Survey, and replacing me in this role. Dr Ostle is a research scientist based at the Marine Biological Association, UK and for the last 3 years has been leading the expansion of the Pacific survey into the western Arctic. She gave a presentation on this program at the recent annual PICES meeting during the MONITOR/BIO workshop celebrating two decades of the Pacific CPR survey (W5). This month she takes over the role of coordinating the North Pacific Survey and so is ideally suited to continue the close interaction between PICES MONITOR and the MBA and to further the CPR program within PICES.

I believe the next steps would be for you to recommend her addition to Science Board who can then pass the request to Governing Council.

with very best wishes
Sonia

****

Dr Sonia Batten
Director Pacific CPR Survey

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Join the Marine Biological Association
Sonia.Batten@mba.ac.uk

http://pices.int/projects/tcprsotnp/default.aspx
www.sahfos.org

Global Alliance of CPR Surveys (GACS): gacs@mba.ac.uk
www.globalcpr.org

Appendix F – Expert Group Updates - WG 39 Joint PICES/ICES/PAME Working Group on an Integrated Ecosystem Assessment for the Central Arctic Ocean

April 7, 2020

Mid-Year Report of WG-39 for ISB

Sei-Ichi Saitoh

- activities that were conducted since PICES-2019

We have been compiling first IEA report of WGICA, titled 'Integrated Ecosystem Assessment of the Central Arctic Ocean: ecosystem description and vulnerability characterization.'.

- activities that were PLANNED for 2020 and their status. Did any of these get replaced by virtual meetings?

We proposed an intersessional activity to hold the 5th WGICA meeting in Copenhagen, from April 27 to April 29, 2020 in connecting with UN Decade of Ocean Science Arctic workshop in Copenhagen, from April 28 to May 1, 2020. Under COVID-19 outbreak situation in the world, we decided to have online(virtual) meeting of 5th WGICA workshop using WebEx as same planned day on April 27 - 29, 2020. ICES will support this online workshop using WebEx system. UNDOS Arctic workshop has now been rescheduled to 21-23rd October 2020 in Copenhagen. We have a plan one day workshop of WGICA to follow this UNDOS Arctic workshop on October 24, 2020, as same place in Copenhagen for following up online WGICA workshop and developing second IEA Report of CAO.

- Status of any publications

We will submit final version of first IEA report of CAO to ICES the end of April.
We Started to discuss on second IEA report of CAO.

- Planned activities at PICE-2020 and ICES ASC 2020 (assuming these meetings take place).

WG-39 has a plan to hold a half day Workshop on "How does the Pacific Arctic gateway affect the marine system in the Central Arctic Ocean (CAO)?" in PICES-2020. This workshop is assigned for W4 as SB Topic Workshop which will be held on October 22, 2020. Co-conveners are Sei-Ichi Saitoh (Japan), corresponding, Hyoung-Chul Shin (Korea), Guangshui Na (China) , Lisa Eisner (USA) , and Libby Logerwell (USA).

- any other issues that you need Science Board direction on.

AMAP would like to become a part of the WGICA so we will be "ICES-PICES-PAME-AMAP" joint working group. Please advise us how to proceed this process.

Appendix F – Expert Group Updates

WG ONCE: Joint PICES/ICES Working Group on Ocean Negative Carbon Emissions

Group Type: Working Group

Group Name: Joint PICES/ICES Working Group on Ocean Negative Carbon Emissions (ONCE) – From Science to Applications

Reporting to: BIO, POC, and FUTURE (these three EG's were recognized as being very relevant to the topic, but Robin and I think that possibly FUTURE would not be a parent for this—FUTURE is taking on a lot related to the UN Ocean Decade

Term: October 2019 – October 2022

Linkage(s) to previous PICES Expert Groups or activities
The ONCE WG is linked to the previous PICES/ICES joint WG 33 on "Climate Change and Biologically-driven Ocean Carbon Sequestration" (https://meetings.pices.int/members/working-groups/disbanded/wg33), which proposed the potential ocean negative carbon emission idea of increasing the microbial carbon sink in the sea by reducing nutrient discharge from land, based on the naturally occurring marine carbon pumps. The ONCE WG has the objective of linking the science of ocean negative carbon emissions to applications.

Linkage(s) to other organizations and programs
The ONCE WG will be co-organized by PICES and ICES. The objectives of ONCE are within the scope, and will contribute to the scientific goals, of the two organizations (such as the FUTURE program of PICES). Ocean carbon cycling and negative emission are global issues which require co-ordinated international multi-disciplinary research. The success of WG 33 demonstrated the advantage of combining the efforts of scientists from PICES and ICES.

In PICES, the ONCE WG could be linked to the activities of the PICES Section on Carbon and Climate (https://meetings.pices.int/members/sections/S-CC) since the major goal of ONCE will be to understand the relationship between carbon and climate, and to apply this knowledge to practical issues.

Linkage/Contributions to the FUTURE program
The objectives of the ONCE WG will directly link with the scientific priorities of the PICES FUTURE program (https://meetings.pices.int/Members/Scientific-Programs/FUTURE), such as the effects of climate change on biological processes in the ocean and the responses and consequences of these effects on ecosystem services such as the regulation of carbon. In addition, the outputs of the ONCE WG will help FUTURE to develop a better understanding of thresholds, buffers and amplifiers of the cumulative effects of multiple ecosystem stresses on ecosystem resilience. (I am not sure how the output of this WG will help these aspects of FUTURE? Need to be clarified!)

Motivation and Goals and/or Background
Negative emissions is an approach to the goal of the Paris Agreement to limit global warming to 2.0°C or even 1.5°C by the end of this century. The ocean has a large capacity to sequester carbon and has absorbed approximately 25% of the CO_2 produced by fossil fuel combustion and cement production since the beginning of the industrial revolution. Ocean Negative Carbon Emission (ONCE) has the potential to contribute to negative emissions if the mechanisms and processes involved are properly understood. The majority of the organic carbon in the ocean is in the form of dissolved organic matter

(DOM), which contains an amount of carbon equivalent to the total inventory of atmospheric CO_2 and whose refractory component is a form of sequestered carbon in the ocean. The previous PICES/ICES joint WG 33 on "Climate Change and Biologically-driven Ocean Carbon Sequestration" highlighted the importance of microbial processes in the production of refractory DOM in the ocean, and identified a potential ONCE technique based on the naturally occurring microbial carbon pump. However, there is a gap between this natural process and its potential application. In addition, our knowledge of other ocean carbon sequestration mechanisms and processes, such as the solubility pump, carbonate pump and the different components of the biological carbon pump, limit their potential application for mitigating climate change. The proposed new PICES/ICES joint Working Group will promote interdisciplinary exchange among different research communities by bringing together experts with backgrounds in science (biological, biogeochemical, chemical and physical oceanography) and engineering, to develop theoretical bases, provide guidelines, and evaluate the implementation of ONCE. The activities of the proposed WG will receive strong financial support from Xiamen University, China, and more funding is currently being sought from other Chinese sources. The WG members will use data from coastal and open ocean time-series and macrocosm facilities to assess proposed ocean negative carbon emission models. The WG has the long-term objective of providing advice for climate policy and practical implementation of ONCE for the scientific community, the public and governments.

Terms of Reference:

- Main objective of this WG is to identify current knowledge gaps in negative carbon emission in the ~~inshore and offshore~~ oceans, and propose ~~new~~ future research directions ~~linking scientific research~~ and its applications to the enhancement of negative carbon emissions including the below items:
  a) Developing additional long-term time series stations to observe carbon sequestration in representative coastal and offshore waters;
  b) Proposing integrated experimental studies to better understand carbon sequestration under paleo-, current and future oceanic conditions;
  c) Proposing an international collaborative project or program dedicated to ocean negative carbon emission;

Work plan and time-line? (Do we need this?)

- Hold annual workshops (1 and 2nd yr) and business meetings (1 to 3yrs?);
- Organize a theme symposium by the end of the 3-year WG term (?);

Deliverables:

- Publish reviews, special sections and/or research papers to summarize and/or analyze the mechanisms and processes of negative carbon emission in the ocean;
- Proposal for future research directions of negative carbon emissions
- Final report summarizing the results of the WG.

Proposed leadership:

PICES Co-chair: Nianzhi Jiao (China) and Douglas Wallace (Canada)
ICES Co-chair: Louis Legendre (France) and Carol Robinson (UK)

Proposed PICES membership:

Canada (2):	Douglas Wallace, Dalhousie University;
	Curtis Suttle, University of British Columbia;
USA (3):	Farooq Azam, Scripps Institution of Oceanography;

Appendix F – Expert Group Updates - WG ONCE (cont'd)

	Ronald Benner, University of South Carolina;
	David Hutchins, University of Southern California;
Russia (1):	Pavel Tishchenko, Il'ichev Pacific Oceanological Institute, Far East Branch Russian Academy of Sciences;
Korea (1):	Jung-Ho Hyun, Hanyang University;
Japan (1):	Youhei Yamashita, Hokkaido University;
China (3):	Nianzhi Jiao, Xiamen University;
	Rui Zhang, Xiamen University;
	Jihua Liu, Shandong University;

BELOW are the Notes taken by Hal during the discussion of ONCE by SB of this proposed working group:

I believe the PPT presentation at PICES-2019 was provided by Rui Zhang on behalf of the proponents of this group. Not sure if Secretariat has a copy of the PPT that was shown.

Se-jong Ju voiced a concern that (1) the TOR need some refinement, and (2) that overall the text was kind of hastily put together. The TOR should be modified to link more closely to FUTURE.

There was a statement that there should be nominations of members from Government Labs (in US, Canada, and perhaps other PICES member countries). Eleven members were listed as proposed members of this WG, and all of them are from Universities. There should be an approximate 50-50 balance of members from government labs (in all countries) and universities.

Originally, it was suggested that FUTURE, POC and BIO would be the most relevant committees related to ONCE, if/when PICES approves this as a working group. However, three committees as "parents" might be too much. If FUTURE does not want to be a parent, then POC and BIO could co-parent, with one of them being the lead. If FUTURE would also like to be a parent, then the three potential parents should decide who would be the primary parent. Personally, I think FUTURE has enough child EG's at the moment and is developing approaches to integrate more into the UN Ocean Decade. I would recommend that the parents of ONCE be only POC and BIO, but it will be important, I believe, that S-CC be a resource for evaluating the outcomes of the products produced from this proposed working group.

Appendix F – Expert Group Updates - WG GRAFY

WG GRAFY: Joint ICES/PICES Working Group on Impacts of Warming on Growth Rates and Fisheries Yields

Group Type: Working Group

Group Name: Joint ICES/PICES Working Group on Impacts of Warming on Growth Rates and Fisheries Yields

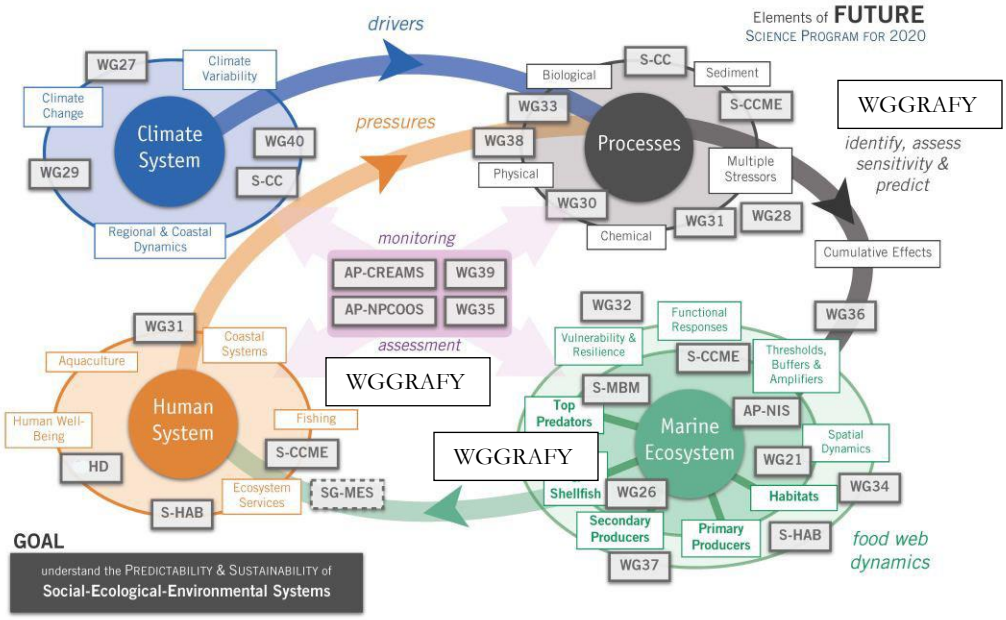
Reporting to: FIS

Term: October 2020 – October 2023

Linkage(s) to previous PICES Expert Groups or activities (if any): None

Linkage(s) to other organizations and programs (if any): : Joint ICES-PICES WG; administered in ICES by the Ecosystem Processes and Dynamics Steering Group chaired by Dr. Silvana Birchenough (http://www.ices.dk/community/groups/Pages/WGGRAFY.aspx)

Linkage/Contributions to the FUTURE program (if any): WGGRAFY will contribute to address the second key question of FUTURE "How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?" by identifying whether temporal trends in individual growth rates of marine fish are consistent with the Temperature Size Rule. WGGRAFY will contribute to better understanding of processes of marine ecosystems, improvement of projection skill of fish responses, and advise for future fisheries yields. The outputs from WGGRAFY will contribute to S-CCME (Climate Change Effects on Marine Ecosystems) and WG-40 (Climate and Ecosystem Predictability).



Motivation and Goals and/or Background: The Temperature Size Rule (TSR) proposes that fish living

Appendix F – Expert Group Updates - WG GRAFY (cont'd)

at warmer temperatures will have rapid early growth but lower adult size (Forster et al. 2012). Several North Sea fish stocks have exhibited a synchronous, common trend towards smaller maximum body sizes that was correlated with increasing temperature. This "shrinking" decreased per-capita yields of those stocks by ca. 23% (Baudron et al. 2014). Similarly, it has been projected that by 2050 global fish yields will decrease by 14-24% due to shifting biogeography and the TSR (Cheung et al 2012). Forecasting climate impacts on food security require establishing how past warming has impacted fish growth rates and subsequently fisheries yield.

The aim of WGGRAFY is to determine whether temporal trends in individual growth rates of marine fish are consistent with the TSR and, if so, evaluate the impacts of these responses for fisheries yields. Length and age have been routinely measured for many commercial fish stocks around the world on time scales that are associated with warming. These substantial data have never been compiled as a single, analytical resource for climate change research on global scales.

The WG will compile decadal-scale length at age datasets for large marine ecosystems experiencing differential rates of warming or cooling or no overall trend (e.g., upwelling regions). A standardized statistical approach for modelling average somatic growth will be developed to specifically test whether there is a component of the total variation in growth rates that can be attributed to temperature. This knowledge could provide an empirical foundation for forecasting the impacts of future climate warming on yields.

The unique spatial and temporal scale of length-at-age data are a valuable resource for ecological research. The WG will also develop a strategic plan for archiving length-at-age data similar to how ICES archives data for European waters (Datras) or how global data on recruitment and catch are reported and maintained (e.g., RAM Legacy). This strategic plan will require active and considered engagement with a range of agencies (ICES, EMODnet, FAO, universities, tech specialists) and national fisheries laboratories as well as potential funding sources. In addition, contribution of PICES WG-43 (Joint PICES/ICES Working Group on Small Pelagic Fish) is expected.

Terms of Reference:

1) Assess the capacity of statistical models to incorporate temperature-dependency of growth, and compare their predictions of growth variation across specific warming scenarios and locations. **Output/deliverable expected is a paper suitable for a peer-reviewed fish journal.**
2) Analyse long-term growth patterns across multiple large marine ecosystems that are experiencing different trends in temperature, including the direct comparison of empirical length at age data for specific species across their range, and the application of a common modelling approach. **Output/deliverable expected is a peer-reviewed paper in a high impact journal.**
3) Assess the impacts of warming on past yield per recruit of commercial fisheries, and forecast trends in future yield under plausible warming scenarios. **Output/deliverable expected is a peer-reviewed paper in a high impact journal.**
4) Identify options for expanding scientific community access to global length-at-age data that are routinely collected by fisheries agencies worldwide. **Output/deliverable expected is a strategic plan assessing options for enhancing access to length-at-age data collected routinely.**

The ToRs describe a program of coordinated research to be undertaken by a global network of scientists. The ToRs have been developed jointly through discussions at an earlier workshop on fish growth and distribution, held in Aberdeen, Scotland in November, 2018 (https://fiscot.org/wp-content/uploads/2019/07/FIS028.pdf). Given the specific nature of the ToRs it is the intention of the

Appendix F – Expert Group Updates - WG GRAFY (cont'd)

co-chairs to minimize the need for face-to-face meetings. Progress on the ToRs will be accomplished by audio-video conference calls supplemented by email and skype. WG meetings will be scheduled to coincide with other international meetings that the co-chairs are attending. Meetings will use video conferencing to allow other WG members to participate remotely. This has several practical advantages. It minimizes the requirement for WG participants to secure the substantial funding required for international travel. Secondly, it reduces carbon emissions of the WG thereby constituting a more climate-friendly program of research. This working practice will be a challenge but is logical given that the WG concerns climate impacts.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	September	ICES ASC, Sweden		Information meeting was held with co-chairs and prospective members attending the ASC. Strategy for securing participants meeting WG needs was discussed
Year 2020 (Year 1)	September	TBA		(ICES ASC- progress reporting on ToR activities; chairs attend, optional attendance by member)
Year 2021 (Year 2)	October	TBA		(PICES ASC- progress reporting on ToR activities; chairs attend, optional attendance by member)
Year 2022 (Year 3)	September	TBA		(ICES ASC- progress reporting on ToR activities; chairs attend, optional attendance by member)
Year 2022	November	Seattle, Washington (proposed)		Final meeting to complete publications (ToRs a,b,c) and strategy document (ToRd)
			Final report by December 2023	

Proposed membership:

Members of the WG will come from both ICES and PICES communities as well as a broader array of global scientists from regional seas experiencing warming, cooling or upwelling who hold longterm length-at-age data (e.g., Australia). Bold font in the list below indicates people who have confirmed their interest in particating in the Working Group.

Canada: Joanna Bernhardt (PICES/ICES, University of British Columbia), William Cheung (PICES/ICES, University of British Columbia), **Rick Rideout (PICES/ICES, Department of Fisheries and Oceans, St. Johns)**, **Sean Anderson (PICES/ICES, Department of Fisheries and Oceans, Nanaimo)**

China: **Yongjun Tian (Ocean University of China), Yue Jin (Yellow Sea Fisheries Research Institute)**

Japan: **Shin-ichi Ito (PICES, University of Tokyo), Kunihiro Fujiwara (Japan Fisheries Research and Education Agency), Takeshi Tomiyama (Hiroshima University)**

Korea: **Sukgeun Jung (PICES, Jeju National University), Jung Jin Kim (National Institute of Fisheries Science)**

Appendix F – Expert Group Updates - WG GRAFY (cont'd)

Russia: **Yury Zuenko (PICES)**

USA: Tim Essington (PICES/ICES, University of Washington), Alan Haynie (PICES/ICES, NOAA-Alaska Fisheries Science Center), Christine Stawitz (PICES/ICES, NOAA-Office of Science and Technology), James Thorson (NOAA-Alaska Fisheries Science Center), Melissa Haltuch (NOAA-Northwest Fisheries Science Center), Tim Miller (NOAA-Northeast Fisheries Science Center), Robert Allman (NOAA-Southeast Fisheries Science Center), Tom Helser (NOAA-Alaska Fisheries Science Center), **Paul Spencer (NOAA-Alaska Fisheries Science Center)**, Malin Pinsky (Rutgers University)

ICES countries: **Alan Baudron (Marine Scotland Science, United Kingdom), Tara Marshall (University of Aberdeen, United Kingdom),** Bryony Townhill (CEFAS, United Kingdom), John Pinnegar (CEFAS, United Kingdom), Einar Hjorleifsson (Marine Research Institute, Iceland), Myron Peck (University of Hamburg, Germany)

Non-PICES and non-ICES countries**: John Morrongiello (University of Melbourne, Australia)**, Asta Audzionyte (University of Tasmania, Australia)

Proposed leadership: C. Tara Marshall (UK, ICES), Paul Spencer, (USA, PICES), Alan Baudron (ICES), Shin-ichi Ito (Japan, PICES) and John Morrongiello (Australia, Guest).

List of potential members from PICES countries for Joint ICES/PICES Working Group WGGRAFY

Name	Country	Email	Current member of ICES WGGRAFY? (if yes, role and affiliation recognized by ICES)
Paul Spencer	USA	paul.spencer@noaa.gov	Yes – (co-chair, PICES)
Alan Haynie	USA	alan.haynie@noaa.gov	Yes – (member, PICES)
Christine Stawitz	USA	christine.stawitz@noaa.gov	Yes – (member, PICES)
James Thorson	USA	james.thorson@noaa.gov	Yes – (member, PICES)
Melissa Haltuch	USA	melissa.haltuch@noaa.gov	Yes – (member, PICES)
Robert Allman	USA	robert.allman@noaa.gov	Yes – (member, PICES)
Tim Miller	USA	timothy.j.miller@noaa.gov	Yes – (member, PICES)
Malin Pinsky	USA	malin.pinsky@rutgers.edu	Yes – (member, ICES)
Tim Essington	USA	essing@uw.edu	Yes – (member, ICES)
Tom Helser	USA	thomas.helser@noaa.gov	No
William Cheung	Canada	w.cheung@oceans.ubc.ca	Yes – (member, PICES)
Johanna Bernhardt	Canada	joey.bernhardt@biodiversity.ubc.ca	Yes – (member, PICES)
Sean Anderson	Canada	Sean.Anderson@dfo-mpo.gc.ca	No
Rick Rideout	Canada	Rick.Rideout@dfo-mpo.gc.ca	No
Yongjun Tian	China	yjtian@ouc.edu.cn	No
Yue Jin	China	jinyue@ysfri.ac.cn	No
Shin-ichi Ito	Japan	goito@aori.u-tokyo.ac.jp	No
Kunihiro Fujiwara	Japan	fujikuni@affrc.go.jp	No
Takeshi Tomiyama	Japan	tomiyama@hiroshima-u.ac.jp	No
Yury Zuenko	Russia	Zuenko_yury@hotmail.com	No

Sukgeun Jung	South Korea	sukgeun.jung@gmail.com	No
Jung Jin Kim	South Korea	king.jungjin@korea.kr	No

List of current non-PICES members of ICES Working Group WGGRAFY

Name	Country	Email	Current member of ICES WGGRAFY? (if yes, role and affiliation recognized by ICES)
Tara Marshall	United Kingdom	c.t.marshall@abdn.ac.uk	Yes – (co-chair, ICES)
Alan Baudron	United Kingdom	Alan.Baudron@gov.scot	Yes – (co-chair, ICES)
Bryony Townhill	United Kingdom	bryony.townhill@cefas.co.uk	Yes – (member, ICES)
John Pinnegar	United Kingdom	john.pinnegar@cefas.co.uk	Yes – (member, ICES)
Einar Hjorleifsson	Iceland	einar.hjorleifsson@gmail.com	Yes – (member, ICES)
Myron Peck	Germany	myron.peck@uni-hamburg.de	Yes – (member, ICES)
John Morrongiello	Australia	john.morrongiello@unimelb.edu.au	Yes – (co-chair, external)
Asta Audzijinyte	Australia	asta.audzijonyte@utas.edu.au	Yes – (member)

References:

Baudron, A.R., Needle, C.L., Rijnsdorp, A., Marshall, C.T. 2014. Warming temperatures and smaller body sizes: synchronous changes in growth of North Sea fishes. Global Change Biology 20: 1023-1031.

Cheung, W. W. L., et al. 2012. Shrinking of fishes exacerbates impacts of global ocean changes on marine ecosystems. Nature Climate Change, 3:254–258.

Forster, J., Hirst, A.G., Atkinson, D. 2012. Warming-induced reductions in body size are greater in aquatic than terrestrial species. PNAS 109:19310 LP-19314.

Appendix F – Expert Group Updates

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WG 44 Joint PICES/ICES Working Group on Integrated Ecosystem Assessment for the Northern Bering Sea - Chukchi Sea (NBS-CS)

The Executive Secretary will provide an update.

Appendix F – Expert Group Updates -

WG CHANGE "Correlating Habitats using Artificial Intelligence, Numerical models and Gathered Empirical data"

(no material provided for this item)

Appendix G – NPESR3 Synthesis Report – DRAFT for review

Draft NPESR 3 Synthesis Report

Sent to Science Board as separate file for review:
➔ 2020-ISB_APPENDIX_G_Draft_NPESR3_SynthesisReport_Apr2020

This file is also available for download here:

Appendix H – Greener Meetings

https://www.nature.com/articles/d41586-020-00786-y

nature
NEWS
16 MARCH 2020

• A year without conferences? How the coronavirus pandemic could change research

As scientific meetings are cancelled worldwide, researchers are rethinking how they network — a move that some say is long overdue.

Giuliana Viglione

This is shaping up to be an unusual year — it might even be the year scientists stop going to conferences. As the coronavirus pandemic marches around the world, leading to unprecedented measures to stop the virus's spread, the number of scientific conferences being cancelled is rising and researchers are scrambling to find alternative ways to share their work and interact with collaborators. Some of these discussions are even pushing researchers to rethink the concept of meetings entirely.

"At some point, we need to be having conversations about 'What is the point of a conference now?'" says Sarah Hörst, a planetary scientist at Johns Hopkins University in Baltimore, Maryland. Although cultural changes happen slowly in the scientific world, she says, "I'm hoping this will at least force some real conversation."

The shift could help to address long-standing calls to make meetings more accessible to a wider set of researchers, for instance those from resource-poor universities and those with disabilities, say some academics. And many researchers already complain about the relentless expectation of travel and worry about the carbon footprints they create by taking international flights.

Infection risk

Dozens of conferences have been called off as the coronavirus outbreak worsens — including the major spring meeting of the American Chemical Society (ACS) in Philadelphia, Pennsylvania, which was cancelled last week amid mounting pressure from people concerned about attending. The necessity for such cancellations is clear: any attendees who are infected risk passing the virus on to colleagues around the world. A meeting of the biotechnology firm Biogen in Boston, Massachusetts, on 26 February was linked to 70 cases of COVID-19, the disease caused by the coronavirus, in Massachusetts alone. Public gatherings are being discouraged or banned worldwide in a bid to halt the spread of the virus.

Many organizers and participants have turned to online platforms as a way to share work, creating virtual conferences that mimic at least some parts of a physical meeting. These could be the beginning of a shift to more accessible conferences, says Ezequiel Ferrero, a physicist at Bariloche Atomic Centre in San Carlos de Bariloche, Argentina. Prohibitive costs had meant that Ferrero was unable to travel to Denver, Colorado, to attend the American Physical Society (APS) March Meeting earlier this month. But that meeting, for which 11,000 people had registered, was abruptly cancelled just two days before it was due to begin on 2 March.

Some APS divisions had already begun discussing ways to build a virtual community, says Ferrero. And many of them rapidly set up platforms to hold virtual sessions for the meeting, inviting their speakers to present by webcam or to upload their presentations to online repositories. Researchers who hadn't been in a position to fly to Denver found themselves able to participate from afar in what became the Virtual APS March Meeting. "I was not attending and then, suddenly, I was," says Ferrero.

"If anything, the talk quality was easier to see," says Karen Daniels, a

physicist at North Carolina State University in Raleigh. "Nobody's head was blocking your way." Daniels, who spearheaded the effort to move the soft-matter-physics talks online, says that after some minor hiccups in reformatting the meeting, everything went very smoothly. One of the sessions she organized had about 100 virtual attendees.

Inclusivity advantage

But these aren't the only benefits. "There's a lot of reasons that we should have virtual meetings," Daniels says. Meeting spaces that are inaccessible to some disabled scientists, health considerations, a lack of access to childcare and travel restrictions can all end up alienating potential attendees from physical conferences. "This may be the thing that convinces us" to give virtual meetings a try, Daniels says.

All these factors mean there's a "large appetite" for alternative conference set-ups, says Divya Persaud, a planetary scientist at University College London (UCL). She and Eleanor Armstrong, a UCL sociologist of space science, have a grant from their university to hold an experimental virtual conference, called Space Science in Context, in May. The conference aims to improve accessibility, cut down on researchers' carbon footprints and reach a wider audience than a conventional meeting could. Participants will watch recorded talks ahead of time and then join in online conversations on the day of the conference. The response to plans for the meeting, which launched its save-the-date website last week, has been overwhelmingly positive, says Persaud.

But she also points out that many of the adjustments that conferences are making — such as introducing virtual participation — are accommodations for which disability activists have been clamouring for years, and it's a shame that it took a global health crisis to make them happen. "It's a bittersweet thing," she says.

"Institutional feet have been dragged" in making meetings more inclusive, agrees Juniper Simonis, a quantitative ecologist in Portland, Oregon, who is an activist and advocate for disabled scientists. They point out that legal frameworks such as the 1990 Americans with Disabilities Act are already supposed to ensure reasonable accommodations for those who need them. "In terms of hearing and responding to those requests," Simonis says, "conferences need to do better."

Still, as conference organizers are finding out, making these changes — especially on short notice — is no easy feat. The European Geosciences Union (EGU) general assembly is scheduled for 3–8 May in Vienna, and session leaders are making contingency plans in case it is cancelled. "It would be very hard to recreate the experience of a big meeting like EGU online," says Joanne Williams, a scientist who studies sea-level changes at the UK National Oceanography Centre in Liverpool. "But I want to make best use of the work we've put in already."

Those intending to participate in the Lunar and Planetary Science Conference this week in The Woodlands, Texas, found themselves similarly scrambling to come up with alternative solutions when that conference was cancelled on 4 March. "Most of the responses were just 'Well, have the conference online,'" says Hörst. "You can't just suddenly make a conference be online."

Appendix H – Greener Meetings

• Information on American Meteorological Society carbon offsets for meetings

https://www.ametsoc.org/index.cfm/ams/meetings-events/attendees/carbon-offsets/

Home > Meetings & Events > Attendees > Carbon Offsets |

Carbon Offsets

The following information can be found during the registration process for our meetings:

Offsetting the climate impact associated with traveling to this meeting

The American Meteorological Society (AMS) recognizes that personal travel to our professional meetings likely represents the largest contribution to the carbon footprint of our meetings and is probably a significant fraction of your own personal carbon footprint. The average round-trip commercial flight to an AMS meeting is about 2000 miles and produces roughly 1700 lbs of CO_2 per passenger. Consistent with the AMS Policy Statement on Climate Change, and in an effort to reduce emissions, we ask meeting participants to consider measures to offset the climate impacts of traveling to AMS meetings. At this time, we encourage either personal actions to reduce emissions or purchasing carbon offsets (what are carbon offsets?). Details of each approach are given below. Clicking on any of those links will open a new window.

What are carbon offsets?

The concept of carbon offsets is to reduce or avoid greenhouse gas (GHG) emissions in one place to "offset" GHG emissions occurring elsewhere. Carbon offsets are typically measured in tons of CO_2 so a project that reduces carbon dioxide emissions results in the creation of one carbon offset per ton of CO_2. Project developers sell these offsets to finance their projects.

Carbon offsets mechanisms are an acknowledgment that there are practical limits to an individual's ability to reduce energy use. To make up for the carbon emissions we cannot avoid, we can instead use a third party or take another action to reduce carbon emissions elsewhere. This reduction would not have happened otherwise without our involvement. Carbon offset projects help finance the construction of new sources of renewable energy, energy efficiency, and land-use and agriculture-based projects, such as methane abatement. By purchasing the offsets, you help finance and build projects, and their emission reductions compensate for the carbon pollution you create by driving, flying, etc. Offsetting is not an excuse to pollute. It is a way to take responsibility for pollution we cannot avoid. Ideally, one would reduce his or her energy use as much as possible, and then consider offsetting the climate impacts of energy use that cannot yet be avoided.

Further information on the challenges of effective carbon offsets can be found here.

Challenges, obstacles, and key criteria for effective carbon offsets

We understand and acknowledge that efforts to offset fossil fuel–derived greenhouse gas

emissions may be complicated, ineffective, or even counterproductive if not chosen carefully. Nevertheless, we believe the approaches we have identified can be successful. A primary goal of this effort is to help AMS, our members and the larger society to begin learning about and overcoming these complex challenges.

Three broad classes of offsets currently exist: 1) protecting/enhancing natural carbon sinks, 2) energy efficiency projects, and 3) renewable energy projects. Each of these presents potential problems associated with accounting challenges (e.g. the retention time of carbon in fossil fuel is vastly different from that of plants and soil), the potential for triggering alternative environmental or societal impacts, and limited effectiveness.

To be effective, offsets must ensure the following at a minimum:

1. Additionality—That the offsetting reduction in emissions would not occur without our effort,
2. No leakage—That reductions do not simply shift emissions elsewhere,
3. No double-counting—That offsets are not counted in other reduction programs, and
4. No perverse incentives—That entities that provide offsets do not have an incentive to fight more effective climate policies. For example, a company that sells offsets for renewable energy may face an incentive to block policies that establish more strict renewable energy standards or mitigation efforts that eliminate the need for those offsets.

We cannot currently ensure that the two options we have chosen for encouraging members to offset their participation in meetings meet each of these requirements. We will continue to work to address these issues, and others as they arise, in the future.

Personal actions to offset emissions

There are a variety of actions to offset (or lower) one's own carbon emissions. Listed below are just a few examples.

Change light bulbs: Replacing incandescent light bulbs with compact fluorescent bulbs at your home or the home of your friends or family is a simple way to reduce energy use and carbon emissions. Replacing one 100-W incandescent bulb with a 20-W compact fluorescent bulb will reduce approximately 330 lbs of CO2 in three years of use (assuming average national statistics for electricity energy generation and 3 hours usage per day). So to offset 1700 lbs of CO2 associated with a 2000-mile round-trip flight, one would need to replace six light bulbs. For more info on compact fluorescent bulbs, see www.energystar.gov/ia/partners/manuf_res/CFL_PRG_FINAL.pdf.

Sign up for green power: Ask your local home energy provider if you can get part or all of your electricity from renewable sources (e.g., wind or solar). The additional cost is usually quite modest. For more info, see www.epa.gov/greenpower/.

Power off computers: Use power management software on your home and work computers to reduce energy use. A desktop computer left on 24 hours a day, 7 days a week can produce more than 1000 lbs of CO2 in a year. For more info, see www.energystar.gov/index.cfm?c=power_mgt.pr_power_management.

Drive less: Transportation is one of the largest contributors to our personal carbon footprint, so walk, ride a bike, or use public transport to work, to the shops, and to friends whenever possible. Each gallon of gas we use is about 20 lbs of CO2.

Think before you buy: While the motto, "reduce, reuse, and recycle" is well known, many people place their greatest emphasis on the idea of recycling. Reducing and reusing means thinking carefully before purchasing something new and asking the question, "Do I really need this?" The energy required to

make products (like a car or television) is an environmental cost that consumers often neglect to consider.

Food choices: The carbon emissions associated with growing and transporting our food is significant. Eating more fresh, local, and minimally processed food is good for our health and creates fewer carbon emissions. Consider shopping at farmers' markets, buying direct from local farms (i.e., community-supported agriculture) and eating less red meat and animal products in favor of foods that require less energy to produce. For more info, see www.fresh-energy.org/publications/flyer_freshfood.pdf.

Purchasing carbon offsets

A variety of organizations will sell you carbon offsets to compensate your travel-related emissions, but the obvious question is, What are you getting for your money? Because offsets are an emerging field and not yet well regulated, one should choose organizations wisely to ensure the purchase really will reduce emissions. Please see the section on the challenges, obstacles, and key criteria for effective carbon offsets above.

We are currently recommending four different offset organizations based on the conclusions of a study done by Tufts University, although we recognize that there may be other equally good options.

Atmosfair is a German offset nonprofit company focusing on offsetting air travel.

Climate Friendly is an Australian for-profit enterprise working with individuals and businesses.

My Climate is a Swiss international nonprofit that supports many small-scale projects in developing countries.

Native Energy is a for-profit Native American–owned company working on renewable energy projects and farm-based methane projects.

For more detailed information on carbon offsets and how to select an offset project or company, please see http://www.tufts.edu/tie/tci/carbonoffsets/.

Appendix H – Greener Meetings

• Thinking about carbon: A preliminary carbon footprint for MSEAS air travel

Subject: Thinking about carbon: A preliminary carbon footprint for MSEAS air travel
Date: Thu, 27 Feb 2020 15:27:12 -0800
From: "Robin Brown" <Robin.Brown@pices.int>
To: "'Terhi Minkkinen'" <terhi@ices.dk>, "'Mitsutaku MAKINO'" <mmakino@aori.u-tokyo.ac.jp>, "'Rich Little'" <Rich.Little@csiro.au>, "'Alondra Sofia Rodriguez'" <alondra.sofia.rodriguez@ices.dk>, "'Doug Lipton'" <Douglas.Lipton@noaa.gov>, "'Hal Batchelder'" <hbatch@pices.int>, "'Julia Yazvenko'" <secretariat@pices.int>, "'Keith Criddle'" <keith.criddle@alaska.edu>, "'Marloes Kraan'" <marloes.kraan@wur.nl>, "'Wojciech Wawrzynski'" <Wojciech@ices.dk>
Cc: "Lori" <Lori.Waters@pices.int>

Lori Waters from our office did a rudimentary calculation of the carbon footprint of the air travel for participants to get from their homes to Yokohama and return:

Further to discussions on carbon impacts of meetings, I have done a quick ballpark calculation of the CO2 emissions for MSEAS 2020 in Yokohama, Japan.

This calculation is based on:

- The attendee list as of Feb 27, 2020: 271 attendees, from 35 countries;
- Flight duration calculations were made using Google maps and standard aviation decimal hours;
- In cases where the attendees' city was not near a major flight destination, closest destination city was chosen (e.g. London instead of Oxford);
- Carbon calculation was based on calculations using ICAO Carbon Emissions calculator to arrive at a CO2 per hour per passenger amount for a long-haul flight (https://www.icao.int/environmental-protection/Carbonoffset/Pages/default.aspx);
- The majority of flights used in the overall calculation are long-haul flights so AC TO weight, therefore, CO2 burn to destination should be roughly equivalent;
- Methodology is on the calculation tab after the calculations;
- CO2 per passenger is based on economy flights - upgraded classes generate additional carbon;
- No other CO2 is taken into account in this calculation, i.e. those who attend by train or other ground transportation, nor the carbon cost of the venue, hotels, food consumed, etc.

MSEAS 2020 Flights only carbon emission estimate: a minimum of 182.41 Metric tonnes of additional carbon into our global atmosphere as a result of this meeting.

Other ways to express this: http://www.globalcarbonatlas.org/en/CO2-emissions
This is equivalent to the total annual emissions of:

- 12.2 Canadians
- 20.0 Japanese
- 10.7 Americans
- 14.0 Koreans
- 12.0 Russians
- 26.1 Chinese
- 29.9 Danes (go Denmark!)

This isn't a very granular method (i.e. it wouldn't take into account any short-haul flights to get to a long-haul flight, as those carbon calculations are different), and it's not a perfect calculation being based on the Google flight durations, however, it is pretty close, and therefore a pretty good ballpark, so I hope it's helpful, nonetheless.

There are alternate and more sophisticated methodologies (e.g. MyClimate.org). I don't know how to pick amongst these. If anyone has any expertise or knows someone who does, let me know.
Regards
Robin

Appendix I – PICES 2020 – DRAFT Schedule

PICES-2020 Annual Meeting Schedule — *Shangri-La Hotel (tentatively),* Qingdao, China IMPORTANT NOTE: Draft schedule, subject to change. #1G HPB 200303							
Thursday, October 22							
0900 1230	**W4** **Central Arctic Ocean** *Chairman room* *T80*	**W1** **Expansion of HABS (Cosponsors:)** *FR-22* *T160*	**WG-IMCE** **Bus Mtg** *FR-33* *U20*	**W2** **Zooplankton & Fisheries Recruitment** *FR-36* *T40*	**W3** **Flatfish & climate and environmental variability** *FR-37* *T40*	**W7 SEES** **dynamics of climate extremes in Pacific coastal systems Bioacoustics (Day1) (Cosponsored by ONC)** *FR-31* *T40*	***RESERVED (Tentative)*** *FR-35* *T40*
1400 1800							
Friday, October 23							
0900 1230	**FUTURE SSC** **Bus Mtg** *FR-26* *U32*	**S-HABS** **Bus Mtg** *FR-24* *U32*	**WG-41** **MES** **Bus Mtg** *FR-33* *U20*	**W8** **Sea Turtles** *FR-27* *C36*	**WG-39** **CAO** **Bus Mtg** *FR-25* *U32*	**W7 SEES** **dynamics of climate extremes in Pacific coastal systems Bioacoustics (Day2)** *FR-31* *T40*	***SG IEA-NBS*** ***Bus Mtg*** *FR-35* *U20*
1400 1800		**WG-ONCE** **Carbon** **Bus Mtg** *FR-24* *U32* *(Tentative)*			**WG-37** **Zooplankton** **Bus Mtg** *FR-25* *U32*		
Saturday, October 24							
0900 1230	**Ciguatera** **Bus Mtg** *FR-26* *U32*	**S-CC** **Bus Mtg** *FR-24* *U32*	**AP-NIS** **Bus Mtg** **Day1** *FR-33* *U20*	**W6** **ICES/PICES Small Pelagic Fishes** *FR-31* *T40*	**SEAturtle Project** **Bus Mtg** *FR-25* *C54*	**W9** **Early Career Scientist Professional Network** *FR-27* *T60*	***WG35*** ***NPESR3*** ***Bus Mtg*** *FR-35* *C18*
1400 *1800*		***S-CCME*** ***Bus Mtg*** *FR-24* *U32*		***WG-43*** ***ICES-PICES SPF*** ***Bus Mtg*** *FR-31* *T40*			

Sunday, October 25							
0900 1230	**Room Available?** *FR-26* *U32*	**AP-CREAMS** **Bus Mtg** *FR-24* *U32*	**AP-NIS** **Bus Mtg** **Day2** *FR-33* *C30*	**WG-42** **MMP** **Bus Mtg** *FR-25* *U32*	**W5** **Pelagic and Forage Fish Resiliency** *FR-27* *C40*	**WG-40** **Climate & Ecosytem Predictability** **Bus Mtg** *FR-31* *U20*	***Room Available*** *FR-35* *C30*
1400 1700	**Science Board** **Bus Mtg*** *FR-26* *U32*	**AP-NPCOOS** **Bus Mtg** *FR-24* *U32*	**S-MBM** **Bus Mtg** *FR-33* *C30*				
1800 2000	**POC** **Bus Mtg** *FR-26* *U32*	**MEQ** **Bus Mtg** *FR-24* *U32*	**HD** **Bus Mtg** *FR-33* *C18*	**MON** **Bus Mtg** *FR-25* *U32*	**FIS** **Bus Mtg** *FR-27* *C36*	**TCODE** **Bus Mtg** *FR-31* *U20*	***BIO*** ***Bus Mtg*** *FR-35* *C30*
Monday, October 26							
0845 1010	***OPENING SESSION (China Hall 2+3)***						
1030 1230	Plenary Science Board Symposium (**S1$_{SB}$**) ***China Hall 2+3*** *C650*						
1400 1600	Plenary Science Board Symposium (**S1$_{SB}$**) ***China Hall 2+3*** *C650*						
1620 1820	Plenary Science Board Symposium (**S1$_{SB}$**) ***China Hall 2+3*** *C650*						
1830 2100	***WELCOME RECEPTION*** ***(open to all participants and registered guests; Ballrooms 2+3)***						
Tuesday, October 27							
0900 1250	**S5** **Atmospheric Nutrient Deposition** *FR-27* *T60*	**S8** **MES** *FR-33* *T40*	**S17** **OA Effects on Harmful Algae** *FR-24* *T80*	**S2** **Global Warming Patterns (Day1)** *FR-26* *T80*	**S7** **Pathways of Resilience (Day1)** *FR-31* *T40*	**S15** **Species Migration and Shifts (Day1)** *FR-25* *T80*	***Room Available*** *FR-35* *T40*
1400 1800	**POC** **Bus Mtg** *FR-27* *C36*	**MEQ** **Bus Mtg** *FR-33* *T40*	**FIS** **Bus Mtg** *FR-24* *C60*	**MON** **Bus Mtg** *FR-26* *C60*	**HD** **Bus Mtg** *FR-31* *C18*	**BIO** **Bus Mtg** *FR-25* *C54*	***TCODE*** ***Bus Mtg*** *FR-35* *T36*
1800 2000	***FUTURE SSC Meets after Committee Meetings 1800-2000*** *(Tentative or Final?)* *FR-24 C60*						
Sporting event - TBD							
• ***POSTERS can be put up on Tuesday night for Poster Session on Wed and Thu Night***							

Wednesday, October 28							
0900 1030	***PLENARY SESSION*** *Classroom-650 [Will this be in China Hall 2+3 as in the opening session?]* ***(3 Invited Talks + Discussion)***						
1050 1250	**S6** **Small Pelagic Fish in the North Pacific** *FR-26* *T80*	**S11** **Environmental Indicators of Plastic Pollution** *FR-24* *T80*	**S13** **eDNA Assessment of non-indigenous Species** *FR-33* *T40*	**S2** **Global Warming Patterns (Day2)** *FR-25* *T80*	**S7** **Pathways of Resilience (Day2)** *FR-27* *T60*	**S15** **Species Migration and Shifts (Day2)** *FR-31* *T40*	***F&A Meeting**** *FR-36* *U20+perimeter chairs*
1400 1800							
1800 2000	***POSTER SESSION**(reception in China Hall 1)***						
Thursday, October 29							
• *Posters hung early; available for viewing all day in Salon A (Upper level)***							
0900 1250	**S3** **Meeting the Societal Needs of the Ocean Decade** *FR-26* *T80*	**S4** **Meso to Small-scale Turbulence in the North Pacific** *FR-31* *T40*	**S14** **High Seas Salmon Surveys** *FR-33* *T40*	**S10** **Impacts of Climate on Aquaculture** *FR-27* *T60*	**S9** **AI for Understanding Marine Science** *FR-25* *T80*	**S12** **Extreme Events in the North Pacific** *FR-24* *T80*	***S3*** ***Meeting the Societal Needs of the Ocean Decade*** *FR-26* *T80*
1400 1600							
1620 1800							
1800 2100	***POSTER SESSION***** ***(Wine and Cheese reception in China Hall 1)***						
• *Posters to be taken down Thursday at 2100, following the poster session.*							
Friday, October 30							
0900 1020	**BIO-P** *FR-24* *T80*	**FIS-P** *FR-27* *T60*	**POC-P** *FR-25* *T80*	**HD-P** *FR-33* *T40*	***MEQ-P*** *FR-31* *T40*		
1040 1240							
1250 1350	***CLOSING SESSION*** *Awards for Best Oral/Poster presentations* *China Hall 1*						
1400 1800	***Science Board Business Meeting**** *FR-26: U32+perimeter chairs*						
1830 2100	***Chairman's Reception****						
Saturday, October 31							
0900 1800	**Science Board Meeting*** *FR-26: U32+perimeter chairs*			***Governing Council Meeting**** *FR-24 + FR-25: U40+perimeter chairs*			
Sunday, November 1							
0900 1800	***Governing Council Meeting**** *FR-24 + FR-25: U40+perimeter chairs*						
* Closed meetings/Activities (by invitation only)							

** Posters of general interest to the PICES Scientific Committees, including those not necessarily matching the themes of the Topic Sessions and workshops, are welcome. Posters will be on display from Wednesday evening (28 Oct) until 2100 on 29 October. Poster presenters are expected to be available near their poster to answer questions during the Thursday evening (1800-2100) poster session. The max size of a poster is A0 size (841 mm wide x 1,180 mm high or 33.1" wide by 46.8" high), portrait form.

Topic Session Titles: Note: where multiple committees are listed, only one (**in bold**) is shown as the judging committee.
Note, only POSTERS of Early Career Scientists are judged for potential best poster presentation awards.

S1: (**SB**) How does 30 years of research on changing North Pacific ecosystems inform the UN Decade of Ocean Science for Sustainable Development Goals (SDGs)?
S2: (**POC**) Global warming patterns and multiscale climate variability in the North Pacific
S3: (**HD**) How the studies on human dimensions can contribute to meet the six societal needs of the Decade of Ocean Science?
S4: (**POC**) Upper ocean energetics from mesoscale, submesoscale to small-scale turbulence in the North Pacific
S5: (**BIO**/POC) Atmospheric nutrient deposition and microbial community responses, and predictions for the future in the North Pacific Ocean
S6: (**FIS**/POC) Environmental variability and small pelagic fishes in the North Pacific: exploring mechanistic and pragmatic methods for integrating ecosystem considerations into assessment and management
S7: (**FUT**) Managing for pathways of resilience in a changing climate: recent examples and emerging approaches
S8: (**HD**) Marine Ecosystem Services – Connecting science to decision making
S9: (**FUT**/POC/TCODE) Applications of artificial intelligence to advance the understanding of North Pacific ecosystems
S10: (**MEQ**) Impacts of climate change on aquaculture
S11: (**MEQ**) Using environmental indicators to assess baselines, targets, and risk of plastic pollution in the North Pacific
S12: (**FUT**/POC) Predictions of extreme events in the North Pacific and their incorporation into management strategies
S13: (**MEQ**) Using eDNA to assess and manage non-indigenous species in the North Pacific
S14: (**FIS**) Implementing a collaborative, integrated ecosystem high seas survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean
S15: (**FIS**/POC) Species migration and shifts responding to climate change: linking physics, plankton dynamics and fish ecology
S16: (**FUT**) FUTURE plenary on PICES' role in the UN Decade
BIO-P: Biological Oceanography Committee Paper Session
FIS-P: Fisheries Science Committee Paper Session
MEQ-P: Marine Environmental Quality Committee Paper Session
POC-P: Physical Oceanography and Climate Committee Paper Session
HD-P: Human Dimension Committee Paper Session

GP: General Poster Session
Note: All of the above oral sessions can also accept posters, and there also will be an Observer/Organization Poster Session.

Topic Session judging: SB: 1; BIO: 2; FIS: 4; FUT: 4; HD: 3; MEQ: 4; MON: 0; POC: 3; TCODE: 0

Workshop Titles: Note, only POSTERS of Early Career Scientists are judged for potential best poster presentation awards.

W1: (**MEQ**) The Expansion of Harmful Algal Blooms (HABs) from lower to higher latitudes
W2: (**BIO**/FIS) Can we link zooplankton production to fisheries recruitment?
W3: (**FIS**) Integrating biological research, fisheries science and management of broadly distributed flatfish species across the North Pacific Ocean in the face of climate and environmental variability
W4: (**SB**) How does the Pacific Arctic gateway affect the marine system in the Central Arctic Ocean (CAO)?
W5: (**FIS**) Pelagic and forage species – predicting response and evaluating resiliency to environmental variability
W6: (**FIS**) Research priorities for understanding the population dynamics of small pelagic fish in the North Pacific (*Potential cosponsors: ICES, IOC, NPFC*)
W7: (**FUT**/POC) The social-ecological-environmental dynamics of climate extremes in Pacific coastal systems (*Possible Cosponsored by ONC*)
W8: (**BIO**/MEQ) Sea turtles and environmental stressors in the North Pacific
W9: (**FUT**) Building a PICES early career professional network

Poster Session judging for sessions (s) and workshops (w): SB: 1s1w; BIO: 2s1w; FIS: 4s3w; FUT: 4s2w; HD: 3s1w; MEQ: 4s1w; MON: 0s0w; POC: 3s0w; TCODE: 0s0w

Open Business Meetings:

FUTURE SSC; KIOST Turtle Project; Ciguatera Project
BIO; MEQ; FIS; MONITOR; POC; TCODE; HD;
WG-35 (Third North Pacific Ecosystem Status Report)
WG-37 (Zooplankton Production Methodologies, Applications and Measurements in PICES Regions)
WG-39 (Joint PICES/ICES/PAME WG on Integrated Ecosystem

Assessment for the Central Arctic Ocean)
WG-40 (Climate and Ecosystem Predictability)
WG-41 (Marine Ecosystem Services)
WG-42 (Marine Microplastics)
WG-43 (Joint PICES/ICES Working Group on Small Pelagic Fish)
S-HAB; S-CC; S-CCME; S-MBM

AP-CREAMS; AP-NPCOOS; AP-NIS
SG/WG-IMCE (Study/Working Group on Impacts of Mariculture to Coastal Ecosystems)
SG-PICES/NPFC (Joint PICES-NPFC group for Scientific Cooperation in the North Pacific Ocean)
Tentative: WG-ONCE; SG-IEA-NBS

Local Organizer Contacts for PICES-2020:
Yafeng Yang (email: yyf@fio.org.cn)

Appendix J – UN Ocean Decade

The *REVISED* UN Ocean Decade Roadmap is available in full, here:
https://unesdoc.unesco.org/ark:/48223/pf0000265141

United Nations Decade of Ocean Science for Sustainable Development (2021-2030) Website:
https://en.unesco.org/ocean-decade

PUBLICATION: The Science we need for the ocean we want: the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) https://unesdoc.unesco.org/ark:/48223/pf0000265198

Appendix J – UN Ocean Decade (cont'd)

Description of UN Decade Societal Outcomes – Annexes 1 and 3

- 3 –

ANNEX 1: DESCRIPTION OF UN DECADE SOCIETAL OUTCOMES
(extracted from UN Decade Roadmap document)

The main principle is that the Decade will address both deep disciplinary understanding of ocean processes and solution-oriented research to generate new knowledge. This knowledge will support societal actors in reducing pressures on the ocean, preserving and restoring ocean ecosystems and safeguarding ocean-related prosperity for generations to come. The Decade should turn the scientific knowledge and understanding into effective actions supporting improved ocean management, stewardship and sustainable development.

The Roadmap identifies six societal outcomes:

1. *A **clean ocean** whereby sources of pollution are identified, quantified and reduced and pollutants removed from the ocean*

"Human activities are increasingly impacting its local and, subsequently, the global environment, leading to pollution by both chemical and physical wastes. Through the Decade, integrated research will be fostered to assess the human and environmental risks of ongoing and future types of ocean pollution, to generate new ideas to reduce the ocean pressures by promoting recycling, improved waste management and related incentives, and by strengthening the governance regimes to encourage more sustainable production and consumption. The most challenging ocean pollutants include: atmospheric carbon dioxide, which is the main cause of the climate change with ocean warming, ocean acidification, and sea-level rise; agricultural fertilizers, which lead to increased primary production but result in ocean deoxygenation; untreated waste water; invasive species; and micro- and macro-plastics."

2. *A **healthy and resilient ocean** whereby marine ecosystems are mapped and protected, multiple impacts, including climate change, are measured and reduced, and provision of ocean ecosystem services is maintained*

"Marine ecosystem degradation has greatly accelerated during the last five decades due to the multitude of stressors affecting the ocean. To support the conservation and protection of ocean ecosystems, the Decade will promote inter-disciplinary research aimed at elucidating impacts of cumulative stressors on the ocean, its seas, ecosystems and resources, hence providing more complete information to fill gaps, and specify actions, which can improve the situation and reverse the degradation. Improved appreciation of the economic and societal value of ocean ecosystems will also be key to stimulate the development of marine spatial planning, marine protected areas, and other ecosystem-based management approaches. Supplementing and completing the science base with holistic mapping of the ocean, in all its dimensions, will also be needed for adaptive management approach towards good ocean stewardship. All nations will benefit in a healthy and resilient ocean and by preserving its capacity to deliver food, income, support transportation and many other elements of sustainable development."

3. *A **predicted ocean** whereby society has the capacity to understand current and future ocean conditions, forecast their change and impact on human wellbeing and livelihoods*

"The vast volume of the ocean and its complex coastlines are neither adequately observed nor fully understood. In particular, the deep sea is a frontier of ocean sciences. Under the Decade, sustained and systematic ocean observations can be expanded to all ocean basins and depths to document ocean change, initialize ocean system models and provide critical information for improved ocean understanding. Such information is increasingly needed by nations and the ocean business community operating within or beyond national jurisdictions. Improved access to understanding ocean present and future conditions will be a pre-requisite to the development of

sustainable ocean economic policies and ecosystem-based management and will lead to more efficient shipping, mitigate storm damage and flooding of coastal cities, sustain healthy fisheries, protect coral reefs and other key marine ecosystems from degradation, and improve climate forecasting, amongst a few. The Decade will also build on advances in ocean robotics and the combination of remote and in situ ocean observations which offer new opportunities and will reduce operational costs; it will also promote free and open data sharing and multi-stakeholder contributions by governments (rich and poor), the private sector and citizens."

4. *A **safe ocean** whereby human communities are protected from ocean hazards and where the safety of operations at sea and on the coast is ensured*

"Ocean hazards such as storm surges, tsunamis, harmful algal blooms, or coastline erosion can be devastating for coastal communities. The rush for coastal recreation and economic expansion in the maritime domain has increased access to the sea to a multitude of users, producing newly built infrastructures that are increasingly vulnerable to ocean extreme events. Climate change impacts on the ocean will have profound implications for all human societies and most of our activities. The Decade will promote research aimed at reducing and minimizing impacts of various changes (risk reduction) through adaptation and mitigation, at assessing social and physical vulnerability and help clarify interactions between natural and man-induced changes. It will also support the development of integrated multi-hazard warning systems in all basins hence contributing to enhanced preparedness and awareness of society with regards to ocean risks. This could trigger the introduction and use of new technologies through private-public partnerships. Community resilience and adaptive capacity, with elevated education and awareness as regards the use of observations and data, will also contribute to reduced impacts and improved efficiency of early warning systems for natural and man-made hazards."

5. *A **sustainably harvested and productive ocean** ensuring the provision of food supply and alternative livelihoods*

"Society now depends on the ocean more than at any time before. It is a vital source of nourishment, supporting directly the livelihood of about 500 million people, especially in the poorest nations, and, indirectly, the global population. Ocean economies are among the most rapidly growing and promising in the world, providing benefits to many sectors of great economic value, such as fisheries, biotechnologies, energy production, tourism and transport, and many others. The Decade should create a better understanding of the interactions and interdependencies of the environmental conditions and processes, the use of resources and the economy. A major task in context of the development of the ocean economy will be in documenting the potential impacts from environmental changes on the established and emerging maritime industries and their ability to generate growth, especially for LDCs (Least Developed Countries) and SIDS (Small Island Development States). Defining safe and sustainable thresholds for economic operations in the ocean will help policy-makers and stakeholders in implementing a truly sustainable blue economy. New research should develop and flesh out sustainable blue-green growth agendas and link it to efforts in ecosystem protection."

6. *A **transparent and accessible ocean** whereby all nations, stakeholders and citizens have access to ocean data and information, technologies and have the capacities to inform their decisions*

"The achievement of the above outcomes very much depends on global capacity building and resource-sharing between countries at different levels of wealth and development. The enormous need for more ocean information at the scientific, governmental, private sector, and public levels demands a step-change in ocean education at all levels. New technology, and the digital revolution are transforming the ocean sciences; these will be harnessed to deliver data and information to all

stakeholders. Science-policy interface for oceans should be enhanced as well. Open access to ocean information, increased interactions between the academic and societal actor communities, and ocean literacy for all should capacitate all citizens and stakeholders to have a more responsible and informed behaviour towards the ocean and its resources. Innovative capacity development schemes between south–south and north–south ocean actors as well as courses for ocean professionals will be key in raising ocean awareness and promote better solutions."

Annex 3: DRAFT UN Decade of Ocean Science for Sustainable Development (2021-2030): Criteria of Inclusion of activities

Draft
2019 Sept 13

Intergovernmental Oceaonographic Commission and Executive Planning Group

Introduction.
The United Nations Decade of Ocean Science for Sustainable Development (Decade) welcomes all Member States, UN bodies, the global science community and scientific organizations, public, private, government and non-governmental organizations and other stakeholders to propose scientific contributions that endeavor to serve the attainment of the Sustainable Development Goals and contribute to the Decade across many disciplines and sectors. Proposed activities may be incorporated into the Decade as an endorsed programme, project, enabling activity, or contribution to the Decade as reviewed and affirmed by the IOC, acting on behalf of the UN wide-system.

Definitions.
A programme may consist of component projects, enabling activities, and supported by contributions.
A programme is global or regional in scale and undertakes a profound scientific objective, is conducted over a long term, and is multi-national and inter-disciplinary.
A project is a discrete and focused undertaking and may stand alone or contribute to a programme, and is of a limited or shorter duration, performed by one or more entities such as a single nation's or single entity activity.
An enabling activity supports the success of the Decade overall, a programme, or project.
A contribution supports the Decade through donation of a necessary resource, including funding, data, or in kind.

Decision Making Authority.
The IOC, or the governing body for the Decade identified by IOC, shall determine the acceptance and endorsement of a programme, project, enabling activity, or contribution related to the Decade of Ocean Science.

Criteria.
The Decade programmes, projects, or activities shall involve such international co-operation as to accelerate knowledge and understanding of the ocean more rapidly than if individual programmes or projects were conducted separately and at a normal rate. The criteria of inclusion are:

1. Addressing of the overall objectives of the Decade and associated societal goals set out in the Decade Roadmap and [other documents capturing priorities identified through planning meetings and] contribute to or achieve the Decade Science Action Plan.
2. Commencing and delivering results between 2021 and 2030.
3. Conducted for exclusively peaceful purposes
4. Enabling a significant scientific or capacity advancement and strengthening the uptake of science at policy/societal levels, including for but not limited to, Small Island Developing States or Lesser Developed Countries,
5. Including participation of scientists and experts from other nations secured in the early stages.
6. Ensuring that all data are open access, shared, discoverable and appropriately deposited in designated repositories consistent with the IOC data policy.[1]

[1] In 2019, the IODE recommended that the IOC Assembly consider establishment of an inter-sessional working group to propose a strategy on ocean data and information stewardship for the UN Ocean Decade to address the flow, discovery, access, and use of data collected during the decade. Proposed terms of reference included: common data

7. Identifying the specific contributions to the UN 2030 Sustainable Development Goals.
8. Demonstrated resource path or resource sufficiency.

The UN proclamation of the Decade announced that it be conducted within existing and available resources. There are no mandated contributions through the financial systems of the UN. The success of the Decade is dependent upon the capacity of participants to mobilize financial and human resources. Member States and participant organizations shall be responsible for securing the necessary resources for activities conducted as part of the Decade.

The endorsement by the IOC of a programme, project, enabling activity, or contribution serves to govern the inclusion of events identified as comprising the Decade. This threshold of acceptance defined in these Criteria will establish the prestige and trust of an action identified as part of the UN Decade of Ocean Science for Sustainable Development. The inclusion of an action as part of the Decade should influence funding sources favorably in noting the transformational ambition and opportunity of the Decade, the leveraging and sharing of the resource burden available through partnership, and the opportunity to contribute to the 2030 SDG's, achieving more together than any one party could alone. In this respect, proponents of such programmes, projects and activity should be encouraged to coordinate similar projects with a view to achieve bigger aims and impacts.

The Decade will inspire learning, greater ocean literacy, science-based decision making and broaden societal participation in decision making for a sustainable fututre. To ensure these results, ocean literacy should be an active component of the Decade in planning and execution of science activities, and embraced by all participants.

exchange policy, protocols and metadata structure, quality control/quality assurance, dissemination of data, long-term preservation of data, and development of a joint data and information portal.

Appendix K – FUTURE OSM - Planning update

- S. Bograd to present information on planning for FUTURE Open Science Meeting.

Previous FUTURE OSM:
https://www.pices.int/meetings/international_symposia/2014/2014-FUTURE-OSM/scope.aspx

Symposium Scope 2014

Drastic ecosystem changes have been observed in recent decades in both open and coastal systems. These changes are believed to have occurred in response to climate change and increasing anthropogenic pressures. “What is the future of the North Pacific given current and expected pressures?” This is the question addressed by the PICES Integrated Science Program, FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems). FUTURE will synthesize and disseminate knowledge provided by national and multi-national research programs. Under the overarching question, FUTURE attempts to answer three Key Scientific Questions related to: a) ecosystem resilience and vulnerability; b) ecosystems response to natural and anthropogenic forcing; and c) future ecosystem change. The Program also addresses poorly understood, yet important, issues of interactions between human societies and coastal ecosystems, such as the effects human activities have on the provision of ecosystem services. In addition to the scientific understanding of mechanisms of ecosystem change, FUTURE aims to engage human societies by providing useful products on ecosystem change. Inaugurated in 2009, FUTURE will enter its mid-life in 2014, making it an appropriate time to evaluate what has been achieved and what remains to be addressed. Based on information assessed at this symposium, FUTURE may redirect its course in order to achieve its final goals.

Appendix L – PICES-Sponsored Conferences / Symposia

PICES – International Year of the Salmon (IYS)

Full report is available at http://www.nafc.org (International Year of the Salmon Working Group. 2020. Report of the 2020 International Year of the Salmon North Pacific Steering Committee Meeting.

PICES IYS --- PICES agreed to collaborate with the North Pacific Anadramous Fish Commision (NPAFC) in supporting an International Year of the Salmon program, which is actually more of a 5-year program than a single year.

Background and some History of the NPAFC-IYS

In 2012, a proposal was made to the NPAFC by Canada to establish a major research initiative based on the idea of an International Year of the Salmon (Beamish 2012). Discussions continued within the NPAFC leading to the creation of the IYS Study Group (IYS-SG) in 2013, which held a scoping workshop in early 2015 to assist with the development of IYS research themes. Following this meeting, a compelling rationale for the IYS was developed by the IYS-SG that was well-received at the NPAFC 2015 Annual Meeting, where it was agreed to further scope the IYS and refine research activities. An IYS Working Group was then formed.

The IYS-WG convened a second scoping workshop in April 2016. During this meeting, further progress was made towards planning for IYS implementation, including seeking early views on funding sources and strategies, identifying potential partners, and delineating a governance structure involving the lead organizations of the IYS, NPAFC and NASCO. Following the second scoping meeting, the IYS-WG prepared the Outline Proposal of the IYS, which was accepted by NPAFC and NASCO at the annual meetings of both organizations in May and June 2016, respectively. The initiative was funded in 2017, 2018, and 2019 by allocations of NPAFC internal funds as well as additional contributions from Canada, the United States and UBC.

In September 2016, the IYS Coordinating Committee was formed by NPAFC and NASCO, with one of their first priorities being to finalize the IYS governance model. A draft governance document was produced by the Coordinating Committee, including terms of reference for itself, two Regional Steering Committees (NPSC and NASC), and the Symposium Steering Committee (SSC). The Coordinating Committee would be responsible for coordination, planning, implementation, and administration of the IYS and reviewing its progress at the hemisphere level. Some activities included determining hemispheric research and outreach priorities, developing an IYS brand and website, and criteria for IYS endorsement. A distributed governance model was agreed upon, with all decisions of the Coordinating Committee based on recommendations from the Regional Steering Committees, and, wherever possible, organized as a range of options so as to allow for some discretion by the Coordinating Committee to make decisions in the best interests of the IYS at the hemisphere level. NOTE: the North Pacific Steering Committee (NPSC) is one of the main steering committees of the IYS, and PICES is represented on this committee by the Deputy Executive Secretary (currently Hal Batchelder).

In addition to making recommendations to the Coordinating Committee, the NPSC is responsible for coordinating the planning, implementation, and administration of the IYS in the North Pacific region. Activities of the NPSC include engaging core partners, identifying outreach and research priorities, reviewing outreach and research proposals, developing research plans, and coordinating fundraising for activities in the North Pacific. Additional duties included developing outreach activities, target audiences, and messages in this region.

In late February/early March of 2017, the North Pacific Steering Committee met for the first time to discuss the funding strategy for the IYS and to continue the planning of IYS strategies, activities, and the opening event (IYS-WG 2017). The purpose of the 2019 meeting of the NPSC was to consider these discussion documents, with a specific

focus on IYS implementation in the focal year and fundraising strategies or opportunities. The IYS was launched in the fall of 2018 through a number of opening events throughout the salmosphere. The focal year of the IYS was 2019 and it met with success in raising the profile of the IYS and attracted funding from numerous external sources. Substantial progress was made on the Signature Projects, in particular the High Seas Expeditions. The IYS focal year was a year of growth, outreach and increasing engagement from local to hemispheric scales, along with solidifying connections with our partners.

Abbreviated summary of the two day meeting

This report documents the proceedings of the 2020 meeting of the North Pacific Steering Committee (NPSC) that took place from February 26–27th in Vancouver, Canada, to provide direction regarding the implementation of the International Year of the Salmon (IYS). The NPSC is one of two basin-scale Steering Committees that provide direction to an IYS Coordinating Committee (CC) that in turn considers issues related to overall implementation of the IYS at the hemispheric scale. This was the fourth meeting of the NPSC. The agenda was supported by detailed discussion documents on overarching issues of concern to be considered at meetings of all three committees, the North Atlantic Salmon Conservation Organization (NASCO) has expressed an interest in participating in the IYS wrap-up symposium but will not be moving forward with an International Year of the Salmon Coordinating Committee (CC). The NPSC will continue to meet and provide advice on the implementation of the IYS in the Pacific.

The meeting highlighted continued support for the IYS. The increase in engagement during the IYS 2019 focal year was reflected by the increased registration of events and projects on the IYS website, along with the growth of the IYS social media accounts, which NPSC members found to be a reflection of the exciting momentum of the IYS. Participants provided direction on ways to improve IYS communication and outreach, including the website and social medias, and provided feedback on Signature projects. There were presentations on planned and proposed IYS signature projects and very productive discussions on communications regarding the 2021 Pan Pacific High Seas Expedition planned to survey the breadth of the North Pacific. The NPSC reviewed the effectiveness and membership of the Theme Counsel Groups (TCG), which consist of up to 15 experts from the five member nations of the North Pacific Anadromous Fish Commission. The Terms of Reference (TOR) were reviewed and updated with the intentions of increasing the capacity of the TCG to assist with the IYS Signature Projects.

Appendix L – PICES-Sponsored Conferences / Symposia

ICES / PICES ZPS Background

The most recently Zooplankton Production Symposium (ZPS6) was completed in May 2016 in Bergen, Norway. The meeting was led by ICES and PICES (with ICES hosting the web site). About 12 months ago, PICES and ICES began searching for a suitable venue and host country for the 7th Zooplankton Production Symposium. Anthony Richardson, a long-time participant in zooplankton ecology and frequent attendee to ZPS, agreed to lead an effort to evaluate whether CSIRO of Australia would host the next ZPS in Hobart, Tasmania. The down payment on the venue of the event is paid. The dates of the event are 13-18 March 2022 (mid-summer, so nice weather). Getting there is done by flying to Sydney, Melbourne, Brisbane or Perth, and then flying into Hobart. The venue is the Hotel Grand Chancellor in Hobart. Organizers are hoping to have an attendance of 350. Previous ZPS have had up to 4 concurrent sessions, and this venue can accommodate that as well. There will be one or two poster sessions depending upon the demand for posters. There will be certificates to honor the best posters and oral presentations by students and early career scientists (less than 5 yr past their PhD). Science Board recommended at PICES-2019 in Victoria that PICES approve the ZPS7 in Hobart, and also recommended that PICES allocate $10000 CAD from the PICES Trust Fund, and $10000 CAD from the General Fund to partially support the travel expenses of early career scientists from PICES member countries to attend the meeting. An organizing committee of four has been selected, they are Anthony Richardson (Univ of Queensland/CSIRO), Kerrie Swadling (Univ. of Tasmania), Sophie Pitois (CEFAS/ICES), and Hal Batchelder (PICES). A Scientific Steering Committee is in the process of being established.

Appendix L – PICES-Sponsored Conferences / Symposia

International Symposium on "Small Pelagic Fish"

Subject: Re: International Symposium on "Small Pelagic Fish: New Frontiers in Science for Sustainable Management"
Date: Tue, 24 Mar 2020 14:40:56 -0400
From: bychkov@pices.int
To: robin.brown@pices.int, sonia.batten@pices.int, hbatch@pices.int
Cc: secretariat@pices.int, lori.waters@pices.int, ryan.rykaczewski@noaa.gov, atakasuka@mail.ecc.u-tokyo.ac.jp

Dear All,

This is not a very critical information in the current unpredictable situation, but hopefully things will get back to notmal at some point so we have to move on.

I was just informed that the ICES Science Committee (SCICOM) met last week in a 2-day virtual meeting. Among other issues they reviewed the proposed resolution for the joint ICES/PICES/FAO International Symposium on "Small Pelagic Fish: New Frontiers in Science for Sustainable Management" (attached here for your convenience). The resolution was approved with one change - SCICOM recommended that the funding from ICES be used only to supporting Early Career Scientists and requested to reflect this in the budget. The updated resolution has to be submitted by March 31.

The symposium was also discussed at the kick-off meeting of the ICES/PICES WGSPF (WG 43) held from March 9-11 in Copenhagen and attended by 31 scientists (11 via WebEx) from 17 nations. The following are agreed timelines:

End of March 2020 – WGSPF Co-Chairs to develop the symposium scientific steering committee with consideration of the regional, disciplinary, and gender balance;

Mid-May 2020 – WGSPF Co-Chairs to confirm the location, venue, and dates of the symposium. The Mediterranean region is the target. Barcelona is still an option. The tentative time period is still December 2021. The symposium can also be delayed until spring 2022.

Mid-May 2020 – Leaders of the specific WGSPF Activities to work with their groups to propose theme sessions for the symposium. [At the WGSPF kick-off meeting three Task Forces (Ecological Process Knowledge; Translating process knowledge - Inputs and outputs to management structures and policy advice; Social ecological approaches) were defined, each with different (inter-related) Activities. The intent is to identify an Atlantic and Pacific co-leader for each of the Activities by the end of March. Within each Activity, group members are expected to collaborate on a specific topic. Thus, we have three levels: Task Force – Activity – Topic. The topics are designed and championed by group members. Each topic should use a comparative approach across systems and/or species.]

I will keep you updated.

We hope that everyone is safe and healthy.
With best regards, Alex

Appendix L – PICES-Sponsored Conferences / Symposia

Symposium on "International Symposium on Small Pelagic Fish: New Frontiers in Science for Sustainable Management"

An **International Symposium on "Small Pelagic Fish: New Frontiers in Science for Sustainable Management"** will be held in early December 2021, in Barcelona, Spain, with Marta Coll (Spain, ICES), Myron Peck (Germany, ICES), Ryan Rykaczewski (USA, PICES), Ignacio Catalán (Spain, ICES), Akinori Takasuka (Japan, PICES) and Miguel Bernal (FAO-GFCM) as co-conveners.

A Scientific Steering Group and/or an Organizing Committee will be established with members nominated by ICES and PICES and the newly-formed joint ICES/PICES Working Group on Small Pelagic Fish (WGSPF) in order to assist the conveners in planning the symposium. The ICES Secretariat will be involved in the Scientific Steering Group and/or Organizing Committee.

Supporting information

Priority:	The symposium forms a key Term of Reference of the joint ICES/PICES WGSPF who will have their kick-off meeting at ICES HQ in early March 2020. FAO will be a co-sponsor. The symposium has a very high priority for ICES, PICES and FAO. The science to be highlighted at the symposium aligns with at least five of the seven science priorities set in the ICES Strategic Plan, including: (1) Ecosystem science, (2) Impacts of human activities, (3) Observation and exploration, (4) Seafood production and (5) Conservation and management science. The symposium will also contribute to the first three of the six goals identified in the PICES Strategic Plan: (1) Foster collaboration among scientists within PICES and with other multinational organizations; (2) Understand the status and trends, vulnerability, and resilience of marine ecosystems; and (3) Understand and quantify how marine ecosystems respond to natural forcing and human activities. FAO's involvement is important to ensure effective engagement of researchers working on the dynamics of SPF in regions outside ICES and PICES areas such as the Mediterranean (GFCM) and Black Sea and southern hemisphere (e.g., Benguela and Humboldt EBUS).
Scientific justification:	Small pelagic fish (SPF) account for more than 30% by weight of the total landings of marine capture fisheries around the world and play an important role in the transfer of energy through mid-trophic levels in marine ecosystems and in global protein security. Oscillations of SPF populations are dramatic and cyclical in response to climate variability on multi-decadal scales. Researchers around the world continue to coordinate efforts to understand the mechanisms linking climate variability to basin-scale teleconnections in the population dynamics of SPF. This international collaboration was spearheaded by the GLOBEC Regional Program on Small Pelagic Fish and Climate Change (SPACC) from 1994 to 2010. In the most recent decade, ICES and PICES have co-sponsored two symposia on SPF, including in 2012 (Nantes, France) and 2017 (Victoria, Canada). The latter re-confirmed the need to meet every 3 to 4 years to discuss, debate and collaborate to further improve the science-based advice required to sustainably manage SPF in an ecosystem context. Substantial scientific progress continues to be made on understanding the drivers and dynamics of SPF in several ecosystems: different hypotheses of mechanisms of population dynamics of SPF continue to be tested, data from long-term monitoring and stock-assessment efforts continue to accumulate, numerical modelling approaches continue to advance, technologies, such as genome analysis, continue to rapidly develop, and experience continues to be gained from management decisions and stakeholder involvement. The exchange of information and ideas drawn from comparable populations across the globe are, therefore, particularly insightful as we seek to improve management strategies. The proposed symposium will highlight the state-of-the-art in these and other topics surrounding the sustainable exploitation of SPF within an ecosystem context.

Resource requirements:	A conference fee will cover the majority of the financial resource requirements of the symposium. The joint ICES/PICES WGSPF will also perform fundraising to help defray international travel costs. Funding requests will be submitted to global, regional and national agencies. Additional requests will be sent to businesses with interests in SPF. Some example includes IFFO (Petter Martin Johannessen), PFA (Maartin Pastoors) and the Danish Pelagic Reduction Fisheries (Claus R. Sparrevohn).
Participants:	Similar to the global composition of the joint ICES/PICES WGSPF, a wide range of participation of ICES and PICES member and other countries (via FAO) is anticipated. Attendance at this 2021 symposium is expected to be approximately 250 participants, similar to the size and breadth of the 2017 PICES/ICES SPF symposium (237 participants from 31 countries).
Secretariat facilities:	ICES Secretariat will advertise the event through its professional network and the potential participation of its science officers in the Scientific Steering Group (SSG) and/or Organizing Committee (OC). As a member of the SSG and/or OC, the secretariat's science officers will also be involved in designing / co-convening theme sessions and/or workshops. The PICES Secretariat will support the symposium website including on-line registration, abstract submission, fee payments, etc. Having symposium coordinators, one person from each ICES and PICES, is suggested to coordinate activities.
Financial:	The conveners request 10,000€ from ICES to support travel and subsistence of keynote and invited speakers. The majority of these funds (8,000€) will be used to support travel of selected early career scientists. Similar resources will be provided by PICES. The symposium has been tentatively approved by PICES (GC Decision 2019/S/1).
Linkages to the Advisory Committee:	The symposium is not directly linked to the remit of any advisory group but it should be of interest to any stock assessment group working on SPF (e.g., HAWG, WGBFAS, WGWIDE).
Linkages to other committees or groups:	The symposium will be part of the activities of the joint ICES/PICES WGSPF within the Ecosystem Processes and Dynamics SG (Silvana Birchenough). The symposium will also be of interest to the Aquaculture SG (Mike Rust). The symposium will be linked to ongoing activities in at least two Strategic Initiatives including the SIHD and the ICES/PICES SICCME. The science discussed will be relevant to a number of ICES WGs including WGACEGG, WGALES, WGCOMEDA, WGHANSA, WGIPEM, WGMEGS, and other WG (e.g., integrated ecosystem assessment). The symposium is co-chaired by FAO and PICES and will link closely to their groups.
Linkages to other organizations:	This is a joint ICES-PICES-FAO symposium. The WGSPF is within PICES FIS (Xianshi Jin) and FUTURE (Steven Bograd and Sukyung Kang). FAO links include the FAO-GFCM (Miguel Bernal). Other regional fisheries organizations will be contacted, including the North Pacific Fisheries Commission (Kenji Kagawa), as well as national management bodies such as US NOAA NMFS (Jason Link) and Fisheries and Oceans Canada (Arran McPherson).
Publication of proceedings	The proceedings of the symposium will be published in a peer-reviewed journal. Various journals will be approached (e.g., Progress in Oceanography, Marine Ecology Progress Series, Frontiers in Marine Science, etc.). The ICES Journal Marine Science is not requested.

Appendix M – Capacity Building

Past Summer Schools/Conferences co-sponsored by PICES			
Dates	Event	PICES funding for ECS from PICES member countries	Location
Jul 23–Aug 4, 2018	7th International SOLAS Summer School	2 ECS from Canada	Cargèse, France
Aug 1–8, 2018	IMBeR ClimEco6 Summer School on "Interdisciplinary approaches for sustainable oceans"	3 ECS from Canada	Yogyakarta, Indonesia
Feb 23–25, 2018	Pacific Ecology and Evolution Conference (PEEC 2018)	$1,500 towards capacity building activities	Bamfield, Canada
Oct 2–6, 2017	IMBER IMBIZO5 on "Marine biosphere research for a sustainable ocean: Linking ecosystems, future states and resource management"	3 ECS, 2 from Canada, 1 from China	Woods Hole, USA
Feb. 24-26, 2017	Pacific Ecology and Evolution Conference (PEEC 2017)	$1,500 towards capacity building activities	Bamfield, Canada
Sep. 15–23, 2016	CLIVAR Open Science Meeting	1 invited speaker from Korea; 2 ECS, from Russia and US	Qingdao, China
Aug. 10-17, 2016	IMBER ClimECO5 Summer School on "Towards more resilient oceans: Predicting and projecting future changes in the ocean and their impacts on human society"	2 ECS, from China and Russia	Natal, Brazil
Feb. 26–28, 2016	Pacific Ecology and Evolution Conference (PEEC 2016)	$1,500 towards capacity building activities	Bamfield, Canada
Oct. 27–30, 2015	IMBER IMBIZO IV on "Marine and human systems: Addressing multiple scales and multiple stressors"	No support; request came too late	Trieste, Italy
Feb. 27–Mar.1, 2015	Pacific Ecology and Evolution Conference (PEEC 2015)	$1,500 towards capacity building activities	Bamfield, Canada
Aug. 4–9, 2014	IMBER ClimECO4 Summer School on"Delineating the issues of climate change and impacts to marine ecosystems: Bridging the gap between research, assessment, policy and management"	1 instructor and 5 ECS, from Canada, China, US	Shanghai, China
Aug, 23–Sep. 2, 2013	6th International SOLAS Summer School	3 ECS, from Japan, Russia, US	Xiamen, China
July 23–28, 2012	IMBER ClimECO3Summer School on "A view towards integrated earth systems models – Human nature interactions in the marine world"	6 ECS, from China, Japan, Korea	Ankara, Turkey
Aug. 29–Sep. 10, 2011	5th SOLAS Summer School	3 ECS from 3 PICES member countries	Cargèse, Corsica
Oct. 10-14, 2010	IMBER IMBIZO II on "Integrating biogeochemistry and ecosystems in a changing ocean: Regional	3 invited speakers	Crete, Greece

	comparisons		
Aug. 23–27, 2010	IMBER ClimECO2Summer School on “Oceans, marine ecosystems, and society facing climate change”	9 ECS, from all PICES member countries	Brest, France

Appendix M – Capacity Building (Cont'd)

2020 PICES Spring School Synopsis and Schedule - Cancelled due to Covid-19

Main scope: "What is the Deep Scattering Layer (DSL) in the coastal region?"

Scope: We can easily to observe the deep scattering layer (DSL) by acoustic doppler current profiler or quantitative echo sounder, however we usually do not know What is the DSL? Thermocline, phytoplankton, zooplankton, fish or any other particles? In this summer school, students identify the DSL by the various sampling gears. CTD and water sampling can define thermoclines, nutrients, oxygen maxima and subsurface chlorophyll maximum. Zooplankton net sampling can collect zooplankton patch in the subsurface layers around the DSL. Trawl net sampling can collect fishes and their larvae from the deep layers. Participants will have experiences for oceanographic observations and their data analyses and understand the interactions between physical and biogeochemical environments and marine ecosystem in the coastal regions.

Synopsis
We propose a 5-day spring school on "Coastal Ocean Observatory Science" consisting of lectures, fieldwork aboard a coastal research vessel, laboratory experiments of various sample analysis, and data analysis and visualization. The scope of the lectures, demonstrations and exercises will cover a range of sensors and sampling equipment used to measure physical, biological, chemical, and biogeochemical properties of the coastal ocean (the Kagoshima Bay). Data sets will include CTD measurements (temperature, salinity and conductivity), active acoustics (echosounder and acoustic doppler current profiler) and biogeochemical sensors (e.g., chlorophyll fluorescence, dissolved oxygen and pH) and biological measurements from samples. Topics to be covered include ocean monitoring, remote sensing, fishery stock, coastal oceanography, and fisheries oceanography.

The goal of the spring school is to provide students with an understanding of contemporary techniques used in observatory science to assess physical, biological, chemical, and biogeochemical processes in the coastal ocean. To this end, the curriculum we propose includes detailed lectures from local experts, laboratory demonstrations of sample analysis, exercises intended to provide students with tools and required to treat the derived data sets, and data visualizations.

Student's objectives and goals
What is the Deep Scattering Layer (DSL) in the coastal region?
- ✓ To visualize deep scattering layer using active acoustics data sets.
- ✓ To evaluate the depth range of diel vertical migration of deep scattering layer
- ✓ To clarify which kind of particles or organisms constructing deep scattering layer.

Organizers
Sponsors
- ✧ Faculty of Fisheries, Kagoshima University
- ✧ Japan Society for the Promotion of Science
- ✧ PICES (North Pacific Marine Science Organization)
- ✧ PICESAdvisory Panel on North Pacific Coastal Ocean Observing Systems (AP-NPCOOS)
- ✧ PICES Working Group 37

Local Organizing Committee
- ✧ Naoki Yoshie (Ehime University, AP-NPCOOS, Chair of LOC)
- ✧ Toru Kobari (Kagoshima University, PICES WG37)
- ✧ Gen Kume (Kagoshima University)

Appendix M – Capacity Building (Cont'd)

Lecturers
- ✧ Daisuke Hasegawa (Tohoku National Fisheries Research Institute, Japan)
- ✧ Aiko Tachibana (University of Tokyo, Japan)
- ✧ Gen Kume (Kagoshima University, Japan)

Supporting staff
- ✧ MeguIwazono (Kagoshima University, Japan)
- ✧ Emma Moritoshi Hinako (Kagoshima University, Japan)
- ✧ Shin Kazuno (Kagoshima University, Japan)
- ✧ Yusuke Manako (Kagoshima University, Japan)
- ✧ Satoshi Jinno (Kagoshima University, Japan)

Date
Workshop dates
March 4-8, 2020
Important dates
November 15, 2019 (Application deadline)
December 13, 2019 (Outcome notification emails)
December 20, 2019 (Invitees confirm participation)

Venue
Faculty of Fisheries, Kagoshima University (KUFF)
4-50-20 Shimoarata, Kagoshima City, 890-0056
http://www.fish.kagoshima-u.ac.jp/en/aboutus/access-map/
- ✓ The nearest tram station is "Kisyaba". The simplest access is to get off the airport limousine bus to Kamoike port at "Yojiro" (about 80 minutes) and walk to the campus (about 15 minutes).

Accommodation
International Residence Hall, Kagoshima University
4-50-20 Shimoarata, Kagoshima City, 890-0056 (neighboring to the Fisheries campus)
https://www.kagoshima-u.ac.jp/en/news/2017/08/rooms-available-at-international-residence-hall-1.html

Participation and eligibility
- ✧ 20 participants maximum (young scientist and students)
- ✧ NO abstract submission
- ✧ NO registration fee is required
- ✧ Preference to PICES member nations, but open to others, especially North Pacific rim.
- ✧ Early career scientists (within 5 years of receiving their Ph.D.) and scientists from countries with 'economies in transition'
- ✧ Encourage participants whose research is related to or will benefit from the curriculum content

Steps to APPLY for participation in workshop
All applicants should submit the following TWO DOCUMENTS: 1) A CV (including Name, Affiliation, Gender, and Email address); and 2) a cover letter outlining the applicants motivation for participating in this workshop and describing the necessity for traveling funding to join this workshop. Deadline for submitting the two essential documents is November 15, 2019; please email these directly to LOC, Naoki Yoshie (yoshie.naoki.mm@ehime-u.ac.jp) and Toru Kobari (kobari@fish.kagoshima-u.ac.jp). If more than 20 applicants submit, selection committee will select the participants (maximum: 20) dependent on the beds available in the vessel. Questions about the practical workshop can be addressed to N. Yoshie also.

Appendix M – Capacity Building (Cont'd)

Registration, ground transport during the workshop, and lodging costs are provided by the workshop, however, participants are required to cover the cost of airfare to and from the venue (Kagoshima, Japan).

Schedule
March 4th (Wednesday): Fisheries Library
15:00-15:30 Registration to workshop (Seminar room at Fisheries Library)

- All participants come to registration desk and receive all documents (name tag, time schedule and textbook).

15:30-16:00 Opening session (Seminar room at Fisheries Library)

- Welcome address and description on background and objectives (Yoshie)
- Orientation for schedules, facilities including experimental room and accommodation, and neighboring sites (e.g. supermarket) (Kobari)

16:00-16:30 Registration to International Residence Hall
16:30-18:30 Opening reception (International Residence Hall)

- Opening address (Yoshie)
- Ice breaker with snacks and beverages
- Self-introduction (all staffs and participants)
- Name, Institute/University, Academic interests, Others

March 5th (Thursday): Fisheries campus and T/S *Nansei Maru*
Group A (Onboard supporting staff: Kobari, Moritoshi and Iwazono)
07:30 Meeting at the front of the 5th building in the Fisheries campus
07:30-08:30 Transport and loading gears to *Nansei Maru*

- Move to *Nansei Maru* by lend-a-car.

09:00-09:30 Orientation and emergency drill
09:30-11:00 Oceanographic observations (daytime)

1. Conductivity-Temperate-Depth profiler (CTD): temperature, salinity, dissolved oxygen and pH
2. Rinko biogeochemical sensors: CTD, dissolved oxygen and chlorophyll fluorescence
3. Carousel Multibottle Sampler (CMS): 12 layers
4. Sample collections and processing: nutrients and chlorophyll

11:00-12:00 Lunch (prepared by the vessel stew)
12:00-15:30 Biological samplings (daytime)

1. Scientific echo-sounder: check deep scatting layers
2. Closing plankton net: zooplankton
3. Larva Catch net: micronekton
4. Sample processing: identification, sorting and counting, length measurements

16:30-17:00 Arrive at Kagoshima
17:00-17:30 Back to the International Residence Hall by lent-a-car.
17:30 Break

Appendix M – Capacity Building (Cont'd)

Group B (Onboard supporting staff: Kobari, Moritoshi and Iwazono)
09:00-12:00 Seminar (1-1 laboratory in 5th building)
1. Significance of oceanographic monitoring, and visualization and application of their data (Hasegawa)
2. What is "Deep Scattering Layer (DSL)?" and their importance on coastal monitoring (Yoshie)
3. Significance of zooplankton time-series and their applications (Tachibana)

12:00-13:30 Lunch break
13:30-17:00 Laboratory work (1-1 laboratory in 5th building)
- Data processing of CTD data (Yoshie and Kazuno)
- Measurements of chlorophyll and zooplankton biomass (Tachibana and Manako)
- Identification fish species and measurements of their weight and length (Kume and Jinno)

17:30 Break

March 6th (Friday): Fisheries campus and T/S Nansei Maru
Group A
09:00-12:00 Seminar (1-1 laboratory in 5th building)
1. Significance of oceanographic monitoring, and visualization and application of their data (Hasegawa)
2. What is "Deep Scattering Layer (DSL)?" and their importance on coastal monitoring (Yoshie)
3. Significance of zooplankton time-series and their applications (Tachibana)

12:00-13:30 Lunch break
13:30-17:00 Laboratory work (1-1 laboratory in 5th building)
- Data processing of CTD data (Yoshie and Kazuno)
- Measurements of chlorophyll and zooplankton biomass (Tachibana and Manako)
- Identification fish species and measurements of their weight and length (Kume and Jinno)

17:30 Break

Group B
07:30 Meeting at the front of the 5th building in the Fisheries campus
07:30-08:30 Transport and loading gears to Nansei Maru
- Move to Nansei Maru by lent-a-car.

09:00-09:30 Orientation and emergency drill
09:30-11:00 Oceanographic observations (daytime)
1. Conductivity-Temperate-Depth profiler (CTD): temperature, salinity, dissolved oxygen and pH
2. Rinko biogeochemical sensors: CTD, dissolved oxygen and chlorophyll fluorescence
3. Carousel Multibottle Sampler (CMS): 12 layers
4. Sample collections and processing: nutrients and chlorophyll

11:00-12:00 Lunch (prepared by the vessel stew)
12:00-15:30 Biological samplings (daytime)

1. Scientific echo-sounder: check deep scatting layers
2. Closing plankton net: zooplankton
3. Larva Catch net: micronekton
4. Sample processing: identification, sorting and counting, length measurements

16:30-17:00 Arrive at Kagoshima
17:00-17:30 Back to the International Residence Hall by lent-a-car.
17:30 Break

March 7th (Saturday): Fisheries campus
09:00-12:00 Laboratory work (1-1 laboratory in 5th building)
- Data processing and analyses
- Preparations of materials for oral presentation

Student subjects

- ✓ Evaluate who makes DSL based on the provided data and their visualizations.
- ✓ Describe the reasons why DSL is formed.

12:00-13:30 Lunch
13:30-18:00 Inspection tour

- ➢ View of the study site from volcano Mt. Sakurajima
- ➢ Sakurajima visitor center (geology and ocean environments)
- ➢ Kagoshima aquarium (local marine biology and ecosystems)

18:30 Back to the International Residence Hall and break

March 8th (Sunday): Fisheries campus
08:30-10:00 Presentation of Group A, B and C (Seminar room at fisheries library)

- ➢ Oral presentation (15 minutes)
- ➢ Questions, comments and discussions (10 minutes)

10:00-10:20 Coffee break
10:20-12:00 Presentation of Group D, E and F (Seminar room at fisheries library)

- ➢ Oral presentation (15 minutes)
- ➢ Questions, comments and discussions (10 minutes)

12:00-13:00 Lunch
13:00-13:30 Closing session (Common space in the International Residence Hall)

- ➢ Closing address and providing certificate (Yoshie)
- ➢ Some notes regarding accommodation (Kobari)
- ➢ Questionnaire
- ➢ Take group-photo

Notes
Staffs to be necessary

- ✧ Laptop PC (with pre-installed MS Excel and Power Point)
- ✧ Medical insurance
- ✧ Rain boots and work clothes for onboard training (if necessary)
- ✧ Medicine for motion sickness (if necessary)
- ✧ Bath amenity and towel (not available in International Resident Hall)

Other issues

- ✧ LOC does not cover mealcosts.
- ✧ Supermarkets, shops and restaurants are available around the Fishery campus and International Residence Hall.
- ✧ Student restaurant is also available from 11:30 to 13:30 during Monday to Friday.
- ✧ Please let the chair know some information regarding allergy and religious avoidance to food and others by the end of January 2020. Unfortunately, LOC cannot take care anything for meals on-board.
- ✧ All participants should take own medical insurance. LOC does not cover medical costs for all participants in accident.
- ✧ When you do not attend this workshop, please send email to the chair (yoshie.naoki.mm@ehime-u.ac.jp) at your earliest convenience (by 15 February 2020).
- ✧ The chair will send email to all participants if this workshop is cancelled due to severe storms, earthquake and volcano eruption by the end of February 2020. Such situations are not likely happened.
- ✧ Public internet access in the campus is available.

Contact
If you have any problems, please contactNaoki Yoshie (yoshie.naoki.mm@ehime-u.ac.jp)

Appendix N – PICES 2022

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Appendix O – ICES Code of Ethics – for Discussion

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

Council Meeting 2018

October 2018

CM 2018 Del-5

ICES Code of Conduct

Introduction

Given ICES role as a knowledge provider, it is essential that experts contributing to ICES science and advice maintain scientific independence, integrity and impartiality. It is also essential that their behaviours and actions minimise any risk of actual, potential or perceived Conflicts of Interest (CoI). A CoI arises when there is an actual, potential or perceived possibility that a scientist or adviser makes a contribution to ICES work that is not based on a systematic scientific review of the available information and evidence. An actual, potential or perceived CoI arises because the decision or outcome of a process may be influenced, or is perceived to be influenced, by self-interest, professional-interest, external pressures and other factors.

ICES has the ambition to be an inclusive organisation. This implies that experts are primarily judged by their expertise, behaviours and contributions, not their affiliations. Experts with a potential or perceived CoI can be included, provided they follow the Code of Conduct (below) and show through their behaviours and contributions to be fully capable of managing the CoI.

To ensure credibility, salience, legitimacy, transparency and accountability in ICES work, to avoid CoI and to safeguard the reputation of ICES as an impartial knowledge provider, all contributors to ICES work are required to abide by the ICES Code of Conduct below.

The ICES Code of Conduct provides guidance on identifying and handling actual, potential or perceived Conflicts of Interest, defines the standard for behaviours of ICES experts contributing to ICES science and advice and sets the responsibilities of those contributing to ICES work.

Roles of Delegates and Chairs

The National Delegates and Chairs (in the case of "Chair Invited Experts") are the gatekeepers of the system when nominating experts. It is their responsibility to ensure active adherence to the ICES Code of Conduct. This implies that they are responsible for ensuring:

- All experts contributing to ICES work are aware of the ICES Code of Conduct.
- Actual, potential or perceived Conflicts of Interest are identified and assessed prior to nominating experts.
- Experts are only nominated or invited if the nominating Delegate or inviting Chair are confident that the experts have provided adequate evidence that they can and will abide by this Code of Conduct.

Application of the Code of Conduct

The Code of Conduct applies to scientists participating in ICES Expert Groups, Review and Advice Drafting Groups and ACOM /SCICOM meetings. Occasionally, ICES may run meetings which are intended to solicit stakeholder views. For these meetings, explicitly identified by the Secretariat and in advance of the meeting, participants will be asked to represent specific professional interests.

Code of Conduct

1) The purpose of this code is to ensure transparency and accountability in ICES work and to safeguard the reputation of ICES as an impartial knowledge provider
2) The Code of Conduct applies to all contributors to ICES work and all contributors to ICES work must abide by the Code of Conduct.
3) All contributors to ICES work are expected to conduct themselves in a manner consistent with scientific independence, integrity, and impartiality and to declare any Conflicts of Interest.
4) All contributors to ICES work must actively support the ICES vision and mission.
5) All participants at the meeting, including the Chair, are required to declare any Conflicts of Interest and their commitment to abide by the Code of Conduct before their work commences. It is the responsibility of the Chair to ensure these declarations are made.
6) In cases of uncertainty as to whether an action of activity constitutes an actual, potential or perceived Conflict of Interest, it is expected that all persons engaged in ICES work will err on the side of caution and identify, disclose and manage the actual, potential or perceived Conflict of Interest. In situations of actual, potential or perceived Conflict of Interest, all those involved in the discussions are expected to actively seek feedback from one-another, in an open and transparent discussion and in line with the expectations outlined in this Code of Conduct.
7) In cases of actual, potential or perceived Conflict of Interest an expert can still contribute to ICES work if the National Delegate and Chair involved are satisfied that the independence and objectivity of work to be carried out are not at risk, or will not be perceived to be at risk, and that long-term confidence in the impartiality, vision and mission of ICES will not be diminished.
8) In cases when there is an actual, potential or perceived Conflict of Interest of the Chair, the Chair can still contribute to ICES work if the National Delegate and Secretariat are satisfied that the independence and objectivity of work to be carried out are not at risk, or will not be perceived to be at risk, and that long-term confidence in the impartiality, vision and mission of ICES will not be diminished.
9) Chairs should ensure that the full range of available data, evidence and scientific opinions are considered in their groups and that any differences are identified and explored before reaching conclusions.
10) All contributors to ICES work should present and review data, scientific evidence, theory or interpretation honestly and accurately and no contributor to ICES work should knowingly mislead, or allow others to be misled, about scientific matters.

Action in case of a perceived or actual breach of the Code of Conduct

1) The expert involved must seek feedback, from the meeting Chair and participants, on how to resolve the breach and ensure the Code of Conduct is followed.
2) If the discussion (1) does not resolve the issue, the Chair should consult the Secretariat before making a decision on the participation of the expert, either excluding the expert for the entire meeting or for the period during which the issue leading to the perceived or actual breach is being addressed. In this case the Secretariat will inform and if necessary consult the ICES Bureau about the decision within 24 hours. Council acts as the final arbiter in the case of ongoing dispute.
3) To record perceived or actual breaches of the Code of Conduct and to ensure that the Code is being applied in a consistent and transparent manner, the Secretariat will provide Council with an annual report listing breaches and the actions taken to address them.

Appendix P – Science Board / Governing Council Decisions

To be sent via email: Report on Science Board Governing Council Decisions

Appendix Q – Organizations / Programs relevant to PICES

ISC (International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean)

- ISC has sent observers to PICES Annual Meetings since 2009. ISC and PICES share research interests in the relation between spatio-temporal patterns of variability and environmental signals, future climate scenarios, and end-to-end modeling. A joint ISC-PICES Study Group for *Scientific Cooperation of ISC and PICES* established in April 2015 to develop a framework for scientific cooperation in the North Pacific. The framework identified 3 broad research themes of mutual interest to ISC and PICES:
  - Oceanographic conditions and the distribution and productivity of pelagic fish;
  - Environmental interactions with fishers and fisheries (Section 2.2);
  - Effects of climate change on the distribution and productivity of pelagic fish.

Examples of ISC/PICES collaborations include:

- ISC co-sponsored a FIS/TCODE Topic Session (S10) at PICES-2013: *Banking on recruitment curves: Returns on intellectual investment*. Invited speaker: Jon Brodziak (PIFSC, USA and ISC);
- PICES scientist (C.I. Zhang, Korea) presented a talk on "*Ecosystem-based assessment and management for sustainable fisheries*" at ISC13, Busan, Korea, July 17–22, 2013;
- ISC co-sponsored a 2-day workshop (W1) on "*Dynamics of pelagic fish in the North Pacific under climate change*" (W1) at PICES-2014, Yeosu, Korea;
- An ISC/PICES Study Group (SG-SCISC) workshop was held in Kona, HI, July 2015 to explore and prioritize scientific topics of interest to both ISC and PICES, and to develop the TOR and activities for a joint ISC-PICES working group. See the framework for scientific cooperation for a Working Group.
- A joint PICES/ISC Working Group on Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish (WG 34) was established at PICES-2015;
- ISC co-sponsored a FIS Workshop (W4) at PICES-2016: *Methods relating oceanographic conditions to the distribution of highly migratory species* (Co-Convenors: Gerard DiNardo (ISC/USA), Chi-Lu Sun (ISC/Chinese Taipei);
- ISC co-sponsored the PICES International Symposium on "*Understanding changes in transitional areas of the Pacific",* April 24–26, 2018, La Paz, Mexico;
- ISC co-sponsored a FIS Topic Session (S12) on "*Applying ecosystem considerations in science advice for managing highly migratory species*"(Co-Convenor: Steve Teo (ISC USA)at PICES-2018.

Dr. Gerard DiNardo represented ISC at PICES-2017; Dr. Hal Batchelder represented PICES at ISC17 in Vancouver, Canada.

Argo

Argo is an international project to collect information on the temperature and salinity of the upper part of the world's oceans. Argo uses robotic floats that spend most of their life drifting below the ocean surface. They make temperature and salinity measurements when they come up to the surface and after transmitting their data to satellites, they return to depth to drift for 10 days. Currently, there are roughly 3000 floats producing 100,000 temperature/salinity profiles per year. The floats go as deep as 2000m.

Among the many breakthroughs in observational technology and capabilities the Argo float observatory is one of the most impressive and successful examples (Freeland et al., 2010. Argo - A decade of progress, doi:10.5270/OceanObs09.cwp.32). As Argo enters its second decade and chemical/biological sensor technology has improved significantly, it is becoming obvious that this observatory will be embraced by the ocean biogeochemistry community.

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

The primary goal of Argo, as enunciated in the original prospectus is to create a global network of instruments integrated with other elements of the climate observing system:

- to detect climate variability on seasonal to decadal time-scales. The targeted variability includes changes in the large-scale distribution of temperature and salinity and in the transport of these properties by large-scale ocean circulation;
- to deliver information needed for calibration of satellite measurements, and
- to provide data for initialization and constraint of climate models.

- Third Argo Science Workshop: The future of Argo (co-sponsored by PICES and several Chinese agencies/organizations), March 25–27, 2009, Hangzhou, China;
- Freeland, H. & Co-Authors (2010). "Argo - A Decade of Progress" in *Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society* (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., D.E. Harrison & D. Stammer, Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.cwp.32
- Argo co-sponsored (with GOOS) MONITOR Topic Session (S7) on "*State of the art of real-time monitoring and its implication for the FUTURE oceanographic study*" co-convened by Jack Barth (U.S.A.), Dake Chen (China), David L. Mackas (Canada), Vyacheslav Lobanov (Russia), Young Jae Ro (Korea) and HiroyaSugisaki (Japan) at PICES-2009, Jeju, Korea.
- The International Argo Steering Team (Dr. Toshio Suga, Co-Chair of the Team) was the recipient of the 2018 POMA.

Argo usually sends a representative to PICES Annual Meetings. Dr. Tetjana Ross is representing Argo at PICES-2019.

FAO (Food and Agriculture Organization of the United Nations/Fisheries and Aquaculture Department)

The FAO Fisheries and Aquaculture Department usually sponsors large-scale PICES on symposia involving fish and fisheries:

- FAO and PICES co-sponsored (with GLOBEC and EUR-OCEANS) the Symposium on "*Coping with global change in marine social-ecological systems*", July 8–11, 2008, Rome, Italy;
- FAO and PICES co-sponsored (with IOC, FAO, SCOR, NOWPAP) the 15th International Conference on Harmful Algae, October 29–November 2, 2012, Changwon, Korea;
- PICES/ICES/FAO symposium on "Climate change effects on fish and fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies" (April 25–29, 2010, Sendai, Japan);
- FAO was represented at the PICES/ICES Workshop on "Global assessment of the implications of climate change on the spatial distribution of fish and fisheries", May 22–24, 2013, St. Petersburg, Russia;
- PICES/ICES/FAO International Symposium on "*Drivers of dynamics of small pelagic fish resources*", March 6–11, 2017, Victoria, Canada (Dr. Manuel Barange, Director of the Fisheries and Aquaculture Policy and Resources Division, represented FAO);
- PICES/ICES/IOC/FAO 4th International Symposium on "*The effects of climate change on the world's oceans*" (June 4–8, 2018, Washington, DC, USA);
- S-CCME contributed Chapter 6, Climate change impacts, vulnerabilities and adaptations: North Pacific and Pacific Arctic marine fisheries, to an FAO Fisheries and Aquaculture Technical Paper 627 (2018) on "Impacts of climate change on fisheries and aquaculture. Synthesis of current knowledge, adaptation and mitigation" (an update of FAO Tech. Paper 530 (2009)).
- Dr. Yimin Ye represented FAO at PICES-2017.

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

Regional program of IMBeR

Ecosystem Studies of Sub-Arctic and Arctic Seas (ESSAS)

ESSAS objectives are to understand how climate variability and climate change affect the marine ecosystems of Subarctic and Arctic seas and their sustainability, and in turn, how changes in the marine ecosystems affect humans. ESSAS conducts research to compare, quantify, and predict the impact of climate variability and global change on the productivity and sustainability of Subarctic and Arctic marine ecosystems and their effect on humans. ESSAS has close ties to PICES and its Forecasting and Understanding Trends, Uncertainty and Response (FUTURE) project, and to the North Pacific Research Board (NPBR) in the Pacific and with International Council for the Exploration of the Sea (ICES) in the North Atlantic. ESSAS has connections and is collaborating in studies of interactions between Arctic and Sub-Arctic regions with Arctic-Subarctic Ocean Fluxes (ASOF), Arctic Ocean Sciences Board (AOSB), and Climate Variability and Predictability (CLIVAR) programs.

Symposia and inter-sessional workshops co-sponsored by PICES

- An ESSAS Symposium on "*Climate variability and sub-Arctic marine ecosystems*", May 16–20, 2005, Victoria, Canada;
- ESSAS and PICES held a joint a workshop to develop comparative studies of the sub-Arctic seas, June 12-14, 2006, St. Petersburg, Russia;
- The second ESSAS Open Science Meeting (also co-sponsored by ICES) on "*Comparative studies of climate effects on polar and sub-polar ocean ecosystems: Progress in observation and prediction*" (May 2011, Seattle, USA) by providing organizational support (including: maintaining the meeting website, handling major finances, on-line registration and abstract submission, compiling the book of abstracts, and arranging the logistics for the venue).
- An ESSAS Symposium on "Moving in, out and across the Subarctic and Arctic - shifting boundaries of water, ice, flora, fauna, people and institutions" June 12-16, 2017, Tromsø, Norway.

PICES Annual Meetings

- PICES and ESSAS initiated the Marine Ecosystem Model Inter-comparison Project (MEMIP) in 2008, in which the goal was to compare the performance of various lower trophic level marine ecosystem simulation models in predicting the abundance and distribution of coastal zooplankton functional groups. A series of joint MEMIP workshops were organized in conjunction with PICES Annual Meetings starting in 2008:
    - MONITOR/ESSAS workshop (W3) on "Status of marine ecosystems in the sub-arctic and arctic seas - Preliminary results of IPY field monitoring in 2007 and 2008", PICES-2008, Dalian, China;
    - CCCC/ESSAS workshop (W5) on "*Marine ecosystem model inter-comparisons*", PICES-2008, Dalian, China;
    - BIO workshop (W4) co-sponsored by ESSAS on "*Marine ecosystem model inter-comparisons (II)*", PICES-2009, Jeju, Korea;
- ESSAS/PICES workshop (W4) on "*Subarctic-Arctic interactions*" at PICES-2012, Hiroshima, Japan;

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

Publications

- Selected papers from the GLOBEC Symposium on "*Effects of climate variability on Sub-Arctic marine ecosystems*" (Guest Editors: G.L. Hunt Jr., K. Drinkwater, S.M. McKinnell, D.L Mackas) was published in Deep-Sea Research II, 2007, Vol. 54(23-26);
- A summary of the ESSAS 2011 Open Science Meeting on "*Comparative studies of climate effects on polar and sub-polar ocean ecosystems*" was published in the July 2011 issue (Vol. 19 No. 2) of PICES Press;
- Selected papers from ESSAS 2011 Open Science Meeting on "*Comparative studies of climate effects on polar and sub-polar ocean ecosystems*" (Guest Editors: K. Drinkwater, G. Hunt, Jr., O. Astthorsson, and E. Head) was published in ICES Journal of Marine Science, 2012, Vol. 69(7).

ESSAS is regularly represented at PICES Annual Meetings. Dr. Franz Meuter is representing ESSAS at PICES-2019.

Large-scale Ocean Research Programs co-sponsored by IOC

WESTPAC (IOC Sub-Commission for the Western Pacific)

By bringing together, and in partnership with, governmental agencies and marine scientific communities, WESTPAC is committed to developing, coordinating and implementing marine scientific research, observations and services on four themes:
1) Understanding ocean processes and climate change in the Indo-Pacific (*e.g.*, through NEAR-GOOS);
2) ensuring marine biodiversity and seafood safety;
3) safeguarding the health of ocean ecosystems (*e.g.*, through projects/programs such as marine coastal and biodiversity conservation, coral reef under climate and anthropogenic perturbations, harmful algal blooms, remote sensing of coastal habitats, marine toxins and seafood safety); and
4) enhancing knowledge of emerging ocean science issues (*e.g.*, regular process for global reporting and assessment of the state of the marine environment, mapping of harmful jellyfish, Asian dust and its impact on the ocean ecosystem).

The main topics for cooperation between WESTPAC and PICES to date have been through ecosystem monitoring (NEAR-GOOS), harmful algal blooms, invasive species, and capacity building activities.

WESTPAC and PICES have co-sponsored:

- An International Workshop (also co-sponsored by KIOS, PKNU, NPEC, NFRDI, MOMAF, NOWPAP)on "*Remote sensing of marine environment in the Northwest Pacific region*", August 1–2, 2006, Busan, Korea;
- Dr. Vyacheslav Lobanov represented PICES at the 11th Session of IOC/WESTPAC Coordinating Committee for the North-East Asian Regional Global Ocean Observing System (January 2007, Bangkok, Thailand);
- PICES and IOC/WESTPAC HAB experts met (October 24–25, 2007, Seattle, USA and November 25–27, 2007, Tokyo, Japan) to discuss possible directions for HAB projects, what might be learned from past IOC/WESTPAC training courses, and potential collaborations to enhance the effectiveness of a HAB training program;
- Participation of PICES and WESTPAC experts in the 2nd Asian GEOHAB meeting (January 28–February 1, 2008, Nha Trang, Vietnam) to introduce activities of S-HAB and aPICES Seafood Safety/MAFF project;
- NOWPAP/PICES/WESTPAC training course on "*Remote sensing data analysis*", October 8–12, 2011, Vladivostok, Russia;

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

PICES members (XianshiJin/FIS), Vyacheslav Lobanov (POC/AP-CREAMS), Lin Liu (SG-NPESR3), Xuelei Zhang (S-CCME), Douding Lu (S-HAB), FangliQiao (POC/FUTURE SSC/SG-CEP), Chan Joo Jang (POC, SG-CEP), Shang Chen (HD), and Mitsutaku Makino (HD) convened sessions at IOS/WESTPAC 10th Conference, on "Advancing Ocean Knowledge, Fostering Sustainable Development: from the Indo-Pacific to the Globe", April 17–20, 2017, Qingdao, China.

Capacity building events:

- As part of FUTURE's original Implementation Plan, WESTPAC was cited as one of the programs important for collaboration on human and coastal issues in the western North Pacific;
- PICES/ WESTPAC Workshop on "Rapid Assessment Survey methodologies for detecting non-indigenous marine species", July 19-21, 2011, Phuket, Thailand;
- PICES/MAFF Workshop on "*Introduction to Rapid Assessment Survey methodologies for detecting non-indigenous marine species*" (co-sponsored by FRA, NOWPAP and WESTPAC), February 8–9, 2012, Nagasaki, Japan.

WESTPAC has sent observers periodically to PICES Annual Meetings since 2000.Dr. Kentaro Ando represented WESTPAC at PICES-2018.

IOCCP (International Ocean Carbon Coordinated Project) [this project is also sponsored by SCOR]

IOCCP, co-sponsored by SCOR and IOC-UNESCO, promotes the development of a global network of ocean carbon observations for research through technical communication and communications services, international agreements on standards and methods, and advocacy and links to global observing systems. This should lead to the joint development of global data products and synthesis activities documenting the ocean carbon cycle. PICES, through its earlier Working Groups, and now through the Section on *Carbon and Climate* (S-CC; 2006–present), has been a regional coordinator for these activities and provides a link to IOCCP.

GOOS has established three disciplinary panels: Biology and Ecosystems Panel (BioEco; PICES members are: **Sonia Batten**, and **Sanae Chiba**), Biogeochemistry Panel (IOCCP; **Masao Ishii**), and Physics Panel (OOPC; PICES is not represented on OOPC [Ocean Observations Panel for Climate]).

S-CC communication/coordination with SCOR/IOC-UNESCO IOCCP on ocean carbon activities
PICES, through its Working Groups on *CO_2 in the North Pacific* (WG 13; 1998–2001) and *Biogeochemical Data Integration and Synthesis* (WG 17; 2002–2005), and now through the Section on *Carbon and Climate* (S-CC; 2006–present) has been providing coordination for synthesis of ocean carbon research and the development of a network of ocean carbon observations in the North Pacific. The importance of ensuring effective two-way communication with other international scientific groups that have a responsibility for the coordination of ocean carbon research, such as the SCOR/IOC-UNESCO International Ocean Carbon Coordinated Project (IOCCP) and to the SOLAS/IMBeR Carbon (SIC) Research Working Group, has been explicitly included in the terms of reference for S-CC.

There are S-CC members on two of SIC's subgroups: Currently, Dr. **Masao Ishii** is on one of the SIC's 3 subgroups: subgroup 2 on *Interior Ocean Carbon*.

Dr. **Masao Ishii**, is also the Co-Chair of the IOCCP SSG; S-CC member, Dr. **Richard Feely**, is a member (member responsible for ocean acidification component) and Alex Kozyr, are also members of the IOCCP Scientific Steering Group.

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

IOCCP is normally represented as an observer at PICES Annual Meetings. Dr. Masao Ishii represented IOCCP at PICES-2018.

GlobalHAB/IPHAB (GlobalHAB and Intergovernmental Panel on Harmful Algal Blooms)

PICES communicates with various international HAB programs, including GlobalHAB (an initiative under the auspices of IOC and SCOR, and superseding GEOHAB (Global Ecology and Oceanography of Harmful Algal Blooms) program) and IPHAB (UNESCO-IOC Intergovernmental Panel on Harmful Algal Blooms) through the Section on *Ecology of Harmful Algal Blooms in the North Pacific*. Some of GlobalHAB's and IPHAB's goals will be to focus on climate change impacts on HABs and socio-economic impacts of HAB occurrences and S-HAB is well positioned from past activities to make a large contribution.

Climate change impacts on HABs:

- GEOHAB/PICES/ICES/SCOR co-sponsored a workshop on "*Harmful algal blooms in a changing world*", March 18–22, 2013, Friday Harbor, USA (Phase I);
- Outcome from the workshop was a paper on "*Harmful algal blooms and climate change: Learning from the past and present to forecast the future*" by M.L. Wells *et al*., 2015, *Harmful Algae*doi: 10.1016/j.hal.2015.07.009;
- PICES/FORMAS/SCOR/GEOHAB/NOAA Symposium co-organized by M.L. Wells on "*Harmful algal blooms and climate change*", May 19-22, 2015, Göteburg, Sweden (Phase II).

Socio-economic impacts of HAB occurrences:

- PICES Scientific Report No. 47 on "*Proceedings of the Workshop on Economic Impacts of Harmful Algal Blooms on Fisheries and Aquaculture*", edited by V.L. Trainer and T. Yoshida;
- GlobalHAB Second SSC meeting was held in Naples, Italy on 27–31 March 2017. Vera Trainer (partial funding from PICES) and Mark Wells (no funding from PICES) represented PICES at the meeting. *GlobalHAB—A New Program to Promote International Research, Observations and Modelling of Harmful Algal Blooms in Aquatic Systems*, was published in a special issue on International Cooperation in Harmful Algal Bloom Science in *Oceanography*, 30(1): 70–81 (Vera Trainer, co-author);
- GlobalHAB co-sponsored MEQ Workshop (W18) on "GlobalHAB: Evaluating, reducing and mitigating the cost of harmful algal blooms: A compendium of case studies", PICES-2019, Victoria, Canada.
- Dr. Trainer is an *ex officio* member of GlobalHAB SSC;
- Dr. Wells is Chair of the Editorial Board for the Best Practices Manual for Climate Change and HABs in IPHAB.

GOOS (Global Ocean Observing System)

GOOS is a program executed by IOC, but relies on coordinated contributions from organizations worldwide for its success. GOOS is a permanent global system for observations, modelling and analysis of marine and ocean variables to support operational ocean services worldwide. It provides accurate descriptions of the present state of the oceans, including living resources; continuous forecasts of the future conditions of the sea for as far ahead as possible, and the basis for forecasts of climate change.

PICES established a Study Group to develop a strategy for GOOS in 2005 whose purpose was to identify and describe the major observing systems in the PICES region and to provide recommendation and justification to MONITOR on whether or not PICES should propose a North Pacific GOOS pilot project to IGOOS.

Drs. David Checkley (AP-CREAMS), Sanae Chiba (MONITOR) and Masao Ishii (S-CC) attended the IOC's First Technical Expert Workshop for the GOOS Biology and Ecosystems, and GOOS Biogeochemistry Panels, November 13–15, 2013, Townsville, Australia. The goal of this workshop was to identify and develop approaches to observe

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

non-physical Essential Ocean Variables as per the concept described in the Framework for Ocean Observations (FOO) (developed by Dr. Checkley who represented PICES on the Integrated Framework for Sustained Ocean Observations Task Team to in 2010 work on a framework, http://www.ioccp.org/foo).

- GOOS co-sponsored the workshop to discuss the Framework for Ocean Observing (FOO) held in conjunction with the above mentioned PICES/ICES/IOC Symposium the 2nd International Symposium on "*Effects of climate change on the world's oceans*", May 13–20, 2012, Yeosu, Korea. The report of the workshop can be found in the July 2012 issue of PICES Press, pp. 14-15;
- GOOS held a First Technical Expert Workshop for the GOOS Biology and Ecosystems, and GOOS Biogeochemistry Panels, November 13–15, 2013, Townsville, Australia;
- GOOS co-sponsored the 2nd PICES/ICES/IOC Symposium on "*Effects of climate change on the world's oceans*", May 13–20, 2012, Yeosu, Korea;
- Dr. Toshio Suga represented GOOS at PICES-2014;
- The GOOS Biology and Ecosystems Panel (PICES members, Dr. Checkley and Chiba) held its first (online) July 15, 2015;
- The first GOOS Biology and Ecosystems Panel meeting was held February 19-20, 2016 in New Orleans, USA;
- A second GOOS Biology and Ecosystems Panel meeting was held September 19–21, 2016 in Oostende, Belgium;
- Drs. Sanae Chiba and Sonia Batten (MONITOR) serve as members on the GOOS Biology and Ecosystems Panel;
- Dr. Batten attended a workshop on "*Implementation of multidisciplinary sustained ocean observations*" February 8–10, 2017, Miami, USA;
- PICES fully supported Dr. Batten in 2018 to attend SCOR WG 154 on Integration of Plankton-Observing Sensor Systems to Existing Global Sampling Programs (P-OBS);
- PICES was an Intellectual Sponsor for OceanObs'19, September 16–20, 2019, Honolulu, USA
- Dr. Sanae Chiba (MONITOR) and Dr. Minhan Dai (S-CC) were Co-Chairs of the OceanObs'19 Program Committee.

IODE (International Oceanographic Data Exchange) program

From the FUTURE Implementation Plan:

"There is a need to enhance the timely availability of physical and biological data for FUTURE through indices, inventories, compilations, and other appropriate means. The responsibilities of the PICES Technical Committee on Data Exchange include supporting the data management needs and recommending data management policies for the FUTURE Program. This should be done in close cooperation with National Oceanographic Data Centers (NODCs) of the region and with the IOC International Oceanographic Data Exchange (IODE) program."

The International Oceanographic Data and Information Exchange system of national data facilities was established in 1961 to "…Enhance marine research, exploration, and development by facilitating the exchange of oceanographic data and information between participating Member States." All PICES member countries are Member States of IODE. In order to strengthen relations with IODE, PICES began sending a TCODE representative to IODE annual sessions starting in 2009. TCODE maintains dialogue with the IODE and its programs such as the IODE Group of Experts, OBIS (Ocean Biogeographic Information System), ODP (Ocean Data Portal) and ODINWESTPAC (Ocean

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

Data and Information Networks in Western Pacific region).

- Dr. Hernan Garcia represented IODE and Dr. Ward Appeltans (OBIS and IODE ODP) participated through WebEx at PICES-2012;
- Dr. Toru Suzuki attended a technical workshop of ODP Oostende, Belgium (February 27-29, 2012) and the IODE GE-BICH workshop in Oostende, Belgium (October, 2012);
- Dr. Suzuki and 3 other TCODE members attended the 22nd Session of IODE of IOC-UNESCO (Ensenada, Mexico, March 11–15, 2013);
- IODE co-sponsored TCODE workshop (W4) on "*Tools, approaches and challenges for accessing and integrating distributed datasets*" (cancelled at PICES-2013 due to US govt. shutdown but rescheduled for PICES-2014, but cancelled again);
- Drs. Toru Suzuki and Joon-Soo Lee attended IODE-XXIII and the Celebration Session and Scientific Conference on the occasion of the 10th Anniversary of the opening of the IODE Project Office (March 16–21, 2015, Bruges, Belgium);
- Drs. Lee and Suzuki attended a meeting of ODINWESTPAC (Oceanographic Data and Information Network for the Western Pacific region) at WESTPAC-X (May 12–15, 2015, Phuket, Thailand);
- Dr. Lee represented PICES at IODE-XXIV (March 27–31, 2017, Kuala Lumpur, Malaysia).

TCODE and IODE regularly attend each other's meetings/conferences. Dr. Yutaka Michida is an *ex officio* member of TCODE, representing IODE. TCODE is currently applying for Associate Data Unit membership in IODE.

IWC (International Whaling Commission)

The IWC was set up under the International Convention for the Regulation of Whaling, signed in 1946. Its purpose is to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry. Canada was a member from 1949-1982. Dr. Hidehiro Kato (former Co-Chair AP-MBM) was a PICES observer (through its AP-MBM) at IWC annual meetings from 2003-2014, replaced by Dr. Tsutomu Tamura (Japan) as PICES liaison to IWC. Dr. Tsutomu Tamura has represented IWC since PICES-2015.

Dr. Tsutomu Tamura is representing IWA at PICES-2019.

CLIVAR (Climate and Ocean – Variability, Predictability, and Change)

The main area for cooperation between PICES and CLIVAR has been the impact of climate variability and change on marine ecosystems. CLIVAR is a core project of the World Climate Research Programme (WCRP) which has undergone re-organization, with new core panels and new research foci. CLIVAR has interacted with PICES through collaborations with WG 27 and WG 29. A Study Group on *Climate and Ecosystem Predictability* (SG-CEP) was established at PICES-2015 to develop terms of reference for establishing a joint PICES/CLIVAR Working Group on *Climate and Ecosystem Predictability*.

- CLIVAR co-sponsored a POC Topic Session on "*Challenges in understanding North Hemisphere climate variability and change*" (also co-sponsored by ICES), PICES-2012, Hiroshima, Japan;
- Dr. ShoshiroMinobe represented PICES at the CLIVAR SSG meeting (May 6–9, 2013, Kiel, Germany) to look at integrated research opportunities on the 2nd phase of CLIVAR activities on "Biophysical interactions and dynamics of upwelling systems" led by Dr. Kenneth Drinkwater;
- A joint CLIVAR/PICES Theme Session on "*Biophysical interactions and dynamics of upwelling systems*" (Convener: ShoshiroMinobe) was held at the 2nd International Symposium on "*Boundary Current dynamics*", July 8–13, 2013, Lijiang, China;
- Dr. Minobe attended the 1st Pan-CLIVAR meeting in July 17-18, 2014, The Hague, The Netherlands.

Appendix Q – Organizations / Programs relevant to PICES (cont'd)

Dr. Minobe convened a 2-day Workshop (W4) on "*Upwelling systems under future climate change*" (which stemmed from a CLIVAR/IMBER/SOLAS working group) at the 3rd PICES/ICES/IOC Symposium on "*Effects of climate change on the world's oceans*", March 21–27, 2015, Santos, Brazil;

- Dr. Enrique Curchitser (WG 27) is a member of CLIVAR WG on Ocean Model Development;
- Mr. Robin Brown (PICES Executive Secretary) visited the CLIVAR International Project Office in Qingdao, China in May 2015 for discussions, and attended a CLIVAR Workshop at the First Institute of Oceanography, where he outlined some potential venues for collaboration between CLIVAR and PICES.
- CLIVAR co-sponsored a POC Topic Session (S5) on "*Ocean circulation of the Western Pacific and its response to climate change*" at PICES-2015, Qingdao, China;
- PICES provided support for 4 early career scientists (1 from Korea, 1 from Russia and 2 from USA) to attend the CLIVAR Open Science Conference on "*Charting the course for climate and ocean research*", September 18-25, 2016, Qingdao, China.
- A joint PICES/CLIVAR Working Group on *Climate and Ecosystem Predictability* was established at ISB-2017;
- CLIVAR co-sponsored a POC/FUTURE Topic Session on "Ecological responses to variable climate changes and their applicability to ecosystem predictions" at PICS-2018, Yokohama, Japan.

Dr. Annalisa Bracco (International CLIVAR Project Office) is representing CLIVAR at PICES-2019.

Inter-American Tropical Tuna Commission (IATTC)

The IATTC is responsible for the conservation and management of tuna and other marine resources in the eastern Pacific Ocean. All PICES member countries, except Russia, are members of IATTC. Research of the IATTC is on stock assessment, biology and ecosystem, data collection and database, and bycatch and IDCP (International Dolphin Conservation Program).

IATTC, along with PICES, is a non-voting member of ISC. ISC provides stock assessment results and research and undertakes scientific collaboration with the Inter-American Tropical Tuna Commission (IATTC).

PICES Annual Meeting

- Dr. Robert Olson (IATTC) was an Invited Speaker at the BIO Workshop (W3) on "The feasibility of updating prey consumption by marine birds, marine mammals, and large predatory fish in PICES regions" at PICES-2012, Hiroshima, Japan;
- IATTC co-sponsored (with ISC) FIS Topic Session S12 on "*Applying ecosystem considerations in science advice for managing highly migratory species*" at PICES-2018, Yokohama, Japan.

Dr. Carolina Minte-Vera represented IATTC at PICES-2018.